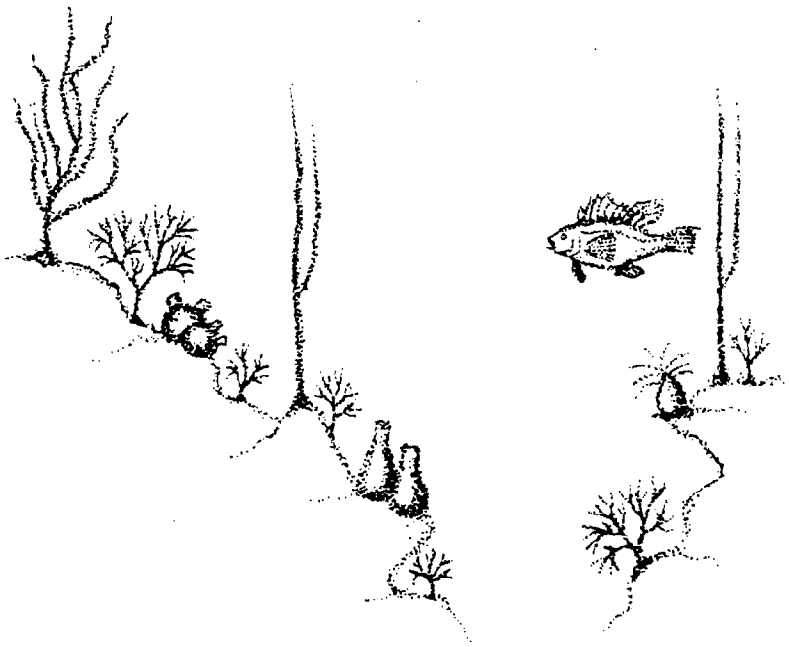
Final Environmental Impact Statement on the Proposed Gray's Reef Marine Sanctuary



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of Coastal Zone Management

UNITED STATES

DEPARTMENT OF COMMERCE

FINAL ENVIRONMENTAL IMPACT STATEMENT

PROPOSED GRAY'S REEF MARINE SANCTUARY

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DESIGNATION: Final Environmental Impact Statement

TITLE: Proposed Gray's Reef Marine Sanctuary

ABSTRACT: The National Oceanic and Atmospheric Administration (NOAA) proposes the designation of the waters at Gray's Reef, a submerged live bottom area on the South Atlantic Continental Shelf located 34.2 km (175.5 nmi) due east of Sapelo Island, Georgia, as a marine sanctuary. The proposed sanctuary consists of a 57 square kilometer (16.68 square nautical mile) high sea area.

The designation of a marine sanctuary would provide a program of integrated management including research, assessment, monitoring, education, long-term planning, coordination and regulation. The proposed regulations would apply only within the sanctuary boundaries. Recreational activities such as boating, diving, boat fishing, spearfishing and anchoring would be allowed within the sanctuary. Certain other activities such as seabed alteration and construction; bottom trawling and specimen dredging; wire trap fishing; marine specimen collecting; and tampering with or removal of submerged historic and cultural resources would be allowed under NOAA permit for scientific and educational purposes. The proposed regulations would prohibit all discharges except fish parts or wastes, bait, and chumming materials, vessel cooling waters, and effluents from marine sanitation devices. NOAA would monitor all activities in the sanctuary and would propose more or less strigent regulations at a future time if warranted. All regulations must be applied consistently with recognized prinicples of the international law. Alternatives to the proposed action include the no action or status quo alternative, modification of the sanctuary boundaries, and more and less stringent regulations.

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I. INTRODUCTION AND SUMMARY

A. BACKGROUND

Title III of the Marine Protection, Research and Sanctuaries Act of 1972 (16 U.S.C. 1431-1434) authorizes the Secretary of Commerce, with Presidential approval, to designate ocean waters as marine sanctuaries to preserve or restore their conservation, recreational, ecological or aesthetic values. Title III is administered through the Office of Coastal Zone Management of the National Oceanic and Atmospheric Administration (NOAA). The Marine Sanctuary Program provides a unique management structure for special marine areas which integrates research, assessment, education, long-term planning, coordination, and regulation.

In June 1978, the Coastal Resources Division of the Georgia Department of Natural Resources (DNR) nominated Gray's Reef, a nearshore live bottom reef on the South Atlantic Continental Shelf off Georgia, for consideration as a marine sanctuary for its habitat preservation, recreation, aesthetic and research values (Georgia DNR, 1978). NOAA preliminarily reviewed the nomination and determined, based on its distinctive marine resources and potential sensitivity to environmental perturbation, that Gray's Reef met the criteria outlined in NOAA regulations as required for placement on the sanctuary program's List of Recommended Areas (LRA).

In July 1979, NOAA distributed the Gray's Reef Nomination for review and comment among Federal and State authorities, regional fishery management councils, environmental and special interest groups and interested individuals. Most responses to the nomination were favorable. Many provided technical information concerning resources of the area and issues which should be addressed in the proposed action; others recommended various management approaches. A few responses expressed concern that the nomination failed to demonstrate a need for the proposed action, or suggested that existing authorities might adequately protect the area, but did not oppose a possible sanctuary.

NOAA gave full consideration to all information obtained through consultation and visits to the proposed site. Based on this information and on criteria stated in the NOAA regulations, NOAA selected Gray's Reef from the LRA as an Active Candidate for sanctuary designation and announced in the Federal Register (44 Fed. Reg. 58938 10/12/79) its intent to prepare an Issue Paper and to schedule public workshops in areas affected by the proposed designation.

NOAA received technical input from Georgia DNR and others familiar with the Gray's Reef area during preparation of the Issue Paper. The Paper was widely circulated in late October 1979 for public review and comment. It described the resources, major issues and a range of boundary, regulatory and management alternatives related to the proposed action. NOAA held public workshops in Brunswick and Savannah, Georgia, on November 19 and 20, 1979, respectively. Written coments on the Issue Paper and public participation at the workshops were requested and received.

Overall, the Gray's Reef Marine Sanctuary proposal received considerable support, both via written comments and at the public workshops. Proponents have cited, as beneficial impacts, the coordination of uses and promotion of conservation of live bottom resources and habitats, development of research, education programs, and appropriate regulations. Scientists and resource managers, for example, emphasized the need to expand the current understanding of the nature and role of live bottom ecosystems, especially in light of impending energy development in the South Atlantic and the apparent importance of live bottoms to marine fishery resources. Currently, it is impossible to predict adequately the potential consequences of natural or man-induced environmental change in live bottom ecosystems. Preliminary scientific evidence indicates that live bottom areas such as Gray's Reef support rich and diverse but ecologically vulnerable marine populations. Similarly, a number of educators emphasized the value of Gray's Reef as a "living laboratory," and the sanctuary as a vehicle to promote academic and public awareness and understanding of regionally significant live bottom ecosystems. Finally, several commentors stressed the significance of a comprehensive management framework for multiple-use marine resource areas.

Local fishermen and divers took issue with the possible regulation of spearfishing, arguing that it does not threaten Gray's Reef. They explained that SCUBA diving at the reef is limited by environmental conditions (e.g., sea conditions, depth, and visibility) and that divers observe self-imposed spearfishing policies (e.g., target species type, size and numbers speared). In combination, these limitations prescribe a low intensity, non-impacting sport. It was further stated that hook and line fishing is often more consumptive than spearfishing in terms of catch per unit effort. Divers expressed an interest in assisting NOAA in the formulation of management and regulatory policies for Gray's Reef, input which NOAA welcomed and has since pursued. Since the workshops, it has become increasingly apparent that spearfishing is not a current issue.

A few commentors, while not opposing the proposed action, questioned the purpose and need for a marine sanctuary at Gray's Reef. Some felt that the objectives might be pursued through existing regulatory authority, such as through the Regional Fishery Management Councils. Others expressed the reservation that, as a marine sanctuary, Gray's Reef would be subject to increased visibility and perhaps increased human usage, which could detract from existing ecological, recreational and aesthetic values. Another contended that a marine sanctuary would impede commercial fisheries potential.

NOAA carefully evaluated all comments, issues and available information concerning the Gray's Reef proposal and announced the intent to conduct a Scoping Meeting at the Federal level, and to prepare a Draft Environmental Impact Statement (DEIS) which appeared in the Federal Register (45 FR 2078, 1/10/80).

The DEIS was widely circulated for public review in May 1980. To notify persons not currently on the program mailing list, an announcement of its availability appeared in the Federal Register (45 FR 39507, 6/11/80), and in several Georgia newspapers. Copies of the statement were also available locally for public review at the Georgia Department of Natural Resources (DNR), Coastal Resources Division, Brunswick, Georgia, and in regional public

libraries around the state. Additionally, a summary of the DEIS was prepared by the Georgia DNR and distributed among fishermen, divers, and other user groups in coastal Georgia. The closing date for comments on the DEIS was August 5, 1980.

NOAA held public hearings on the proposal on July 7 and 8, 1980, in Brunswick and Savannah, respectively. Announcements of the hearings appeared in the Federal Register (45 FR 41407, 6/17/80), and in several Georgia newspapers. The hearings provided local citizens with the opportunity to express their views concerning the Gray's Reef proposal.

Several persons who provided testimony at the public hearings recognized the various public benefits the sanctuary program would provide, including conservation of live bottom resources for future generations, protection of fishery habitats for recreational, education and research purposes, promotion of the scientific understanding of the live bottom, and enhancement of the general public appreciation of natural marine resources. As a control area, it was also brought out that Gray's Reef would serve as a biological baseline for comparison with other live bottoms on the South Atlantic Outer Continental Shelf where energy development activities are beginning to take place.

Concern was expressed by several commentors regarding damage to the live bottom caused by various types of fishing and research equipment. Most commentors agreed with the preferred alternatives to control by permit the use of wire fish traps, bottom trawls and dredges and other sampling equipment in order to reduce the future risk of harm to live bottom resources.

Some members of the diving community of coastal Georgia did not fully understand that NOAA only plans to monitor diving and spearfishing activities, not regulate them, and took issue with the possible regulation of spearfishing. Many felt that equal treatment was not being given to hook and line fishing which can be more consumptive than spearfishing and proposed that NOAA also monitor hook and line fishing.

Several commentors raised issue with the preferred alternative to require vessels to anchor in sand bottom areas. Most contended that (1) there were not enough data available to determine if anchoring of small vessels (less than 30 feet) on the live bottom poses a significant threat to Gray's Reef; (2) the regulation would discriminate against user groups which did not have the skill or equipment for locating sand bottom areas; (3) SCUBA dive vessels already observe a self-imposed anchoring practice of sending a diver down the anchor line to secure placement in sandy areas; and (4) the regulation would be unenforceable.

Several commentors suggested that NOAA enforce regulations under the status quo. A few commentors inquiring about the cost of the program, requested a cost/benefit analysis. Others suggested that NOAA clarify the proposed management goals and objectives. Another questioned the adequacy of the proposed boundary to encompass all significant live bottom areas within the Gray's Reef core area. Other comments were directed to surveillance and enforcement and the State of Georgia's involvement in sanctuary management. Finally, some commentors questioned why Gray's Reef was selected as a marine sanctuary candidate over other live bottom areas in the South Atlantic.

Overall, the Gray's Reef Marine Sanctuary proposal has received support from the local community and the various user groups. Public involvement has included meetings with local dive groups to discuss their concerns and future participation in the sanctuary program. Public participation has been active, informative and extremely helpful.

This Final Environmental Impact Statement (FEIS) summarizes and responds to all comments received through August 5, 1980. Summaries of the public hearing statements and written comments with NOAA's response appear in Appendix K. This FEIS is being distributed to all persons indicating an interest in reviewing a copy, and to Federal and State agencies concerned with the proposal.

One change to the proposal from the preferred alternative in the DEIS has been made. The proposed vessel anchorage regulation has been changed. Anchoring will be listed in the Designation Document and will be monitored rather than regulated. A bathymetric survey will be conducted to characterize the benthic features of the sanctuary, and studies will be conducted on the feasibility and desirability of designating anchorage areas and/or using mooring buoys.

The FEIS includes an expanded discussion on proposed sanctuary management. Immediately following designation, a formal Management Plan (MP) will be developed, responsive to the importance and needs of sanctuary resources and user groups. Components of MP are described in Section III. Additionally, the FEIS emphasizes the use of monitoring as an essential management tool for providing information on sanctuary user groups and the health of the live bottom ecosystem.

The proposed designation and regulations do not represent a final decision. NOAA will receive comments on this FEIS for 30 days following publication. During this 30-day period NOAA will consult with the Federal Agencies. After review and consultation, a decision will be made whether to proceed with the designation. If so, the Secretary of Commerce must obtain Presidential approval of the designation. The final rules will be promulgated after designation.

B. National Marine Sanctuary Program (NMSP) Purposes

The NMSP focuses on comprehensive management of marine ecosystems for the long-term protection of natural resources and the enjoyment and benefit of society.

The following program purposes present a framework for the national sanctuary system:

- To provide long-term protection to special marine areas with unique conservation, recreational, ecological or aesthetic values;
- To provide a focus for comprehensive management of these areas;

- To enhance public awareness of special marine areas and emphasize wise use of these natural resources; and
- To encourage research and exchange of information about marine ecosystems.

C. Proposal to Designate the Gray's Reef Marine Sanctuary

NOAA proposes to designate Gray's Reef, a live bottom area 34.2 km (17.5 nmi) east of Sapelo Island, Georgia, as a national marine sanctuary.

1. Resource Summary

The area under consideration is a naturally occurring live bottom reef on the South Atlantic Continental Shelf. Live bottom reefs are defined as "those areas which contain biolgical assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography, or whose lithotope favors the accumulation of turtles, fishes, and other fauna" (BLM, Department of the Interior, 1978). Live bottom areas occur infrequently and intermittently across the shelf and are distinguished from otherwise relatively flat and barren expanses of ocean bottom by irregular relief and considerable biological productivity. Major marine fisheries, both demersal (free swimming at or near the bottom) and pelagic (open ocean), are associated with live bottom habitats on a permanent or transient basis, in ways not yet fully understood.

The area known as Gray's Reef (or locally known also as Sapelo Live Bottom) covers an estimated 42.9 sq km (12.8 sq nmi) and consists of northeast-southwest trending limestone rock ridges, shallow buried hardground and surrounding sedimentary (soft bottom) areas (Hunt, 1974). Geological studies concerning its origin and history indicate that the reef substrate was deposited and consolidated many millennia ago in a marine environment experiencing fluctuating sea and energy levels, perhaps in a shallow estuarine-like area. Following the latest sea level transgression (Holocene), the rock was inundated and the submerged hardground provided substrate for the subsequent development of a marine reef community.

Gray's Reef is one of the few live bottom areas for which rock outcrops and biological assemblages have been mapped and studied, even though to a limited extent. Rock outcrops appear to be more prevalent off the Carolinas and Florida than off Georgia. Relief nearshore is generally less than 1-2 m (3.4 - 6.8 ft); Gray's Reef may be an exception with relief in the 2-6 m (6.8-20 ft.) range, which is usually encountered in deeper water locations.

Gray's Reef is located in an inner shelf zone, in a transition area between a coastal freshwater, weather-dominated regime and an offshore Gulf Stream-influenced regime. Physical oceanographic parameters (temperature, salinity, dissolved oxygen, density, and wind-determined currents) in the Gray's Reef area show slight seasonal fluctuations primarily in response to meteorological conditions. Gray's Reef probably experiences coastal and offshore influences sporadically, such as during periods of high spring runoff and Gulf Stream eddying, respectively. Chemical and biological processes respond to the physical parameters.

Although biological inventory and identification are not complete, preliminary investigations indicate the occurrence of several thousand taxa at Gray's Reef, representing the major algal, invertebrate and vertebrate groups commonly associated with reef-like environments in the South Atlantic and in the northeastern Gulf of Mexico. Observations suggest that the live bottom supports a transitional marine biota, with the result that cold water species and warm water species overlap in the area.

Marine flora (seaweeds and microscopic algae) offshore Georgia have not received much systematic attention, but are thought to be similar to those found offshore the Carolinas and northeast Florida; i.e., a mix of northern and southern varieties with some endemics.

Hard corals grow at Gray's Reef as solitary heads and are probably at or near their limits of environmental tolerance, as evidenced by scarcity and energy compensations. More common sedentary invertebrates include soft corals (sea whips and sea fans), hydroids, anemones, ascidians (tunicates or sea squirts), barnacles, attached bivalves, and tubiculous worms. Crabs, shrimps, lobsters, sea snails, and sea stars move on and about the rock surfaces. Infauna (living in between sediment particles) appear to be more abundant and diverse in the live bottom sediments than in non-live bottom sedimentary regimes.

Live bottom areas also favor the accumulation of finfish and have long been known for their general importance to commercial and recreational fisheries. While deep water live bottoms may be more productive than inshore sites due to prevailing environmental stability, Gulf Stream influence and nutrient-rich deepwater intrusions, shallow water hardgrounds, such as Gray's Reef, also host rich and varied ichthyofaunal populations. Representatives of major target demersal fisheries (those most desirable to fishermen) are found at Gray's Reef, including snapper, grouper, black sea bass, porgy, and ecologically similar species. Coastal migratory pelagic species (e.g., bluefish, jacks, cobia, mackerel and little tunny) are found at Gray's Reef on a seasonal basis. Reef fish exhibit certain biological traits (e.g., growth patterns, reproductive characteristics, and migratory patterns) which correspond to evolutionary pressures in isolated environments and which make them especially vulnerable to environmental perturbation. For reef species which are nonmigratory (e.g., black sea bass), Gray's Reef represents a permanent residence; for others which migrate to deeper depths with age and those with wider terrritorial ranges in response to spawning and feeding behaviors (e.g., snapper and grouper), residence at Gray's Reef is probably temporary.

Marine turtles, including the Kemp's (Atlantic) ridley, green and loggerhead, are thought to utilize live bottom areas in the South Atlantic during various stages of their life histories. Loggerheads have been encountered at Gray's Reef where they probably forage and shelter. Less is known about the other sea turtles of the region.

Marine mammals, primarily dolphins, are frequently sighted in the vicinity of Gray's Reef; however, data are lacking concerning particular importance of live bottom, if any, to cetaceans. The use of live bottom areas by the Florida manatee has been proposed; manatees frequent Georgia coastal areas and may roam offshore as well.

Little information exists concerning coastal or pelagic birds in the vicinity of Gray's Reef. Pelagic bird rookeries are found along the entire Georgia coast. Petrels, shearwaters, gannets, phalaropes, jaegers, and terns are likely to be encountered at Gray's Reef during passage from rookeries to offshore feeding grounds.

The close proximity to land of Gray's Reef makes the live bottom accessible to many people from southeastern Atlantic States. Private recreational diving and fishing, public recreational-for-hire (charter) fishing, research and educational demonstrations take place at Gray's Reef year round. Recreationists, researchers and educators frequent other offshore reef areas as well; however, as fuel prices rise and supplies become limited, competition will increase for this nearshore area.

2. Purpose and Need for a Gray's Reef Marine Sanctuary

The Gray's Reef live bottom is proposed for marine sanctuary status in recognition of its distinctive conservation, research, recreational, ecological and aesthetic values which are in need of protection and comprehensive management. These values are discussed in detail in the following Section II: Purpose and Need for the Action.

3. Proposed Management

Management of Gray's Reef as a marine sanctuary will focus on the national program purposes and policies. Site-specific goals for Gray's Reef have been developed tentatively in order to address effectively the issues which prompted the sanctuary proposal and to provide a basis for assessment of boundary and regulatory options considered in the environmental impact analysis. Final goals and objectives are developed pursuant to designing a formal management plan (MP) following sanctuary designation. All planning and decisions concerning management and use of the sanctuary will be directed by this plan towards fulfilling the goals and achieving the program objectives. Objectives for each goal will represent short-term measurable steps towards achieving the long-term, unquantifiable goals and will be similar to the types of activities listed below:

Goal: To maintain and protect physical, biological, ecological, and aesthetic resources of the live bottom ecosystem in their natural state.

Tentative objectives would include development of specific activities and/or mechanisms designed to maintain water quality; to protect benthic habitats from damage and destruction (particularly essential geological formations); and to preserve and maintain living resource abundance, ecological diversity and viability (particularly sensitive epibenthic and demersal organisms).

Goal: To promote scientific understanding of the ecological nature and role of the Gray's Reef live bottom ecosystem and the functional relationships of live bottom areas throughout the South Atlantic to one another and to the overall coastal and marine ecosystems of the region.

Tentative objectives could include activities to encourage and

cooperate with interested parties in research and marine science education, such as the establishment of a scientific advisory committee; to facilitate qualitative and quantitative assessment of species richness and diversity; to obtain a better understanding of temporal and spatial community dynamics and energy relationships; to make available on a competitive basis funds for assessment and monitoring; to maintain an accessible repository concerning live bottom research; and to create a focus for scientific data exchange.

Goal: To promote public appreciation and wise use of regionally significant live bottom resources.

Tentative objectives would be to design programs to educate the public concerning the nature and importance of live bottom ecosystems; to promote creative activities and practices which are compatible with resource conservation and management; and to establish and maintain a sanctuary information center.

The Gray's Reef Marine Sanctuary MP will include provisions for on-site management; surveillance and enforcement; advisory committees representing all user groups; consultation and coordination with other management authorities and interested parties; resources management, including strategies for research, resource assessment and monitoring; and public education and visitor use. NOAA has initiated consultation with the U.S. Coast Guard regarding surveillance and enforcement in the sanctuary. The Georgia Department of Natural Resources (DNR) is working under a cooperative agreement with NOAA to prepare recommendations for specific management concerns, such as the issues of coordination, public participation, research, monitoring, resource assessment, public education and enforcement. Specifically, DNR will provide: (1) an analysis of the resources required to monitor the effectiveness of the management system and the regulations; (2) a description of the surveillance and enforcement system necessary to meet management objectives; (3) suggestions for the design of the process for reviewing and evaluating requests for permits to conduct prohibited activities; and (4) a preliminary list of the types of scientific research needed to accomplish management goals and objectives. Preliminary forms of these recommendations will be available at the time of final statutorily required consultation with Federal agencies and will be subjected to a public participation process involving consultation, review and comment before adoption. A more detailed discussion of the MP is found in Section III.

4. Proposed Boundary

The proposed sanctuary boundary consists of 57 square kilometers (16.68 square natuical miles) of high seas waters under Federal jurisdiction contained within a rectangular boundary: starting at coordinate value

31°	21'	45"	N	commencing to coordinate	31°	25"	15"	N	thence coordinate
80	55	17	W		80	55	17	W	
31°	25"	15"	N	thence to coordinate	31°	21"	45"	N	thence back to the
80	49	42	W		80	49	42	W	

point of origin. The proposed sanctuary encompasses all presently known exposed limerock outcrops ("breaks") and surrounding shallow-buried hardground and soft sedimentary (sand) bottom.

The sanctuary boundary will be delineated on nautical charts prepared by the National Ocean Survey. NOAA will identify and evaluate mechanisms to physically mark the sanctuary boundaries (e.g., a marker buoy system) pursuant to development of a formal management plan.

5. Proposed Regulations

NOAA has analyzed alternatives to the proposed action, including that of taking no action. Alternatives are outlined in Section III: Alternatives Including The Proposed Action, and are fully discussed in Section V: Environmental Consequences. The draft designation and regulations proposed in this FEIS do not represent a final decision; they are presented for public review and comment.

Sanctuary management will consult and coordinate with existing authorities in both the administration and enforcement of the regulations. The regulations apply only within the sanctuary boundaries. The full text of the proposed regulations as they appear in the Federal Register is presented in Appendix A.

The proposed regulations (THE PREFERRED ALTERNATIVE) would impose the following controls:

- Prohibit, except by permit, alteration of, or construction on, the seabed;
- Prohibit discharge or deposit of any polluting substance except (a) fish parts or wastes, bait and chumming materials; (b) vessel cooling waters; and (c) effluents from marine sanitation devices;
- Prohibit, except by permit, bottom trawling and specimen dredging;
- Prohibit, except by permit, wire trap fishing;
- Prohibit, except by permit, marine specimen collecting; and
- Prohibit, except by permit, tampering with, damage to or removal of submerged historic and cultural resources.

No regulations are proposed for anchoring, spearfishing or other fishing activities (hook and line fishing). NOAA does intend to monitor these activities, along with all other activities, in the sanctuary. NOAA proposes to list anchoring in the Designation Document and to undertake the following management tasks: (1) monitor existing anchoring practices to determine activity levels, gear types and environmental impact (see definition of monitoring below); (2) conduct an underwater resource survey to determine the nature and extent of hardbottom coverage, and to transpose findings onto interpretive nautical charts; and (3) conduct studies on the feasibility and desirability of designating anchoring areas and/or placing mooring buoys at the reef.

NOAA proposes to list spearfishing in the Designation Document and

undertake the following management tasks: (1) poll divers to determine diving experiences and self-imposed dive policies; (2) develop a guide to recreational diving; (3) enlist the help of local diving organizations in monitoring diving and spearfishing activities (see definition of monitoring below); and (4) conduct studies on the feasibility and desirability of establishing marked dive trails.

NOAA proposes to rely upon the regulations implemented by the South Atlantic Fishery Management Council pursuant to fishery management plans for other fishing activities in the sanctuary such as hook and line fishing, and to undertake the following management tasks: (1) poll fishermen to determine fishing motives; (2) develop a guide to recreational fishing; and (3) enlist the help of local fishing organizations for monitoring fishing activities at the reef.

6. Designation Document

The Designation Document (the draft Designation for the proposed Gray's Reef Marine Sanctuary is presented in Appendix A) serves as a constitution for the sanctuary. It establishes the boundary and purpose of the sanctuary, identifies the types of activities that may be subject to regulation and specifies the extent to which other regulatory programs will continue to be effective within the sanctuary. NOAA may legally promulgate regulations only in relation to the specific activities listed in the Designation. Its content can be modified only after repeating the entire designation process and securing Presidential approval.

If the Designation is adopted, the following activities will be subject to necessary and reasonable regulation.

- Alteration of or construction on, the seabed;
- Discharging and depositing substances;
- Bottom trawling and specimen dredging;
- Anchoring;
- Wire trap fishing;
- Spearfishing;
- Marine specimen collecting; and
- Tampering with, damage to and removal of historic or cultural resources.

D. Summary of Environmental and Socioeconomic Consequences of the No Action and the Proposed Action Alternatives

Gray's Reef is located in the high seas, seaward of State waters. A variety of Federal laws, regulations, policies and procedures govern activities on the high seas. Those which already apply in and adjacent to the proposed Gray's Reef marine sanctuary are analyzed in Section IV F: The Legal Status Quo.

A review of the existing statutes reveals several areas in which sanctuary designation would afford benefits to the natural resources. The mandates of existing authorities are sometimes too broad to focus adequately on small discrete areas requiring special management measures. Thresholds for hazardous substances, for example, are established for all waters or seabed out to 200 nautical miles off the entire United States coastline. In other cases, jurisdictions may be often too narrow to provide holistic attention; statutes which protect a particular resource may neglect or exclude components of the entire ecosystem. Finally, decentralized management of multiple use areas can result in policy conflicts, and does not lend itself to integrative directives emphasizing education, research, recreation and information exchange in light of conservation.

Live bottoms are unique and potentially vulnerable habitats, and very limited knowledge exists concerning their ecological nature and role. Presently, it is difficult to predict the environmental consequences of present or future human activities on the South Atlantic Continental Shelf. Preliminary scientific observation and interviews with persons familiar with Gray's Reef live bottom indicate that present activity levels do not pose a major strain on the reef's physical and biological resources but that the live bottom is ecologically fragile and any major changes in ambient conditions could severely stress community structure and productivity.

Sanctuary designation will provide long-term protection for a representative live bottom ecosystem on the South Atlantic Continental Shelf. Comprehensive management of this nearshore area will focus on conservation of natural resources, promotion of live bottom research, and promotion of public appreciation and wise use of regionally significant live bottom resources through interpretive programs and public services. Management of the live bottom will allow for appropriate distribution of visitors' uses and consequent control of any potentially harmful effects.

Minimal economic impacts will result from proposed restriction within the preferred boundary alternative (see Section V: Environmental Consequences).

1. Boundary

The preferred alternative for the sanctuary area (57 sq km - 16.68 sq nmi) will protect the live bottom core area and associated marine resources. A sanctuary of this size will result in protection and maintenance of the entire reef system, rather than only an individual component, and in effective management in order to maximize public benefits and minimize resource threats. It will help insure accomplishment of all sanctuary goals and will also allow for adequate enforcement of sanctuary regulations.

2. Restrictions

- Alteration of or construction on the seabed

Activities which involve alteration of or construction on the seabed, such as hydrocarbon and mineral extraction, pipeline placement, floating power plant siting, deep-water port dredging and certain manipulative research activities could potentially harm the live bottom. Drilling, dredging, filling

or the placement of structures could involve temporary or permanent destruction of essential benthic habitat areas and concurrent perturbation of living marine resources. The status quo provides some protection for live bottom area from seabed alteration/construction activities related to OCS development (e.g., BLM's biological lease stipulation concerning oil and gas exploration and development and the installation of pipelines in areas containing live bottom resources, as described in Appendix B).

There is no widespread evidence that presently unregulated seabed activities at Gray's Reef (e.g., placement of research quadrant markers, securing scientific equipment to the seabed, collecting geological specimens, or placing and maintaining aids to navigation) has caused substantial harm to the live bottom. However, in light of the increasing focus on Gray's Reef for research and the slight possibility of OCS development in nearshore areas of the South Atlantic, the live bottom may be subjected to activities which could eventually disrupt the reef system structure and function by altering habitats and reducing species abundance and diversity.

A permit process will provide immediate protection for the sanctuary resources by screening and prohibiting or redesigning seabed alteration/construction activities which might otherwise alter or destroy essential habitat areas, and stress or reduce ecologically important live bottom populations. It will also provide for monitoring of activity levels and impacts. No adverse impacts on the live bottom environment or on user groups are expected.

- Discharges

Disposal and discharge of polluting substances at the proposed sanctuary are also sources of concern. Most current disposal and discharge activities occurring at Gray's Reef are incidental to recreation and research; i.e., disposal of fish parts from cleaning and dressing fish caught at the live bottom, release of marine-type chumming or bait materials, discharge of effluents from marine sanitation devices, discharges of cooling water effluents from normal vessel engine operations and disposal of trash and litter from pleasure and research watercraft and transient vessels. There is no current evidence of dumping or discharge of toxic or foreign substances (e.g., hydrocarbons, industrial chemicals, radioactive wastes, dredge materials, and municipal sewage wastes) in the sanctuary area. Increased recreational, educational, and research-oriented use of the Gray's Reef area is anticipated in the future and with such, an increase in the volume of materials entering the surrounding waters can be expected.

The U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers, under the Water Pollution Control Act and the Marine Protection, Research and Sanctuaries Act, presently have the authority to develop criteria, select dump sites and issue permits for the ocean disposal of materials which adversely affect marine ecosystems. Pollution from dredging and the disposal of dredge materials and point discharges from ocean outfalls is controlled through permits. Regulations to prevent pollution of marine high seas waters from shipboard wastes, other than sewage and oil spillage, do not presently exist. Federal regulation of sewage wastes from marine sanitation devices, effective January 30, 1980, pursuant to the Clean Water Act, does not extend beyond territorial waters.

The proposed marine sanctuary regulation would prohibit the discharge and dumping of trash and litter, oil and other polluting substances. The regulation permits the discharge of fish parts and wastes, bait and chumming materials, cooling waters and effluents from marine sanitation devices.

The proposed regulation will contribute to high water quality by controlling the discharge of most polluting materials and will enhance the area's aesthetic features by lessening levels of waste discharge and litter thrown overboard. The regulation will not impact fishing activities. The economic impact of this regulation on sanctuary users is minimal, although users will be required to retain their trash for proper disposal elsewhere.

° Bottom Trawling and Specimen Dredging

Several researchers and educators use bottom trawls and specimen dredges to sample benthic and demersal organisms at Gray's Reef. Modified otter (roller-rigged) trawls have been used with some success to harvest fish off the Carolinas and Georgia in low to moderate relief live bottom areas. Circumstantial evidence indicates that indiscriminate bottom sampling with such gear may adversely impact the physical environment in live bottom areas by suspending sediment, breaking hard formations or removing essential habitat areas, and may stress the living marine resources by injuring or removing attached benthos or by reducing population levels of ecological important resources.

There are no Federal regulations to control potentially harmful bottom-trawling and specimen dredging activities in high seas areas. The South Atlantic Fishery Management Council has not proposed any management measures for such activities.

The proposed regulation controlling bottom-trawling and specimen-dredging activities at Gray's Reef by permit, on a case-by-case basis, will provide immediate protection for live bottom habitat areas and living marine resources. No adverse impacts on the environment or on user groups are expected to result from implementation of this regulation.

° Wire Trap Fishing

Fishing with wire fish traps in live bottom areas can have adverse ecological and socioeconomic impacts. Trapping is primarily a secondary commercial fishery in the South Atlantic; most trappers are off-season shrimpers who trap black sea bass and incidental bottom fish in the winter. Traps are also used in resource assessment projects such as "tag and release" studies.

The proposed regulation allows the use of wire fish traps in the sanctuary, by NOAA permit, for research, education and resource assessment. It would provide long-term protection for Gray's Reef because it would (1) eliminate the threat of overharvest of reef fish; (2) reduce the number and impact of "ghost" traps (lost or abandoned traps which continue to fish); (3) prevent the bycatch of juvenile and non-food tropical fish; (4) reduce

the potential for physical damage to corals and associated live bottom epifauna; (5) prevent interference with or displacement of less efficient fishing methods; (6) preserve the aesthetic values of the live bottom; and (7) eliminate the unpleasant diving experience of encountering ghost traps containing mutilated and dying fish.

° Marine Specimen Collecting

There are currently no Federal regulations to control the collecting of coral and other tropical marine resources in the high seas. The Gulf of Mexico and South Atlantic Fishery Management Councils propose certain management measures for corals under the Draft Coral and Coral Resources Fishery Management Plan. Tentative regulations would approve for harvest limited quantities of soft coral (sea whips and sea fans) and would allow, by permit, collecting of hard and soft corals for scientific and educational purposes. Timing of the proposal is uncertain at present.

The proposed marine sanctuary regulation would prohibit the collecting of corals and other tropical resources except by permit, on a case-by-case basis. Tropical biota are naturally rare species at Gray's Reef, many of which represent extensions of their normal geographic range. Many uncertainties exist concerning their viability (health and growth characteristics), reproduction and response to natural and man-induced environmental change. The proposed regulation would provide immediate protection by prohibiting indiscriminant tropical specimen collecting which could otherwise deplete ecologically significant species and upset the natural ecological balance at the live bottom.

° Historic or Cultural Resources

The proposed regulation controlling investigation and recovery of historic and cultural resources by permit will protect the live bottom environment and any significant shipwreck, paleoenvironmental or other historical and cultural resources without unduly impacting the user groups.

3. Other Activities

Anchoring is necessary, at times, to secure recreational fishing vessels, dive boats and research vessels at the live bottom. Anchoring by large vessels on hardbottom substrates is thought to pose a threat to habitat formations and sessile benthos (e.g., corals, sponges). Gray's Reef has not been adequately surveyed to determine whether present anchoring activity has adversely impacted the live bottom. Observations suggest that sufficient sand bottom areas exist for anchorage. Rather than implement a regulation on anchoring, NOAA will monitor the activity to determine environmental impacts. A bathymetric survey will be conducted and preferred anchorage areas indicated on charts. An educational program will be implemented to advise users on anchoring procedures. A mooring buoy design and feasibility study may be initiated upon designation. If such a system seems desirable, this proposed regulation could be modified as buoys are installed. This regulation would allow fishermen, divers and researchers to continue to anchor without any major inconvenience.

A small number of local recreational divers spearfish at Gray's Reef to catch edible fish. At current activity levels, spearfishing does not appear to threaten the health or stability of the live bottom ecosystem.

Diving conditions and self-imposed spearfishing policies limit total activity. NOAA will monitor diving activities, including spearfishing. No adverse consequences are expected and in the absence of future data demonstrating adverse impacts, no NOAA regulations will be proposed.

Gray's Reef is a popular recreational fishing spot for harvesting demersal species such as snapper, grouper, and black sea bass, and for pelagic species such as king mackerel, Spanish mackerel, cobia, and barracuda.

Gray's Reef does not support a large commercial fishery. Trawling in live bottom areas off Georgia is infrequent, and generally takes place in farther offshore. A few off-season shrimpers trap black sea bass off the Georgia coast and may occasionally frequent Gray's Reef. Commercial mackerel fishermen troll occasionally through the area with handlines or rod and reel.

NOAA proposes to monitor fishing activities at Gray's Reef and to rely upon the South Atlantic Fishery Management Council to manage selected fisheries through development and implementation of Fishery Management Plans. Such Plans may specify size limits, bag limits, and gear types which would apply at Gray's Reef.

Finally, with regard to this proposal the long-term productivity of Gray's Reef will be enhanced under a comprehensive management program and there will be no significant adverse short-term trade-offs. The proposal, in fact, is designed to provide public benefits in the short-term through establishment of educational and research programs to increase awareness and promote information exchange.

There will be no irreversible and irretrievable commitment of resources or of economic benefits. Economic benefits from wire trap fishing will not be irretrievably lost since the fish resources remain protected. Should a significant need arise for this type of commercial activity in the future, the prohibitive regulation could be considered for revision.

E. Marine Sanctuary Permits

Marine sanctuary permits, issued by NOAA, will be required for an activity which would otherwise violate the regulations and may be granted only if the activity will serve research or educational purposes. The permit procedure is specified in the regulations (Appendix A). Additional criteria specific to certain activities may be added in the Management Plan for Gray's Reef.

F. Certification of Other Permits

The regulations propose to certify, in advance, any permit, license, or other authorization issued pursuant to any other authority within the sanctuary as long as the activity does not violate marine sanctuary regulations. This notice of validity avoids duplicating permit delays and costs where there is no violation.

SECTION II. PURPOSE AND NEED FOR THE ACTION

NOAA has identified Gray's Reef as a special marine area with important species, habitat, research, recreational, ecological and aesthetic resources threatened by existing and potential human use and deserving consideration for marine sanctuary designation. The purposes or goals of the proposed Gray's Reef Marine Sanctuary are as follows:

- To maintain and protect the physical, biological, ecological and aesthetic resources of the live bottom ecosystem in their natural state;
- To promote scientific understanding of the ecological nature and role of the Gray's Reef ecosystem and the functional relationships of live bottom areas throughout the South Atlantic, to one another and to marine and coastal ecosystems of the region; and
- To promote public appreciation and wise use of regionally significant live bottom resources.

Several considerations prompted the proposed action. Gray's Reef is one of the largest inshore live bottoms in the South Atlantic, covering approximately 16 square nautical miles. The geomorphology of the Georgia Embayment is such that hardground outcrops are not typically encountered in nearshore areas off Georgia; generally, the occurrence of live bottoms increases to the north and south of Georgia in response to regional shelf structure and processes.

Gray's Reef is one of the few live bottom areas in the South Atlantic in which bathymetry, morphology, geology and origin have been studied, although only to a limited extent. Unlike tropical reefs formed by living corals and algae, Gray's Reef consists of exposed limestone rock in the form of ridges, ledges, caves and burrows of various sizes. The bottom relief (up to 6 feet and more) is usually only encountered in deepwater locations farther offshore. Preliminary studies reveal marine fossils at the live bottom which suggests the likely occurrence of other cultural and historic artifacts such as Paleoindian remains.

Gray's Reef represents a marine ecosystem of exceptional productivity as indicated by an abundance and variety of marine species at various levels in the food web. The live bottom is an important habitat for marine fishery resources of commercial and recreational value, for threatened or endangered species of sea turtles, and for tropical biota which are naturally rare in this area, representing extensions of their normal range.

The nearshore location of Gray's Reef, its year round accessibility and the distinguishing nature of its resources make the live bottom particularly inviting for public use. The live bottom is perhaps the most highly utilized natural reef off Georgia, attracting recreational fishermen and divers, researchers and educators year round.

Increased future use is expected, especially in light of fuel shortages and rising costs which make travel farther offshore more difficult.

Live bottom areas have just recently been recognized as significant biotopes in the South Atlantic and very limited knowledge exists concerning their ecological nature and role. The dynamics of live bottom benthic communities and their importance to marine fishery resources of the South Atlantic haven't been fully explored or interpreted. Scientific research concerning live bottom areas has been limited to qualitative biological inventories and geological characterizations.

Relatively little data exist on the impacts of human activities on live bottom systems. Preliminary research data suggest that live bottom resources are vulnerable to environmental perturbation. In combination, certain human activities (e.g., seabed alteration and construction, disposal of shipborne wastes, anchoring, bottom trawling and dredging, wire trap fishing and marine specimen collecting) could adversely impact ocean water quality, benthic habitat areas and living marine resources in live bottom areas.

Public knowledge of live bottoms is limited. Most public education in marine science features stereotypical tropical coral reefs.

Marine sanctuary designation offers an opportunity to provide management and to promote conservation of this multiple use marine area through coordination of current and future activities. Effective management will insure long-term protection of the live bottom resources while promoting activities which are compatible with conservation. The sanctuary also offers a mechanism to promote scientific research so that the "living laboratory" of a live bottom, such as Gray's Reef, might be fully explored and to initiate an assessment of environmental situations at the live bottom. Similarly, it provides for public education concerning the ecological importance of the live bottom ecosystem.

NOAA therefore proposes to designate Gray's Reef as a National Marine Sanctuary under Title III of the Marine, Protection, Research and Sanctuaries Act of 1972 to provide a program of integrated management including research, assessment, monitoring, education, long-term planning, coordination and regulation.

SECTION III. ALTERNATIVES INCLUDING THE PROPOSED ACTION

A. Introduction

NOAA proposes to designate Gray's Reef as a marine sanctuary to protect the natural features of the live bottom system and to promote scientific understanding, public appreciation and wise use of its resources. Various management, boundary and regulatory alternatives have been considered in the evaluation of the proposed action.

This section presents a brief analysis of all reasonable alternatives, including a no action alternative (status quo), the program action (a marine sanctuary with proposed boundary and regulatory measures), alternative boundaries and regulatory measures, and a brief discussion of the physical, biological, ecological and socioeconomic impacts resulting from these alternatives. A detailed impact analysis is presented in Section V: Environmental Consequences.

B. No Action Alternative: Rely on the Legal Status Quo

Gray's Reef is located on the continental shelf seaward of the territorial sea and State jurisdiction. A variety of Federal laws, regulations, policies and procedures apply to activities taking place in the general area of the proposed sanctuary. An alternative to the proposed action is the "no action alternative" (status quo), meaning that Gray's Reef would not be designated as a marine sanctuary. Under this alternative, these existing statutes would continue to control activities and protect the environment in and around the Gray's Reef live bottom. The reader is referred to Section IV F: The Legal Status Quo for a detailed discussion of existing statutes and affected agencies as well as current enforcement procedures, cooperative arrangements and any specific permitting, surveillance or monitoring requirements applicable to activities in the Gray's Reef area. Under the no action alternative, no special management programs or research and education efforts would be instituted.

As discussed in Section II above and in more detail in Section IV below, Gray's Reef is a special marine area; a complex, fragile ecosystem containing distinctively valuable natural resources. It is also an ecosystem where human use is significant and growing. Human activities that either singularly or in combination may place stress on the live bottom system include seabed alteration and construction activities, anchoring, wire trap fishing, bottomtrawling and dredging, spearfishing, live bottom specimen collecting, and damage to or removal of historical and cultural resources in high seas or in the Gray's Reef area. Although knowledge of the ecological nature and role of live bottom ecosystems is limited, available data suggests that live bottom resources are vulnerable to environmental disturbances. Given these unique resources, their particular vulnerability, and the multiple, increasing human pressures on the area, assurance of long term preservation for Gray's Reef requires (a) a management framework that will monitor, assess and act on information about the cumulative effects of human uses, (b) a mechanism to coordinate and encourage research

that will lead to necessary management decisions, and (c) efforts to educate the public about the value and the fragility of the live bottom system. The no action alternative appears to meet none of these requirements.

Existing statutes, including the Outer Continental Shelf Lands Act, the Clean Water Act, and the Marine Mammal Protection Act, are directed either at the accomplishment of a single purpose or the regulation of a single activity, such as the extraction of oil and gas resources, the preservation of water quality, and the conservation of marine mammals. These authorities do not provide a comprehensive management mechanism. These statutes also do not address all aspects of human threats to the area. To take one example, the regulations controlling ocean discharge and dumping do not consider all shipboard wastes. For example, Federal regulation of sewage wastes from marine sanitation devices does not extend beyond State waters (see the January 30, 1980 amendment to the Clean Water Act in Section IV F). The discharge of oil beyond the territorial sea (3 nmi) from tankers under 150 gross tons and other vessels under 500 gross tons is unregulated, and regulations pertaining to discharges from machinery space bilges require that the activity must take place as far as practical from nearest land, while in route, and must not exceed 60 liters per mile or have oil content exceeding 100 parts per million. Finally, there are no regulations to control the disposal of trash and litter in high seas areas.

In addition, the status quo provides no programmatic mechanism to promote and coordinate research in live bottom ecology in the South Atlantic or to disseminate information to the direct and indirect user public. Most, if not all, public education available on reef environments features stereotypical tropical coral reefs which differ significantly from live bottom areas found in the South Atlantic. There are currently no programs to provide education and information concerning the nature and importance of live bottom ecosystems or to increase long-term protection of these areas by increasing public awareness of the distinctive resources and their susceptibility to disturbance.

The regulatory regime closest in purpose and scope to the marine sanctuary program is that provided by the Fishery Conservation and Management Act of 1976 (FCMA). Even that regime, however, does not satisfy all of the management requirements described above. Under the FCMA, Regional Fishery Management Councils propose and implement necessary regulations for the management of selected commercial and recreational fisheries which are in need of management pursuant to Fishery Management Plans (FMP). The South Atlantic Fishery Management Council (SAFMC), which has jurisdiction over fisheries in the Gray's Reef area, is currently considering several FMPs. (The reader is directed to Section IV F: The Legal Status Quo, for a detailed summary of the SAFMC's Draft FMP for Snapper-Grouper Resources--Phase 1: Description of the Fishery, and the three FMPs prepared jointly with the Gulf of Mexico Fishery Management Council (GMFMC)--Draft EIS and FMP for Spiny Lobster, Draft EIS and FMP for Coral and Coral Reef Resources, and Draft EIS and FMP for Coastal Pelagic Migratory Resources (Mackerel).) These FMPs will provide for some protection of selected fishery resources

at Gray's Reef but will not likely focus on the site specific ecosystem management. FMPs do not necessarily consider elements of the ecosystem which are not harvested, nor do they address the entire range of threats to which an ecosystem such as Gray's Reef may be subject. None of the FMPs is final. Projected time schedules are uncertain, and in the case of the Snapper Grouper FMP, proposed management measures have not yet been distributed for public review. Thus, the management protections offered by the FCMA for Gray's Reef are at best uncertain. Nor does the FCMA assure the site-specific research, monitoring and education elements that long term preservation of the area requires. That a marine sanctuary would provide a useful complement to the FMP process is a view apparently shared by the SAFMC, which has endorsed the Gray's Reef proposal.

In conclusion, available information indicates that perpetuation of the status quo will not adequately protect the Gray's Reef live bottom from present or future impacts on the physical, biological, and ecological environment nor enhance scientific, educational, recreational and aesthetic values of the ecosystem. The marine sanctuary program proposes to provide a comprehensive mechanism through long-term management to protect the live bottom ecosystem and to respond in a timely fashion to marine conservation issues and to the interests of affected user groups as those issues arise.

C. The Proposed Action Alternative: The Gray's Reef Marine Sanctuary

1. Gray's Reef Marine Sanctuary Management Plan

In Section II: The Purpose and Need for Action, NOAA identified the issues prompting the proposed action. In order to address effectively these issues and to evaluate the range of boundary and regulatory options considered, a set of management goals and objectives has been formulated. The first step in the management of a marine sanctuary is the preparation of a formal Management Plan (MP). The final goals and objectives for Gray's Reef will be formulated at the time the MP is prepared and will form the heart of the Plan. They will provide a framework for conserving resources and integrating sound public uses into the broader national marine sanctuary program purposes. Objectives for each goal will represent short term quantified steps towards achieving the long term unquantifiable goals. Objectives for Gray's Reef will be similar to the types of activities listed in this section. Goals and tentative objectives are discussed pursuant to issues identified below:

Issue: The Gray's Reef live bottom resources are vulnerable to environmental perturbation.

Goal: To maintain and protect physical, biological, ecological and aesthetic resources of the live bottom ecosystem in their natural state.

at Gray's Reef but will not likely focus on the site specific ecosystem management. FMPs do not necessarily consider elements of the ecosystem which are not harvested, nor do they address the entire range of threats to which an ecosystem such as Gray's Reef may be subject. None of the FMPs is final. Projected time schedules are uncertain, and in the case of the Snapper Grouper FMP, proposed management measures have not yet been distributed for public review. Thus, the management protections offered by the FCMA for Gray's Reef are at best uncertain. Nor does the FCMA assure the site-specific research, monitoring and education elements that long term preservation of the area requires. That a marine sanctuary would provide a useful complement to the FMP process is a view apparently shared by the SAFMC, which has endorsed the Gray's Reef proposal.

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Issue: The Gray's Reef live bottom resources are vulnerable to environmental perturbation.

Goal: To maintain and protect physical, biological, ecological and aesthetic resources of the live bottom ecosystem in their natural state.

Tentative objectives include development of specific activities and/or mechanisms to maintain water quality; to protect benthic habitats from damage and destruction (particularly essential geological formations); and to promote living resource abundance, ecological diversity and viability (particularly sensitive epibenthic and demersal organisms).

Issue: Very limited knowledge exists concerning the ecological nature and role of live bottom ecosystems in general, and the Gray's Reef system in particular.

Goal: To promote scientific understanding of the ecological nature and role of the Gray's Reef live bottom ecosystem and the functional relationships of live bottom areas throughout the South Atlantic, to one another and to marine and coastal ecosystems of the region.

Tentative objectives include activities to encourage and cooperate with interested parties in research and marine science education, such as through the establishment of a scientific advisory committee; to facilitate qualitative and quantitative assessment of live bottom resources; to obtain a better understanding of spatial and temporal community dynamics and energy relationships; to apply acquired knowledge to fishery resource and OCS energy development programs; to make available, on a competitive basis, funds for assessment and monitoring; to maintain an accessible repository concerning live bottom research; and to encourage scientific data exchange.

Issue: The ease of accessibility of nearshore areas, the increasing emphasis in the South Atlantic for resource development and the present and future fuel energy limitations make productive inshore areas such as Gray's Reef vulnerable to increasing multiple use and possible misuse in the future without a mechanism for protecting the natural resources and for managing environmentally compatible public uses.

Goal: To promote public appreciation and wise use of regionally significant live bottom resources.

Tentative objectives would be to design programs to educate the public concerning the nature and importance of live bottom ecosystems; to promote creative activities and practices which are compatible with resource conservation and management; and to establish and maintain a sanctuary information center.

A general purpose of the marine sanctuary program is to provide a focus on comprehensive management of special marine areas with unique conservation, recreational, ecological or aesthetic values.

Marine sanctuaries are managed in a way that preserves the particular natural resources which provided the basis for creation of the sanctuary and also allows environmentally compatible public use. Because the marine sanctuary is considered an integrated holistic system, the Management Plan will be structured in a way that conveys the interrelationships among areas of management concern and proposed actions. Descriptive components of the MP are as follows:

a. Introduction/Summary

The first section will provide the minimal information necessary to orient the reader to the area covered by the Plan, including a

management issues. The introduction will also introduce the reader to the national marine sanctuary program, outline site-specific management goals and objectives for Gray's Reef and define the sanctuary Management Plan purposes.

b. Environmental Setting

This section will focus on the resource features of the sanctuary and will include a description of or reference to the following:

- Sanctuary resources, including geological, biological, cultural and historic features;
- Existing human activities, impacts and any relevant socioeconomic features;
- Existing regulatory authority;
- Regional socioeconomic trends of significance, including fisheries development, OCS energy development, coastal issues, etc.;
- Information status, including research needs, data gaps, programmatic coordination, etc.; and
- Maps, illustrations and matrices accompanying the above descriptions.

c. Management Plan

The Plan will address the specific areas of management concern, which are (tentatively): administration, surveillance/enforcement, resources management and public education and visitor use. It will propose specific actions and programs to be implemented within a specific timeframe, will provide the rationale behind them, and will relate them to other activities in the sanctuary and its vicinity. The Plan will also set forth strategies for complying with legislative and executive requirements and for establishing sanctuary advisory committees.

The standards for each required section of the plan are discussed below:

° Administration

This section will discuss the organization and procedures for sanctuary administration. NOAA is responsible for the development and management of marine sanctuaries, pursuant to Title III of the MPRS Act. In order to provide local expertise and supervision, a State/Federal cooperative management system is desirable for Gray's Reef. NOAA is considering entering into a cooperative agreement with the Georgia Department of Natural Resources (DNR) following implementation of the MP, whereby DNR would serve as on-site sanctuary manager. Considering the experience of DNR as the responsible agency for managing coastal and estuarine resources within the State, and its resultant familiarity with local user groups and the resources of the proposed sanctuary, this approach would facilitate efficient and effective management (See Appendix C for a description of Georgia DNR).

This section of the MP will outline on-site management responsibilities. On-site management will assume the lead role in the day-to-day administration; coordination with the U.S. Coast Guard surveillance and enforcement activities and maintenance of aids to navigation; and chair any advisory committee to NOAA concerning, but not limited to, environmental assessment, user activities, scientific research, permit applications, public education and information, and decisionmaking strategies.

NOAA proposes to establish a Gray's Reef Marine Sanctuary Advisory Committee to address the needs, concerns and interests of all affected parties, including government (Federal, State and local), the South Atlantic Fishery Management Council, researchers and educators, environmental organizations, local divers and fishermen, and other concerned citizens. The committee could provide timely direct information which might not otherwise be assimilated. The committee could also enhance public support and participation in sanctuary affairs. The MP will outline specific strategies for advisory committee involvement in sanctuary management.

This section will also address strategies for coordination and consulation with other authorities responsible for marine resources in the Gray's Reef area. NOAA has the legal authority to exercise appropriate control over activities in a marine sanctuary through regulation. This authority is exercised after consultation with affected Federal agencies such as the U.S. Department of the Interior (Bureau of Land Management, U.S. Geological Survey and Fish and Wildlife Service), U.S. Coast Guard, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Marine Mammal Commission and the Regional Fishery Management Councils (See Section IV F: The Legal Status Quo). NOAA will continue to consult with these parties concerning the Gray's Reef sanctuary proposal. NOAA and the South Atlantic Fishery Management Council will continue to observe their Memorandum of Understanding which provides for the exchange of advice and information on management of marine resources under their respective jurisdictions. NOAA will consider similiar arrangements with other agencies to complement the more traditional modes of agency interaction (e.g., commenting on permit applications and environmental impact statements).

The preferred regulation alternative for several activities contemplates a permit process. Also included in this section will be a description of the process for reviewing and evaluating requests for permits to conduct prohibited activities within the sanctuary. Generally, permits will be evaluated by NOAA according to the appropriateness of the proposed activity, study design, and potential environmental impacts.

This section will also describe the general location and facilities required to implement on-site management strategies. A general blueprint will be prepared to show location of existing and proposed facilities. The strategy for phasing on-site development will depend upon implementation of administrative, surveillance/enforcement, resource management and public education/visitor use proposals. This section will also indicate staffing, equipment, maintenance, technical assistance and other requirements for operations associated with on-site facilities.

Surveillance/Enforcement

Surveillance and enforcement are an integral part of the management and protection of the proposed marine sanctuary, a key to effective management of the resources. The U.S. Coast Guard is responsible for law enforcement, safety of life and property at sea, aids to navigation, and search and rescue as described in Section IV. These responsibilities directly apply to the proposed marine sanctuary since it is located in international (high seas) waters. It is suggested that NOAA develop a Memorandum of Understanding with the Coast Guard setting forth the specific responsibilities and reimbursement for costs for each party for management of the marine sanctuaries program. This section of the Plan will describe the surveillance and enforcement system necessary to meet sanctuary management goals and objectives for Gray's Reef and will indicate how natural and cultural resources, existing and potential human activities and environmental constraints will be considered in sanctuary surveillance and in enforcement of sanctuary regulations.

Resources Management

Research, resource assessment and monitoring are basic to sound management. At present, detailed quantitative and qualitative data are lacking on various aspects of the physical, chemical, biological, and ecological environments at the Gray's Reef live bottom. This section of the Plan will establish the management emphasis for the sanctuary's resources. It will evaluate a range of strategies for managing particular habitat areas, resources and processes, for determining principal research needs and for designing resource surveys and monitoring programs. In several cases, monitoring of the status quo is a preferred alternative. A sound data base and a responsive monitoring system are therefore essential management tools. Where appropriate, based on existing knowledge of the resources, their significance and their carrying capacity and extent of public uses, this section should recommend specific management activities to be initiated immediately following implementation of the MP. Discussions of the rationale, timephasing and estimated cost for each activity will be included.

Emphasis will be given to gathering sufficient information to assess the composition of the live bottom environment and to evaluate management strategies. Therefore, this section will also include provisions for periodic refinement of management plans to fulfill future resources, research and monitoring needs and for the evaluation of management efficiency and effectiveness.

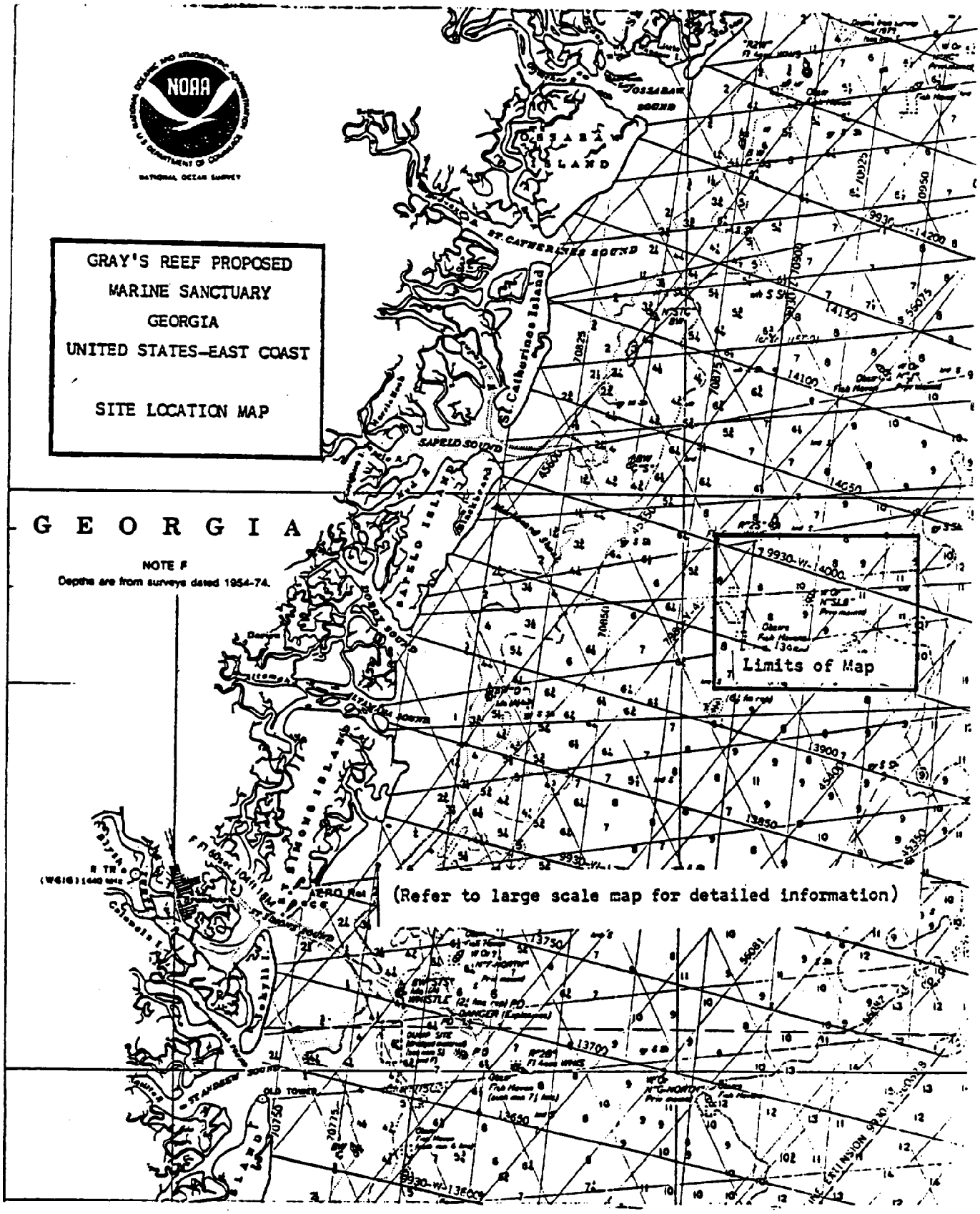
Management strategies for investigating cultural or historic resources within the sanctuary will also be specified in the section and will provide guidance necessary for preserving and interpreting these resources.

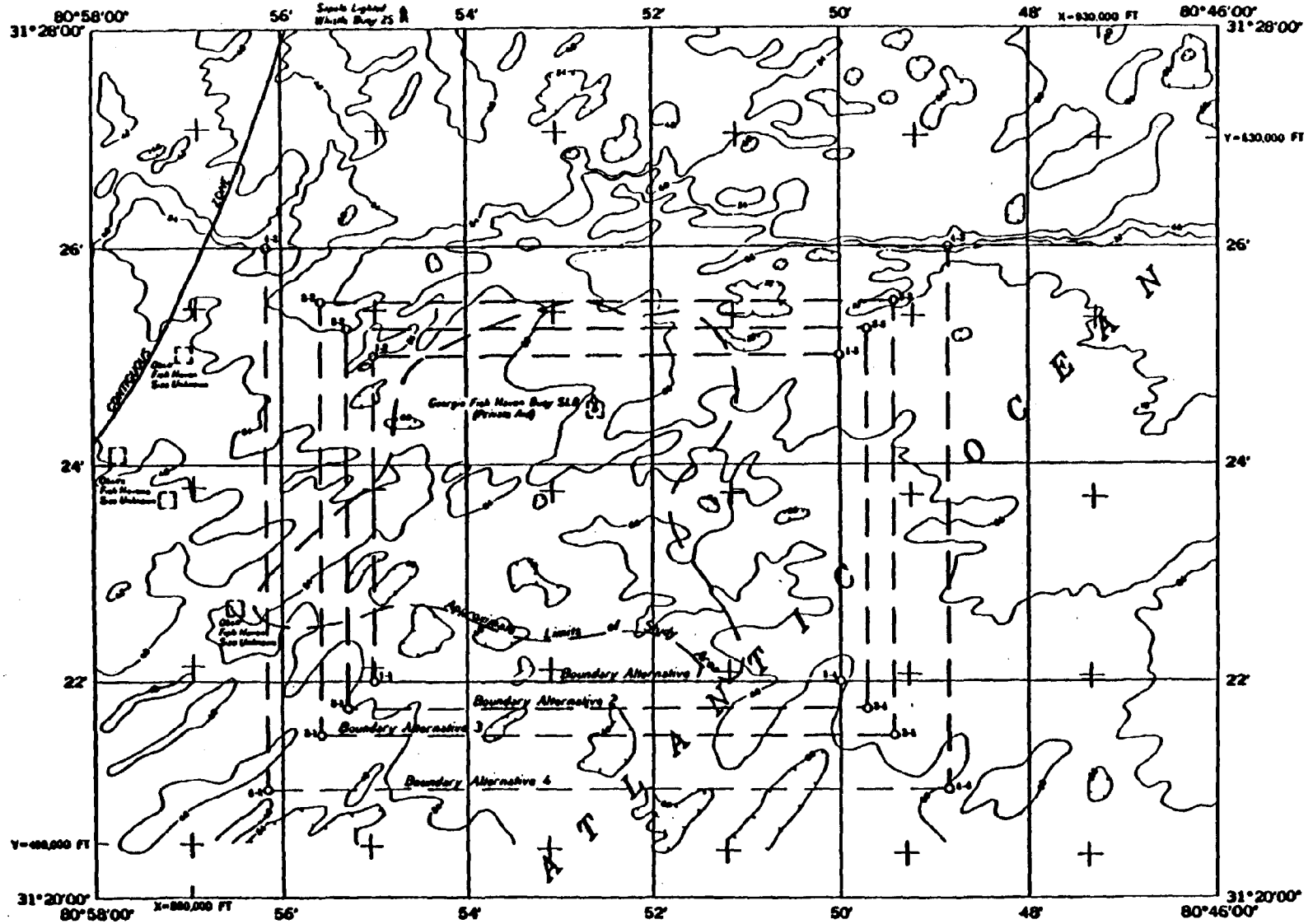
- Public Services, Education and Information Exchange

NOAA will promote recreation in the sanctuary compatible with resource conservation and wise management and will facilitate education programs and information exchange in order to promote public understanding and appreciation of the live bottom ecosystem. This section of the Plan establishes the management emphasis for recreation and public education. It will provide a range of management strategies for interpreting the sanctuary's resources to the public, for providing information, orientation and other public services, and for accommodating recreational and interpretive activities. It will describe, or make reference to, current public uses of the sanctuary area and will indicate any activities which will be expanded, restricted or phased out, as well as new activities to be provided, pursuant to sanctuary designation. It will define interpretive themes of the sanctuary and will indicate attributes of anticipated visitor experience. Also of importance will be references to seasonality of sanctuary use (day-to-day activities, long-term programs and benchmark events), general nature of facilities or vessels to be used in interpretive programs, a discussion of rationale, timephasing and estimated costs of proposed activities, and other considerations, as appropriate.

2. Boundary Alternatives

Selection and evaluation of alternative boundaries for the proposed sanctuary is based upon estimates of the areal extent of live bottom habitat, the ecological nature of live bottom resources, the current and anticipated activities in the area and the logistics of enforcement and management. Figure III-1 is a site location map and Figure III-2 is a special study map plotted by NOAA's National Ocean Survey (NOS, 1980) showing alternative boundaries, hydrographic contours and the approximate limits of the live bottom area based on preliminary survey data (Hunt, 1974). (It should be noted that the projection of Hunt's study map within the alternative boundaries represents a best fit. Hunt's study was plotted on a linear projection and NOS charts are plotted on transverse mercator projections; the differences in projections make it difficult to obtain an accurate fit. Furthermore, the very accurate navigation systems and precision side scan sonar in common use


NOAA
NATIONAL OCEAN SURVEY
GRAY'S REEF PROPOSED
MARINE SANCTUARY
GEORGIA
UNITED STATES-EAST COAST
SITE LOCATION MAP
G E O R G I A
NOTE F
Depths are from surveys dated 1954-74.
Limits of Map
(Refer to large scale map for detailed information)
ST. CATHERINES SOUND
SAPELO SOUND
ST. CATHERINES ISLAND
SAPELO ISLAND
ST. ANDREW SOUND
JEKYLL ISLAND



TRANSVERSE MERCATOR PROJECTION

GEORGIA STATE PLANE COORDINATE SYSTEM-
EAST ZONE

NORTH AMERICAN 1927 DATUM

SCALE 1:80,000

LEGEND

1-0 DIGITIZED POINT ON BOUNDARY ALTERNATIVE 1
2-0 DIGITIZED POINT ON BOUNDARY ALTERNATIVE 2 (¼ NAUTICAL MILE EXTENSION)
3-0 DIGITIZED POINT ON BOUNDARY ALTERNATIVE 3 (¼ NAUTICAL MILE EXTENSION)
4-0 DIGITIZED POINT ON BOUNDARY ALTERNATIVE 4 (1 NAUTICAL MILE EXTENSION)

Note
Depth curves were determined through interpretation of the sounding data of Hydrographic Survey H-8429. Depth curves charted in the fifty foot.

UNITED STATES - EAST COAST

GEORGIA

EAST OF DOBOY SOUND

GRAY'S REEF MARINE SANCTUARY
BOUNDARY ALTERNATIVES

(0.5X REDUCTION)

today were not available for Hunt's study.) Hunt's (1974) detailed map, showing live bottom ridge and trough "growth patterns," appears as Figure IV-3 in Section IV: Description of the Affected Environment.

Boundary Alternative 1 proposes a 43.8 sq km (12.81 sq nmi) Gray's Reef Marine Sanctuary. It represents the live bottom area identified as Gray's Reef by Hunt (1974) and proposed as a marine sanctuary by the Georgia Department of Natural Resources (Georgia DNR, 1978). Preliminary surveys (Hunt, 1974) indicate that the live bottom consists of northwest to southeast trending limestone rock ridges surrounded by wide expanses of a shallow-buried hardlayer and sedimentary (soft bottom) regime. Hunt (1974) suggested that a majority of the live bottom core and associated biological assemblages are contained within a rectangular area: starting with coordinate value

31° 22' N commencing to coordinate 31° 25' N thence to coordinate
80° 55' W 80° 55' W

31° 25' N thence to coordinate 31° 22' N thence back to the point of
80° 50' W 80° 50' W

origin.

Most human activities associated with the live bottom ecosystem (e.g., fishing, SCUBA diving, research, and educational demonstrations) take place within this boundary. The proposed boundary area encompasses an effective unit for management and enforcement purposes.

Discussions with persons knowledgeable about Gray's Reef and delineation of Boundary Alternative 1 by NOS on a special study chart, however, suggest that a significant portion of the live bottom core area lies beyond the boundary projection described above. Although the survey data are preliminary, it is apparent that adoption of this boundary alternative could leave a sizeable area of live bottom and associated marine resources unprotected and could lead to confusion among user groups concerning which live bottom areas were included in the sanctuary and which were not.

Boundary Alternative 2 proposes a 57 sq km (16.68 sq nmi) Gray's Reef Marine Sanctuary. This boundary includes the 43.8 sq km area (12.8 sq nmi) identified above (Hunt, 1974; Georgia DNR, 1978) plus a 0.46 km (0.25 nmi) extension in all directions to yield a total sanctuary area of 57 km (16.68 sq nmi). The proposed area is contained within a rectangle starting at coordinate 31° 25' 45"N commencing to coordinate
80 55 17 W

31° 21' 15"N thence to coordinate 31° 25' 15"N thence to coordinate
80 55 17 W 80 49 42 W

value 31° 21' 45"N thence back to the point of origin.
80 49 42

Most of the live bottom known as Gray's Reef and all associated human activities are contained within this boundary. Adoption of this

boundary alternative would provide an increased level of resource protection for all presently known live bottom habitat areas and living marine resources and would eliminate confusion among user groups by including all contiguous resource areas in the sanctuary. The increase in proposed sanctuary area over that provided under Boundary Alternative 1 would not impede management or enforcement capabilities.

Boundary Alternative 3 proposes a 72 sq km (21.07 sq nmi) Gray's Reef Marine Sanctuary. The boundary includes the previously estimated live bottom core area of 43.8 sq km (12.8 sq nmi) (Hunt, 1974, Georgia DNR, 1978) plus a 0.93 km (0.5 nmi) extension in all directions for a total area coverage of 72 sq km (21.07 sq nmi). The proposed area is contained within a rectangle starting at coordinate value 31° 21' 30"N 80 55 35 W

commencing to coordinate 31° 25' 30"N 80 55 35 W thence to coordinate 31° 25' 30"N 80 49 25 W

thence to coordinate 31° 21' 30" N 80 49 25 W thence back to the point of origin.

Boundary Alternative 3 would encompass all presently known live bottom. Any subsequent live bottom discoveries within the immediate vicinity would likely be contained within the boundary. The increase in boundary size, however, would increase significantly the percentage of sand bottom areas within the sanctuary relative to hardground and would raise the costs of enforcement without commensurate benefit to the resource objectives of the sanctuary.

3. Regulatory Alternatives

A review of existing and potential uses concerning the Gray's Reef area indicates that certain activities may require controls and/or monitoring in order to fulfill the management goals and objectives presented earlier: seabed alteration and construction; ocean dumping or discharge; vessel anchorage; bottom-trawling or dredging; wire trap fishing; spearfishing and other fishing activities; marine specimen collecting; and tampering with, removal of or damage to historic and cultural resources. Alternative regulations for these activities are analyzed and their potential environmental, social and economic consequences are discussed briefly here and in depth in Section V: Environmental Consequences.

The proposed regulations would apply throughout all three boundary alternatives. In most cases, the range of regulatory alternatives considered include: (1)rely on the status quo to control the activity within the marine sanctuary area without additional present or future sanctuary regulations; (2) list the activity in the Designation document but propose no current regulations and monitor the status quo with the option of proposing regulations for public consideration if subsequent environmental, social, and economic assessments warrant such action; (3) selectively regulate the activity through issuance of permits on a case-by-case basis for research and educational purposes; and (4) prohibit the activity within the marine sanctuary area.

The status quo alternative for certain fishing activities (e.g., bottom trawling and specimen dredging, wire trap fishing, spearfishing and other fishing activities) would rely upon the South Atlantic Fishery Management Council (SAFMC) to issue regulations in the future pursuant to implementation of final Fishery Management Plans (FMPs). These activities are currently unregulated. As described earlier, FMPs which would be applicable to Gray's Reef fishery resources are in draft phases, and proposed regulations concerning these activities either: (1) are in draft and subject to modification by the SAFMC (and GMFMC) in response to public comment; (2) have not been distributed for public review; or (3) do not address the specific issues at Gray's Reef. Therefore, the nature and impact of regulations promulgated by the SAFMC pursuant to FMPs is uncertain at this time.

The Preferred Alternative concerning certain activities proposes controls through permits and monitoring. NOAA outlines general permit criteria in its proposed regulations (see Appendix A) and will develop more specific permit criteria and monitoring strategies pursuant to the proposed Gray's Reef Marine Sanctuary Management Plan following sanctuary designation. Applications for permits would be evaluated by NOAA, with particular attention given to the purpose and need of the proposed project, project design (e.g., site location, duration of study, materials and methods) and probable impacts on the live bottom, including any irreversible and irretrievable commitment of resources. Permits for research, education, and resource assessment projects would be issued by NOAA to appropriate investigators or institutions. Permit holders would be required to maintain activity logs, submit annual reports and cooperate with the sanctuary management.

The following is a discussion of regulatory alternatives considered, listed by activity. Preferred alternatives have been determined among them and are listed separately later in this section (see Section III E: The Preferred Alternative).

SEABED ALTERATION AND CONSTRUCTION

Alternative 1 -- Status Quo: Rely upon existing authority to control activities involving alteration of and construction on the seabed within the sanctuary, including, but not limited to, dredging, drilling, filling and placement of any structure

Under this alternative, NOAA would set no further restrictions on activities involving alteration of or construction on the seabed in the sanctuary area beyond the controls imposed by the Army Corps of Engineers, the U.S. Coast Guard and the U.S. Department of the Interior (Bureau of Land Management (BLM) and U.S. Geological Survey (USGS) as described in Section IV F: The Legal Status Quo and Appendix B. Certain activities in this category are currently controlled under the Outer Continental Shelf Lands Act in areas subject to oil and gas leasing. For example, BLM Stipulation No. 1--Biological Resources--calls for the identification of live bottom areas within one mile of proposed hydrocarbon exploration, developement and transport by pipeline and the implementation of mitigating measures on a case-by-case basis to protect the live bottom (see Appendix B). However, this lease stipulation was developed for

application to leases issued pursuant to OCS Oil and Gas Lease Sale No. 43 only. Although it has been proposed for Lease Sale No. 56, it is not necessarily a general stipulation that will be applied to all future leases in the South Atlantic OCS area.

Impacts: Adoption of this alternative would provide only minimal protection for the live bottom. It would leave certain activities unregulated, such as placement of research equipment and dredging hard and soft substrates (other than for mineral extraction). With regard to OCS oil and gas development activities, protection of live bottom resources would depend upon specific mitigating measures implemented pursuant to lease stipulations. Adverse conditions could lead to temporary or permanent destruction of essential habitat areas and concurrent disturbance of living marine resources.

Alternative 2 -- Allow by permit activities involving alteration of and construction on the seabed within the sanctuary

Under this alternative, certain seabed alteration and construction projects would be allowed on a case-by-case basis, by permit, if the proposed activity did not pose a substantial risk of harm to the live bottom resources, was consistent with sanctuary goals and objectives and met other permit criteria. Activities in this category could include installation of research equipment, marking dive trails and placing and maintaining navigational aids.

Impacts: A permit process would give immediate added protection to live bottom resources at Gray's Reef by conditioning seabed alteration/construction activities to modify or exclude those which pose a substantial risk of harm to the physical, biological and ecological environment within the sanctuary. Adoption of this regulation would have a positive impact on the habitat areas and on the living marine resources and would benefit scientific and educational understanding of the live bottom ecosystem. There may be an impact on persons applying for a permit in terms of opportunity costs; i.e., time and energy needed to complete required applications, activity logs and annual reports. Otherwise, because major projects which could not be redesigned are not foreseen, no social or economic hardships are expected.

Alternative 3 -- Prohibit all activities involving alteration of or construction on the seabed within the sanctuary

Under this alternative, no person would be allowed to dredge, drill or otherwise alter the seabed in any way. This alternative would prohibit construction or placement of research equipment, dive trail markers, and navigational aids.

Impacts: No negative impacts on the physical, biological or ecological environment are expected since this regulation would provide for maximum protection of sanctuary habitat and resources. Significant adverse sociological impacts are expected, however, since the regulation would prohibit many activities which might otherwise be desirable and beneficial to user groups, such as those listed in the paragraph above.

OCEAN DUMPING AND DISCHARGE

Alternative 1 -- Status Quo: Rely on existing authority to control ocean dumping and discharge within the sanctuary.

This alternative would set no further restrictions on the dumping or discharge of waste substances within the sanctuary beyond the controls imposed by the Environmental Protection Agency, the U.S. Coast Guard and the Corps of Engineers (see Section IV F: The Legal Status Quo, for details).

Impacts: Adoption of this alternative would leave certain operational discharges of oil and machinery space bilges and trash disposal by vessels beyond the territorial sea unregulated. Negative impacts on water quality (water chemistry) and on the physical, biological and ecological environment at the live bottom are expected if the deposit or discharge of pollutants is excessive and goes unabated. Resultant resource degradation would adversely impact user groups.

Alternative 2 -- No person shall deposit or discharge any materials or substances of any kind except:

(a) fish parts and wastes, bait and chumming materials;
(b) effluents from marine sanitation devices; and
(c) non-polluted cooling water effluents from vessels.

This alternative would allow deposits or discharges which do not pose a substantial risk of harm to sanctuary resources and which do not conflict with sanctuary goals and objectives.

Impacts: This alternative is not expected to have any major adverse environmental, social or economic impacts upon sanctuary resources or user groups. Adoption of this alternative would protect the sanctuary from the visual and biological degradation associated with the discharge of foreign, toxic or littering substances that are not otherwise prohibited.

Alternative 3 -- Prohibit the deposit or discharge of any materials or substance within the sanctuary.

Under this alternative, no person would be allowed to deposit any material or substance (including fish parts and wastes, bait or chumming materials, effluents from marine sanitation devices and non-polluted cooling water effluents from vessels) into sanctuary waters.

Impacts: This regulation would not have any adverse physical, biological or ecological impact on live bottom resources. In fact, the regulation would provide the greatest degree of protection for the live bottom from the visual and biological degradation which might be caused by dumping and discharge activities. However, adoption of this regulation would severely limit vessel use of the sanctuary since certain vessel discharges are impossible to prevent or are very costly to contain.

BOTTOM TRAWLING AND DREDGING (SEAFOOD OR SPECIMEN)

Alternative 1 -- Status Quo: Rely on the South Atlantic Fishery Management Council (SAFMC) to control bottom trawling and dredging within the sanctuary

Bottom trawling and dredging activities on the high seas are currently unregulated. Modified otter (roller-rigged) trawls, fish sleds, bottom dredges or other vessel-towed bottom samplers are used to collect benthic and demersal resources for commercial, scientific, educational or private purposes. Under this alternative, NOAA would rely upon the SAFMC to implement necessary and reasonable regulations, pursuant to final FMPs, to control bottom trawling and dredging at the Gray's Reef live bottom and to meet sanctuary goals and objectives. A tentative management decision pursuant to the Draft Snapper-Grouper FMP, however, indicates that the SAFMC will not regulate bottom trawling for reef fish (SAFMC, 1979). It is not certain whether regulations will be proposed pursuant to the joint Draft Coral and Coral Resources FMP to control bottom trawling and specimen dredging activities in coral habitat areas.

Impacts: Unregulated bottom trawling and specimen dredging at Gray's Reef may produce adverse impacts on the physical live bottom habitat and on the biological and ecological resources. In turn, adverse impacts on recreational and aesthethic resources may be expected. The impacts resulting from implementation of FMPs are difficult to assess due to uncertainties in the final regulations and time schedules.

Alternative 2 -- NOAA Issues Marine Sanctuary Regulations

NOAA would issue marine sanctuary regulations to control bottom trawling and specimen dredging activities at Gray's Reef, after consultation with the SAFMC. The following subalternatives have been considered:

Subalternative a -- Monitoring of the Status Quo

Under this alternative NOAA would list the activity in the Designation Document, propose no regulations currently, and monitor (1) currently unregulated bottom trawling and specimen dredging activities and (2) future activities allowed by the SAFMC under any adopted final FMP's. NOAA would have the option to propose restrictions within the sanctuary if monitoring and resource assessment indicated that significant impacts were occurring.

Impacts: Monitoring the status quo would not guarantee added protection for live bottom resources because it would basically constitute damage assessment where any damages to sanctuary resources and proposed mitigating measures would be identified after the fact. Unregulated bottom trawling and dredging at Gray's Reef could adversely impact the physical, biological, ecological and socioeconomic environments through loss or reduction of resource values. It does not appear likely that the SAFMC will regulate bottom trawling pursuant to the Snapper-Grouper FMP, in which case trawling and dredging and the potential for adverse environmental consequences will continue uncontrolled.

FMP, in which case trawling and dredging and the potential for adverse environmental consequences will continue uncontrolled. Impacts resulting from any future regulation by the SAFMC cannot be assessed at this time since the scope and timing of any regulation is uncertain.

Subalternative b -- Allow by permit bottom trawling and specimen dredging within the sanctuary

Under this option, bottom trawling and specimen dredging activities would be allowed on a case-by-case basis, by permit, if the proposed activity did not pose a substantial threat of harm to sanctuary resources, was consistent with sanctuary goals and objectives and met other permit criteria. Activities in this category could include trawling and dredging for research, education and resource assessment.

Impacts: A permit process would give immediate added protection to the resources at Gray's Reef by conditioning bottom trawling and specimen dredging activities to modify or exclude those which might pose a substantial risk to the physical, biological and ecological resources of the live bottom. This alternative would provide for monitoring of activity levels and impacts. Information obtained through permitted activities would benefit scientific understanding of the live bottom ecosystem. Current users of bottom trawls and specimen dredges are researchers and educators. Impact on these groups is expected to be minimal, in the form of opportunity costs; i.e., time and energy needed to complete the required applications, activity logs and annual reports. No additional impacts on user groups are expected.

Subalternative c -- Prohibit bottom trawling and specimen dredging within the sanctuary

Under this alternative, all bottom trawling and dredging activities would be prohibited within the sanctuary, including those involving research, education and resource assessment.

Impacts: Adoption of this alternative would provide the highest degree of protection to the live bottom habitat and its resources, but it would adversely impact scientific and educator user groups and would increase enforcement requirements in the field.

VESSEL ANCHORAGE

Alternative 1 -- Status Quo: Rely on existing authority to control vessel anchorage within the sanctuary

At the present time there are no regulations which pertain to anchoring on the high seas or in live bottom areas, except in relation to obstructions to navigation.

Impacts: Unregulated anchoring could subject essential habitat areas and sensitive living marine resources at the live bottom to possible physical, biological or ecological damage or injury. Adverse socioeconomic impacts are expected to result from adoption of this alternative, in

terms of potential loss or reduction in resource values from anchor-related stress.

Alternative 2 -- Monitor the status quo

Under this alternative, NOAA would monitor anchoring practices at Gray's Reef to determine activity levels, gear types used and environmental consequences. Educational materials concerning safe anchoring procedures will be made available as information is obtained through environmental impact analysis. Pursuant to a management plan, NOAA would conduct a detatiled underwater resource survey to determine the location and extent of hard and soft bottom areas in the sanctuary and prepare nautical maps showing the bathymetry depicted by the survey. In addition, NOAA would study the feasibility and desireability of designating anchorage areas and placing and maintaining mooring buoys.

Impacts: Monitoring would provide for assessing anchoring activities and for proposing mitigating measures if adverse impacts occur. Survey data and educational materials would provide for a better understanding of the live bottom habitat and facilitate wise use of the sanctuary resources. No adverse impacts on user groups are expected to result from implementation of this management measure.

Alternative 3 -- Prohibit anchoring on hardbottom substrates within the sanctuary

Under this alternative, NOAA would require that all efforts be made by vessel operators to drop anchors on sand bottom and to avoid anchoring on sensitive hardground areas.

Impacts: Adoption of this alternative could have a positive impact on sanctuary resources by protecting hardbottom habitat areas and sensitive epibenthos (e.g., hard and soft corals, sponges, etc.) from possible anchor damage. However, there is not enough data available to determine if anchoring currently poses significant threats to the live bottom system. This regulation would discriminate against user groups who do not have the skill or equipment for locating sand bottom areas.

Alternative 4 -- Prohibit all vessel anchorage within the sanctuary

Under this alternative, no person would be allowed to anchor a vessel within the sanctuary, thus requiring vessel operators to drift or maintain position by operating engines while within sanctuary boundaries.

Impact: This provision would provide the maximum degree of protection for live bottom habitat and resources but would adversely impact user groups by prohibiting anchoring for recreational, research and educational purposes. Negative economic impacts would be incurred by vessel operators in terms of fuel expended to maintain a desired position in the sanctuary.

WIRE FISH TRAPS

Alternative 1 -- Status Quo: Rely on the South Atlantic Fishery Management Council (SAFMC) to control the use of wire fish traps within the sanctuary

The use of wire fish traps is presently unregulated. Pursuant to the draft Snapper-Grouper FMP, the SAFMC tentatively proposes to require traps to have: (1) degradable panels or degradable door fasteners; (2) mesh size no smaller than 1x2 inches or 1.5 inch hexagonal; and (3) buoys color coded to the owner's boat. Additionally, SAFMC proposes that persons not fish traps other than their own without authorization of the owner (SAFMC, 1979). [Additional tentative management measures have been proposed to control wire trap fishing south of Cape Canaveral, Florida and thus are not applicable at Gray's Reef (see Section IV F: The Legal Status Quo).] These management measures are only tentative and may be subject to modification when distributed for public review and comment at a later (unknown) date.

Impacts: Unrestricted use of wire fish traps in the sanctuary, prior to implementation of any SAFMC regulations, may result in adverse physical, biological and ecological impacts on the live bottom environment. Use of wire fish traps could lead to a reduction in species abundance and diversity, cause physical damage to epibenthic organisms on the reef surface and reduction in recreational aesthetic values of the live bottom. Impacts resulting from implementation of proposed SAFMC management measures, pursuant to the draft Snapper-Grouper FMP, are difficult to assess at this time due to uncertain final scope and timing. Tentative measures listed above would facilitate escape of fish from "ghost" traps, prevent retention of some small fish and possibly reduce some gear and user conflicts. Measures which would limit harvest, reduce the number or size of traps used and eliminate the possibility of resource overfishing have not been proposed for the Gray's Reef area of the South Atlantic.

Alternative 2 -- NOAA Issues Marine Sanctuary Regulations

NOAA would issue marine sanctuary regulations to control the use of wire fish traps within the sanctuary, after consultation with the SAFMC. The following subalternatives have been considered:

Subalternative a -- Monitoring of the Status Quo

Under this alternative, NOAA would list the activity in the Designation Document, propose no regulations currently, and monitor (1) currently unregulated use of wire fish traps at Gray's Reef and (2) future activities allowed by the SAFMC pursuant to final FMPs. Under this alternative, NOAA would have the option to propose restrictions within the sanctuary if monitoring and resource assessment indicated that significant adverse impacts were occurring.

Impacts: Unregulated wire trap fishing at Gray's Reef could

SPEARFISHING

Alternative 1 -- Status Quo: Rely upon the South Atlantic Fishery Management Council (SAFMC) to control spearfishing within the sanctuary.

Spearfishing is currently unregulated. The SAFMC tentatively proposes, pursuant to the draft Snapper-Grouper FMP, to allow spearfishing in artifical reefs established solely for recreational fishing (north of Cape Canaveral) and, in artifical reefs constructed for other purposes, to allow the legally authorized constructor of the reef (the permittee) to petition the Council for special regulations on the permit (see Section IV F: The Legal Status Quo). Management measures concerning spearfishing in natural coral reef and live bottom areas in the South Atlantic have not been proposed.

Impacts: Present spearfishing activities at Gray's Reef do not appear to threaten live bottom resources or to interfere greatly with other user groups. Tentative management measures proposed by the SAFMC do not appear to apply to natural live bottom reefs such as Gray's Reef and therefore proposed measures are not applicable. No adverse impacts are expected from continuance of unregulated spearfishing activities.

Alternative 2 -- NOAA Issues Marine Sanctuary Regulations

Under this alternative, NOAA would control spearfishing in the sanctuary after consultation with the SAFMC. The following subalternative has been considered:

Subalternative a -- Monitoring of the Status Quo

NOAA would list the activity in the Designation document, propose no regulations currently, and monitor (1) currently unregulated spearfishing activities at Gray's Reef and (2) any future activities allowed by the SAFMC as a result of implementation of final FMPs. Under this alternative, NOAA would have the option to propose restrictions in the sanctuary if monitoring and resource assessment indicated that significant adverse impacts were occurring. NOAA would design and implement monitoring strategies and educational programs, pursuant to a Gray's Reef Sanctuary Management Plan, to assess the impacts of spearfishing activities on live bottom resources and user groups and to educate the public concerning conservation issues. Spearfishermen would be requested to participate actively in monitoring and education programs and to continue to observe self-imposed spearfishing policies concerning target species type, size and number taken.

Impacts: There is no evidence to suggest that current spearfishing activities at Gray's Reef pose any substantial threat of harm to natural resources or any threat of human injury. Spearfishing at the live bottom is limited by self-imposed diver policies, by natural features of the reef environment (e.g., visibility, depth and duration of dive) and by a diver's ability to hunt. Monitoring would provide for assessing

Impacts: Unregulated wire trap fishing at Gray's Reef could result in the adverse physical, biological, ecological and socioeconomic impacts discussed under Alternative 1. Impacts resulting from any regulations promulgated by the SAFMC cannot be assessed fully at this time without prior knowledge of their final scope and timing. Monitoring of the status quo basically constitutes damage assessment and any harm to the sanctuary resources and concurrent socioeconomic impacts would probably be identified after the fact.

Subalternative b -- Allow by permit use of wire fish traps within the sanctuary

Under this alternative, wire trap fishing would be allowed in the sanctuary on a case-by-case basis, by permit, provided that the proposed activity did not pose a substantial risk of harm to the live bottom resources, was consistent with sanctuary goals and objectives and met other permit criteria. Activities under this category could include use of traps for research, educational demonstration and resource assessment.

Impacts: A permitting process would provide immediate and long-term protection to fishery resources at Gray's Reef because it would (1) eliminate the threat of overharvest of reef fish; (2) reduce the number of "ghost" traps (lost or abandoned traps which continue to attract and catch fish); (3) prevent the incidental catch of juvenile fish and showy tropicals; (4) reduce the potential for physical damage to corals and associated epibenthic organisms (mechanical damage caused as traps are dragged or tossed about the reef surface); (5) alleviate user group conflicts (prevent displacement of less efficient fishing methods); and (6) preserve the aesthetic quality of the live bottom. Adoption of this regulation would have a positive impact on benthic habitat areas and benthic and demersal fisheries and would benefit scientific and educational understanding of the live bottom ecosystem. Impacts on user groups are expected to be minimal, in the form of opportunity costs; i.e., time and energy needed to complete the required applications, activity logs and annual reports. Otherwise no additional impacts on user groups are expected.

Subalternative c -- Prohibit the use of wire fish traps within the sanctuary

Under this alternative, no person would be allowed to use or possess a wire trap within the sanctuary, thus restricting scientific and educational sampling to alternative methods.

Impact: A complete prohibition on the use of wire fish traps would eliminate any potential adverse physical, biological and ecological impacts resulting from trapping activities. This prohibition would, however, adversely impact user groups such as researchers, educators and resource managers who utilize traps for sampling and the public could be deprived of information concerning fish resources in the area which might not be attainable through alternative sampling techniques.

if necessary. Survey data and educational materials would provide for better understanding and wise use of live bottom resources.

OTHER FISHING ACTIVITIES

Alternative 1 -- Status quo: Rely upon the South Atlantic Fishery Management Council (SAFMC) to control other fishing activities within the sanctuary

Gray's Reef is a popular recreational fishing area. Commercial fishing is on a very limited and small scale basis. Fishing activities, including, but not limited to use of gill nets, purse seines, longlines, rod and reels, lobster potting, poisons, explosives and powerheads, are currently unregulated. The SAFMC proposes specific management measures for selected fisheries under various FMPs (see Section IV F: The Legal Status Quo, for details).

Briefly, under the draft FMPs, the SAFMC (and GMFMC) tentatively proposes to set quotas equal to optimum yield for selected fisheries, set size limits, prohibit the use of poisons, explosives and powerheads to harvest fish and restrict certain gear types geographically and seasonally. Many of the tentative management measures apply to certain fishery resources and user groups at Gray's Reef.

Under this alternative, NOAA and SAFMC would (1) monitor all fishing activities in the sanctuary, (2) work together to insure compatible management measures; (3) make available educational information about the biology of reef and pelagic fish, especially with regard to growth and reproductive characterisitcs which tend to make them vulnerable to overharvest; and (4) propose additional management measures if monitoring and resource assessment warrant them.

Impact: NOAA does not have sufficient documented evidence to suggest that present levels of other fishing activities pose a threat of harm to the live bottom resources. Because applicable FMPs are in draft and are subject to modification in response to public comment, it is impossible to assess fully at this time the potential impacts which would result from their implementation. Tentative management measures are conservation-oriented and are consistent with optimizing the social and economic values of selected fisheries as well as preventing some overfishing of selected stocks and obtaining socioeconomic and biological data. The FMPs do not have significant impacts on fishery stocks not included in specified management units. Resolution of gear and/or user group conflicts and correcting for excessive stock allocations could have positive or negative impacts depending on how such problems are resolved.

Alternative 2 -- NOAA Issues Marine Sanctuary Regulations

Under this alternative, NOAA would issue regulations to control fishing activities in the sanctuary (linefishing, net, lobstering, or other fishing practices not previously discussed in this section), after

consultation with the SAFMC. The following subalternative has been considered:

Subalternative a -- Monitoring of the Status Quo.

NOAA would list the activity on the Designation Document, propose no regulations currently, and monitor (1) presently unregulated fishing activities and (2) any future activities allowed by the SAFMC under final FMPs. Under this alternative, NOAA would have the option to propose restrictions in the sanctuary if monitoring and resource assessment warrant them.

Impacts: Insufficient data exist to suggest that current fishing activities, other than bottom trawling, specimen dredging and wire trap fishing, pose any substantial risk of harm to physical, biological or ecological resources of the live bottom or interfere with other user groups. Monitoring would provide for assessing activity levels and resultant impacts on fishery resources and other user groups and for proposing any management measures necessary. The positive and negative impacts of management measures proposed by the SAFMC (and GMFMC) are difficult to assess fully due to uncertainties in scope and timing of the final FMPs.

MARINE SPECIMEN COLLECTING

Alternative 1 -- Status Quo: Rely upon existing authority to control commercial and amateur marine specimen collecting within the sanctuary

At the present time, no regulations control marine specimen collecting, including the taking of dead or alive marine plants, invertebrates and tropical fish from live bottom reefs. The SAFMC and GMFMC propose to allow limited harvest of soft corals and to issue permits for hard coral collecting for scientific and educational purposes, pursuant to a joint draft Coral FMP. No management measures have been proposed to control taking of marine plants or tropical fish.

Impacts: Perpetuation of the status quo would allow marine specimen collecting to continue unabated. Implemention of the Coral FMP would provide a degree of protection for hard and soft corals but not for other ecologically important organisms such as tropical fish and marine plants.

Alternative 2 -- Allow by permit collecting of marine specimens (marine plants, invertebrates and tropical fish) for research and education purposes

Under this alternative, NOAA would allow marine specimen collecting within the sanctuary on a case-by-case basis, by permit, if the proposed activity did not pose a substantial risk of harm to sanctuary resources, was consistent with sanctuary goals and objectives and met

other NOAA permit criteria (e.g., if the intended activity is for research to further scientific understanding of the live bottom or for education to further public appreciation for marine resources).

Impacts: Adoption of this alternative would provide immediate protection for sanctuary resources by conditioning the taking of marine specimens through a permit process and by providing for monitoring of activity levels and impacts. This regulation would help preserve the functional integrity of the live bottom ecosystem by prohibiting indiscriminate removal of ecologically important or rare resources. Requiring permits should not impose burdens on user groups, except in terms of opportunity costs; i.e., time and effort required to complete permit applications, activity logs and annual reports.

Alternative 3 -- Prohibit all marine specimen collecting within the sanctuary

Under this alternative, no person would be allowed to collect marine specimens, including marine plants, invertebrates or tropical fish, within the sanctuary.

Impacts: A prohibition on marine specimen collecting would provide a maximum level of resource protection for the live bottom system by eliminating the taking of rare or ecologically sensitive marine plants, invertebrates, and tropical fish. A prohibition, however, would adversely impact researchers and educators who collect for scientific or educational purposes. No commercial collectors are known to frequent Gray's Reef, so no economic impacts would result from adoption of this alternative.

TAMPERING WITH, REMOVAL OF OR DAMAGE TO SUBMERGED HISTORIC AND CULTURAL RESOURCES

Alternative 1 -- Status quo: Rely upon existing authority to control activities involving tampering with, damage to, or removal of submerged historic and cultural resources within the sanctuary

No laws at the present time regulate activities involving submerged historic and cultural resources on the high seas (see Section IV F: The Legal Status Quo).

Impacts: The status quo would allow unregulated investigation and removal of submerged artifacts (i.e., shipwrecks or paleoenvironments) should any be discovered within the sanctuary. Possible damage to adjacent physical and living marine resources on the live bottom could result.

Alternative 2 -- Allow permit activities involving tampering with, damage to, or removal of historic or cultural resources within the sanctuary

Under this alternative, investigation, salvage and recovery of historic and cultural artifacts could be allowed in the sanctuary on a case-by-case basis for historical, educational or research purposes if

the proposed activity did not pose a substantial threat of harm to sanctuary resources, was consistent with sanctuary goals and objectives and met other NOAA permit criteria.

Impacts: This alternative would provide immediate protection for the live bottom ecosystem by limiting activities which would involve tampering with, damage to, or removal of historic and cultural artifacts for research and educational purposes and would reduce any potential live bottom reef damage from those activities. Requiring permits should not impose a significant burden on researchers and educators who desire to investigate the historical and cultural history of Gray's Reef.

Alternative 3 -- Prohibit tampering with, damage to, or removal of historic or cultural resources within the sanctuary

Under this alternative, investigation, salvage and recovery of historic and cultural artifacts, such as shipwrecks and paleoenvironmental remains, would be prohibited within the sanctuary.

Impacts: This prohibition would provide maximum protection for historic and cultural artifacts and concurrent protection for affected live bottom resources, but would adversely impact those researchers or educators who might desire to investigate historic and cultural holdings at Gray's Reef.

D. Alternatives Considered, but Eliminated from Detailed Analysis

1. Boundary Alternative 4 -- A 106.8 sq km (31.24 sq nmi) Gray's Reef Marine Sanctuary.

A boundary alternative to include the estimated 43.8 sq km (12.8 sq nmi) live bottom area plus a 1.8 km (1 nmi) extension in all directions for a total area coverage of 106.8 sq km (31.24 nmi) was considered but rejected because the large size would include extensive expanses of non-live bottom (sandy) areas and would raise costs of enforcement and management without commensurate benefit to the resource objectives of the sanctuary. The increased sanctuary size would overlap other area activities (e.g., military training areas) and might impact unnecessarily users of the area.

2. Limitation of Certain Activities to Designated Areas Within the Sanctuary.

The possibility of confining certain activities, such as anchoring, bottom trawling or spearfishing, to designated areas was considered but rejected. Existing knowledge and experience concerning the live bottom are not adequate to identify appropriate activity areas. Even if an activity area could be realistically determined, confining consumptive and potentially harmful activities to a specific area could subject localized habitat areas and living marine resources to repeated disturbance, which in turn could adversely affect the functional integrity of the entire live bottom ecosystem. For instance, bottom trawling

within a designated area could subject standing stocks (biological assemblages) to repeated disturbance, impede natural ecological succession by "cropping" new recruits and limit random sample design for survey purposes. Designation of specific areas would also require placement and maintenance of marker buoys, the costs and logistics of which are prohibitive at the present time, and could cause confusion among user groups.

3. Mandatory Use of Mooring Buoys.

NOAA is considering a feasibility study on mooring buoys at the present time. An alternative concerning mooring buoys was considered but rejected from further analysis. Feasibility studies will determine the costs and logistics of placement and maintenance of mooring buoys and will examine ways to prevent physical damage to reef substrate and to avoid overcrowding and over-exploitation of resources at the mooring sites. Based on the results, NOAA may propose a mooring buoy system for Gray's Reef.

4. Selective Regulation of Spearfishing.

The possibility of regulating certain aspects of spearfishing such as permissible species, times and types of gear, was considered but was rejected because the current level of spearfishing activity at Gray's Reef does not appear to pose a threat to reef resources and there are no data upon which to base specific regulations.

5. Selective Regulation of Other Fishing Activities.

The possibility of regulating fishing by hook and line, net, and other gear types or of establishing bag limits and seasons was considered and rejected. At the present time, there is no indication that any other fishing activity threatens reef resources. Therefore, there is no empirical basis upon which to draft such regulations.

E. Preferred Alternatives

1. Preferred Boundary:

--57 sq km (16.68 sq nmi)

2. Preferred Regulatory Alternatives:

--Allow, by permit, activities involving alteration of or construction on the seabed within the sanctuary;

--Prohibit the deposit or discharge any materials or substances of any kind within the sanctuary except:

(a) fish parts or wastes, bait, and chumming materials;
(b) effluents from marine sanitation devices; or
(c) cooling water effluents from vessels;

--Allow, by permit, bottom trawls or specimen-dredges within in the sanctuary;

--Allow, by permit, the use of wire fish traps within the sanctuary;

--Allow, by permit, marine specimen collecting within the sanctuary; and

--Prohibit tampering with, damage to or removal of submerged historic and cultural resources, except by permit.

3. NOAA proposes to list anchoring and spearfishing in the Designation document, propose no regulations at the present time and monitor these activities.

NOAA proposes to monitor other fishing activities and to rely on the SAFMC to implement management measures for selected fisheries pursuant to final FMPs.

SECTION IV. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The purpose of this section is to provide pertinent geological, physical, chemical and biological oceanographic data and human activity information which are relevant to the environmental impact of designating Gray's Reef as a marine sanctuary. It is of foremost importance that the reader realize that the scarcity of data concerning the Gray's Reef live bottom provides that only generalizations of the affected environment may be made. Only one major work has been directed towards Gray's Reef (Hunt, 1974), although current interest in the area is growing. Most of the information presented herein has been gleaned from a variety of published literature, unpublished reports and personal communications, concerning the South Atlantic in general and live bottoms in particular, and therefore, by necessity, is wide in geographic scope. Presenting a general overview of the South Atlantic marine environment with emphasis on prevailing conditions off the coast of Georgia may facilitate a better understanding of the Gray's Reef environment.

A. Environmental Setting

The area under consideration for marine sanctuary status, Gray's Reef, is a nearshore live bottom "reef" located on the South Atlantic Continental Shelf in approximately 20 m (65 ft) of water, 32.2 km (17.5 nmi) due east of Sapelo Island, Georgia (Figure IV-1). Hunt (1974) estimated that the live bottom encompasses approximately 43.8 sq km (12.8 sq nmi) between the coordinates 31° 22'N and 31° 25'N latitude and 80°50'W and 80°55'W longitude. Limestone rock outcrops, shallow sub-surface hardground and surrounding sand bottom serve as an "oasis" supporting abundant and varied species of marine life on an otherwise sandy and relatively barren ocean bottom.

Hunt (1974) proposed the name "Gray's Reef" for the live bottom in recognition of the late Dr. Milton B. Gray of the University of Georgia Marine Institute at Sapelo Island, Georgia, whose offshore collections in the early 1960's contributed much to our understanding of benthic communities of coastal and continental shelf areas off the coast of Georgia. The live bottom is also variously known locally as Sapelo Reef and Sapelo Live Bottom.

Gray's Reef is located within a portion of the southwestern Atlantic Ocean known as the Georgia Bight, a marine extension of the Southeast Georgia Embayment. Bounded by Cape Fear, North Carolina (Cape Fear Arch) to the north and by Cape Canaveral, Florida (part of the Florida Peninsular Arch) to the south, the Georgia Bight extends seaward from the coast to the Florida-Hatteras Slope. The coastal (landward) margin of the Bight in the vicinity of Gray's Reef is characterized by largely undeveloped sea islands and extensive coastal marshes and tributaries.

B. Geological Setting

The width of the South Atlantic Continental Shelf varies, increasing in the northern direction from a width of 3 km (1.6 nmi) off the Florida Keys to 40 km (21.6 nmi) off Cape Canaveral, Florida to over 130 km (64.8 nmi) off Georgia. The width then gradually attenuates northward to 23 km (12.4 nmi) off Cape Hatteras, North Carolina.

The shelf is a marine extension of the Atlantic Coastal Plain. It is a relatively flat plain which slopes seaward at less than one degree and ends at the Florida-Hatteras Slope (Pilkey and Giles, 1965). Off Georgia, the overall slope averages 36 cm per km (2 ft per nmi)(Henry and Hoyt, 1968).

The shelf-slope break occurs at depths as shallow as 10 m (33 ft) off the Florida Keys, at irregular depths of between 50 and 70 m (165 and 231 ft) between Cape Canaveral, Florida and Cape Romain, South Carolina and at depths of 120 to 160 m (396 to 528 ft) off Cape Hatteras (Uchupi, 1968; Millman et al., 1972). Depth of the shelf break off Georgia averages 56 m (185 ft) (Hunt, 1974).

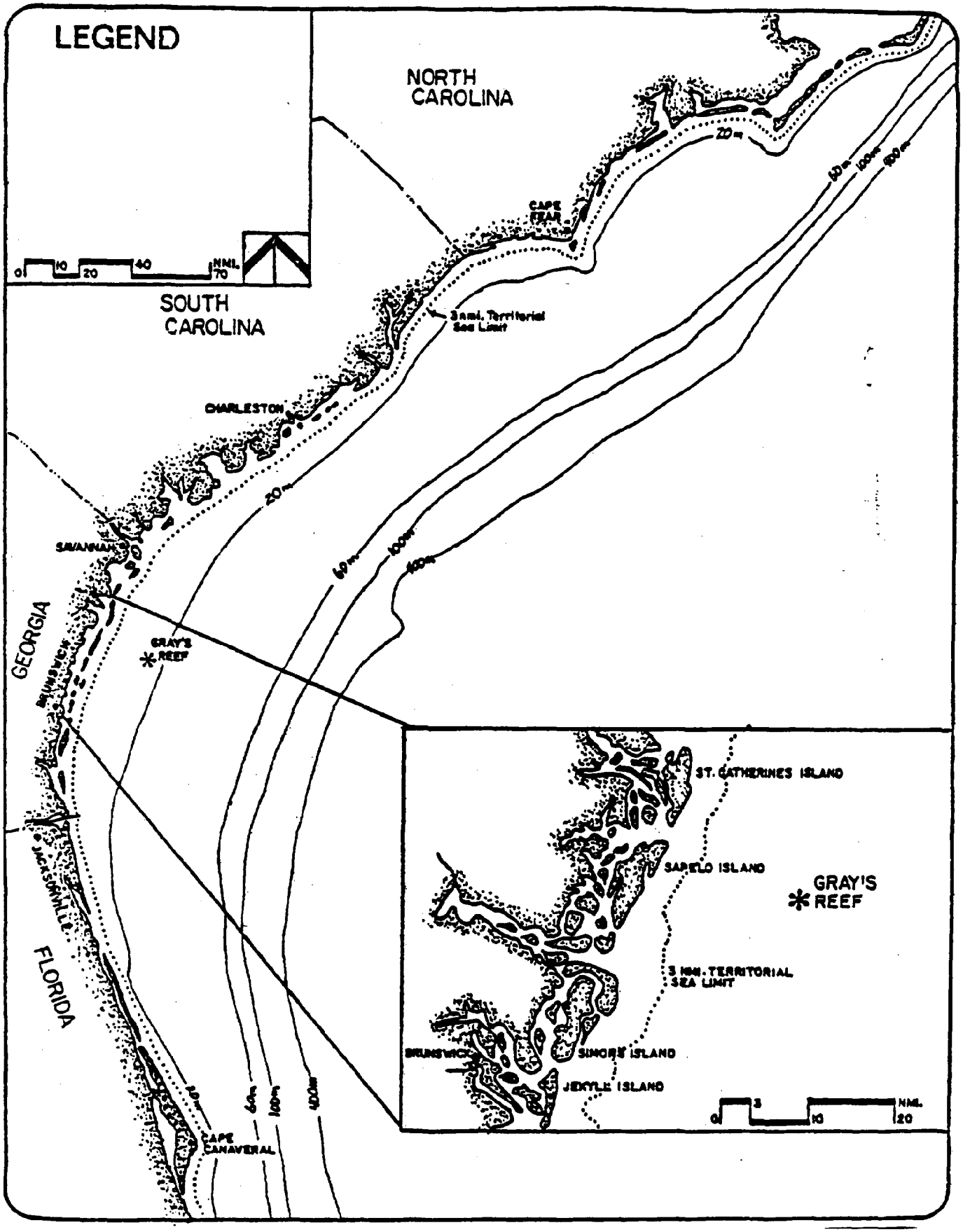
Surveys indicate that over 80 percent of the South Atlantic seafloor is sand bottom (Hollister, 1973; George and Staiger, 1979). Two major sedimentary regimes occur: an inshore area approximately 10 to 27 km (10 to 15 nmi) wide characterized by fine to very fine grained sand of recent (Holocene) sedimentation and an offshore expanse stretching to the shelf-slope break covered by coarse-grained, relict (Pleistocene) sediments (Gorsline, 1963; Henry and Hoyt, 1968). Off the coast of Georgia, the relict-recent boundary is distinct, with a narrow band of interfingering sediment types in between, and occurs quite consistently at a depth of 6 fm (36 ft) (Pilkey and Frankenberg, 1964).

The nearshore shelf zone acts as an effective sediment trap, beyond which little sediment depositon occurs. Studies on the distribution of minerals in continental shelf waters and sediments off Georgia indicate a longshore transport from north to south within the nearshore zone (Neiheisel and Weaver, 1967; Pilkey, 1963; Bigham, 1973). Lateral transport of sediments across the shelf is not extensive (Pilkey, 1968).

Sediments at Gray's Reef consist predominantly of medium-grained quartz sand with very fine-grained sand and granule-sized gravel in the 0.1 to 4.0 millimeters (0.004 to 0.157 in) size range (Hunt, 1974). Sand grains are subangular to well rounded. Iron-stained quartz sand is common in the larger grains, and phosphorite is common in small to medium-grained fractions. Samples contain 15 to 20 percent calcareous debris, with mollusk fragments being the most abundant constituent. This description suggests sediments of Pleistocene origin (Hunt, 1974).

Additional aspects of sedimentation on the Georgia Continental Shelf are described in a number of studies: Neiheisel (1962) discussed heavy minerals; Gorsline (1963) discussed sediment size distribution; Pilkey (1963) described heavy mineral and (1964) carbonate content; Pilkey and Frankenberg (1964) described the relicit-recent sediment boundary; Neiheisel and Weaver (1967) and Bigham (1973) analyzed transport and deposition of class minerals;

Figure IV - 1 Location of the Proposed Gray's Reef Marine Sanctuary



Peaver and Pilkey (1966) analyzed phosphorite fraction; and Milliman et al., (1972) discussed sediments of the eastern U.S. continental margin.

The shelf surface is generally smooth with infrequent occurrence of undulatory and irregular topography due to erosional and depositional processes (Uchupi, 1968). Relief, if any, is quite subdued; high relief of 5-6 m (16-20 ft) has been observed but is rare (Pilkey and Giles, 1965). Prominent bottom features on the shelf include: sand swells or ridges aligned at right angles to the shore; submerged terraces or ancient shorelines reminiscent of standstills of the sea; low-relief, ancestral river valleys of lowered sea levels during the Pleistocene; and intermittant outcrops of hardground (Uchupi, 1968). Within the Gray's Reef area, east of Sapelo Island, Georgia, there occurs a poorly defined valley of low relief, described by Pilkey and Giles (1965) as perhaps the old Altamaha River channel formed during the lower sea levels of the Pleistocene Epoch.

For the purpose of this study the occurrence and distribution of hardground is of particular concern. Hardgrounds in the South Atlantic are "reefs" either of sedimentary origin (lithified to semiconsolidated rock) or of biohermal origin (deposited by living organisms such as corals or algae). These reefs express relief above the surrounding sedimentary regime or are, at times, buried under superficial sediments of varying thicknesses. Exposed hardground areas occur as patch reefs or as part of more extensive hardbanks and are distributed in an unpredictable nature from the nearshore shelf zone to the shelf edge and beyond. The exact areal coverage is not known at this time. Estimates of total shelf hardground occurrence range from 10 to 20 percent (Henry 1979, pers. comm.), or coverage of approximately 6524 sq km (1907.6 sq nmi) between Cape Fear, North Carolina and Cape Canaveral, Florida (Barans and Burrell, 1976).

Hardground outcrops are less common nearshore due to the deposition of recent sediments and the scouring effects of river channelization during periods of lower sea level. Evidence of well-developed but subsequently buried reefs can be found landward of middle shelf regions. Seaward of the recent sedimentation zone sediment cover thins and the occurrence of hardground exposure increases (Henry and Giles, 1978).

Henry and Giles (1978) described hardground in the Georgia Bight in terms of three morphotypes. Low-relief hardgrounds occur as relatively smooth, flat rock outcrops (less than 0.5 m-1.64 ft relief) and are subject to cyclic covering and uncovering by sand of varying thicknesses. Moderate-relief hardgrounds exhibit irregular relief to 2 m (6.56 ft) or more; and shelf-edge reefs and ridges have high relief of 5-6 m (16-20 ft).

Hardground areas vary significantly according to geographical location, areal coverage, geological history, and substrate type. The most extensive coverage of hardground on the South Atlantic Continental Shelf is associated with longitudinally discontinuous hardbanks: inner, middle and outer hardbanks. Generally, the occurrence of hardground increases to the south of northern Florida and to the north of southern South Carolina which results in a outcrop density which is lower off central Georgia than to the south or north (Henry and Giles, 1978; George and

Staiger, 1979). Henry and Giles (1978) attribute this pattern to regional shelf structure and functional processes, particularly nearshore.

The inner shelf hardbank zone extends offshore from Jacksonville, Florida to near Charleston, South Carolina in water depths of approximately 15-25 m (50-82 ft) (BLM, 1978). Hardground exposure is discontinuous and infrequent. The band is characterized by expanses of subsurface hard layers covered by varying thicknesses of sediment. Rock surfaces outcrop in low areas to form low to moderate relief reefs. Gray's Reef is located in a low density outcrop area on the inner hardbank off Georgia. (A description of Gray's Reef follows this general overview). Intermittent, low-relief limestone reefs also occur at 16-24 m (53-79 ft) depths off Charleston. These areas may or may not be continuous with the inner shelf hardbank zone with which Gray's Reef is associated. Other inner shelf hardground areas are described off the Carolinas in the literature but, for the most part, occur outside the inner shelf hardbank zone and differ in geological history and physiomorphology, including: semi-continuous bands of coquina limestone (Pleistocene) in less than 15 m (50 ft.) of water in Raleigh and Onslow Bays, North Carolina and in Long Bay, North and South Carolina (Milliman et al., 1968); black rock reefs composed of a Trent Marl base and a gastropod and tubiculous (tube-building) polychaete worm cap in 4-17 m (13-56 ft) of water in Onslow and Long Bays (Pearce and Williams, 1951); conglomerate "coquina" rock reef off Cape Lookout, North Carolina (McCloskey, 1970); patch coral reefs in 19-40 m (62-131 ft) depths in Onslow Bay (MacIntyre, 1970; Huntsman and MacIntyre, 1971; Huntsman, 1976); and unclassified rock outcrops in 23 m (75 ft) of water off Cape Lookout (Schneider, 1976).

Seaward of the Gray's Reef area, a middle shelf hardbank zone extends from Jacksonville, Florida to Onslow Bay, North Carolina in water depths averaging 30-40 m (98-131 ft). Less is known about hardground outcrop patterns in this region (BLM, 1978). Referred to locally as snapper banks, the middle hardbank appears to be of a similar discontinuous nature as described for the inner bank. Henry and Giles (1978) described scattered hardground areas off Georgia in 28-60 m water depths (84-180 ft). George and Staiger (1978) described the biota of hardbottom areas in 27-37 m (89-122 ft) of water off Charleston and in 26 m (85 ft) off Jacksonville. Shoemaker (1972) described raised benches, rounded humps, and ridges and flat rock reefs which parallel the Gulf Stream off South Carolina as well as shallower reefs at 25-30 m (82-99 ft) depths. Roberts and Pierce (1967), Cleary and Pilkey (1968), Milliman et al. (1969) and Mixon and Pilkey (1976) described various hardground areas in mid-shelf locations in Raleigh, Onslow and Long Bays.

Outer shelf hardbanks occur as discontinuous ridges and ledges which follow the shelf break from Cape Hatteras, North Carolina to Cape Canaveral, Florida (USDI, 1978) and beyond to Key West, Florida (Uchupi, 1966; 1969; MacIntyre and Milliman, 1970; Avent et al., 1979). Live bottom is found in water depths of approximately 60-100 m (197-328 ft). Outer shelf hardbanks consist of calcareous algal ridges which were formed during lower stands of sea level (Holocene transgression). Deepwater coral banks also occur.

Sparse to rich reef-like or live bottom communities are associated with hardground areas. Moderate to high relief outcrops are almost always covered by rich invertebrate and algal growth and support productive reef fisheries. On the other hand, while shallow-buried hardground and low relief outcrops provide substrate for invertebrates and seaweeds, variable shifting sediments create a stressful environment which limits live bottom development.

Struhsaker (1969) was the first to apply in the literature the term "live bottom" to hardground relief areas which are covered by rich sessile invertebrate and algal growth and which support demersal fisheries. He recognized the live bottom as a discrete biotope when dividing the South Atlantic Continental Shelf into five general habitat types according to topography and associated marine life; i.e., coastal, open-shelf, live bottom, shelf-edge and lower shelf habitats. Live bottoms have since been described as:

> "those areas which contain biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography, or whose lithotope favors the accumulation of turtles, fishes, and other fauna" (BLM, 1978).

The term live bottom is commonly synonymous with vernacular patch reefs, hard bottoms, coral patches, black rock reefs, algal (lithamnion) reefs, limestone reefs, fishing banks and snapper banks.

Gray's Reef is one of the few live bottom areas in the South Atlantic in which bathymetry, hardground morphology, geology and origin and associated live bottom resources have been studied, although only to a limited extent. High resolution seismic studies show that a shallow hardbottom reflector (Duplin marl?) extends seaward from the Georgia coast to the vicinity of Gray's Reef where it projects above the sediment and forms the substrate for reef community growth (Hunt, 1974). Bathymetric survey data and underwater visual documentation of Hunt's (1974) study area indicate that Gray's Reef is located within the landward indentation of the 10 fathom (60 ft) contour. Fathometer profiles from Sapelo Whistle Buoy (R "2S") across the study area show an increase in water depth from 16.7 m (55 ft) at the buoy to 23.5 m (77 ft) 3.1 km (1.7 nmi) away from the buoy to the south-southeast (Figure IV-2). Approximately 7.4 km (4 nmi) from the buoy, Hunt (1974) noted that the bottom rises sharply to about 19.8 m (65 ft) at the reef margin. The bathymetry is typified by several ridges and troughs which extend for several miles in a northeast to southwest direction (Figure IV-3). The most prominent bathymetric features occur in the northern and northeastern portion of the study area with quite patchy expressions in the southern and eastern portions. The more prominent limestone ridges are characterized by small vertical scarps from 0.15-1.2 m (0.5-4 ft) in relief. Associated slopes and scarps dip at from less than 1° to approximately 6° to the northwest and to the southeast (Hunt, 1974).

Figure IV-2--Gray's Reef Bathymetry Source: Hunt (1974)

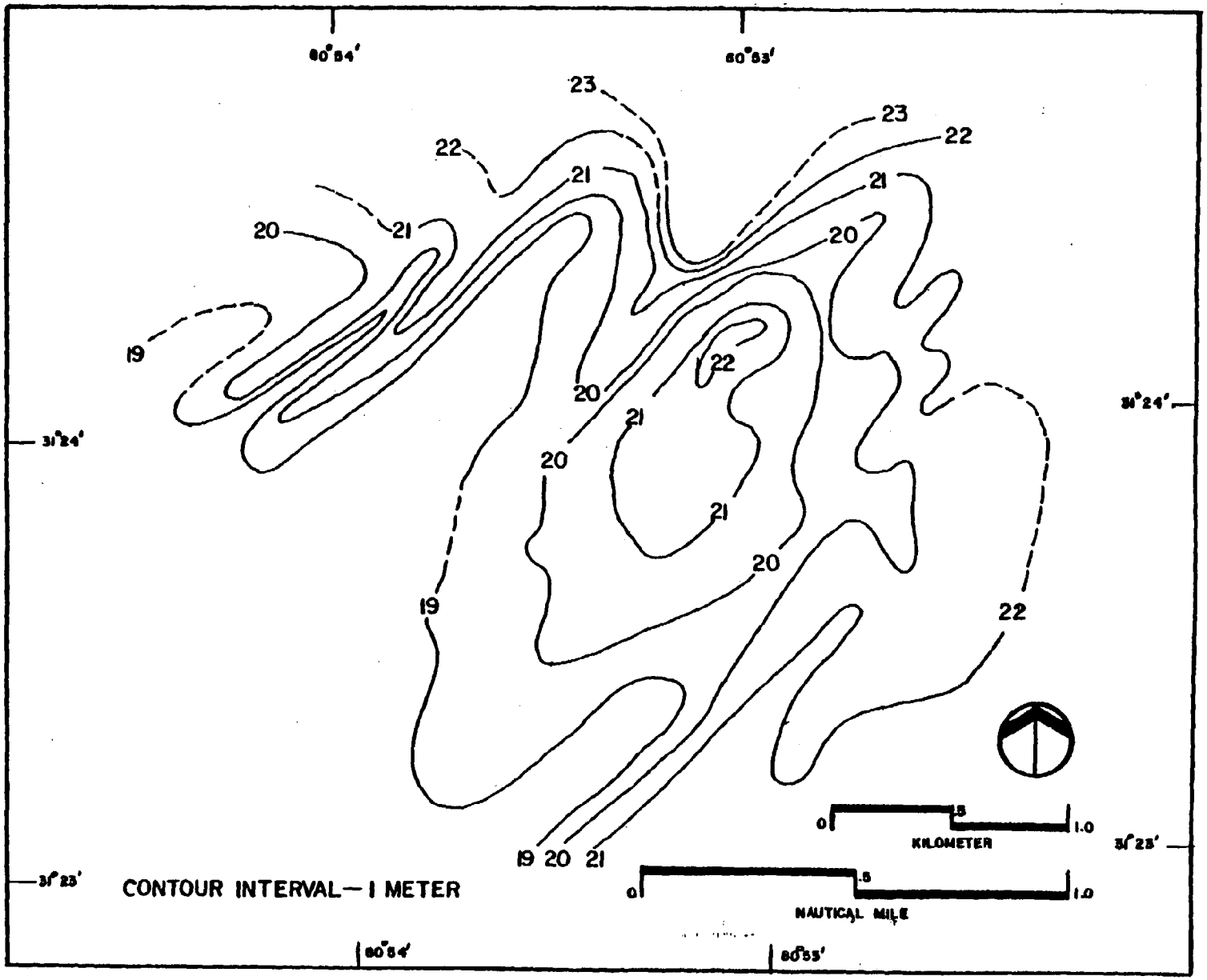
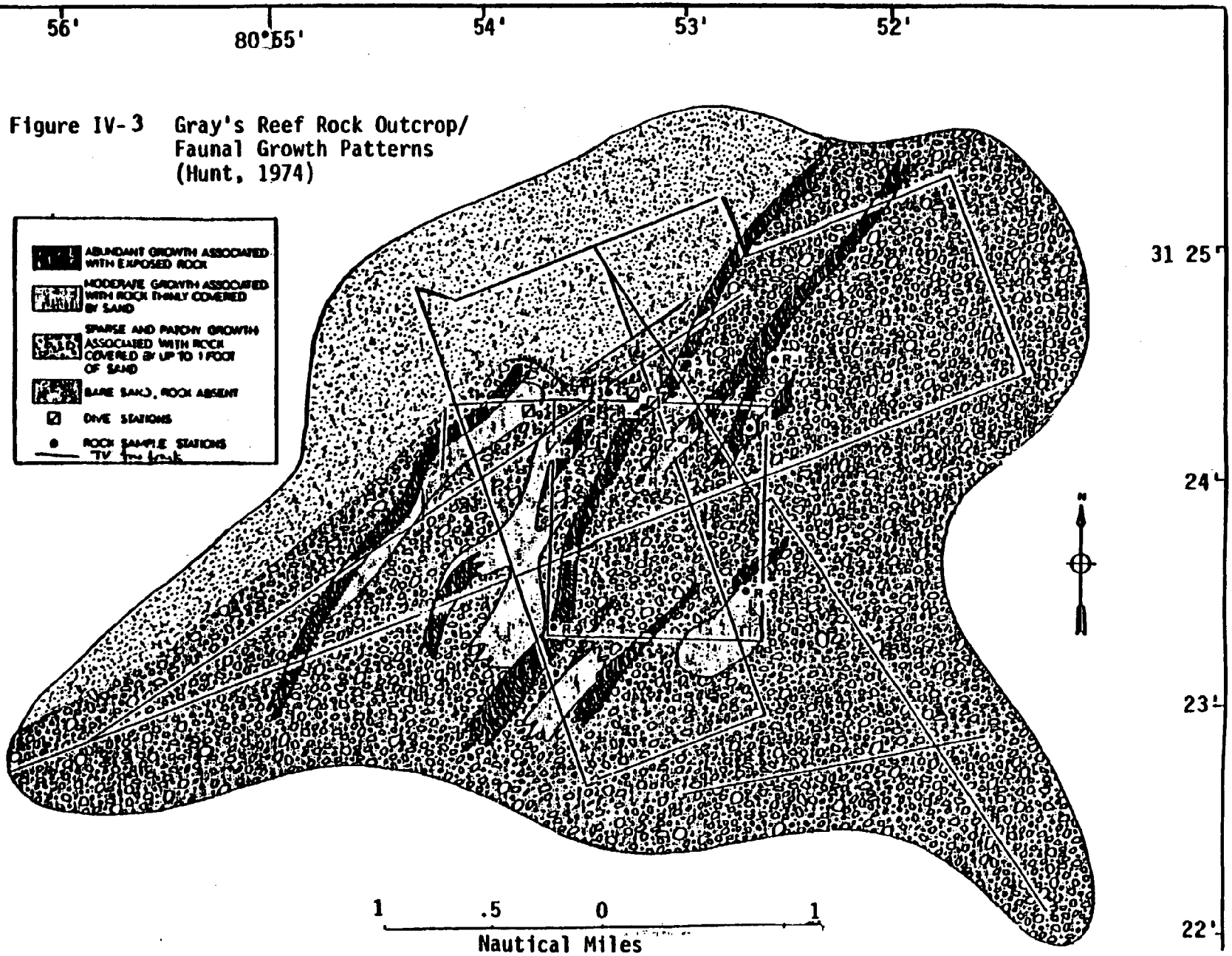


Figure IV-3 Gray's Reef Rock Outcrop/
Faunal Growth Patterns
(Hunt, 1974)



Total vertical relief encountered at Gray's Reef is estimated at 2-6 m (6.5-20 ft) (Hunt, 1974; Henry, 1979, pers. comm.; Hunt, 1979, pers. comm.). Relief of this extent is rare in inner shelf areas and is generally only encountered in middle and shelf-edge zones (Henry and Giles, 1978; Pompenoe, 1979, pers. comm.).

Morphological features of the Gray's Reef live bottom structure include overhanging ledges, caves and burrows of various sizes, and sandy rock-littered troughs (Figure IV-4). Hunt (1974) described a cave beneath an overhanging ledge which measured approximately 1.2 m (4 ft) in height, 9.1 m (30 ft) in width and at least 3.0 m (10 ft) in depth. He noted that part of the ledge was broken off and scattered across the sand bottom. Small caves, burrows and ledges up to 22 cm (8 in) high and/or wide are common throughout the proposed area. The bottom substrate, with few exceptions, represents the top layer of the rock. The flat upper surfaces of rock and shallow-buried hardbottom may be covered by a veneer of sediment up to 30 cm (1 ft) thick. Rock associated with ridges and scarps is exposed (Hunt, 1974).

Hunt (1974) described the geology and origin of Gray's Reef. Unlike reefs deposited by calcareous coral or algae, Gray's Reef is a layer of limestone rock (moderately to strongly dolomitized, sandy biomicrite). Evidence suggests that the reef substrate was deposited tens of thousands of years ago in a marine environment experiencing intermittent wave energy. Fossil remains of certain mollusks, bryozoans, echinoids, and corals suggest that deposition occurred in shallow water, possibly along a shoal or bar. For example, fossil remains of the oyster Crassostrea virginica and the clam Mercenaria mercenaria suggest an estuarine-like environment and those of the Pleistocene pelecypod Amusium species in upper rock layers indicate a calm, shallow environment.

Hunt (1974) theorized that following deposition, the reef substrate was subjected to an increasingly dry climate when seawater in shallow and possibly restricted bays or lagoons evaporated and that the resulting heavy brines seeped down through the deposits, causing extensive dolomitization (chemical alteration and recrystallization of carbonate rock from a calcium-rich limestone composition to magnesium-rich dolomite composition).

Fluctuating sea levels during the Pleistocene Epoch may have subaerially exposed the consolidated rock more than once and may have precipitated deformation of the rock structure. Pores in rock and recrystallized minerals are interpreted as signs of fresh groundwater intrusion. Rock outcrop patterns, undercut ledges, and large blocks of broken rock suggest exposure to wave action, perhaps during the latest sea level transgression beginning approximately 18,000 years ago. After the last inundation, the live bottom community began to develop. The substrate has apparently undergone little change since that time, except perhaps some collapse of reef ledges and possibly exposure of fresh rock surfaces for live bottom community development (Hunt, 1974).

Preliminary seismographic data for the southeast coast show no major geological faults in the vicinity of Gray's Reef, although minor earthquakes, while relatively infrequent, have occurred in the vicinity. Since 1754, more than 400 minor earthquakes have been recorded in the South Atlantic Bight. In 1886, a major earthquake centered near Charleston, South Carolina affected an area of over 1287 km (695 nmi) in radius, including the Gray's Reef area (BLM, 1978).

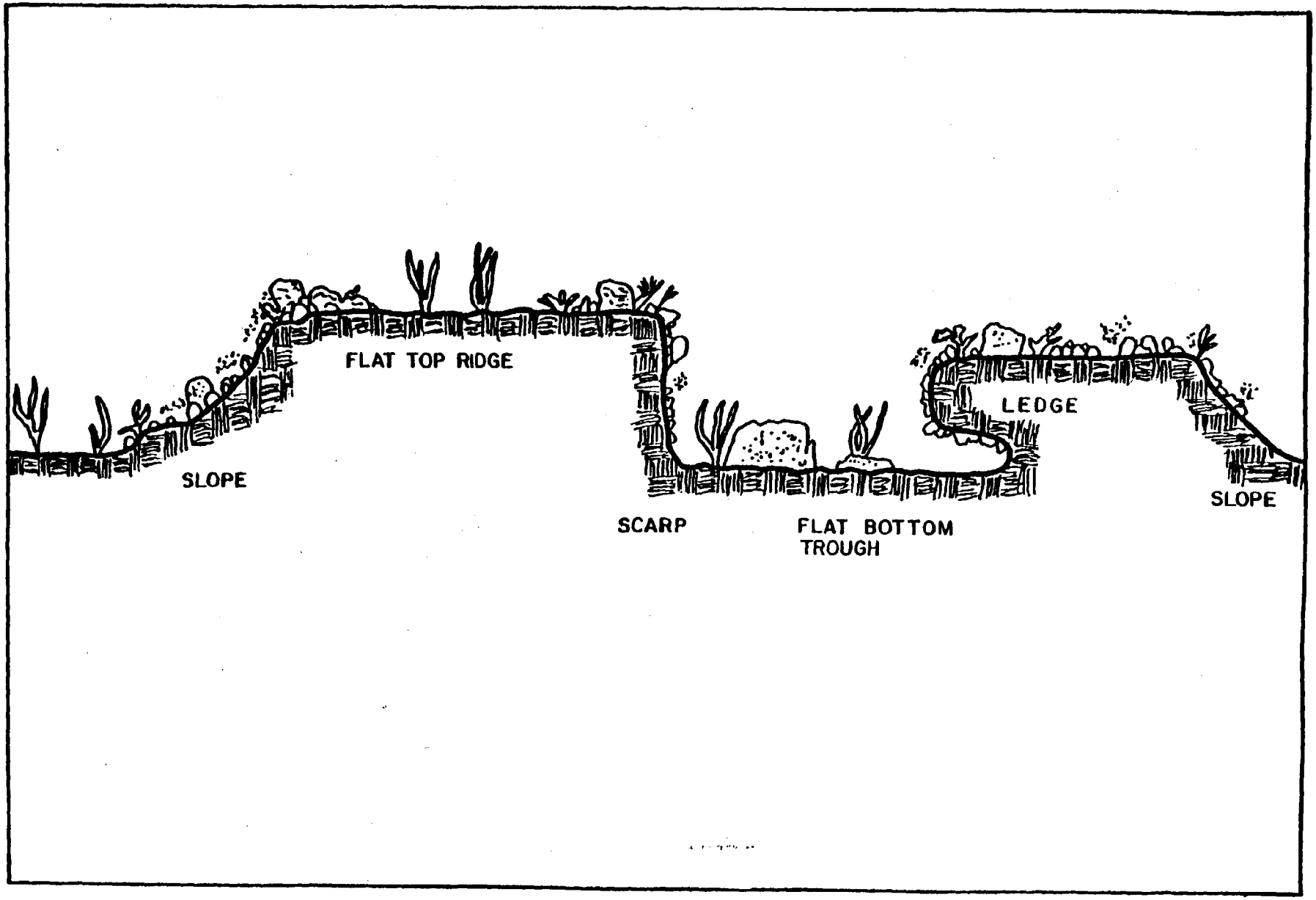
C. Oceanographic Setting

Continental shelf water of the Georgia Bight is divisible into two regions based upon dominant hydrographic features: a freshwater/weather-influenced inshore (coastal water) zone and a Gulf Stream-influenced offshore (shelf water) zone. Coastal water is immediately adjacent to shore and is composed of both river effluent and shelf water. Cape Hatteras, North Carolina acts as an effective barrier between southeastern coastal water and colder water masses (the Virginia Current) to the north although northern waters periodically breach the Cape (Cerame-Vivas and Gray, 1966). The Gulf Stream flows along the shelf break and is the source of warm saline water onto the shelf. Gray's Reef is located on the inner shelf between the seasonally shifting inshore coastal and offshore shelf water masses in a transitional wind-driven regime.

Variations in local continental weather and drainage patterns have a significant effect on the hydrography of coastal waters of the Georgia Bight, with air temperature, rainfall, wind speed and direction and coastal runoff being the most influential factors. Tributaries emptying into the Bight drain extensive areas of the southern Piedmont Province and the southeastern Coastal Plain. Astronomic tides along the Georgia coast are semi-diurnal and have a maximum range of 2.75 to 3.0 m (9 to 10 ft) and a normal range of approximately 1.8 m (6 ft). Monthly freshwater runoff can be high (e.g., from 1 to 5 cubic km between Cape Romain, South Carolina and Fernandina Beach, Florida) (Atkinson, Blanton and Haines, 1978). Southeastern rivers and estuaries carry heavy loads of easily eroded and suspended materials (Milliman et al., 1972). When not trapped in estuaries or coastal marshes, suspended materials are expelled into the nearshore zone. Along the coast of Georgia, sediment-laden runoff plumes from numerous inlets protrude into nearshore shelf waters and merge to form a band of turbid, low density, brackish water (12-33 parts per thousand (ppt) salinity) approximately 10 to 20 km (5.5 to 11 nmi) wide (Brokaw and Oertel, 1976). Most suspended particulate material is retained in this nearshore zone, although outwelling may occur during severe weather. An accumulation of cordgrass (Spartina alterniflora) under rock outcroppings and in crevices at Gray's Reef gives evidence of some seaward transport (Ansley, 1979, pers. comm.).

The fate of coastal water on the shelf; i.e., subsequent dispersion and mixing, is determined to a large part by prevailing hydrographic and meteorological conditions (e.g., tides, currents, density gradients, and wind stress) as well as local coastline and shelf topography. Turbid brackish coastal water is mixed horizontally and vertically with more saline offshore water in the inner shelf zone off Georgia in a fashion

Figure IV-4--Gray's Reef Topography Source: Hunt (1974)



similar to hydrographic entrainment in a traditional "salt-wedge" estuary; i.e., less dense river water forms the upper water layer while saline sea water makes up the lower level and mixes upward to increase the salinity of the surface waters as the flow moves seaward (Blanton and Atkinson, 1978).

Gray's Reef is located just seaward of the zone of coastal water influence. However, under conditions of peak spring runoff, strong solar heating and weak tidal energies, the nearshore brackish water/turbidity front may extend seaward across the shelf 30 km (17 nmi) (Brokaw and Oertel, 1976). On such occasions, coastal water may be found in the vicinity of Gray's Reef. (For additional descriptions of nearshore/offshore transfer processes in the Georgia Bight, see Neiheisel and Weaver (1967), Bigham (1973), Haines and Dunstan (1975), Brokaw and Oertel (1976), Atkinson, Blanton and Haines (1978), Blanton and Atkinson (1978), Blanton and Chandler (1978), and Blanton et al. (1978).)

In contrast to nearshore coastal water, offshore water in the Georgia Bight is more saline (33 to 36 ppt) and clear with secchi disc recordings (vertical underwater visibilities from the surface) in excess of 10 to 40 m (33 to 131 ft). Offshore water is less influenced by continental weather and drainage systems and is dominated by the Gulf Stream which parallels the shelf break. At times, distinct bodies of Gulf Stream water, referred to as eddies, meanders and intrusions, are encountered well into middle shelf areas (Dunstan and Atkinson, 1976). Intrusions are associated with the upwelling of cool, nutrient-rich deep water along the outer shelf. Under certain wind and current conditions, and especially during summer, Gulf Stream water will commonly intrude across the shelf off northeastern Florida and the Carolinas and to a lesser extent off Georgia. The mode of intrusion; i.e., whether Gulf Stream water overrides, interlayers or intrudes under shelf water, depends primarily upon ambient shelf water densities (Atkinson, 1977). In summer, shelf water is warmer and less dense, and Gulf Stream water intrudes on the bottom. During winter, cooler nearshore water cascades down the shelf and Gulf Stream water overrides on the surface (Stefansson et al., 1971). The chemical and biological effects of Gulf Stream intrusion are currently under study (Atkinson, 1980, pers. comm.).

The variability of oceanographic parameters and the general distribution of water masses in the South Atlantic are thus directly related to the influence of nearshore and offshore conditions. A composite description of oceanographic parameters is summarized below from Jacobson (1974) and BLM (1978), unless otherwise indicated, and specific reference is given to Gray's Reef, where data are available (Hunt, 1974).

1. Temperature

Surface water temperatures follow seasonal air temperatures, with a slight lag. Nearshore in the South Atlantic, surface temperatures often show wide seasonal variation in response to varying climatic and runoff patterns and commonly range from 10 to 25°C (50 to 77°F). In the offshore zone, surface temperatures also respond to climatic changes, but are mod-

erated by the consistently warm (25°C-- 77°F) Gulf Stream and thereby show only minor seasonal variations. In midshelf areas, surface water temperatures are relatively constant (19 to 27°C- 66 to 80°F) year round.

Distinct surface temperature gradients (isotherms) parallel the southeastern coast, with temperatures increasing with distance from shore. During the fall and winter, isotherms are closely packed when coastal waters are cooler than offshore Gulf Stream waters. During the summer, solar heating uniformly warms surface waters across the shelf and isotherms effectively disappear.

Bottom water temperature isotherms also generally parallel the coast, but because depth varies across the shelf, bottom temperatures respond to different influences. Nearshore, bottom temperatures show a wide annual range in response to seasonal air temperatures and wind mixing. Offshore at deeper depths, bottom temperatures are not readily influenced by weather or wind and are more stable. Two factors possibly influence deep water temperatures; i.e., Gulf Stream intrusions (Blanton, 1971) and cascading of chilled surface waters down the shelf during winter (Stefansson, et al., 1971).

Vertical temperature gradients are relatively small year round, with temperatures decreasing with depth through the water column and bottom temperatures decreasing with distance from shore.

Hunt (1974) recorded surface water temperatures at Gray's Reef averaging 14°C (57°F) in winter and 28°C (82°F) in summer and noted a thermocline of several degrees C at depths from 7 to 10.7 m (25 to 35 ft) below the surface.

2. Salinity

Salinity distribution across the South Atlantic shelf is quite variable, although in general surface salinity contours parallel the coast with salinity increasing appreciably across the shelf from nearshore freshwater-influenced zone (27 ppt) to offshore Gulf Stream-dominated waters (37 ppt). Salinity shows no distinct seasonal variation, except perhaps during periods of low runoff (e.g., fall and winter) or when Gulf Stream waters eddy shoreward. Surface salinity data recorded at the Savannah Lightship (located to the north of Gray's Reef) show a minimum salinity in spring of greater than 32 ppt and a maximum in fall of greater than 34 ppt. Generally, a 35 ppt isohaline follows the 18 m (10 fm) water depth contour. Salinity values recorded by Hunt (1974) at Gray's Reef ranged from 34 to 36 ppt, values typical for shelf water.

On the shelf, bottom salinity is variable, increasing with depth and distance from shore, but in general is around 34 ppt. Bottom salinity is lowest inshore, especially off Georgia and northern Florida (Wenner et al., 1979).

3. Density

Density of seawater responds to temperature and salinity characteristics. Densities on the South Atlantic shelf are fairly high although localized reductions may occur at any time of the year due to increased freshwater runoff. In the winter, nearshore water may be sufficiently cooled to become denser than water offshore and may cascade down the shelf. During the summer, a weak reverse density gradient may occur. No density measurements have been made at Gray's Reef.

4. Dissolved Oxygen

Trends in dissolved oxygen concentration are not readily apparent due to the responsive nature of oxygen content in the water to biological events (respiration and photosnythesis) and to physical processes (turbulent mixing, diffusion and advection). Dissolved oxygen is generally higher in surface waters during winter in response to lower temperatures (e.g., increased solubility and retention capacities) and increased turbulence (e.g., mixing and aeration). Deeper water generally exhibits a lower dissolved oxygen content.

Hunt (1974) recorded dissolved oxygen concentrations at Gray's Reef which ranged from 4.5 to 6.0 milliliters per liter.

5. Suspended Materials

Turbidity increases towards shore because most suspended particulate material is restricted to within 10 to 20 km of the coast. At Gray's Reef, which is just seaward of the nearshore turbidity/deposition zone, turbidity levels generally vary with sea condition and tide. Underwater horizontal visibilities may range from 1 to 7 m (5 to 30 ft) with best visibilities occuring around high tide in calm weather (Hunt 1974).

6. Nutrients

Nutrient concentrations (nitrates, phosphates and silicates) are useful in identifying or confirming the existence of various water masses on the shelf. Nutrient concentrations are low in surface layers, except in coastal waters in the immediate vicinity of river discharge. Concentrations generally increase with water depth and distance from shore in response to nutrient release via organic decomposition and as a result of up-welling of nutrient-rich deep slope waters onto the shelf. Off the Georgia/Carolina coast, gyres which occur seasonally and annually tend to recirculate nutrients received from coastal areas and upwelled from the shelf edge and slope. (These gyres also tend to accumulate substances discharged into tributaries and the littoral zone.) Temporal changes in nutrient concentration occur in the surface layers, and to a lesser extent in bottom layers (Atkinson, Paffenhofer, and Dunstan, 1978). Nutrient concentration levels for Gray's Reef are not available.

7. Circulation

Circulation in the South Atlantic Bight is affected primarily by freshwater runoff, wind, and the northerly flowing Gulf Stream, and to a minor extent by tidal currents, which proceed in a clockwise fashion, and the Coriolis effect. Bumpus (1955; 1973) reported on drift bottle recoveries in the South Atlantic during the period 1960-1970 (see Appendix D) and much of what is presently known about circulation in the Georgia Bight is derived from these studies. Surface currents in the vicinity of Gray's Reef have been studied only indirectly, in relation to regional circulation patterns.

Surface circulation is northeasterly off the Carolinas and intermittent off Georgia and Florida, with a northerly drift in the autumn and winter (see Figure IV-6). A southerly flowing coastal current prevails nearly year round, inshore of a predominant northeasterly drift offshore, except during winter when runoff is low and when northeasterlies blow for several days (Bumpus, 1955). Kuroda and Marshall (1973) noted that circulation off Georgia is strongly influenced by the prevailing winds which are most often northeasterly or southwesterly.

Bottom currents off Georgia show no consistent pattern and it is speculated that these currents are influenced by indrafts from the northerly flowing Gulf Stream. Ripple marks in the sediment in and around rock outcroppings at Gray's Reef indicate prevailing currents; SCUBA divers attest to their presence. Reefs often provide areas of calm bottom water or favorable bottom currents by damping or deflecting currents and it has been noted that vertical relief of natural patch reefs or live bottoms causes an upwelling effect (Stone, 1978; Stone et al., 1979).

8. Offshore Wave Climate

Offshore waves are formed by the transfer of wind energy to water, and are thus referred to as wind waves. Wind waves are of two types: (1) sea waves which are often fairly steep with irregularly or churned surface water and which travel in the direction of the prevailing wind and (2) swells which are no longer under the influence of the generating wind and which are usually regular in shape and show minimal wave steepness. A "confused" sea is created when both sea waves and swell occur in an area at the same time.

Gray's Reef is located in an area of the South Atlantic where, on an annual basis, waves come from all directions about the same percentage of the time with slightly larger amounts coming from the east and northeast. Seas of less than 4 ft occur 59 percent of the time while wave heights of greater than 12 ft occur less than one percent. As the waves pass from deep water into shallow coastal areas, the existing wave condition is modified and often weakened in embayed areas by refraction, shoaling and bottom friction (Jacabson, 1974). Wave conditions are more severe during fall and winter in response to weather conditions. During the winter months, the Gray's Reef area is subject to extra-tropical storms, frequently known as Hatteras lows, and during the summer and fall, to tropical storms and hurricanes originating in the Caribbean and the Gulf of Mexico.

D. Living Marine Resources

The living marine resources of interest in this study are the variety of resident benthic plants and invertebrates and demersal fishes associated with live bottom areas in the South Atlantic and the more transient pelagic planktons, fishes, turtles and marine mammals which are encountered at or near live bottoms infrequently or on a seasonal basis.

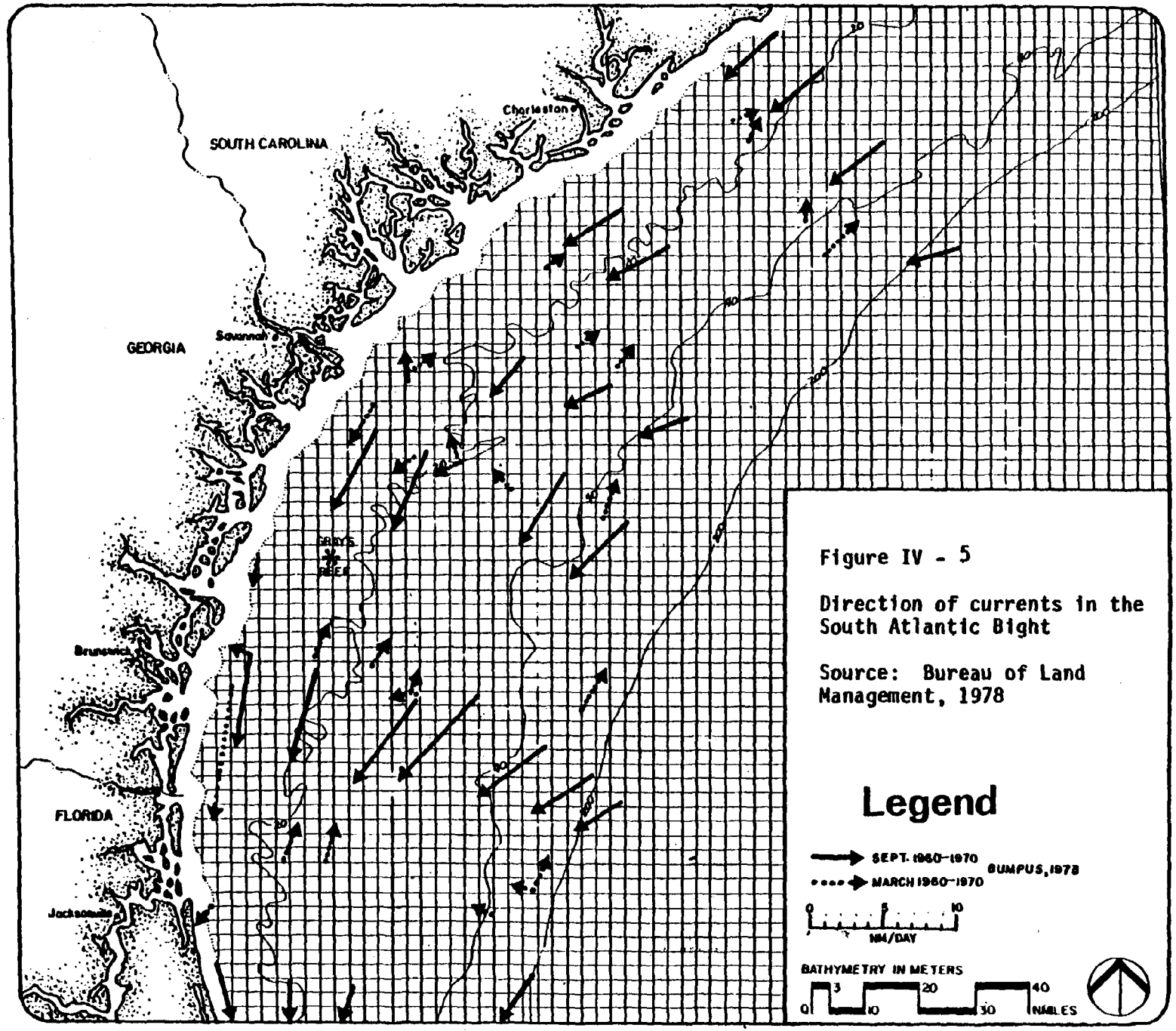
Seasonally variable physical and chemical oceanographic processes and benthic habitat types profoundly influence biological communities in the South Atlantic. Biogeographic distribution patterns have been described for some of the more conspicuous bottom and near bottom macro flora and fauna. Cerame-Vivas and Gray (1966) described the distribution of epifaunal invertebrates on the South Atlantic shelf in terms of three biogeographic provinces: an inner-shelf Virginian Province, containing a mixture of inshore and northern species; a mid-shelf Carolinian Province, containing temperate species; and an offshore tropical or Caribbean Province, containing primarily southern species. Schneider (1976) described the distribution of benthic seaweeds similarly. Struhsaker (1969) correlated the distribution of demersal fisheries with topography and described five physical habitat types: coastal, open-shelf, live bottom, shelf-edge, and lower-shelf. George and Staiger (1979) added seasonal dimensions to earlier findings on epifaunal invertebrates and demersal ichthyofaunal (bottom fish) distribution. Tenore (1979) compared macroinfaunal affinities with bottom sediments and hydrographic features of inner, middle, and outer shelf sedimentary zones.

Preliminary species lists for the Gray's Reef area appear in Appendices E, F, and G. Much of the available information is derived from Gray's (1961) collection catalogue, from recent survey work (Hunt, 1974; Harris, 1978) and from a variety of reports and personal communications with persons knowledgeable in the field. Benthic and demersal species are similar to those associated with other inshore hardgrounds found in the South Atlantic and in the northwestern Gulf of Mexico; that is, a dominant assemblage of Virginian and Carolinian biota, with minor and more seasonal tropical (West Indian) components. No quantitative data exist, however, on community dynamics, sizes of populations, spatial and temporal patterns, and nature and role of live bottom areas in overall coastal and marine ecosystems.

1. Plankton

Plankton communities in the Georgia Bight have not been extensively studied. Some of the available information applies to inner shelf areas off Georgia; none, however, applies specifically to live bottom areas or to Gray's Reef.

Hulbert and Rodman (1963) found that phytoplankton numbers and diversity were highest in low salinities nearshore within the 10 fathom (60 ft) contour. Hulbert and MacKensie (1971) attributed high abundance (e.g., between 30 and 1000 cells/ml) to a combination of environmental factors; i.e., cool temperatures, semi-isolated onshore waters and salinity


SOUTH CAROLINA
Charleston
GEORGIA
Savannah
Brunswick
FLORIDA
Jacksonville
Figure IV - 5
Direction of currents in the South Atlantic Bight
Source: Bureau of Land Management, 1978
Legend
SEPT. 1960-1970
MARCH 1960-1970
BUMPUS, 1978
0 5 10
NM/DAY
BATHYMETRY IN METERS
0 3 10 20 30 40
NAUTICAL MILES

and nutrient distribution. Haines and Dunstan (1975) studied phytoplankton dynamics in Georgia shelf waters and noted recurrent short-term, non-seasonal blooms in nearshore zones. They attributed the infrequent pulses in productivity to processes which mix and bring nutrients and phytoplankton into the photic zone (e.g., weather-induced turbulence) and to conditions which increase the supply inorganic nutrients in shelf waters (e.g., discharges from coastal tributaries and Gulf Stream intrusions). Thomas (1966) measured areal net primary production in nearshore waters off Georgia and recorded increasing values with increasing distance from shore and increasing water clarity.

Diatoms dominate the phytoplankton in the Georgia Bight shelf waters, with tropical dinoflagellates becoming more important during the summer (Marshall, 1971). Major diatoms encountered are Skeletonema costatum and Rhizosolenia alata. Varieties and numbers of phytoflagellates are greatest offshore in the vicinity of the Gulf Stream (Marshall, 1971). Representative cyanophycean (bluegreen algae) are found at both inshore and offshore locations in the Geogia Bight and several cyanophycean assemblages are distinguishable in apparent response to specific areas of upwelling, nutrient depleted waters and the Gulf Stream (Marshall, 1979).

Zooplankton has not received much attention in the South Atlantic. The most extensive collections were made in the early 1950's by the R/V T.N. Gill Cruises (Anderson et al., 1959) from which detailed reports on certain groups have evolved. Much of the material presented herein is derived from these studies, because zooplankton populations have not been studied at Gray's Reef.

Zooplankton includes holoplankton (animals which spend their entire life cycle in the plankton, such as copepods, chaetognaths and pteropods), and meroplankton (temporary planktonic stages of miscellaneous coelentrates, polychaetes, crustaceans, molluscs, tunicates, fish and other organisms). Fish eggs and larvae are generally referred to as icthyoplankton. Generally, zooplanktors in the the South Atlantic exhibit an inshore/offshore zonation by species (increase in diversity) and numbers (decrease in standing crop) which often correlates with specific water masses (e.g., coastal waters, inner and outer shelf waters, the Gulf Stream and the Sargasso Sea). Densities of meroplankton and ichthyoplankton tend to increase from north to south, implying that southern waters may be a source of eggs and larvae of adult organisms found in the South Atlantic. There is no major seasonal change in zooplankton community structure and abundance, except that most meroplankton tend to be present in greatest numbers and represent a large fraction of the total zooplankton during the warmer months.

Powles and Stender (1976) studied the distribution of icthyoplankton in the South Atlantic in an attempt to describe the integrity of finfish populations commonly encountered in the region. Juvenile and adult stages of many of the ichthyoplankton studied are associated with live bottom habitats. Several distributional patterns are discernable: (1) a slope pattern typical of fish characteristically found offshore in depths greater than 200 m; (2) a shelf pattern dominated by species spawning offshore but which are found as juveniles in estuarine and coastal areas;

and (3) a shelf/slope distribution resulting from either fish spawning on shelf and subsequent transport of larvae into slope waters (as in Bothidae, Serranidae, Monacanthidae and some Carangidae) or fish spawning in neritic waters and subsequent larval transport nearshore (as in Muglidae, Pomatomidae and some Carangidae). Young carangids and serranids show additional zonation in spring in the form of two discrete bands: one on shelf and another over the slope. The authors suggest that slope ichthyoplankton are spawned in areas outside of the South Atlantic Bight and are imported via the Gulf Stream and that shelf ichthyoplankton are spawned on the shelf by breeding populations and exhibit restricted onshore/offshore movement.

Nearshore mud/sand bottom areas, live bottoms and grass beds serve as nursery areas for many postlarval and juvenile stages of marine invertebrates and fishes. The function of Gray's Reef in this respect has not yet been investigated.

2. Benthic Seaweeds

Relatively little is known about the offshore occurrence, distribution and trophic significance of benthic macrophytic algae (attached seaweed) and seagrasses in the South Atlantic. While a few studies provide information on floral assemblages off the Carolinas and off northeastern Florida, there remains a tremendous void of knowledge concerning seaweeds offshore Georgia. Other than collections by Chapman (1971) offshore Sapelo Island, information on benthic algae off Georgia is largely from inference and personal observations.

Most benthic seaweeds are found on firm substrate or hardground. Searles and Schneider (1978) reported over 300 seaweed species (classes Rhodophyceae, Xanthophycae, Phaeophyceae, Prasinophyceae, and Chlorophyceae) off North Carolina. Most offshore flora have centers of distribution in the Caribbean whereas those found nearshore have a more northern range (Schneider, 1976). One might expect to find many of these same species offshore Georgia and many at Gray's Reef (Blair, 1980, pers. comm.; Joe Richardson, 1980, pers. comm.). A preliminary list of species likely to be found at Gray's Reef is presented in Appendix E.

3. Benthic Invertebrates

a. Sand Bottom Communities

There are few comprehensive studies on the soft bottom benthic communities on the South Atlantic shelf and none directed specifically to the sedimentary communities around live bottom areas. In some isolated cases, the location and physical description of a few study sites offshore Georgia are similar to the Gray's Reef area, as described below, and therefore, sand bottom communities may be similar.

Frankenberg (1971) and Frankenberg and Leiper (1977) studied seasonal cycles in inshore and offshore soft bottom benthic communities off Sapelo Island, Georgia and concluded that macrobenthic communities on the Georgia Shelf vary spatially and temporally. One offshore sampling station was located quite close to Gray's Reef (Station F2 at 31° 25.5'N

longitude by 81° 48.0'W latitude) and was similarly described: 21 m (69 ft) water depth at low tide, 33 to 36 ppt salinity range, 0.74 mm median grain, coarse sand and 38.55 km (21.4 nmi) from shore. Dominant species at "F2" year round included the cephalochordate Branchoptoma caribaeum, the amphipods Paraphoxus floridanus and Acanthohaustorius grayi, and the polychaete Glycera capitata. Certain inshore species were found offshore seasonally. The polychaete Spiophanes bombyx, the sharp-tailed cumacean Oxyurostylis smithi, and the tube-dwelling amphipod Ampelisca compresa were found offshore from January to June; mysid shrimps Gastrosaccus johnsoni, from May to December; and the amphipod Lembos sp., the common razor clam (pelecypod) Ensis directus, the syllid polychaete Syllis cornuta, the spionid polychaete Scolelepis squamata, the brittle star Amphipholis squamata, the hermit sipunculid Phascolion strombi and urchin (Echiniod) juveniles from February to May. Many of these species could be encountered at Gray's Reef.

Smith (1971; 1973) studied infaunal community structure and function at an offshore station off Sapelo Island, Georgia (31° 23' 23" N, 81° 13' 45" W, 7 m depth). This study site was inland and to the southwest of Gray's Reef, however, infauna encountered may be similar. A total of 103 invertebrate species in 10 phyla were collected over a one year period. The fauna were dominated by polychaetes (36 spp.) followed by molluscs (31 spp.) and crustaceans (21 spp.), with numerical dominants including Notomastus sp. and Spiophanes bombyx among the polychaetes, Abra aequlis and Tellina texana among the molluscs and Oxyurostylis smithi, Callianassa sp. and Pinnixa chaltopteraxa (commensal with Callianassa) among the crustaceans. The abundance of the total fauna changed seasonally with peaks occurring between January and March.

Dorjes (1972) recognized two distinct benthic communities offshore Sapelo Island, between the beach and 15 km (8 nmi) offshore: an upper offshore (nearshore) Hemipholes elongata community and a lower offshore Moira atropos/Branchioptoma caribaeum community. Leiper (1973) sampled at three stations offshore Sapelo Island and found 322 species in 21 phyla. Differences in community structure were noted among stations (increase in number of species with depth although number of individuals was variable) and among seasons (greatest seasonal variation at shallow depths). Leiper (1973) also compared infauna by feeding types present and concluded that the proportion of deposit feeders declined with distance offshore while the proportion of suspension feeders increased and that these proportions change seasonally.

Tenore et al., (1978) studied benthic processes over a wide area of the Georgia Bight and found soft bottom or sedimentary regimes to be generally impoverished of benthic fauna. They suggested that benthic communities at shallow water depths are limited by a number of prevailing environmental conditions, including: unfavorable sediment composition; low nutrient levels; low primary productivity; wind stress; tidal scour and low temperatures. Tenore (1979) described the macroinfauna of the Georgia Bight as an oligotrophic system characterized by low mean density and biomass and high species diversity. Most species were considered rare. Although polychaetes dominated the macroinfauna there were no clearcut dominants. Seasonal variations were detected, with mean density, biomass and total numbers of species being

highest in the spring and lowest in the summer. Infaunal biomass was low on the outer shelf, relatively high on the middle shelf, and fluctuated greatly at inner shelf locations. Any high biomass values in middle and outer shelf locations were attributed to the influence of scattered hardbottom reef communities in the sampling area. A study of the infauna at Gray's Reef may provide similar data.

Soft bottom communities provide foraging areas for major commercial and recreational fisheries in the South Atlantic. Although they may not contain the dense and diverse assemblages of life found in hard bottom areas, soft bottoms play a significant role in the strucutre and function of marine ecosystems.

In summary, while soft bottom communities in the vicinity of live bottom areas have not received systematic study, it is generally believed that these aggregations are richer and more diverse than those found in non-live bottom sedimentary regimes. It is speculated that outcrops of rock or other hardground serve to capture, conserve and cycle nutrients from detritus and plankton in ocean waters which, in turn, contributes to the productivity of the associated soft bottom communities.

b. Hardbottom Epifaunal Communities

Hardground provides firm, stable substrate and multiple micro-environments for a variety of benthic invertebrates. Benthic communities of hard or live bottom areas in the South Atlantic are virtually unknown in terms of taxonomic composition and of ecological processes (Boesch, 1977). Sketchy information on benthic hardground communities of this region is available in the literature: shelf coral outcroppings off Mid-North Carolina (MacIntyre, 1970; McCloskey, 1970; Huntsman and MacIntyre, 1971; Huntsman, 1976); coquina limestone reefs off the Carolinas (Milliman, et al., 1968; McCloskey, 1970); ancient Lithothamnion algal deposits just seaward of the shelf break off North Carolina (Mengies, et al., 1966; Cain, 1972); black rock reefs off North Carolina (Pearse and Williams, 1952); and live bottom areas of patch rock/coral outcroppings off South Carolina and Georgia, including the Gray's Reef area (Shoemaker, 1972; Hunt, 1974; George and Staiger, 1978; Shoemaker, et al., 1978) and off Florida (Moe, 1963; Avent et al., 1977). Unpublished collection notes and species lists from extensive sampling in hardbottom areas off Sapelo Island, Georgia are also available (Gray, 1961). The literature generally describe atypical species such as tropical corals, species easily identified, or species of a particular interest. There are no data on population densities, temporal and spatial relationships, metabolic processes and energy dynamics or other community characteristics.

Many sessile (attached or sedentary) invertebrates are associated with the Gray's Reef live bottom (Hunt, 1974), including hard and soft corals, sponges, hydroids, ascidians (tunicates), bryozoans, barnacles, attached bivalves and tube-building worms (see Appendix F). Most of these organisims require a firm bottom, relatively devoid of a superficial sediment for larval (stock) recruitment, attachment and subsequent development and most are dependent upon the surrounding fluid environment for nutrients (e.g, through filter feeding), information exchange, waste control and various aspects of their reproductive cycles, (e.g., gamete, egg and larvae dispersion).

Hunt (1974) described conspicuous sessile benthos at Gray's Reef. The occurrence and distribution of the benthos varied according to the degree of substrate exposure above the ocean floor and the physiomorphology of hard surfaces. Exposed, flat hard surfaces supported abundant epifaunal growth and densities decreased with increasing sediment coverage.

The hard corals found at Gray's Reef are near the northern limit of their geographical range (McCloskey, 1970). They are found in patchy distribution on the live bottom and often as solitary heads. Data from preliminary in situ metabolic studies conducted at Gray's Reef during the summer of 1979 indicated that the hard coral Oculina sp. was living fairly close to temperature and light intensity tolerance limits (Porter, 1979, pers. comm.).

Hard corals identified thus far include star coral (Astrangia danae =A. astreiformis), branching eye coral [Oculina sp. = O. varicosa (Leseur) and/or O. arbuscula (Verrill)], cup coral Phyllangia americana and Paracyanthus convertus (Porter, 1979, pers. comm.; Shipman, 1979, pers. comm.). Further studies will probably reveal the presence of other hard corals at the live-bottom: stump coral (Solenastrea hyades); tube coral (Cladocora arbuscula); and brain coral (Montastrea annularis) (Porter, 1979, pers. comm.).

Gorgonian sea fans and sea whips (octocorallian corals) are abundant on Gray's Reef. Their skeletons are in the form of calcareous spicules and their appearance ranges from delicate and feathery to rubbery and whiplike to tough and rigid. Species encountered at Gray's Reef include the sea fan Titanideum frauenfeldii and the sea whips Leptogorgia setacea, Lophogorgia hebes and possibly Leptogorgia virgulata (Hunt, 1974; Porter, 1979, pers. comm.).

Other octocorallian corals at Gray's Reef include the three species of Telesto corals collected by Hunt (1974), one of which is suspected to be a range extension.

Tunicates, or sea squirts, and especially the large pink ascidian Eudistoma sp., make up a large proportion of reef benthic biomass (Porter, 1979, pers. comm.). Large basket or vase sponges (Ircinia campana) are also prominent features at Gray's Reef.

In many respects, the epifaunal assemblages at Gray's Reef are different from those encountered on midshelf and outer shelf reef formations (George and Steiger, 1978). Epibenthic populations on the inner shelf show significant seasonal change in response to wide thermal variation; i.e., water temperatures range from 8°C - 47° F in winter to 28° C - 82° F in summer. Inshore species are either eurythermal (capable of tolerating a wide range of temperatures) or appear seasonally under favorable conditions.

Conversely, midshelf and outershelf live bottom communities contain more warm steno-thermal species which experience little or moderate seasonal thermal variation. Midshelf live bottom reefs are dominated by the hard corals Siderastrea siderea, which are able to tolerate

moderate winter temperatures (MacIntyre and Pilkey, 1969; MacIntyre, 1970). George and Staiger (1978) reported extremely high epifaunal biomass (sponges, tunicates and soft corals) at a midshelf reef formation off South Carolina. Outershelf live bottom areas under the influence of the warm Gulf Stream contain faunal assemblages more typical of the tropical Caribbean reef fauna (Menzies et al., 1966).

Motile invertebrates are found intermittently on and about limestone outcrops at Gray's Reef (See Appendix F). The Phylum Mollusca is well represented by several classes including: gastropod molluscs (whelks, conchs, cowries, tulips, cones, and other sea snails); shell-less gastropod molluscs (nudibraches); bivalve molluscs (mussels, scallops, venus, pens, and other clam-like molluscs); and cephalopod molluscs (octopus and squid). Shoemaker et al.(1978) presented a checklist of marine molluscs from South Carolina with habitat requirements where data are available. Crustaceans (Phlyum Arthropoda, Class Crustacea) encountered at Gray's Reef include a variety of shrimps, lobsters and crabs. Sea urchins, sand dollars, sea stars, basket and brittle stars (Phylum Echinodermata) are also found.

Taxonomic and physiological studies on invertebrates at Gray's Reef are particularly important from a management standpoint to determine what species are present and the health and viability of these populations and the reef community in general. Also needed are data on the ecological processes that affect community structure and that couple the benthos with the live bottom ecosystem. The trophic structure and function of live bottom communities, such as the role of benthic invertebrates in sustaining bottom feeding fishes and turtles, are poorly understood (Boesch, 1977). There are indications that positive identification of some invertebrates found at Gray's Reef may foster revisions of taxonomy and previously known range (Kraueter, 1979, pers. comm.; Porter, 1979, pers. comm.). Classification of the hard coral Oculina sp. found at Gray's Reef is particularly relevant to its distribution. Identification of spiny lobster (Panulirus argus) is another example. Empty carapaces have been found at Gray's Reef and live specimens are reported farther offshore (Ansley and Shipman, 1979, pers. comm.). The range, biology, and habitats of this species as described in the literature and conditional sightings give evidence that Gray's Reef may serve as a shelter, forage and possibly spawning area for the lobsters.

3. Finfish

Many of the "key" demersal (bottom fish) and pelagic (open ocean) species, or those most desired by Georgia recreational fishermen, are found at Gray's Reef either as permanent or seasonal residents (Harris, 1978). Appendix G contains a list of frequently encountered fishes by common and scientific names. Black sea bass is the dominant demersal "food fish" species, however, snappers, groupers, porgies, grunts and associated reef species (e.g., triggerfish, filefish, scup and tomtate) are also encountered. Prominent pelagic "food fish" species include greater amberjack, cobia, king and Spanish mackerel, little tunny, and

great barracuda (Hunt, 1974; Harris, 1978). Non-food forage and tropical species include blennies, angelfishes, spiny boxfishes and moray eels. Sharks and billfishes are occasionally encountered at or near the reef.

Only 5.7 percent of the entire U.S. Fishery Conservation Zone is available as suitable habitat for reef finfish species (GMFMC, 1980). The open-shelf of the South Atlantic is primarily depauperate sandy bottom with only infrequent emergence of inhabitable reef areas. These so-called live bottom areas serve as biological "oasis" supporting rich demersal populations and occasional foraging pelagic species.

There has been relatively little work on the ecology of finfish of the South Atlantic/Georgia Bight. Several workers have surveyed the estuarine and coastal fishes of the region, including the fishes of nine aquatic habitat types within the Georgia coastal zone (Dahlberg, 1972). Some exploratory fishing has been conducted offshore in recent years, primarily to survey the composition and abundance of commercial and recreational resources. Several of these works describe live bottom areas and fishery development potentials of these areas as well as past and present research activities, including: Powell (1950); Cummins, Rivers and Stuhsaker (1962); Bullis and Thompson (1965); Rivers (1966); Stuhsaker (1969); Bullis and Carpenter (1968); Klima (1976); Bearden and McKenzie (1971); Sekavec and Huntsman (1972); Barans and Burrell (1976); Bullis and Jones eds. (1976); Huntsman (1976); Powles and Stender (1976); Ulrich (1976); Cupka et al. (1977); Wenner et al.,(1979); and SAFMC (1980). Little is known, however, on biological and ecological relationships, and the data on life cycles, geographical distribution and ecological characteristics of many species in the South Atlantic are derived from observations elsewhere in their ranges.

An association of ecologically important demersal fishes, commonly referred to as reef fish or the snapper-grouper complex, are found in live bottom areas in the South Atlantic. Principal components of the complex include members of the families Lutjanidae (snappers); Serranidae (groupers and sea basses); Sparidae (porgies); Pomadasyidae (grunts); Carangidae (jacks); Balistidae (triggerfishes) and Branchiostegidae (tilefishes) (SAFMC, 1980). In contrast, the bottom fishes characteristic of smooth, sandy bottom areas nearshore include primarily croakers, spot, kingfish, silver perch, sea trouts, and drums (Struhsaker, 1969; Dalberg, 1972) and those found in similar sandy areas on the open-shelf include sea robins, filefishes, porgies, lizard fishes and a variety of flat fishes (Bearden and Mackenzie, 1971). The presence of snappers and other tropical reef fishes in the South Atlantic, as far north as Cape Hatteras (e.g., 35° N Latitude) is permitted primarily by two factors: numerous areas of rocky substrate and reef assemblages on the shelf and at the shelf-edge and year-round warm water (21-28° C or 70-82° F) influenced by the Gulf Stream (Grimes, et al., 1977).

An understanding of the biological and ecological relationships of reef species at Gray's Reef is very important from a management standpoint. Reef communities are complex units and the life histories of many reef fish species are only poorly known. Reef species composition

and abundance in the South Atlantic fluctuate on a seasonal and yearly basis and vary from north to south and across the shelf. The availability of reef species is dictated by abiotic factors (e.g., temperature, salinity, topography, photoperiod and currents) and by biotic factors (e.g., spawning patterns, developmental and seasonal migrations, reef productivity and predator-prey relationships). Reef fish are limited for the most part by temperature and by available habitat and localized productivity (Manooch and Laws, 1979). In many cases, reef fishes are relatively sedentary and remain in a moderately restricted geographical area around live bottoms and coral reefs within a radius of several hundred yards to a few miles (Moe, 1972).

Many reef species display unique traits in response to evolutionary pressure in geographically isolated areas (e.g., reefs as "mini-islands"). Many of these characteristics tend to make reef fish highly suseptible to disturbance (e.g., habitat alteration or over-fishing), including various feeding habits; slow growth to maturity; sex reversals; pelagic development or brooding characteristics; restricted residential range; territorial displays; and migration patterns. The reader is referred to Appendix H for an expanded discussion on reef fish characteristics.

The availability of reef fish is also influenced by commercial and recreational fishing efforts. The SAFMC (1980) reported on the condition of fisheries within the snapper-grouper complex and concluded that some inshore and mid-depth demersal species may be experiencing growth overfishing ["growth overfishing is that case when fishing does not affect recruitment of young to a population; however, the young recruits are caught before they reach optimal size" (SAFMC, 1980).] Vermillion snapper, red porgy, and several mid-water groupers are possibly entering a growth overfishing phase. Black sea bass populations off the Carolinas are currently experiencing growth overfishing, whereas those off Georgia and northeastern Florida appear stable (SAFMC, 1980).

Surveys indicate that open-shelf live bottom habitats seaward of the 10 fathom (60 ft.) contour and those at the shelf edge under the influence of the Gulf Stream harbor richer forage or "fish-food" organisms (e.g., marine plants, invertebrates and smaller fishes) and more productive demersal fisheries (Struhsaker, 1969).

Coastal pelagic migratory species, including members of the families Scombridae (mackerals and little tunny), Pomatomidae (bluefish); Rachycentridae (cobia); and Coryphaenidae (dolphin), are also found in the vicinity of live bottoms, most often on a seasonal basis during migrations. In contrast with most reef species, pelagic fishes are highly mobile. Both adults and juveniles migrate north in the spring and summer and south in the fall and winter. Tagging studies, however, suggest that pelagic migrations are more complex than simple north-south movements (GMFMC and SAFMC, 1980a). The Gulf Stream has a direct influence on the distribution and composition of pelagic fisheries. For example, Spanish and king mackerel make migrations to stay within waters averaging 20° C (68° F) or higher (Manooch and Laws 1979).

Most coastal migratory pelagics are fast-moving, surface-feeding predators which form immense schools. Schools of king mackerel tend to assemble in areas of bottom relief, such as in holes or over reefs. Older,

solitary mackerel are often encountered around wrecks or oil rigs (GMFMC and SAFMC, 1980a).

Pelagic species attain maximum size rapidly, are short-lived and experience fairly high natural mortality rates. Coastal pelagics demonstrate reproductive strategies which have definite advantages for rapid and successful stock replenishment, including high fecundity and protracted spawning (Manooch and Laws, 1979).

There are little data relative to non-food forage finfish species in live bottom areas of the South Atlantic.

4. Marine Turtles

Three species of sea turtles are found within the study area: the green turtle (Chelonia mydas mydas), the loggerhead turtle (Caretta caretta caretta) and the Atlantic (or Kemp's) ridley (Lepidochelys empii). Loggerheads are frequently encountered around live bottom outcrops at Gray's Reef; there have yet to be positive sightings of the green and ridley turtles. The loggerhead is listed as a threatened species and the green and ridley, as endangered, pursuant to the Endangered Species Act of 1973 (see Table IV-1).

The Georgia Bight area from Cape Romain, South Carolina to Vero Beach, Florida hosts one of the largest known loggerhead populations in the world (Richardson, 1979, pers. comm.). Loggerheads nest on many of the barrier island beaches along the Georgia coast, where nest protection and restoration projects are aiding in the recovery of the species and are supplementing scientific information. Major nesting beaches include Cape Romain, the Cumberland Island area, Georgia and Merritt and Hutchinson Islands, Florida. Little is known, however, about their ecological characteristics and population dynamics at sea. Recent studies indicate that loggerheads utilize offshore live bottom areas for refuge, feeding, resting, sleeping, overwintering, and staging in between trips to barrier islands to lay eggs. Loggerheads are mainly carnivorous, consuming crabs, conchs, barnacles, fish, clams, oysters, squid, sponges, jellyfish and even some vegetation.

During the overwintering process, these turtles are believed to lodge themselves under ledges or rock outcrops and they stay underwater from approximately November to April in a metabolic state resembling hibernation in some terrestrial mammals (Richardson, 1979, pers. comm.). Loggerheads have been observed lodged under ledges at Gray's Reef; no metabolic recordings have been obtained.

Over 400 loggerhead carcasses washed up onshore in the Brunswick area between April and November 1979 (Richardson, 1979, pers. comm.). This high mortality is unexplained at present.

The Atlantic Ridley, though never sighted specifically at Gray's Reef, has been found near Brunswick and is believed to use the hard bottom areas offshore for feeding grounds and refuge. Juvenile green turtles are also believed to utilize hard bottom areas. It is not known whether adult greens frequent live bottoms such as Gray's Reef (Richardson, 1979, pers. comm.).

Table IV - 1 Species of turtles reported at Gray's Reef.

COMMON NAME	SCIENTIFIC NAME	ABUNDANCE	STATUS	COMMENTS
Loggerhead	Caretta caretta	High	Threatened	Probably uses Gray's Reef and other hard bottom areas for feeding, refuge and/or wintering.
Green	Chelonia mydas	Moderate-Low	Threatened	Juveniles probably utilize area for feeding, sleeping, and refuge.
Atlantic (Kemp's) Ridley	Lepidochelys kempi	Low	Endangered	Only a few turtles of this species have been found in the area--total population is believed to be around 500--Ridleys would utilize hard bottom areas for feeding, sleeping, and refuge.

5. Marine Mammals

Twenty-five species of cetaceans (whales, dolphins and porpoises) have been reported in offshore waters between Cape Hatteras, North Carolina and Cape Canaveral, Florida (see Table IV-2). Twelve of these species have been found stranded along the Georgia coastline and one, the spotted dolphin, has been identified by numerous offshore sightings (Neuhauser and Ruckeschel, 1978).

Except for the reported sightings of spotted dolphins and one sighting of an adult right whale and calf (Harris, 1979, pers. comm.), there is little evidence that the proposed sanctuary is important to cetaceans for purposes other than occasional transit during seasonal migrations. However, further research is necessary before it can be stated whether or not live bottoms in general, or Gray's Reef in particular, are important to cetaceans (Richardson, 1979, pers. comm.).

Although there are no confirmed sightings in the proposed sanctuary area, it is believed by the Department of the Interior that the endangered West Indian manatee (Trichechus manatus latirostris) may occur in nearshore shelf waters off portions of the southeastern coast of the United States (South Carolina to Florida) during the summer when the shallow island waters in which they live begin to warm (Moore, 1979, pers. comm.). Manatees cannot tolerate high salinities and it is doubtful that manatees occur at Gray's Reef where salinities range 34 to 36 ppt (Richardson, 1980, pers. comm.). However, if manatees do migrate offshore, they may encounter sand bars, oyster reefs and live bottoms in low salinity near-shore waters. Aquatic vegatation is the primary food source of the Florida manatee (BLM, 1978).

6. Pelagic Birds

Pelagic bird rookeries are found along the entire Georgia coast. Pelagic birds which could be encountered at Gray's Reef include petrels, shearwaters, gannets, phalaropes, jaegers and terns. No counts have been made in the vicinity of the proposed sanctuary site.

7. Cultural Resources

a. Shipwrecks

Very little is known about the numbers and location of shipwrecks along the South Atlantic coast. While the entire shelf holds the potential for containing shipwrecks, the majority are found in relatively shallow waters off Florida, in the Cape Hatteras-Cape Fear area and near the ports of Charleston, Georgetown, and Port Royal (BLM, 1978). Merchantmen, ships-of-war, blockade-runners and fishing vessels dating from the 18th Century to the present have been sunk, lost or run aground off the Carolinas and Georgia and the locations of many of the wrecks have not been identified. The BLM initiated a study to identify areas of cultural sensitivity on the OCS between Cape Hatteras, North Carolina and Key West, Florida.

Table IV - 2 Cetaceans reported in the offshore waters between Cape Hatteras and Cape Canaveral, and cetaceans stranded on Georgia beaches (Neuhauser and Ruckeschel, 1978).

Balaenoptera acutorostrata	Minke whale	Region	
Balaenoptera physalus	Fin whale	Region	
Balaenoptera borealis	Sei whale	Region	
Balaenoptera edeni	Byrde's whale	Region	Ga
Megaptera novaeangliae	Humpback whale	Region	Ga
Eubalaena glacialis	Right whale	Region	Ga
Mesoplodon densirostris	Dense-beaked whale	Region	Ga
Mesoplodon europaeus	Antillian beaked whale	Region	Ga
Mesoplodon mirus	True's beaked whale	Region	
Ziphius cavirostris	Goosebeaked whale	Region	Ga
Physeter catodon	Sperm whale	Region	
Kogia breviceps	Pygmy sperm whale	Region	Ga
Kogia simus	Dwarf sperm whale	Region	Ga
Steno bredanensis	Rough-toothed dolphin	Region	Ga
Pseudorea crassidens	False killer whale	Region	Ga
Globicephala macrorhynchus	Short-finned pilot whale	Region	Ga
Orcinus orca	Killer whale	Region	
Tursiops truncatus	Bottlenosed dolphin	Region	Ga
Grampus griseus	Grampus	Region	
Stenella longirostris	Spinner dolphin	Region	
Stenella frontalis	Bridled dolphin	Region	
Stenella coeruleoalba	Striped dolphin	Region	
Stenella plagiodon	Spotted dolphin	Region	Ga
Delphinus delphis	Saddleback dolphin	Region	
Phocoena phocoena	Harbor porpoise	Region	

*Region: Species found between Cape Hatteras and Cape Canaveral.
Ga: Species found in Georgia coastal waters.

Based on cultural use patterns, the potential for finding shipwrecks is highest nearshore, especially off major ports and harbor areas. It is possible that shipwrecks, armament and other relics could be discovered in the vicinity of Gray's Reef following close examination of the area.

b. Paleoenvironments

Archeologists suspect that there may be submerged remnants of prehistoric human occupation on the South Atlantic Shelf. Evidence of Paleo-Indian occupation of many parts of United States dates from 12,000 years before present (perhaps dating from the Pleistocene) at a time when sea level on the southeast coast was an estimated 40 m (131 ft.) below present. At this lower sea level, the Georgia coastline would have been 95 km (59 mi) from its present location at Savannah and 106 km (66 mi) from that at Brunswick (BLM, 1978). Hunt (1974) suggested that the Gray's Reef area experienced intermittant periods of aerial exposure and estuarine-like climate. It is possible that cultural resources of paleoenvironments may be found at Gray's Reef given the fact that evidence of early Indian living sites (e.g., mounds, shell middens, pottery, and tools) are found in coastal areas of the South Atlantic and that the geological history of Gray's Reef suggests a earlier coastal environment.

E. Human Activities

1. Introduction

The Gray's Reef live bottom attracts a variety of user groups, including recreational fishermen, recreational SCUBA divers, scientists, educators and possibly occasional commercial fishermen. Because of its proximity to the Georgia coast, and the favorable climatic and oceanic conditions which pervail, Gray's Reef is frequented year round. However, overall activity levels are low, except during peak fishing seasons.

2. Recreational Fishing

Recreational vessels capable of fishing offshore are available to a large number of people along the southeastern coast of the United States. Within recent years, increased income, leisure time and a wide variety of equipment available have increased participation in offshore recreational fisheries. Specialized sportfishing boats in the 20 ft and larger range are popular with recreational fishermen because they are capable of venturing offshore to areas where reef species typical of Caribbean banks and reefs and pelagic species are found. Smaller vessels also venture offshore, weather permitting. Between Cape Hatteras and Cape Canaveral, most recreational boats fish inshore live bottoms and artificial reefs, with only the speedier and more seaworthy vessels venturing out to offshore and shelf edge live bottoms (e.g., to the Brunswick Snapper Banks) (SAFMC, 1980). Shortages of fuel and increasing fuel prices are likely to restrict recreational fishing to productive fishing grounds nearshore in the future.

Natural live bottom areas and artificial reefs off the Georgia coast are fish havens and are popular areas for recreational fishing. Resource assessment surveys have identified 80 fish species, representing 32 families, associated with live-bottom habitats on a permanent or seasonal basis (Harris, 1978). Major bottom dwelling sport fish include black sea bass, groupers, snappers, flounders, gray triggerfish, sheepshead, porgies, grunts and spadefish (see Table IV-3). Pelagic game fish include bluefish, little tunny, cobia, amberjack, crevalle jack, barracuda (great), king mackerel, and Spanish mackerel. Atlantic sailfish, sharks, and other species are also occasionally taken over offshore reefs. Many of these species are taken at Gray's Reef. (See Appendix G for a listing of the important recreational species encountered at Gray's Reef).

Gray's Reef is frequented by charter and private boats, with the latter accounting for the majority of recreational use. Charter boats are craft available for hire at a fixed price per day regardless of passenger or load, as opposed to head or party boats which charge a per passenger fee and may have a regular schedule (GMFMC and SAFMC, 1980a). There are approximately 30 charter boats operating in Georgia (Harris, 1980, pers. comm.) and over 30,000 private recreational vessels in the State, although the latter estimate includes boats which fish salt water portions of rivers, sounds and bays as well as those which fish in the ocean (SAFMC, 1980). Two headboats operate out of Savannah (Huntsman, 1976). Charter operators from St. Simons Island, Shellmans Bluff, Belle Bluff and Savannah frequent Gray's Reef. It is estimated charter vessels in the State take out 250 fishermen per year, 175 of whom are taken to Gray's Reef (Doss, 1979, pers. comm.; Jackson, 1979, pers. comm.). Between one and five chartered trips of three to twelve persons are taken to Gray's Reef per month during the fishing season (Fendig, 1979, pers. comm.; Hutchinson, 1979, pers. comm.).

There are no comprehensive data available on the number of vessels which frequent Gray's Reef. Estimates are that 10 to 20 private boats fish the reef on weekends from April to September, assuming favorable weather conditions. Fishing activity is significantly less during the remainder of the week (Doss, 1979, pers. comm.; Fendig, 1979, pers. comm.). Aerial surveys conducted by the Georgia DNR recorded approximately 8000 recreational angler hours at Gray's Reef between February 1977 and January 1978, with the months between May and October being the most popular fishing months (Ansley, 1979, pers. comm.).

Most recreational anglers use depth recorders and compass headings from a given point to locate productive fishing grounds. Charter boats are generally better equipped than private vessels. Many have Loran A or C as well as depth finders which enable them to return to a specific spot, rather than a general area. For the past seven years, the Coastal Resources Division of the Georgia DNR has maintained a Fish Haven Buoy at Gray's Reef to facilitate its location by anglers. The buoy is marked on NOS Nautical Charts as "SLB" .

Gray's Reef is a preferred fishing ground for boats operating out of Brunswick and other nearby coastal areas, because it is the nearest known natural fish haven in the vicinity and, because during the

last few years, fishing has been better at the reef than at artificial reefs nearby (Fending, 1979, pers. comm.; Hutchinson, 1979, pers. comm.). Recreational fishermen from Savannah, Georgia and Jacksonville, Florida and other populated areas to the north and south of Gray's Reef occasionally frequent the area, however, normally they tend to fish artificial and natural reefs closer to their respective home ports or further offshore (Harris, 1979, pers. comm.).

According to Huntsman (1976), a typical full day fishing off the Georgia coast begins at daybreak and lasts 10-14 hours. After a 2-4 hour trip to the fishing grounds and a brief search either for fish or for bottom topography likely to produce fish, anglers spend 3-5 hours fishing and then return to port. Charter boats at Gray's Reef engage primarily in trolling for pelagic species. Private vessels also troll but more often engage in bottom fishing. Several recreationists also SCUBA and spearfish while at the reef. Most anglers use a 4/0 to 6/0 rod and reel combination with a two or three hook rig (SAFMC, 1980).

3. Commercial Fishing

Historically, Georgia's commercial fishery has been based around a six-month coastal shrimping industry. In order to expand this operation to a year-round enterprise, a few local and transient vessels fish commercially offshore for demersal (bottom) and pelagic finfish in-between shrimping seasons. Three types of fishing gear have proven successful for offshore bottom fisheries in the South Atlantic: handlines (manual or powered reels), wire fish traps and, to a limited extent, roller-rigged trawls. Pelagic fishing is primarily by hook and line, although gill nets and seine nets are also reportedly used (GMFMC and SAFMC, 1980a).

Huntsman (1976) described the history of recreational and commercial bottom fishing offshore Georgia and the Carolinas and examined relationships and factors concerning the development of these fisheries. Live bottom areas off Georgia as well as elsewhere in the South Atlantic have traditionally supported moderate commercial bottom fisheries and many consider the snapper-grouper fishery of the South Atlantic as being an under-utilized resource in terms of commercial potential (Klima, 1977). Inexperience with offshore fishing and lack of equipment are the two most frequently cited reasons. However, with fluctuating shrimp conditions in coastal areas, the pursuit of offshore fisheries is expected to increase in the future (Rivers, 1980, pers. comm.).

Commercial landings of demersal fisheries off Georgia have been recorded since the late 1800's. Red snapper (red, silk and blackfin snappers), grouper (scamp, speckled hind, Warsaw, snowy, and yellow edge groupers) and black sea bass, and scup/porgy have comprised most of the landings but the proportion of catch by species has varied annually (see Tables IV-4 and IV-5). The historical pattern has been irregular due to sporadic fishing efforts, infrequent and, at times, incomplete catch data and inconsistent landings/reporting patterns in home ports. Catches taken off one area may be reported in another and, therefore, reported landings may be underestimates of actual commercial production for a given area (Huntsman, 1976).

Table IV - 3 Recreational landings of reef fishes in Georgia 1977 (in pounds).* Source: South Atlantic Fishery Management Council, 1979.

Snappers	
Red	18,181
Vermilion	11,419
Unclassified	159
TOTAL SNAPPERS	29,759
Groupers	5,615
Others	
Black sea bass	31,668
Grunts	8,244
Porgies	1,450
Jacks	15,618
Triggerfish	972
TOTAL OTHERS	57,952
TOTAL REEF FISH	187,024

* Estimates derived from several sources and subject to modification, when data are available.

As Table IV-4 shows, Georgia landings of snapper/grouper were high between 1902 and 1930; annual combined catch ranged from 1,040,000 lbs (1908) to 37,000 lbs (1930). Landings were virtually non-existent from 1930 to 1967 and since then have ranged from a combined catch of 147,000 lbs in 1967 to 197,000 lbs in 1977 and averaged 87,000 lbs annually (Huntsman, 1976; SAFMC, 1980). Annual landings of scup/porgy averaged 3,400 lbs between 1967 and 1975 and then increased dramatically to 135,000 lbs in 1977 (Table IV-5). Landings of black sea bass have fluctuated greatly since 1967 (Table IV-5), averaging over 8,000 lbs annually until 1970, increasing to over 40,000 lbs annually from 1971 to 1974 and then decreasing to around 14,000 lbs between 1975 and 1977 (SAFMC, 1980).

The commercial demersal fishery in the South Atlantic is comprised of three main participating user groups which may be local or transient: (1) hook and line fishermen (both part-time and full-time); (2) trap fishermen (both part-time and full-time) and (3) trawl fishermen (primarily part-time) (SAFMC, 1980). Commercial reef fishermen in Georgia are off-season shrimpers who use latent equipment and labor skills for fishing during the winter (Smith & Rivers, 1977; Harris, 1977, pers. comm.). Most recently, the University of Georgia Marine Extension Service at Brunswick, Georgia has initiated an on-going project to encourage the development of the various offshore fishery resources available off the Georgia coast (e.g., black sea bass, snapper, rock shrimp, etc.) (Harrington, 1980, pers. comm.; Rivers, 1980, pers. comm.). The SAFMC (1980) described commercial vessels and fishing gear currently used for demersal fisheries. Commercial vessels are often of multi-purpose design, wooden or fiberglass diesel-powered vessels between 26 and 70 feet in length. Most are equipped with Loran A, white line (echo-sounder) recording fathometer and VHF and/or CB radio. A few vessels have scope scale expanders (CRT) which are used in conjunction with fathometers for detecting fish close to the bottom and for assessing the size and possibly the species composition within a given depth stratum (Ulrich et al., 1977; SAFMC, 1980).

Full-time handliners are highly mobile, ranging the entire southeast Atlantic coast, and at times venture as far north as Georges Bank or south to the Gulf of Mexico, and land their catches wherever it is most economical and convenient (SAFMC, 1980). Part-time handliners, on the other hand, consist primarily of shrimpers who seek off-season income from offshore snapper/grouper fisheries. Their catches are generally unloaded in home ports. The fishing gear used by handline vessels varies with the location and the species and size class sought from simple handlines with one to a few baited hooks to handpowered, electric or hydraulic line reels with up to 40 hooks per reel line (Carpenter, 1965). Only 2 Georgia vessels were engaged in the handline fishery for snapper/grouper during 1979, at least on a part-time basis (Harris, 1979, pers. comm.).

Rivers (1966) described the trap fishery off the Carolinas. Commercial trapping began in this area of South Atlantic around 1960 as a secondary fishery when offseason shrimpers diversified fishing efforts during the winter by using modified Chesapeake Bay blue crab pots in live bottom areas to produce commercial quantities of black

TABLE IV - 4 Commercial Landings of Snappers and Groupers for Georgia (1880 - 1974).

Years	Snappers and Groupers (pounds)	
1880	1/	1/
1887	1/	1/
1888	1/	3,000
1889	1/	1/
1890	1/	—
1897	—	—
1902	—	125,000
1908	160,000	880,000
1918	28,000	112,000
1923	11,000	105,000
1927	26,000	64,000
1928	8,000	22,000
1929	8,000	33,000
1930	7,000	30,000
1931	—	—
1932	—	—
1934	—	—
1936	—	—
1937	—	—
1938	—	—
1939	—	—
1940	—	—
1945	—	—
1950	—	—
1951	—	—
1952	—	—
1953	—	2,000
1954	—	3,000
1955	—	—
1956	—	2/
1957	—	2/
1958	—	—
1959	—	—
1960	2,000	8,000
1961	4,000	3,000
1962	2/	3,000
1963	2/	2,000
1964	2/	1,000
1965	—	2/

TABLE IV - 4 (Continued).

Years	Snapper and Groupers (pounds)	
1966	----	2/
1967	92,000	55,000
1968	17,000	17,000
1969	12,000	14,000
1970	50,000	16,000
1971	43,093	54,571
1972	58,305	52,338
1973	37,331	19,929
1974	43,913	42,532

1/ Data not available.

2/ Less than 500 pounds.

Sources: Compiled from Fishery Statistics of the United States, U.S. Department of the Interior, Fish and Wildlife Service (to 1967) and U.S. Department of Commerce, NOAA NMFS (after 1967); and North Carolina, South Carolina, and Georgia Landings (1973-74), Current Fishery Statistics, U.S. Department of Commerce, NOAA, NMFS, Washington, D.C.

sea bass (Centropristes striata) and incidental catches of snappers, groupers, porgies and grunts. During the early 1970's, full-time efforts began to develop (SAFMC, 1980).

Wire traps used for black sea bass are similar to those described by Isaacson (1963); i.e., 2 x 2 x 2 ft or larger welded wire mesh traps with one or more conical-shaped opening. Marker buoys (flagged bamboo poles inserted through a floation buoy and anchored in a cement-filled container for ballast) are used to locate submerged traps. Traps are baited with a variety of cut bait, or as Rivers (1966) reported, with punctured cans of cat food, and are set as a single unit in hard bottom areas of irregular relief containing epifaunal invertebrates (live gorgonians, sponges and hard coral heads) and demersal fishes, primarily along the 10 fathom (60 ft) contour. Black sea bass are extremely gregarious and are immediately attracted to traps for several reasons, including bait, conspecific attraction, and thigmotrophic attraction. Productive areas are fished repeatedly. Small two-men vessels fish inshore with 10 to 20 traps and large five-man vessels fish offshore, working up to 40 traps per day. Rivers (1966) reported daily catches of up to 6300 lbs consisting primarily of black sea bass; landings have been declining in recent years (SAFMC, 1980). There are currently no reliable estimates of the number of trap fishermen in the South Atlantic, although there are reports of increasing activity off North Carolina and southeast Florida (SAFMC, 1980).

Fishing with traps has several inherent advantages including the fact that traps: (1) are inexpensive, easy to build and repair, and require little maintenance; (2) are a passive gear which require a minimum of effort and fuel energy once set, enabling fishermen to pursue other interests and reduce fuel costs; (3) yield high catches of commercially valuable fish, even in areas of low fish density; (4) are successful for fish not easily taken by other means; (5) can be used in areas where irregular bottom relief precludes the use of trawls or nets; (6) protect catch from predator damage and retain fish alive, in relatively good marketable condition; and (7) are an important research and resource assessment tool.

Recently wire trap fishing has become an issue shrouded with controversy and emotion. Most concern stems from fears that intense trap fishing depletes reef fish stocks, mechanically damages reef habitats, causes user group/gear conflicts and fosters more lost or "ghost" traps (traps which continue to fish indefinitely until retrieved by divers or destroyed by predators or corrosion). Unfortunately, little documented evidence exists regarding actual or potential impacts of trap usage (see Appendix I). Both the GMFMC (1980) and SAFMC (1980) have concluded that more research is needed to determine the effects of traps on reef fish resources.

The use of wire fish traps offshore Georgia and in the vicinity of Gray's Reef is not extensive. Several off-season shrimpers occasionally trap for black sea bass in live bottom areas south of Gray's Reef during the winter and may have trapped at Gray's Reef in the past (Harris, 1979, pers. comm.; Harrington, 1980, pers. comm.). In the past, market prices and the stock abundance of black sea bass at Gray's Reef may have

been high enough to support commercial trapping efforts but not presently. Stock abundance has fluctuated at the reef in recent years for unexplained reasons (Harris, 1979, pers. comm.)

Several wide-ranging surveys have been conducted in the South Atlantic to gather data concerning the availability of demersal fishes to bottom trawls (Powell, 1950; Cummins et al., 1962; Struhsaker, 1969; Barans and Burrell, 1976; Wilk and Silverman 1976; Ulrich et al., 1977; and Wenner et al., 1979). Early attempts at establishing a bottom trawl fishery were unsuccessful primarily due to unsuitable gear, inexperienced operators, poor catches and low revenues. Conventional New England-style groundfish trawls (e.g., Yankee otter trawls) and their catches tended to sustain high levels of damage from encounters with reef substrate and with dislodged stony corals or stinker sponges. Efforts were not cost effective (Struhsaker, 1969). However, it was shown that modified otter trawls (roller-rigged trawls) returned profitable catches of vermillion and other snappers, assorted groupers, black sea bass, and associated species (scup, porgy, triggerfish and grunt) in low to moderate relief areas and with careful attention to depth recorder fish traces (Cummins et al., 1962; Ulrich et al., 1977).

The Marine Resources Institute of South Carolina Wildlife and Marine Resources Department in cooperation with the National Marine Fisheries Service conducted exploratory trawl surveys in the South Atlantic between 1973 and 1975 and concluded that live bottom habitats between the depth of 18 and 55 m (62 and 188 ft) offered the greatest potential for bottom trawl fisheries over an annual cycle. Pelagic fish contributed very little to total catches (Barans and Burrell, 1976; Wenner et al., 1979). The South Carolina Marine Advisory Program in cooperation with local fishermen demonstrated the use of roller-rigged trawls in live bottom areas during the winter and spring of 1976 (Ulrich et al., 1977). Catches consisted primarily of red snapper, vermillion snapper, grouper and red porgy from live bottoms in water depths between 30-46 m (100-150 ft). It was concluded that winter offshore trawling probably exceeded existing utilization of capital and labor of the off-season shrimp fishery (e.g., black sea bass trapping) in terms of return on investment.

The Georgia Marine Extension Service in conjunction with the University of Georgia and local fishermen have tested various types of nets to determine whether bottom trawling off Georgia was economically feasible (Smith and Rivers, 1977). Sucessful catches were obtained in depths of 35-40 fathoms (220-240 ft). The pink porgy was the predominant demersal species caught, although many were of unmarketable size.

Several Georgia vessels have since been equipped for trawling offshore. The success of the new fishery has been highly variable, depending a lot upon the experience of the trawl operator to locate fish concentrations and avoid gear damage (SAFMC, 1980).

Smith (1977) and Smith and Rivers (1977) described bottom trawl rigs which have been used successfully in the South Atlantic. Cylindrical 24 inch rubber rollers are fitted to the lead line of the

Table IV - 5 Commercial Landings of Species of Reef Fish in Georgia, 1967-77 in thousands

Species	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Snappers											
Red	55	17	14	16	55	52	20	42		56	71
Vermillion											7
unclassified									31		9
Total Snappers	55	17	14	16	55	52	20	42	31	56	87
Total Groupers											
Unclassified	92	17	12	49	43	58	37	44	6	45	110
Others											
Amberjack											
Grunts											
Scup/Porgy		4	3	7	7	2		4	4	47	135
Sea Bass	3	12	9	11	43	61	27	35	16	19	8
Sheepshead										5	
Total Others	3	16	12	18	50	63	27	39	20	72	145
TOTAL REEF FISH	150	50	38	83	148	173	84	125	57	174	342

Source: South Atlantic Fishery Management Council, 1979.

net of a New England style otter trawl and cone-shaped rollers are fitted on the wings of the net. These modifications are intended to permit use in rough bottom areas of low to moderate relief without snagging.

A description of commercial pelagic fisheries in the South Atlantic is provided by Manooch and Laws (1979) and the GMFMC and SAFMC (1980a). Coastal pelagic migratory fisheries consist of large predators which roam inshore and offshore waters, including king mackerel, Spanish mackerel, bluefish, dolphin fish, cobia and little tunny. The availability of these fishes to commercial (and recreational) harvest is influenced by spring and fall migrations. In the South Atlantic, coastal pelagics are fished commercially off northeastern Florida and to some extent off Georgia and the Carolinas. Traditional gear includes hook and line (handline and power reel), gill nets and seine nets.

Gray's Reef does not support a full-time commercial fishery. Fish species composition and concentration at the reef are not sufficient to encourage large-scale commercial fishing (Pryterch, 1979, pers. comm.). Most reef species do not reach commercially exploitable size in areas as shallow as Gray's Reef; i.e., in waters less than 10 fathoms (18.3 m) (GMFMC, 1980). It is possible that a few transient commercial fishermen from the Carolinas, Georgia and Florida frequent the area, however, this has not been verified. Most commercial reef fishermen fish deep water reefs which are generally more productive. For example, a few small vessels from Georgia participate in the snapper/grouper fishery on the Brunswick Snapper Banks in late winter/early spring (Shipman, 1979, pers. comm.), and a few large vessels from Florida and the Carolinas fish the Banks and possibly other live-bottom areas off Georgia on a seasonal basis (Pryterch, 1979, pers. comm.). The Snapper Banks are located approximately 30 km (43 nmi) west of Brunswick, Georgia and are considered part of a discontinuous, mid-shelf hardbank which extends northward from Florida.

4. Recreational Diving

Diving enthusiasts are attracted to Gray's Reef for a number of reasons: relatively moderate weather year round, relatively shallow water, close proximity to shore, fair underwater visibility and various natural features of live-bottom habitat. Activities engaged in while diving include spearfishing, shell collecting, photography and training and checkouts of novice divers. Some of these may be engaged in simultaneously. Divers periodically maintain activity logs, recording ambient environmental conditions and underwater experiences.

While popular among the divers who frequent it, Gray's Reef is not heavily used. Other reefs, including inshore artificial reefs and the offshore Snapper Banks, also attract sport SCUBA divers. It has been estimated that less than 100 divers use the area (Chance, 1979, pers. comm.), and divers at the Gray's Reef public workshops reported rarely, if ever, encountering other dive boats at the reef. Several factors tend to limit recreational diving at Gray's reef: (1) the four-to-six hour round trip from Savannah or Brunswick for a dive

which lasts only about forty-five minutes due to water depth; (2) currents are occasionally strong, ranging from 0-2 knots; and (3) visibility may be poor, ranging from 1 to 7 m (5 to 30 ft) (Bell, 1979, pers. comm.; Chance, 1979, pers. comm.).

Diving occurs year round, although most activity occurs during the summer months. While visibility is generally better during the winter months, weather conditions are often not favorable (Bell, 1979, pers. comm.).

There are two local diving organizations which frequent the area: one in Savannah and one in Brunswick. The group located in Savannah estimated that they had visited the reef seven times between May and November, 1979, with parties ranging from 7 to 15 people (Bell, 1979, pers. comm.). The group located in Brunswick made two trips during the same period with parties of four to eight divers (Kelly, 1979, pers. comm.).

It has been estimated that less than 50 percent of the dive-hours spent at Gray's Reef include spearfishing. Spearfishing is limited not only by the environmental conditions mentioned above, but also by a diver's ability to hunt and by self-imposed target policies. Groupers are targeted exclusively, as few mature snappers are seen in the area (Bell, 1979, pers. comm.). As a general rule, divers take only what they can consume.

5. Marine Research

To date, Gray's Reef has received little systematic study. The first documented recognition of Gray's Reef was made by the late Dr. Milton B. Gray (Gray, 1961) while assembling extensive collections of benthic organisms from various locations offshore Georgia as part of the University of Georgia Marine Institute's Systematics/Ecology Program. The Gray Collection is currently housed at the University of Georgia, Athens Campus, where curation and systematic identification are in progress (Edwards, 1979, pers. comm.).

Coastal Resources Division of the Georgia DNR has surveyed the fishery resources of Gray's Reef on several occasions within the past decade as part of investigations of offshore fisheries species composition, abundance, seasonal distribution and population dynamics and the fishing potential on artificial and natural reefs off the coast (see Appendix C). Descriptive brochures on fishing potential of offshore areas have been published (Georgia State Game and Fish Commission, 1970; Georgia DNR 1978).

Henry and Hoyt (1968) briefly mentioned Gray's Reef and theories concerning its origin. Hunt (1974) was the first to describe the reef's geological history and some of the biological assemblages encountered while conducting a systematic study of the area using side-scan sonar, sub-bottom profiling, bottom-towed TV cameras, and SCUBA diving.

Porter (1979, pers. comm.) surveyed sessile invertebrate populations and measured respiration rates (in situ) for the hard coral Oculina sp. during a mid summer 1979 cruise. Video tapes of the reef were taken using submersible and diver-held cameras. Another cruise has been scheduled for July 1980.

Within the past several decades, a number of large scale multiinstitutional oceanographic studies have been initiated in the South Atlantic Bight. While not explicitly directed at Gray's Reef, the data have contributed to a better understanding of live bottoms in relation to overall Bight processes.

The Southeast Oceanographic Program was initiated by the Department of Energy, to study physical, chemical and biological processes of the South Atlantic Bight (Singer, 1980, pers. comm.). The Program has involved a number of institutions, including the University of Georgia Skidaway Institute of Oceanography, North Carolina State University and the University of Miami.

Marine Resources Monitoring Assessment and Prediction Program (MARMAP) was initiated by the National Marine Fisheries Service (NMFS) in 1972 for the purpose of surveying the living marine resources of the waters of the United States in a standardized, coherent manner. In 1973, the Marine Resources Research Institute (MRRI) of the South Carolina Wildlife and Marine Resources Department, through a long-term contract agreement with NMFS, assumed responsibility for MARMAP activities in the South Atlantic Bight of the United States. In its initial phase, the MRRI-MARMAP program has been limited to large scale surveys (two or three times a year) covering most of the shelf and slope waters of the South Atlantic Bight. Ichthyoplankton surveys (MARMAP Survey I) and groundfish surveys (MARMAP Survey II) beginning in 1973 have contributed much valuable information on occurrence, abundance and distribution of planktonic young fish and bottom dwelling fish, and have provided guidance for designing smaller scale studies on specific species and study areas.

MRRI with cooperation from the Coastal Resources Division of the Georgia DNR is currently conducting "An intensive investigation of live bottom areas on the southeastern Atlantic Continental Shelf of the United States" for the Bureau of Land Management. The study is designed to assess reef fisheries resources and to provide data for evaluating potential impacts of energy exploration and development activities in the South Atlantic, with special attention to reef environments. One sampling site is Gray's Reef. A sampling scenario was proposed for a winter and a summer survey in 1980 at each of nine sites within 19-27m, 28-55m and 56-100m bathymetric zones. Winter sampling at Gray's Reef was conducted the third week in January, 1980; summer sampling will occur in August, 1980. Survey techniques include television tows, hand held cameras, rock dredge tows, juvenile fish sled tows, fish trap sets, long line sets (Van Dolah, 1980, pers. comm.).

Table IV-6 provides a list of independent researchers, by affiliation and research interest, who periodically conduct research or have expressed research interest at Gray's Reef.

Table IV - 6 Researchers who periodically conduct activities at Gray's Reef.

Institution	Researcher	Interest
University of Georgia-Athens	Dr. James Porter	Coral Physiology
	Dr. Donald Scott	Taxonomy of Fishes
	Dr. Grace Thomas	Reef Invertebrate Zoology
	Dr. John Patton	Invertebrate Physiology
	Dr. Milt Cormier	Soft Coral Physiology
	Dr. Gene Helfman	Fish Behavior
Skidaway Institute of Oceanography	Dr. J. V. Henry	Reef Formation; Biotic Community-Sedimentation Interaction
	Dr. James Howard	Geomorphology of the Continental Shelf
Marine Institute	Dr. Paul Kinsey	Invertebrate Physiology

6. Marine Science Education

Gray's Reef is the site of on-going marine science education for organized groups from the University of Georgia System, including the Department of Zoology (Athens Campus), the Marine Extension Service (Brunswick and Savannah), and the Marine Institute (Sapelo Island), who occasionally conduct field surveys, collect specimens and demonstrate oceanographic equipment at the live bottom. A variety of benthic and nekton samplers are used to collect representatives of the live bottom community and surrounding sedimentary regime, including dredges, trawls, nets, SCUBA and grab samplers. Collections are made once or twice a year and are limited to short periods of time. Samples are identified on board ship and/or preserved for later identification. Recently the use of dredges and trawls has been cut back in favor of less destructive samplers such as SCUBA divers and grab samplers (Durant, 1979, pers. comm.; Gillespie, 1979, pers. comm.; Thomas, 1979, pers. comm).

The Skidaway Institute of Oceanography occasionally takes visiting high school groups to Gray's Reef for ship-board demonstrations, and would like to take dive groups there once legal questions concerning liability are settled (Gillespie, 1979, pers. comm.).

7. Commercial Shipping

According to information supplied by the Coast Guard and the Brunswick Pilots Association, there is little commercial shipping through or near the proposed marine sanctuary. Most ship traffic servicing South Atlantic ports is found 46 to 93 km (25 to 50 nmi) from shore. As a general rule those vessels travelling in a northerly direction remain in the Gulf Stream to take advantage of its northerly flow, while those travelling south remain shoreward of the current (Donohoe, 1979, pers. comm.; Sandick, 1979, pers. comm.).

The port of Brunswick is located approximately 55.5 km (30 nmi) southeast of the proposed sanctuary. Commercial vessels servicing the port include general cargo vessels, bulk carriers, and oil tankers. Most vessels pick up the Brunswick Harbor channel entrance at a bouy 37 km (20 nmi) from the harbor, although occasionally smaller vessels will pick up the channel closer to shore (Sandick, 1979, pers. comm.). Of the vessels entering the harbor in 1976, none had a draft exceeding 9.7 m (32 ft) and the majority ranged between 6.4-7.6 m (20-25 ft) (U.S. Army Corps of Engineers, 1976).

General cargo vessels arrive at Brunswick two or three times per month. Bulk carriers loaded with limestone, salt, or basic chemicals for local industry generally enter from the north and exit to the south. They do not arrive on a regular schedule. Two to three tankers visit Brunswick each month to offload petroleum at a pipeline facility maintained by Eastern Seaboard Petroleum, Inc. These vessels almost exclusively enter loaded from the south and exit in ballast in the same direction (Hendricks, 1979, pers. comm.; Sandick, 1979, pers. comm.). (See Tables IV-7 and IV-8 for a list of major commodities entering and existing Brunswick Harbor).

Table IV-7 Major commodities carried in and out of Brunswick, GA by oceanborne shipping 1976 (short tons)* Source: Waterborne Commerce of the U.S., 1976, COE.

Commodity	Total	Foreign Imports	Foreign Exports	Domestic Coastwise
Residual Fuel Oil	402,864	238,014		164,850
Salt	260,009	260,009		
Limestone	243,998	243,998		
Basic Chemicals & Chemical Products	93,348	89,807	3,541	
Fertilizer & Fertizer Materials	17,455	17,329	126	
Pulp	11,396		11,396	
Gum & Wood Chemicals	4,621		4,621	
Prepared Animal Feed	1,423	1,423		

* This Table does not include receipts or shipments of commodities via internal waters, i.e., the intercoastal waterway

Table IV-8 Major commodities carried in and out of Brunswick, GA by oceanborne shipping 1977 (short tons)* Source: Waterborne Commerce of the U.S., 1977, COE.

COMMODITY	TOTAL	FOREIGN IMPORTS	FOREIGN EXPORTS	DOMESTIC COASTWISE
Residual Fuel Oil	456,965	304,595		152,370
Salt	195,125	195,125		
Limestone	299,600	299,600		
Basic Chemicals & Chemical Products	57,279	54,797	2,482	
Fertilizer & Fertilizer Materials	63,781	63,681		
Pulp	34,630		34,630	
Sugar	13,906	13,888	18	
Nonmetalic Minerals	11,941	11,941		
Gum & Wood Chemicals	8,348		8,348	

*This table does not include receipts or shipments of commodities via internal waters, i.e., the intercoastal highway.

Given the distance from shore these vessels generally maintain while in transit and the distance at which most vessels pick up the channel approach, it is unlikely that many pass through or near the proposed sanctuary. However, information provided by the Brunswick Pilots Association indicates that when vessels call at both Brunswick and Savannah, they may pass just landward of the proposed sanctuary area in a direct line between the buoys marking the entrances of the respective channels (Sandick, 1979, pers. comm).

The Navy's Naval Ocean Surveillance Information Center (1979) indicated that no merchant or fishing ships in excess of 100 GRT or 100 ft were in the proposed sanctuary areas during the months of January, February, March, September, October, or November. Since oil tankers servicing Brunswick almost exclusively arrive from and return south, it is highly unlikely that one would transit near the sanctuary. This, however, could change in the future depending upon oil and gas development activity as a result of South Atlantic OCS Lease Sale #54 (1981) and and #78 (1984).

8. Military Operations

The United States Navy conducts a wide range of military operations in the South Atlantic Bight. Relatively few of these operations take place in the immediate vicinity of Gray's Reef and all operations are strictly controlled in area waters and the superadjacent air space. The southeast boundary of the proposed Gray's Reef marine sanctuary lies within the western edge of U.S. Navy's Jacksonville Fleet Operating Area W-157 (see Figure IV-6). Within this immense Fleet Operating Area, the Navy conducts operations related to training, readiness and national defense support and security. Operational usage can be heavy in certain areas of W-157, and can include surface and aerial gunnery, bombing, and torpedo firing; air to air, surface to air and surface to surface missile firings; air combat maneuvering; aircraft carrier operations; and surface ship and submarine operations (Scruggs, 1979, per. comm.).

Gray's Reef is in sub-area 4-C on the extreme western edge of W-157 where minimal fleet operations take place. The Navy does, however, reserve the flexibility to operate in this section of the fleet operating area as circumstances require (Scruggs, 1979, per. comm.).

The Air Force, on rare occasions, with the concurrance of the Navy may engage in training activities in sub-area 4-C of Area W-157. It is unlikely that such training exercises would occur more than once a year and in any event they would not include activities such as gunnery practice, bombing or missile firing (Smith, 1979, per. comm.).

9. Ocean Dumping and Dredge Disposal

Hydrocarbon development is likely to increase commercial shipping in the South Atlantic. As there are no navigational fairways established for the South Atlantic OCS region (BLM, 1978), increased shipping may increase the probability of collisions and thereby the potential for

spillage of oil. Increased volume of vessel-borne waste disposal is expected also. Impact on the proposed sanctuary area is speculative. While most vessel traffic serving South Atlantic ports is found 25-50 nmi from land (Gray's Reef is located approximately 17.5 nmi from land), when calling at both Brunswick and Savannah, vessels often pass just landward of the Gray's Reef area. Routine discharge of wastes, a collision or cargo spillage in the vicinity of the live bottom could severely threaten the environment if the spillage or discharge was a toxic chemical, crude or refined petroleum product or some other polluting substance.

Increased shipping may require more frequent maintenance dredging schedules for harbor entrance channels and port facilities in the vicinity of Gray's Reef; i.e., the ports of Brunswick, Savannah and Charleston. A need for deep water harbors may arise, in which case extensive dredging operations may be required. Two active dredge material sites are located shoreward and to the north and south of Gray's Reef: a site south of the Savannah River entrance, 8.3 km (4.5 nmi) seaward from Tybee Island and a site south of the entrance to the Brunswick Bar-Channel approximately 11 km (6 nmi) from Jekyll Island. Given the restricted nature of nearshore transport processes in the South Atlantic and the current low levels of dumpsite use, it is unlikely that dredged materials dumped at these sites adversely impact the Gray's Reef live bottom. If scheduling of maintenance or construction dredging and the volume of dredged material increases, demands could overburden the already utilized sites and could require designation of additional or alternate sites. NOAA has no evidence to indicate whether additional or alternate dumpsites are contemplated near the Gray's Reef area.

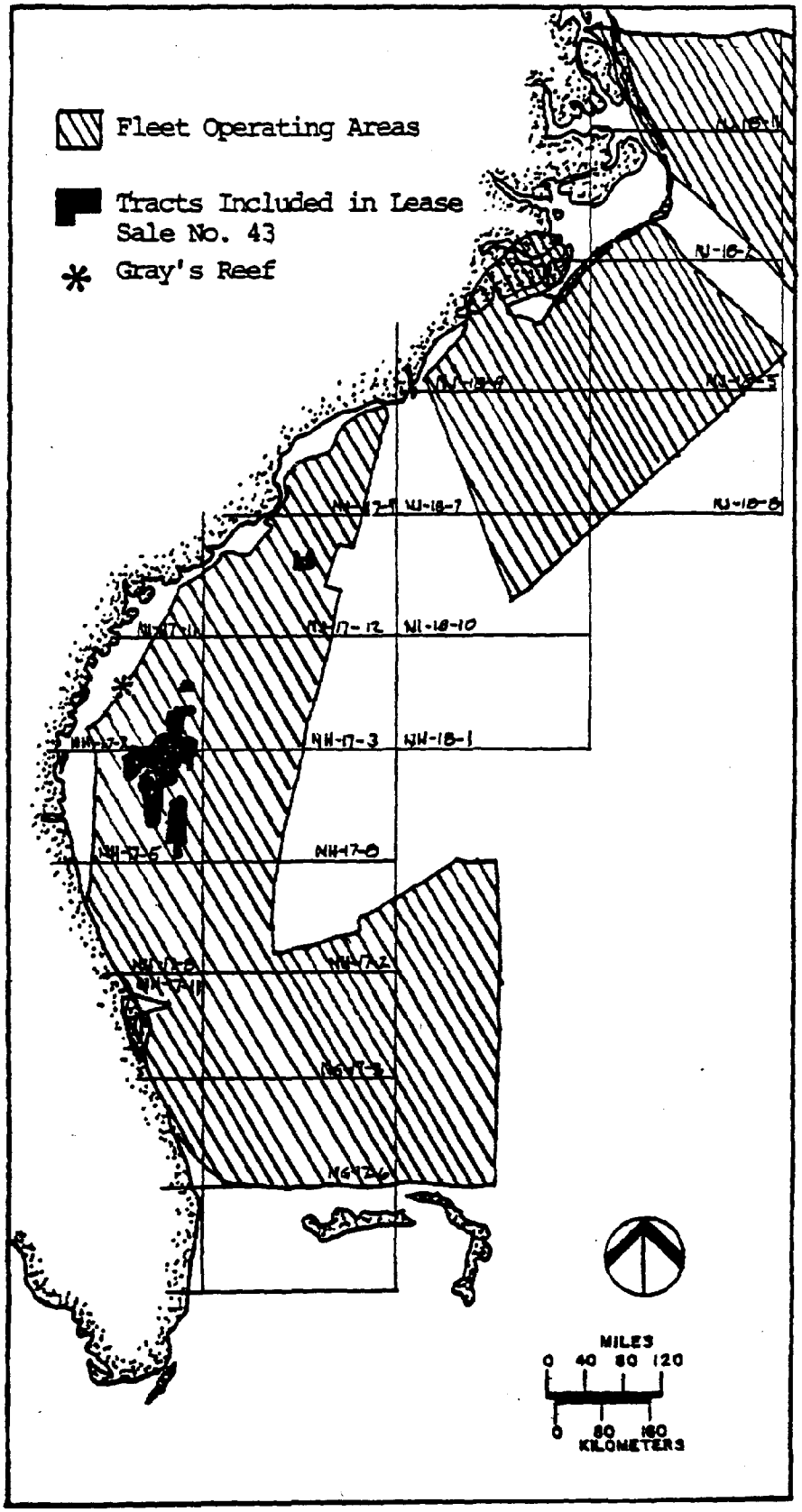
OCS energy development may promote industrial development in areas of the southeast coast. This growth may increase the need for ocean disposal sites accomodate wastes generated by industry and municipalities. EPA issued a permit for dumping chemical wastes to the APM Manufacturing Company, Augusta, Georgia at an ocean dumping site located 28 nmi (51.8 km) northeast of Gray's Reef. The Company never utilized the area and the permit expired as of January 11, 1980 (Ramsey, 1979, per. comm.). There is no evidence of any proposal to revalidate this permit or to designate alternate sites.

10. Oil and Gas Activities

Currently, there are no oil and gas activities within 46.3 km 25 nmi) of the proposed sanctuary, nor are there any natural gas or oil pipelines going through the Gray's Reef area. Lease Sale #43 (March 28, 1978) offered 225 of 778 tracts originally nominated in the southeast Georgia Embayment for bid (Figure IV-7).

Lease Sale #56 is scheduled for August 1981 and #78 for January 1984. Six hundred thousand acres are under consideration for inclusion in both sales off the coast of North Carolina, South Carolina, Georgia, and northeastern Florida. Calls for nominations (March, 1979) for Lease Sale #56 indicate that there are no tracts in the vicinity of Gray's Reef (Figure IV-8).

Figure IV-6--Naval Fleet Operating Areas in the South Atlantic
Source: Bureau of Land Management, 1978



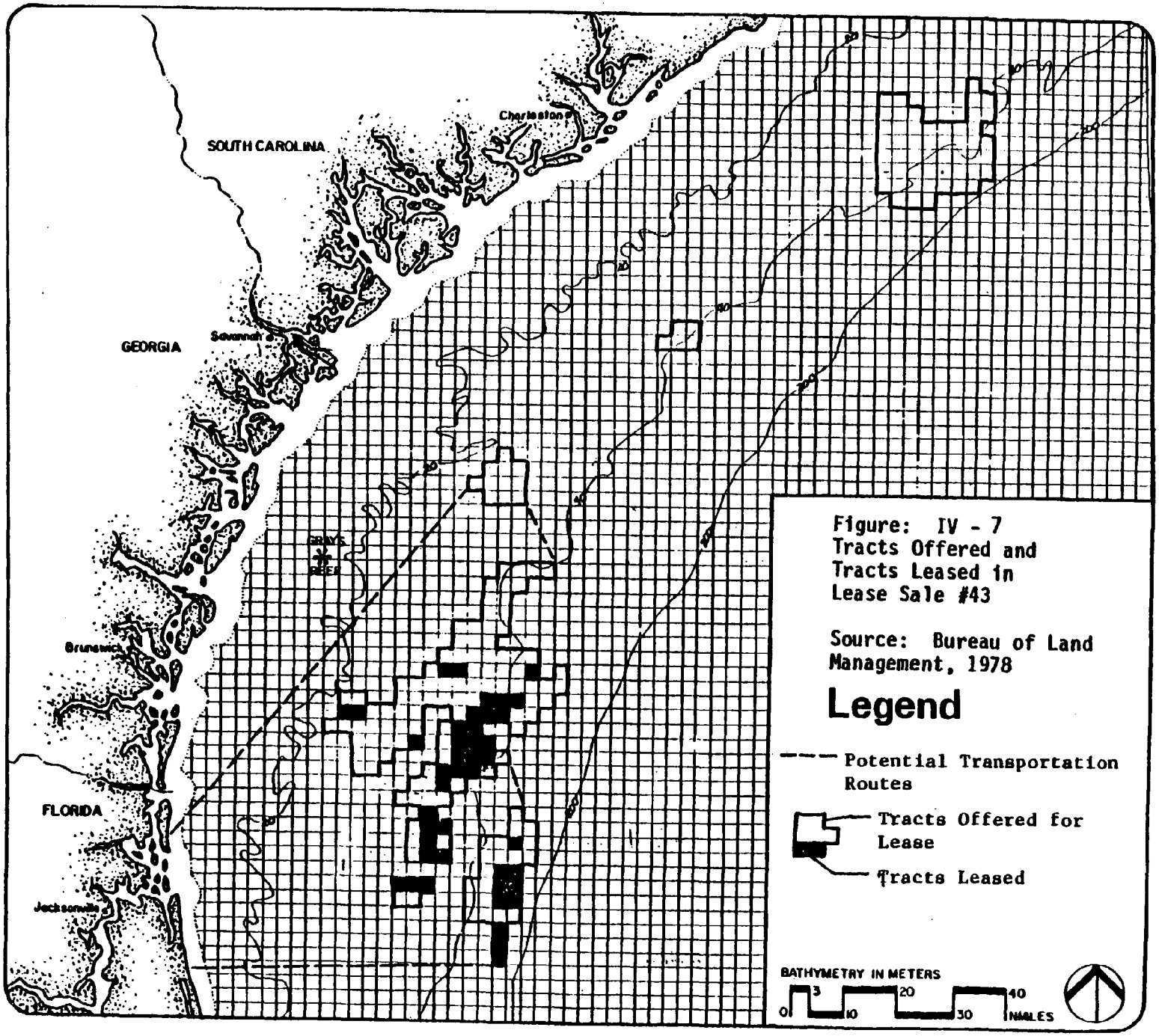

SOUTH CAROLINA
Charleston
GEORGIA
Savannah
GRAYS REEF
Brunswick
FLORIDA
Jacksonville
Figure: IV - 7
Tracts Offered and
Tracts Leased in
Lease Sale #43
Source: Bureau of Land
Management, 1978
Legend
Potential Transportation Routes
Tracts Offered for Lease
Tracts Leased
BATHYMETRY IN METERS
0
3
10
20
30
40
MILES

Table IV-9 shows the formal steps in the lease sale process. For Lease Sale #43, the Bureau of Land Management (BLM) issued a call for nominations in September 1975. The call for nominations allows tracts to be both "positively" and "negatively" nominated. Positive nominations indicate those tracts on which industry wants to bid, while negative nominations apply to those tracts which other interests desire withdrawn. As a result of this process, of the 778 tracts nominated, 372 tracts were removed for lack of industry interest and 181 because they were within environmentally sensitive areas reducing the number of tracts for sale to 225. Tentative tract selections were announced April 27, 1976, which resulted in 225 of 778 nominated tracts being included in the sale.

The tentative tract selection determines areas to be analyzed in the environmental statement. The U.S. Geological Survey (USGS) initiates preparation of development scenarios and starts gathering socioeconomic data and developing oil spill trajectory models used in the environmental statement. (Maps of the BLM oil spill trajectory analysis for the Gray's Reef, developed using the USGS model as a result of Lease Sale #43, appear in Appendix J). Tentative tract selection also provides the public and government agencies with a preliminary tract list on which to comment. At several points, up to the final notice of sale, a tract may be withdrawn from bidding.

Estimates of the magnitude of recoverable resources as a result of Lease Sale #43 may be found in Table IV-10. These estimates are an important factor in determining areas likely to be used in the area. Based on these estimates, tract locations and distance from shore, and modest project production rates, BLM has concluded that initial transport of oil will be via tanker for three to five years with the possibility of up to two oil and two gas pipelines after production levels increase (BLM, 1979). BLM proposes the use of existing refineries rather than construction of new facilities (BLM, 1979).

Amoco operates a refinery in the Savannah area which is used to produce asphalt. It is not a general purpose refinery. The likely development scenario described by BLM would result in a transport corridor being located as close as 9.3 km (5 nmi) to Gray's Reef. However, since no blocks were leased in the northern portion of the Brunswick Lease area this would not occur unless these tracts were developed following future lease sales.

At the present time only six plans for exploratory drilling have been approved by USGS which have resulted in actual drilling activites (Martin, 1979, pers. comm.). Teneco has engaged in exploratory drilling in Tracts 208 and 427 in the Jacksonville Lease Area. Neither of these operations was successful in identifying recoverable reserves of oil or gas, and the wells were plugged and abandoned. Getty's drilling operations in block 913 of the same area have likewise been terminated. Exxon has recently completed exploratory drilling in lease blocks 472 and 564 in the Jacksonville lease area, as has Transco in block 1005 in the Brunswick lease area (see Figure IV-10). Neither company plans any future activities in these blocks (Osvald, 1980, pers. comm.).

All natural gas produced from the OCS is considered to be interstate and therefore is subject to the Federal Energy Regulatory Commission (FERC) jurisdiction. The Natural Gas Act, the National Environmental Policy Act and the OCS Lands Act Amendments of 1978 all grant authority or require that the FERC investigate the environmental effects of a proposed offshore project, as well as the potential gas reserves, the need for this gas, and the availability of capital to develop this resource. Also, the FERC is primarily responsible for administering and enforcing compliance with the Natural Gas Policy Act of 1978 (NGPA) (92 Stat. 3350). As applied to OCS matters, the NGPA provides new well head pricing controls for certain natural gas produced from the OCS.

11. Deepwater Tanker Terminal/Refinery Complex

A feasibility analysis has been conducted to determine economic, technical and environmental issues related to locating refineries, petrochemical and auxillary deepwater tanker terminals in the Coastal Plains region of North Carolina, South Carolina, and Georgia (Coastal Plains Regional Commission, 1975).

The study concluded that single point mooring system (SPM) deepwater facilities in 110 ft of water were feasible in the South Atlantic and that offshore conditions were acceptable for SPM operations off all three coasts examined, with waters offshore Georgia being most conducive because of the prevailing mild climatology (e.g., wave conditions, wind stress, visibility class, and storms).

It is anticipated that even with current conservation efforts, there will be a continuing need for imported crude oil, most of which will arrive by tanker. Marketable discoveries of domestic oil and gas in the South Atlantic will be transported largely by tankers and perhaps by pipelines (BLM, 1978). The deep-water terminal/refinery complex would yield potentially significant economic returns and perhaps some environmental advantages in coastal areas resulting from fewer ship-calls to deliver petroleum products and from the fact that fewer vessels would congest harbors and threaten vital estuarine areas.

An SPM system consists of a buoy securely anchored to the ocean bottom, incorporating a swivel arrangement for orientation of moored vessels in response to oceanic conditions. A specially designed flexible hose extends from the surface to a rigid submarine pipeline which joins the deepwater terminal to onshore storage and/or refinery areas. An elevated pumping platform located approximately two miles away from the SPM would house pumps capable of moving crude oil 40 to 50 miles to shore as well as operational facilities, crew quarters, weather recording and communication facilities, metering equipment, environmental monitoring devices and spill containment and removal equipment. The system could accommodate vessels in excess of 500,000 dead weight tons (DWT) with an initial capacity of 600,000 barrels-per-day (BPD) throughout for a two buoy/one pipeline setup.

The coastal reaches from the Savannah River to St. Catherines Sound, Ga. and from the Altamaha River to St. Mary's River, Ga. met the criteria

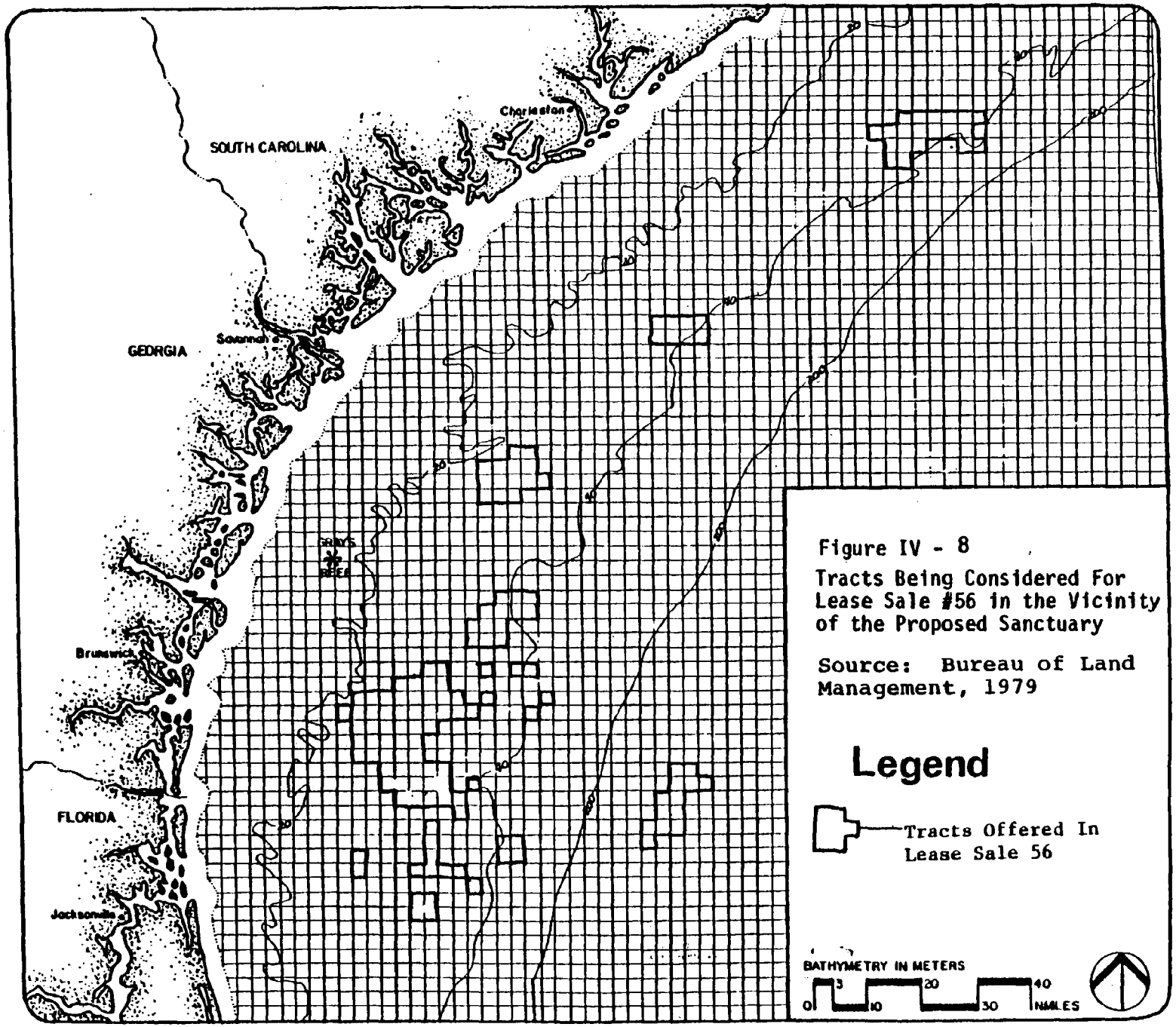


Figure IV - 8

Tracts Being Considered For Lease Sale #56 in the Vicinity of the Proposed Sanctuary

Source: Bureau of Land Management, 1979

selected for siting terminal/tank farm/refinery complexes. Bathymetric, topographic and meterological conditions offshore and the proximity of 110 ft contour to shore make these sites attractive.

At the present time, no specific proposals for offshore and onshore facilities have been made or analyzed.

12. Offshore mineral potential

Sand is the only mineral mined commercially in Georgia's coastal region. Most sands are mined along major coastal rivers for use as construction and fill material. Heavy-mineral sands are mined in northeast Florida and although other are generally known to occur along Georgia's coast, it is not known if they are in sufficient concentrations to be commercially mined. Phosphate mining, however, has a strong potential for economic development. There are substantial phosphate ore-bodies beneath onshore and offshore areas of Chatham County (Savannah is located in Chatham County). Little is known about the offshore phosphate deposits, although they are believed to be present in abundance. In some locations offshore, deposits have been found at the surface of the seabed (Georgia DNR, 1975).

Table IV - 9 Steps in the OCS decision-making process.

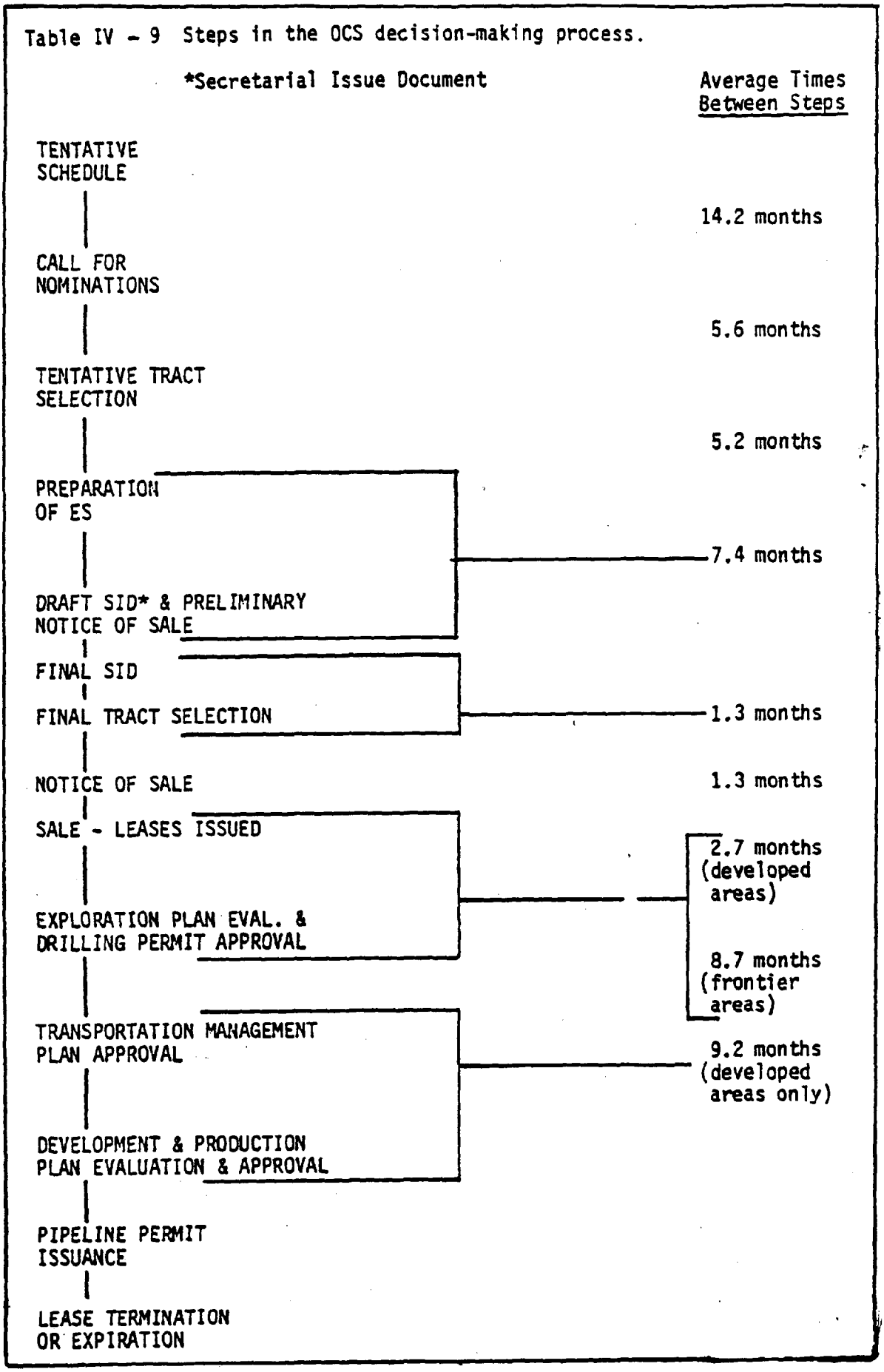
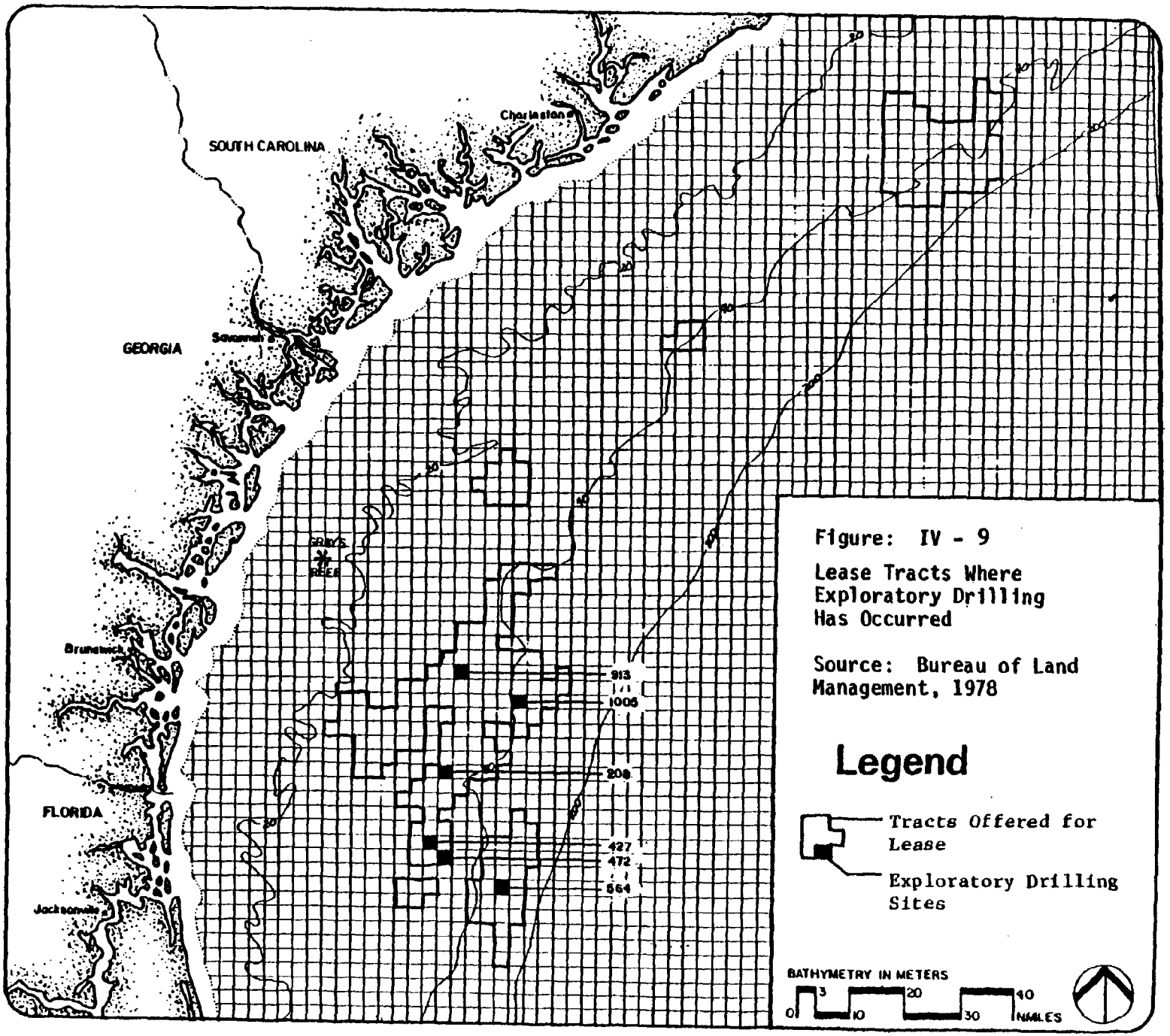


TABLE IV -10 Forecast of amounts of recoverable resources from area emcompassed by Lease Sale #43. Source: U.S. Geological Survey, 1976.

	Low	High	Mean
Oil (Billions of barrels)	0.282	1.009	0.65
Gas (Trillions of cubic feet)	0.890	6.810	4.30

TABLE IV -11 Oilspill frequency estimates by potential source for the South Atlantic lease area based on distributions of Devanney and Stewart, 1974. Source: Bureau of Land Management, 1978.

	Expected number	Probability of at least one spill
A. Spills ~1,000 bbl		
Platforms	1.5	0.78
Pipelines	1.7	.81
Tankers	2.2	.89
Platforms and pipelines	3.2	.96
Platforms and tankers	3.8	.98
B. Spills 50-1,000 bbl		
Platforms and pipelines	32	~0.99
Tankers	16	~.99
C. Spills 0-50 bbl (mean size approx = 1 bbl)		
Platforms	2,338	~0.99
Tankers	277	~.99


SOUTH CAROLINA
Charleston
GEORGIA
Savannah
Brunswick
FLORIDA
Jacksonville
GRAYS REEF
913
1006
209
427
472
564
Figure: IV - 9
Lease Tracts Where Exploratory Drilling Has Occurred
Source: Bureau of Land Management, 1978
Legend
Tracts Offered for Lease
Exploratory Drilling Sites
BATHYMETRY IN METERS
0
3
10
20
30
40
NMILES

F. The Legal Status Quo

1. Summary

Gray's Reef is located on the South Atlantic Continental Shelf seaward of the territorial sea and State jurisdiction.

A variety of Federal statutes and regulations apply to activities taking place in the area. Those that apply to activities posing significant threats to the resources at Gray's Reef identified earlier in this section are discussed here. Each statute is examined in terms of its present effectiveness and potential capability in controlling impacts on these resources.

In addition, the enforcement responsibility and capabilities of the relevant Federal agencies are examined including their permitting, surveillance and monitoring procedures and the enforcement arrangements among themselves and with State agencies.

Regulations for the most direct threats to the live bottom; i.e., seabed alteration and construction, bottom-trawling and specimen-dredging, anchoring, wire trap fishing, marine specimen collecting, damage to or removal of cultural/historical resources, do not presently exist, except perhaps in conjunction with OCS mineral development and obstructions to navigation. Until recently, activities involving taking of coral were regulated by the Bureau of Land Management (BLM) under the Outer Continental Shelf Lands Act (OCSLA) but a recent decision of the Fifth Circuit Court of Appeals held these regulations invalid except in connection with BLM's OCS leasing activities.

Gray's Reef is located within the geographical jurisdiction of the South Atlantic Fishery Management Council (SAFMC). As described in this section, the SAFMC is in the process of preparing a Fishery Management Plan (FMP) for Snapper-Grouper Resources, and jointly with the Gulf of Mexico Fishery Management Council (GMFMC), FMPs for Coastal Pelagic Migratory Resources (Mackerel), Spiny Lobster and Coral and Coral Resources. FMPs would impose various limitations on the fishing of these resources as detailed below. Anticipated timing of the respective plans is uncertain. No FMP's are being prepared for other resources which are interrelated in the live bottom ecosystem.

The effectiveness of the draft FMPs to mitigate activities causing adverse physical and ecological impacts on the Gray's Reef live bottom cannot be fully assessed at the present time. SAFMC management goals of managing fisheries for commercial development are quite different from the proposed Gray's Reef Marine Sanctuary Program goal of managing an ecological system for the protection and maintenance of a live bottom reef with emphasis on enhancing public awareness and wise use of live bottom reef systems, public education, research and resource assessment, even though the regulatory structures under each system may be fully compatible and complementary.

Protection for a threatened and endangered marine species and for marine mammals is provided under the Endangered Species Act and Marine Mammal Protection Act, respectively. Regulation of tropical marine specimen collecting does not presently exist.

There are no regulations controlling the taking of cultural or historical resources on the high seas.

In addition to these more direct threats, the disposal of sewage and trash, primarily by recreational boaters, and discharge, leakage or spillage of hydrocarbon products from cargo vessels, pipelines and exploratory or production wells could threaten the resources of Gray's Reef. These threats are not considered in any FMP and the existing regulation under other laws is limited as detailed below.

Pollution from dredging and dredge spoil disposal, ocean outfalls and other point source discharges and from any ocean dumping activities is possible, but not likely at present in the Gray's Reef area. The Environmental Protection Agency and the Corps of Engineers have authority under the Clean Water Act and Ocean Dumping Act to address these activities on a case-by-case basis.

Surveillance and enforcement duties for the previously mentioned laws and implementing regulations have been assigned, for the most part, to the U.S. Coast Guard and in certain instances, to the National Marine Fishery Service's Division of Law Enforcement.

2. Survey of Authorities Relevant to the Protection of Gray's Reef Resources

Outer Continental Shelf Lands Act (43 USC §1331 et seq.)

The Outer Continental Shelf Lands Act, as amended in 1978, (OCSLA) establishes Federal juridisction over the natural resources of the Outer Continental Shelf (OCS) beyond 3 nmi (5.6 km), and gives the Secretary of the Interior primary responsibility for managing OCS mineral exploration and development. The Secretary's responsibility has been delegated to two Bureaus within the Department of the Interior: the Bureau of Land Management (BLM) and the U. S. Geological Survey (USGS).

The BLM has overall responsibility for leasing OCS lands for mineral exploration and development and the authority to approve applications for pipeline rights-of-way on the OCS (43 CRF Part 2883) (BLM, 1979). Two OCS Lease Sales have been slated for the South Atlantic within the next five years. Calls for Nominations in March, 1979 for lease sale 56 scheduled for August, 1981 indicated that there was no interest in the tracts in the vicinity of Gray's Reef. It is too early to make a prediction in regards to a scheduled January 1984 sale.

In unique or special areas, BLM may impose special lease stipulations to protect specific geological, cultural, and biological features. For example, BLM considers live-bottoms to be sufficiently

unique and sensitive to require identification and characterization prior to oil and gas exploration activities and assumes responsibility for insuring adequate protection to minimize any adverse impacts if drilling takes place (BLM, 1979) (see Appendix B). BLM is currently funding projects to locate and map live-bottom areas in the South Atlantic and to do biological reconnaissance in order to apply appropriate stipulations to protect these areas if lease tracts appear around them.

The USGS is charged with approving plans for exploratory drilling and the development and supervision of OCS operations, including enforcement of regulations pursuant to the OCSLA (30 CFR Part 250) and stipulations applicable to particular leases and issuing OCS Orders to supplement regulations in particular regions.

An Intergovernmental Planning Program (IPP) has been established to provide a coordinating and planning mechanism for three major OCS oil and gas development planning elements: leasing; environmental studies; and transportation planning. The IPP has established 6 Regional Technical Working Groups which make recommendations at various decision points during the lease sale process. If a marketable discovery is made, a State Working Group Subcommittee is convened to prepare site-specific management plans, including:

- o analyses and recommendations for discrete corridors and alternative transportation routes to onshore facilities or to off-shore terminals serving as collection points;
- o identification of environmentally sound alternative areas for location of on-shore facilities;
- o identification of any alternative regarding surface vessel transportation in accordance with appropriate regulatory agencies;
- o plans for monitoring construction activities on the OCS and any follow-up studies; and
- o analysis of any stipulation and lease sale restrictions identified as applicable to right-of-way

Until recently, BLM protected corals and coral resources on the OCS from taking and disturbance, except by permit in certain cases, pursuant to 43 CFR 6224: Protection and Management of Viable Coral Communities. However, a recent 5th Circuit Court of Appeals decison ruled that BLM's jurisdiction only applies to activities pursuant to offshore oil and gas leasing operations, thereby eliminating that particular source of protection for coral resources on the OCS.

Under section 4(f), the Army Corps of Engineers is given authority over fixed structures on the Outer Continental Shelf (43 USC 1333(D)). While the statutory language refers to the prevention of obstruction to navigation, the authority has been interpreted more broadly and permit applications are

reviewed according to a variety of criteria (33 CFR Part 322) except when the structure is on lands leased by BLM where the review is limited to the impact on navigation and national security (33 CFR 322.5(A)).

All natural gas produced from the OCS is considered to be interstate and therefore is subject to the Federal Energy Regulatory Commission (FERC) jurisdiction. The Natural Gas Act, the National Environmental Policy Act, and OCS Lands Act Amendments of 1978 all grant authority or require that the FERC investigate the environmental effects of a proposed offshore project, as well as the potential gas reserves, the need for this gas, and the availability of capital to develop this resource. Also, the FERC is primarily responsible for administering and enforcing compliance with the Natural Gas Policy Act of 1978 (NGPA) (92 Stat. 3350). As applied to OCS matters, the NGPA provides new wellhead pricing controls for certain natural gas produced form the OCS.

The U.S. Coast Guard is the enforcement agent for the OCSLA. (See Section IV. F. 3. for a description of Coast Guard responsibilities).

Fishery Conservation and Management Act of 1976 (FCMA) (16 USC §1801 et seq.)

The FCMA provides for the conservation and management of all commercial and recreational fishery resources in the U.S. Fishery Conservation Zone, from 3 to 200 nmi (5.6-370 km) offshore. Regional Fishery Management Councils have the authority under the FCMA to develop Fishery Management Plans (FMPs) to propose and implement management measures (regulations) for fishery stocks within respective geographical ranges of jurisdiction. Plans are developed only for those fish stocks in need of special management measures to insure adequate population levels. FMPs determine the levels of commercial and sport fishing effort which are consistent with the goal of achieving and maintaining an optimum yield of each fishery. The National Marine Fisheries Service (NMFS) is charged with establishing guidelines for and approving FMPs.

In the Gray's Reef area, this authority is vested in the South Atlantic Fishery Management Council (SAFMC). Four FMPs are under consideration at the present time; and are described as follows:

1. Draft Snapper-Grouper FMP

Phase 1: Description of the FMP for Snapper-Grouper Resources (latest draft February 1980), reviews (1) the short- and long-range goals of the FMP; (2) the distribution, abundance and present condition, ecological relationships, estimate of maximum sustainable yield, and probable future condition of fisheries within the snapper-grouper complex; (3) the condition of natural and artificial habitats of the stocks and Federal and State habitat protection programs, laws and policies; (4) fishery management jurisdiction, laws and policies; (5) the history and present efforts of commercial and recreational user groups, vessels and fishing gear; (6) the economic characteristics of the fishery; (7) a description of the businesses, markets and organizations associated with the snapper-grouper fishery; and (8) a description of the social and cultural framework of domestic snapper-grouper fishermen.

A summary of SAFMC Action (February 28, 1979) Decision Elements outlines tentative Snapper-Grouper FMP Management Goals and Management Measures, as follows:

Tentative Managment Goals include:

- o Long range goal: Optimize the economic and social values of the harvest consistent with preventing overfishing of the stocks.

  Sub-goals:

- o Prevent overexploitation of stocks not now overexploited.
- o Prevent further overfishing of those stocks which now may be overexploited.
- o Restore, over time, to the MSY level those stocks which now may be overexploited.
- o Allow full exploitation of those stocks not fully harvested.
- o Encourage protection of existing habitat and the development of new habitat by the construction of artificial reefs.
- o Reduce gear and user conflicts.
- o Short term goal: Because of the dearth of information about social and economic values of this fishery and the biological status of the stocks, the short term goal is to stabilize harvest while socioeconomic and biological data are being obtained.

Tentative Management Sub-units:

- o Black Sea Bass
- o North of Canaveral (mid-depth)

Gag	Vermillion snapper
Scamp	Grunts
Red porgy	Speckled hind
Red snapper	Triggerfish

- o South of Canaveral (mid-depth and inshore)

Mangrove snapper	Inshore groupers
Yellowtail snapper	Grunts
Mutton snapper	Porgies
Lane snapper	

- o Deep Water Complex (throughout range)

Snowy grouper	Golden tilefish
Yellowedge grouper	Black tilefish

The SAFMC approved the following estimates of current catch and maximum sustainable yield (MSY) by Sub-Unit:

o Estimates of the Current Catch by Sub-Unit:*

1.	Black Sea Bass	1,605,914 lbs
2.	North of Canaveral (mid-depth)	4,126,116 lbs
3.	South of Canaveral (mid-depth & inshore)	8,933,199 lbs
4.	Deep Water Complex (throughout range)	1,184,770 lbs
	Total catch	15,894,999 lbs.

*To be rounded to the nearest 100,000 pounds.

o Estimates of MSY by Sub-Unit:

1.	Black sea bass	1.6 million lbs
2.	North of Canaveral (mid-depth)	4.1 million lbs
3.	South of Canaveral (mid-depth & inshore)	8.9 million lbs
4.	Deep water (throughout range)	1.5 million lbs
	Total catch	16.1 million lbs

Determination of OY:

OY is equal to MSY in each of the management sub-units with the exception of an adjustment to be made to black sea bass.

Tentative Management Recommendations:

° Quotas

Establish a quota for each management sub-unit.

Set the quota for each management sub-unit equal to OY for that sub-unit.

The quota year is to be the calendar year.

Quotas are established with an awareness that the estimates of MSY used to determine OY and sub-unit quotas were, to a great degree, based on the best available estimates of the current catch. Therefore, if better data becomes available which indicate that the current landing statistics and/or estimates of MSY are in error, the Secretary and the Council will re-evaluate MSY, OY and sub-unit quotas before actions to restrict the fishery are taken.

° Size Limits

Impose a minimum size limit of 9 inches for black sea bass (sub-unit 1) for the entire region.

The Committee recommends that in the first generation plan, size limits not be considered as a manangement tool, except in the black sea bass fishery. First generation is understood to mean the first set of regulations promulgated.

° Zoning of Artificial Reefs

Allow the use of only hand operated reels and handlines within 300 yards of permitted artificial reefs which are (or were) constructed solely for the purpose of recreational fishing.

This zoning restriction of artificial reefs established solely for recreational fishing, will permit spearfishing in the zone north of Cape Canaveral and prohibit spearfishing south of Cape Canaveral.

For artificial reefs constructed for other purposes, such as spearfishing, allow permittee to apply to the Council for special regulations on a special permit.

° Traps (Items a, b, c, & d apply throughout the range)

a. Traps will have degradeable panels of appropriate size (at least as large as the entry ports) or degradeable door fasteners.

b. Traps will have mesh no smaller than 1x2 inches or 1.5 inch hexagonal.

c. Trap buoys must be identified with the boat of the owner by a color code.

d. A person must not fish traps other than his own without authorization of the owner.

(Items e, f. & g will apply to the area south of Canaveral in water shallower than 50 fathoms.)

e. Pulling traps is prohibited between the period one hour after sunset and one hour before sunrise.

f. Traps may not be larger than 54 cubic feet.

g. No boat may fish more than 200 traps.

° Prohibit the use of poisons, explosives, and powerheads in the harvest of fishes.

° The snapper-grouper FMP will contain a mandatory reporting system, the details of which will be developed after the presentation by NMFS on their vessel enumeration system.

In addition, the harvest of reef fishes by trawling was a management measure considered and rejected by committee (SAFMC, 1979).

2. Draft Coral and Coral Reef Resources FMP

The latest draft, February 14, 1980, is being considered now by the Gulf and South Atlantic Fishery Management Councils.

Until the recent court decision concerning BLM jurisdiction over the collecting of coral, (September 1979), Federal law prohibited the collecting of coral outside State waters, without a permit. Consequently, there is not at present a commercial fishery for the harvesting of corals.

The "plan" therefore concentrates on identifying participating user groups, analyzing the resource and the human impacts on it and describing the economic and legal factors involved, and recommending alternatives for the coral fishery, including commercial harvest.

Specific management objectives recommended in the FMP are as follows:

- o Develop the scientific information necessary to determine the feasibility and advisability of harvest of the coral resource.
- o Minimize, as appropriate, adverse human impacts on coral and coral reef resources.
- o Provide for special management for coral Habitat Areas of Particular Concern (HAPC).
- o Increase public awareness of the importance and sensitivity of coral and coral reef resources.

The FMP proposes to prohibit a harvest of hard corals in the FCZ except by permit for scientific and educational purposes and to allow limited commercial harvest of soft coral.

Gray's Reef has been proposed for consideration as a HAPC, however no management provisions have been recommended by the Councils.

3. Draft EIS And FMP for the Spiny Lobster Resources

The latest draft, August 1979, is presently under development. The spiny lobster management zone "encompasses the offshore areas from North Carolina to Texas, in practice the commercial and recreational harvest to spiny lobster from U.S. waters is almost exclusively limited to waters off Southern Florida" (DEIS, 1979).

> "The proposed action will result in management of the spiny lobster fishery in the Gulf of Mexico and South Atlantic Fishery Conservation Zone (FCZ), with the primary fishery located in South Florida. The species involved are spiny lobster (Panulurus argus) and associated incidental species as follows: smooth tail

lobster (Panulirus laevicauda); and Spanish lobster (Scyllarides aequinoctialis, Scyllarides nodifer, Scyllarus americanus, and Scyllarus chacei). The basic objectives are to protect long-term yields and prevent depletion of lobster stocks, increase yield from the fishery, reduce user group and gear conflicts, and acquire the necessary information to manage the fishery. Management measures include a size limit, a closed season (including a special recreational season), certain gear restrictions, measures to protect 'shorts' and 'egg-bearing females' and prevent poaching, and a measure to encourage a mechanism to minimize conflicts. Limited mandatory statistical reporting will be implemented under the Fishery Management and Conservation Act of 1976 (P.L. 94-265) and regulated and enforced by the National Marine Fisheries Service, Department of Commerce." (Summary Sheet, DEIS, 1979).

The plan strives to protect the spiny lobster population for future use while allowing harvesting at a rate which approaches the maximum sustainable from the fishery. According to the DEIS, negligible economic, social or environmental changes are anticipated due to the proposed action.

Until preliminary sighting of spiny lobsters at Gray's Reef are confirmed, it is impossible to determine the impact of this FMP on resources and user groups of the Gray's Reef live-bottom area. Only empty lobster carapaces have been found at the live bottom thus far.

4. Draft EIS and FMP for Coastal Pelagic Migratory Resources (Mackerel)

The Gulf and South Atlantic Fishery Management Councils have developed and distributed for review and comment a Draft EIS and FMP for Coastal Pelagic and Migratory Resources (Mackerel)(February, 1980).

Species within the management unit for which management regulations are proposed include the king mackerel, Scomberomorus cavalla, Spanish mackerel, S. maculatus, and cobia, Rachycention canadum. Species included in the management unit but for which regulations have not been proposed, include the cero mackerel, S. regalis, little tunny Euthynns alletteratus, dolphin Coryphaena hippurus and bluefish, Pomatomus saltatrix.

Recommended management objectives for king and Spanish mackerel are:

- o Instigate management measures necessary to prevent exceeding maximum sustainable yield (MSY) ["the mathematical estimate for the pounds of resource which can be harvested annually without overfishing the resource" DEIS, 1980].
- o Establish a mandatory statistical reporting system for monitoring catch.
- o Minimize gear and user conflicts.

- (For Spanish mackerel only) Promote the maximum use of the resource up to the optimum yield estimate (the MSY estimate modified by economic, sociological and ecological (biological) characteristics of the fishery and user groups DEIS, 1980).

The recommended management objective for cobia is to instigate management measures necessary to increase yield per recruit and average size and to prevent overfishing.

Management measures proposed for public review and comment in the DEIS may be summarized as:

- If a conflict arises through expansion of historical king mackerel or Spanish mackerel fisheries in a traditional fishing area or region, the Secretary of Commerce (Secretary), after consultation with affected Council and States, may take action to:

  a. Separate users or gear by area (fishing zone);
  b. Separate users or gear by time (day or week);
  c. Assign quotas; or
  d. Allow unlimited usage of gear or device.

- If conflict arises through the introduction of king or Spanish mackerel gear or devices into new regions where they have not been historically fished, the Secretary, after consultation with affected Council and States, may take action to:

  a. Prohibit use of the gear or device in that region;
  b. Allow only limited use of the gear or device;
  c. Limit number of units of gear or device; or
  d. Allow unlimited gear usage.

- If king mackerel catch exceeds the 37 million pound annual allocation, the Secretary may take action to close the recreational or commercial fisheries, after considering all relevant data and consulting with affected Councils;

- Purchase, sale or processing king mackerel under 25 inches fork length will be illegal;

- All king mackerel nets shall have a 4 3/4 inch minimum mesh size;

- Use of purse seines shall be prohibited in the king mackerel fishery of the South Atlantic except in conjunction with research programs to determine their effect on the fishery;

- After consulting with affected Councils, bag and/size limits for king mackerel taken by recreational or recreational-for-hire users or trip limits for commercial users will be instituted when suppporting data becomes available;

- o A 12-inch fork length minimum size limit will be set on Spanish mackerel in both commercial and recreational fisheries. Undersized fish cannot exceed five per cent of total catch by weight;

- o The Secretary is requested to develop a research program to determine the effect of purse seines on Spanish mackerel;

- o Bag limits for Spanish mackerel taken by recreational or recreational-for-hire users and/or trip limit for commercial users will be set when supporting data becomes available;

- o Possession of cobia less than 33 inches fork length shall be prohibited;

- o The Councils will "require a reporting system for all user groups and processors based on statistical sampling whereby it would be mandatory for a selected respondant to provide answers to a sample questionnaire on a recurring basis that is not of great frequency;"

- o For king mackerel the Councils will require a mandatory trip ticket system for all the for-hire charter and party boats; and

- o For Spanish mackerel, the Councils will require a mandatory trip ticket system for a sample of the "for-hire" charter and party boats. (GMFMC and SAFMC, 1980a).

(Additional management measures have been proposed but are not listed here because they are not likely to impact coastal migratory pelagic fisheries at Gray's Reef.)

The SAFMC in conjunction with other Councils are developing FMPs for billfish and sharks.

The FCMA is enforced by the U.S. Coast Guard (USCG) in the Department of Transportation and the National Marine Fisheries Service (NMFS) in the Department of Commerce (see Section IV. F. 3.). The Act empowers the Secretary of Commerce to enter into cooperative agreements with any State agency to coordinate regulatory and enforcement responsibilities.

5. DEIS Preliminary Management Plan for Atlantic Billfishes and Sharks

The DEIS Preliminary FMP currently prohibits the retention of billfishes and other non-target species taken incidental to directed foreign fisheries for tunas and sharks within the FCZ. In the Preliminary FMP, it is being proposed to extend the 1979 procedures to minimize the capture and subsequent mortality of non-target species

in directed foreign shark fisheries by imposing area and gear limitations. This proposal is designed to limit the bycatch of incidental grouper and snapper and other prohibited species.

Endangered Species Act of 1973 (ESA) (16 USC §1531-1543)

The Endangered Species Act of 1973 (ESA) provides protection for listed species of marine mammals, birds, fish, invertebrates and plants. The U. S. Fish and Wildlife Service (FWS) and NMFS determine which species need protection and maintain a list of endangered and threatened species. The most significant protection provided by the ESA is the prohibition on taking. The term "take" is defined broadly to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in such conduct" [16 USC §1532(14)]. The FWS regulations interpret the term "take" to include significant environmental modification or degradation and acts which annoy listed species to such an extent as to significantly disrupt essential behavior patterns (50 CFR 17.3).

The ESA also provides for the protection of endangered species and critical habitat. This is accomplished by means of a consultation process designed to insure that projects authorized, funded, or carried out by Federal agencies do not jeopardize the continued existence of endangered or threatened species or "result in the destruction or modification of habitat of such species which is determined by the Secretary (of Interior) to be critical" (16 USC §1536). Critical habitat areas for endangered species are designated by the FWS and NMFS depending on the species. It does not provide such protection against private or State actions. The 1978 amendments to the ESA established a Cabinet level committee authorized to exempt Federal agencies from compliance with responsibility in regard to critical habitats where it can be demonstrated that there are not reasonable alternatives to the action, and that benefits of the action outweigh those of conserving species or their critical habitat.

The loggerhead turtle Caretta caretta is the only threatened species encountered at Gray's Reef thus far. The endangered right whale (Balaena glacialis) has been sighted in the vicinity. Experts suggest that Gray's Reef has suitable habitat for the endangered Atlantic ridley turtle (Lepidochelys kempi) and the Atlantic green turtle Chelonia mydas mydas. The endangered Florida manatee (Trichechus manatus latirostus) occurs in coastal areas of Georgia during the warmer months of the year. In addition, experts claim that further taxonomic studies, notably among the corals and sponges, may reveal the presence of additional species which should be listed as threatened or endangered.

Enforcement agencies for provisions of the ESA are the Treasury Department (Customs), the U.S. Coast Guard, and NMFS Division of Law Enforcement (see Section IV. F. 3.).

Marine Mammal Protection Act of 1972 (MMPA) 16 USC §1361 et seq.)

The MMPA provides protection of all species of marine mammals, again primarily against "taking," which for practical purposes has the same meaning as for the ESA. However, there are no specific provisions for habitat protection.

Provisions of the MMPA are implemented by the Department of Commerce, National Marine Fisheries Service (NMFS), which is responsible for whales, porpoises, and pinnipeds other than walruses, and by the Department of the Interior, U.S. Fish and Wildlife Service (FWS), which is responsible for all other marine mammals. The Marine Mammal Commission advises these implementing agencies and sponsors relevant scientific research.

Twenty-five species of cetaceans (whales, dolphins and porpoises) are reported in offshore waters of the South Atlantic Bight. Twelve species have been identified by strandings or sightings in the Georgia area, including Byrde's, humpback, right, dense-beaked, Antillean-beaked, goosebeaked, pygmy sperm, dwarf sperm, false killer and short-finned pilot whales and rough-toothed, bottlenose and spotted dolphins (Neuhauser and Ruckdeschel, 1978).

Clean Water Act (CWA) (33 USC §1251 et seq.)

It is the goal of the CWA to restore and maintain the chemical, physical and biological integrity of the Nation's waters. The CWA set out two basic regulatory mechanisms for preventing and reducing water pollution: (1) the regulation of discharges from point sources and the regulation of discharges of oil and hazardous substances. The Act also regulates vessel sewage disposal and disposal of dredge material. To varying degrees, waters in the territorial seas, contiguous zone, and the ocean beyond are subject to the requirements of the CWA, as outlined below.

The CWA's chief mechanism for preventing and reducing water pollution is the National Pollutant Discharge Elimination System (NPDES), administered by the Environmental Protection Agency (EPA). Under the NPDES program, a permit is required for the discharge of any pollutant from a point source into the navigable waters of the U.S., the waters of the contiguous zone and ocean waters. Permits are issued by EPA or by a State to whom the permit authority has been delegated. In Georgia this authority has been delegated to the Environmental Protection Division of the Georgia Department of Natural Resources.

An NPDES permit from EPA is required for discharges associated with oil and gas development. EPA generally grants NPDES permits for offshore oil and gas developments based on the effluent guidelines. Other conditions beyond these guidelines can be imposed by the Regional Administrator on a case-by-case basis. State NPDES authority only extends to the limits of the territorial sea, not beyond to the contiguous zone or high seas.

The CWA prohibits the discharge of oil and hazardous substances in such quantities as may be harmful to public health or the environment except discharges outside the territorial sea permitted by the International Convention for the Prevention of Pollution of the Sea by Oil, 1954 (33 USC §1321(b)(3)) (see Oil Pollution Act below).

There is no present or proposed activity in or adjacent to the Gray's Reef area that requires a NPDES permit.

The CWA provides for the implementation of a National Contingency Plan (NCP) to deal with oil spills if they do occur. The Coast Guard, in cooperation with EPA, administers the NCP, which applies to all discharges of oil in the contiguous zone and to activities conducted under the Outer Continental Shelf Lands Act (OCSLA), including oil and gas activities conducted pursuant to a lease as well as geological and geophysical exploration independent of a lease. As a result of a Memorandum of Understanding between the Secretaries of Transportation and Interior, however, USCG has exclusive authority to institute measures to abate the source of pollution (United States Departments of the Interior and Transportation, Memorandum of Understanding, August 16, 1971).

The NCP establishes the organizational framework to respond to oil spills. To carry out the national plan, regional plans (RCP) have been established; the United States Coast Guard (USCG) has issued such an RCP for Federal Region VII which includes the Gray's Reef Area. Under the RCP, Coast Guard personnel investigate all reported offshore spills, notify the party responsible (if known) of its obligation to clean up the spill, and supervise the cleanup operation. The Coast Guard retains final authority over the procedures and equipment used in the cleanup. If the party responsibile for the spill does not promptly begin cleanup operations, the USCG can hire private organizations and seek to recover costs from the party responsible.

The Coast Guard is the enforcement agency for the CWA(see Section IV. F. 3.).

Marine Protection, Research, and Sanctuaries Act
(33 USC §1401-1444)

Title I of the Marine Protection, Research, and Sanctuaries Act (MPRSA), also known as the Ocean Dumping Act, regulates the dumping of materials into the territorial sea (i.e., State waters), the contiguous zone, and the ocean beyond, but only where transported for the purpose of dumping. The U.S. Environmental Protection Agency (EPA), under Section 1412(c) of this act, pre-selects sites or times within which certain materials may not be dumped and issues permits for the disposal of all materials, with the exception of dredge spoils, over which the U.S. Army Corps of Engineers(COE) excercises authority. The permit process takes into consideration the effects of the proposed dumping on marine ecosystems.

At the present time, there are no EPA pre-selected dump sites in use off the coast of Georgia. One site was designated but was never

used and EPA allowed the site to expire January 11, 1980 (Ramsey, 1980, pers. comm.). There are two active COE dredge material disposal sites which are located shoreward and to the north and south of Gray's Reef.

The U.S. Coast Guard is the enforcement agency for the MPRSA (see Section IV. F. 3.).

Oil Pollution Act of 1961 (33 USC §1001-10016)

The Oil Pollution Act of 1961 (which implements the International Convention for the Prevention of Pollution of the Sea by Oil, of 1954) regulates discharges of oil or oily mixtures from vessels with the exception of tankers of less than 150 tons and other vessels of less than 500 gross tons. With the exception of discharges from machinery space bilges, tankers subject to the Act may not discharge oil or oily mixtures unless they are 50 nmi (93 km) from the nearest land and the total quantity of oil discharged does not exceed 1/15,000 of the total cargo capacity. Discharges from other vessels regulated by the Act, and discharges from the machinery bilges of tankers, must be made as far as practicable from land and may not have an oil content of more than 100 parts per million. In addition to the above requirements, a discharge by any vessel regulated by the Act must be made while the vessel is en route and the instantaneous discharge rate must not exceed sixty liters per mile.

The U.S. Coast Guard is the enforcement agency for the OPA (see Section IV. F. 3.).

Intervention on the High Seas Act

The Intervention on the High Seas Act of (33 USC §1471 et seq.) gives the Secretary of Transportation responsibility to take those measures necessary to protect the United States' marine resources, wildlife, coastal zone and estuaries, and shorelines and beaches against polluting oil discharges from ships on the high seas. The Secretary may coordinate efforts to eliminate the threatened pollution and remove or destroy the ship and cargo creating the danger, if necessary. The Act implements the Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualities of 1969.

The U.S. Coast Guard is the enforcement agency for the IHSA (see Section IV. F. 3.).

Ports and Waterways Safety Act, amended (PWSA) (33 USC 1221)

The PWSA, as amended by the Port and Tanker Safety Act of 1978, is designed to promote navigation and vessel safety and the protection of the marine environment.

The PWSA authorizes the U. S. Coast Guard (USCG) to establish vessel traffic services and systems for ports, harbors, and navigable waters to protect navigation and the marine environement. The Coast Guard may designate Port Access Routes both in the territorial sea and in high sea approaches to ensure safe access routes.

The Port and Tanker Safety Act of 1978, also authorizes the Coast Guard to control a variety of practices including the discharge of tank washings of oil or hazardous materials. The Act applies to U.S flag vessels and foreign flag vessels seeking access to U.S. ports.

The 1978 Amendments also establish a comprehensive program for regulating the design, construction, operation, equipping, and manning of all tankers using U.S. ports to transfer oil and hazardous materials. These requirements are, for the most part, in agreement with protocols (passed in 1978) to the International Convention for the Prevention of Pollution from Ships, 1973, and the International Convention of Safety of Life at Sea, 1974 (33 USC §1221), and include segregated ballast tanks for new tankers and retrofitting of most other tankers by 1983. The amendment also requires the USCG to conduct a nationwide study on Port access routes necessary to reconcile impacting uses and protection of marine resources.

The U.S. Coast Guard is the enforcement agency for the PWSA (see Section IV. F. 3.).

The Antiquities Act, 16 U.S.C. 143 et seq.
The Abandoned Property Act, 40 U.S.C. 310
The National Historic Preservation Act, 16 U.S.C. 470 et seq.

The Antiquities Act provides that the DOI may designate and protect certain historically important sites. A recent court decision determined that DOI's authority for such action does not apply to antiquities located on the OCS. The Abandoned Property Act, 40 U.S.C. 310 is similarly limited. The National Historic Preservation Act, 16 U.S.C. 470 et seq. offers protection for marine artifacts once listed, but only with respect to Federal or Federally supported activities. BLM initiated a study to identify areas of cultural sensitivity between Cape Hatteras, North Carolina and Key West, Florida.

Given the geological and cultural history of the South Atlantic Embayment, it is possible that the Gray's Reef area holds notable shipwrecks or paleoenvironmental artifacts.

The U.S. Coast Guard is the enforcement agency for these Acts (see Section IV. F. 3.).

Fish and Wildlife Coordination Act, as amended
16 U.S.C. 661-66c

Authorizes the Secretary of the Interior to cooperate with Federal, State, and public or private agencies in the conservation and development of fish and wildlife resources affected by water-resource

development programs. He is further authorized to make reports and recommendations on the wildlife aspects of such projects based on surveys and investigations to be conducted by the Fish and Wildlife Service. These reports and recommendations are made an integral part of the report, prepared by any Federal agency responsible for engineering surveys and construction of such projects, to be presented to Congress or authorizing agency.

The U.S. Coast Guard is the enforcement agency for the FWCA (see Section IV. F. 3.).

Lacey Act (A Part) Transportation of Wildlife Taken in Violation of State, National, or Foreign Laws. 18 U.S.C. 43-44

The original Lacey Act (Act of May 25, 1900, 31 Stat. 187) authorized activity in the Department of Agriculture for the preservation, distribution, introduction, and restoration of game birds and other wild birds.

The Act prohibited the importation of foreign wild animals or birds except under a permit with exceptions as determined by the Secretary of Agriculture. The Act also prohibited the interstate transportation of foreign animals and birds, the importation of which is prohibited. The law has been amended several times since 1900. During this period Interior has replaced Agriculture and language changes have been made to apply the transportation prohibition first to "any wild animal or bird of any kind" and more recently to "wildlife" which is defined to mean "...any wild mammal, wild bird, amphibian, reptile, mollusk, or crustacean,...". The addition of "mollusk or crustacean" by Public Law 91-135, (December 5, 1969, effective June 3, 1970), made this law useful in commercial fisheries management for the first time. At the present time the law prohibits the transportation of wildlife, as defined, if taken in violation of State, National or foreign laws and provides both civil and criminal penalties.

The Black Bass Act, as amended 16 U.S.C. 851-856

This Act makes it unlawful to transport to or from States, Territories, the District of Columbia, or a foreign country, any black bass or other fish caught, killed, taken, sold, purchased, possessed, or transported at any time contrary to the law of the State, Territory, the District of Columbia, or a foreign country where such acts were committed. The Act also authorizes enforcement procedures. An amendment has been proposed to also include coral under this Act.

3. Review of Enforcement Agencies with Authority in the Federal Waters of Gray's Reef Area.

U. S. Coast Guard

The Coast Guard, as established in 1790, is a military service, a branch of the armed forces of the U.S. and is the major Federal maritime law enforcement agency. Its overall authority, to enforce or assist in the enforcement of applicable Federal laws on and under the high seas and waters, comes from Title 14, USC 2.

Primary Duties:

> "The Coast Guard shall enforce or assist in the enforcement of all applicable Federal laws on and under the high seas and waters subject to the jurisdiction of the United States; shall administer laws and promulgate and enforce regulations for the promotion of safety of life and property on and under the high seas and waters subject to the jurisdiction of the United States covering all matters not specifically delegated by law to some other executive department, shall develop, establish, maintain, and operate, with due regard to the requirements of national defense, aids to maritime navigation, icebreaking facilities, and rescue facilities for the promotion of safety on, under, and over waters other than the high seas and waters subject to the jurisdiction of the United States; shall engage in oceanographic research on the high seas and in waters subject to the jurisdiction of the United States; and shall maintain a state of readiness to function as a specialized service in the Navy in time of war."

The extent to which the Coast Guard can provide effective enforcement of marine laws on the high seas depends on the number of personnel, vessels, aircraft and other equipment at their disposal and the complexity of the missions assigned to them. Gray's Reef is part of the 7th U. S. Coast Guard District with headquarters in Miami, Florida. There are six Coast Guard facilities within the vicinity of Gray's Reef: Elizabeth City, North Carolina; Charleston, South Carolina; St. Simons Island, Georgia; Savannah, Georgia; Tybee Island, Georgia; and Mayport, Florida. Eighty percent of their missions deal with search and rescue operations. Law enforcement resources which are used in the vicinity of Gray's Reef on occasion include:

Savannah	Helicopters and patrol vessel
Elizabeth City	Long and short range aircraft
Charleston	Patrol vessels and boats
St. Simons	Patrol boats
Mayport	Patrol vessels and boats
Tybee	Patrol boats

In addition to search and rescue operations, USCG missions can include:

- Boating safety;
- Enforcement of Customs laws with respect to smuggling (primarily drugs);

- o Enforcement of immigration laws with respect to aliens/refugees;
- o Establishing and maintaining aids to navigation in navigable waters and on the high seas;
- o Environmental clean-up of toxic and hazardous substances in accordance with the Federal Water Pollution Control Act; and
- o Merchant marine safety.

Without formal agreement and funding, the Coast Guard makes no scheduled patrols in the Gray's Reef area. Distances between stations and the large territory to be covered make these patrols intermittent and infrequent. It is estimated that a Coast Guard vessel transits the sanctuary area about three times per month. Overflights by USCG patrol aircraft are made two to three times per month (Barbour, 1980, pers. comm.; Russell, 1980, pers. comm.).

The USCG has no separate funding earmarked for marine sanctuary regulation enforcement and has withheld official comment on the Gray's Reef proposal until specific enforcement responsibilities have been outlined in the DEIS or in a proposed Management Plan. USCG has stated a willingness to enforce sanctuary regulations subject to availability of vessels and aircraft and subject to the demands of other enforcement responsibility. Should, however, the sanctuary regulations require special efforts, the USCG would need to receive additional funding (Custer, 1980, personal communication).

National Marine Fisheries Service, Division of Law Enforcement, Office of Fisheries Conservation and Management.

The NOAA/NMFS enforcement function originated in 1958 under the Bureau of Commercial Fisheries, evolving from loosely coordinated regional programs responsible for enforcing international conventions, agreements, Federal wildlife statutes and regulations pertaining to certain species of fish, whales and fur seals. This function expanded in the late 1960's to meet the growing demand to control increased foreign fishing effort off the U.S. coast, including enforcement of the newly established Contiguous Fishery Zone (Bartlett Act). As more treaties, agreements and laws with substantial national consequences were implemented, the NMFS law enforcement program necessarily grew. Enforcement responsibility substantially increased with the passage of the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, and the Fisheries Conservation and Management Act of 1976.

The enforcement responsibilities delegated by the Secretary of Commerce to NOAA/NMFS are currently administered and carried out by an Enforcement Division in the Office of Fisheries Management (a staff function) and by five separate and independent regional law enforcement organizations (line function) operating under the direction and control of the respective Regional Directors.

The headquarters enforcement organization in Washington, D.C. is responsible for establishing national enforcement policies and procedures but has no direct control over regional law enforcement organizations.

Gray's Reef is part of the Eastern Enforcement Area of the NOAA/ NMFS Southeast Law Enforcement Region, extending from North Carolina to Key West and including Florida Bay. There are 10 Field Agents in the Southeast Region; 1 Dockside Agent in Charleston and 1 Fishery Statistics Agent in Brunswick.

At the present time NMFS Enforcement Agents do not engage in any routine patrol of waters near Gray's Reef; enforcement capabilities, which are restricted by lack of personnel and vessels, are limited primarily to dockside enforcement. NMFS relies primarily on the Coast Guard and the State in territorial waters; NMFS has just purchased a 25' covert surveillance boat which will be used in the southeast region in areas where identified problems arise. The vessel will be trailered and used in conjunction with a mobile communications van (Fuss, 1980, pers. comm.).

SECTION V. ENVIRONMENTAL CONSEQUENCES

A. Introduction

The purpose of this section is to consider the potential impacts of the proposed action on the environment, including the human environment. Various boundary and regulatory alternatives are considered and evaluated and preferred alternatives identified among them. In Section III: Alternatives Including the Proposed Action, each alternative was described and the potential positive and negative impacts briefly compared. In this section, the initial evaluation is expanded to include a detailed description of potential physical, biological, ecological, social and economic consequences, where data are available.

B. Environmental Consequences of the No Action Alternative (The Status Quo)

An alternative to the proposed action is to continue to rely on the existing regulatory framework (the legal status quo) to control activities at the Gray's Reef live bottom. Consequences of the no action alternative are more thoroughly addressed in relation to specific activities occurring at Gray's Reef in the following sub-section. Briefly, however, an evaluation of the status quo indicates that perpetuation of the present regulatory framework would not: (1) adequately protect the Gray's Reef live bottom from present or future adverse impacts on the physical, biological or ecological environments; (2) provide for comprehensive ecosystems-oriented management, or (3) provide direct and indirect user groups with the benefits of marine sanctuary sponsored research, education, information and recreation programs.

C. Environmental Consequences of the Proposed Action

1. Consequences of Proposed Boundary Alternatives

Three boundary alternatives are considered and analyzed for the proposed action. Each proposed boundary is described by nautical area and coordinates. Consequences of alternative boundaries are based upon available information concerning the estimated areal coverage of live bottom habitat, the ecological nature of the living marine resources, the affected human environment and the logistics of management and enforcement. Selection of a preferred alternative is based upon this evaluation.

Boundary Alternative 1 proposes a 43.8 sq km (12.8 sq nmi) Gray's Reef Marine Sanctuary. This area equates to the live bottom area identified by Hunt (1974) and nominated as a possible marine sanctuary by the Georgia Department of Natural Resources (Georgia DNR, 1978). The boundary is described by a rectangle figured by drawing a straight line from coordinate

value 31° 22' N commencing to coordinate 31° 25' N thence to 31° 25' N
80 55 W 80 55 W 80 50 W

thence to coordinate 31° 22' N thence back to the point of origin.
80 50' W

Most of the live bottom habitat, including major limestone outcrops (ridges, ledges, caves and other relief features), shallow submerged hardlayer and contiguous sedimentary regime, is contained within the area identified as Boundary Alternative 1. Limited survey data (Hunt, 1974) indicate that most of the living marine resources associated with the exposed and shallow buried limestone hardlayer at Gray's Reef are within this geographic unit even though their temporal and spatial occurrence vary in response to environmental factors (e.g., degree of suitable habitat/shelter; feeding characteristics; diurnal, developmental and seasonal behavior and movement patterns; reproductive characteristics; and recruitment and succession). Sessile epibenthic invertebrates described by Hunt (1974) appear spatially distributed relative to hardground exposure, with densest growth occurring on bare rock surfaces. Neither infaunal invertebrates nor marine flora have been studied. Many motile reef dwellers (invertebrates, demersal finfish, and possibly turtles) are year round residents at the live bottom; others (Pelagic migratory species) have wider ranges and are found at the live bottom on a more seasonal basis.

Human activities (e.g., trolling, drift-fishing and bottom fishing, SCUBA diving, spearfishing, educational demonstration and research) are confined for the most part to a small area at or near the Gray's Reef Fish Haven Buoy. The Buoy is located on NOS Nautical Charts (N "SLB") and is the only local reference to the live bottom. Once in the vicinity of the buoy, some captains use recording fathometers and/or Loran to locate live bottom relief areas while others must rely entirely on the buoy for location.

The western edge of the proposed sanctuary boundary overlaps slightly the eastern boundary of the U.S. Navy's Jacksonville Fleet Operating Area W-157, however, minimal fleet operations take place in the area of overlap (see Section IV: Description of Affected Environment). The proposed sanctuary boundary does not overlap any heavily traversed commercial shipping areas.

Boundary Alternative 1 establishes a protection/management unit which is small enough to be reasonably and efficiently managed and surveilled.

Survey data on live bottom coverage (Hunt, 1974) are preliminary and it has been suggested that significant portions of live bottom occur outside the original boundary (Hunt, 1979, pers. comm.). Indeed, when the approximate limits of Hunt's study area are plotted on a special survey map (Figure V-1; NOS, 1980), portions of the elevated ridge system in the north and scattered rock outcrops in the south lie outside this boundary area. Adoption of this alternative, thus, would leave significant areas of live bottom habitat and associated living marine resources unprotected. This raises the question of the wisdom of protecting part, but not all, of an ecological unit or system. Additionally, adoption of this boundary could foster considerable confusion among user groups concerning which live bottom areas and resources were included in the sanctuary and which were not, and citing violators under this alternative would be difficult.

Boundary Alternative 2 (THE PREFERRED ALTERNATIVE) proposes a 57 sq km (16.68 sq nmi) Gray's Reef Marine Sanctuary. This area includes the 43.8 sq km (12.8 sq nmi) live bottom area described under Boundary Alternative 1 plus a 0.46 km (0.25 nmi) extension in all directions, to yield a 57 sq km (16.68 sq nmi) marine sanctuary. The boundary is identified by a rectangle starting with coordinate value 31° 25' 45" N commencing to 80 55 17 W

coordinate 31° 21' 15" N thence to coordinate 31° 25' 15" N thence to
80 55 17 W 80 49 42 W

coordinate 31° 21' 45" N thence back to the point of origin. (Coordinates
80 49 42 W

have been rounded off to whole values for seconds of latitude and longitude.)

Delineation of Boundary Alternative 2 and projection of preliminary survey work (Hunt, 1974) on a special study chart indicate that most of the live bottom core, i.e., exposed limestone rock outcrops, shallow hardground reflector and surrounding sedimentary regimes and associated biological assemblages, are included within this proposed management unit. All human activities associated with the live bottom occur within this boundary.

Adoption of this alternative would provide immediate protection for all presently known live bottom habitat areas and resources. This boundary alternative would create a sanctuary containing contiguous live bottom habitat areas that is "systematic" in scope because it would provide for the maintenance and enhancement of the entire live bottom as an ecological unit. This boundary would provide a geographic basis for realizing the proposed sanctuary goals.

Adoption of this boundary would reduce the risk of confusion among user groups concerning sanctuary live bottom areas. The increased boundary size would not adversly impact direct or indirect user groups. Although the increase in sanctuary size would increase the overlap between the Gray's Reef Marine Sanctuary and the Navy's Area W-157, little, if any, conflicting usage is expected due to the current low activity levels in the area of overlap. Likewise, increased sanctuary area could increase overlap with navigation areas of transit vessels. Again, no additional adverse impacts are expected due to the current low level of shipping traffic in the proposed area.

The increase in sanctuary size would not appreciably diminish management and enforcement efficiency or effectiveness.

Adoption of this boundary might risk leaving some unknown live bottom habitat areas unprotected. Without further knowledge of the live bottom, it is impossible to predict the significance of any omission.

Boundary Alternative 3 proposes a 72 sq km (21 sq nmi) Gray's Reef Marine Sanctuary. This area includes the 43.8 sq km (12.8 sq nmi) live bottom area described under Boundary Alternative 1 plus 0.96 km

(0.5 nmi) extension in all directions, yielding a 72 sq km (21 sq nmi) marine sanctuary. This boundary is identified by a rectangle starting at coordiinate value 31° 21' 30" N commencing to coordinate 31° 25' 30" N 80 55 35 W 80 55 35 W

thence to coordinate 31° 25' 30" N thence to coordinate 31° 21' 30" N 80 49 25 W 80 49 25 W

thence back to the point of origin. (Coordinates have been rounded-off to whole values for seconds of latitudes and longitudes.)

Boundary Alternative 3 includes all live bottom habitat areas and associated biological assemblages identified by Hunt (1974). All human activities related to the live bottom habitat occur within this area.

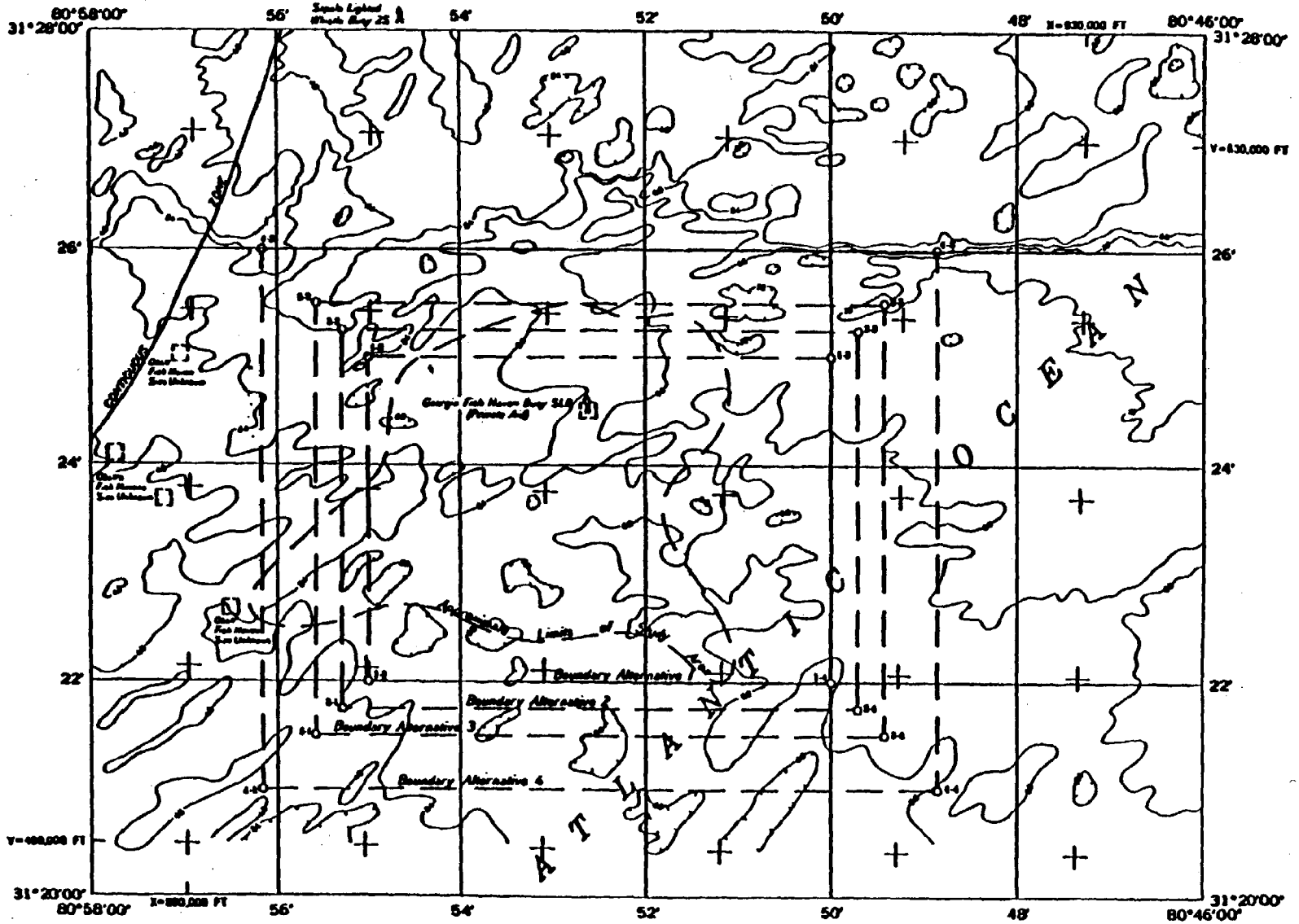
Adoption of this alternative increases the likelihood that all contiguous areas of live bottom, (e.g. the entire ecosystem unit would be included in a single protective management unit). It would increase the chance that any subsequent discoveries of live bottom within the immediate vicinity of the presently known live bottom would be contained within the sanctuary boundary.

An increase in sanctuary area would increase the area of sand bottom relative to known hard bottom. This increase would significantly increase enforcement/surveillance activity in the area and would add to operation costs without appreciable resource management benefits.

Adoption of this boundary alternative would further reduce the risk of user group confusion concerning live bottom areas within the sanctuary. It is uncertain whether the increase in sanctuary size would have any adverse impact on contiguous activity areas, such as military operations areas or transit shipping lanes, given the present low activity levels. Nonetheless, the probability of potential conflict with these activities would be higher.

2. Consequences of Proposed Regulatory Alternatives

A wide range of regulatory alternatives are considered for the proposed action: (1) rely upon the status quo to control the activity within the sanctuary without additional present or future restrictions; (2) monitor the status quo with the option to propose regulations at a later date if necessary; (3) allow the activity with permit controls; and (4) prohibit the activity within sanctuary boundaries. Regulatory alternatives are discussed and evaluated below in terms of present and potential activity levels at Gray's Reef and present or probable environmental impacts of the activities under the status quo and under the proposed management measures. Only reasonable and necessary alternatives are considered and evaluated in detail. Those which were considered but rejected from further analysis are presented in Section III: Alternatives Including the Proposed Action. Regulatory alternatives are the same regardless of the boundary decision.



TRANSVERSE MERCATOR PROJECTION

GEORGIA STATE PLANE COORDINATE SYSTEM-
EAST ZONE

NORTH AMERICAN 1927 DATUM

SCALE 1:40,000

LEGEND

1-0 DIGITIZED POINT ON BOUNDARY ALTERNATIVE 1
2-0 DIGITIZED POINT ON BOUNDARY ALTERNATIVE 2 (½ NAUTICAL MILE EXTENSION)
3-0 DIGITIZED POINT ON BOUNDARY ALTERNATIVE 3 (½ NAUTICAL MILE EXTENSION)
4-0 DIGITIZED POINT ON BOUNDARY ALTERNATIVE 4 (1 NAUTICAL MILE EXTENSION)

UNITED STATES - EAST COAST

GEORGIA

EAST OF DOBOY SOUND

GRAY'S REEF MARINE SANCTUARY
BOUNDARY ALTERNATIVES

(2.5X REDUCTION)

It should be noted that the status quo alternative for several fishing related activities (e.g., bottom trawling and specimen dredging, wire trap fishing, and spearfishing) provides for relying upon regulations proposed and implemented by the South Atlantic Fishery Management Council (SAFMC) pursuant to final Fishery Management Plans (FMPs). Several FMPs have been drafted and distributed for public review by the SAFMC and by the SAFMC jointly with the Gulf of Mexico Fishery Management Council (GMFMC). When these plans become final they could affect fishery resources and fishing practices at Gray's Reef.

SEABED ALTERATION AND CONSTRUCTION

Alternative 1 -- Status Quo: Rely on existing authority to control activities involving alteration of and construction on the seabed within the sanctuary, including, but not limited to, dredging, drilling, filling and placement of any structure.

At the present time, the only activities involving alteration of or construction on the seabed in the proposed sanctuary are those related to the placement and maintenance of private aids to navigation (e.g. bouys) and those related to research (e.g., placement of quadrat marker stakes for quantitative resource assessments, securing scientific equipment to the seafloor for in situ experiments and removal of geological samples for identification). While all such activities are carried out by responsible parties, accountable to local governments and academic institutions, there has been limited coordination and no evaluation of the cummulative impact of such activities.

With increased interest in the Gray's Reef live bottom for research and impending development of South Atlantic resources (e.g., fisheries, energy), Gray's Reef may experience more pressure in the future. Although the probability is very remote at present, other possible alteration/construction projects in the Gray's Reef area could include hydrocarbon exploration and production, pipeline corridor placement, sand, gravel and other minerals extraction, floating powerplant siting, communications cable siting, and deep water port facilities. Currently there are no hydrocarbon development activities within 25 nmi of the proposed sanctuary site. Indications are that there are no proposed OCS Lease Tracts for Lease Sales #56 (1981) or #78 (1984) in the vicinity of Gray's Reef. It is impossible to make predictions about the other forementioned activities at this time except to say that the possibility for future development in nearshore areas of the South Atlantic Bight should not be discounted.

The paucity of knowledge on the nature of live bottom ecosystems makes it difficult to evaluate fully the environmental consequences of seabed alteration/construction related activities on a site-specific basis. The discussion of potential consequences which follows, by necessity, is general and speculative with respect to the live bottom environment.

Many OCS development projects involve alteration of and construction on the seabed, through dredging, drilling, filling and placement of structures. These activities often involve temporary or permanent loss

of marine benthic habitat areas, as through excavation and suspension of sediments, blasting and drilling of hardground and grading or leveling of relief areas. On the other hand, some OCS activities create habitats, such as artificial reefs.

During exploratory and development phases of OCS hydrocarbon development operations, BLM has predicted that:

> "structures, drilling, and the disposal of muds and cuttings will have a severe effect on the benthic organisims at the immediate site of these structures, wells, and disposals but this effect is considered to be minimal, short term, and of no significance to any species or populations. Unique benthic areas, "live-bottoms" will be adversely affected by muds and cuttings disposal from drilling rigs operating on the feature or in the near proximity. The benthic organisims comprising these unique areas can have massive mortalities caused by smothering or toxicities of the drilling fluids" (BLM, 1978).

BLM has raised the concern that because live bottoms in the South Atlantic express low to moderate relief and occur on relatively smooth seafloor or in depressions, "the live bottom communities of the South Atlantic OCS are probably more susceptible to impacts resulting from the discharge of drilling effluents than those of the Gulf of Mexico OCS area" (BLM, 1978).

Construction of pipeline corridor routes, should pipelines be used for transportation of petroleum products going ashore from production wells in the South Atlantic, could result in temporary and periodic disturbance of live bottom communities along transport routes (BLM, 1978). Installation of pipelines in water depths of less than 61 m (200 ft) would involve jetting away of sediments or cutting into substrates to provide trenches for pipeline settling and burial. This process physically disrupts and suspends large quantities of sediments. Periodic maintenance inspections of pipelines following installation could subject benthic habitats to repeated disturbance. In nearshore areas adjacent to industrial development, resuspension of sediments could involve toxic pollutants. Suspended sediments could impact live bottoms away from the immediate area of impact because they are carried by currents as turbidity plumes and redeposited at distances depending upon shape, size and density of materials suspended, water turbulence and duration of suspension activity.

Although benthic systems are often considered resilient, there is potential for long-range damage as a result of marked reduction in populations, interference with complex ecological relationships, or permanent destruction of essential habitat areas. Direct mortalities occur from displacement or burial of organisms. Reduction in welfare can be expected as a result of clogged filter feeding apparatus, blocked respiratory surfaces, or interference with spatial orientation and reproductive capabilities.

Recovery and recolonization of an impacted site would depend upon several factors: seasonal reproductive cycles of representative species; recruitment success; and degree of habitat modification. Recolonization by polychaetes can take months and by molluscs and echinoderms, several

years (BLM, 1978). For isolated live bottom areas, the distance between the impacted site and recruitment stocks may be vast, as is the probable case of tropical corals with centers of distribution in the Caribbean.

Seabed alteration/construction activities may also adversely impact neritic (free swimming) invertebrates, finfishes, turtles and marine mammals. Potential impacts in a given area are proportional to the concentration of resources at various vulnerable life history stages. Potential impacts range from death to avoidance of the impacted area. Pipelines and floating power plants in nearshore areas are considered as potential sources of stress (Burrell, 1975; BLM, 1978). Spawning sites and migratory routes of many marine finfishes and crustaceans in the South Atlantic and the mode of distribution of their larvae and postlarvae are related to nearshore areas (Burrell, 1975). Present knowledge does not permit full assessment of cumulative impacts on these resources.

The forementioned stresses could occur potentially from any major activity involving alteration of or construction on the seabed, including dredging, drilling or placement of structures. Long term, cumulative or synergistic effects cannot be determined at this time.

Under the legal status quo, four Federal agencies have jurisdiction over activities in the category of seabed alteration/construction (see Section IV F: The Legal Status Quo). Briefly, pursuant to the Outer Continental Shelf Lands Act (OCSLA) as amended in 1978, the Bureau of Land Management (BLM) has overall responsibility for leasing OCS lands for mineral exploration and development and for approving of pipeline rights-of-way. This responsibility includes protection of unique or special resource areas (e.g., live bottom) from any adverse affects related to the above operations by imposing lease stipulations. By virtue of the same statute, the U.S. Geological Survey (USGS) is responsible for approving plans for exploratory drilling, supervising day-by-day operations, and development of and supervision of OCS orders, including enforcement of regulations and lease stipulations. Under Stipulation No. 1-- Biological Resources (see Appendix B), the Supervisor of the USGS requires the lessee to survey "for the presence of live bottom areas within a minimum one-mile (1800 m) radius of the proposed exploration or production activity site" (BLM, 1978). If it is determined that live bottom areas might be adversely impacted, the Supervisor would determine what measures must be taken by the lessee to protect the area. This may include relocation of operations, transportion of drilling fluids and cuttings away from the area to avoid live bottom or monitoring to assess impacts of operating activities. Under the OCSLA, the Army Corps of Engineers (COE) also has responsibility for assuring that OCS structures, including pipelines, platforms, drill ships and semisubmersibles, do not obstruct navigation through a permit process. The U.S. Coast Guard (USCG) has the authority to require that such structures are properly marked on nautical charts and maps.

The status quo would provide minimal protection for the Gray's Reef ecosystem. With regard to oil and gas development, the protection available under Stipulation No. 1 would depend upon specific mitigating measures required by the Supervisor of the USGS. Furthermore, it should be noted that the lease stipulation referenced here was developed for application to leases pursuant to OCS Oil and Gas Lease Sale No. 43.

Although it has been proposed for Lease Sale No. 56, it is not necessarily a general stipulation that applies to all future leases in the South Atlantic OCS area.

Impacts from past and present seabed alteration/construction activities at Gray's Reef have not been assessed fully; however, no obvious visual negative impacts are apparent. Preliminary scientific data suggest that changes in environmental conditions at Gray's Reef through increased seabed alteration/construction activities could have a deleterious effect on certain resident and transient organisms at various stages of their life histories. For example, corals and other tropical benthos, already living close to their maximum limits of enviromental tolerance, are particularly sensitive to change. Other invertebrates, finfish and turtles could also be effected. Some loss of research, recreational and aesthetic values could be expected. Since the dynamics of a live bottom ecosystem are not well understood at present, the overall long term impact of alteration/construction activities on Gray's Reef, in terms of loss or reduction of conservation, recreational, ecological and aesthetic value, cannot be fully assessed.

Alternative 2 -- Allow by permit activities involving alteration of or construction on the seabed within the sanctuary (THE PREFERRED ALTERNATIVE)

Under this alternative, no person would be allowed to dredge, drill or otherwise alter the seabed in any way, nor construct or place any structure within the sanctuary without a permit from NOAA. Certain alteration/construction activities could be allowed on a case-by-case basis for research and education purposes where NOAA could determine through permit evaluation that the proposed activity did not pose a substantial threat of harm to sanctuary resources or other sanctuary activities, was consistent with sanctuary goals and objectives, and met other NOAA permit criteria.

Controlled seabed alteration/construction would serve to protect live bottom resources from the negative environmental impacts described above and at the same time allow wise use of the sanctuary by researchers, educators and resource managers. Requiring permits should not impose a significant burden on current user groups, except perhaps in terms of opportunity costs; i.e., the time and effort required to complete permit applications, activity logs and annual reports, nor would it necessarily preclude others from conducting research or education at the sanctuary. Some burden will be placed on NOAA in terms of administrative agreements to review permit requests and enforcement requirements in the field.

Alternative 3 -- Prohibit activities involving alteration of or construction on the seabed within the sanctuary

Under this alternative, no person would be allowed to dredge, drill or otherwise alter the seabed in any way, nor construct or place any structure within the sanctuary. This prohibition would provide maximum protection for live bottom habitat areas and sensitive living marine resources. Such a prohibition, however, would impact certain user groups by prohibiting activities, such as installation of research equipment, navigational aids or dive trail markers, which would ultimately

provide a service to the general public. This prohibition would deny research, education and recreation opportunities and would be inconsistent with proposed sanctuary goals and objectives. NOAA is not aware of any commercial seabed alteration-construction activities contemplated in the sanctuary area and, therefore, economic impacts of this alternative are limited.

OCEAN DUMPING AND DISCHARGE OF POLLUTING SUBSTANCES

Alternative 1 -- Status Quo: Rely on existing authority to control dumping and discharge of polluting substances into sanctuary waters

Dumping and discharge of a wide variety of waste materials from municipalities, industries and by ocean-borne vessels occur in ocean waters contiguous to the United States. Dumping or discharge presently occurring at Gray's Reef, according to available information, is incidental to recreation and research; i.e., disposal of fish parts and wastes after cleaning and dressing fish caught at the live bottom, release of marine-type chumming or bait materials, discharge of effluents from marine sanitation devices, discharge of cooling water effluents from normal vessel engine operations and disposal of trash and litter from pleasure and research watercraft and transient commercial vessels.

NOAA is not aware of any dumping or discharge at the proposed sanctuary site of toxic or polluting substances; i.e., hydrocarbons, industrial chemicals, petroleum refinery wastes, acids, nuclear industry or laboratory radioactive wastes, obsolete or unservicable military munitions, dredge materials, and municipal sewage sludge. Disposal of these materials, for the most part, requires special permits under existing regulations (see Section IV F: The Legal Status Quo and the discussion below).

Since recreational, educational and research use of the Gray's Reef area is anticipated to increase in the future, a corresponding increase in the volume of materials entering the surrounding waters can be expected. Our nation's energy situation is placing an increased focus on the South Atlantic for petroleum exploration development potential, and with such production, transportation and refinement phases and accompanying coastal development (e.g., maintenance dredging for ports and harbors, product manufacturing and municipal growth) may place greater demands on coastal and oceanic waters for receiving wastes. (The reader is directed to Section IV: Description of the Affected Environment for further discussion on ocean dumping and discharge activities, both present and future.)

A limited number of documented studies exist concerning the short and long term effects of toxic or polluting substances in the marine environment. None are directed toward impacts on live bottom environments. Therefore, the discussion which follows is general and not site-specific for live bottoms.

The impacts of ocean dumping and discharge activities are related to the volume, concentration and toxicity of the discharged substance, its eventual fate in the water column and in benthic habitats and the susceptibility of physical, biological, ecological and aesthetic resources

to degradation. In addition to direct kills of organisims, toxic or foreign substances interfere with or disrupt vital physiological and behavioral life processes (e.g., feeding, metabolism, growth, gas exchange and reproduction), change the physical and chemical nature of essential habitat areas causing exclusion of species and reduction in populations and stress the marine ecosystem structure, productivity levels, and species richness and diversity.

Organic and inorganic wastes which enter the marine environment via industrial and municipal sewage effluents, ship disposal or direct dumping constitute an environmental and aesthetic problem. Heavier wastes eventually collect on the ocean bottom or remain in a thin-slurry suspension above the water-sediment interface. Depending on the nature and concentration of these wastes, physical impacts on the benthic environment may vary from slight modification of bottom features to significant alteration of ambient conditions. Impacts on the benthic organisms vary accordingly, from temporary population reductions to complete annihilation due to habitat destruction.

Organic substances accumulating on the bottom in large concentration may have an unfavorable effect on benthic and demersal organisms. Degradation of organic matter consumes oxygen, creating a biological oxygen demand (removal of available oxygen from the water column and sediments), and often involves release of associated toxic gases. Stressed benthic and demersal organisms flee or succumb.

Solid refuse, including plastics, bottles, tin cans, tires and other non-degradable debris, become litter on the ocean bottom. While some of the former littering substances, such as tires and bottles, form artifical reefs, plastic substrates generally preclude larval settlement and reef community development and accumulate as unsightly trash. Trash and litter detract from the aesthetics of a reef habitat.

Little data are available concerning the acute and long term effects of oil wastes on the open ocean environment, much less on live bottom environments. However, certain generalizations can be made. Oily sludges from machinery space bilges, which tend to be heavier than seawater and contain metallic and other inorganic waste residues, sink to the bottom where they may be slowly degraded or incorporated into bottom sediments. These sediments are susceptible to resuspension during storms or through human activities on the seabed. In sufficiently large amounts, oil sludge can blanket the bottom, leading to adverse effects on the benthos through suffocation, alteration of the substrate for larval settlement and attachment or interference with mobility, feeding, reproduction or other vital life processes.

The impacts of oil spills, pipeline leaks and well blow outs vary depending upon ecological and environmental conditions of the affected environment and the type and quantity of the product. Different oils have different effects, "with toxicity being most pronounced for refined distillates and physical smothering most severe with viscous crude oil" (BLM, 1978). Physical, chemical and biological processes begin to act upon oil as soon as it is released into the ocean environment. These include physical evaporation, spreading emulsification, solution, sea-air interchange, sinking, and sedimentation; chemical oxidation;

and biological degradation by microorganisms and uptake, metabolism storage or release by plankton, invertebrates, fishes, turtles, mammals, and marine birds. Biologically speaking, oil in the marine environment functions in a range from a nutritive supplement to an acute toxicant. Generally the most severely impacted marine organisms are subtidal organisms, organisms with slow reproductive and growth rates and organisms near their limits of tolerance to temperature and salinity.

The recovery rate of an oil impacted area varies depending upon degree of perturbation (e.g., size of spill, toxicity, etc.) and local features (e.g., hydrographic features, substrate type, community composition and degree of isolation). Productive opportunistic species recolonize first, with more time (months to several years) required for recovery of long-lived species.

If the status quo alternative were adopted, NOAA would rely upon the existing authorities to control the dumping or discharge of substances into the sanctuary waters and would propose no additional restrictions beyond those imposed by the EPA, COE, and USCG. The regulatory authority of these agencies is fully reviewed in Section IV F: The Legal Status Quo.

Briefly, the disposal of dredge materials and certain toxic and hazardous substances is regulated by the Clean Water Act and Title II (Ocean Dumping) of the Marine Protection Research and Sanctuaries Act. Certain operational discharges of oil and machinery space bilge wastes are loosely regulated. EPA has the authority to develop criteria for disposal of dredge materials and toxic and hazardous materials and for the selection of dump sites for dredge disposal in ocean waters. For example, EPA designated a chemical waste dumpsite approximately 25 nmi northeast of Gray's Reef (see Section IV: Affected Environment), however, the site was never used. Federal regulation of sewage wastes from marine sanitation devices, effective January 30, 1980, does not extend beyond the territorial (State) waters. Therefore, vessels are still alowed to discharge trash, litter and solid wastes and sewage in the vicinity of Gray's Reef.

Perpetuation of the status quo to control discharge and dumping activities would not necessarily provide additional long-term protection of marine and benthic environment in the Gray's Reef area. Water quality and benthic habitat and associated marine resources could be adversely impacted if the deposit or discharge of polluting substances becomes a problem in the future. The status quo would not preserve the aesthetic qualities of the reef habitat.

Alternative 2 -- Prohibit the deposit or discharge of any materials or substances into sanctuary waters except:

(a) fish parts, bait or chumming materials;
(b) effluents from marine sanitation devices; and
(c) non-polluted cooling water effluents (THE PREFERRED ALTERNATIVE)

Under this alternative, NOAA would prohibit deposit or discharge of foreign or toxic (polluting) substances into sanctuary waters, including hydrocarbons, industrial chemicals, petroleum refinery wastes, acids, radioactive wastes, military munitions, dredge materials or raw or untreated

sewage wastes. Only those discharges which are incidental to fishing and normal vessel operation, and which do not represent a serious threat to sanctuary resources, would be allowed. This alternative would control deposit of litter and solid trash which is unregulated under the present system.

The deposit of any foreign substance could have an adverse impact on the Gray's Reef environment if it were toxic, if concentrations reached excessive levels and if water movement did not effectively mix, dilute and remove the offensive material.

This alternative would allow fishermen to discharge fish parts or wastes resulting from cleaning and dressing recreational catches, and marine-type baits and chumming materials, into sanctuary waters. By not restricting discharge of cooling water effluents resulting from normal engine operations, this alternative would allow use of the area by motorized vessels. Most vessels using the sanctuary area do not retain sewage wastes on board but rather discharge overboard. While fish parts and marine-type bait and chumming materials do not necessarily introduce anything foreign into the marine environment, degradation of excessive concentrations could create an aesthetic problem. Such substances serve as "fish food" and could attract large predators (sharks), evoke feeding frenzies and threaten the safety of local SCUBA divers or swimmers. Vessel cooling waters could affect water quality to a limited extent. Operation and maintenance of marine engines leach oil, gasoline, copper, lead and other toxic substances into the water along with cooling waters. Accumulation of these materials into pelagic or benthic organisms could adversely impact the welfare of the living marine resources and user groups.

Raw sewage and litter reduce ecological and aesthetic qualities of receiving waters and benthic habitat. Untreated sewage may contain ammonia, nitrogen, phosphate, phosphorus, oil and grease, detergents, phenols, trace metals, dissolved and particulate organic matter, pathogenic microbes and other materials which could disrupt or degrade the marine environment, offend the senses or endanger human health. Sewage from marine sanitation devices is treated to varying degrees. Nondegradable solid litter and refuse could accumulate on the live bottom substrate, causing a physical nuisance.

The present dumping and discharge activity levels at Gray's Reef are thought not to be of a magnitude to threaten the quality of sanctuary habitat and resources. This alternative provides the most stringent resource protection compatible with allowing vessels within the sanctuary. While some minor, short lived and local deterioration in water quality may result, the risk to sanctuary resources is insubstantial compared to the recreational, educational and research functions the sanctuary can only fulfill through the presence of vessels. NOAA will establish a monitoring program to determine levels of deposit and discharge of substances into sanctuary waters and flushing rates and the ability of ocean waters to mix, disperse, dilute or otherwise mitigate potentially polluting substances and to determine residence times for disposed substances and subsequent impacts on sanctuary resources.

Alternative 3 -- Prohibit the deposit or discharge of any materials or substances of any kind into sanctuary waters

Prohibition of all discharge and dumping activities in the sanctuary would provide the maximum level of protection for the physical, biological and ecological qualities of the live bottom environment. The prohibition would require that all liquid and solid wastes, including fish wastes, bait and chumming materials, marine sanitation effluents, and cooling water be contained on board vessels while within the sanctuary. This would preclude use of the sanctuary by vessels which continuously discharge cooling water effluents during normal engine operation and which lack equipment for retaining sewage wastes on board.

Adoption of this regulation would place an economic burden on user groups bearing the expense of installing sewage holding tanks unless they choose not to use the sanctuary. NOAA does not have documentary evidence to support the need for a regulation of this severity or consequence.

BOTTOM TRAWLING AND DREDGING (SEAFOOD AND SPECIMEN)

Alternative 1 -- Rely upon the South Atlantic Fishery Management Council (SAFMC) to control bottom trawling and dredging within the sanctuary

Exploratory bottom trawling for reef fish with roller-rigged trawls in the South Atlantic (e.g., off the Carolinas and in deep water areas off Georgia, as described in Section IV: Description of the Affected Environment) has proven economically and technically feasible in live bottom areas with shallow buried or low to moderate rocky outcrops. It is possible that commercial trawling offshore Georgia, in areas such as Gray's Reef, may increase in the future (Rivers, 1980, pers. comm.). Modified fish dredges or sleds are also successful in these demersal fishery areas. Gear modifications (e.g., rollers, runners or skids) partially elevate trawls and sleds above the irregular ocean bottom and help minimize gear and catch damage. However, even when elevated above the surface, various parts of the gear (e.g., rollers, runners, skids, bottom guard-chains, nets and specimen bags) still come in contact with the bottom substrates and benthic organisms.

Seafood dredges are used in soft bottom areas and can be used around or between live bottom outcrops. By design, teeth on the lower metal frame dig into and dislodge sediments and scoop up specimens into retaining boxes or nets.

Trawls, dredges and fish sleds have been used at Gray's Reef in the past and are currently used by a number of researchers and educators with the Georgia University System and Marine Extension Service, the Georgia Department of Natural Resources, and the South Carolina Department of Wildlife and Marine Resources. Sampling is infrequent (quarterly, at most) and of short duration (a few minutes at selected locations).

Commercial use of trawls, sleds and dredges has not been reported at Gray's Reef.

The dearth of information concerning the live bottom system makes it difficult to assess fully environmental consequences resulting from the use of bottom-trawls and sampler dredges in these areas. Various impacts on the physical environment are associated with bottom-trawling and dredging activities; i.e., suspension of sediments and dislodging or breaking hard structural formations. Suspended sediments, while settling, may temporarily interfere with marine and benthic processes; i.e., primary production (by increasing turbidity, decreasing light penetration and decreasing photosynthesis), feeding and respiration (by smothering organisms and by clogging filter feeding apparatus and gas exchange membranes), spatial orientation and information exchange (by disrupting reception and conduction of stimuli), growth and reproduction (by altering behavioral cues for molt and spawning), and recruitment potential (by trapping and carrying planktonic larvae to the bottom and by modifying benthic habitat for settlement). Many of these temporary changes can promote long-term stressed conditions.

Sessile benthic biota which cannot escape an oncoming trawl or dredge are often seriously impacted. Passing trawls or dredges often dislodge sedentary invertebrates and seaweeds from basal attachments, fracture or bruise distal projections or completely crush the organism. Although a portion of the motile invertebrates and fish possess the ability to escape the path of the trawl or dredge, others are too small or too slow to move aside. Injury, removal or death of ecologically significant resources can threaten the health and stability of the entire live bottom ecosystem and can reduce the conservation, recreational, ecological and aesthetic values of the Gray's Reef area.

Under the status quo, NOAA would not propose any regulations. At the present time, no Federal regulations control bottom-trawling and specimen-dredging operations in high seas water; none are likely unless the SAFMC proposes regulations pursuant to FMPs. Phase 1 of the Draft Snapper-Grouper FMP describes trawl and dredge gear, target fisheries, and commercial efforts and catch in the South Atlantic. SAFMC considered but rejected a tentative management measure to control bottom-trawling for reef fish in its area of jurisdiction (SAFMC, 1979). It is uncertain whether the SAFMC will reconsider this decision in the future. The GMFMC in its Draft Reef Fish Resources FMP proposes to initiate research to determine the impacts of trawls on juvenile reef fish and habitat areas; it is possible that the SAFMC will propose a similar management measure.

Because bottom trawls and dredges may have adverse impacts on coral reef areas, the GMFMC and the SAFMC are considering regulations pertaining to these gears under the joint draft Coral and Coral Resources FMP, although none have been approved to date. Gray's Reef has been proposed as a Habitat Area of Particular Concern (HAPC) under this FMP, but the Councils have not yet proposed special management measures for Gray's Reef.

The lack of final or likely special management measures to control bottom trawling and dredging activities at Gray's Reef pursuant to the Snapper-Grouper and Coral FMPs makes it impossible for NOAA to evaluate fully the possible positive and/or negative impacts which would result from relying upon the SAFMC under this alternative. Unregulated bottom trawling and dredging activities could result in adverse physical, biological and ecological impacts, conflict with other sanctuary user groups and reduce conservation, recreational, ecological and aesthetic values of the live bottom.

Alternative 2 -- NOAA Issues Marine Sanctuary Regulations

Under this alternative, NOAA would issue regulations controlling bottom-trawling and specimen-dredging activities in the sanctuary, after consultation with the SAFMC. NOAA regulations would be consistent to the maximum practical extent with draft or final regulations pursuant to FMPs. The following suboptions are considered:

Subalternative a - Monitoring of Status Quo

Under this alternative NOAA would list the activity in the Designation document, propose no regulations currently and monitor (1) currently unregulated bottom trawling and specimen dredging activities at Gray's Reef and (2) future activities allowed by the SAFMC under final FMPs.

NOAA would develop and implement a monitoring program to obtain data on activity levels and resultant impacts on affected sanctuary resources and user groups. Under this provision, NOAA would have the option to propose controls for the SAFMC if monitoring indicated that significant adverse impacts on the live bottom were occurring.

Unregulated bottom trawling and specimen dredging activities pose a substantial threat of harm to live bottom habitat areas and to associated living marine resources. Trawl and dredge damage can be expected to result in negative socioeconomic impacts in terms of loss or reduction in conservation, recreational, research and aesthetic values. Special management measures for the possible Gray's Reef HAPC under the Coral FMP have not been proposed. Monitoring alone would not guarantee immediate resource protection since both damage and any possible mitigation would be identified after damages had occurred.

Subalternative b -- Allow by permit bottom trawling and specimen dredging within the sanctuary. (THE PREFERRED ALTERNATIVE)

Under this option, bottom trawling and specimen dredging would be permitted within the sanctuary on a case-by-case basis for research, education and resource assessment purposes, if the proposed activity did not pose a substantial threat of harm to sanctuary resources, was consistent with sanctuary goals and objectives, and met other permit criteria.

Adoption of this regulation would provide immediate protection for Gray's Reef by conditioning bottom trawling and specimen dredging to exclude or modify those which might otherwise physically damage or destroy essential habitat area (e.g. rock formations or coralline structures) and injure or remove ecologically important living marine resources.

This regulation would serve to protect the functional integrity of the live bottom ecosystem while allowing use of the sanctuary by researchers, educators and resource managers. It would reduce or eliminate user conflicts by preventing unregulated trawling and dredging operations. It would limit sampling with trawls and dredges to only those persons demonstrating a knowledge of the equipment and the live bottom area and would insure that the least destructive sampling techniques were used.

Special permit criteria supplementing the proposed regulations and a monitoring program would be included in the proposed Gray's Reef Marine Sanctuary Management Plan. Permitting would allow monitoring to obtain data on activity levels and any concomitant impacts on live bottom resources and user groups.

Requiring permits is not expected to impose a significant burden on present user groups, except perhaps in terms of opportunity costs, or the time and effort required to complete permit applications, activity logs, and annual reports, nor is it expected to preclude others from sampling via trawls or dredges in the future.

Adoption of this regulation would add to the administrative responsibilities of NOAA and to enforcement requirements in the field.

Subalternative c -- Prohibit bottom trawling or specimen dredging in the sanctuary

A prohibition on all bottom trawling and specimen dredging activities would provide for maximum protection of sensitive live bottom resources in the sanctuary. Adoption of this regulation, however, would adversely affect those currently utilizing trawling and dredging equipment at Gray's Reef for research and educational purposes as well as those who might wish to use them in the future. The prohibition would impede efforts to obtain a thorough understanding of the reef ecosystem since alternative methods, such as hand sampling and grab sampling, may not be appropriate in some cases. A prohibition would not impact fisherman because commercial trawling does not occur at Gray's Reef.

VESSEL ANCHORAGE

Alternative 1 -- Status Quo: Rely on existing authority to control anchoring within the sanctuary.

Anchoring is often necessary at Gray's Reef to secure fishing, dive research, and education vessels. The number of vessels presently anchoring at the reef is low. However, anchoring can be expected to increase in the future.

The potential for anchor damage is generally related to level of use, method of anchoring, anchor size and design, anchor fluke span and scope of chain relative to water depth, vessel mass, and composition of the biotic community (GMFMC and SAFMC, 1980 b). Gray's Reef has not been adequately surveyed to determine whether the present level of anchoring activity has adversely impacted the live bottom habitat or associated living marine resources. It is generally not possible to secure anchorage on the hardground, given the nature of the resistant substrate, unless anchor flukes snag crevices or overhanging ledges. Persons familiar with Gray's Reef suggest that anchoring of large vessels at the live bottom may have caused some damage to the benthic habitat. Contact with live bottom outcrops could physically damage or modify the habitat by scraping, cracking or displacing substrate and could break, remove or otherwise harm attached marine life. Further studies are needed to fully analyze the impacts of anchoring.

Corals and other exposed sedentary benthos are particularly vulnerable to anchor damage. Preliminary evidence suggests that hard corals at Gray's Reef are living close to their limits of environmental tolerance and therefore would have little excess energy to expend repairing anchor caused damages (Porter, 1979, pers. comm.). Recovery from anchor damage would depend upon the species involved as well as a host of environmental factors.

At the present time, no Federal regulations pertain to vessel anchorage on the high seas in general or in live bottom areas in particular, except those imposed by the COE and USCG in relation to obstructions to navigation under the Port and Waterway Safety Act, as amended by the Port and Tank Safety Act of 1978 (see Section IV F: The Legal Status Quo). Reliance on the status quo alternative, therefore, would not provide additional protection for the live bottom habitat and sensitive marine resources against possible anchor damage.

Unregulated anchoring enables vessel operators to anchor wherever they choose or wherever activities warrant. Dive boat operators at Gray's Reef search for soft bottom adjacent to elevated hard bottom and send a diver down the anchor line to secure anchorage. No adverse impacts on user groups would result from adoption of this regulation, unless anchor stress caused significant reduction in live bottom resource values.

Alternative 2 -- Monitor the status quo (THE PREFERRED ALTERNATIVE)

Under this alternative, NOAA would monitor anchoring practices in the sanctuary to determine activity levels, gear types used and environmental consequences. NOAA would educate the user public concerning safe anchoring procedures as this information became available through environmental analysis. NOAA would list the activity in the Designation document and propose mitigating measures if adverse impacts from anchoring were detected.

Pursuant to the sanctuary management plan, NOAA would conduct a detailed underwater resources survey to determine the location and extent of hard and soft bottom areas in the sanctuary. Nautical maps

would be prepared for public use, showing the bathymetry and substrate types depicted by the survey. In addition, NOAA would study the feasibility and desireability of designating anchorage areas and placing and maintaining mooring buoys.

Survey data and educational materials would provide for better understanding of the live bottom habitat and facilitate wise use of the sanctuary resources. No user public hardships or displacement of activities are expected to occur from adoption of this alternative.

Alternative 3 -- Prohibit anchoring on hardbottom substrates in the sanctuary

This provision would require that all practical efforts be taken to drop anchors in sand bottom areas and to avoid contact with sensitive hardground areas. It would serve to protect hardbottom substrates and sensitive epibenthic organisms from the possible anchor damage described under Alternative 1.

There is not enough data to determine whether anchoring currently poses a threat to the live bottom resources. This regulation would discriminate against user groups which did not have the skill or equipment to locate sand bottom areas. Furthermore, this regulation would be unenforceable.

Alternative 4 -- No person shall anchor a vessel within the sanctuary.

This provision would facilitate maximum protection of live bottom habitat and living marine resources against potential anchor-caused stress. A prohibition on anchoring would adversely impact recreationists, researchers, and educators and therefore would be inconsistent with the proposed sanctuary goals and objectives which support activities relating to these users. There is presently no convincing evidence to support the need for this prohibition.

WIRE FISH TRAPS

Alternative 1 -- Status Quo: Rely upon the South Atlantic Fishery Management Council (SAMFC) to control wire trap fishing within the sanctuary

The use of wire fish traps offshore Georgia and in the vicinity of Gray's Reef is not widespread. When used, traps are set primarily for black sea bass, with other demersals (snappers, groupers and porgies) taken incidentally. The trap fishery is primarily seasonal, pursued between shrimping seasons. Traps, converted Chesapeake Bay blue crab pots, are baited and set near rocks, wrecks, live bottom and other demersal fishery areas (River, 1966). Black sea bass are extremely gregarious and are quickly attracted to traps by the bait and by conspecific attraction. Daily catches of 6300 pounds per boat are reported (Rivers, 1966). Historically, trapping was centered off South Carolina but has spread to other areas along the southeast coast. Several

off-season shrimpers occasionally trap in live bottom areas to the south of Gray's Reef during the winter (Harrington, 1980, pers. comm.) and may have trapped at Gray's Reef in the past (Harris, 1979, pers. comm.).

Within recent years, wire trap fishing has become a highly emotional controversy among fishermen and conservationists. The controversy is a result of both factual and preceived aspects of trap fishing which have become more pronounced since the mid 1970's: a marked increase in the number, size and efficiency of traps; high potential for gear and user group conflicts in areas of overlap; fate of "ghost" traps; and potential adverse impacts on reef fish and reef habitat. To date, very little documentation exists. Appendix I provides a review of current literature concerning the mode of operation of wire fish traps and the possible environmental implications. The following discussion is based upon this information.

Traps are popular because they (1) are inexpensive, easy to build and repair, and require little maintenance; (2) require a minimum of effort once set, allowing fishermen to pursue other interests; (3) yield high catches of valuable food fish; (4) retain fish in superior quality as opposed to those taken in trawls or nets which can be disfigured by missing scales or puncture wounds; (5) continue to fish and retain fish alive for several days when left unattended; (6) can be used in areas where irregular bottom relief precludes the use of trawls, dredges or nets; (7) are successful for fish not easily taken by other methods; (8) provide a degree of catch protection against predation; and (9) are useful research and resource assessment tools.

Conversely, traps are also considered disadvantageous. Financial success of the fishery depends primarily upon unstable market demand, supply and price. Fishermen claim that trap efficency interferes with hook and line fishing success (catch-per-unit effort) by reducing reef population abundance in areas of overlap (GMFMC, 1980). There are few fish which will not enter a fish trap, whereas there are many fish which will not take a hook or which avoid or escape a net or trawl. Traps often snag, tear and foul fishing lines, trawls, and nets, and thereby serve as a physical obstacle to competitive methods. Furthermore, marker buoys obstruct navigation.

The mode of trap operation exhibits selectivity for fish and shellfish species type, size, weight and year class captured. Factors influencing catch success include: (1) environmental considerations (biogeographical area fished; areal extent and productivity of the reef; trap location relative to localized habitat types; composition of fish community; (2) mechanical aspects of trap operation (trap design and demensions, trap density, trap immersion period or "soak"); (3) meteorological conditions (season, weather, lunar periodicity and associated tidal rhythms); and (4) biological considerations (conspecific attraction, thigmotrophic attraction, curiosity, territoriality, and predator-prey relations). Several workers have shown that by manipulating one or more of these variables, one can control, to a large degree, trap catch composition and rate.

Fish traps are non-selective and many fish which are of little or no value to fishermen (e.g., undersized juveniles, trash "non-food" fish and showy tropicals) are taken incidental to target fishes (e.g., snappers, groupers and black sea bass). The degree of selectivity is related to the factors listed above (and described in Appendix I). For example, Craig (1976) noted that in south Florida, traps set in sand flats away from live bottom outcrops caught more "food" fish whereas traps set on top of the reef caught more "non-food" tropicals (e.g., angelfishes, surgeonfishes, and parrot fishes). Taylor and McMichael (1980) reported trap catches containing large proportions of non-food tropicals in the Florida Keys.

Several workers have demonstrated that certain trap designs (shape), sizes, mesh sizes, soak times, and construction materials are selective, singularly and in combination, for catch rate and species composition and characteristics. Traps vary in size from small (2 x 2 x 2 ft) black sea bass traps to large (9 x 4 x 2.5 ft) Antillean Z traps. Generally, large volume traps yield greatest returns, and small mesh traps (less than 1.5 inch hexagonal diameter) outfish larger mesh traps in terms of number of fish retained and percentage of juveniles and small forage species caught.

Traps are selective for permanent reef dwelling fishes. Tagging experiments with black sea bass show a less than one percent migration from reef habitats. Black sea bass are thus more vulnerable to capture than mobile species because their movement may be restricted to a particular reef. Trap fishermen can count on the fish being at or near the same location all the time.

Traps also show selectivity for the special adaptations which reef fish have evolved in response to the isolated nature of reefs. Many species of reef fish are long-lived, but attain their maximum size very slowly. However, the slow rate of attainment of maximum size can lead to overfishing of reproductively immature individuals and places pressure on fishery potential. Munro, Reeson and Gaut (1971) theorized that intense fishing with small-mesh traps in nearshore areas off Jamaica dramatically reduced fish density. They stated that "the largest reef fishes and thus usually those which mature at a relatively larger size, are subject to severe biological overfishing. Smaller reef fish which mature before recruitment to the traps are subject to intense exploitation with correspondingly low stock density but are not biologically overfished."

Similarly, the abundance of black sea bass in the South Atlantic has declined dramatically in recent years and various experts in the field speculate that the resources are experiencing growth overfishing (i.e., young black sea bass recruits are being caught before they reach optimum size). In the case of growth overfishing, catches are large in numbers but low in total weight.

Traps which are lost or abandoned constitute a major problem because they continue to fish and remove stock from reefs indefinitely unless retrieved by divers or destroyed by corrosion or large predators. Traps are easily lost: marker buoy lines are commonly severed by passing vessels; traps are often vandalized; traps are swept away by bottom currents and often tumble off the shelf edge to be lost to

great depths. It is estimated that over 9,000 traps are lost each year in the Virgin Islands alone. Wolf and Chislett (1974) reported losses of 10 to 20 percent per experimental cruise. There are no reports on trap losses in the South Atlantic.

Unnecessary trap-related mortalities often occur within traps from cannibalism or starvation and from embolisms caused by rapid ascent from depths. Many noncommercial fish taken incidentally are wasted. While Munro (1974) showed that a substantial portion of the fishes which enter a trap escape, he also noted that those which do not escape live for variable lengths of time. However, almost all fishes confined to traps for up to 2 weeks showed obvious signs of physical damage including wounds from predators, abrasions from wire mesh, and secondary fungal infestations.

Traps can cause considerable physical damage to coral reef and live bottom resources, notably epibenthos such as corals, sponges, seaweeds, when traps are dropped on coral heads, dragged across the reef surface during retrieval or displaced by waves and currents.

Traps containing large numbers of stressed fish or in the case of "ghost" traps, mutilated fish or skeletal remains, are unsightly and detract from a SCUBA diver's aesthetic experience. Traps which have accumulated large numbers of fish attract large predators, such as sharks (Munro, Gaut and Reeson, 1971) which could threaten in turn the safety of divers.

The use of wire fish traps in the South Atlantic is presently unregulated. Under this proposed regulatory alternative, NOAA would rely upon the SAFMC to regulate wire trap fishing pursuant to implementation of FMPs. Phase I of the draft Snapper-Grouper FMP describes South Atlantic trap fishery gear, target fisheries and current trapping efforts. Tentative management measures which would apply in the Gray's Reef area, if adopted, have been proposed: (1) traps will have a degradable panel (if appropriate size at least as large as entry ports) or degradable door fasteners; (2) traps will have mesh no smaller than 1x2 inches or 1.5 inch hexagonal; (3) trap buoys will be identified with the boat of the owner color code; and (4) a person must not fish another person's trap without authorization of the owner (SAMFC, 1979). (The SAMFC has tentatively approved additional measures which would apply only south of Cape Canaveral, Florida in waters shallower than 50 fathoms, including prohibiting pulling traps between the period of one hour after sunset and one hour before sunrise, prohibiting use of traps larger than 54 cubic feet, and allowing no more than 200 fish traps per boat). A mandatory reporting system is also proposed.

While insufficient data are available to measure fully the impact of trap fisheries in the South Atlantic, it is generally believed that uncontrolled use of wire fish traps in live bottom areas may pose a substantial risk of harm to physical, biological and ecological resources.

Trap fishermen in the South Atlantic report that when black sea bass abundance in one live bottom area declines, searches are made for new productive fishery spots (Rivers, 1966; Harrington, 1980,

pers. comm.). Black sea bass population levels have declined dramatically off the Carolinas but appear to be stable off Georgia and northeast Florida and should remain so unless trapping effort increases (SAMFC, 1980). It is possible that trapping may have contributed to an observed decline in black sea bass at Gray's Reef several years ago (Harris, 1979, pers. comm.).

It is difficult to assess fully the implications of tentative SAFMC management measures due to uncertainty in final scope and timing. Several tentative management measures are conservation oriented; i.e., degradable panels and door fasteners and minimum mesh size concur with the recommendations made by field scientists to facilitate fish escape from "ghost" traps and prevent capture of small fish. Both provisions will impose some costs and restrictions on user groups. The other measures are designed to reduce gear and user group conflicts and to improve the cost of effectiveness of enforcement and "contribute to the orderly prosecution of the fishery" (SAMFC, 1978).

Evidence suggests that these measures are not adequate to sufficiently protect the Gray's Reef live bottom from potential harm. While these measures would serve to reduce to a certain degree the impact of "ghost" fishing, gear selectivity, and gear and user group conflicts, the potential for overfishing of particularly desirable or vulnerable species (e.g., demersal reef fish such as black sea bass, snapper, grouper, etc.) would still exist because these fish are readily attracted to traps by bait, conspecific attraction and predator-prey relationships. Moreover, management measures which would limit overall fishery efforts, gear size and number have not been proposed for the Gray's Reef area. Under the status quo, the potential for traps to displace less efficient fishing methods would remain as a threat to the existing socioeconomic situation.

Alternative 2--NOAA Issues Marine Sanctuary Regulations

Under this provision, NOAA would issue regulations to control the use of wire fish traps in the sanctuary, after consultation with the SAFMC. NOAA regulations would be consistent to the maximum practical extent with the provisions of draft or final Fishery Management Plans. The following suboptions are considered:

Subalternative a -- Monitoring of the Status Quo

NOAA would monitor (1) currently unregulated wire trap fishing or (2) any changes resulting from implementation of the SAFMC's final Snapper-Grouper FMP. The consequences of this regulation would depend upon the final scope and timing of SAFMC's management measures and NOAA's ability to detect through monitoring any problems before they become severe. NOAA could later propose regulations to control the use of wire fish traps and reduce the harm to sanctuary resources if data supported a need.

Subalternative b -- Allow, with a NOAA permit use of wire fish traps in the sanctuary (THE PREFERRED ALTERNATIVE)

Under this alternative, wire fish traps would be allowed at Gray's Reef on a case-by-case basis by permit for research, education, and resource assessment purposes if the intended activity would not pose a substantial threat of harm to sanctuary resources nor conflict with other activities, was consistent in scope with sanctuary goals and objectives, and met other permit criteria.

Adoption of this regulation and implementation of a permit review process and monitoring regime would provide immediate protection for the physical, biological, and ecological resources at Gray's Reef. An effective permit process would coordinate research, education, and resource assessment projects and screen-out any potentially damaging proposals.

Additionally, controlled use of traps could provide several long term positive benefits: (1) reduce the risk of physical damage to reef substrate and marine life; (2) eliminate a threat of growth and recruitment overharvest from extended trapping efforts; (3) reduce the bycatch of incidental juveniles and tropicals; (4) help preserve the integrity of the reef fish community; and (5) maintain and enhance conservation, ecological, recreational and aesthetic values of the area. Wire fish traps have practical utility in research, education and resource management. Traps serve as a temporary restraining mechanism for tag and release studies and can be used to study the demographic and behavioral characteristics of reef populations. Because frequently attended traps retain fish alive and in good condition, specimens often survive retrieval and can be kept for aquarium studies or released unharmed. Quality specimens are also desirable for post-mortem studies.

Controlled wire trap use would not necessarily cause negative socioeconomic impacts because at present the commercial use of traps is not widespread.

SPEARFISHING

Alternative 1--Status Quo: Rely on the South Atlantic Fishery Management Council (SAMFC) to control spearfishing within the sanctuary.

A number of local recreational divers spearfish at Gray's Reef to catch edible fish. Most spearfishermen are members of dive clubs or are escorted by professionals associated with dive shops. Current activity levels are low due to the number of divers in the area and the fact that artifical and deepwater reefs off Georgia also attract spearfishermen.

Spearfishing, at current activity levels, does not appear to pose a threat to the health and stability of the Gray's Reef ecosystem nor to the welfare of other user groups. The potential for conflict among user groups at Gray's Reef is less than that found in more popular tropical reef areas. While species preference and fishing areas may overlap, spearfishermen at Gray's Reef are more limited than line fishermen in overall activity and catch-per-unit effort (CPUE), by a

diver's ability to hunt, by self-imposed catch regulations, and by natural features of the reef environment (e.g., water depth, length of dive, area coverage, sea condition, weather, visibility, current and temperature). Although spearfishermen can be more selective than linefishermen, which can have adverse implications most spearfishermen at Gray's Reef observe self-imposed policies regarding target species, size and bag limits and as a rule take only what they can eat. Preliminary data suggest that daily average CPUE for spearfishermen at Gray's Reef is less than that for linefishermen in the same area (Bell and Smith, 1979, pers. comm.).

Spearfishing in many reef areas elsewhere is controversial. The controversy stems from charges that spearfishing (1) competes with more traditional rod and reel or handline fishing; (2) removes larger, more mature fish and thereby reduces breeding stock and recruitment potential; (3) reduces predator stocks (snappers, groupers and barracuda) and alters predator-prey relations; (4) fosters incidental removal of tropicals; (5) physically or ecologically damages coral and other sessile benthos on account of inexperienced divers; (6) creates a fear or avoidance response in fish; and (7) threatens the safety of other divers. These charges may be wellfounded in certain reef areas, but there is no evidence to support them at Gray's Reef.

Spearfishing activities in the South Atlantic are not regulated by any Federal laws. Under this provision, NOAA would rely upon the SAFMC to regulate spearfishing activities in the sanctuary once FMPs have been developed and implemented. The SAFMC has not proposed any management measures to regulate spearfishing in natural reef or live bottom environments; tentative management decisions approved by the Council pursuant to the draft Snapper-Grouper FMP would apply only in artifical reef areas (see Section IV F: The Legal Status Quo).

NOAA does not have any evidence to suggest that unregulated spearfishing activities, at current activity levels, adversely impact live bottom resources or user groups.

Alternative 2 -- NOAA Issues Marine Sanctuary Regulations

Under this provision, NOAA issues regulations to control spearfishing activities in the sanctuary, after consultation with the SAFMC under the Memorandum of Understanding. NOAA regulations would be consistent to the maximum practical extent with provisions of any draft or final FMP. The only reasonable alternative considered is as follows:

Subalternative a -- Monitoring of the Status Quo
(THE PREFERRED ALTERNATIVE)

There is no evidence to suggest that unregulated spearfishing, at current activity levels, poses a substantial threat of harm to physical, biological, ecological or socioeconomic environments at Gray's Reef and therefore NOAA proposes no restrictions on this activity. Under this provision, NOAA would list spearfishing in the Designation document and undertake various management tasks: (1) monitor spearfishing

activities to obtain more information on fishing and fishery stocks; (2) share information with the SAFMC and work together to insure compatible management measures; (3) work closely with local dive groups to promote a continued observance of self-imposed spearfishing policies; (4) conduct resource surveys and make available educational materials about the biology of reef fish, especially with regard to growth and reproductive characteristics which tend to make them vulnerable to overharvest; and (5) study the feasibility and desireability of marking dive trails. The sanctuary management plan would specify monitoring strategies. In the absence of future data demonstrating adverse impacts, no NOAA regulations would be proposed.

Survey data and educational materials would provide for better understanding and wise use of live bottom resources. No significant impacts on user groups are expected to result from the monitoring program.

OTHER FISHING ACTIVITIES

Alternative 1 -- Status Quo: Rely on the South Atlantic Fishery Management Council (SAFMC) to control other fishing activities within the sanctuary (THE PREFERRED ALTERNATIVE)

Gray's Reef is a popular recreational fishing spot. Vessels range in size from small 16 foot outboard-powered boats to 50 foot sport fishing boats. Line, baited hook and hand operated reels are standard gear. Several linefishermen also spearfish while at the live bottom. Fishermen engage in drift fishing and trolling for pelagic species and bottom fishing for demersals. Directed and incidental catches include bottom fish in the snapper-grouper complex (black sea bass, snappers, groupers, porgies, grunts, triggerfish) and coastal migratory pelagic species (king and Spanish mackerel, cobia or bonita, and occasionally amberjack, little tunny, dolphin and bluefish). Billfish and sharks are occasionally taken. Fishing occurs year round, but most fishing takes place in spring and fall, when migratory species are running, and during the summer. The Coastal Resources Division (Georgia DNR, Brunswick) recorded approximately 8000 angler hours at Gray's Reef between February 1977 and January 1978, with the months May to October being the most popular. Many recreational fishermen belong to and participate in local sport fishing associations which are active in promoting conservation and wise use of reef fisheries.

Gray's Reef does not support a large commercial fishery. Occasional commercial fishermen have frequented Gray's Reef in the past. Handliners follow mackerel migrations, and their pursuits have brought some in the vicinity of Gray's Reef. Traps have been used to a limited extent for demersal species, as described previously. Other than occasional handliners, trap fishermen and spearfishermen, NOAA is not aware of other fishermen with a directed or incidental interest in the Gray's Reef fisheries.

Elsewhere in the South Atlantic and off the Georgia coast, fishermen employing gill-nets, fish trawls, handlines, powerdriven snapper reels and longlines fish demersals and pelagics. These fishermen are typically highly mobile and are dependent upon seasonal availability of fish and favorable market trends. Limited use of poisons, explosives and

powerheads may occur (SAFMC, 1980). Further south, spiny lobsters are taken in pots at reef areas; only lobster carcasses have been found at Gray's Reef.

Information on the present condition of fishery stocks in the South Atlantic suggests that some mid-depth and inshore demersal fisheries, especially in southern sectors, may be experiencing some moderate growth overfishing (SAFMC, 1980). The SAFMC reports that population levels of sea bass and red porgy off Georgia and northeast Florida, red and vermillion snapper off the Carolinas, and grunts and triggerfish throughout the South Atlantic are stable. However there are indications that vermillion snapper off Georgia and northeastern Florida, red porgy off the Carolinas and mid-water groupers off the Carolinas and off Georgia and northeastern Florida are entering a growth overfishing phase. Black sea bass off the Carolinas are currently experiencing growth overfishing (SAFMC, 1980). The present condition of coastal pelagic resources cannot be conclusively established at this time (GMFMC and SAFMC, 1980 a).

The SAFMC is considering several FMPS which, when final and implemented, may have some bearing upon fisheries and fishermen at Gray's Reef. Provisions of the draft Snapper-Grouper Resources FMP and the Coastal Pelagic Migratory Resources (Mackerel) FMP will apply at Gray's Reef; those of the Spiny Lobster FMP will apply only theoretically because neither live spiny lobsters nor lobster fishermen presently use Gray's Reef. Billfish and sharks are occasionally taken at Gray's Reef, and when respective FMP are implemented, these fisheries and respective user groups may be impacted, also.

Draft and tentative management measures considered by the SAFMC (and the GMFMC for joint FMPs) are described in detail in the respective draft FMPs and are summarized in Section IV.F: The Legal Status Quo. These measures are recapitulated here to illustrate possible management under this alternative and to facilitate discussions of possible environmental impacts.

Pursuant to the draft Snapper-Grouper FMP, the SAFMC tentatively proposes (1) to establish a quota equal to estimated optimum yield for each fishery management subunit to stabilize stocks while obtaining more information about their status and user groups; (2) to impose a minimum size limit of 9 inches for black sea bass; (3) to prohibit use of poisons, explosives, and powerheads in the harvest of fishes; and (4) to impose management measures to control wire trap fishing and spearfishing, as previously discussed.

Under the Coastal Pelagic Migratory Resources (Mackerel) FMP, the SAFMC and GMFMC propose (1) to implement necessary management measures to reduce gear and user group conflicts occurring as a result of expansion of a historical fishery in a traditional fishing area or region or through introduction of gear to devices into new areas where they have not been historically fished; (2) to establish fishing zones (for king mackerel only) to separate users by gear and time; (3) to establish stock allocations (quotas) equal to optimum yield; (4) to prohibit buying, selling and processing of undersized mackerel; (5) to

set minimum gillnet mesh size for king mackerel; (6) to prohibit use of purse seines in the South Atlantic; (7) to develop a research program to determine the impact of purse seining on mackerel fisheries; and (8) to establish bag and/or size limits for affected fisheries, where data are available.

Implementation of draft and/or tentative management measures pursuant to these FMPs could have various impacts on fishery resources and user groups at Gray's Reef. Briefly, establishment of quotas would be conservation-oriented and consistent with optimizing the social and economic values of the fishery, preventing overfishing of the stocks, and obtaining socioeconomic and biological data. Quotas, however, afford only limited protection for stocks which may be experiencing overfishing and would require timely data collection, compilation, and analysis. Quotas do not necessarily discriminate against present or potential gear types and user groups and do not protect traditional fisheries from introduction of new, and possibly adverse technologies (SAFMC, 1979).

Separation of user groups by gear and time would reduce user conflicts. Imposition of minimum gill net mesh size would prevent harvest of fish smaller than the size for maximum sustainable yield of the fishery. No clear rationale was given in the draft Mackerel FMP for the proposal to prohibit purse seining in the South Atlantic (GMFMC & SAFMC, 1980 a).

Imposition of minimum catch size limits and/or bag limits and prohibition on buying, selling and processing undersized fish would reduce fish mortality and minimize overfishing, without closing the fishery entirely. Size limits would require culling (sorting) of catch and return to the water fish which are undersize, and possibly gear modifications, thus burdening user groups (SAFMC, 1979). FMPs would have no significant impact on fishery stocks not included in specified management units; e.g., incidental or bycatch (GMFMC and SAFMC, 1980 a).

Prohibition of poisons, explosives and powerheads would eliminate wasteful destruction of fishery habitats and removal of directed and incidental reef fish (SAFMC, 1979).

Resolution of gear and/or user conflicts or excessive catch allocations could have positive or negative impacts on user groups depending on how such conflicts are resolved. Mandatory reporting systems would impact user groups in terms of the time and energy needed to complete the required data forms.

Research and monitoring programs would provide statistical information concerning affected user groups and fishery resources.

Recreational and recreational-for-hire fishing is consumptive and non-selective but does not pose a present threat to fishery resources at Gray's Reef. Under this alternative, NOAA would rely upon the SAFMC to control other fishing activities in the sanctuary pursuant to FMPs. NOAA and SAFMC would monitor all fishing activities in the sanctuary and work together to insure compatible management measures. In addition, NOAA would survey fishery resources and make available educational materials about reef and pelagic fish, especially with regard to growth and

reproductive characteristics which tend to make them vulnerable to overharvest. Under this alternative, NOAA would propose to SAFMC additional management measures if monitoring and resources assessment warrant.

Survey data and educational materials would provide for better understanding and wise use of live bottom resources. No negative impacts on user groups are expected.

Alternative 2 -- NOAA Issues Marine Sanctuary Regulations

Under this provision, NOAA would issue regulations for fishing activities (other than bottom trawling and dredging, wire trap fishing, and spearfishing which have been addressed previously) at Gray's Reef, after consultation with the SAFMC. The following suboption is the only alternative considered reasonable:

Subalternative -- Monitoring of the Status Quo

Under this alternative, NOAA would propose no regulations, list the activity in the Designation document and monitor (1) presently unregulated fishing activities and (2) future activities allowed by the SAFMC pursuant to Final FMPs.

NOAA does not have sufficient documented evidence to suggest that present levels of unregulated fishing activity pose a threat of harm to the live bottom resources. Tentative management measures pursuant to the SAFMC FMPs are conservation-oriented and will prevent overfishing of selected stocks and will provide for obtaining necessary socioeconomic and biological data without adversely impacting sanctuary user groups.

MARINE SPECIMEN COLLECTING

Alternative 1 -- Status Quo: Rely upon existing authority to control commercial and amateur marine specimen collecting, including marine plants, invertebrates and tropical fish in the sanctuary

Collecting of marine plants, invertebrates and tropical fish occurs at Gray's Reef incidental to research, education and possibly recreational diving. Collecting for the home aquaria, biological specimen industry, curio trade and municipal aquaria or incidental to salvage work is not known to occur at Gray's Reef, although future possibilities for such activities do exist.

Research and educational collecting is done by SCUBA divers, submersibles, bottom trawls and specimen dredges for identification and experimentation purposes. Hand or mechanical collecting by divers and submersibles is selective for species type, numbers, and possible year class, whereas trawling or dredging is not and often results in incidental bycatch of undesirable species and habitat disturbance.

Complete biological inventories are lacking for the Gray's Reef live bottom. Marine plants have not been studied and only limited knowledge exists concerning invertebrates and tropical fish. Tropical species are naturally rare biota at Gray's Reef, representing northern range extensions for many typical Caribbean or West Indies stocks. Many uncertainties exist concerning their viability, reproductive capability and response to environmental change. Indiscriminate taking of marine specimens in large numbers from the live bottom could adversely impact a delicate ecological balance by reducing their numbers relative to competitors, predators or prey.

At the present time, there are no Federal regulations for marine specimen collection, except with regard to the taking of threatened and endangered species and marine mammals, as provided under the Endangered Species Act and Marine Mammal Protection Act, respectively. Until recently, BLM's mandate to protect coral and coral resources under the Outer Continental Shelf Lands Act applied to all activities involving the taking of coral. However, the Fifth Circuit Court of Appeals ruled that BLM's mandate applied only in those areas under lease for OCS oil and gas exploration and development and only to the lessee. Thus coral and coral resources are unprotected in other OCS areas and from other activities which might directly or inadvertently damage the resource, including specimen or souvenir collecting and salvage work (see Section IV F: The Legal Status Quo).

The SAFMC and GMFMC are proposing management measures for coral and coral resources, in general, and within HAPC's, in particular, pursuant the joint Coral FMP. The current draft FMP proposes to approve for harvest limited quantities of soft coral species (e.g., sea fans and whips) and to issue permits for hard and soft coral collecting for scientific and educational purposes (SMFMC and SAFMC, 1980 b). The FMP is still in the draft stage and the environmental impact statement has not yet been completed. Although Gray's Reef has been proposed as a HAPC, the Councils are not considering special management measures at this time.

There are no existing regulations or proposed FMP managment measures for marine plants, other invertebrates and tropical fish. The SAFMC and GMFMC have initiated preliminary scoping on the desirablility of preparing a description of tropical reef fisheries in their respective geographical areas of jurisdiction.

The perpetuation of the status quo would allow all marine specimen collecting to continue, prior to implementation of the Coral FMP. Since no FMPs are in process to regulate other specimen collecting (e.g., marine plants and tropical fish), vitally important segments of the ecosystem would be remain vulnerable under this alternative.

Alternative 2 -- Allow by permit collecting of marine plants, invertebrates, and tropical fish within the sanctuary (THE PREFERRED ALTERNATIVE)

Under this alternative, marine specimen collecting would be allowed in the sanctuary on a case-by-case basis, by permit, if the proposed activity did not pose a substantial threat to sanctuary

resources, was consistent with sanctuary goals and objectives and met other NOAA permit criteria. Adoption of this alternative would provide immediate protection for essential components of the ecosystem at Gray's Reef. It would prevent the depletion of ecologically important species and preserve a fragile ecological balance by limiting collecting to only those persons demonstrating a knowledge of marine species and to the most accepted and least damaging sampling techniques. The taking of specimens for scientific research and education purposes would continue under permit governing activity levels and NOAA would provide for additional controls if necessary to reduce or eliminate any adverse impacts.

Adoption of this alternative would add to the administrative burden of NOAA, however, the resource management benefits would outweigh any hardships. Requiring permits should not impose a significant burden on researchers and educators presently taking specimens, nor would it necessarily preclude others from becoming collectors for research or educational purposes.

Alternative 3 -- Prohibit marine specimen collecting in the sanctuary

A prohibition on marine specimen collecting would provide a maximum level of protection for the live bottom ecosystem by eliminating the taking of rare and ecologically important biota and the potential consequences of that action. Participation in marine specimen collecting is not widespread and the prohibition would have minimal negative socioeconomic impacts except on those researchers and educators who presently collect or have interest in collecting in the future. Due to adverse impacts on the latter groups, the prohibition would conflict with those sanctuary goals and objectives which emphasize research and education.

REMOVAL OF SUBMERGED HISTORIC AND CULTURAL RESOURCES

Alternative 1 -- Status quo: Rely on existing authority to control tampering with, damage to or removal of submerged historic and cultural resources from the sanctuary

The BLM has identified areas of cultural sensitivity between Cape Hatteras, North Carolina and Key West, Florida out to 200 nmi. At the present time, no historic or cultural resources, including shipwrecks and paleoenvironmental (Indian) artifacts, have been identified at Gray's Reef.

No Federal laws at the present time regulate salvage and recovery operations in the high seas. Under a recent court decision, it was determined that the Antiquities Act, which provides that the Department of the Interior may designate and protect certain historically important sites, does not apply in high seas areas. In addition, neither the Abandoned Property Act nor the National Historic Preservation Act offer protection for valuable marine artifacts in high seas areas. The status quo would allow unregulated investigation and removal of submerged artifacts should any discoveries be made within the sanctuary. Tampering with, artifacts could damage adjunct physical and living marine resources on the live bottom, as well.

Alternative 2 -- Prohibit tampering with, damage to or removal of historic and cultural resources without a permit (THE PREFERRED ALTERNATIVE)

Under this alternative, investigation, salvage and recovery of historic and cultural resources would be allowed in the sanctuary on a case-by-case basis, by permit, for historical, educational or research purposes, if the proposed activity did not pose a substantial threat of harm to sanctuary resources, was consistent with sanctuary goals and objectives and met other NOAA permit citeria. This alternative would provide immediate protection for the live bottom ecosystem by limiting investigation and salvage operations to historical and cultural purposes and would reduce live bottom reef damage from excavation and salvage activities. Shipwrecks and paleoenvironmental artifacts in the sanctuary could be explored and artifacts removed under a NOAA permit. Permitting the activity would allow monitoring of activity levels and ensuing impacts and would provide for implementation of further controls whenever necessary to reduce or eliminate any adverse impacts. Requiring permits should not impose a significant burden on researchers and educators who desire to investigate the historical and cultural potential at Gray's Reef. This regulation would apply to foreign citizens only insofar as consistent with international law.

Alternative 3 -- Prohibit tampering with, damage to or removal of submerged historic and cultural resources within the sanctuary

This prohibition would provide a maximum level of protection for any possible shipwrecks or paleoenvironmental artifacts of historical and cultural significance within the sanctuary by eliminating tampering and removal.

There is little or no investigation and salvage operation activity at Gray's Reef at the present time. Therefore, this regulation would not impact present operations, but it would prevent research and educational endeavors and benefits in the future.

SECTION VI. LIST OF PREPARERS

Many persons participated in the preparation of this document. A prior portion of the environmental analysis was performed under contract with the Center for Natural Areas, 1525 New Hampshire Avenue, N.W., Washington, D.C. 20036. The following persons have made major contributions to the effort:

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SECTION VII. REFERENCES

Abbott, R. T. 1974. American Seashells. Van Nostrand Reinhold Co. New York.

Alevizon, W. S. and M. G. Brooks. 1975. The comparative structure of two western Atlantic reef fish assemblages. Bull. Mar. Sci. 25: 482-490.

American Fisheries Society. 1970. A list of common and scientific names of fishes from the United States and Canada. 3rd ed. Amer. Fish. Soc. Spec. Publ. 6, 150 pp.

Anderson, W. D., J. 1967. Field guide to the snappers (Lutjanidae) of the Western Atlantic. U. S. Dept. Int. Fish Wildl. Serv. Cir. 252: 1-14

Anderson, W.W. and J. W. Gehringer. 1959. Physical oceanographic, biological and chemical data--South Atlantic coast of the United States, M/V THEODORE N. GILL Cruise 8. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. No. 303. 227 p.

Ansley, H. L. H. 1979. Personal communication. Coastal Resources Division Georgia Department of Natural Resources, Brunswick, Ga.

Ansley, H. L. H. and S. Shipman. 1979. Personal communication. Coastal Resources Division, Georgia Department of Natural Resources, Brunswick, Ga.

Antoine, J. W. and V. J. Henry. 1965. Seismic refraction study of shallow part of continental shelf off Georgia coast. Bull. Am. Assoc. Petrol. Geol. 49: 601-609.

Atkinson, L. P. 1975. Oceanographic observations in the Georgia Bight. R/V EASTWARD Cruises E-13-73 and E-19-73. Ga. Mar. Sci. Tech. Rpt. 75-6.

Atkinson, L. P. 1976. Oceanographic observations in the Georgia Bight. R/V EASTWARD Cruises E-3-74 and E-12-74. Ga. Mar. Sci. Tech. Rpt. 76-1.

Atkinson, L. P. 1977. Modes of Gulf Stream intrusion into the South Atlantic Bight shelf waters. Geophys. Res. Let. 4:583-586.

Atkinson, L. P. 1978. The results of four oceanographic cruises in the Georgia Bight. Ga. Mar Sci. Ctr. Tech. Rpt. 78-1.

Atkinson, J. P. 1980. Personal communication. Skidaway Institute of Oceanography, Savannah, Ga.

Atkinson, L. P., J. O. Blanton and E. B. Haines. 1978. Shelf flushing rates based on the distribution of salinity and fresh water in the Georgia Bight. Est. Coast. Mar. Sci. 7: 465-472.

Atkinson, L. P., G. A. Paffenhofer and W. M. Dunstan. 1978. The chemical and biological effect of a Gulf Stream intrusion off St. Augustine, Florida. Bull. Mar. Sci. 28(4): 667-679.

Avent, R. M., M. E. King and R. H. Gore. 1977. Topographic and faunal studies on shelf-edge prominences off the central eastern Florida coast. Int. Res. ges. Hydrobiol. 62(2): 185-208.

Barada, B. 1979. Wire fish traps: torture chambers of the deep. Skin Diver. Nov. 5 pp.

Barans, C. A. and V. G. Burrell, Jr. 1976. Preliminary findings of trawling on the continental shelf off the southeastern United States during four seasons (1973-1975). S.C. Mar. Res. Ctr. Tech. Rept. No. 13, 16 pp.

Barans, C. W. and H. W. Powles. 1977. South Carolina MARMAP program: present and future, p. 6-12. In: D.M. Cupka, P. J. Eldridge and G. R. Huntsman (eds.) Proceedings of workshop on the snapper-grouper resources of the South Atlantic Bight. S. C. Mar Res. Cent. Tech. Rept. 27, 46 pp.

Barbour, Cmdr. 1980. Personal communication. Seventh U. S. Coast Guard District, Miami, Fla.

Bell, W. H. 1979. Personal Communication. Sport Diver. 18 E. Victory Drive. Savannah, Ga.

Beumariage, D. C. and L. H. Bullock. 1976. Biological research on snappers and groupers as related to fishery management requirements, p. 86-94. In: H. R. Bullis, Jr. and A. C. Jones (eds.) Proc. Colloquium on snapper-grouper fishery resources of the Western Central Atlantic Ocean. Fla. Sea Grant Prog. Rept. 17, pp. 86-94.

Bigham, G. A. 1973. Zone of influence--inner continental shelf off Georgia. J. Sediment Petrol. 43(4): 207-215.

Blair, S. 1980. Personal communication. Harbor Branch, Fort Pierce, Fla.

Blanton, J. 1971. Exchange of Gulf Stream water with North Carolina shelf water in Onslow Bay during stratified conditions. Deep-Sea Res. 18: 167-178.

Boesch, D.F. 1977. A summary and analysis of environmental information on the Continental Shelf and Blake Plateau from Cape Hatteras to Cape Canaveral. In Draft. p VIII-1-71. Prepared by Center for Natural Areas for Bureau of Land Management.

Bohnsack, J. A. 1979. Photographic quantitative sampling of hard bottom benthic communities. Bull. Mar. Sci. 29: 242-252.

Bowman, T. E. 1971. The distribution of calanoid copepods off the southeastern United States between Cape Hatteras and Southern Florida. Smithson. Contrib. Zool. 96. 58 pp.

Breaden, C. M. 1969. A report and recommendation on the saltwater sport fisheries of South Carolina. S. C. Wildl. Res. Dept. mimeo. 95 pp.

Breaden, C. M. and M. D. McKenzie. 1971. An investigation of the offshore demersal fish resources of South Carolina. S. C. Wildl. Res. Dept. Tech. Rept. 2, 19 pp.

Breder, C. M., Jr. 1959. Studies on social groupings in fishes. Bull. Amer. Mus. Nat. Hist. 117(6): 393-482.

Brokaw, R. S. and G. F. Oertel. 1976. Suspended sediment data from nearshore waters of Georgia. Ga. Mar. Sci. Center Tech. Rept. 76(3): 1-42.

Buchanan, C. C. 1973. Effects of an artificial habitat on marine sport fishery and economy of Murrels Inlet, South Carolina. Mar. Fish. Rev. 35(9): 15-22.

Buchanan, C. C., R. B. Stone and R. O. Parker, Jr. 1974. Effects of artificial reefs on a marine sport fishery off South Carolina. Mar. Fish. Rev. 36(11): 32-38.

Bullis, H. R. and J. R. Thompson. 1965. Collections by the exploration fishing vessels Oregon, Silver Bay, Combat and Pelican made during 1956-1960 in the southwestern North Atlantic. Spec. Sci. Rpt. Fish. 510: 1-130.

Bumpus, D. F. 1955. The circulation over the continental shelf south of Cape Hatteras. Trans. Am. Geophys. Un. 36: 601-611.

Bumpus, E. F. 1973. A description of the circulation on the continental shelf of the east coast of the United States. Prog. Oceanogr. 6: 11-157.

Bureau of Land Management, United States Department of the Interior. 1978. Final environmental impact statement proposed 1978 outer continental shelf oil and gas lease sale, South Atlantic OCS Sale No. 43 Vol. I-III.

Bureau of Land Management, United States Department of the Interior. 1979. South Atlantic Hard Bottom Study. Prepared by Continental Shelf Associates, Tequista, Florida, Inc. 352 pp.

Burrell, V. G. 1975. The relationship of proposed offshore nuclear powerplants to marine fisheries of the South Atlantic Region of the United States. Ocean 75 record. IEEE Conf. Engineering Ocean Envir. 11th Ann. Meeting Mar. Tech. Soc. 491-495.

Burrell, V. G. 1976. Nekton of the continental shelf of the southeastern United States. Proc. Sp. Continental Shelf Symp. AIBS. New Orleans, May, 1976.

Cerame-Vivas, M. J. and I. E. Gray. 1966. The distributional pattern of benthic invertebrates of the continental shelf off North Carolina. Ecology 47: 260-270.

Cain, T. D. 1972. Additional epifauna of a reef off North Carolina. J. Elisha Mitchell Sci. Soc. 88: 79-82.

Caldwell, A. K. and M. C. Caldwell. 1974. Marine mammals from the southeastern United States coast: Cape Hatteras to Cape Canaveral. In: A socio-economic environmental baseline summary for the South Atlantic region between Cape Hatteras, North Carolina and Cape Canaveral, Florida. Prepared by the Virginia Institute of Marine Science Gloucester Point, Virginia for the Bureau of Land Management U.S. Department of the Interior.

Caldwell, D. K., H. Neuhauser, M. C. Caldwell, and H. W. Coolidge. 1971. Recent records of marine mammals from the coast of Georgia and South Carolina. Cetology 5: 1-12.

Carpenter, J.S. 1965. A review of the Gulf of Mexico red snapper fishery. U.S. Fish & Wildlife Service Circular 208. 35pp.

Chance, J. 1979. Personal communication. Sport diver. 1231 E. 70th Street. Savannah, Ga.

Chapman, R.L. 1971. The macroscopic marine algae of Sapelo Island and other sites on the Georgia coast. Bull. Ga. Acad. Sci. 29: 77-89.

Chislettt, G. R. and M. Yesaki. 1974. Spiny lobster fishing explorations in the Caribbean. Mar. Fish. Rev. 36(9): 43-48.

Collette, B. B. and F. H. Talbot. 1972. Activity patterns of coral reef fishes with emphasis on nocturnal-diurnal changeover, In: B. B. Collette and S. A. Earle (eds.). Results of the Tektite program: ecology of coral reef fishes. Bull. Nat. Hist. Mus. Los Angeles. 14: 125-170.

Coastal Plains Regional Commission. 1975. The Coastal Plains deepwater terminal study. Vol. I and II. Prepared by Robert R. Nathan, Assoc., Inc. Washington, D.C.

Craig, A. K. 1976. Trapping experiments with snappers in south Florida. p. 222-236. In A.C. Jones (ed.) Proc. colloquium on snapper-grouper fishery resources of the western Central Atlantic Ocean. Fla. Sea Grant Program Rep. No. 17.

Cummins, R., Jr., J. B. Rivers and P. J. Struhsaker. 1962. Exploratory fishing off the coast of North Carolina, September 1959-July 1960. Comm. Fish. Rev. 24: 1-9.

Cupka, D. M. 1972. Aspects of the fishery for and biology of Centropristis striata in South Carolina waters. S. C. Dep. Wildl. Resour., Annu. Rep. Proj. 2-138-R-1, 64 pp.

Cupka, D. M., P. J. Eldridge and G. R. Huntsman. 1977. Proceedings of the workshop in the snapper/grouper resources of the South Atlantic Bight. S. C. Mar. Resources Center Tech. Rept. 27.

Custer, E. 1979. Personal communication. U. S. Coast Guard, Washington, D.C.

Dahlberg, M. D. 1972. Ecology of Georgia Coastal Fishes. Fishery Bull. 70(2). 323-353.

Dahlberg, M. D. 1975. Guide to coastal fishes of Georgia and nearby states. Univ. Georgia Press, Athens. 186 pp.

Denmark, M. 1980. Personal communication. Sport diver, Savannah, Ga.

Donahue, Lt. J.G. 1979. Personal communication. United States Coast Guard. Seventh District. Division of Marine Safety. Miami, Florida.

Dorjes, J. 1972. Georgia coastal region, Sapelo Island, U.S.A. sedimentology and biology: VII. Distribution and zonation of macrobenthic animals. Senckenb. Marit. 4:183-216.

Dorjes, J. 1977. Marine macrobenthic communities of the Sapelo Island, Georgia region. In: B. Coull (ed.) Ecology of marine benthos. Univ. S. Carolina Press, Columbia. 339-422.

Doss, K. 1979. Personal communication. Sport diver and charter boat operator. St. Simons Island, Ga.

Dowds, R. E. 1979. References for the identification of marine invertebrates on the southern Atlantic coast of the United States. NOAA Tech. Rep. NMFS SSRF729. 37 pp.

Dunstan, W. M. and L. P. Atkinson. 1978. Sources of new nitrogen for the South Atlantic Bight. p. 69-78 In: M. Wiley, (ed.) Estuarine Processes, Vol. I. Academic Press, New York.

Durant, C. 1979. Personal communication. University of Georgia Marine Institute Sapelo Island, Ga.

Eagle, R. A. 1975. Natural fluctuations in a soft bottom benthic community. J. mar. biol. Ass. U. K. 55:865-878.

Ebbs, N. K. 1966. The coral-inhabiting polychaetes of the northern Florida reef tract. Part 1 - Aphroditidae, Polynoidae, Amphinomidae, Eunicidae and Lysaretidae. Bull Mar. Sci. 16(3): 485-555.

Eddy, J. E., V. J. Henry, J. H. Hoyt and E. Bradley. 1967. Description and use of an underwater television system in the Atlantic continental shelf. U.S. Geol. Surv. Prof. Paper 575-C: 72-76.

Edwards, A. 1980. Personal communication. Currator: The Gray Collection, University of Georgia, Athens, Ga.

Fendig, C. 1979. Personal communication. Charter boat operator, St. Simons Island, Ga.

Frankenberg, D. 1965. Variability in marine benthic communities off Georgia. Trans. Joint Conf. Ocean. Sci. & Ocean Engi. 2: 1111.

Frankenberg, D. 1968. Seasonal aggregation of amphioxus. Biol. Sci. 18: 877-878.

Frankenberg, D. 1971. The dynamics of benthic communities off Georgia, USA. Thalassia Jugoslavica 7: 49-55.

Frankenberg, D. and A. S. Leiper. 1977. Seasonal cycles in benthic communities of the Georgia continental shelf. In: B. Coull (ed.) Ecology of marine benthos. Univ. S. Carolina Press, Columbia. 6: 383-398.

George, R. Y. 1975. Potential effects of drilling and dumping activities on marine biota. Proc. EPA Symp. on Env. Aspects of Chem. Use in Well-Drilling Operations. 333-356.

George, R. Y. and J. C. Staiger. 1979. Epifauna: benthic invertebrates and demersal fish populations of South Atlantic/Georgia Bight, p. 211-254. In: South Atlantic Benchmark Program, Volume 3 (Final Report). A Bureau on Land Management report to U.S. Department of Interior, Washington, D.C. by Texas Instruments, Inc., Dallas.

Georgia Department of Natural Resources. 1975. Activities in Georgia's coastal waters: past trends and future prospects. Prepared by the Resource Planning Section, Office of Planning and Research, Ga. DNR, Atlanta, Ga.

Georgia Department of Natural Resources, Coastal Resources Division. 1978. Georgia's Artificial Reefs (brochure) 1200 Glynn Ave., Brunswick, Georgia 31520

Georgia Department of Natural Resources. 1978. Nomination to the Secretary of Commerce of Gray's Reef, Georgia Continental Shelf, as as National Marine Sanctuary. Brunswick, Ga.

Gillispie, D. 1979. Personal communication University of Georgia Marine Extension Service. Savannah, Ga.

Godcharles, M. F. 1970. Exploratory fishing for southern sea bass, Centropristis striata melana, in the northeastern Gulf of Mexico. Fla. Dep. Nat. Resour. Mar. Res. Lab., Tech. Ser. No. 63. 26 pp.

Gorsline, D. S. 1963. Bottom sediments of the Atlantic shelf and slope off the southern United States. J. Geol. 71: 422-440.

Gosner, K. L. 1971. Guide to identification of marine and estuarine invertebrates. John Wiley & Sons, Inc., New York. 693 pp.

Gosner, K. L. 1979. A field guide to the Atlantic seashore. Houghton Mifflin Co., Boston.

Grahl-Nielsen, O. 1978. The Ekofisk Bravo Blowout: petroleum in the sea. In: Proceedings of a Conference on Assessment of Ecological Impacts of Oil Spills. American Institute of Biological Research. Keystone, Colorado.

Gray, M. B. 1961. Unpublished collection notes and species lists from stations in the vicinity of Sapelo Whistle Buoy. Univ. Georgia Mar. Inst., Sapelo Is., Ga.

Grimes, C.B. 1976. Certain aspects of the life history of the vermilion snapper Rhomboplites aurorubens (Cuvier) from North and South Carolina. PH.D. Dissertation, Univ. North Carolina (Chapel Hill). 251pp.

Grimes, C.B., C.S. Manooch, III., G.R. Huntsman and R.L. Dixon 1977. Red snappers of the Carolina Coast. Mar. Fish. Rev. 39(1): 12-15.

Gulf of Mexico Fishery Management Council. 1980. Draft environmental impact statement and fishery management plan for reef fish resources of the Gulf of Mexico. Prepared by the Florida Sea Grant College, Gainsville, Fla. 164 pp. & appendices.

Gulf of Mexico and South Atlantic Fishery Management Councils. 1980a. Draft environmental impact statement and fishery management plan for coastal pelagic migratory resources (mackerel).

Gulf of Mexico and South Atlantic Fishery Management Council. 1980b. Draft environmental impact statement and fishery management plan for coral and coral resources.

Gulf of Mexico and South Atlantic Fishery Management Council. 1980c. Draft environmental impact statement and fishery management plan for spiny lobster resources.

Haines, E. B. 1975. Nutrient inputs to the coastal zone: the Georgia and South Carolina shelf. p. 303-324. In: L. E. Cronin (ed.) Estuarine Research: Vol. I: Chemistry, biology and the estuarine system. Acad. Press, New York.

Haines, E. B. and W. M. Dunstan. 1975. The distribution and relationship of particulate organic material and primary productivity in the Georgia Bight, 1973-1974. Est. Coast. Mar. Sci. 3: 431-441.

Hall, C. A. 1964. Shallow-water marine climates and mollusca provinces. Ecology. 45(2): 266-234.

Harrington, D. 1980. Personal communication. University of Georgia Marine Extension Service, Brunswick, Ga.

Harris, C. D. 1978. The fisheries resources on selected artificial and live bottom reefs on Georgia's Continental Shelf. Coastal Resources Division, Georgia Department of Natural Resources, Brunswick, Ga.

Harris, C. D. 1979. Personal communication. Coastal Resources Division. Georgia Department of Natural Resources, Brunswick, Ga.

Hendricks, J. 1979. Personal communication. Eastern Seaboard Petroleum, Inc., Brunswick, Ga.

Henry V. J., Jr. 1979. Personal communication. Skidaway Institute of Oceanography, Savannah, Ga.

Henry, V. J., Jr. and R. T. Giles. 1978. Distribution and occurrence of reefs and hardgrounds in the Georgia Bight. A draft final report to U. S. Geological Survey, Office of Marine Geology, Woods Hole, Massachusetts. 55 pp.

Henry, V. J., Jr. and J. H. Hoyt. 1968. Quaternary paralic and shelf sediments of Georgia. Southeastern Geol. 9: 195-214.

High, W. L. and A. J. Beardsley. 1970. Fish behavior from an undersea habitat. Comm. Fish. Rev. 32(10): 31-37.

High, W. L. and I. E. Ellis. 1973. Underwater observations of fish behavior in traps. Helgol. wiss. Meeresunters, 24: 341-347.

Hipkins, F. W. 1974. A trapping system for harvesting sablefish, Anoplopoma fimbria. U.S. Dept. of Commer., NOAA, NMFS, Fishery Facts 7, 20 pp.

Hulbert, E. D. and J. Rodman. 1963. Distribvution of phytoplankton species with respect to salinity between the coasts of southern New England and Bermuda. Limnol. Oceangr. 8:263-269.

Hulbert, E. D. and R. S. MacKenzie. 1967. Some notes on the phytoplankton off the southeast coast of the United States. Bull. Mar. Sci. 17: 330-337.

Hunt, J. L., Jr. 1974. The geology and origin of Gray's Reef, Georgia Continental Shelf. M. S. Thesis. Univer. of Georgia. Athens, Ga. 83 pp.

Hunt, J. L., Jr. 1979. Personal communication. Bureau of Land Manangement New Orleans, La.

Huntsman, G. R. 1976a. Offshore bottom fisheries of the United States South Atlantic Coast. p. 192-221. In: A. C. Jones (ed.) Proc. colloquim on snapper-grouper fishery resources of the western central Atlantic Ocean. Fla. Sea Grant Rep. No. 17.

Huntsman, G. R. 1976. Offshore headboat fishing in North Carolina and South Carolina. Mar. Fish. Rev. 38(3): 13-23.

Huntsman, G. R. and I. G. MacIntyre. 1971. Tropical coral patches in Onslow Bay. Am. Litt. Soc. Bull. 7(2): 32-34.

Huntsman, G. R. and R. L. Dixon. 1976. Recreational catches of four species of groupers in the Carolina headboat fishery. Proc. Southeast Assoc. Game and Fish Comm., 29th Annual Conf., Oct. 1975. 185-194.

Hutchings, P. A. 1974. A preliminary report on the density and distribution of invertebrates living on coral reefs. In: Proc. 2nd Int. Coral Reef Symp. Brisbane, Great Barrier Reef Committee. 2: 285-296.

Isaacson, P. A. 1963. Modifications of Chesapeake Bay commercial crab pot. Com. Fish. Rev. 25(1): 12-16.

Ingle, R. M. 1952. Studies on the effect of dredging operations upon fish and shellfish. Fla. Bd. of Conserv. Tech. Series No. S. 26.

Jacobson, J. P. 1974. A socio-economic environmental baseline summary for the South Atlantic Region between Cape Hatteras, North Carolina and Cape Canaveral, Florida. Vol. I. Physical Oceanography. A report for the Bureau of Land Management, U. S. Department of the Interior prepared by the Virginia Institute of Marine Science, Gloucester Point, Va.

Johannes, R. E. 1976. Life and death of the reef. Audubon 78(5): 36-56.

Juhl, R. 1969. Exploratory fishing survey and gear tests in Puerto Rico. Contr. Agr. and Fish. 1(1): 1-40.

Juhl, R. and J. D. Suarez-Caabro. 1973. Fish pot fisheries in Puerto Rico. Contr. Agr. y Pesp. 5(4): 1-18.

Kawaguchi, K. 1971. Handline and longline fishing explorations for snapper and related species in the Caribbean and adjacent waters. UNDP/FAO Caribbean Fisheries Development Project, Rep. SF/CAR/REG 189, F5. 29 pp. & appendices.

Keiser, R. K., Jr. 1976. Species composition, magnitude and utilizations of the incidental catch of the South Carolina shrimp fishery. S. C. Mar. Res. Center Tech. Rept. No. 16. 55 p.

King, C. 1979. Personal communication. National Marine Fisheries Service, Washington, D.C.

Klima, E. F. 1976. Snapper and grouper resources of the western central Atlantic Ocean. In: A. C. Jones (ed.) Proc. coll. on snapper-grouper fishery resources of the western central Atlantic Ocean. Fla. Sea Grant Program Report 17.

Kraeuter, J. N. 1979. Personal communication. Virginia Institute of Marine Science, Wachaprague, Va.

Leatherwood, S., D. K. Caldwell and H. E. Winn. 1976. Whales, Dolphins, and Porpoises of the Western North Atlantic: A guide to their identification. University of Rhode Island. Kingston, R. I.

Leary, T. 1980. Personal communication. Gulf of Mexico Fishery Management Council, Tampa, Fla.

Lee, R. F. 1978. Short term effects of oil on plankton in controlled ecosystems. In: Proceedings of a conference on assessment of ecological impacts of oil spills. American Institute of Biological Sciences. 14-17. June 1978. Keystone, Co.

Lee, T. N. and D. A. Brooks. 1979. Initial observations of current, temperature and coastal sea level in response to atmospheric and Gulf Stream forcing on the Georgia Shelf. Ga. Res. Letters 6: 321-324.

Leiper, J. 1973. Seasonal change in structure of three sublittoral benthic communities off Sapelo Island, Georgia. Ph.D. Disertation. Univ. Georgia. 296 pp.

MacIntyre, I. G. 1970. New data on the occurrence of tropical reef corals on the North Carolina continental shelf. J. Elisha Mitchell Sci. Soc. 86(4): 178.

MacIntyre, I. G. 1972. Submerged reefs of eastern Caribbean. Am Assoc. of Petrol. Geol. Bull. 56(4): 720-738.

MacIntyre, I. G. and O. H. Pilkey. 1969. Tropical reef corals: tolerance of low temperatures on the North Carolina continental shelf. Science. 166: 374-375.

MacIntyre, I. G. and J. D. Milliman. 1970. Physiographic features on the outer shelf and upper slope, Atlantic continental margin, southeastern United States. Geol. Soc. Amer. Bull. 81: 2577-2598.

Manooch, C. S. III and S. T. Laws. 1979. Survey of the charter boat troll fishery in North Carolina, 1977. Mar. Fish. Rev. 41(5): 15-27.

Manhein, F. T., R. H. Meade and G. C. Bond. 1970. Suspended matter in surface of the Atlantic continental margin from Cape Cod to the Flordia Keys. Science 167: 371-376.

Marshall, H. G. 1971. Composition of phytoplankton off the southeastern coast of the United States. Bull. Mar. Sci. 21(4): 807-825.

Marshall, H. G. 1979. Distribution patterns of blue-green algae off the southeastern coast of the United States. Abs. Amer. Soc. Limnol. Oceanogr. June 18-21. 79.

Martin, P. 1979. Personal communication. United States Geological Survey. St. Simons Island, Ga.

Maturo, F. J. S., Jr. 1957. A study of the bryozoa of Beaufort, North Carolina and vicinity. J. Elisha Mitchell Sci. Soc. 73: 11-68.

Maturo, F. J. S., Jr. 1966. Bryozoa of the Southeast coast of the United States: Bugulidae and Beaniidae (Cheilostomata; Anosca). Bull. Mar. Sci. 16(3): 556-583.

McCloskey, L. R. 1970. The dymamics of the community associated with a marine scleractinian coral. Int. Rev. ges Hydrobiol. 55:13-81.

McKenzie, M. J. 1974. Description of industry: harvesting sector, p. 39-69. In: D. R. Calder, P. J. Eldridge, and E. B. Joseph (eds). Tech. Rept. 5, South Carolina Mar. Res. Ctr., Charleston, S. C.

Menzies, R. J., O. H. Pilkey, B. W. Blackwelder, D. Dexter, P. Huling, and L. McCloskey. 1966. A submerged reef off North Carolina. Int. Revue. ges. Hydrobiol. 51(3): 393-431.

Meisburger, E. P. and M. E. Field. 1975. Geomorphology, shallow structure and sediments of the Florida inner continental shelf Cape Canaveral to Georgia. Corps of Eng. Tech. Memo 54, 119 pp.

Milliman, J. D., O. H. Pilkey, and D. A. Ross. 1972. Sediments of the continental margin of the eastern United States. Geol. Soc. Am. Bull. 83: 1315-1334.

Moe, M. A., Jr. 1966. Tagging fishes in Florida offshore waters. Fla. Bd. Conserv. Mar. Lab., Tech. Ser. No. 49: 10-40.

Moe, M. A., Jr. 1969. Biology of the red grouper Epinephelus morio (Valenciennes) from the eastern Gulf of Mexico. Fla. Dept. of Nat. Res. Lab, Prof. Pap. Series No. 10.

Moe, M. A., Jr. 1972. Movement and migration of South Florida fishes. Fla. Dept. of Nat. Resources Mar. Res. Lab. Tedh. Ser. No. 69. 25 pp.

Moore, H. 1979. Personal communication. Special Assistant to the Assistant Secretary of the Interior for Fish, Wildlife and Parks. Department of the Interior.

Mosher, Lt. Cdr. 1980. Personal communication. Aids to Navigation Division. U.S. Coast Guard, Washington, D.C.

Munro, J. 1973. Large volume stackable fish traps for offshore fishing. Proc. Gulf Caribb. Fish. Inst. 25: 121-128.

Munro, J. 1974. The mode of operation of Antillean fish traps and the relationship between ingress, escapement, catch and soak. J. Cons. Int. Explor. Mer. 35(3): 337-350.

Munro, J., P.H. Reeson and V. C. Gaut. 1971. Dynamic factors affecting the performance of the Antillean fish trap. Proc. Gulf. Caribb. Fish. Inst. 23: 184-194.

National Academy of Sciences. 1975. Petroleum in the Marine Environment. Workshop on inputs, fates and the effects of petroleum in the marine environment May 21-25, 1973. Held under the auspices of the Ocean Affairs Board Commission on Natural Resources, National Research Council. Washington, D. C.

National Oceanic and Atmospheric Administration. 1975. South Atlantic Fisheries Annual Summary 1972. Current Fish. Stat. No. 6568. 1-11.

National Ocean Survey, National Oceanic and Atmospheric Administration. 1980. Map: Gray's Reef marine sanctuary boundary alternatives.

Neiheisel, J. and C. E. Weaver. 1967. Transport and deposition of clay materials in southeastern United States. J. Sediment. Petrol. 37: 1084-1116.

Neuhauser, H. N. and C. Rickdeschel. 1978. Whales of Georgia. In: Proceedings of the Rare and Endangered Wildlife Symposium. 3-4. August 1987. Athens, Ga.

Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, United States Department of Commerce. 1979. Key Largo Coral Reef Marine Sanctuary: Management Plan. March, 1979. Washington, D. C.

O'Malley, P.G., L.P. Atkinson, J. J. Singfer, W. S. Chandler, and T. N. Lee. 1978. Hydrographic observations in the Georgia Bight. Georgia Mar. Sci. Center, Tech. Rept. Serv. 78-5.

Olsen, D. A. 1978. Virgin Islands fisheries remain primitive. National Fisherman 58(13): 164-165.

Olsen, D. A., A. E. Dammann and J. A. LaPlace. 1978. Mesh selectivity of West Indian fish traps. Mar. Fish. Rev. 40 (7): 15-16.

Pallozzi, M. 1979. Personal Communication. National Marine Fisheries Service, Washington, D.C.

Parker, R. O., Jr., R. B. Stone and C. C. Buchanan. 1979. Artificial reefs off Murrels Inlet, South Carolina. Mar. Fish. Rev. 41(9): 12-24.

Pearse, A. S. and L. G. Williams. 1951. The biota of the reefs off the Carolinas. J. Elisha Mitchell Sci. Soc. 67: 133-161.

Peaver, D. R. and O. H. Pilkey. 1966. Phosphorite in Georgia Continental Shelf Sediment. Geo. Soc. of Am. Bull. 77:849-858.

Pilkey, O. H. 1963. Heavy minerals investigations of pleistocene terraces of lower coastal plain Georgia Soc. Am. Bull. 73: 365-374

Pilkey, O. H. 1964. The site distribution and mineralogy of the carbonate fraction of the U. S. South Atlantic shelf and upper slope sediment. Mar. Geo. 2: 121-136.

Pilkey, O.H. and D. Frankenberg. 1964. The relict recent sediment boundary on the Georgia continental shelf. Bull. Ga. Acad. Sci. 22(1): 37-40.

Pilkey, O. H . and R. T. Giles. 1965. Bottom topography on the Georgia Continental Shelf. Southeast Geol. 7(1): 15-18

Pilkey, O. H., Schnitker, and D. R. Peaver. 1966. Oites on the Georgia continental shelf. J. Sed. Petro. 36: 562-467.

Popenoe, P. 1979. Personal communication. U. S. Geological Survey, Office of Marine Geology, Woods Hole, Massachusetts.

Porter, J. W. 1979. Personal communication. University of Georgia, Athens, Ga.

Powell, D. E. 1950. Observations on the commerical fishing potentials in the offshore waters of North Carolina (January-February 1950). Comm. Fish. Rev. 12: 1-7.

Powles, H. and B. W. Stender. 1976. Observations on composition, seasonality and distribution of ichthyoplankton from MARMAP cruises in the South Atlantic Bight in 1973. S.C. Mar. Res. Cent. Tech. Rep. Ser. No. 11.

Pryterch, H. 1979. Personal communication. National Marine Fisheries Service. Washington, D.C.

Ramsey, B. 1979. Personal communication. Marine Protection Branch. Environmental Protection Agency. Washington, D.C.

Randall, J. E. 1963. Methods of collecting small fishes. Under. Nat. 1 (2): 6-11.

Reimold, R. J. 1979. Personal communication. Coastal Resources Division, Georgia Department of Natural Resources, Brunswick, Ga.

Reisinger, T. 1980. Personal communication. Georgia Marine Extension Service. Brunswick, Ga.

Richardson, F. 1980. Personal communication. Assistant Regional Director. Fish and Wildlife Service. Department of the Interior. Atlanta, Ga.

Richardson, J. 1979. Personal communication. University of Georgia. Athens, Ga.

Richardson, J. 1980. Personal communication. Savannah State College. Savannah, Ga.

Rivers, J. B. 1966. Gear and techniques of the sea bass trap fishery in the Carolinas. Commercial Fish. Rev. 28(4): 15-20.

Rivers, J. B. 1980. Personal communication. University of Georgia Marine Extension Service. Brunswick, Ga.

Roberts, M.H., Jr. 1974. A socio-economic environmental baseline summary for the South Atlantic region Cape Hatteras, North Carolina and Cape Canaveral, Florida. Vol. III. Chemical and biological oceanography. A report to Bureau of Land Management, U. S. Department of the Interior, prepared by Virginia Institute of Marine Science, Gloucester Point, Va.

Roberts, W. P. and J. W. Pierce. 1967. Outcrop of the Yorktown formation (upper Miocene) in Onslow Bay, North Carolina. Southeastern Geol. 8: 131-138.

Rodkey, R. 1980. Personal commuinication. National Oceanic and Atmospheric Administration, National Ocean Survey, Rockville, Maryland.

Russell, D.N. 1980. Personal commnication. Asst. Chief Intelligence and Law Enforcement Branch. Seventh Coast Guard District. Miami, Fla.

Sandwick, R. 1979. Personal communication. Brunswick Pilot Association. Brunswick, Ga.

Schneider, C. W. 1976. Spatial and temporal distributions of benthic marine algae on the continental shelf of the Carolinas. Bull. Mar. Sci. 26:133-151.

Scruggs, Capt. R. M. 1979. Personal communication. Office of Naval Operations. Department of the Navy. Washington, D.C.

Searles, R.B. and C.W. Schneider. 1978. A checklist and bibliography of North Carolina seaweeds Bot. Mar. 21; 99-108.

Shipman, S. 1979. Personal communication. Coastal Resources Division, Georgia Department of Natural Resources, Brunswick, Ga.

Shoemaker, A. H. 1972. Reef molluscs of South Carolina. Nautilus 85(4): 114-120.

Singer, J. 1980. Personal communication. Skidaway Institute of Oceanography. Savannah, Georgia.

Smith, A. B. 1980. Personal communication. Sport diver. Savannah, Ga.

Smith, Lt. Col. 1979. Personal communication. Air Force Liaison Officer, attached to the Federal Aeronautics Administration. Savannah, Georgia.

Smith, D. 1980. Personal communication. South Carolina Marine Advisory Program. Charleston, South Carolina.

Smith, D. and J. B. Rivers. 1977. Fish trawling activities off the Georgia coast, 1976 and 1977, p. 19-22. In: D. M. Cupka, P. J. Eldridge, and G. R. Huntsman (eds.) Proceedings of workshop on the snapper-grouper resources of the South Atlantic Bight. South Carolina Mar. Resources Center, Tech. Rept. 27.

Smith, K. L., Jr. 1971. Structural and functional aspects of a sublittoral community. Ph.D. Dissertation, Univ. Georgia. 163 pp.

Smith, K. L. 1973. Respiration of a sublittoral community. Ecology 59(5): 1065-1075.

South Atlantic Fishery Management Council. 1979. Decision elements. Summary of Council action. February 28, 1979. Jensen Beach, Fla.

South Atlantic Fishery Management Council. 1980. Draft snapper-grouper fishery management plan. Phase I: description of the fishery.

Springer, V. G. and A. J. McErlean. 1962. A study of the behavior of some tagged south Florida coral reef fishes. Amer. Midl. Nat. 67(2): 386-397.

Stefansson, U. and L. P. Atkinson. 1967. Physical and chemical properties of the shelf and slope waters off North Carolina. Duke U. Tech. Rep., 230 pp.

Stevenson, D. K. 1977. Management of a tropical fish pot fishery for maximum sustainable yield. Proc. Gulf Caribb. Fish. Inst. and Conference on small-scale fisheries ion the Caribbean, Nov. 1977.

Stone, R. B. 1978a. Artificial reefs. Water Spectrum. Spring: 24-29.

Stone, R. B. 1978b. Artificial reefs and fishery management. Fisheries 3(1):2-4.

Stone, R. B., H. L. Pratt, R. O. Parker, Jr. and G. E. Davis. 1979. A comparison of fish populations on an artificial and natural reef in the Florida Keys. Mar. Fish. Rev. 41(9): 1-11.

Struhsaker, P. 1969. Demersal fish resources: composition distribution and commercial potential of the continental shelf stocks off southeast United States. Fishery Industrial Research. 4(7): 261-287.

Swingle, W. E., A. E. Dammann and J. A. Yntema. 1970. Survey of the commercial fishery of the United States. Proc. 22 Ann. Sess., Gulf and Caribb. Fish. Inst. (Nov. 1969) Coral Gables, pp. 110-121.

Sylvester, J. R. and A. E. Dammann. 1972. Pot fishing in the Virgin Islands. Mar. Fish. Rev. 34 (9-10): 33-35.

Taylor, R. and R. McMichael. 1980. Quarterly report on fish trap study. Florida Dep. of Nat. Resour. Tallahassee, Fla. 99-112.

Tenore, K. R., C. F. Chamberlain, W. M. Dunstan, R. B. Hanson, B. Scherr and J. H. Tietjen. 1978. Possible effects of Gulf Stream intrusions and coastal runoff on the benthoa of the continental shelf of the Georgia Bight. 577-598. In M. Wiley, (ed.) Estuarine Interactions. Academic Press, New York.

Tenore, K. R. 1979. Macroinfaunal benthos. p. 283:307. In: South Atlantic Benchmark Program, Outer Countinental (OCS) Shelf Studies, Volume 3 (Final Report). A Report to U. S. Department of the Interior, Bureau of Land Management, Washington, D. C. by Texas Instruments Inc., Dallas.

Thompson, M. J., L. E. Gilliland, and J. E. Mendlein. 1978. Bathymetric mapping of three selected areas on the southeastern Florida continental shelf. Harbor Branch Foundation, Inc. Tech. Rept. No. 27.

Uchupi, E. 1967a. The continental margin south of Cape Hatteras, North Carolina: shallow structure. Southeast Geol. 8: 155-177.

Uchupi, E. 1967b. Bathymetry of the Gulf of Mexico. Gulf Coast Assoc. Geol. Soc. Trans. 17: 161-172.

Uchupi, E. 1969. Morphology of the continental margin off southeastern Florida. Southeastern Geol. 11: 129-134.

Uchupi, E. and K. O. Emery. 1967. Structures of continental margin off Atlantic Coast of United States. Bull Am. Assoc. Petrol. Geol. 51: 223-234.

Uchupi, E. and A. R. Tagg. 1966. Microrelief of the continental margin south of Cape Lookout, North Carolina. Geol. Soc. Amer. Bull. 77: 427-430

Ulrich, G. F., R. J. Rhodes and K. J. Roberts. 1977. Status report on the commercial snapper-grouper fisheries off South Carolina. Proc. Gulf and Carribbean Fisheries Institute, 29th Annual Session, Nov., 1976, p. 102-125.

United States Department of the Interior, Bureau of Land Management, 1978. Outer Continental shelf off the South Atlantic coast. Proposed oil and gas lease sale No. 43, March 28, 1978. Federal Register, 43(36): 7373-7378.

United States Department of the Interior, U. S. Geological Survey, Conservation Division, Eastern Region, Atlantic Area. 1978. Notice No. 78-2 South Atlantic Supplement 1. Notice to Lessees and operators of federal oil and gas leases in the South Atlantic outer continental shelf.

Van Dolah. 1980. Personal communication. South Carolina Wildlife and Marine Resources Department, Charleston, South Carolina.

Wells, H. W., M. S. Wells, and I. E. Gray. 1960. Marine sponges of North Carolina. J. Elisha Mitchell Sci. Soc. 76(2): 200-245.

Wenner, C. A., C. A. Barans, B. W. Stender, and F. H. Berry. 1979. Results of MARMAP otter trawl investigations in the south Atlantic Bight I. Fall, 1973. South Carolina Marine Resources Center Tech. Rept. No. 33: 79 p.

Whittle, K. J. 1978. The effects of the Ekofisk blowout of hydrocarbon residues in Fish. In: Proceedings of a Conference on Assessment of Ecological Impacts of Oil Spills. American Institute of Biological Sciences. 14-17 June 1978. Keystone, Colorado.

Williams, A. B. 1965. Marine decapod crustaceans of the Carolinas. Fishery Bull. 65(1): 1-298.

Williams, A. B. 1979. Personal communication. The Smithsonian National Museum of Natural History. Washington, D. C.

Wolf, R. S. and G. R. Chislett. 1971. Trap fishing explorations for snapper and related species in the Caribbean and adjacent waters. UNDP/FAO Caribb. Fish. Develop. Proj. Rep. SF/CAR/REG 189 F6. 36 pp.

Wolf, R.J. and W. F. Rathejen. 1974. Exploratory fishing activities of the UNDP/FAO, Caribb. Fish. Develop. Proj. 1965-1971: A summary. Mar. Fish. Rev. 36 (9): 1-8.

Woolsey, J. R. and V. J. Henry. 1974. Shallow, high resolution seismic investigations of the Georgia coast and inner continental shelf. In: Symposium on the Petroleum Geology of the Georgia Coastal Plain. Dept. Nat. Res. Bull. 77, Atlanta, Ga.

Zarudski, E. F. K. and E. Uchupi. 1968. Organic reef alignments on continental margin south of Cap Hatteras. Geol. Soc. Am. Bull. 79: 1867-1870.

Zeighler, J. M. and M. A. Patton. 1974. A socio-economic environmental baseline summary for the South Atlantic region between Cap Hatteras, North Carolina and Cape Canaveral, Florida. Vol. IV. Geological Oceanography. A report to the Bureau of Land Management, U. S. Dept. of the Interior prepared by the Virginia Institute of Marine Science, Gloucester Point, Va.

Appendix A

Draft Designation Document

Designation Of The Gray's Reef Marine Sanctuary

Preamble

Under the authority of the Marine Protection, Research and Sanctuary Act of 1972, P.L. 92-532 (the Act), the waters at Gray's Reef, South Atlantic Bight off the Coast of Georgia and hereby designated a Marine Sanctuary for the purposes of: (1) protecting and enchancing the quality of this unique and fragile ecological community; (2) promoting scientific understanding of this live bottom ecosystem; and (3) enhancing public awareness and wise use of this significant regional resource.

Article 1. Effect of Designation

Within the area designated as The Gray's Reef Marine Sanctuary (the Sanctuary) describes in Article 2, the Act authorizes the promulgation of such regulations as are reasonable and necessary to protect the values of the Sanctuay. Article 4 of the Designation lists those activities which may require regulation, but the listing of any activity does not by itself prohibit or restrict it. Restrictions or prohibitions may be accomplished only through regulation, and additional activities may be regulated only by amending Article 4.

Article 2. Description of the Area

The Sanctuary consists of an area of high seas waters covering the live bottom located 17.5 nmi due east of Sapelo Island, Georgia. Exact coordinates are defined by the regulation (§938.3).

Article 3. Characteristics of the Area

The Sanctuary consists of submerged limestone rock reefs and contiguous shallow-buried hardlayer and soft sedementary regime which support rich and diverse marine plants, invertebrates, finfish, turtles and occasional marine mammals in an otherwise relatively barren expanse of ocean. The area attracts multiple human use, including reecreational fishing and diving, research and educational use.

Article 4. Scope of Regulation

Section 1. Activities Subject to Regulation. To ensure the potection and preservation of the Sanctuary's marine features and the ecological, recreational, and aesthetic value of the area, the following activities within the Sanctuary may be regulated to the extent necessary:

a. Dredging or alteration of, or construction on, the seabed;
b. Discharging or depositing any substance or object;
c. Vessel operations, including anchoring;
d. Wire trap fishing;
e. Bottom-trawling and specimen-dredging;
f. Spearfishing;
g. Marine specimen collecting;

h. Removing or otherwise harming cultural or historical resources.

Section 2. Consistency with International Law. The regulations governing the activities listed in Section 1 of this Article will apply to foreign flag vessels and persons not citizens of the United States only to the extent consistent with recognized principles of international law, including treaties and international agreements to which the United States is signatory.

Section 3. Emergency Regulations. Where essential to prevent immediate, serious, and irreversible damage to the ecosystem of the area, activities other than those listed in Section 1 may be regulated within the limits of the Act on an emergency basis for an interim period not to exceed 120 days, during which an appropriate amendment of this Article will be proposed in accordance with the procedures specified in Article 6.

Article 5. Relation to Other Regulatory Programs

Section 1. Defense Activities. The regulation of activities listed in Article 4 shall not prohibit any Department of Defense activity that is essential for national defense or because of emergency. Such activities shall be consistent with the regulations to the maximum extent practicable.

Section 2. Other Programs. All applicable regulatory programs will remain in effect, and all permits, licenses and other authorizations issued pursuant thereto shall be valid within the Sanctuary unless authorizing any activity prohibited by any regulation implementing Article 4. The Sanctuary regulations will set forth any necessary certification procedures.

Article 6. Alterations to this Designation

This Designation can be altered only in accordance with the same procedures by which it has been made, including public hearings, consultation with interested Federal and State agencies and the South Atlantic Regional Fishery Management Council, and approval by the President of the United States.

DRAFT REGULATIONS

Part 938 - THE GRAY'S REEF MARINE SANCTUARY REGULATIONS

938.1. Authority.

The Sanctuary has been designated by the Secretary of Commerce pursuant to the authority of Section 302(a) of Title III of the Marine Protection, Research and Sanctuaries Act of 1972, 16 U.S.C. 1431-1434 (the Act). The following regulations are used pursuant to the authorities of Sections 302(f), 302(g) and 303 of the Act.

938.2. Purpose.

The purpose of designating the Sanctuary is to protect and preserve the live bottom ecosystem, and other natural resources of the waters of Gray's Reef, and to ensure the continued availability of the area as an ecological, research, and recreational resource.

938.3. Boundaries.

The Sanctuary consists of an area 16.68 square nautical miles (57 square kilometers) of high seas waters off the coast of Georgia contained within a rectangle starting at coordinate 31° 21' 45"N commencing to coordinate 80 55 17 W

31° 25' 15"N thence to coordinate 31° 25' 15"N thence back to point of origin.
80 55 17 W 80 49 42 W

938.4. Definitions.

(a) "Administrator" refers to the Administrator of the National Oceanic and Atmospheric Administration.

(b) "Assistant Administrator" refers to the Assistant Administrator for Coastal Zone Management, National Oceanic and Atmospheric Administration.

(c) "Person" is any private individual, partnership, corporation, or other entity; or any officer, employee, agent, department, agency or instrumentality of the Federal goveernment or any State or local unit of government.

938.5. Allowed Activities.

All activities except those specifically prohibited by Section 938.6 may be carried within the Sanctuary subject to all prohibitions, restrictions and conditions impose by any other authority.

938.6. Prohibited Activities.

(a) Except as may be necessary for national defense in accordance with Article 5, Section 2 of the Designation or as may be necessary to respond to an emergency threatening life, property or the environment, the following activities are prohibited within the Sanctuary unless permitted by the Assistant Administrator in accordance with Sections 938.8. All prohibitions must be applied consistently with international law.

1. Alteration of or construction on the seabed.

No person shall dredge, drill or otherwise alter the seabed in any way nor construct any structure other than a navigation aid without a permit.

2. Discharge of substances.

No person shall deposit or discharge any materials or substances of any kind except:

(a) Fish or parts, bait and chumming materials;
(b) Effluent from marine sanitation devices; and
(c) Non-polluted cooling waters from vessels.

3. Operation of watercraft.

All watercraft shall be operated in accordance with Federal rules and regulations that owuld apply if there were no Sanctuary.

4. Wire trap fishing.

No person shall use or place wire fish traps within the sanctuary without a permit.

5. Bottom-trawling and specimen.

No person shall use a bottom-trawl, specimen-dredge or similar vessel-towed bottom sampling device within the Sanctuary without a permit.

6. Marine specimen collecting.

(a) No person shall break, cut or similarly damage, take or remove any bottom formation, any marine invertebrate or any marine plant without a permit.

(b) No person shall take any tropical fish which is a fish of minimal sport and food value, usually brightly colored, often used for aquaria purposes and which lives in a direct interrelationship with the live bottom community without a permit.

(c) There shall be a rebuttable presumption that any items listed in this paragraph found in the possession of a person within the Sanctuary have been collected or removed from the Sanctuary.

(d) No person shall use poisons, electric charges, explosives or similar methods to take any marine animal or plant.

7. Removing or damaging historic or cultural resources

No person shall tamper with, damage or remove any historic or cultural resources without a permit.

(b) All activities currently carried out by the Department of Defense within the Sanctuary are essential for the national defense and, therefore, not subject to these prohibitions. The exemption of additional activities having significant impacts shall be determined in consultation between the Assistant Administrator and the Department of Defense.

(c) The prohibitions in this section are not based on any claim of territoriality and will be applied to foreign persons and vessels only in accordance with recongnized principles of international law, including treaties, conventions and other international agreements to which the United States is signatory.

938.7. Penalties for Commission of Prohibited Acts.

(a) Section 303 of the Act authorizes the assessment of a civil penalty of not more than $50,000 against any person subject to the jurisdiction of the United States for each violation of any regulation issued pursuant to the Act, and further authorizes a proceeding in-rem against any vessel used in violation of any such regulation.

938.8. Permit Procedures and Criteria.

(a) Any person in possession of a valid permit issued by the Assistant Administrator in accordance with this section may conduct any activity in the Sanctuary including any activity specifically prohibited under Section 938.6, if such activity is (1) research related to the resources of the Sanctuary, (2) to further the educational value of the Sanctuary, or (3) for salvage or recovery operations.

(b) Permit applications shall be addressed to the Assistant Administrator for Coastal Zone Management, Attn: Office of Sanctuary Programs Division of Operations and Enforcement, National Oceanic and Atmospheric Administration, 3300 Whitehaven Street, N.W., Washington, D.C. 20235. An application shall provide sufficient information to enable the Assistant Administrator to make the determination called for in paragraph (c) below and shall include a description of all activities proposed, the equipment, methods, and personnel

(particularly describing relevant experience) involved, and a timetable for completion of the proposed activity. Copies of all other required licenses or permits shall be attached.

(c) In considering whether to grant a permit, the Assistant Administrator shall evaluate (1) the general professional and financial responsibility of the applicant, (2) the appropriateness of the methods envisioned to the purpose(s) of the activity, (3) the extent to which the conduct of any permitted activity may diminish or enhance the value of the Sanctuary, (4) the end value of the activity and (5) other matters as deemed appropriate.

(d) In considering any application submitted pursuant to this section, the Assistant Administrator may seek and consider the views of any person or entity, within or outside of the Federal Government, and may hold a public hearing, as deemed appropriate.

(e) The Assistant Administrator may, at his or her discretion, grant a permit which has been applied for pursuant to this section, in whole or in part, and subject to such condition(s) as deemed appropriate. The Assistant Administrator or a designated representative may observe any permitted activity and/or require the submission of one or more reports of the status or progress of such activity. Any information obtained will be made available to the public.

(f) The permit granted under paragraph (e) may not be transferred.

(g) The Assistant Administrator may amend, suspend or revoke a permit granted pursuant to this section, in whole or in part, temporarily or indefinitely, if the permit holder (the Holder) has violated the terms of the permit or applicable regulations. Any such action will set forth in writing to the Holder, and will include the reason(s) for the action taken. The Holder may appeal the action as provided for in Section 938.10.

938.9. Certification of Other Permits.

(a) All permits, licenses and other authorizations issued pursuant to any other authority are hereby certified and shall remain valid if they do not authorize any activity prohibited by Section 938.6. Any interested person may request that the Assistant Administrator offer an opinion on whether an activity is prohibited by these regulations.

(b) The Assistant Administrator may amend, suspend, or revoke the certification made under this section whenever continued operation would violate any term or conditions of the certification. Any such action shall be forwarded in writing to both the holder of the certified permit and the issuing agency and shall set forth reason(s) for the action taken. Either the holder or the issuing agency may appeal the action as provided for in Section 938.10.

938.10. Appeals of Administrative Action.

(a) Any interested person (the Appellant) may appeal the granting, denial, or conditioning of any permit under Section 938.8 to the

Administrator of NOAA. In order to be considered by the Administrator, such appeal must be in writing, must state the action(s) appealed, and the reason(s) therefore, and must be submitted within 30 days of the action(s) by the Assistant Administrator. The Appellant may request an informal hearing on the appeal.

(b) Upon receipt of an appeal authorized by this section, the Administractor will notify the permit applicant, if other than the Appellant, and may request such additional information and in such form as will allow action upon the appeal. Upon receipt of sufficient information, the Administrator will decide the appeal in accordance with the criteria defined in Section 938.8(c) as appropriate, based upon information relative to the application on file at OCZM and any additional information, the summary record kept of any hearing, and the Hearing Office's recommended decision, if any, as provided in paragraph (c), and such other considerations as as deemed appropriate. The Administrator will notify all interested persons of the decision, and the reason(s) for the decision, in writing, within 30 days of receipt of sufficient information, unless additional time is needed for a hearing.

(c) If a hearing is requested or if the Administrator determines one is appropriate, the Administrator may grant an informal hearing before a designated Hearing Officer after first giving notice of the time, place, and subject matter of the hearing in the Federal Register. Such hearing must normally be held no later than 30 days following publication of the notice in the Federal Register unless the Hearing Officer extends the time for reasons deemed equitable. The Appellant, the Applicant (if different) and other interested persons (at the discretion of the Hearing Officer) may appear personally or by counsel at the hearing and submit such material and persent such arguments as determined appropriate by the Hearing Officer. Within 30 days of the last day of the hearing, the Hearing Officer shall recommend in writing a decision to the Administrator.

(d) The Administrator may adopt the Hearing Officer's recommended decision, in whole or in part, or may reject or modify it. In any event, the Administrator shall notify interested persons of the decision, and the reason(s) for the decision (in writing) within 30 days of receipt of the recommended decision of the Hearing Officer. The Administrator's action will constitute final action for the Agency for the purposes of the Administrative Procedures Act.

(e) Any time limit prescribed in this section may be extended for a period not to exceed 30 days by the Administrator for good cause upon written request from the Appellant or Applicant stating the reason(s) for the extension.

APPENDIX B

DEPARTMENT OF THE INTERIOR

LEASE STIPULATION FOR PROTECTION OF BIOLOGICAL RESOURCES*

Stipulation No. 1 - Biological Resources (Source: BLM, 1978)

Prior to any drilling activity or placement of any fixed structures or pipeline or any other exploration or production activity, the lessee will submit to the Supervisor as part of his exploration and/or development plan a bathymetry map, prepared utilizing remote sensing and/or other survey techniques. This map will include interpretations for the presence of live bottom areas within a minimum one-mile radius of the proposed exploration or production activity site.

For the purpose of this stipulation, live bottom areas are defined as those areas which contain biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; or whose lithotope favors the accumulation of turtles and fishes.

If it is determined that the remote sensing data indicate the presence of hard or live bottom areas, the lessee will also submit to the Supervisor photo-documentation of the sea bottom near proposed exploratory drilling sites or proposed platform locations.

If it is determined that live bottom areas might be adversely impacted by the proposed activities, then the Supervisor will require the lessee to undertake any measures deemed economically, environmentally, and technically feasible to protect live bottom areas. These measures may include, but are not limited to the following:

a. The relocation of operations to avoid live bottom areas.

b. The shunting of all drilling fluids and cuttings in such a manner as to avoid live bottom areas.

c. The transportation of drilling fluids and cuttings to approved disposal sites.

d. The monitoring of live bottom areas to assess the adequacy of any mitigation measures taken and the impact of lessee initiated activities.

* It should be noted that the lease stipulation cited here was developed for application to leases issued pursuant to OCS Oil and Gas Lease Sale No. 43 only. Although proposed for Lease Sale No. 56, it is not necessarily a general stipulation that will be applied to all future leases in the South Atlantic OCS area.

APPENDIX C

GEORGIA DEPARTMENT OF NATURAL RESOURCES

COASTAL RESOURCES DIVISION

The Coastal Resources Division (CRD) of the Georgia Department of Natural Resources (DNR) was created in 1978 to manage coastal environmental resources within the six coastal Georgia counties of Camden, Glynn, McIntosh, Liberty; Bryan and Chatham and offshore waters within the territorial sea, although much of its fishery studies extend offshore to the 200 nmi Fishery Conservation Zone. CRD is under the directorship of Dr. Robert J. Reimold, a recognized authority in ecology and ecosystem modelling who is extremely familiar with research needs in relation to offshore energy development.

CRD's responsibilities are divided among three primary areas: fisheries management, coastal protection and coastal management.

CRD's fisheries activities include studies necessary for management of Georgia's coastal fisheries (including finfish, shrimp, oysters and crabs in brackish estuarine and nearshore shelf waters), offshore finfisheries (snappers, grouper and ecological similar species) and offshore shellfisheries (rock shrimp, ocean scallops, etc.)

The goals of the Coastal Fisheries Section are to:

o Effectively management estuarine and marine shellfish and finfish resources to obtain a maximum sustainable commercial harvest of high economic value while ensuring adequate resource allocation for sport fisheries purposes.

o Promote diversification of Georgia's commercial shellfish and finfish industry.

o Promote wise use and development of renewable nearshore and offshore resources by recreational and commercial fishermen through continued research and public information activities.

o Perform research to increase knowledge about coastal and offshore threatened and endangered species, and continue efforts to protect those species.

o Develop and implement a comprehensive and long range fisheries management plan for Georgia.

o Develop and maintain additional offshore recreational fishery opportunities through the use of artificial reefs (Proposal to the Bureau of Land Management, 1979).

Within the Coastal Protection Section, CRD is charged with assuring the conservation protection and wise use of the coastal resource, including

ocean beaches and dunes, offshore sand bars, marshlands and coastal shorelines. The goals of the Coastal Protection Section are to:

o Protect Georgia's coastal wetlands, beaches, and offshore bars and supervise their judicious utilization for the benefit of Georgia's citizens.

o Provide environmental assessments to determine the effects of significant alterations (such as dredged material disposal) on the life support functions of marshlands and sand sharing systems.

o Provide technical assistance to coastal inhabitants whose activities may result in alteration of the coastal wetlands or the sand sharing system.

o Regulate coastal marshland and shoreline alteration to insure compliance with the Coastal Marshlands Act of 1970 and the Shore Assistance Act of 1979 (Propoosal to the Bureau of Land Management, 1979).

CRD has been involved in an enforceable State/local partnership in planning for and managing controlled coastal development. The coastal management program is designed to be consistent with requirements of the Federal Coastal Zone Management Act of 1972, as amended and has specific responsibility to coordinate coastal energy exploration and development activities as to assist localities cope with development impacts and to provide technical assistance to local governments on resources management decisions. The goals of the Coastal Management Section are to:

o Implement a coastal management program that provides for conservation of Georgia's coastal waters and those shoreline areas whose use would have a direct and significant impact on the coastal waters.

o Enhance the State/local decision-making process through technical assistance, coordination, and full consideration of ecological, cultural, historic, and aesthetic values as well as the needs for economic development.

o Educate the citizens of Georgia's coast and interior about the importance, uniqueness, and attributes of the State's coastline so the general public will participate in wise use, planning, and regulation of coastal resources.

o Address all outer continental shelf energy exploration and development activities to assure effective energy development with a minimum of impact (Proposal to the Bureau of Land Management, 1979).

CRD staff have considerable experience in contract and grant administration, having cooperated with Federal and other State agencies in projects directed towards obtaining a greater knowledge and better understanding of coastal and marine resources. The following list of projects identifies the diverse nature of CRD pursuits and accomplishments, several of which involve studies at Gray's Reef:

- Coastal Zone Management Fisheries Development Project.
- Shad Catch Effort Study.
- Population dynamics and life history aspects of major marine sportfish in Georgia's coastal waters.
- Studies and assessment of Georgia's fishery resources.
- Development of fishery management plans for selected anadromous fishes in South Carolina and Georgia.
- Location and exploration of natural reefs off the Georgia coast.
- Feasibility analysis of selected artifical reef materials.
- Oyster restoration studies in Georgia.
- Shellfish sanitation program.
- Artificial reef construction and buoy system design, placement and maintenance.
- Preliminary studies of a potential finfish industry from commercial shrimp landings.
- Cooperative blue crab study - South Atlantic States.
- A study of the nursery areas and biology of juvenile anadromous fishes of the Altamaha River, Georgia.
- Exploratory study of the commercial marine resources of the Georgia coast.
- Shad fishery of the Altamaha River, Georgia.
- Economic survey of the marine commercial fishing industry of Georgia.
- Survey of potential hard clam fishery in Georgia.
- Seasonal abundance and biological stability of the commercial shrimp of Georgia.
- Research vessel construction.

APPENDIX D

INFERRED SURFACE DRIFT IN THE SOUTH ATLANTIC

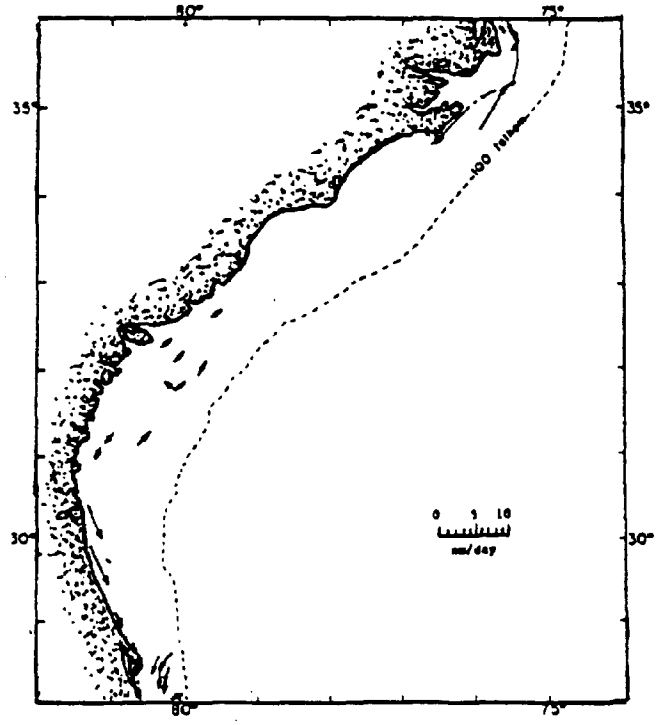


Figure 8-19. Inferred surface drift, Jan. 1960-1970 (after Bumpus, 1973).

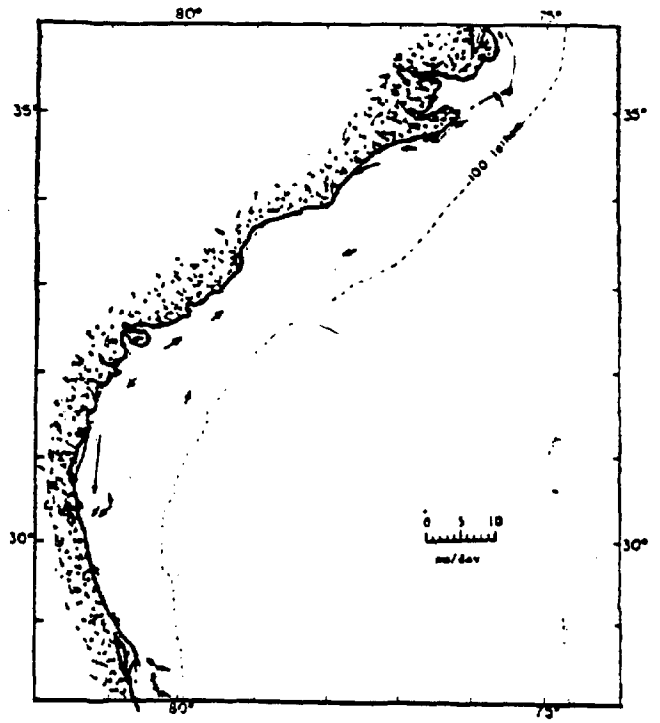


Figure 8-20. Inferred surface drift, Feb. 1960-1970 (after Bumpus, 1973).

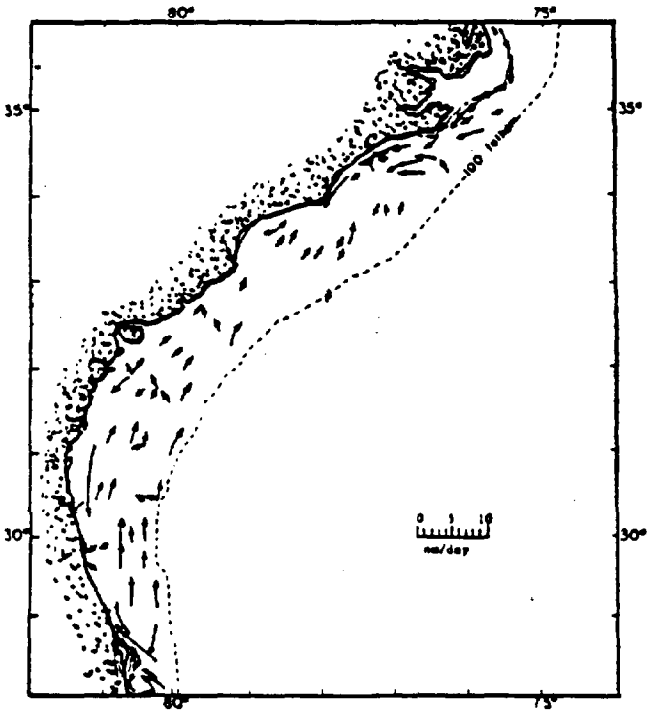


Figure 8-21. Inferred surface drift, Mar. 1960-1970 (after Bumpus, 1973).

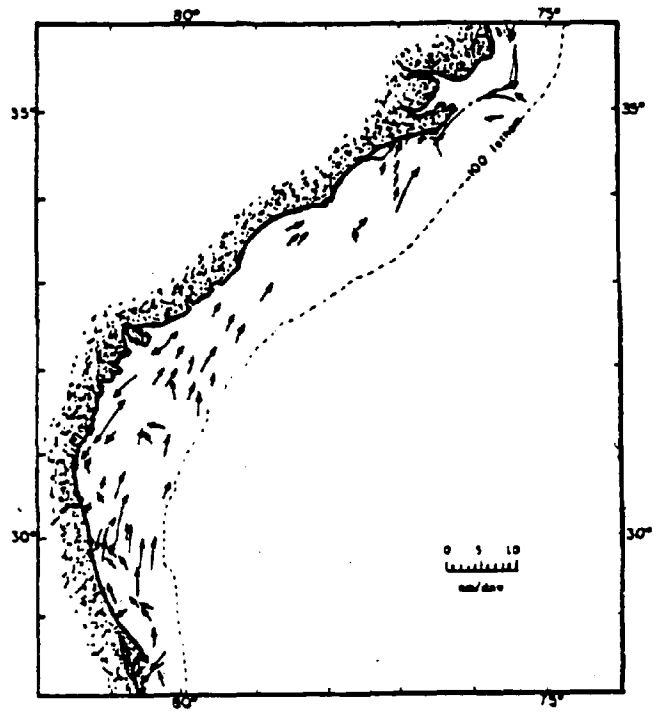


Figure 8-22. Inferred surface drift, Apr. 1960-1970 (after Bumpus, 1973).

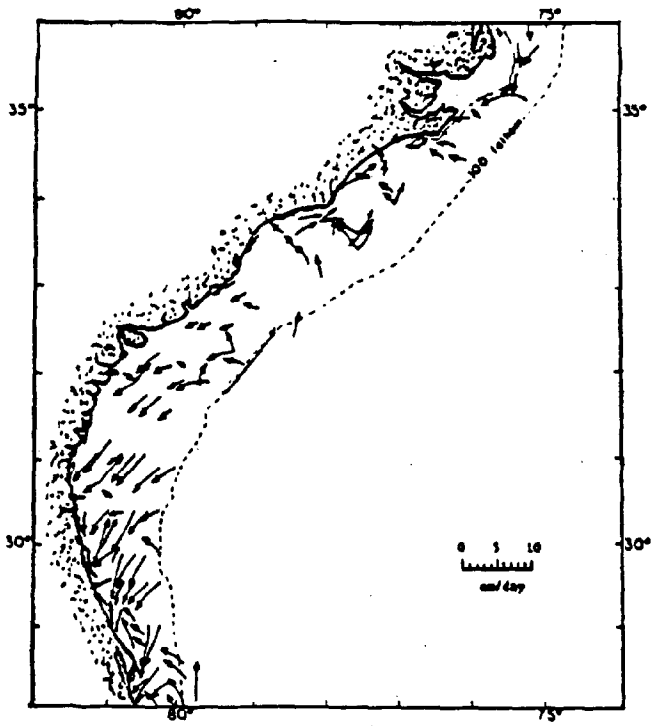


Figure B-23. Inferred surface drift, May 1960-1970 (after Bumpus, 1973).

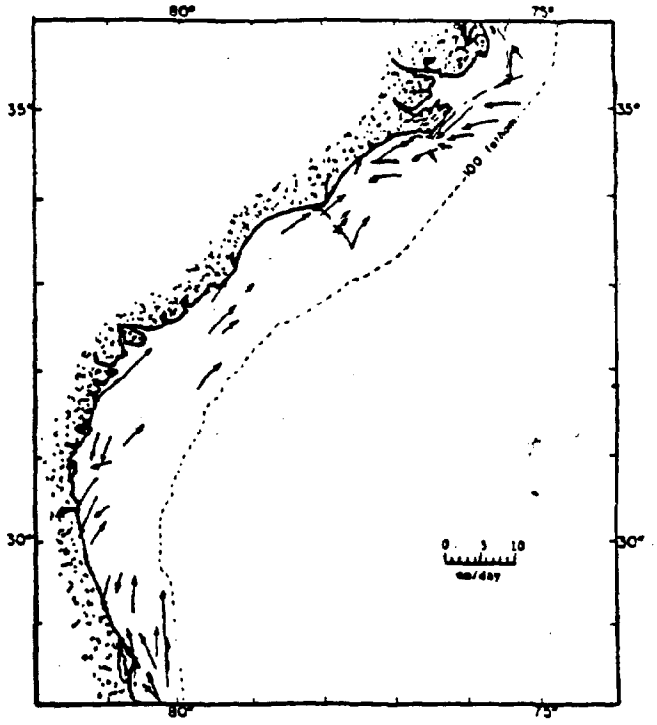


Figure B-24. Inferred surface drift, Jun. 1960-1970 (after Bumpus, 1973).

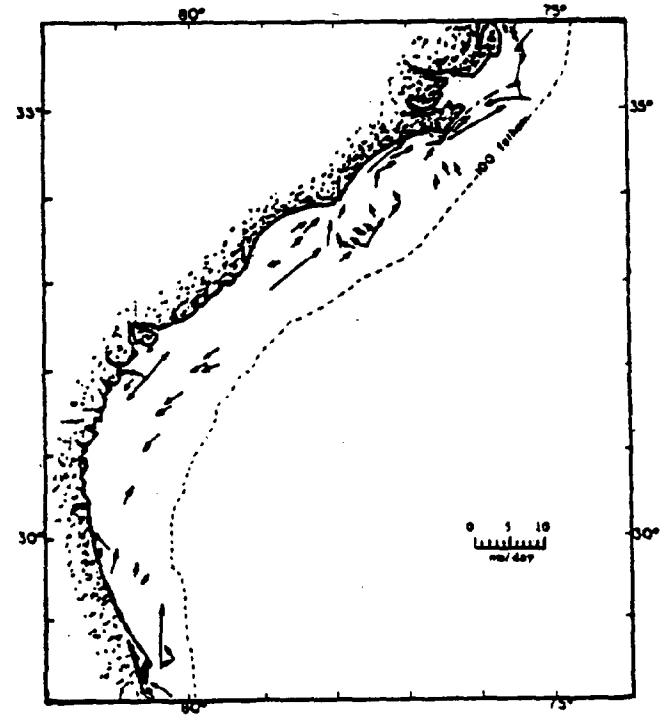


Figure B-25. Inferred surface drift, Jul. 1960-1970 (after Bumpus, 1973).

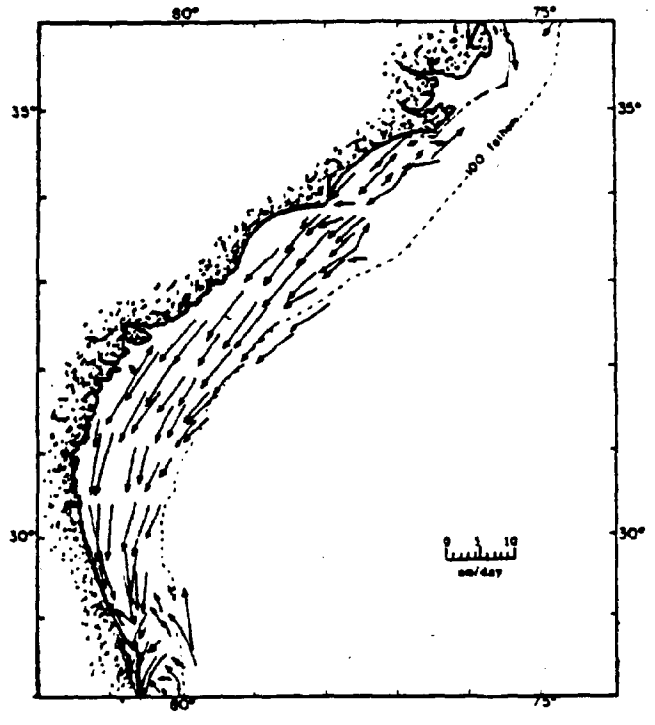


Figure B-26 Inferred surface drift, Aug. 1960-1970 (after Bumpus, 1973).

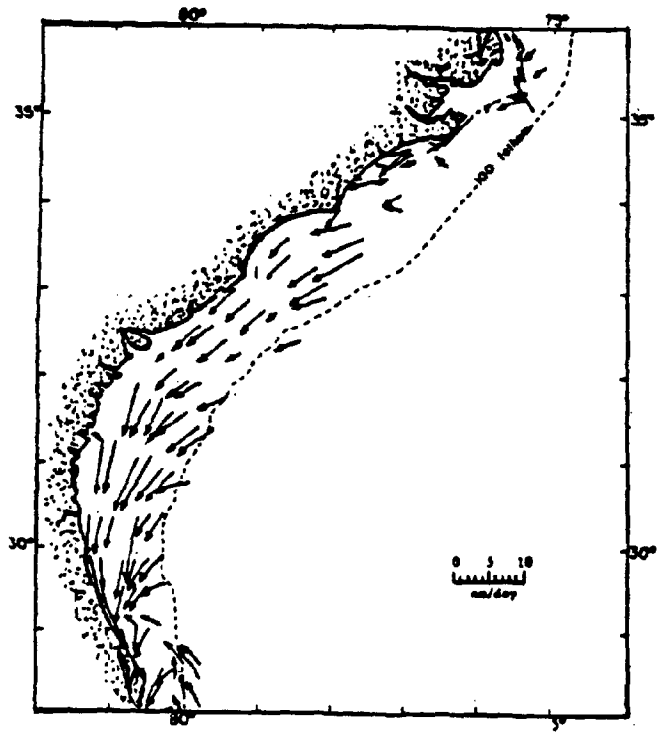


Figure B-27. Inferred surface drift, Sept. 1960-1970 (after Bumpus, 1973).

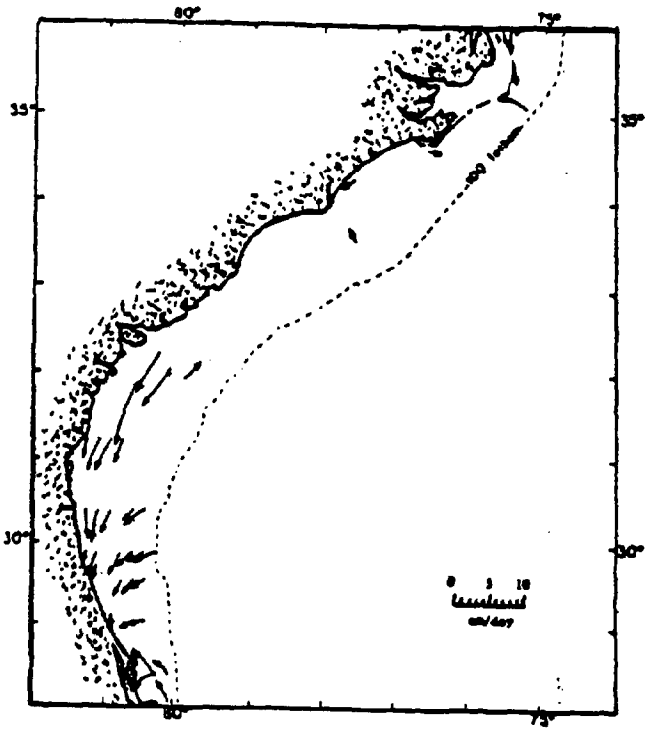


Figure B-28. Inferred surface drift, Oct. 1960-1970 (after Bumpus, 1973).

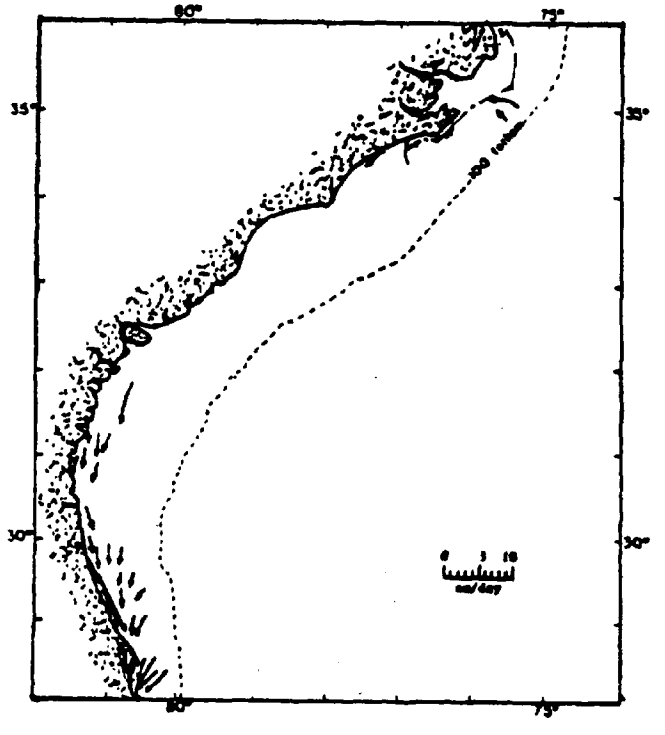


Figure B-29. Inferred surface drift, Nov. 1960-1970 (after Bumpus, 1973).

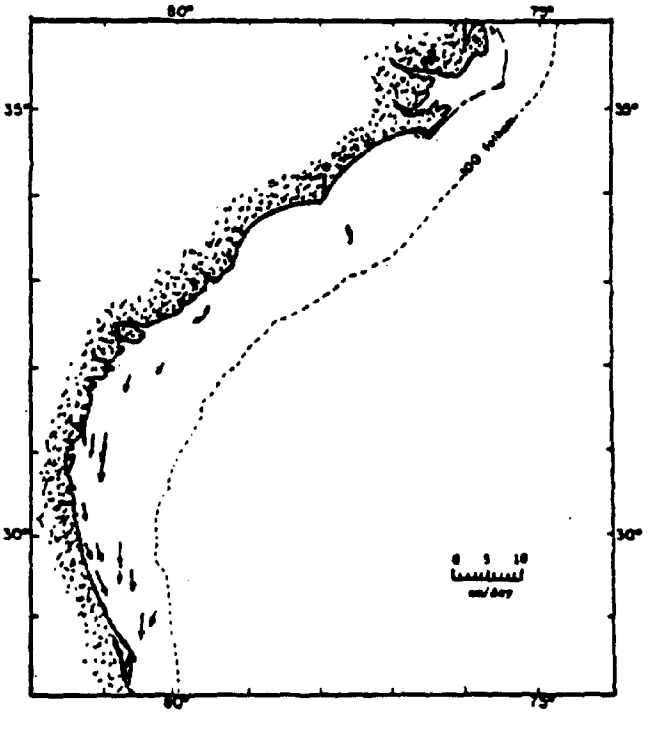


Figure B-30. Inferred surface drift, Dec. 1960-1970 (after Bumpus, 1973).

Appendix E - MARINE FLORA

Checklist of seaweeds likely to be found on the continental shelf off Georgia (Richardson 1979, per. comm.)

Five classes are included: the Rhodophycae, anthophyceae Phaeophyceae, Pracinophyceae and Chlorophyceae. The blue green algae and planktonic algae are not included. Genera are listed alphabetically for each family and species alphabetically within each genus. The format is adapted from the Searles and Schneider (1978) checklist of North Carolina seaweeds. Notes by Richardson (1979, pers. commun.)

RHODOPHYCEAE
Bangiophycidae
Goniotrichales

Goniotrichaceae

Goniotrichum alsidii

Florideophycidae
Nemaliales
Chaetangiaceae
Galaxaura obtusata
Scinaia complanata

Gelidiales

Gelidium pusillum

Cryptonemiales
Dumontiaceae
Dudresnaya crassa
Peyssonneliaceae
Peyssonnelia rubra

Corallinaceae
Amphiroa beauvoisii

Corallina cubensis
Corallina officinalis
Jania adhaerens

Cryptonemiaceae

Oryptonemia luxurians
Grateloupia filicina
Halymenia agardhii
Halymenia bermudensis
Halymenia floridana

Halymenia hancockii

Kallymeniaceae

Kallymenia perforata

Gigartinales

Nemastomaceae

Predaea feldmanni
Predaea masonii

Sebdeniaceae

Sebdenia polydacta

Gracilariaceae

Gracilaria blodgettii
Gracilaria curtissiae
Gracilaria cylindrica
Gracilaria foliifera
Gracilaria mammillaris

Plocamiaceae

Plocamium brasiliense

Solieriaceae

Eucheuma isiforme
Meristotheca floridana
Neoagardhiella ramosissima
Sarcodiotheca divaricata
Solieria tenera

Hypneaceae

Hypnea volubilis

Rhodymeniales

Rhodymeniaceae

Agardhinula browneae
Botryocladia occidentalis
Botryocladia pyriformis
Chrysymenia agardhii
Chrysymenia enteromorpha
Leptofauchea brasiliensis
Lephofauchea rhodymenoides

Gloiderma atlantica

Rhodymenia divaricata
Rhodymenia pseudopalmata
Rhodymenia occidentallis

Weberella peltata

Fauchea hassleri

Champiaceae

Champia parvula
Lomentarid baileyana

Ceramiales

Ceramiaceae

Antithamnion cruciatum radicans
Callithamnion byssoides
Ceramium fastigiatum
Compsothaminon thuyoides
Griffithsia globulifera
Griffithsia tenuis
Mesothamnion boergeseni
Pleonosporium flexuosum
Rhododictyon bermudensis
Spermothamnion investiens
Spyridia clavata

Delesseriaceada

Acrosorium uncinatum
Branchioglossum prostratum
Calonitophyllum medium
Grinnellia americana
Hypoglossum tenuifolium
Membranoptera subtropica
Nitophyllum wilkinsoniae

Cryptopleura sp.

Dasyaceae

Dasys baillouviana
Dasys ocellata
Dasys rigidula

Heterosiphonia laxa

Rhodomelaceae

Bryothamnion seaforthii
Chondria atropurpurea
Chondria baileyana
Chondria dasyphylla
Chondria littoralis
Chondria sedifolia
Chondria tenuissima
Laurencia corallopsis
Laurencia pinnatifida
Laurencia poitei
Micropeuce mucronata
Polysiphonia denudata
Polysiphonia flaccidissima
Polysiphonia macrocarpa
Polysiphonia tepida

Wrightiella tumanowiczii

XANTHOPHYCEAE

PHAEOPHYCEAE

Ectocarpales

Ectocarpaceae
Ectocarpus siliculosus

Spermatochnaceae

Nemacystus howei

Dictyosiphonales

Punctariaceae

Colpomenia sinuosa

Sporochnales

Sporochnaceae

Sporochnus pedunculatus

Sphacelariales

Sphacelariaceae

Sphacelaria tribuloides

Dictyotales

Dictyotaceae

Dictyota ciliolata
Dictyota dichotoma
Dictyopteris delicatula
Dictyopteris hoytii
Dictyopteris justii
Dictupteris membranacea
Lobophora variegata
Padina profunda
Padina vickersiae
Spatoglossum schroediri
Zonaria tournefortii

Fucales

Sargassaceae

Sargassum filipendula
Sargassum pteroplueron

PRASINOPHYCEAE ?

CHLOROPHYCEAE

Cladophorales

Cladophoraceae

Chaetomorpha crassa
Cladophora crystallina
Cladophora gracilis
Cladophora prolifera
Rhizoclonium hookeri

Anadyomenaceae

Anadyomene stellata

Siphonocladales

Siphoncladaceae

Cladophoropsis membranacea

Boodleaceae

Stuevea ramosa

Caulerpales

Derbesiaceae

Derbesia ?vaucheriaeformis

Caulerpaceae

Caulerpa prolifera

Codiaceae

Avrainvillea longicaulis

Codium carolinianum
Codium decorticatum
Codium isthmocladum
Codium taylori

Udotea cyathiformis
Udotea flabellum

APPENDIX F

INVERTEBRATE FAUNA OF GRAY'S REEF*

PORIFERA: Sponges

Halichondria sp.	
Microciona prolifera	Red bread sponge
Cliona celata	Boring sponge
Ircinia campana	Basket sponge
Chondrilla sp.	
Homaxinella waltonsmithi	
Endectyon tenax (?)	
Scypha sp.	
Demosporangia spp.	

CNIDARIA - Coelenterata: hydroids, anemones, medusae

Hydrozoa: hydroids

Tubularia sp.	Tubularian hydroid
Pennaria tiarella	Feather hydroid
Hydractinia sp.	Snail fur
Eudendrium ramosum	Stick hydroids
Aglaophenia sp.	
Monostaeches sp.	
Sertularia stookeyi	
Sertularia sp.	
Athecata sp.	
Clavidae sp.	

Anthozoa: Corals

Octocorallia: soft and horny corals

Leptogorgonia virgulata	Branched sea whip
L. setacea	Unbranched sea whip
Lephogorgonia hebes	Sea whip
Titandeum frauenfeldia	Sea fan
Telestaci sp.	
Telesto spp.	
Thenaria sp.	

(*Source: Unpublished collection notes Gray, 1961; Hunt, 1974; Shipman, 1979, pers. comm.; Edwards, 1980, pers. comm.).

Zooantharia: stony corals

Astrangia danae	Star coral
Phyllangia americana	Cup coral
Oculina varicosa (=*O. arbuscula* ?)	Branching eye coral
possibly:	
Monastrea annularis	Brain coral
Solenastrea hyades	Stump coral
Cladocera arbuscula	Tube coral
Paracyathus confertus	Non-photosynthethic scleractinian coral

BRYOZOA: Bryozoans

Bugula turrita	Bushy bugula
B. neritana	
Amathia convoluta	Spiral bryozoan
Membranipora sp.	Lacy crusts
Crisia sp.	
Schizoporella unicornis	
Scrupocellaria sp.	
Cheiolostomata sp.	

MOLLUSCA: Molluscs

Gastropoda: the univalves

Shelled gastropods

Calliostoma sp.	Top shell
Crepidula fornicata	Common flat slipper-shell
C. plana	Eastern white slipper-shell
Petaloconchus sp.	Worm shell
Fascidaria tulipa	True tulip
Diodora cayenensis	Cayenne keyhole limpet
Urosalpinx cinerea	Atlantic oyster drill
Cerithiidae sp. A	Cerith
Mitrella lunata	Lunar dove shell
Thais haemastoma floridana	Florida rock shell
Murex pomum	Apple murex
Cypraea cervus	Deer cowrie
Hastula cinera	Gray Atlantic auger
Olivia sayana	Lettered olive
Pleuroploca gigantea	Florida horse conch
Strombus alatus	Florida fighting conch
Cancellaria reticulata	Common nutmeg
Conus floridamus	Florida cone
Cassis madagascariensis	Emperor helmit shell
C. spinella	Clench's helmet shell
Phalium granulatum	Scotch bonnet

Shell-less gastropod

Dendrodoris warta	Dorid nudibranch

Bivalvia: the bivalves

Arca zebra	Turkey wing
Glycymeris americana	Giant American bittersweet
Brachidontes sp.	Bent mussel
Lyropecten nodosus	Lion's paw oysters
Pteria coymbus	Winged pearl oysters
Arcinella cornuta	Spiny jewel box
Americardia media	American cockle
Macrocallista nimbosa	Sunray venus
M. maculata	Spotted venus
Atrina rigida	Rigid pen shell
Chama sp.	

Cephalopoda: squid, octopus and cuttlefish

Octopus joubini	Joubine's octopus
O. vulgarus	Common Atlantic octopus
O. burryi	Burry's octopus

ANNELIDA: segmented worms

Polychaeta: bristle worms

Filograna implexa	
Sabellidae spp.	Fan worms
Serpulidae spp.	Hard-tubed worms
Nereidae spp.	Clam worms

SIPUNCULA: sipunculan worms

Phascolasoma sp.

ARTHROPODA: Jointed-legged animals

Crustacea: crustaceans

Pynogonida

Anoplodactylus lentus

Cirripedia	
Balanus amphitrite	Acorn barnacle
Isopoda	
Paracerceis caudata	
Malacostraca	
Penaeid shrimp	
Sicyonia brevirostris	Rock shrimp
Caridean shrimp	
Alpheus normanni	Snapping shrimp
Lobsters	
Scyllarus sp.	Spanish lobster
Panulirus argus	Spiny lobster
Anomuran crabs	
Porcellana sayana	Spotted porcellai crab
Megalobrachium soriatuim	Porcellai crab
Hermit crabs	
Pagurus sp.	Hermit crab
Brachyuran crabs (true crabs)	
Persephona punctata aquilonaris	Purse crab
Calappa flammea	Shame-face crab
Pilumnus sayi	Hairy crab
P. sp.	
Stenorynchus seticornis	Arrow crab
Parthenope sp.	
Dormidia sp.	
Hepatus epheliticus	Calico crab
Portunus sayi	Portunid crab

ECHINODERMATA: Spiny-skinned animals

Holothuroidea: sea cucumbers

Havelockia scabra

Echinoidea: sea urchins and sand dollars

Arbacia punctulata	Purple sea urchin
Lytechinus variegatus	Variegated urchin
Encope michelini	

Stelleroidea: sea Stars and brittle Stars

Asteroidea: sea stars

Luida clathrata	Slender sea star
Asteropecten sp.	Margined sea star
Echinaster sp.	

Ophiuroidea: brittle or serpent stars

Ophiothrix angulata

CHORDATA: Chordates

Urochordata: tunicates

Amaroucium stellatum	Sea pork
Amaroucium sp.	
Symplegma sp.	
Ecteinascidia sp.	
Styela atlantica	Rough sea squirt
Styela sp.	Sea squirt
Molgula sp.	Sea grape

APPENDIX G

FAMILY, SCIENTIFIC AND COMMON NAMES OF FISHES OBSERVED

AT GRAY'S REEF

Balistidae	
Balistes capriscus	Gray triggerfish
Batrachoidinae	
Opsanus tau	Oyster toadfish
Blenniidae	Blennies
Branchiostegidae	
Caulolatilus microps	Gray tilefish
Carangidae	
Seriola dumerili	Greater amberjack
Caranx hippos	Crevalle jack
Decapterus punctatus	Round scad
Chaetodontidae	
Holacanthus bermudensis	Blue angelfish
Holacanthus ciliaris	Queen angelfish
Labridae	
Halichoeres bivittatus	Slippery dick
Lutjanidae	
Lutjanus campechanus	Red snapper
Mullidae	Goatfishes
Muraenidae	Morays
Pomadasyidae	
Haemulon aurolineatum	Tomtate
Orthopristis chrysoptera	Pigfish
Diodontidae	
Chilomycterus schoepfi	Striped burrfish (Spiny boxfish)
Ephippidae	
Chaetodipterus faber	Atlantic spadefish
Garidae	
Urophycis spp.	Hake

Gobiidae	
	Gobies
Grammistidae	
Rypticus saponaceus	Greater soapfish
Sciaenidae	
Equetus umbrosus	Cubbyu
Scombridae	
Scomberomorus cavalla	King mackerel
S. maculatus	Spanish mackerel
Euthynnus alletteratus	Little tunny
Serranidae	
Centropristis striata	Black sea bass
Diplectrum formosum	Sand perch
Mycteroperca microlepis	Gag
Epinephelus itajara	Jewfish
Epinephelus morio	Red grouper
Epinephelus nigritus	Warsaw grouper
Sparidae	
Archosargus probatocephalus	Sheepshead
Stenotomus chrysops	Scup
Diplodus holbrooki	Spottail pinfish
	Porgy (Unidentified)
Sphyraenidae	
Sphyracna barracuda	Great barracuda

APPENDIX H

ENVIRONMENTAL CONSIDERATIONS OF REEF FISH

An understanding of the population dynamics of a reef community is very important from a management standpoint. Reef communities are complex units and the life histories of many reef species are only poorly known. Many marine fish species depend upon reef habitats during all or part of their life histories. Permanent reef species tend to display special characteristics which are responsive to evolution in a geographically isolated area, to the extent and productivity of their reef habitat and to predator-prey relationships. Scientists consider certain growth patterns, reproductive characteristics, movement patterns, and natural mortalities to be adaptations to an isolated reef environment (SAFMA, 1980). Many of these characteristics make reef fish vulnerable to overuse.

Reef fish are generally long-lived, but grow to maximum size very slowly. Many of the demersal fish found at Gray's Reef are long-lived. The average life span of tomtates is 9 years, for gag, 15 years, and for red grouper, 25 years (SAFMC, 1978). Long lives are often associated with trophic dynamics. Long-lived fish are usually secondary or tertiary consumers, at the top of a reasonably large and diverse food web. Long lives are also associated with maximizing reproductive potentials. This is extremely important for fish with pelagic larvae. In order to replenish reef stocks, pelagic larvae and some juveniles must survive heavy predation, natural mortalities, and low probabilities of finding suitable habitat while planktors. Slow growth to maximum size indicates that many individuals could be harvested before reaching maximum size or before fulfilling maximum reproductive potentials (SAFMC, 1980).

Some reef fish undergo sex reversals from female to male or protogyny (SAFMC, 1980). This is an adaptation which helps to keep sex ratios in proper balance for reproduction within isolated communities. Under protogynous conditions, significant numbers of males do not appear in the population until advanced age is reached. Red and possibly all groupers, black sea bass, gag, and Calamus porgies are protogynous (SAFMC, 1980). Many of the reef fish inhabiting Gray's Reef are considered to protogynous. From a resource management standpoint, harvest of protogynous species should be kept low or to primarily older individuals to ensure proper sex ratios and reproductive success.

Fish movements and migrations in the South Atlantic are deduced from studies of conspecifics in Florida waters. Migrations are cued to feeding reproductive, developmental, climatic and osmoregulatory requirements (Moe, 1972). For many species, live bottom such as Gray's Reef are "island" or "oasis" habitats, being separated from similar such areas by miles of relatively barren and potentially hostile ocean. Many fish species are permanent reef residents, rarely venturing more than 100 meters from the reef proper. Small reef dwelling fishes such as black sea basses, cardinal fishes, damselfishes, angelfishes, wrasses and squirrel fishes are residentailly restricted, non-migratory

fishes. Most feed within the home range of the reef proper (core) and display territoriality concurrent with reproductive cycles. Tagging studies on black sea basses at Gray's Reef and in artifical reef areas off Georgia show a less than one percent migration from the reef proper. Larger reef species such as snappers, groupsers, grunts and porgies while they do show affinity for reefs move randomly over a broader residential range and exhibit inshore-offshore migratory patterns in relation to spawning seasonal and/or developmental patterns. Intradiel movements, generally related to feeding habitata, may take individuals up to a mile from the reef proper. reef species (especially snappers) shelter in large schools over reefs during the day and forage at night away from the reef (George and Staiger, 1979). Sedentary or isolated life styles or predictable diurnal/nocturnal movement patterns tend to make reef fish more susceptible to capture than more mobile pelagic species.

There are often distinct ecological differences between nearshore and offshore populations of the same species. For many reef species, feeding habits and localized habitat preferences change with age. For example, in snappers and groupers, juveniles are usually found in shallow reef areas whereas older and larger fish are found progressively farther offshore.

APPENDIX I

WIRE FISH TRAPS

ENVIRONMENTAL IMPLICATIONS AND RECOMMENDED MANAGEMENT MEASURES

A. Introduction

Wire fish traps account for significant fish catches from coral reefs and live bottoms (rock outcrops covered by epibenthic seaweeds and invertebrates and supporting demersal fisheries) in the South Atlantic, the Gulf of Mexico and the Caribbean. Within recent years, trap fisheries have become highly controversial. Traps are popular because they (1) are inexpensive, easy to build and repair, and require little maintenance; (2) require a minimum of effort once set, allowing fishermen to pursue other interests; (3) yield high catches of valuable fish for food, even in areas of low fish density; (4) can be used in areas where irregular bottom relief precludes the use of trawls or nets; (5) are successful for fish not easily taken by other methods; and (6) retain fish in superior market quality as opposed to those taken in trawls or nets which can be disfigured by missing scales or puncture wounds; (7) continue to fish and retain fish alive for several days when left unattended; (8) provide a degree of catch protection against predators; (9) are important and efficient research and resource assessment tools. In contrast, traps are considered disavantageous because (1) financial success depends primarily upon unstable market demand, supply and price; (2) trap efficiency interfere with the catch per unit effort of hook and line fishing; (3) traps often snag, tear and foul fishing lines and nets, and thereby serve as a physical obstacle to competitive methods; (4) marker buoys obstruct navigation; (4) trap dimensions (mesh size, entrance funnel size, orientation and location, and trap volume) are selective for a wide variety of reef fish, including juveniles, trash or forage species and non-food tropicals; (5) coral reef resources can be physically damaged when traps are dragged across the reef surface during retrieval or when displaced by waves and currents; (6) traps are easily lost; (7) lost traps, popularly known as "ghost" or "drowned" traps, continue fishings indefinitely unless retrieved by divers or destroyed by corrosion or large predators; (8) unnecessary trap-related mortalities occur from cannibalism or starvation inside fished and "ghost" traps and from embolisms caused by rapid ascent from depths; (9) traps containing large numbers of stresed fish or in the case of "ghost" traps, mutilated fish or skeletal remains, are unsightly and detract from a SCUBA diver's aesthetic experience. The purpose of this paper is to provide a review of the current scientific literature concerning the mode of operation and potential environmental implication of wire fish traps and to outline several managment measures which have been recommended to mitigate possible adverse impacts without severely limiting traditional trap fisheries.

B. Description of the Fishery

Fishing with traps is recognized as one of the earliest artisanal fisheries in tropical coralline areas of the world. Aboriginal Indians trapped extensively throughout the Caribbean long before the arrival of New World explorers. The Indians were all but wiped out by the explorers and little of their culture preserved. Imported slaves introduced West African fish trap designs and modern traps are largely relics of these later designs (Buesa Mas, 1962; Craig, 1976).

Traps were originally constructed from woven hoop vine (Trichostigma octandrum), split bamboo, cane or rattan, and mangrove (Munro et al., 1971; Olsen, 1978) and were fished from small, open canoes or sailing vessels in nearshore reef areas. Wire mesh traps appeared in the 1920's when pre-fabricated wire mesh became readily available at affordable prices. Basic trap design and mode of deployment have changed very little in the past centuries.

Historically, fish trapping has been a subsistence or small-scale commercial fishery. Even with the advent of engine-powered boats and with the relevance of recent government - sponsored demonstration/ exploratory/ experimental fishing surveys and gear tests, the extant fisheries have not expanded much beyond traditional practices, areas or seasonal boundaries (Swingle et al., 1970; Olsen, 1978).

Trap fisheries off the southeastern continental United States have been largely a secondary fishery. Rivers (1966) described the existing trap fishery off the Carolinas, which began around 1960 when off-season shrimpers diversified fishing efforts in the winter by using modified Chesapeake Bay blue crab traps in live bottom areas to produce commercial quantities of black sea bass (Centropristes striata). Godcharles (1970) described the southern sea bass (C. s. melana) trap fishery off the west coast of Florida. Until the mid 1970's, trap use off the Florida peninsula and the Keys was rather insignificant, however, since 1976-1977 a marked increase in trap number, size and productivity has been noted (GMFMC, 1980). Taylor and McMichael (1980) described present wire trap fisheries in Monroe and Collier Counties, Florida and Sutherland and Harper (1980) described similar operations in Dade and Broward Counties, Florida.

The basic gear unit of the Caribbean trap fishery consists of an "Antillean" wire fish trap ("pot," in local terminology), or one of several variations in this standard West Indian design. Trap shape, size and method of construction relate to tradition, region and availability and nature of building materials. Modern Antillean traps are wire mesh enclosures supported by a frame of mangrove or other local wood, or most recently, by a metal frame. Both plastic-covered and galvanized wire mesh (chicken-cage) are used. A few fishermen hand-weave unbraced "hard-wire" traps, yet uncommonly so, owing to difficulty in obtaining materials and time-consuming construction technique (Swingle, et al., 1970).

Several "Antillean" trap designs are common: an Arrowhead "chevron-shaped" trap with a single funnel entrance is used in Puerto Rico and the Virgin Islands; an Antillean or West Indes "Z-shaped" (double chevron) trap with two funnel entrances is used in Jamaica; and various Cuban "S-shaped" traps with two funnels, originating in Haiti, are used in Cuba and Jamaica (Buesa-Mas, 1962; Munro et al., 1971). A two-entrance rectangular wire and mangrove trap is also popular in the Virgin Islands (Swingle et al., 1970).

Several experimental trap designs have been tested in the Caribbean, including: an Australian "D" trap and an Australian "O" trap, both with steel rod frames (Wolf and Chislett, 1974); an oval-shaped molded plastic trap (High and Beardsley, 1970); and a collapsible rectangular nylon-mesh pot reinforced by an aluminum frame (High and Beardsley, 1970). Several large volume, stackable metal traps have been designed to increase carrying capacity (space saving) on board boat, including: a "nesting type trap" (Wolf and Chislett, 1974); a split S or Dollar trap (a modification of the traditional Cuban S trap); and a split-hexagonal trap (Munro et al., 1971). Stackable traps are constructed by splitting a traditional Cuban S trap or hexagonal trap through the vertical-longitudinal axis and reducing the outer dimensions of one half so that when disassembled, the smaller half stacks inside the large half. Overall trap dimensions vary widely. Table 1 lists some of the more common trap designs by overall measurements and volume.

Traditional Antillean traps have found their way to south Florida and the Keys. Craig (1976) designed an experimental, metal rectangular trap which has proven successful for demersal fishes off South Florida. Taylor and McMichael (1980) reported that although no fisherman's traps are identical in design and size, the majority of the fish traps in the Florida Keys are rectangular in shape and have only one funnel entrance. Other shapes used in the Keys include cylindrical and semi-heart shaped traps. Cubed-shaped modified Chesapeake Bay crab pots are used in the South Atlantic (Rivers, 1966).

The diameter of the wire mesh used to construct traps varies. Hexagonal mesh with diameters of .75 inch (1.9 cm), 1.0 inch (2.2 cm), 1.25 inch (3.2 cm), 1.5 inch (3.8 cm), 1.63 inch (4.13 cm), 1.75 inch (4.4 cm), and 2 inch (5.1 cm) are reported in the literature. Rectangular mesh measuring 1 by 2 inches (2.54 by 5.1 cm) is also used.

The standard entrance funnel described by Munro et al. (1971), is a "horseneck" style conical funnel, downward turned at the inner end with a pear-shaped inner aperture 11.8 in (30 cm) in length and 28 in (72 cm) in circumference. Funnels are constructed of similar wire mesh. Hipkins (1974) described a funnel made of knotted nylon treated to give a springlike action to help prevent fish escapement. Experimental triggers or non-escapement devices on the funnels have not proved successful, as of yet, because they tend to interfere with entrance into traps. Traps are fitted with "removal doors" to allow access to bait holder and catch.

TABLE 1

Trap Type Design	Measurements (length x width x height in meters)	Volume (m^3)	Source
Rectangular metal trap	2.43 x 1.22 x 0.61	1.8	Craig, 1976
Rectangular Virgin Island Trap	4' x 3' x 26"		High and Beardsley, 1970
Collapsible Nylon Pot	6' x 3' x 3'		"
Jamaican "Z" Trap	1.8 x 1.0 x .61 (to 2.3) (to 1.22)		Munro et al, 1971
Rectangular Trap	5' x 4' x 1.5'		Olsen et al, 1978
Arrowhead (Chevron) Trap	5' x 5' x 1.5'		Juhl and Suarez-Caabro, 1973
Lesser Antilles "Z" Trap	9' x 4' x 2.5'		Wolf and Chislett
Split Hexagonal Trap	1.83 x 1.22 x .61		Munro, 1972
Puerto Rican Trap	--	.70m^2	Stevenson, 1978
Black Sea Bass Trap (modified Chesapeake Bay Trap)	24" x 24" x 24"		Issacson, 1963

Use of escapement panels to allow fish escape from lost or abandoned traps is not yet widespread. Hipkins (1974) described natural fibre (cotton) panels which are inserted into steel mesh traps and which deteriorates in salt water. Craig (1976) described an "automatic escape hatch," a removal door hinged with magnesium-alloy "time release" rings (trade name, "pop ups") having a known constant corrosion rate in salt water.

The cost to purchase or construct new traps ranges from $20 to $80. Taylor and McMichael (1980) reported that the cost to build a 2 x 3 x 4 ft, 1 x 2 inch mesh wire trap with 100-150 ft of 0.25 inch buoy line and two polystyrene buoys is between $35 and $50 excluding labor. After approximately six months of use, traps usually have to be replaced.

Traps are fished as individual units or as a longline set (trotline) of 20 to 30 traps. Traps are fished from fixed (permanent) positions in areas of extreme tidal fluctuations or in areas of extensive shallow water. Otherwise, portable traps are used. Traps are normally set at depths ranging from 1.0 m (3.42 ft) to 183 m (626 ft) (GMFMC, 1980). Some of the small shallow water operators can visually select where to set traps; deeper water fishermen rely upon recording fathometers or other "fish finding" devices to locate suitable demersal fishery habitats.

One or more marker buoys are used to locate submerged traps. Traditional buoys are flagged bamboo poles inserted through flotation and anchored in cement-filled plastic containers for ballast (Rivers, 1966).

Traps are set baited or unbaited. This latter practice is preferred in the Caribbean whereas most traps in the South Atlantic and in the Florida Keys are baited. Few differences in performance are detected, however, between baited and unbaited traps success. Fish are attracted to unbaited traps for a variety of reasons: conspecific attraction; curosity; thigotrophic attraction; territoriality; and predator-prey relations. They are similarly attracted by a wide variety of non-marine type baits (e.g., sage brush (Lantana sp.), doctor grass, cactus, bread, cowhide, tropical fruits and vegetables, crockery, mirrors and battery-operated lights) and marine type baits (e.g., fresh and frozen sprat, Atlantic herring, Spanish mackeral sea "robins" or round scad, four-wing flying fish, menhaden, mullet, spot, croaker, shark, conch, sea urchin and fish meal). Rivers (1966) reported on the use of punctured cans of catfood to attract black sea bass to traps off the Carolinas. Live non-food tropicals are often left in reset pots as bait (Swingle et al., 1970). The types of bait used generally reflect availability and fishermen preference rather than fish-attracting quality.

"Fundering" is an infrequently practiced technique where traps heavily both inside and outside induce a feeding frenzy and after a short set yield spectacular catches (up to 200 pounds of fish per trap) (Swingle et al., 1970).

Regardless of trap design, size or other generalities, the fundamentals of trap fishing are the same: traps are set on the seabed, preferably in habitats suitable for demersal fish and fish enter traps, for a variety of reasons, through one or more conical openings and are retained for varying periods of time, until retrieved by fishermen, escapement, or death.

C. Catch determinants

Research to determine the mode of operation of fish traps has demonstrated that trap success is related to several factors, including: environmental considerations (biogeographic area fished, areal extent, productivity and species composition of individual reefs and trap location relative to localized habitat types); mechanical aspects of trap operation (trap design and dimensions, trap density, trap immersion period or "soak"); meteorological conditions (season, weather, lunar periodicity and associated tidal rhythms); and biological considerations (trap attraction features, territoriality and predator-prey relations). Several workers have shown that by manipulating one or more of these variables, one can control, to a large degree, trap catch composition and rate.

Munro et al. (1971) described many aspects of trap fishing. They demonstrated that fish trap catch is a function of the comparative rates of ingress (the number of fish which enter the trap, regardless of the number which subsequently escape, die or are preyed upon inside the trap) and escapement (losses from the trap) and observed that mean daily rate of ingress is relatively constant, but that with time an increasing number of the cumulative ingress escape (up to 50 percent in 14 days) and cumulative catch tends to asymptote (where rate of ingress equals rate of escapement). Munro (1974) further described this sequence of events via theoretical statistical models and field observations.

1. Ecological considerations

The ability to locate productive fishing grounds with minimum time and energy spent is a foremost consideration for successful trapping. Many fishermen use various "fish finding" devices (fathometers or scope scale expanders) which give indications of the ocean contour, and even schooling fishes, to find habitat suitable for demersal fishes. Traps are set in areas of coralline sands, near coral heads, on submerged fringing coral reefs and shallow patch reefs, in live bottom areas, and adjacent to artifical reefs and shipwrecks.

In the South Atlantic, traps are set in live bottom areas along the 10 to 30 fathom contours (Rivers, 1966). In south Florida and the Florida Keys, the most desirable bottom types are continuous expanses of moderate relief (2 to 4 ft) hardbottom containing live gorgonians, sponges and heads of hard coral (Craig, 1976; Taylor and McMichael, 1980). In the Caribbean, traps are fished most extensively in nearshore shallow coral zones (Munro et al, 1971). In all areas, productive spots are fished repeatedly.

Placement of traps in relation to localized habitats (biotopes) can determine, to a large extent, species composition of catch. Knowledge habitat characteristics of among reef species can be used to attract target species or to avoid unwanted species. High and Beardsley (1970) demonstrated in a reef system off the Virgin Islands that trap location relative to underwater ledges, coral growth and other bottom features made a significant difference in the species and numbers caught. For example, distance between traps and soft coral whips where squirrelfishes aggregated accounted for significant differences in the number of squirrelfish caught. Similarly, placement of traps within the "territories" or resident areas of groupers accounted for observed ingress of these fishes. In experiments off south Florida (Craig, 1976), traps set in sand flats some distance from live bottom outcrops caught more "food" fish (e.g., snapper and grouper), than traps set on top of the reef which caught more "non-food" tropicals (e.g., angelfish, surgeonfish and parrotfish). Craig (1976) suggested that in the former case, traps became the most prominent feature on the seafloor and attracted many small fishes, such as tomtates (Haemulon aurolineatum), first via thigmotrophic attraction, then by conspecific attraction. Larger fishes, such as snappers, groupers, barracuda, etc., which often forage away from the reef proper, were next attracted to the traps, probably by the smaller occupants.

Knowledge of localized habitats can be used to either attract or avoid capture of spiny lobster. (Panulirus guttatus). Losters are considered pests to trap fishermen because they often enter traps and guard entrances, thus blocking entry of finfishes (Munro, 1974). Craig (1976) suggested that spiny lobsters can be avoided by placing traps away from known lobster habitats; i.e., away from caves and crevices in rocky and reef areas. In contrast, to attract spiny lobsters, Munro et al. (1971) shaded the upper surface of traps with interwoven palm fronds to simulate habitat characteristics.

Fishing depth is also an important determinant of species recruitment to traps. Wolf and Chislett (1974) noted that species availability to traps became less complex and proportion of target species (snappers) increased with increasing depth on offshore coral banks in the Caribbean.

Distance between traps determines total area fished and thus figures in fishing potential. Hipkins (1974) suggested that for trotlines (multiple traps on a line) set lines should be taut to avoid grouping traps too close together.

Pelagic fish species, such as jacks, mackerel and dolphinfish, are attracted to and held around floating and semi-submerged objects (Wolf, 1974). To test pelagic fish recruitment to fish traps, slightly submerged Antillean Z traps and deeper submerged Australian D traps were employed. However, both anchored and drifting, submerged traps caught nothing or at most four-wing flyingfish, and ocean triggerfish or nothing, and the technique was determined commercially unsuccessful (Wolf, 1974).

2. Mechanical aspects of trap operation

Trap design (shape) figures significantly as a catch determinant. Munro, Reeson and Gaut (1971) reported that unbaited Cuban S traps outfished Antillean Z traps of equivalent size (1.83 x 1.22 x .61m) under identical fishing circumstances in terms of numbers and weights of fish caught. They suggested that the curved shape of S traps enhanced ingress by guiding fish to entrance funnels. When traps were baited , however, the "shape effect" was not as apparent. Wolf and Chislett (1974) found that baited Z traps outfished D traps of equal dimensions by a ratio of more than 2:1 (41.4 lbs per lift for Z traps to 19.6 lbs per lift for D traps) and Australian O traps and experimental "nesting" traps by a much larger ratio.

Munro (1974) noted that trap size also affected trap performance. If daily mean rates of ingress were relatively constant, Munro (1974) postulated, then the relative effectiveness of a trap depends upon the rate of escapement, and that if escapement was "the result of random movements of fish in traps ... (then) escapement would be inversely proportional to the area or volume in which the fishes are contained." To test this hypothesis, Munro (1974) compared the performance of four traps of varying area coverage: Cuban S trap (2.05 sq m), Z trap (2.79 sq m), "midi" S trap (1.31 sq m) and split S trap (1.99 sq m) and calculated a mean index of trap effectiveness based on catch per square meter. An index of 48.8 was figured for the large traps (standard S and Z traps) and 38.4 for the smaller traps (midi and split S-traps), and it was thus concluded that traps of largest volume yielded the greatest catches. Findings by Wolf and Chislett (1974) supported this conclusion. When comparing Z-traps by size, they found that a larger Z-trap (3.05 x 1.22 x .91m) averaged 30.1 lbs (13.7kg) per lift whereas a smaller Z-trap (2.75 x 1.22 x .61m) yielded only 18.7 lbs (8.5 kg) per trap lift.

Trap construction materials may affect catch performance also. Munro (1974) noted that wood framed traps outcaught steel-framed traps by 27 percent and suggested that the superior attracting quality was due to visual stimulus of the thicker wooden frame. High and Beardsley (1970) found that traps constructed with different materials exhibited distinct differences in the number and species composition of the catches. Black molded plastic pots were totally ineffective. Traditional Virgin Island rectangular wooden-framed wire traps (1.22 x .92 x .51m) outfished experimental steel-framed nylon-mesh traps (1.83 x .92 x .92 m), but fish were smaller. Significant differences in species composition by trap were also detected.

Munro (1974) suggested that the number of entrance funnels per trap influenced ingress and found two-funneled S and Z traps to be superior to one-funneled arrowhead (chervon) traps.

Mesh size is reported to be selective for catch rate and species composition, size, weight, and year class. The low density of fishes observed in nearshore reefs off Jamaica may be a result of intense trapping with small-meshed traps. Munro et al. (1971) suggested that

with small mesh traps, "the largest reef fish and thus usually those which mature at a relatively large size are subjected to severe biological overfishing, while the smaller reef fishes which mature before recruitment to the traps are subjected to intense exploitation with a coorespondingly low stock density, but are not biologically overfished."

Wolf and Chislett (1974) reported that the catch rates for 2-inch mesh pots, expressed below as total number of fish per pot/average weight (lbs per lift), exceeded that for 1 1/4-inch mesh pots during day sets, but not over night:

	2-inch	1 1/4-inch
Day	59/44.2	60/31.6
Overnight	88/33.7	86/54.9
Combined	147/40.9	146/45.3

Wolf and Chislett (1974) also noted that different mesh sizes accounted differences in the sizes of snappers, groupers, jacks and other fishes caught:

Mesh size (in)	Percentage by weight (average weight per fish)			
	Snappers	Groupers	Jacks	Other
1 1/2	83.3 (0.85)	8.9 (13.6)	7.0 (6.1)	0.8 (1.2)
2	75.4 (1.18)	15.8 (12.8)	7.6 (6.3)	1.2 (2.8)

At one station, Wolf and Chislett (1974) caught 545 silk snappers in traps: 223 in 2-inch mesh pots and 322 in 1 1/4-inch mesh pots. Ninety-six percent of the snappers in the larger mesh sized trap were above 25 cm in length, which is the average length at maturity, as determined by gonadal examination, whereas in smaller mesh traps only 50 percent exceeded this measurement. Thus, smaller mesh traps retained a larger percentage of juvenile silk snappers.

Olsen et al. (1978) initiated experiments to determine optimum mesh size and to gather information about mesh-related mortalities in Virgin Islands trap fisheries. Rectangular fish traps (1.5 x 1.22 x .45 m) of three mesh sizes were compared: 1-inch and 1.5-inch hexagonal mesh and 1 x 2-inch rectangular mesh. Standard fish lengths among the three of the most common species caught; i.e., lane snapper (Lutjanus synagris), vermilion snapper (Rhomboplites aurorubens) and tomtate

grunt (Haemulon aurolineatum), were statistically significant by mesh type. They concluded that if ingress was equal, then 1-inch mesh retained 17.9 times more fish and 1 x 2-inch mesh retained 9.5 times more fish than 1.5-inch mesh.

Stevenson (1978) fished 1.25-inch and 1.5-inch mesh pots off Puerto Rico in attempt to estimate growth and mortality rates for target species and to determine the degree to which each population was being over or underfished. Individual length-frequency distributions were recorded by species, by location and by mesh size for a 14-month period. Results showed that annual fishing mortality rates for red hind (Epinephelus guttatus), coney (Cephalopholis fulva) and spotted goatfish (Pseudupeneus maculatus) were greater in smaller mesh traps due to the size selectivity of the gear. Redband parrotfish (Sparisoma aurofenatum) exhibited significant size selection by mesh but no difference in mortality estimates. There was no or negligible evidence of size selectivity for bar jack (Caranx ruber), striped porgy (Haemulon plumiere) and squirrelfish (Holocentrus rufers). Longjaw squirrelfish (Holocentrus ascensionis) showed lower annual mortality rates in smaller mesh traps.

Several workers have studied the relationship between the length of trap immersion time (soak) and trap performance (catch). Munro et al. (1974) recorded maximum catch values after 7 to 10 days soak, after which time catch rates decreased due to increased escapement. Similarly, Wolf and Chislett (1974) noted that catch by weight increased progressively between set number days one and number three, after which time the catch rate fell back to the level encountered on day one. In this latter case, overnight catch rates exceeded diurnal catch rates.

SCUBA observations showed that the composition of catches changed progressively with increasing soak, which Munro et al. (1971) attributed to a succession of species, as follows: "those showing a progressive decline in frequency of occurrence with increasing duration of soak; those which show no significant changes in frequency of occurrence; and those which show a progressive increase in relative frequency of occurrence...(where)...the species included in the last group do not usually appear until several days have elapsed."

Craig (1976) suggested that with increasing soak, successive development of assorted marine fouling organisms on traps occurred and discouraged ingress of fishes off south Florida.

Bait has only a minor role in attracting fish to traps. High and Beardsley (1970) reported no significant differences among various bait types used or between baited and unbaited traps in numbers of fish caught. Moreover, unbaited traps were found to be 15 percent more productive than traps baited with chopped fish. Wolf and Chislett (1974) tested the effectiveness of several traditional West Indies bait types and found sea robin to be more effective than flying fish and sprat. Shark and pot-caught food fish yielded poor catches. In deep water, unbaited traps caught little or nothing whereas baited traps produced catches comparable to that taken in shallower depths.

Munro (1974) predicted that if bait enhanced trap attractiveness and thence the rate of ingress, then catch rate would increase until bait was exhausted, from which time ingress would decrease, and catch rate would decrease and level off as the rate of escapement approached the rate of lower ingress. Field observations confirmed this assumption, showing that ingress decreased after 2 days, when bait was consumed, and catch stabilized at that time.

3. Meteorological conditions

Exploratory catch results and anecdotal accounts by local fishermen in the Caribbean indicated that trap catches are affected by moon phase, or by the corresponding tidal rhythms (Munro et al. 1971). Catch rates for unbaited Antillean Z traps peaked at and around the time of new and full moons and pronounced depressions in catch rates were observed shortly after the quarter-moons. Moreover, cumulative rates of ingress were about 50% greater at or near spring tides. Munro et al. (1971) attributed these results to complex ecological responses corresponding to tidal rhythms.

Lunar and tidal influences affected trap ingress in south Florida in a similar fashion (Craig, 1976). Additionally, sea state was proposed as catch determinant: "regardless of moon phase or trap condition, unfavorable catches were associated with quiet sea conditions in conjunction with clear Florida current water moving slowly through the fishing grounds. Conversely, favorable catches were associated with rough seas, turbid waters and strong bottom currents, especially when these conditions prevailed for several days. The combination of a neritic water mass with strong, reversing long shore currents resulted in the best yields".

4. Biological considerations

High and Beardsley (1970) proposed alternate reasons for observed ingress into traps, including:

> "(1) use of the pots as a residence or territory, which was defended against intruding fish of the same species (groupers); (2) random movements of fish on the reef (butterflyfishes, parrotfishes); (3) curiosity (butterflyfishes, squirrelfishes); (4) social behavior or gregariousness with one or more fish attracting others into the pot (butterflyfishes, squirrelfishes); (5) predator-prey relationship, where the predator (groupers, parrotfishes) chased the prey (parrotfishes, squirrelfishes) into the pot, or the predator would be attracted into the pot by the already captured prey (groupers, parrotfishes)."

Munro et al. (1971) observed that many Caribbean reef fish, including holocanthids (squirrelfishes), acanthurids (surgeonfishes), pomadasyids (grunts), scarids (parrotfishes) and carangids (jacks) were attracted to traps by the capture of conspecifics. They suggested that interspecific variability between catches in traps set adjacent to each other in similar environments was attributed to the conspecific attraction phenomenom.

Tomtates (Haemulon aurolineatum) were often the most dominant component of catches due to conspecific attraction in traps set by Craig (1976) adjacent to live bottom off south Florida. He mentioned that conspecific attraction also enhanced ingress of lane snapper (Lutjanus synagris).

In South Atlantic live bottom areas, gregarious black sea bass are immediately attracted to traps by bait and by conspecific attraction (Rivers, 1966).

Craig (1976) suggested that seasonal variation in reef inhabitants accounted for the sudden, unexplained appearance of various fishes such as sand drum (Umbrica coroides), Bermuda chub (Kyphosus sectatrix), blue runner (Caranx crysos), lane snapper (Lutjanus synagris) and schoolmaster snapper (L. apodus).

Spiny lobsters are attracted to the dead fish which accumulate in soaking traps. Large predators (sharks and moray eels) are attracted also by trapped occupants. Munro et al. (1971) reported that traps containing large numbers of fish are subject to attack and predation by moray eels (Gymnothorax moringa and G. funebris) and nurse shark (Gingylostoma cirratum).

Traps which are lost continue to trap fish indefinitely, unless retrieved by divers or destroyed by large predators or by corrision. Although Munro (1974) showed that a substantial proportion of fish which enter traps escape, he noted that fish which do not escape live for a varying length of time. Many fishes which had been confined in traps for up to two weeks showed obvious signs of physical harm, including wounds from predators, abrasions from wire mesh and secondary fungal infections.

D. Recommended Management Measures

Scientists and resource managers have recommended various management measures which, if adopted, may alleviate some of the problems associated with wire trap fishing without severely limiting traditional trap fisheries. Among those currently being considered by U.S. Regional Fishery Management Councils (who, pursuant to the U.S. Fishery Conservation and Management Act of 1976 [16 USC 1801-1882], prepare Fishery Management Plans for commercial and recreational fisheries in need of management) are:

1. Traps must have degradable panels of approximate size of entry ports or degradable door fasteners;

2. Traps must be constructed with wire mesh no smaller than 1 x 2 inch rectangular or 1.5 inch hexagonal;

3. Traps may not be larger than 54 cubic feet;

4. No more than 200 traps can be fished per vessel;

5. Traps may not be fished overnight;

6. Traps must be color coded to owner's boat; and

7. A person may not fish another person's traps without authorization from the owner (SAFMC, 1979).

The Office of Coastal Zone Management (which pursuant to the Marine Protection, Research and Sanctuaries Act of 1972 [16 USC 1401-1444], has the authority to designate, through the Secretary of Commerce, and with Presidential approval, special marine areas as marine sanctuaries) has implemented or is considering management measures in marine sanctuaries to preserve or restore conservation, recreational, ecological or aesthetic values threatened by wire trap fishing. In Key Largo Coral Reef Marine Sanctuary, Florida Keys, wire traps will also be prohibited if this proposed area is designated as a sanctuary. In the proposed Gray's Reef Marine Sanctuary, Georgia Continental Shelf, wire traps will be allowed by permit for research and resource assessment purposes.

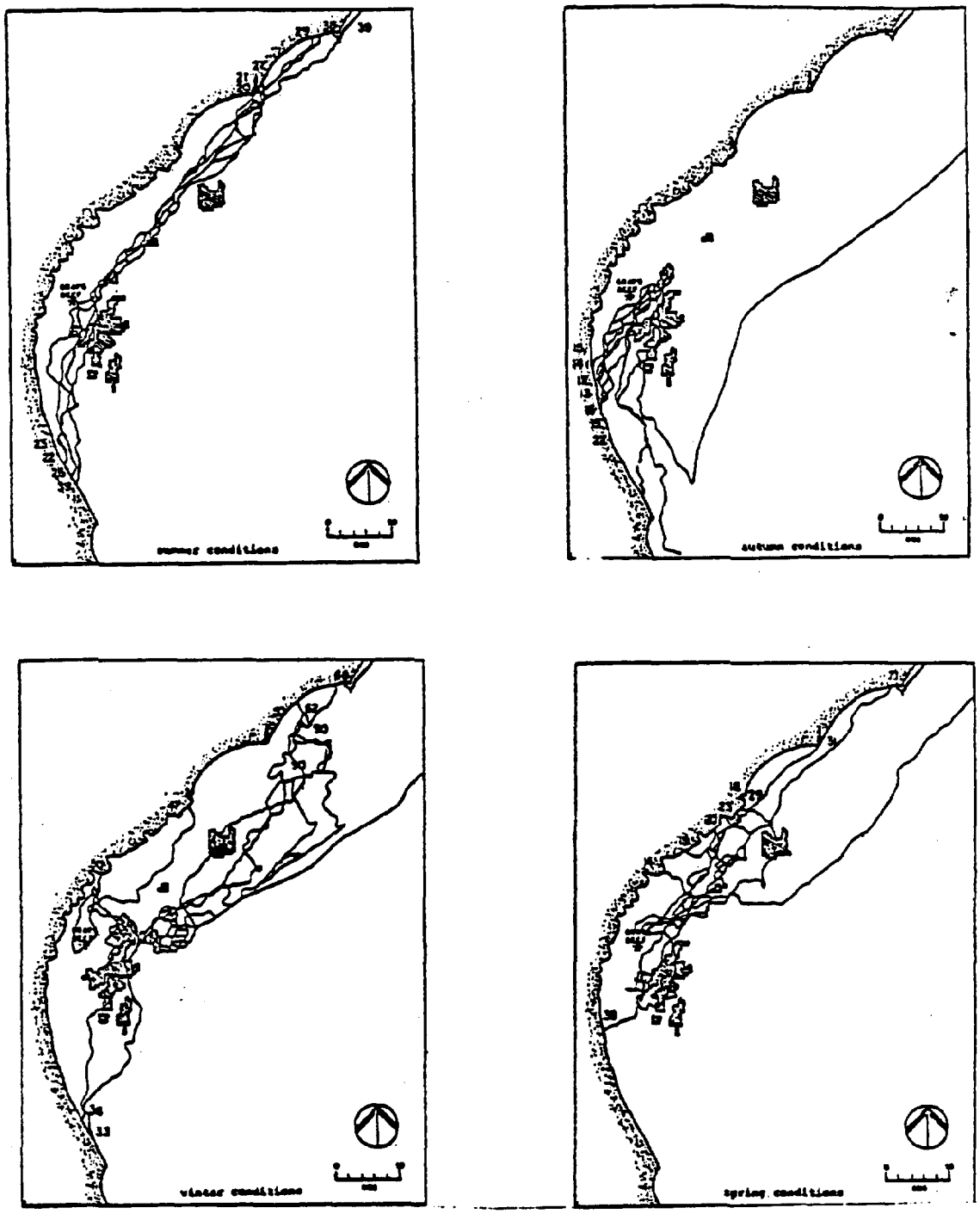
Rationale for the above mentioned controls are conservation-oriented. Degradable "escape" panels in traps, degradable door fasterners and minimum mesh sizes (management measures 1 and 2 above) would facilitate fish escape from "ghost" traps and would help prevent capture of undersized fish (e.g. juv eniles and small showy tropicals). Management measures 3, 4 and 5 above would limit overall trap fishery efforts and reduce the possibilities of overfishing of selected resources from extended fishing efforts. Measures 6 and 7 would help reduce gear and user group conflicts and would improve the cost effectiveness of enforcement and "contribute to the orderly prosecutive of the fishery (SAFMC, 1979)."

Prohibited or carefully controlled use of wire fish traps in marine sanctuaries would provide additional long term benefits and would (1) preserve the ecological intergrity of reef systems; (2) reduce the risk of physical damage to coral reefs and associated epifauna (i.e. mechanical damage from traps dragged or tossed about across reef surfaces); (3) prevent the interference with or displacement of less efficient hook and line fishing; and (4) preservethe aesthetic values of the reef environment for recreational divers.

In conclusion, within the past few years, wire trap fishing in the Coralline areas of the South Atlantic Caribbean and Gulf of Mexico has become highly controversial among fishermen and conservationists as a result of both factual and perceived aspects of trap fishing which have become more pronounced including the size, number and efficiency of traps, the potential for gear and user conflicts in areas of overlap, the fate of "ghost" traps and the potential impacts of trapping on reef fish and reef habitats. To date very little factual documentation exists. Clearly, more research is necessary before the mode of operation and fate and effects of trap fishing are explicitly known. Only then will scientists and resource managers be able to objectivly evaluate measures proposed for the management of the fishery and for the long term welfare of the resources.

APPENDIX J

BUREAU OF LAND MANAGEMENT OIL SPILL TRAJECTORY RESULTS FOR LEASE SALE NO. 43



Example oilspill trajectory results for a spill site near the center of the proposed lease area. Number on trajectory reaching the coast gives time to land in days.

APPENDIX K

RESPONSES TO COMMENTS RECEIVED ON THE PROPOSED GRAY'S REEF MARINE SANCTUARY DRAFT ENVIRONMENTAL IMPACT STATEMENT

This section summarizes the written and verbal comments received on the Draft Environmental Impact Statement (DEIS) and provides NOAA's responses to the comments. Generally, responses are made in one or more of the following ways:

- Expansion, clarification or revision of the EIS;
- Generic responses to comments raised by several reviewers; and/or
- Specific responses to the individual comments made by each reviewer.

1. GENERIC COMMENTS AND NOAA'S RESPONSES

GENERIC COMMENT A: The proposed Gray's Reef Marine Sanctuary offers a reasonable, responsible, and necessary mechanism to preserve and manage an ecologically significant live bottom resource for the benefit of society. The proposed management objectives offer an unique opportunity to enhance the recreational, research, and educational potential and wise use of this important marine area. As a control area, the sanctuary will serve as a research baseline upon which to determine the environmental consequences of various types of marine resource development elsewhere in the South Atlantic.

GENERIC RESPONSE A: NOAA acknowledges all expressions of support for the Gray's Reef Marine Sanctuary Proposal. Public interest in this proposed sanctuary is reflected in the text of the FEIS. (Please see Chapter I - Introduction and Summary).

GENERIC COMMENT B: The status quo already provides enough protection for the natural resources described in the DEIS. A marine sanctuary would only add an unnecessary and expensive layer of Federal bureaucracy.

GENERIC RESPONSE B: The many Federal agencies which exercise authority in the proposed sanctuary provide a considerable degree of regulatory protection for the resources of the area. However, an area as biologically rich and important as this deserves particular attention to the entire range of issues involved in long-term preservation. Marine sanctuary designation will provide for a management framework which does not presently exist.

The marine sanctuary program, unlike other regulatory programs which have jurisdiction in the area of the proposed sanctuary, offers a mechanism to focus on this particular geographically defined marine area and to provide comprehensive planning to preserve the resources of the site. Other statutes either focus on management of much smaller areas, single resources, or have resource protection only as an ancillary goal. Marine sanctuary planning and management also includes provisions for assuring long-term protection and maximum safe use and enjoyment; other statutes do not provide, in most cases the same geographically focused, comprehensive research and monitoring effort. An educational element of the program heightens public awareness of the value of the resources and thereby reduces the potential for harm; again, this aspect of the marine sanctuary program is unavailable under the present system.

The marine sanctuary proposal can fill an important regulatory role. Presently, a multitude of Federal and Regional government agencies are vested with some regulatory authority over certain activities within the area. These authorities provide a considerable degree of protection for marine resources in general. No entity looks to the welfare of all the living resources or the ecosystem of the marine area defined by the sanctuary proposal. Cumulative impacts on the resources, arising from various activities subject to the jurisdiction of separate agencies, may escape the attention of any agency.

The extraordinary diversity of natural resources concentrated at the bottom deserves additional attention beyond that provided by the present institutional structure. Although certain uses of the area do not now seriously threaten resource quality here, they could have more significant impact, if, and when, existing activities increase in intensity. The current multitude of regulatory authorities, many of which have different objectives and jurisdictions, may not be able to respond on the basis of ecosystem issues to future activities. Furthermore, some agencies suffer from limited enforcement resources. Because these waters contain so many valuable resources which, in turn, support so many beneficial uses, the special planning and study possible in a marine sanctuary are necessary to ensure that these resources are used and preserved in the future as effectively as possible.

GENERIC COMMENT C: The goals (purposes) for the proposed Gray's Reef Marine Sanctuary as provided in the DEIS should be expanded and clarified so as to eliminate any possibility of future conflict.

GENERIC RESPONSE C: A set of tentative management goals and objectives was formulated in the DEIS. These goals and objectives will provide a framework for future development of a Management Plan and served as a basis for assessing the effectiveness of the boundary and regulatory alternatives considered. Immediately following designation, the formal Management Plan will be prepared. At this time, the final goals and objectives will be refined and will form the heart of the Plan.

The Georgia Department of Natural Resources, Coastal Resources Division, is presently providing technical assistance to NOAA under a cooperative agreement for predesignation management planning. The task directive provides for the development of alternative strategies for addressing specific management concerns (e.g., sanctuary administration and coordination, surveillance and enforcement, resource management, research, assessment and monitoring, and public education and visitor use). Preliminary recommendations will be available at the time of final statutorily required consultation with Federal agencies and will be subjected to a public participation process involving considerable consultation, review and comment before adoption.

GENERIC COMMENT D: Local area divers and fishermen have not damaged the live bottom and oppose any regulation of diving and fishing activities. Spearfishermen police themselves. The wording of proposed management measures for spearfishing and hook and line fishing as appears in the DEIS is confusing; both activities should be given equal treatment.

GENERIC RESPONSE D: The FEIS clarifies the fact that NOAA does not intend to restrict hook and line fishing and spearfishing activities at Gray's Reef; instead, NOAA will monitor them. Monitoring is a management tool which will be used to assess the resources of significance and all activities within the proposed marine sanctuary (also see Generic Response F).

The EIS states that recreational activities such as SCUBA diving, spearfishing and hook and line fishing do not pose a current threat to fishery resources at the live bottom. It recognizes the fact that spearfishermen are limited in overall activity and catch-per-unit-effort by their hunting skills, by self-imposed catch limits, and by natural environmental contraints (e.g., water depth, safe bottom time, visibility, temperature, currents and the like). It also notes that hook and line fishing is more consumptive than spearfishing at Gray's Reef, but that both fishing activities at increased levels of harvest could pose a threat to the resources.

NOAA has evaluated available information concerning spearfishing and hook and line fishing at Gray's Reef and has determined that both activities should be exempt from NOAA regulations in the currently proposed marine sanctuary. NOAA proposes to undertake various management tasks: 1) monitor all fishing activities at Gray's Reef to obtain more information on recreational fishing and fishery stocks; 2) share information with the SAFMC and work closely together to ensure compatible management measures; 3) conduct a thorough resources survey to provide for a comprehensive description of fishery resources at the live bottom; 4) prepare field guides to recreational fishing and diving using information obtained from the survey described above; 5) make available educational information about the biology of reef fish, especially with regard to growth and reproductive characteristics which tend to make them vulnerable to harvest pressure; and 6) conduct studies on the feasibility and desirability of establishing marked dive trails.

It should be noted, however, that all fishing activities in the South Atlantic Fishery Conservation Zone (the area of water between 3 and 200 nautical miles off the coasts of North Carolina, South Carolina, Georgia and east Florida) whether they occur at Gray's Reef or elsewhere, are subject to current and future regulation by the South Atlantic Fishery Management Council (SAFMC) pursuant to final Fishery Management Plans (FMP). The SAFMC has proposed certain management measures in its draft FMP's which would set harvest quotas, size limits and gear specifications for selected fisheries such as the snapper-grouper complex and migratory pelagic species. Additionally, the SAFMC proposes to monitor all fishing activities via mandatory reporting in order to evaluate the FMP's. Neither the SAFMC nor NOAA foresees any restrictions on recreational fishing at Gray's Reef other than those proposed in FMP's.

In summary, the designation of Gray's Reef as a national marine sanctuary will not restrict recreational fishing or diving activities, nor will it discriminate against any user group. However, any regulations implemented by the SAFMC more restrictive than those in this proposal would apply at Gray's Reef, regardless of sanctuary designation.

GENERIC COMMENT E: The DEIS preferred alternative to require vessels to anchor in sand bottom areas within the sanctuary is inappropriate because (1) there is not enough evidence available to determine if anchoring by user groups (usually vessels less than 40 feet) poses significant threats to the live bottom, however, anchoring by large commercial and recreational vessels and by ships may cause significant damage to the hard bottom; (2) the regulation would discriminate against user groups which do not have the skill or equipment for locating for sand bottom areas for anchoring purposes; (3) SCUBA divers already observe a self-imposed practice of sending a diver down the anchor line to secure anchor placement in sandy areas; and (4) the regulation would be unenforceable. NOAA should consider another alternative that would provide for monitoring of anchoring by vessels until information is obtained that warrants regulation.

GENERIC RESPONSE E: NOAA has reevaluated information concerning anchoring at Gray's Reef and has decided that anchoring should be exempted from regulation at this time. NOAA proposes to list anchoring in the Designation Document and undertake various management tasks: (1) monitor anchoring practices at Gray's Reef to determine activity levels, gear types, and environmental impacts (also see Generic Response F); (2) conduct a thorough underwater resource survey to determine the exact nature and extent of hard bottom and soft bottom coverage in the sanctuary; (3) prepare nautical maps for public use showing the bathymetry depicted by the survey mentioned above; (4) conduct studies on the feasibility and desirability of designating anchorage areas and placing and maintaining mooring buoys; and (5) educate the user public concerning safe anchoring practices as this information becomes available through environmental impact analysis.

NOAA has obtained preliminary evidence to suggest that anchoring of large recreational and commercial vessels (vessels larger than 40 feet) may have caused damage to the hard bottom. Further studies are needed to analyze fully the impact of this activity.

The environmental and socioeconomic impacts of the management measures listed above are analyzed in the text of the FEIS (See Sections III.C.3. and V.C.2).

GENERIC COMMENT F: The DEIS does not define the term "monitoring" nor how this management tool applies to living marine resources and human activities at Gray's Reef. The language in the DEIS indicates monitoring can lead to indirect and direct regulation of a user activity.

GENERIC RESPONSE F: Monitoring means "observing over a period of time." As in any endeavor, and particularly in management, monitoring is a valuable tool used to ensure proper performance.

Monitoring as applied to Gray's Reef will mean keeping tabs on the gauges which give us information on the continuing health of the live bottom.

This may involve determining how many people frequent the area and what activities they pursue while there. If the activity involves the harvesting of a certain resource, monitoring can determine how much of the resource is being harvested and in what relation to the user's harvest efforts and gear type. Resource monitoring might include assessment of fish species present

per month, and what factors affect the observed abundance and diversity. Monitoring might also tell us about the relationships between live bottom invertebrates and the sport fish that feed upon them. Through monitoring one can look at the role of the live bottom in the lives of threatened or endangered species such as sea turtles.

Data gathered from monitoring the reef resources and resource users will keep the sanctuary manager and other interested entities informed as to the health and status of the sanctuary resources and indicate what actions, if any, are needed to maintain, protect or enhance these resources. On a periodic basis, NOAA will reevaluate the sanctuary management measures in terms of their effectiveness in meeting goals and objectives. Monitoring information will form a large part of the basis for this and public participation will be emphasized. It is conceivable that these reviews will result in recommendations for changes in the regulatory regime.

Monitoring also will include determining how many people, without previous knowledge of "live bottoms", learned about them through an educational program sponsored by sanctuary management. Monitoring will also be applied to the evaluation of environmental changes that occur naturally over the years so that comparisons can be made with areas where man-induced changes, such as energy exploration and development, are beginning to take place.

GENERIC COMMENT G: The current and potential users of Gray's Reef are limited by the natural factors of distance, weather and sea conditions in their access to and use of the area. Marine sanctuary status with attendant regulations is unnecessary for the protection of the area due to the aforementioned self-limiting factors.

GENERIC RESPONSE G: Gray's Reef, located approximately 17.5 nautical miles east of Sapelo Island, is one of the largest naturally occuring live bottom areas in the South Atlantic. This is the closest known live bottom area to the Georgia coast.

NOAA recognizes that physical and socioeconomic factors tend to limit present and potential use of Gray's Reef. Time and distance to Gray's Reef by boat depends on a number of factors: boat size and performance, point of departure, navigational course, and sea and weather conditions. Since these factors vary from day to day, and some even from hour to hour, an objective determination of an average distance and time to Gray's Reef would not be meaningful. However, as an example, the average Georgia offshore recreational fishing boat (22 feet 150-175 horsepower) on an average day (2 to 4 foot seas) departing from Sapelo Sound could make the trip to Gray's Reef in approximately one hour or less.

There is no current weather and sea condition history of the Gray's Reef area available at this time. A study of these factors is anticipated during formulation of the Management Plan. Generally, use of the reef is heaviest from April to September; weather conditions during this period are usually more favorable for offshore endeavors.

Use of the reef area is expected to increase in direct relationship to future shortages of fuel and as increasing fuel prices discourage trips further off shore. The limiting factors of distance, sea and weather conditions will become less restricting as fuel becomes the controlling consideration.

Whether coastal Georgia's generally rural composition will act as a deterrent to the potential use and overall increased usage is not known. In conclusion, given population and energy trends, the utilization of Gray's Reef seems likely, with or without sanctuary designation.

GENERIC COMMENT H: How much will the Gray's Reef Marine Sanctuary cost taxpayers? NOAA should provide a cost/benefit analysis before proceeding with sanctuary designation.

GENERIC RESPONSE H: Congress appropriates funding for the Marine Sanctuary Program under Title III of the Marine Protection, Research and Sanctuaries Act of 1972. The Marine Sanctuaries Program receives funding on a yearly basis. Funding for fiscal 1980 was 1.75 million dollars for the entire Marine Sanctuaries Program. This money is used for administrative costs, costs related to the designation process, and management, research and monitoring of existing sites.

It is practically impossible to make a cost/benefit analysis for a particular marine sanctuary prior to its designation and prior to development and implementation of a formal Management Plan. The costs associated with administering the national Marine Sanctuary Program at headquarters level are more definable because annual budgets are forecasted in light of previous expenditures on salaries and indirect administrative costs, such as benefits, travel, communications, printing, supplies and equipment, etc. On the other hand, estimates of the actual on-site management costs for a newly designated sanctuary are for the most part unquantifiable in the absence of a Management Plan. These costs vary with the characteristics of the site, the permitted uses and the proposed program objectives. Forecasting management budget and estimating the dollar value of the public benefits to be derived from the sanctuary designation will evolve with implementation of the Plan.

At the program level in Washington, D.C., site costs of an "average" sanctuary are projected for annual budgeting purposes.

Projected management costs per site average $90,000/year. In some instances enforcement costs must also be provided. Surveillance and enforcement are cost variable depending upon the type of regulations required to protect the site's value, the frequency and methods necessary for site surveillance, the distance which enforcement entities must travel, and the extent of human use and traffic. The Management Plan will analyze alternatives to reduce costs, such as where on-site management costs could be shared with other marine management efforts. Surveillance and enforcement costs may also vary with seasonal factors, such as human use patterns and and weather and oceanographic conditions. For example, a sanctuary used part of the year may not require intensive management year round.

If Gray's Reef is designated, NOAA proposes Coast Guard enforcement through their regular patrols for the first year. Reporting details will be worked out prior to designation. Analyses during development of the Management Plan

will indicate if this is adequate to ensure enforcement of the sanctuary regulations. This cooperative reliance upon the Coast Guard would not require additional expenditures. Research and monitoring costs per site will vary from 0 - $100,000/year, depending upon management needs. Contracting for scientific or management oriented research studies will vary depending on the types of research needed or desired for the particular type of sanctuary. Again, costs may be reduced through cost sharing. By offering matching funds for research at designated sanctuaries, the marine sanctuary program may be able to tap marine related research funds administered by other Federal agencies and private foundations. A "research budget" may be used to cover the expense of: (1) synthesis and development of new baseline data; (2) synthesis and updating of data developed since designation; and (3) pure research.

Other costs funded under management will be associated with: mapping and marking sanctuary boundaries; distributing certain information and regulations pertaining to designated sanctuaries; maintaining certain structures that might be placed within sanctuary boundaries such as buoys, dive trail markers, etc.; operating sanctuary interpretation programs for visitors; and, when necessary, prosecuting violators of sanctuary regulations.

An objective evaluation of the benefits to be derived from sanctuary designation is severely hampered by the difficulty in stating the value of program objectives in a common currency. Cost accounting techniques for industrial, commercial and residential interests are well developed and universally accepted. The state of the art is such, however, that general-purpose, reliable evaluation techniques are not available for predicting preservation, recreational, educational or aesthetic values. These values are very subjective in nature and it is difficult, if not impossible, to place a dollar value on them. For example, recreational fishing and diving, two major means of pleasure and education at Gray's Reef, depend upon the continued health of the live bottom system. However, the value of the natural resources attracting these activities as well as the personal importance attached to them are factors not easily quantified. The Management Plan will examine alternative means for assessing the value of the marine sanctuary to society as a whole; a value based on the public's perception of the program, the social usage of the area, and the monetary value of preserving the marine environment.

GENERIC COMMENT I: What role does the Georgia Department of Natural Resources play in the marine sanctuary program?

GENERIC RESPONSE I: The Coastal Resources Division (CRD) of the Georgia Department of Natural Resources (DNR) has provided technical assistance and guidance throughout the proposed Gray's Reef Marine Sanctuary designation process. The following is a description of the DNR/CRD involvement in the proposal to date.

In June 1978, Georgia DNR/CRD nominated Gray's Reef as a marine sanctuary candidate. In July 1979, in order to determine initially the desirability and feasibility of designating Gray's Reef as a marine sanctuary, NOAA solicited comments on the nomination from various Federal agencies, State agencies, the South Atlantic Fishery Management Council, and local interested groups and individuals. NOAA received technical assistance and cooperation from Georgia DNR/CRD during evaluation of the proposal and the preparation of public documents.

Georgia DNR/CRD is responsible for all natural resource concerns within the coastal region of the State (including six coastal counties and nearshore shelf areas) and for ensuring State stewardship of the marshes, beaches, barrier islands, and other unique coastal ecosystems including all renewable and nonrenewable resources. As described in detail in Appendix B of this FEIS, Georgia DNR/CRD's Coastal Fisheries Section has considerable experience and expertise in the management of estuarine and marine fishery resources for recreational, commercial and research purposes and in establishing and maintaining additional offshore recreational fishery opportunities through the use of artificial reefs. Georgia DNR/CRD's Coastal Management Section has specific responsibility for educating the citizens of Georgia on various attributes of the State's coastlines and for addressing Outer Continental Shelf energy exploration activities to assure effective development with minimal impact.

In light of this experience and expertise, NOAA entered into a Cooperative Agreement with Georgia DNR/CRD to initiate "Predesignation Planning" for the proposed Gray's Reef Marine Sanctuary for a performance period of June 15 - November 15, 1980. As part of the joint nature of this effort, NOAA has provided the on-site services of one staff member from the Sanctuary Program Office, Washington, D.C. to serve as a NOAA representative, to provide technical assistance and guidance in policy matters, and to work with the Georgia DNR/CRD representative. According to the task directive outlined in the Agreement, Georgia DNR/CRD will deliver the following:

- an analysis of the resources required to monitor the effectiveness of the management system and the regulations;
- an analysis of the surveillance and enforcement system necessary to meet management objectives;
- an analysis of the needs involved in designing a process for reviewing and evaluating requests for permits to conduct prohibited activities; and
- a preliminary list of the scientific research needed to accomplish management goals and objectives.

Contingent on the performance of Georgia DNR/CRD in Predesignation Planning, the availability of funding, the concurrence of Georgia DNR/CRD and NOAA, and the marine sanctuary designation, NOAA is considering an amendment to the Cooperative Agreement to secure DNR/CRD's services in preparation of a formal Gray's Reef Marine Sanctuary Management Plan (MP). The formulation of this Plan will include extensive public involvement. NOAA would bear the costs of the MP, specify task directives, and provide technical assistance in guidance in policy matters and on specific items to be included in each task. Following implementation of the MP, NOAA will designate an on-site Sanctuary Manager who will be responsible to NOAA for local day-to-day administration of the sanctuary.

2. PUBLIC HEARING COMMENTS AND NOAA'S RESPONSES

Public hearings on the proposed Gray's Reef Marine Sanctuary DEIS were held on July 7, 1980 in Brunswick, Georgia and July 8, 1980 in Savannah, Georgia. Six persons testified in Brunswick and eleven in Savannah (four of which testified the previous evening).

Golden Isles Diving Club
Al Riley

NOTE: Mr. Riley presented testimony at both the Brunswick and Savannah public hearings. Because the testimonies are similar, they are combined here to avoid repetition.

COMMENT: Accessibility to Gray's Reef is limited due to distance and weather conditions. In combination with the not-so-great fishing and diving, Gray's Reef is a poor choice for sanctuary status; the Fernandina Snapper Banks would perhaps make a better sanctuary. Gray's Reef is not a great reef. There are no hard corals there.

RESPONSE: Gray's Reef is the largest expanse of inshore natural live bottom reef off the Georgia coast. Most local offshore sport fishermen and divers consider the live bottom to be an excellent area in which to fish or dive. Two State of Georgia salt water record gamefish were recently caught at Gray's Reef: king mackerel (June 1977, 56 pounds 4 ounces) and red snapper (March 1980, 36 pounds).

Gray's Reef is a preferred site for marine science and educational demonstrations; it serves as a "living laboratory" for many students from schools in South Carolina, Georgia and northeastern Florida. The live bottom is also the site of several on-going scientific research projects; it is studied in comparison with live bottoms found farther offshore and off other southeastern Atlantic states. Also see Generic Response G.

The Fernandina Snapper Banks is representative of a middle continental shelf hardbottom biotype; it is part of a discontinous hardground zone which extends from offshore Jacksonville, Florida to Onslow Bay, North Carolina. Gray's Reef represents an inner shelf type. Inner, middle and outer continental shelf hardgrounds differ in terms of physical features (composition of hardground, relief and geological history), Gulf Stream influence, and biological assemblages. (See Section IV: Description of the Affected Environment in the EIS). The Fernandina Snapper Banks should not be considered as a substitution for Gray's Reef but as an ecosystem which should be studied in comparison. If formally recommended as a marine sanctuary candidate, the Banks would be evaluated according to site selection criteria as was Gray's Reef. To date however, the Banks have not been recommended.

Hard corals are found at Gray's Reef. They are found in patchy distribution and as solitary heads rather than as reefs because they are near the northern limit of their geographical range at the live bottom. Hard corals identified thus far include star coral, branching eye coral and cup coral (Porter, 1979 pers. comm.; Shipman, 1979, pers. comm.). Further studies will probably reveal the presence of other hard corals at the live bottom, such as stump coral, tube coral and brain coral.

COMMENT: How much is this going to cost us in tax dollars? What are our benefits going to be from our tax dollars?

RESPONSE: Please see Generic Response H.

Golden Isles Diving Club
James Page

NOTE: Mr. Page presented testimony at both the Brunswick and Savannah Public Hearings. Because the testimonies are similar, they are combined here to avoid repetition.

COMMENT: The Gray's Reef Marine Sanctuary Program is not warranted at this time, at least not to the extent proposed in the DEIS. Access to Gray's Reef is limited as compared with the Florida Keys. Gray's Reef should not be considered a Looe Key, a reef accessible by small boats. The limited access to Sapelo Live Bottom (Gray's Reef) should not warrant a great deal of monitoring.

RESPONSE: Please see Generic Response G.

COMMENT: The water visibility at Gray's Reef is considered poor, usually 10 to 25 feet on a horizontal plane as compared to that of 40 to 200 plus in Florida. These factors limit diving at Gray's Reef. Spearfishing harvest can not compare with the number of fish taken by hook and line fishermen. Monitoring or restricting spearfishing are not needed and unwarranted.

RESPONSE: Please see Generic Responses D and F.

COMMENT: An anchoring regulation is not necessary for dive boats. We can not anchor on hardbottom. An anchor will just bounce and drag, tearing up the bottom. We look for soft bottom and before diving, a diver is run down the anchor line to set the anchor in soft bottom. This alleviates the possibility of the anchor dragging and disturbing the hard bottom. NOAA should consider installing anchorages at Gray's Reef and maintaining them through Georgia DNR. This would be a reasonable solution, if put in the right locations, for sport fishermen and sport divers.

RESPONSE: The FEIS describes the difficulties encountered when anchoring on hard bottom substrates. Also see Generic Response E.

COMMENT: NOAA should enforce the marine resource laws currently on the books; added legislation is too expensive to initiate and to enforce. NOAA should: 1) restrict the use of wire traps and oil rigs on live bottoms and the taking of coral and sponges except by permit; 2) install and maintain anchor buoys at Gray's Reef; 3) enforce pollution laws currently in effect for discharges and waste; 4) provide for public input into NOAA decision-making policies; and 5) estimate the time, personnel, number and types of equipment needed for management and enforcement, and total dollar value of the proposed Gray's Reef.

RESPONSE: 1) The regulations proposed in the FEIS concerning wire fish traps, seabed alteration and construction (e.g., placement of oil rigs) and taking of corals and sponges comply with this recommendation. These activities will be prohibited in the sanctuary except by NOAA permit on a case-by-case basis. 2) The research section of the Gray's Reef Marine Sanctuary Management Plan, will include a provision from studing the feasibility and desirability of installing mooring buoys at the live bottom. Also see Generic Response D. 3) The U.S. Coast Guard is the entity responsible for enforcing marine sanctuary regulations on the high seas. The Coast Guard also enforces existing marine pollution laws [e.g., the Clean Water Act, the Oil Pollution Act, and Title I (Ocean Dumping) of the Marine Protection, Research and Sanctuaries Act]. Provisions of the Gray's Reef Marine Sanctuary regulation which concern dumping and discharge of polluting substances will make it unlawful to discharge any substance into marine sanctuary waters except: (a) bait, fish parts, and chumming materials; (b) vessel cooling waters; and (c) effluents from marine sanitation devices. This regulation therefore provides for additional protection of the sanctuary water and benthic quality by prohibiting activities neglected by the above mentioned statutes (e.g., discharge of oil wastes from vessels under 150-500 gross tons and dumping of trash and litter). 4) If public input during plan development continues to indicate desirability of advisory committees which will represent all public interests, the Gray's Reef Marine Sanctuary Management Plan will provide for their establishment. Such committees would include government, research, education, and recreational interests. The purpose of the advisory committees will be to advise NOAA and make recommendations upon management policies. 5) See generic Responses A and E.

COMMENT: What is the Georgia Department of Natural Resources (DNR) involvement in the marine sanctuary program?

RESPONSE: See Generic Response I.

COMMENT: Not many people are in favor of government interference. If we must have this so-called government interference, let it be to help the people.

RESPONSE: See Generic Response B.

Vice President For Conservation
Coastal Audubon Society
Verna McNamara

COMMENT: The Coastal Georgia Audubon Society is not prepared to endorse or oppose the Gray's Reef sanctuary. Additional information is desired. For instance, the DEIS does not show where other live bottom sanctuaries are located and why one in Georgia was chosen over others off North Carolina and other places.

RESPONSE: Section IV: Description of the Affected Environment of the EIS provides a comprehensive description of and references to all known live bottom areas on the South Atlantic Continental Shelf.

Gray's Reef was nominated for national marine sanctuary status by the Georgia Department of Natural Resources for a number of reasons. It is one of the largest concentrations of inshore live bottom in the South Atlantic. Gray's Reef is perhaps the most highly utilized natural reef with respect to sport fishing, diving and research off Georgia and in the South Atlantic. It is relatively accessible to all user groups. (See Generic Comment G).

The vertical relief of the Gray's Reef area (6-10 feet) is exceptional in that it such degree of relief usually only encountered further offshore (40-50 miles), not inshore. The uniqueness and accessibility of the live bottom has prompted more research than in other live bottom areas. As a biological baseline area, Gray's Reef provides a unique opportunity to further our knowledge of live bottom reefs in the South Atlantic and elsewhere.

COMMENT: The goals for the sanctuary should be more clear.

RESPONSE: See Generic Response B.

COMMENT: How useful will the information obtained from research be and what will be done with it?

RESPONSE: Scientists and educators of varied disciplines and of international affiliation are keenly interested in live bottom ecology and in Gray's Reef particularly. Live bottom areas have been known casually as fish havens, by local recreational divers and fishermen for many years. However, the field of live bottom ecology is in its infancy; the opportunities for research at Gray's Reef are almost limitless. Field trips to Gray's Reef provide unique educational and research opportunities. Numerous secondary schools, colleges, universities and research institutions use Gray's Reef as a living laboratory for marine research and education, including the University of Georgia Skidaway Institute of Oceanography, the University of Georgia Marine Institute of Sapelo Island, the University of Georgia Marine Extension Service at Brunswick, Savannah State College, Jacksonville University, the Coastal Resources Division of Georgia DNR at Brunswick, and Emory University Marine Laboratory on St. Simon's Island. Research and educational interests include physical and chemical oceanography, geology, paleontology, taxonomy, biogeography, population dynamics, physiology and community productivity.

The location of Gray's Reef is quite advantageous in that research and education projects conducted there do not require the sophisticated oceanographic vessels and diving equipment nor the expensive ship time that are needed for studies in deeper water and farther from shore. Research findings will be applicable to coastal management planning, marine resource assessment, Outer Continental Shelf energy studies, artificial reef projects, comparative research on live bottoms in the South Atlantic and northern Gulf of Mexico, fishing and coral resource management programs, biogeography, geological studies, coastal-shelf outwelling studies, and threatened and endangered species recovery projects.

COMMENT: What do you mean by "monitoring"?

RESPONSE: Please see Generic Response F.

COMMENT: What is an estimate of the cost? The projected benefits should be meticulously explained and justified against the cost.

RESPONSE: Please see Generic Response H.

COMMENT: The presence of marine life in the sanctuary is reported as being quite uncertain. More comprehensive data are needed before designation. This is particularly true in the area of endangered species, the loggerhead, green and ridley turtles and even the Florida manatee.

RESPONSE: The EIS accounts for all marine life presently known to exist at the live bottom. The species lists appearing in Appendices E, F and G are by no means complete. They represent only a fraction of the marine life thought to inhabit the live bottom, a preliminary species list compiled primarily from unpublished species lists and personal communications with persons familiar with Gray's Reef. Also see written comment by Alan H. Shoemaker, Zoologist, Riverbanks Zoological Park. The Gray's Reef Marine Sanctuary Management Plan will address strategies for a thorough assessment of marine life at Gray' Reef, particularly endangered and threatened species.

Golden Isles Diving Club
Dr. Fred Adicks

COMMENT: Sapelo Live Bottom (Gray's Reef) may not be experiencing the pressures and the perturbation that the Florida Keys are experiencing, but now is the time to start protecting it. I like to collect fish for my aquarium and shoot fish to eat, but I would prefer to not be allowed to shoot any fish and not pick up even one tiny fish for my aquarium than to see what is happening in the Florida Keys. I would hate to think that the live bottom would not be here for my children, my grandchildren, or my great-grandchildren. I am for it.

RESPONSE: Comment accepted. Also please see Generic Responses A and G.

COMMENT: I am a bit afraid of "monitoring", but I have enough confidence in the people working on the project to think that they will do it in a real careful manner.

RESPONSE: Comment accepted. Also please see Generic Response F.

Chairman, South Atlantic Fishery Management Council
David Gould

NOTE: Mr. Gould presented testimony at both the Brunswick and Savannah Public Hearings. Because of their similarities, his testimonies are combined and responded to here, to avoid repetition.

COMMENT: The South Atlantic Fishery Management Council (SAFMC) has critically reviewed the Gray's Reef DEIS and unanimously endorsed the proposal. We commend those responsible for drafting the DEIS for doing a very good job.

RESPONSE: Comment accepted. Also please see General Response A.

COMMENT: Questions have been raised regarding the SAFMC and its impact on activities at Gray's Reef. The Regional Fishery Management Councils are responsible for developing Fishery Management Plans (FMP) to manage fisheries within the Fishery Conversation Zone (from the State 3 nmi territorial sea to 200 mi offshore). According to a Memorandum of Understanding with the Office of Coastal Zone Management, the SAFMC reviews and recommends on proposals concerning the marine sanctuaries. The Gulf of Mexico Fishery Management Council (GMFMC) has a similar agreement.

The SAFMC is involved in developing several FMPs. One of them is a coral FMP, a joint venture with the GMFMC. In the Coral FMP, the Councils recognize that certain areas have unique values and important characteristics that need to be preserved and set aside for special considerations. These areas are recognized as Habitat Areas of Particular Concern (HAPC). Gray's Reef is recognized in the Coral FMP as a HAPC. However, the councils do not propose anything more for this area than is proposed for the sanctuary, and for all other coral areas. Under the Coral FMP, coral harvesting will be very heavily regulated. There will be a very limited harvest of soft corals, by permit. Anyone collecting coral for scientific or educational purposes must have a permit. There will be stringent permit criteria.

RESPONSE: The FEIS acknowledges the draft Coral FMP and the recognition of Gray's Reef as a HAPC.

COMMENT: The SAFMC and GMFMC are also working on a Draft Coastal Migratory Resources (mackerel) FMP which proposes certain regulations for the king and Spanish mackerel and other pelagic fisheries including quotas, size limits and gear restrictions. Once the FMP is approved, the regulations will apply in all areas of the Fishery Conservation Zone. They will apply equally to areas such as Gray's Reef as they will to others. In other words, size limit on Spanish mackerel would be the same at Gray's Reef as it would elsewhere.

RESPONSE: The FEIS acknowledges the Draft Coastal Migratory Resources (Mackerel) FMP and proposes to rely upon the regulations implemented pursuant to this plan to manage coastal migratory fisheries at Gray's Reef. Also see Generic Responses D and F.

COMMENT: A plan for the Snapper/Grouper fishery complex, involving some thirty species including black sea bass, is being developed. There will be certain provisions or management measures in this plan to regulate harvest, size and gear types. At the present time the Council does not foresee anymore for Gray's Reef than the DEIS indicates, but we do propose to provide for monitoring of all types of fishing activities at some level or another to evaluate the FMPs.

RESPONSE: The FEIS acknowledges the draft Snapper/Grouper FMP and proposes to rely upon regulations implemented pursuant to this FMP to manage Snapper/Grouper fisheries at Gray's Reef. Also see Generic Response D and F.

COMMENT: The SAFMC has discussed spearfishing and in some areas of the South Atlantic there may be a need for some regulation of spearfishing. However, I don't foresee through our plans any restrictions being imposed on spearfishing in the type area we have off the Georgia coast. Natural constraints (high turbidity, limited visibility, strong currents, and limited bottom time) will control your ability to spearfish in areas off Georgia. The SAFMC is not really too concerned about spearfishing, but we do plan to monitor. Folks should not be too concerned about the term monitoring, about being told that their activities are going to be monitored. Monitoring is one of the basic things you have to do in management. It just means to observe and see what's being done. If you operate a business you have to monitor your business, your inflow of cash. If you monitored the performance of your engine you'd take a look at your oil pressure gauge, you watch your tachometer and you keep a track on how much fuel you're burning to give you an idea of whether your engine's performing properly or not. In the case of a fishery you monitor, you're really just looking at how much is being caught and how much effort is being required to catch that amount of fish. And certainly you look at different types of harvesting techniques because different types of harvesting gear are more efficient than others. If a person has to fish a whole lot longer to catch the same amount of fish as he caught last year then you can take into consideration that something might be happening to the resource and you need to start looking at it. So you need to really find out a lot about what's going on in the fishery so that you can determine whether or not you need to make some adjustments in your management positions. This is what we're going to be doing with the fishery. We're going to be monitoring the fishing activity.

RESPONSE: In the FEIS, NOAA proposes to rely upon FMPs and to assist the SAFMC in monitoring fishing activities at Gray's Reef. Also see Generic Response F.

QUESTION FROM THE AUDIENCE: How can one monitor the amount of fish caught by spearfishing versus the amount of fish caught by line fishing? How can you determine that these fish were taken by spearfishermen or by line fishermen.

ANSWER FROM MR. GOULD: All of our FMPs will require mandatory reporting. This does not mean that you have to fill out a report every week or every month, but that when you are asked to report on your fishing activity, then you'll be required to report. We will depend upon statisticians to determine a statistically sound percentage of the population to report on a particular fishing activity. We will be obtaining information from spearfisherman, hook and line fisherman, charter boat operators, head boat operators, and commercial fishermen.

COMMENT: Also please see Generic Responses C and F.

Georgia Department of Natural Resources (DNR), Coastal Resources Division (CRD)
Robert J. Reimold, Director

NOTE: Dr. Reimold presented testimony at both the Brunswick and Savannah public hearings. Because of their simililarities, his testimonies and the responses are combined here to avoid repetition.

COMMENT: Georgia DNR (CRD) feels that the designation of Gray's Reef as a marine sanctuary will be a major asset to the South Atlantic offshore area in that (1) it will assure conservation and wise use of the live bottom ecosystem and other natural resources of the water surrounding Gray's Reef; (2) it will insure the continued availability of the live bottom area as a major research control area; and (3) it will serve as a recreational and educational resource. As a control area it will be extremely useful as a biological base line against which we can compare the potential impacts of Outer Continental Shelf energy exploration and development, much as the Sapelo Island National Estuarine Sanctuary has been used to compare the potential impacts of industry and development on the estuaries of the South Atlantic Coast. DNR/CRD strives to educate the citizens of Georgia about the importance, uniqueness and attributes of the coast so as to assure participation of the general public in planning activities and in regulation and control of the coastal resources. We also endeavor to address all Outer Continental Shelf energy exploration and development activities to assure that the energy development will occur with a minimum of environmental impact. We believe that sanctuary status for this area is consistent with our goals. We are especially interested in hearing the views and comments of concerned citizens relative to the nomination and the DEIS. We stand ready to provide technical assistance so people can better understand the proposed sanctuary status as well as interpret some of the more technical details of the DEIS. We insist that plans for the sanctuary assure that all interest groups play an active role in management and in decision making processes relative to permitted uses in the sanctuary.

RESPONSE: Comment accepted. Also please see Generic Response A.

Geological Oceanographer
Jesse L. Hunt, Jr.

COMMENT: As a local SCUBA diver and sport fisherman and as a geological oceanographer who conducted research at Gray's Reef for a master's thesis through the University of Georgia Department of Geology and the Skidaway Institute of Oceanography, I have a personal interest in seeing the live bottom preserved.

RESPONSE: Comment accepted. Also please see Generic Response A

COMMENT: In areas where there is intense pressure by spearfishermen and tropical fish collectors, divers and sports fishermen, such as Looe Key, Florida, strict regulations are warranted. Gray's Reef is not nearly as accessible nor is it as popular a dive site and therefore stringent regulations are not required. Monitoring of such activities as proposed in the DEIS is a good idea, if not too restricting. Monitoring data could be used to maintain a barometer of the health of the live bottom ocosystem.

RESPONSE: Comment accepted. Also please see Generic Responses D, F and G.

COMMENT: Wire trap fishing and trawling are activities which pose a threat to the reef and should be stringently regulated.

RESPONSE: The proposed regulations will prohibit trap fishing, bottom trawling and specimen dredging except by NOAA permit for selected activities which do not pose a threat to the reef and which are consistent with the goals of the sanctuary.

COMMENT: Construction on or alteration of the seafloor, discharging and depositing of substances or anchoring do not pose particular potential threats to the well being of Gray's Reef. The Department of the Interior (DOI) regulates construction and alteration activities which occur through oil and gas and mineral related exploration. The oil and gas industry is not particularly interested in the Gray's Reef area because the sedimentary column is relatively thin. Exploratory wells drilled seaward of Gray's Reef have been dry and abandoned and there are no nominations for tracts in the Gray's Reef area for South Atlantic Lease Sale 56.

RESPONSE: The EIS discusses present and future OCS mineral-related activities with regard to the biological lease stipulation imposed by the Department of the Interior. The EIS acknowledges the fact that the possibility of alteration and construction activities in connection with OCS oil and gas and mineral exploration in the Gray's Reef area is very remote at present. However, the possibility for future development in nearshore areas, whether related to energy reserves, pipeline placement, deep water ports, floating power plants or manipulative research, should not be discounted. Protection by DOI depends upon specific mitigating measures outlined in lease stipulations. Preliminary scientific data from the Gray's Reef area suggests that seabed construction/alteration-induced changes in the environmental conditions at the live bottom could adversely impact habitat areas and certain resident and transient living marine resources.

COMMENT: Discharging and depositing of substances is presently regulated by EPA. Dredging would require a permit from the Army Corps of Engineers and would involve the U.S. Coast Guard if it obstructed navigation.

RESPONSE: The disposal of dredge materials and certain toxic and hazardous substances into ocean waters beyond the 3 mi Territorial Sea is regulated by the Clean Water Act, the Oil Pollution Act and Title I (Ocean Dumping) of the Marine Protection, Research and Sanctuaries Act. However, certain operational discharges of oil and machinery bilge wastes are only loosely regulated. For example, under the Oil Pollution Act, tankers of less than 150 tons and other vessels of less than 500 gross tons are only required to discharge as far as practicable from land and not to have an oil content of more than 100 parts per million. The discharge of trash, litter, solid wastes and sewage from marine sanitation devices into high seas waters is not regulated.

Under the Rivers and Harbors Act, the Army Corps of Engineers jurisdiction over dredging activities is only within the Territorial Sea (3nmi). There are no regulations concerning dredging in high seas areas except under the Ports and Waterways Safety Act for activities which serve to obstruct navigation.

The proposed regulations pertaining to discharges of substances and dredging in the Gray's Reef area serve to fill in where the existing status quo leaves gaps in the protection of the marine environment.

COMMENT: Anchoring is not a problem at Gray's Reef as it is at Looe Key. Poor visibility from surface to bottom makes it impossible for vessel operators to identify sand bottom areas suitable for anchoring and also creates an enforcement problem. Mooring buoys might be a good idea; however, the cost of maintaining the buoys may not justify the benefits.

RESPONSE: Please see Generic Response E

COMMENT: Gray's Reef is a likely candidate for a marine sanctuary, and I support the proposal wholeheartedly as long as the general public is not overly restricted in the use of the area and its resources.

RESPONSE: Comment accepted. Also please see Generic Response A.

Savannah Yact Club and Savannah Sportfishing Club
W.W. Buckhaults

COMMENT: What does "allow by permit marine specimen collection" mean and how do you go about securing a permit?

RESPONSE: Collection of marine specimens will be restricted by the proposed regulations utilizing a permitting process administered by NOAA. Consult Appendix A of the FEIS, section 938.8 for a complete description of proposed permit procedures and criteria.

COMMENT: The proposed regulation concerning the discharge or disposal of polluting substances prohibits the dumping of trash and litter. Don't beer cans and soft drink cans on the seabed enhance the production of small fish in the food chain?

RESPONSE: The dumping of trash and litter at Gray's Reef would be prohibited by the proposed regulations. There is no documentation that beer cans and soft drink cans on the seabed enhance the production of small fish in the food chain at a live bottom. Aesthetically, beer and soft drink cans littering the bottom are an eyesore for the divers.

COMMENT: What are the enforcement costs of this program going to be? Also the cost of a mooring buoy system to alleviate the anchorage problem would be more than the benefits.

RESPONSE: Please see Generic Response E and H.

COMMENT: Citizens of this country need less regulation and less of their tax dollars spend on regulation.

RESPONSE: Please see Generic Responses B and H.

The Georgia Conservancy
Hans Neuhauser

COMMENT: The Office of Coastal Zone Management (OCZM) is to be commended for its efforts to date to consider protective strategies for Gray's Reef and to propose the establishment of the Gray's Reef National Marine Sanctuary. The Georgia Conservancy supports the establishment of the Sanctuary and urges that OCZM proceed with the designation process in an expeditious manner. It is our view that the Sanctuary designation will provide the framework for the comprehensive management of the resources at the Reef. Granted, there are other Federal regulatory programs that provide some of the protection needed, but in combination they do not provide either a sufficient or efficient management program for the Reef's resources. To use a terrestrial parallel, there are many federal laws that help protect the scenic vistas of the Grand Canyon, but it is not until the area is designated as a National Park that management becomes both adequate and streamlined.

RESPONSE: Comment accepted. Also please see Generic Response A.

COMMENT: The purposes for the Sanctuary as provided in the Draft should be expanded and clarified so as to eliminate any possibility of future conflict. The following wording is suggested:

(The Sanctuary is established) ... for the purposes of (1) protecting and preserving the live bottom ecosystem in its natural state, (2) insuring the health and well-being of the Sanctuary's ecosystems, and (3) regulating uses within the Sanctuary boundaries. To the extent that they are consistent with the above purposes, the designation shall also (4) promote scientific understanding of the Sanctuary structure and function, (5) provide for aesthetic and recreational enjoyment, (6) enhance public understanding of the Sanctuary's resources and (7) ensure wise use of the Sanctuary.

RESPONSE: Please see Generic Response C.

COMMENT: Probably the most important management decision to be made in regard to Gray's Reef is the designation of a set of carrying capacity values for the Sanctuary. These values will set the upper limits on the nature and extent of activities to take place on the Reef. If the use of the Reef is promoted to the point where these limits are exceeded, then the principal purposes for which the Sanctuary was established will have been violated.

RESPONSE: The Gray's Reef Marine Sanctuary Management Plan will address the development of a set of carrying capacity values to serve as management tools for assessing visitor use and environmental conditions at the live bottom. Also see Generic Response F.

COMMENT: Our limited knowledge of Gray's Reef will make the establishment of upper limits of use very difficult now. So to avoid overuse through ignorance, we recommend that the managing agency proceed conservatively (that is, with a bias in favor of protecting the resources as opposed to promoting the use of the resource). As our understanding of the capacities of the Reef improve, then this policy might be changed. In the meantime, management decisions should not risk long term or permanent damage to the Reef.

RESPONSE: The proposed regulations for Gray's Reef are conservative; i.e., they favor protection of the resources. See Generic Response F.

COMMENT: A glaring deficiency in the managing agency's capacity to fulfill the purposes for which the Sanctuary is to be established is the inability to regulate fishing other than spearfishing. Fishing activities, particularly by hook and line, presently take far more fish from the Reef environment than does the spearfisherman.

If future research shows a need to implement regulations controlling fishing activities of any kind, then NOAA should be authorized to implement them. This regulatory authority will allow the managing agency to manage the Sanctuary in a comprehensive manner.

The alternative identified and preferred in the Draft EIS (p. 38) of relying on the Status Quo represents a piecemeal approach that seeks to manage only some fisheries stocks. It may be a long time -- if ever -- before the South Atlantic Fisheries Management Plans protect all the fish of Gray's Reef.

In light of the fact that OCZM has not made a coherent argument in favor of the Status Quo (without possible regulatory authority), we recommend that the Alternative 2a be adopted (see pages 38-39). This would allow the implementation of regulations should research and monitoring activities demonstrate a need to do so.

To do otherwise would risk the repetition of "The Tragedy of the Commons" identified by Garrett Hardin (1968). The overuse of the Reef would be inevitable.

RESPONSE: Please see Generic Response D.

COMMENT: The Draft EIS identifies four boundary alternatives for the proposed Sanctuary (pages 23-24 and 41) and then selects as the preferred alternative of 57 sq. km (page 42). However, configuration of the preferred alternative is not consistent.

RESPONSE: The inconsistency of proposed boundary coordinates in the DEIS is due to typographical error. The coordinate values have been corrected in the FEIS, where necessary.

COMMENT: The perferred Sanctuary boundary includes a fairly large area outside of the Reef and exclude some other portions of the Reef.

A fourth boundary alternative should be proposed to encompass all of Gray's Reef. Because J. Hunt's boundaries of the Reef (see page 57 of the Draft EIS) are the best we have at this time, The Georgia Conservancy recommends that a 57 sq. km Sanctuary be established with boundaries to encompass the approximate limits of J. Hunt study area (figure 4). The Coordintes for the Sanctuary should be:

Northwest corner: 31°25'30"N, 80°56'17"W
Northeast corner: 31°25'30"N, 80°51'00"W
Southeast corner: 31°22'00"N, 80°51'00"W
Southwest corner: 31°22'00"N, 80°56'17"W

RESPONSE: The actual areal coverage of the Gray's Reef live bottom is unknown. Hunt's (1974) survey work is the only reference available and it is only an estimate. Hunt (1979, pers. comm.) questioned the accuracy of the original work in light of survey equipment limitations (e.g. Loranec). Figure II-2 (page 27) shows Hunt's approximate study limits transposed onto a chart with coordinated values for boundary alternatives computed by NOAA's National Ocean Survey (NOS). NOS has expressed a reservation as to the accuracy of the transposed data (Hunt, 1974) because it represents a "best fit" approximation of a linear projection (Hunt's data) on to a transverse mercator projection (Rodkey, 1980, pers. comm.)

The Gray's Reef Marine Sanctuary Management Plan will provide for a complete underwater resource survey to determine the actual extent and location of live bottom areas. A chart depicting hard bottom outcrops with elevation and sand bottom areas with grain type will be developed from this survey.

COMMENT: The recommended boundary for the Sanctuary should be an adjustable one. Our knowledge of the extent of Gray's Reef is incomplete at this time. As scientific investigations proceed, more areas of the Reef may be found that would be suitable additions to the Sanctuary. We recommend that the Secretary of Commerce be empowered to make minor adjustments in the boundary after having consulted with other government agencies and with the public (via the Federal Register). These minor adjustments would not require the repetition of the entire designation process including the procurement of Presidential approval.

If this boundary flexibility is not possible without repeating the designation process, then we recommend that the proposed boundary be expanded beyond those we have recommended in figure 4.

RESPONSE: If the underwater resource survey reveals additional live bottom areas that would be suitable for inclusion in the sanctuary, boundary, adjustments can be made by the Secretary of Commerce, after consultations with other Federal agencies and with the public. Because the boundary regulation is listed in the Designation Document, an adjustment would not require the repetition of the entire designation process, including procurement of Presidential approval.

Commercial Fisherman
Lauren Griffith

COMMENT: A few fishermen make a portion of their living either trawling or trapping at Gray's Reef during certain times of the year. Will the designation of Gray's Reef as a Marine Sanctuary impact the income of these commercial fishermen?

RESPONSE: NOAA, Georgia DNR and the University of Georgia Marine Extension Service have no knowledge of any large scale commercial fishing effort currently taking place in the Gray's Reef area. Commercial wire trap fishing has taken place at the live bottom in the past, but only on a part time basis, with marginal financial success for the fishermen. Commercial mackerel fishermen occasionally troll through the area with handlines or rod and reel, but generally do not concentrate efforts at Gray's Reef (Harrington, 1980, pers. comm.)

In 1979, the Georgia DNR surveyed 596 commercial fishermen on the east coast. Only 46 indicated an interest in commercial fisheries other than blue crab and white and brown shrimp offshore Georgia, beyond the 3 nmi state waters (Shipman, 1979, pers. comm.). A follow-up questionaire is being developed by Georgia DNR to expand on this information and its relevance to the Gray's Reef area.

The South Atlantic Fishery Management Council proposes various management measures for selected snapper-grouper and pelagic fisheries pursuant to Fishery Management Plans (see Section IV. F of the FEIS). Commercial fishermen will be affected by these measures. NOAA proposes additional management measures which will affect bottom trawling and trapping within the sanctuary (see Section III. C. and V. C.).

COMMENT: Public access and use of Gray's Reef will be completely cut off through regulation, as has happened on Ossabaw Island.

RESPONSE: Title III of the Marine Protection, Research and Sanctuaries Act of 1972 authorizes the Secretary of Commerce, with Presidential approval, to designate ocean waters as marine sanctuaries to preserve or restore their conservation, recreational, ecological or aesthetic values. Proposed management goals for the proposed Gray's Reef Marine Sanctuary specifically include provisions for public access, education, appreciation, and wise use. See Generic Response B.

Public access to Gray's Reef will not be impeded by sanctuary designation. The concept of a marine sanctuary is similar to that of an underwater park or a marine preserve. It is not necessarily a pristine area or a no-activity zone, as the name may imply. Instead, a marine sanctuary is a site of distinctive marine resources where most public activities such as recreational boating, fishing, diving, scientific and educational diving and research are compatible with sanctuary purposes and are allowed. There are no proposed regulations that limit the access of the public to Gray's Reef. The factors limiting accessibility to Gray's Reef are a result of factors inherent to the area (weather and sea conditions, distance from shore, etc.). Also see Generic Response G.

COMMENT: There seems to be a lot of worry about dredging, trawling and collecting samples from the bottom. The Georgia Department of Natural Resources, Skidaway Institute and the Georgia Marine Extension have made the only serious efforts at dragging dredges and trawls on Gray's Reef; all in the name of research.

RESPONSE: Under the proposed regulations, bottom trawling and specimen dredging would be regulated through a permit process administered by NOAA. Indiscriminate trawling and dredging would be prohibited. For a complete description of the proposed permitting procedure, consult Appendix A of the DEIS, Section 938.8.

COMMENT: In order to enforce the regulations and maintain control, a Coast Guard boat will have to be anchored at Gray's Reef.

RESPONSE: The Coast Guard will be responsible for the overall enforcement of the sanctuary regulations. The Coast Guard's enforcement requirements will be determined upon designation and formulation of the Management Plan. Effective

public education and encouragement of wise usage of the area under the management plan goals could stimulate a sense of public proprietorship, thereby involving all of the various user groups in the reporting of regulation violations. Public awareness could also affect enforcement through peer pressure.

COMMENT: Perhaps the area is worth saving because it is different from more commonly recognized reef areas such as those off Florida.

RESPONSE: Comment accepted. Also please see Generic Response A.

Savannah Dive Club
Mike Denmark

COMMENT: We support the decision to not regulate spearfishing at this time. Hopefully it will never be regulated. If it does come to regulation though, the local divers should be allowed to first try to regulate spearfishing by peer pressure in that we are a very tightly knit group. We offer our services to the monitoring agency for any assistance we may provide, whether it be reporting our observations or any other task we might help with. If we can keep the lines of communication open between the government agencies and the local dive community, the need to regulate will never occur.

RESPONSE: Comment accepted. Also please see Generic Responses D and F.

COMMENT: Some of the greatest dangers of destruction to very fragile reefs such as Gray's Reef come from commercial wire trap fishing. Not only do they damage the reef itself, the soft and hard corals, but great damage is done to the fishery stocks through unattended traps where fish have been observed actually cannibalizing. However, we still do not believe that restrictions or regulations should be imposed on wire trap fishing at this point; maybe a closer monitoring of the situation.

RESPONSE: Fishing near the live bottom with wire fish traps could harm the live bottom by reducing the number of ecologically important reef species and physically damaging attached organisms. For some people, the sight of wire traps on the sea floor containing large numbers of fish would also detract from the natural beauty of the live bottom. Traps are more efficient than hook and line fishing and their use conflicts with the present fishing techniques.

COMMENT: To our knowledge there has been no damage done to the Reef by local area divers or sport fishermen. We are in favor of a marine sanctuary for the Gray's Reef area, but we oppose any regulations at this time.

RESPONSE: Comment accepted. Also see Generic Response A.

Adventure Bound Sports
Andre B. Smith

COMMENT: As owners of one of the few dive boats that runs strictly divers, we probably dive Gray's Reef more than anyone else in the area. Gray's Reef is a very pretty place with ledges two to six feet in height, a lot of hard coral (finger coral) and a lot of tropical fish as in Florida. Finger coral takes approximately 8 to 10 years to gain any size. One of the imposed rules on our dive boat is that you cannot remove any coral whatsoever. I like to look at the coral and think you should stop taking coral altogether. It's supposed to be against the Federal law to take it. Why keep issuing permits to students to take the same type of coral?

RESPONSE: Corals are not only aesthetically pleasing, but they also perform many important ecological functions which are unrivaled by other live bottom organisms. In the tissues of some hard corals found at Gray's Reef, such as the eye or finger coral Oculina, are microscopic photosynthetic algae which produce food and free oxygen from inorganic material in the presence of light energy. The food and the oxygen is utilized by other reef animals; many reef fish, invertebrates and sea turtles graze on coral and algal tissues. Corals also provide shelter for other reef animals. As many as 170 different species and invertebrates can be found living in and around the myriad folds and crevices of an Oculina coral head (McCloskey, 1970). In addition, both hard and soft corals contribute considerable amounts of calcium carbonate, a component of limestone and sediments.

Until recently, it was unlawful to take or disturb coral, except by permit in certain cases, according to 43 FR 6224: Protection and Management of Viable Coral Communities under the Outer Continental Shelf Lands Act. The Bureau of Land Management (BLM), Department of the Interior, was responsible for protecting coral and coral resources under this statute. However, a recent 5th Circuit Court of Appeals decision ruled that BLM's protective authority over coral only applied to activities involving oil and gas mineral exploration and development. This means that corals on the Outer Continental Shelf are presently unprotected by Federal law, except if they are located on tracts leased for energy development. Thus, under the status quo, activities which might directly or inadvertantly damage or disturb the coral resources, such as specimen or souvenir collecting, bottom trawling and dredging, and salvage work, occur unimpeded.

The Gulf of Mexico and South Atlantic Fishery Management Councils propose certain management measures for corals under the draft Coral and Coral Resources FMP. Tentative regulations would approve for harvest limited quantities of soft corals (sea whips and sea fans) and would allow collecting of hard and soft coral by permit for scientific and educational purposes (GMFMC and SAFMC, 1980 b.) The FMP is still in the draft stage and an environmental impact statement has not been completed. Therefore, perpetuation of the status quo, until the FMP is final, would still leave corals vulnerable to indiscriminate collecting.

As proposed in the Gray's Reef Marine Sanctuary FEIS, collecting of coral specimens would be prohibited except in certain cases by permit. This regulation would provide immediate protection for corals and for other tropical

components of the live bottom ecosystem. Tropical biota are naturally rare species at Gray's Reef, representing extensions of their normal geographic range. Many uncertainties exist concerning their viability (health and growth patterns), reproduction and response to natural and man-induced environmental change. Indiscriminate collecting by universities, government and hobbyists could deplete these ecologically important species and upset the ecological balance at the live bottom. Environmental impact analysis concluded that prohibiting the taking of coral at Gray's Reef, except under the scrutiny of a NOAA permit, would serve to preserve coral.

COMMENT: Anchoring by big boats is tearing up the reef. To attest to this, we know one spot where a big shrimp boat anchor has cracked the reef. Shrimpers anchor on hard bottom overnight, when they pull their anchor aboard, it breaks the reef off wherever the anchor is hooked. Once broken off, the sand covers it and it is gone forever.

RESPONSE: Please see Generic Response E.

COMMENT: Gray's Reef is good spearfishing area. The DEIS states, in poor English, "Spearfishing will be monitored, rather than regulated. No restrictions are proposed for hook and line fishermen and NOAA will rely upon the SAFMC to control fishing activities." It should have said, "Spearfishing and hook and line fishing will be monitored." This way, you're leaving it open to come back and regulate it later, as happened at Pennekamp. It is not right to still chastise the spearfishermen.

RESPONSE: Please see Generic Responses D and F.

COMMENT: The most harm done to the live bottom in terms of specimen collecting is done by the University System of the State of Georgia and the Department of Natural Resources. They have collected enough specimens; they have enough to study.

RESPONSE: The proposed regulations would prohibit marine specimen collecting and bottom trawling except on a case-by-case basis by NOAA permit. It would prevent indiscriminate sampling by all concerns, including university and government types. For assessment purposes, the sanctuary management will recommend studies on currently held specimen collections, use of remote sensing via video-recording and still-photography, and where necessary use of non-destructive sampling techniques.

COMMENT: Wire fish traps are defintely bad for the reef. We find a lot of traps on the bottom full of dead fish. Maybe the wire trap fishermen should become divers so that they could go down and retrieve their lost traps.

RESPONSE: The FEIS examines both positive and negative consequences of wire trap fishing and concludes that controlled use of traps for resource assessment through a permit system would provide long-term protection to Gray's Reef by: 1) eliminating the threat of overharvest of reef fish from extended trapping operations; 2) reducing the number and impact of "ghost" traps (lost or abandoned traps which continue to fish); 3) preventing the bycatch of incidental juvenile and non-food tropical fish; 4) reducing the potential for physical

damage to corals and asssociated epifauna (mechanical damage caused by traps which are dragged or tossed about the reef surface); and 5) preventing interference with or displacement of less efficient fishing methods, such as hook and line fishing and spearfishing. The proposed regulation would also preserve the aesthetic features of the live bottom which so many divers value and eliminate the unpleasant experience of encountering ghost traps on the bottom containing mutilated or dying fish.

COMMENT: There are no public marine sanitation dump stations in Savannah, Georgia. How can you enforce a discharge law when there are no dump stations? That means that when I want to dump the commode of my boat, I have to pump it into a bucket, carry it ashore and pour it into a commode in a bathroom or hang a hose over the side of the boat and pump illegally.

RESPONSE: The Clean Water Act requires that noncommercial watercraft comply with marine sanitation regulations issued by the Environmental Protection Agency and enforced by the U.S. Coast Guard. Effective January 30, 1980, it became unlawful to dispose of sewage wastes from marine sanitation devices within the territorial sea (State waters seaward to 3 nmi). This amendment to the Clean Water Act does not apply to the Gray's Reef area which is in high sea waters. The proposed marine sanctuary regulations would prohibit the deposit or discharge of any materials or substances except: a) fish parts, bait or chumming materials; b) marine sanitation effluents and c) non-polluted cooling water effluents.

COMMENT: Gray's Reef is a good fishing area. We have been monitoring it and have some figures on spearfishing versus hook and line fishing. Hook and line fishing takes ten tons of fish as opposed to our two or three thousand pounds. We are very selective in our spearfishing and shoot only the big fish, leaving the small fish alone. In the grouper family, the small fish are egg bearing. Once a grouper reaches a certain age, it no longer produces eggs and changes sex to a male. So all the 10, 20 and 30 pound groupers are male, and you are not hurting the population by killing the big grouper. You only hurt the population when the line fishermen catch all the little grouper, the egg-bearing females. If you're going to come down real hard on spear-fishermen, then we'd like to see it where no one can fish or spearfish. That would enhance our business because then you could train a pet grouper for people to watch and feed without the fear that someone would come along and catch him.

RESPONSE: Please see Generic Response D and F.

COMMENT: If you make Gray's Reef a sanctuary, you will bring attention to it and have people from several states diving at the reef. It can't take that heavy abuse from divers. It is not big enough or strong enough to stand the punishment that a group of divers would put on it.

RESPONSE: Please see Generic Response G.

Sport diver
Richard Nash

COMMENT: I am totally against the proposal and in particular the provision for anchoring. If anchorage sites are set up, you are limiting the area in which a diver can dive due to the area and currents. Also these limited dive areas would be frequented by the majority of divers that are diving at Gray's Reef, which would lead to areas that are heavily worked; ground that is well picked-over.

RESPONSE: Please see Generic Response E.

COMMENT: The spearfishing comments have been very valid. Spearfishing poses no danger to Gray's Reef.

RESPONSE: Please see Generic Response D.

COMMENT: The first section of your pamphlet said the majority of public opinion was in favor of the proposal to make Gray's Reef a sanctuary. In the public workshop meetings, a very scatttered few seemed to agree with, or were in favor of the proposal. I think the general opinion was against the Gray's Reef sanctuary proposal and I think that this ought to be known and not overlooked.

RESPONSE: Many persons who testified at the public workshops were in favor of the proposed sanctuary; some were against. The overwhelming majority of written comments received by NOAA have expressed their support and approval of the proposed marine sanctuary at Gray's Reef. Many of these written statements came from individuals and organizations who voiced their opposition to the sanctuary proposal at the public workshops. Much of this apparent change in attitude is attributable to the development and dissemination of more detailed information concerning the Gray's Reef proposal and more effective communication between the NOAA/ DNR representatives and the public.

3. WRITTEN COMMENTS AND NOAA'S RESPONSES

Written comments on the Gray's Reef Marine Sanctuary DEIS were received until August 5, 1980. Written statements have been photocopied and appear in this section. Specific comments have been flagged and responded to as follows:

COMMENT

RESPONSE

DEPARTMENT OF THE AIR FORCE
REGIONAL CIVIL ENGINEER, EASTERN REGION (HQ AFESC)
[illegible] TITLE BUILDING, 30 PRYOR STREET, S.W.
ATLANTA, GEORGIA 30303

REPLY TO ATTN OF: BDY2

31 July 1980

SUBJECT: Review of Draft Environmental Statement (DEIS) for the Proposed Gray's Reef Marine Sanctuary

TO: Director of Sanctuaries Program
Office of Coastal Zone Management
3300 Whitehaven Street, N. W.
Washington, DC 20235

1. We have reviewed subject DEIS and are satisfied that the "Draft Designation Document", Appendix A, satisfactorily provides for Air Force operations in the proposed sanctuary. Thus, we have no objection to the approval of the proposed marine sanctuary.

2. Thank you for giving us the opportunity to review this DEIS.

THOMAS D. SIMS
Acting Chief
Environmental Planning Division

Cy to: USAF/LEEV
USDC/Mr. Barrett

RESPONSE: Comment accepted. Please see Generic Response A.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

8 AUG 1980

OFFICE OF THE ADMINISTRATOR

Mr. Dallas Miner
Director
Sanctuary Programs Office
Office of Coastal Zone Management
3300 Whitehaven Street, N.W.
Washington, D.C. 20235

Dear Mr. Miner:

The Environmental Protection Agency, in accordance with its responsibilities under the National Environmental Policy Act and Section 309 of the Clean Air Act, has reviewed the Draft Environmental Impact Statement (DEIS) on the Proposed Gray's Reef Marine Sanctuary.

1 EPA supports OCSM's efforts to designate a marine sanctuary at Gray's Reef. We believe that the scarcity of hard bottom habitats and the unique ecosystem dynamics in these areas clearly establishes the need for a sanctuary with the goals and purposes stated in the DEIS. We do not believe, however, that the DEIS has presented a complete analysis of the available alternatives. In addition, we believe the EIS should be revised to include the potential impacts of present and future human activities under the various regulatory alternatives.

2 An adequate definition of the sanctuary resources to be protected is needed before meaningful boundaries can be drawn. The discussion of "live bottoms" in the DEIS misleads the reader to the conclusion that hard bottoms provide substrata for vulnerable biological communities that need protection, and that soft, sandy bottom areas are "barren," "non-sensitive" and "non-living". The FEIS should correct this. Soft bottom communities are important in their own right. While most hard bottom organisms are epibiota living on the substratum, most soft bottom organisms live in the substratum. But the fact that they are less visible in no way diminishes their ecological importance. For example, most of the world's food fishery species, including shrimps, crabs, clams and flounder are soft bottom dwellers. In addition, the soft bottom areas surrounding Gray's Reef appear to be integral to the function of the reef community by being foraging areas for numerous reef fishes.

RESPONSE 1: Comment accepted. Please see Generic Response A.

RESPONSE 2: NOAA's portrayal of South Atlantic soft bottom communities in the DEIS was not meant to give the impression that they are "barren," "non-sensitive," or "non-living," or that they are undeserving of protection. As noted, soft bottom communities are important in their own right and soft bottom organisms support major commercial and recreational fisheries. The FEIS has been expanded to incorporate this information.

The synonyms of the flat, sandy seashore off Georgia with a biological desert of sorts, especially when compared with the dense and diverse life of live bottom "oases," appears in the literature. This is not to say that sand bottom habitats are without life; in fact, Section III.D.3.a of the EIS describes various soft bottom benthic communities encountered across the South Atlantic shelf. The comparison is related primarily to environmental conditions which tend to be stressful and often limit biological community development to the more resistent and resilient opportunistic species.

The results of several comprehensive studies on the South Atlantic shelf off Georgia indicate that soft bottom areas are generally impoverished of benthic fauna (Tenore et al., 1978). Tenore (1979) described the macrofauna communities of the Georgia Bight (animals greater than five centimeters which live within the sediment, such as clams, scallops, and polychaete worms) as being oligotrophic; i.e., low mean species density and biomass and high species diversity. Most species were considered rare and there were no dominants. In this region of the South Atlantic, soft bottom community development seems to be limited by a number of prevailing environmental conditions; unfavorable sediment composition; low nutrient levels; low primary productivity; wind stress; current and tidal scour, and low temperatures.

Soft bottom communities in the vicinity of hard bottom outcrops have not received much systematic attention. However, it is believed that these sedimentary regimes support richer infauna than those in non-hard bottom areas. It is proposed that rock outcrops provide areas of calm, nutrient-rich waters by dampening or deflecting currents and by cycling nutrients and food materials, which in turn enhance soft bottom community development (Stone, 1978; Stone et al., 1979). In this respect, the soft bottom areas surrounding Gray's Reef may be integral to the function of the live bottom community by being foraging areas for numerous reef fish.

We note that NOAA stated in the Proposed Looe Key Marine Sanctuary DEIS (p. 72) that managing fisheries for commercial development is not always compatible with marine sanctuary
3 management goals. However, NOAA appears to rely heavily on future fisheries management plans to protect Gray's Reef resources. We recommend that NOAA further analyze the impacts of relying on fisheries management plans within the Gray's Reef Sanctuary, especially considering the particular vulnerability of reef fishes to overfishing.

Finally, the final EIS should clarify that delegation of the National Pollutant Discharge Elimination System to the
4 State of Georgia gives the State NPDES authority only to the limits of the territorial sea and not beyond to the contiguous zone or high seas.

In view of the above we have rated this the Draft EIS LO-2, lack of objections, insufficient information. We appreciate the opportunity to comment on this Draft EIS and we hope our comments will be helpful as you prepare your Final EIS for the proposed Gray's Reef Marine Sanctuary. If you have any questions, please feel free to contact this office.

Sincerely yours,

for William M. Nedeman, Jr.
William M. Nedeman, Jr.
Director
Office of Environmental Review (A-104)

RESPONSE 3: NOAA will work with the SAFMC to ensure development of compatible management measures.

RESPONSE 4: The FEIS has been expanded to clarify this point.

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER 80/550

AUG 5 1980

Dr. Nancy Foster
Deputy Director
Sanctuary Programs Office
Office of Coastal Zone Management
National Oceanic and Atmospheric
Administration
3300 Whitehaven Street, N.W.
Washington, D.C. 20235

Dear Dr. Foster:

We have reviewed the DEIS and the proposal for the Gray's Reef Marine Sanctuary. Due to the regional interest in this feature, its accessibility to the public, and its history as a site of research and education, we believe that it has marine sanctuary potential and support continuation of the process leading to such a designation. 1

We do, however, wish to offer several comments about the DEIS and the proposed regulations. We hope the FEIS might clarify some of these issues.

GENERAL COMMENTS

Boundary - It appears from the discussion of boundary alternatives (pp. 141-143), that NOAA is attempting to establish a sanctuary for Gray's Reef when the areal extent or boundaries of the reef are not yet known. The only serious mapping effort to date was Hunt (1974, M.S. thesis), and the very accurate navigation systems and precision side scan sonar in common use today were not available for that study. The DEIS acknowledges that the bottom survey data are preliminary and point out that significant portions of live bottom are thought to occur outside the original boundary described by Hunt (1974). Drs. V. J. Henry (Skidaway Institute of Oceanography, pers. comm.) and R. J. Reimold (Coastal Resources Division, Georgia DNR, pers. comm.) confirm that preliminary data--principally from sport divers--suggest that substantial areas of live bottom habitat occur outside of Hunt's original boundary. Indeed, portions of the elevated live bottom ridge system in the north and scattered rock outcrops in the south lie outside this boundary area, according to the 1980 NOS survey map of the Gray's Reef area presented on page 145 (but based on 1927 datum).

It is our concern that adoption of any of the boundary alternatives could leave significant areas of live bottom habitat and associated living marine resources unprotected. Likewise, premature boundary designation could result in the unintentional inclusion of large areas of sand bottom habitat in the sanctuary. We urge NOAA to include the entire Gray's Reef ecological unit or system in the sanctuary. Not only is this the most ecologically sound position, but it would 2

RESPONSE 1: Comment accepted. Please see Generic Response A.

RESPONSE 2: The precise boundaries of the proposed sanctuary are defined by regulation (see Sections III.C. and V of the FEIS and §938.3 of the Proposed Regulations).

The FEIS acknowledges the fact that the actual extent of live bottom coverage at the proposed sanctuary site is not known. Hunt's (1974) survey work is the only reference available and it is only an estimate. Hunt (1979, pers. comm.) questioned the accuracy of his original work in light of survey equipment limitations. The National Ocean Survey (NOS) prepared Figure III-2 (based on 1974 datum and 1980 computor calculated coordinates) which shows the approximate limits of Hunt's study transposed within alternative sanctuary boundaries. NOS expressed reservations as to this representation because it approximates ("best fit") Hunt's linear projection on a NOS transverse mercator projection.

The Gray's Reef Marine Sanctuary Management Plan will develop operation guidelines for conducting a comprehensive underwater resource survey utilizing state of the art navigation and survey instrumentation. Any proposed adjustments in the boundaries based on information from this survey will be evaluated through the public review process.

also avoid confusion among user groups concerning which live bottom areas and resources were included in the sanctuary and which are not. At present NOAA cannot state with certainty that any of the proposed boundaries would include the entire Gray's Reef ecological unit while excluding unnecessary areas of sand bottom habitat.

We feel it is essential, therefore, that prior to any action NOAA should map the area in detail utilizing state of the art navigation and survey instrumentation. Once it has been accurately mapped, the DEIS should be amended to reflect the actual boundary options.

Objective of Designation - The DEIS proposes that sanctuary designation will provide long-term protection for a representative live-bottom ecosystem on the South Atlantic Continental Shelf (p. 11). However, it also acknowledges that live-bottom areas were only recently recognized as significant biotopes in the South Atlantic and that only limited knowledge exists concerning the ecological nature and role of such areas. If this is accurate, how can it be asserted that Gray's Reef is representative? If it is representative, what is it that makes Gray's Reef the particular area proposed for designation among the numerous other live bottom areas of the South Atlantic? Does it possess distinctive or exceptional qualities as these terms are used in NOAA regulations?

It would be helpful if the criteria for distinguishing among different hardground areas could be more completely described. For example, what distinguishes the inner, middle, and outer hardgrounds? What kinds of variations occur (see p.49) and how do they affect the living resources of the hard-bottoms? The discussion should be expanded beyond regional considerations; the hard-bottoms should be compared to those off the west coast, Gulf of Mexico, and North Atlantic.

Management - The goal of this sanctuary designation was stated to be management of an ecological system for protection and maintenance of a live-bottom reef, with emphases on enhancing public awareness and wise use of live bottom reef systems, research, and resource assessment (p. 121). In the discussion of the no action alternative the DEIS stated that without designation there would be loss of sanctuary sponsored benefits to research, education, information and recreation users. It was not made clear, however, in the DEIS how designation would result in these benefits and why the lack of designation would lead to their loss.

For a number of activities (e.g., bottom trawling and specimen dredging, alteration of and construction on the seabed, etc.), the preferred regulatory alternative allows certain aspects of these activities once a permit is obtained from NOAA. However, no criteria or standards are found in the DEIS or draft designation regulations. Will NOAA use criteria of other, but similar authorities for each use category? NOAA should develop criteria to enhance program predictability and enforcement capabilities.

RESPONSE 3: It is generally acknowledged that Gray's Reef is a "unique" live bottom based on its high ecological, recreational, research and educational value to the Georgia coastal region (see Sections II and IV.E. of the FEIS). Its representative nature among other live bottoms will be determined through the years as additional research/surveys are performed throughout the South Atlantic. The term representative is used cautiously and extrapolations should be made only to the extent that scientists do so for rocky intertidal, sandy beach and other better known ecological classifications.

RESPONSE 4: The EIS provides an adequate description of hardground areas necessary to understand the effects of the alternatives. An indepth description of hardground areas in the South Atlantic in the Gray's Reef Marine Sanctuary EIS was not warranted in light of CEQ Regulations (Sections 1502.15 and 1502.21) which propose that the statement describe the environment of the area to be affected by the alternatives under consideration, with other material summarized, consolidated or referenced, in order to avoid bulk. The commentor is referred to the literature cited in the EIS for more comprehensive discussions.

Criterias for distinguishing among different hardground areas in the South Atlantic is not presently available. Nor are there data available to expand discussions beyond regional considerations, such as to compare hard bottoms in the south Atlantic with those of the West Coast, Gulf of Mexico and the North Atlantic. A proposed management objective for the Gray's Reef Marine Sanctuary is to maintain a repository for research in live bottom ecology. As the data becomes available, expanded discussions and comparisons can be prepared and published.

In addition to geographic location, preliminary data (George and Staiger, 1978; Henry and Giles, 1978; Tenore, et al., 1978) suggest that inner, middle and outer hardgrounds differ in substrate composition and morphology and geological origin. Differences in species composition are also detected; yet the factors contributing to these differences are not well known. The Bureau of Land Management is currently sponsoring an investigation of live bottom areas at various locations in the South Atlantic in an attempt to answer some of these questions.

RESPONSE 5: A discussion of proposed sanctuary management objectives has been expanded to include this concern.

RESPONSE 6: Criteria or standards for evaluating permit requests will be developed pursuant to the Gray's Reef Marine Sanctuary Management Plan. The criteria will aim to enhance the sanctuary program goals and objectives. Basic permit criteria are found in the proposed regulations.

The proposed regulations on anchoring would be impossible to enforce and may not be necessary. Underwater visibility at Gray's Reef is not like that at Key Largo or Looe Key. The corals are not as developed, this feature is not as
7 accessible as the reefs in the Florida Keys, and there isn't as much boating pressure. The sand patches and rocky areas cannot be seen from the surface at Gray's Reef, so someone in a boat would not be able to determine whether or not their anchor was in sand or on rock. Enforcement personnel would not be able to make this determination either.

SPECIFIC COMMENTS

8 1. The boundary alternative presented in the DES, and the errata sheet accompanying it, have some serious problems. The coordinates presented on pages 23 and 24 of the DES, and in the errata sheet do not plot rectangles as stated in the text (see attachment).

9 2. p.6, last line. "Pleistocene" should be changed to "Holocene." (Sixty-foot depths of the Georgia Bight area were inundated about 8,000 years ago, which is Holocene.)

10 3. p. 19, para. 4. This section states that a detailed discussion of management under the proposed Gray's Reef Marine Sanctuary Plan is presented in Section III F of the DEIS. However, there is no Section III F in the document, nor is a detailed management discussion presented anywhere in the DEIS.

4. p. 22, para. 2. It is stated here that the proposed Gray's Reef Marine Sanctuary Management Plan will outline procedures for permit application and
11 criteria for evaluation. However, in order to facilitate proper review and evaluation of the Environmental Impact Statement, the proposed Sanctuary Management Plan and all permit procedures and criteria should be developed for inclusion in the FEIS.

12 5. p. 45. We recommend a list of definitions of technical terms such as hardground, hardbanks, reefs, banks, live-bottom, hard-bottom, etc. for the benefit of users and readers.

13 6. p. 49. The last sentence in paragraph 5 is not supported by Figure IV-2 which shows extensive hardgrounds off Georgia. Should the statement refer to exposed hardgrounds?

7. On page 80 and page 136, it is stated that BLM has initiated a Submerged
14 Cultural Resources Plan to identify shipwrecks on the OCS between Cape Hatteras, N.W., and Key West, Florida. This statement is not true. A study was performed to identify areas of cultural resource sensitivity, but it was not to locate shipwrecks.

15 8. p. 106, para. 1, line 2. The first full sentence in this paragraph does not make sense.

RESPONSE 7: Please see Generic Response E.

RESPONSE 8: The errors in the proposed sanctuary boundary coordinates appearing in the DEIS and Errata Sheet are due to typographical error. The coordinates have been corrected in the FEIS.

RESPONSE 9: The FEIS has been corrected to reflect this comment.

RESPONSE 10: The FEIS has been corrected to reflect this comment.

RESPONSE 11: Eventually NOAA plans to include a draft management plan (MP) in all environmental impact statements. This FEIS contains an expanded discussion of the status of preliminary management for Gray's Reef. Public involvement will be emphasized during formulation of a formal MP.

RESPONSE 12: The MP will include a glossary of terms. The FEIS is discriptive enough to insure understanding.

RESPONSE 13: Figure IV-2 in the DEIS is misleading and has been deleted from the FEIS.

RESPONSE 14: The FEIS has been corrected to reflect this comment.

RESPONSE 15: The FEIS has been reworded in response to this concern.

9. p. 106, para. 6, sentence 3. This remark would be more accurate if it read: "(Maps of the BLM oil spill trajectory analysis for Gray's Reef, developed using the USGS model as a result of Lease Sale #43, appear in Appendix J)." 16

10. p. 113. The last sentence of the first full paragraph seems to have omitted something: "BLM proposes the use of existing refinery will be constructed as a result of the sale."? 17

11. p. 113, para. 4, sentence 1. The six plans for exploratory drilling were approved by USGS, not BLM. 18

12. Figure IV-9, opposite p. 114. The legend indicated "tracts offered in Lease Sale 56." At this time, these only represent tracts being considered in the EIS, for sale in Sale 56. A decision about which tracts will actually be offered will not be made until March 1981. 19

13. p. 126. The statement that "the U.S. Coast Guard is the enforcement agent for the OCSLA" fails to recognize the USGS's role in certain development activities, and should be clarified. 20

14. pp. 132 and 133. The endangered West Indian manatee is not mentioned in the accounts of the Endangered Species Act of 1973 or the Marine Mammal Protection Act of 1972. We recommend specific mention of the manatee because it reportedly occurs in coastal areas of Georgia during the warmer months of the year. These coastal areas of Georgia are secondarily affected by the proposed sanctuary. 21

15. p. 135. Marine Protection, Research and Sanctuaries Act. This section should also include that the U.S. Corps of Engineers issue permits for dredge spoil disposal sites under this Act and that two sites are located in the Gray's Reef area (see. p. 105, No. 9). 22

16. p. 149, bottom. The sentence "The status quo would provide minimal protection for the Gray's Reef ecosystem" is conclusional rather than an objective evaluation of the protection available under the present legal system as described in the previous paragraph. 23

17. pp. 153-154. We suggest that the phrase "pending monitoring studies" be added to exclusion (b) of the Discharge regulation. This would show timely consideration of the cumulative adverse impacts of discharge of effluents from marine sanitation devices discussed in the DEIS (e.g., p. 154 and p. 123). 24

18. p. 159. Under alternative 2 for "Anchoring", survey data is to be transposed onto charts. Will these be NOAA nautical charts? 25

RESPONSE 16: The FEIS has been reworded in response to this comment.

RESPONSE 17: The FEIS has been corrected to reflect this comment.

RESPONSE 18: The FEIS has been corrected to reflect this comment.

RESPONSE 19: The FEIS has been corrected to reflect this comment.

RESPONSE 20: The FIES now reflects the fact that the CG is the recognized Federal enforcement entity in marine waters. In a few instances involving natural resources (FCMA, MMPA, etc.) state marine law enforcement agents have been delegated authority to assist in the enforcement of Federal regulations.

RESPONSE 21: The FEIS has been expanded to incorporate this comment.

RESPONSE 22: The FEIS has been expanded to incorporate this comment.

RESPONSE 23: NOAA believes that the analysis of environmental consequences of the status quo alternative objectively reflects the situation at Gray's Reef. The statement in question is a qualitative conclusion based on that evaluation.

RESPONSE 24: All management strategies (MP) will be periodically reevaluated based on available data and public input. This allows sanctuary management to assess thee effectivaness of all aspects of the Plan, including the regulations. Desireable changes could then be proposed as you suggested based on studies.

RESPONSE 25: The FEIS has been reworded in response to this comment.

19. Appendix B. It should be clearly indicated that the lease stipulation for protection of biological resources reprinted here was developed for
26 application to leases issued pursuant to OCS Oil and Gas Lease Sale No. 43 only. It is not necessarily a general stipulation that will be applied to all future leases in the South Atlantic OCS Area.

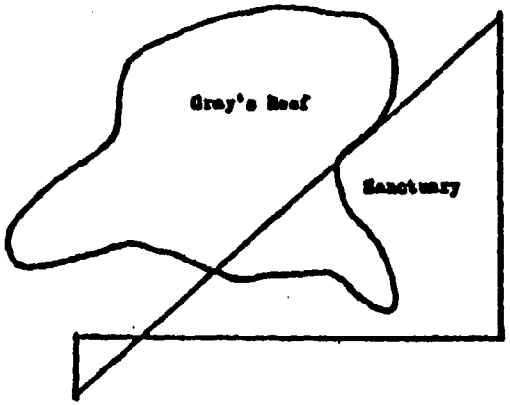
Sincerely,

Acting Assistant Secretary for
Fish and Wildlife and Parks

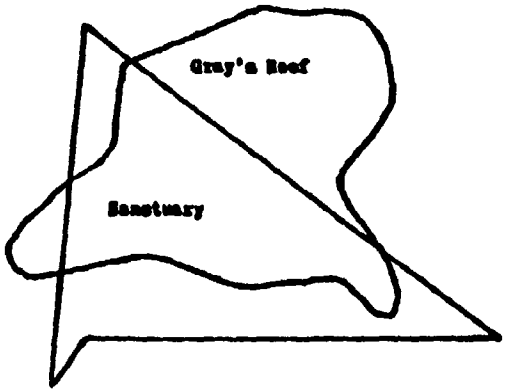
Enclosure

RESPONSE 26: The FEIS has been expanded to incorporate this comment.

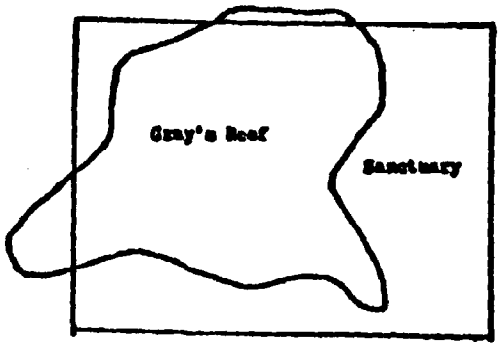
GRAY'S REEF: BOUNDARY ALTERNATIVES



Boundary alternative 2 as identified by coordinates on page 23 and 24 of the Draft EIS, and identified as the prefered boundary on page 42



Boundary alternative as identified by coordinates on the "Errata Sheet for Gray's Reef Marine Sanctuary DEIS" and identified as the proposed boundary on page A-3.



Boundary alternative 2 as mapped on page 27 of the Draft EIS

RESPONSE: See Response 8 above.

COMMENT

RESPONSE

REGION IV

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
ATLANTA REGIONAL OFFICE
RICHARD B. RUSSELL FEDERAL BUILDING
75 SPRING STREET, S.W.
ATLANTA, GEORGIA 30303

July 1, 1980

IN REPLY REFER TO:
4C

Director, Sanctuaries Program
Office of Coastal Zone Management
3300 Whitehaven St., N.W.
Washington, D.C. 20235

Dear Sir:

Thank you for the opportunity to review the DEIS on the PROPOSED GRAY'S REEF MARINE SANCTUARY proposed to be located 34.2 km due east of Sapelo Island, Georgia.

The designation of this sanctuary will not have a direct effect on, or be directly affected by, the actions of this agency. Indirectly, however, the sanctuary will benefit those who we serve by expanding their potential for recreation and educational pursuits. We therefore support the alterative to designate the waters at Gray's Reef as a marine sanctuary.

Sincerely,

Charles N. Straub
Regional Environmental
Clearance Officer

RESPONSE: Comment accepted. Please see Generic Response A.

COMMENT

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
WASHINGTON, D.C. 20410

OFFICE OF THE ASSISTANT SECRETARY
FOR COMMUNITY PLANNING AND DEVELOPMENT

IN REPLY REFER TO:

JUN 26 1980

Mr. Dallas Miner
Director, Sanctuaries Program
Office of Coastal Zone Management
3300 Whitehaven Street, N.W.
Washington, D.C. 20235

Dear Mr. Miner:

As required under the Coastal Zone Management Act, we have reviewed the proposals for both Grey's Reef and Looe Key Marine Sanctuaries. Our Central, Regional and Area Office review indicates no areas of HUD concern.

In view of the lack of effect upon HUD programs, we have no objection to the proposed sanctuary plans.

Sincerely,

Study McFall
Office of Planning
and Program Coordination

RESPONSE

RESPONSE: Comment accepted. Please see Generic Response A.

LOGGED IN JUL 22 1980

DEPARTMENT OF TRANSPORTATION
REGIONAL REPRESENTATIVE OF THE SECRETARY
1720 PEACHTREE ROAD, NORTHWEST
SUITE 316
ATLANTA, GEORGIA 30309

July 15, 1980

Director, Sanctuaries Program
Office of Coastal Zone Management
3300 Whitehaven St., NW
Washington, D.C. 20235

Dear Sir:

In response to your letter of May 30, 1980, subject: Gray's Reef Marine Sanctuary Draft Environmental Impact Statement, enclosed is a copy of our Coast Guard response.

No Response necessary.

Sincerely,

J.L. McDaniel

J.R. McDaniel
Assistant Regional Representative

Enclosure

Copy to:

Bruce Barrett, Acting Director
Office of Environmental Affairs
U.S. Dept. of Commerce
Washington, D.C. 20230

OST, R-20

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:
COMMANDER (dpl)
Seventh Coast Guard District
51 S.W. 1st Avenue
Miami, Fla. 33130
Phone (305) 350-5502

16475

JUL 10 1980

Regional Representative
of the Secretary
U. S. Department of Transportation
Region IV
1720 Peachtree Road, NW
Atlanta, GA 30309

Dear Sir:

In response to your memorandum of 18 Jun 80, the Draft Environmental Impact Statement, Proposed Gray's Reef Marine Sanctuary, was reviewed. The following comments are provided:

1 a. Page 3, Section I, paragraph B.1. Proposed Management. This section fails to identify enforcement and surveillance as an integral part of the management and protection of the proposed marine sanctuary. This is the key to effective management of the resources. The statement should identify and discuss the specific responsibilities and authority for cooperative management of the proposed sanctuary. The Coast Guard is responsible for law enforcement, safety of life and property at sea, aids to navigation, search and rescue, etc. These responsibilities directly apply to the proposed marine sanctuary since it is located in international waters. It is suggested that the National Oceanic and Atmospheric Administration (NOAA) develop a Memorandum of Understanding (MOU) with the Coast Guard setting forth the specific responsibilities and reimbursement for costs of each party for management of the marine santuaries program. Coordination in developing the memorandum should be conducted at the headquarters level.

2 b. Page 10, Section I, paragraph D. Discharges from marine sanitation devices are regulated in territorial waters. The term, "territorial waters" should be changed to state waters. The statement, "Regulations to prevent pollution of marine systems from shipboard wastes, other than sewage and oil spillage, do not presently exist, should be expanded. The term, "marine systems" should be changed to marine waters. Regulation of marine pollution includes: oil and hazardous chemicals, marine sanitation devices, ocean dumping and dredging.

3 c. Page 11, Section I, paragraph E.1. Boundary. The statement, "The 57 sq km (16.68 sq nmi) sanctuary will also allow for adequate enforcement of sanctuary regulations," fails to identify and discuss how the boundary will be identified. Will the Coast Guard, as part of its aids to navigation responsibility, be required to place and maintain buoys to mark the sanctuary boundary? This responsibility should be identified and discussed in the (MOU) suggested in paragraph a, above.

RESPONSE 1: The FEIS has been corrected to include a discussion of enforcement and surveillance as an integral part of management and protection of the proposed marine sanctuary. See Section III. C. 1.: Proposed Gray's Reef Marine Sanctuary Management Plan.

RESPONSE 2: The FEIS has been expanded to include this comment.

RESPONSE 3: Section III. C. 1. addresses surveillance and enforcement of sanctuary regulations. Sanctuary boundary coordinates will be listed in the Designation Document and published in the Federal Register. The boundary will be delineated on official nautical charts prepared by the National Ocean Survey. The proposed Gray's Reef Marine Sanctuary Management Plan will identify and discuss how the sanctuary boundary will be physically identified (e.g., a marker buoy system) and who will be required to place and maintain the marker system.

d. Page 13, Section I, paragraph B.3. Achoring. The statement, "The proposed regulation would allow anchoring in soft sediment (sandy) areas within the sanctuary..." fails to discuss how the navigational position of vessels will be determined to insure anchoring occurs in designated areas. Will the Coast Guard be required to place and maintain buoys used to identify designated anchoring areas? This responsibility should be identified and discussed in the (MOU) suggested in paragraph a, above.

1

e. Page 18, Section III, paragraph B. The statement, "Regulation to prevent pollution of marine systems from shipboard wastes..." should be changed as suggested in paragraph b, above.

5

f. Page 21, Section III, paragraph C.2.a., On-site Manager. The statement, "NOAA is considering entering into a cooperative agreement with the Georgia Department of Natural Resources (DNR) whereby DNR would serve as on-site sanctuary manager," fails to identify and discuss the lack of authority for state enforcement in international waters. The Coast Guard is responsible for law enforcement in the area proposed for the marine sanctuary since it is in international waters. This responsibility should be identified and discussed in the (MOU) suggested in paragraph a, above.

6

The concept of an on-site manager is necessary; however, since this proposed sanctuary is entirely within international waters, the manager should be a federal officer. It is suggested that NOAA establish a "Marine Sanctuary Ranger" program similar to that used by the National Park Service for effective management of the resources.

g. Page 22, Section III, paragraph C.3.C. The statement, "NOAA will study the feasibility of placing marker buoys..." should be expanded as suggested in paragraph d, above.

7

h. Page 136, Section IV, paragraph F.2. The statement, "The U. S. Coast Guard is the enforcement agent for the OCSLA," should be expanded. The enforcement responsibilities of the Coast Guard on the outer continental shelf should be identified and discussed.

8

i. Page 138, Section IV, paragraph F.4. The statement, "The FCMA is enforced by the U. S. Coast Guard (USGS) and the National Marine Fisheries Service (NMFS) within the Department of Commerce," the (USGS) should be changed to (USCG). The Coast Guard is in the Department of Transportation, not Commerce.

9

j. Page 139, Section IV, paragraph F.4.C. The paragraph source reference, "(Custer, 1980, personal communication)" should be identified in section VII. References.

10

k. Page 140, Section IV, paragraph F.4.C. The statement, "NMFS relies primarily on the Coast Guard and the State in territorial waters...," should be expanded. The jurisdiction of the Coast Guard includes federal, state and international waters in the enforcement of federal maritime laws.

11

RESPONSE 4: The proposed regulation on vessel anchorage has been changed. See Generic Response E.

RESPONSE 5: The FEIS has been corrected to reflect this comment.

RESPONSE 6: The FEIS has been corrected to reflect this comment. See Secti
III. C. 1.

RESPONSE 7: The proposed Gray's Reef Marine Sanctuary Management Plan will discuss a study on the feasibility and desireability of placing marker buoys at the live bottom.

RESPONSE 8: A discussion of the enforcement responsibilities of the Coast Guard on the Outer Continental Shelf is included in the FEIS.

RESPONSE 9: The FEIS has been corrected to reflect this comment.

RESPONSE 10: The FEIS has been corrected to reflect this comment.

RESPONSE 11: The discussion of the Coast Guard's responsibilities in federal state and international waters in the enforcement of federal maritime laws h. been expanded in the FEIS.

Thank you for the opportunity to review this document.

Sincerely,

[redacted]
Commander, U. S. Coast Guard
District Planning Officer
By direction of the Commander
Seventh Coast Guard District

Copy: CGHQ (G-MES-1)
CGHQ (G-OLB-4)

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON 20426

IN REPLY REFER TO:

July 24, 1980

Mr. Michael Glazer
Assistant Administrator for
Coastal Zone Management
National Oceanic and Atmospheric
Administration
3300 Whitehaven Street, N.W.
Washington, D.C. 20235

Dear Mr. Glazer:

The staff of the Federal Energy Regulatory Commission (FERC) reviewed the Draft Environmental Impact Statement on the Proposed Gray's Reef Marine Sanctuary. The proposed sanctuary is located off the coast of Georgia.

A study of available maps shows there are no natural gas pipelines in or around the 57 square kilometers of the proposed marine sanctuary. Examination of information available as of August 1979 reveals no recent oil or gas production in the offshore Georgia area. In view of this it may be appropriate to amend the first sentence under item 10., Oil and Gas Activities, (page 106) by adding after the word sanctuary, "nor are there any natural gas or oil pipelines in Gray's Reef."

The DEIS does not mention the Federal Energy Regulatory Commission's jurisdiction over natural gas produced from the Outer Continental Shelf (OCS). We suggest the following information be included in the FEIS, possibly at the end of section E 10, Oil and Gas Activities (page 111) and in section F, the Legal Status Quo (page 121):

> All natural gas produced from the OCS is considered to be interstate and therefore is subject to FERC jurisdiction. The Natural Gas Act, the National Environmental Policy Act, and the OCS Lands Act Amendments of 1978 all grant authority or require that the FERC investigate the environmental effects of a proposed offshore project, as well as the potential gas reserves, the need for this gas, and the availability of capital to develop this resource. Also, the FERC is primarily responsible for administering and enforcing compliance with the Natural Gas Policy Act of 1978 (NGPA) (92 Stat. 3350). As applied to OCS matters, the NGPA provides new wellhead pricing controls for certain natural gas produced from the OCS.

RESPONSE

RESPONSE 1: The FEIS has been corrected to reflect this comment.

RESPONSE 2: The FEIS has been corrected to reflect this comment.

COMMENT

RESPONSE

We appreciate the opportunity to review the Draft Environmental Impact Statement on the Proposed Gray's Reef Marine Sanctuary and look forward to receiving the final version.

Sincerely,

Carl N. Shuster, Jr. - Ph.D.
Coordinator, Coastal Zone Affairs

cc: Honorable Gus Speth
Mr. Bruce Barrett
Mr. Joe Tanner

RESPONSE: Comment accepted. Also see Generic Response A.

COMMENT

RESPONSE

LOGGED IN JUL 22 1980

Department of Natural Resources
COASTAL RESOURCES DIVISION
COASTAL MANAGEMENT BOARD
1200 GLYNN AVENUE
BRUNSWICK, GEORGIA 31520
(912) 264-7289

Joe D. Tanner
COMMISSIONER

Robert J. Reimold
DIRECTOR

9 July 1980

Director
Sanctuary Programs
Office of Coastal Zone Management
NOAA
3300 Whitehaven Street, N. W.
Washington, D. C. 20235

Dear Sir:

On behalf of the Georgia Coastal Management Board, I wish to respond to your nomination of Gray's Reef as a marine sanctuary. Among the program goals of our State's Coastal Management Program, we see fulfillment of many of our objectives if the reef is established as a sanctuary. We feel that Georgia's coastal area offers unique possibilities for equitable environmental and economic growth and health. Our experiences with the Sapelo Island National Estuarine Sanctuary have proven beneficial to all the citizens of Georgia, as well as the many tourists from around the world who visit the Georgia coast.

Although we were unable to accept coercion from your office as to how Georgia should manage its coast, we concur that establishment of Gray's Reef as a marine sanctuary would benefit many citizens. It will also be valuable as a baseline or control for any reference to potential impact of offshore energy exploration and development.

We endorse the nomination and look forward to the official designation.

Sincerely,

J. Dewey Benefield
Chairman

JDB:jpp

RESPONSE: Comment accepted. Please see Generic Response A.

COMMENT

RESPONSE

LOGGED IN JUL 22 1980

Department of Natural Resources

GAME AND FISH DIVISION

Joe D. Tanner
COMMISSIONER

Hans Kleinhuis
DIVISION DIRECTOR

18 July 1980

Director
Sanctuaries Program
Office of Coastal Zone Management
NOAA
3300 Whitehaven Street, N.W.
Washington, D.C. 20235

Dear Sir:

As Chairman of the Georgia Board of Natural Resources, and lifetime resident of the Georgia coast, I would like to express my support for the proposed Gray's Reef Marine Sanctuary. Even though the sanctuary would fall outside Georgia's territorial waters, the program objectives and proposed management strategies would provide a logical extension of conservation and resource management efforts presently conducted by the state. Research and monitoring on and around Gray's Reef would give our resource managers additional information with which to make decisions about fisheries management and development.

I look forward to a successful outcome of the designation process and hope you will feel free to call upon me if I can expedite the project in any way.

Yours truly,

Sam Cofer
Chairman

SC:jpb

RESPONSE: Comment accepted. Please see Generic Response A.

LOGGED IN JUL 22 1980

Department of Natural Resources

270 WASHINGTON ST., S.W.
ATLANTA, GEORGIA 30334
(404) 656-3500

Joe D. Tanner
Commissioner

July 14, 1980

Director
Sanctuary Programs Office
Office of Coastal Zone Management
NOAA
330 Whitehaven Street, N.W.
Washington, D.C. 20235

Dear Director:

In regard to the proposed regulations, Gray's Reef Marine Sanctuary, the Georgia Department of Natural Resources found the proposal generally consistent with its goals and policies. It has been suggested that, although the regulations provide prohibitions which will help protect the live bottoms from anchor damage, further protection could be derived from the placement of mooring buoys at specific locations designating mooring points for fishermen and divers.

The Department appreciates your agencies efforts for this valuable resource.

Sincerely,

for Barbara A. Hagan
Comprehensive Review Coordinator

BAH:ca

RESPONSE: Comment accepted. Please see Generic Response A.

COMMENT

RESPONSE

Office of Planning and Budget

Executive Department

Chas T. Stevens
Director

GEORGIA STATE CLEARINGHOUSE MEMORANDUM

TO: Dr. Nancy Foster, Deputy Director
Sanctuary Programs Office
OCZM
3300 Whitehaven Street, N.W.
Washington, D.C. 20235

FROM: Charles H. Badger, Administrator
Georgia State Clearinghouse
Office of Planning and Budget

DATE: July 31, 1980

SUBJECT: RESULTS OF STATE-LEVEL REVIEW

Applicant: U. S. Department of Commerce/NOAA/CZM

Project: Draft EIS Proposed Gray's Reef Marine Sanctuary

State Application Identifier: 80-06-26-03

The State-level review of the above-referenced document has been completed. As a result of the environmental review process, the activity this document was prepared for is recommended for further development with the following recommendations for strengthening the project:

1 The DEIS states that recreational fishing does not pose a present threat to fishery resources at Gray's Reef. This is probably true; however, recreational fishing at increased levels of harvest could be a significant threat and must be closely monitored. NOAA's decision to rely on the South Atlantic Fishery Management Council (SAFMC) to monitor pressure and harvest is a wise decision as long as open communication is maintained and specific controls may be instituted for Gray's Reef as they are deemed necessary. The Department does not believe the DEIS makes it clear that recreational harvest at Gray's Reef will be closely monitored.

2 The diving community of coastal Georgia does not fully understand that NOAA only plans to monitor spearfishing at the present time and that no controls are proposed. NOAA should make a more conscientious effort to make this point explicitly clear to those concerned. In addition, divers will require more general information about the biology of reef fishes,

RESPONSE 1: The FEIS has been expanded to incorporate this concern. Also see Generic Responses D and F.

RESPONSE 2: The FEIS has been expanded to incorporate this concern. Also see Generic Responses D and F.

COMMENT

especially with regard to their extremely slow growth and reproductive characteristics. NOAA should consult with the SAFMC Snapper/Grouper Plan Development Team relative to the optimum size (age class) at which reef fishes should be harvested and then disseminate this information to the diving community.

3 In the Department's opinion, there is not enough data available to determine if the anchoring of small vessels (less than 30 feet) on the live bottom could be a significant threat to Gray's Reef. Under "Regulatory Alternatives for Vessel Anchorage" (p. 34), it is suggested that a fourth alternative be considered that would provide for monitoring of anchoring by these small vessels to determine the degree of impact.

4 NOAA's preferred alternative of allowing the use of wire fish traps, bottom trawling, dredging and other equipment only for scientific research and by permit, is a wise decision. This offers the best opportunity to protect the reef from potential negative impact of these gears. The permitting should be closely monitored.

The following State agencies have been offered the opportunity to review and comment on this project: Department of Natural Resources
Office of Planning & Budget, Executive Department

cc: Bruce Barrett, OCZM
Barbara Hogan, DNR

CMB:agf

RESPONSE

RESPONSE 3: The proposed regulation on anchoring has been changed in the FEIS to provide for monitoring rather than regulating vessel anchoring. Also see Generic Response E.

RESPONSE 4: Comment accepted. Also see Generic Response A.

COMMENT

AtlanticRichfieldCompany
Environmental and Energy Conservation
515 South Flower Street
Mailing Address: Box 2679 - T.A.
Los Angeles, California 90051
Telephone 213 486 3741

Anne Lindstedt Stoss, Ph.D.
Senior Science Advisor
Environmental Sciences

August 6, 1980

Director, Sanctuaries Program
Office of Coastal Zone Management
3300 Whitehaven Street, N.W.
Washington, D.C. 20235

Dear Director:

Re: Gray's Reef Marine Sanctuary DEIS

From recent communication with Dr. Nancy Foster, we understand that you will accept comments on the Draft Environmental Impact Statement for the proposed Gray's Reef Marine Sanctuary until 11 August 1980.

1| Atlantic Richfield Company does not have operations in this area, but because we consider protection of marine resources important, we appreciate this opportunity to provide the following comments for your consideration.

2| We support designation of Gray's Reef as a marine sanctuary. The proposed size of the sanctuary, including the buffer zone, 16.68 square nautical miles, appears reasonable for protection of the reef, and should allow adequately for development of potential oil and gas resources, if any are found in that area.

3| The designation of Gray's Reef as a marine sanctuary would represent an improvement over the present status quo, giving the area more protection than it now has. At present there seem to be no restrictions on anchoraging, dredging, bottom trawling, use of fish traps or spearfishing. Under the NOAA proposal these activities could be conducted by permit only or (as in the case of spearfishing) their impacts will be monitored with possible regulation to follow. Certainly all of the above uses are in conflict with the principal purpose of a sanctuary designation, "to protect and preserve..."

4| As with previous proposals, this would not be a true "sanctuary", since consumptive uses will be permitted. Rather, it would be a selective-use area. In my view, the most serious conflict with the sanctuary purpose is to allow spearfishing. Spearfishing not only alters the species composition of reef fishes but also alters their behavior. Many divers have observed these changes in heavily fished areas. Dr. Neal Davis (1) has observed these differences at sites near San Diego, where spearfishing is allowed, compared to the La Jolla underwater reserve (where no spearfishing is allowed). Certainly allowing spearfishing on Gray's Reef would detract from both its educational and esthetic values.

RESPONSE

RESPONSE 1: Comment accepted. Please see Generic Response A.

RESPONSE 2: Comment accepted.

RESPONSE 3: Comment accepted.

RESPONSE 4: Comment accepted. Please see Generic Response D.

COMMENT

RESPONSE

5 If you have any questions or require additional information, please contact me.

Sincerely,

June Lindstedt-Siva

(1) Dr. Noel Davis, Sr. Marine Biologist, Chambers Consultants and Planners, Newport Beach, CA

RESPONSE 5: Comment accepted.

COMMENT

RESPONSE

Atlantic States Marine Fisheries Commission

1717 Massachusetts Avenue, N.W.

Washington, D. C. 20036

June 30, 1980

Mr. Dallas Miner
Director, Sanctuaries Program
Office of Coastal Zone Management
3300 Whitehaven Street, NW
Washington, DC 20235

re: DEIS Proposed Gray's Reef Marine Sanctuary, May 1980.

Dear Mr. Miner:

Having reviewed the Draft Environmental Impact Statement of May 1980, on the Proposed Gray's Reef Marine Sanctuary, on behalf of the Atlantic States Marine Fisheries Commission, I am writing in support of the proposal to designate the Gray's Reef Marine Sanctuary under the terms described in Sections I. and III.E and for the purposes delineated in Section II. 1

The Commissioners and the member-States marine resource agencies are in agreement that a Gray's Reef marine sanctuary designation would provide for a program of integrated management and regulation for this unique nearshore live bottom reef supporting within its area an abundance of species, habitat, and resources that require maintenance, protection and enhancement from threatening misuse. 2

The proposed integrated management and regulatory program for the Gray's Reef Marine Sanctuary is entirely consistent with the purposes of our interstate compact

RESPONSE 1: Comment accepted. Please see Generic Response A.

RESPONSE 2: Comment accepted. Please see Generic Response A.

COMMENT

which promotes the protection and best utilization of the
3 marine finfish, shellfish, and anadromous fisheries resources of the Atlantic seaboard.

In respect to the above, the Atlantic States Marine Fisheries Commission, through its participating membership on the South Atlantic Regional Fishery Management Council has endorsed, in conjunction with the states of Georgia, Florida, North
4 and South Carolina, jointly members of the Council and the Commission, the Draft Environmental Impact Statement for the proposed Gray's Reef Sanctuary at the Council meeting of May 27, 1980.

Sincerely,

Irwin M. Alperin

Irwin M. Alperin
Executive Director

/w

RESPONSE

RESPONSE 3: Comment accepted. Please see Generic Response A.

RESPONSE 4: Comment accepted. Please see Generic Response A.

COMMENT

RESPONSE

LOGGED IN JUL 22 1980

EMORY UNIVERSITY
ATLANTA, GEORGIA 30322

DEPARTMENT OF BIOLOGY

July 15, 1980

Ms. Dallas Miner
Office of Coastal Management
3300 Whitehaven Street, N. W.
Washington, D. C. 20235

Dear Ms. Miner:

I am pleased to know that Grey's Reef is being considered as a National Marine Sanctuary. This seems to me to be an extremely important area for protection and control. There is no need for me to reiterate all of the biological and ecological reasons.

During the past five years I have been teaching two summer courses related to coastal biology in and around St. Simons Island. We have plans to extend our study out somewhat into the immediate off shore regions. Grey's Reef provides an excellent area for study and its protection and regulated use would guarantee this place for the future classes.

Several other members of our biology department have indicated possible future use of this area in their research programs.

I would like to recommend that Grey's Reef be designated as a Marine Sanctuary.

Sincerely,

W. E. Brillhart

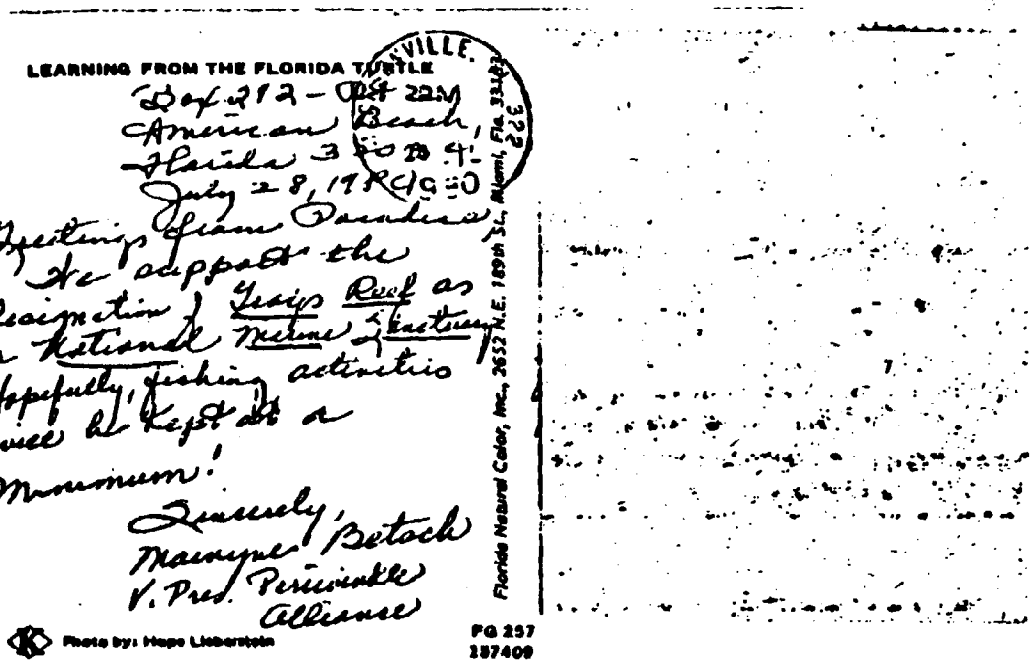
William E. Brillhart
Associate Professor

WEB/cb

RESPONSE: Comment accepted. Please see Generic Response A.

COMMENT

RESPONSE



RESPONSE: Comment accepted. Please see Generic Response A.

COMMENT

Riverbanks zoological park

500 wildlife parkway, columbia, s. c. 29210, USA • (803) 779-8717
Palmer Kranz, director

June 18, 1980

Sanctuaries Program
Office of Coastal Zone Management
3300 Whitehaven Street, N.W.
Washington, DC 20235

Dear Sir,

Thank you for including us in the list of recipients of the Draft Environmental Impact Statement on the Proposed Gray's Reef Marine Sanctuary, dated May 1980. Although, I have commented on an earlier version of this action, I would like to offer a few additional comments, and supply some additional data, primarily of a general nature and involving marine mollusks.

1| I would like to offer my support to the official designation of Gray's Reef Marine Sanctuary. This draft demonstrates a far greater study than the earlier report as it concerns geological and ecological parameters of this area in particular and the Southeast coastal and offshore areas in general. Although the educational, research and recreational values are obvious, the strategic location of this reef among potential offshore drilling sites vastly increases its importance. I am not especially worried about the potential danger to the reef and its sessile inhabitants from dropped anchors, biological trawling, and related non-commercial activities, dangers which have not been noted to date anyway. The inhand value of this reef to researchers and educators will be of immense value should a disaster occur at a later date.

2| As mentioned in the Draft, this reef includes faunal assemblages having both inshore and offshore affinities, the latter including many tropical species. As my work has principly involved mollusks, I am enclosing a list of the larger species which I have found offshore in a living condition during six oceanographic cruises off the Carolinas and Georgia. Although this list is not exhaustive, I would suspect that most species are found on this reef regardless of whether they appear on Appendix F or not. At least as far as this conspicuous and hardy phylum is concerned, the recent (1974) work of Hugh J. Porter, The North Carolina Marine and Estuarine Mollusca, An Atlas of Occurrence, should be of invaluable use in interpolating the reef's species.

3| As mentioned earlier, at least as far as mollusks are concerned, the list in Appendix F which appears in both reports, is probably a fraction of the total species extant, even among the larger ones. The source of the list

RESPONSE

RESPONSE 1: Comment accepted. Please see Generic Response A.

RESPONSE 2: Comment accepted. Please see Generic Response A.

RESPONSE 3: The species lists in the DEIS for the living marine organisms at Gray's Reef are incomplete. Appendix F represents a preliminary invertebrate species list compiled from several sources, primarily from unpublished collection notes (Gray, 1961; Hunt, 1974; Porter, 1979, personal communication; Shipman, 1979, personal communication; Edwards, 1980, personal communication).

While many collections have been made at Gray's Reef to date, there has been limited coordination among investigators which has resulted in scattered and incomplete collections. Furthermore, collections have been distributed to experts around the world for positive taxonomic identification, adding to the scatter and creating the potential for losses. Farming out of collections and the timely identification process for most groups also means a period of several years before results are available. For example, work on the invertebrates collected by Gray in 1961 has not been complete; it may take several good taxonomists several years to catalogue the Gray collection (Kaueter, 1979, personal communication).

The proposed Gray's Reef Marine Sanctuary Management Plan will address specific strategies to coordinate the identification of current marine specimen holdings, to facilitate information exchange among investigators, to initiate additional research, where needed, and to establish a repository concerning live bottom resources in the South Atlantic.

COMMENT

RESPONSE

is not given. I would not recommend total support of this list. One large bivalve, for instance which appeared on the list, Arca zebra, could well be mis-identified, a common problem, and actually is Arca imbricata, a reef species of shallower water. A publication demonstrating their physiological differences in Carolina waters is included. Glycymeris americana would also be unpected due to the shallowness of the water.

4 | Lists of invertebrates, molluscan and otherwise, known to occur off the Southeast have frequently been taken from single findings or older publications derived from sketchy data. Often new supportive data is lacking. Virtually nothing is known about the preferred depths, habitat and abundance of many species. Often species reported from North Carolina and South Florida where more extensive sampling has occurred have never been found in between. Now with the periodic appearance of commercial scallop beds, Argopecten gibbus, off the Carolina coasts, commercial harvesting has revealed large quantities of invertebrate species seldom or never recorded before. A new bed is just now being surveyed and a summerization of the data is being prepared for publication.

The point here is that we are receiving numerous surprises just within this one phylum, a situation probably repeatable for other phyla if workers were available. After this Proposal is completed and Sanctuary status provided,
5 | I do encourage this reef to be investigated and thoroughly sampled for later assessment should an ecological disaster occur. Mere collection by SCUBA is not sufficient. I do not think that serious or long standing damage would occur to the reef but the information would be extremely useful.

6 | As it affects South Carolina, I am also including a copy of the First South Carolina Endangered Species Symposium which includes some of the potential problems examined for this state. The bibliography may also be of use.

7 | Additional live bottom reefs have been located and sampled by Duke University's R/V Eastward in 1970 at Stations 15616, 15651, 15660, 15664, and 15671. Some of these are located midway between Frying Pan Shoals and Cape Lookout in Onslow Bay, NC and are well known to the marine community.

8 | I hope this program proceeds to its culmination and would be glad to add any information possible. I am sorry that I cannot attend the public hearings, hence these written comments.

Yours truly,

Alan M. Shoemaker
Zoologist

AMS/jrp

Enclosure

cc: Dr. Bruce Barrett

RESPONSE 4: Comment accepted. Please see Generic Response A.

RESPONSE 5: Comment accepted. Please see Generic Response A.

RESPONSE 6: Comment accepted. The attached materials have been filed in the Gray's Reef Reference Collection. Please see Generic Response A.

RESPONSE 7: Comment accepted. Please see Generic Response A.

RESPONSE 8: Comment accepted. Please see Generic Response A.

COMMENT

LOGGED IN JUL 22 1980

SAVANNAH STATE COLLEGE
STATE COLLEGE BRANCH
SAVANNAH, GEORGIA

DIVISION OF NATURAL SCIENCES
Marine Biology Program

14 July 1980

Dr. Nancy Foster, Deputy Director
Sanctuary Programs Office
OCZM
3300 Whitehaven St., NW
Washington, D.C.

Dear Dr. Foster,

I am an assistant professor in the Marine Biology Program at Savannah State College, Savannah, Ga., and I wish to comment on the DEIS for the proposed Gray's Reef Marine Sanctuary. I am in favor of making Gray's Reef a marine sanctuary as proposed in the DEIS with the possible exception of one detail that will be discussed later. The primary reason for my support involves the research potential of an offshore hard ground on the southeastern continental shelf. As noted in the DEIS, very little is known concerning the biology or systems ecology of live bottoms, but it is well known that sport and commercial fish concentrate over and in these habitats. Structure, relief or actual habitat space are probably important, but obviously the production of organisms lower in the marine food chains must be quite high in order to support the predaceous fish populations. As a marine ecologist and particularly as a benthic algal ecologist, I am extremely interested in determining why, biologically, fish congregate in these areas and how, biologically, they are maintained or sustained. Little is known of the benthic marine algae on the continental shelf of Georgia, as was noted in the DEIS, and perhaps even more importantly, little is known of the contribution of benthic seaweeds to the continental shelf food chains for the entire southeastern coast. Establishing the Gray's Reef area as a marine sanctuary and funding research to study these very basic questions would be a positive impact that could eventually effect all users (commercial, sport, recreational, educational and certainly research) of the live bottoms along the southern coast - not just Gray's reef itself. As use of continental shelf waters increases, it will be important to understand the biological systems being affected. It appears to me that designation of Marine Sanctuary Status to Gray's Reef would provide an experimental control area (where research is permitted and encouraged) which could allow and perhaps expedite research of the biological interactions occurring on and over southeastern hardbottoms.

1

The only detail that I question in the DEIS is the regulation of anchoring which would allow anchoring only in soft bottom areas. While I agree totally with the concept and the thought behind it, I question whether or not such a regulation is 1) enforceable and 2) fair to those visitors to Gray's Reef who do not have the equipment and skill for locating and positioning in sandy areas. I have not been diving at Gray's Reef and therefore cannot offer an opinion as to whether potential or actual anchor damage is really in need of regulation.

2

Thank you for this opportunity. I will be extremely happy to help your office in any way I can.

Sincerely yours,

Joseph P. Richardson
Coordinator, Marine Biology Program

RESPONSE

RESPONSE 1: Comment accepted. Please see Generic Response A.

RESPONSE 2: The proposed regulation on anchoring within the sanctuary has been changed in the FEIS. See Generic Response E.

COMMENT

RESPONSE

SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL

1 SOUTHPARK CIRCLE, SUITE 306 CHARLESTON, S.C. 29407

TELEPHONE (803) 571-4366

DAVID H.G. GOULD, CHAIRMAN
FORREST A. SHARPE, VICE CHAIRWOMAN

ERNEST D. PRIMROSE, EXECUTIVE DIRECTOR

June 8, 1988

Dr. Nancy Foster
Deputy Director
Sanctuary Programs Officer
OCZM
3300 Whitehaven St., N.W.
Washington, D.C. 20235

Subject: Grays Reef Sanctuary DEIS

Dear Dr. Foster

The South Atlantic Council, at its May meeting, critically reviewed the Grays Reef sanctuary DEIS.

The Council accepted and endorsed the DEIS as presented.

We want to compliment your office on an outstanding job.

Sincerely,

Ernest D. Primrose
Executive Director

EDP:ig

cc: Members, South Atlantic Council

RESPONSE: Comment accepted. Please see Generic Response A.

COMMENT

RESPONSE

The Wilderness Society

Southeastern Regional Office
3110 Maple Drive, Suite 407, Atlanta, GA 30305 · Telephone (404) 262-1267

15 July, 1980

Dr. Nancy Foster, Deputy Director
Sanctuary Programs Office
OCZM
3300 Whitehaven St., N.W.
Washington, D.C. 20235

LOGGED IN JUL 22 1980

Dear Dr. Foster:

After reviewing the various management plans described in the Draft Environmental Impact Statement on the proposed Gray's Reef Marine Sanctuary, I would like to express my support for what was referred to as the Preferred Alternative management plan.

The Preferred Alternative represents a reasonable and responsible plan for the protection and management of the reef as it will require. The sanctuary will preserve the reef, its diverse flora and fauna, for the recreationist and researcher alike.

On behalf of The Wilderness Society I am,

Sincerely,

Randall D. Snodgrass

Randall D. Snodgrass
Southeast Representative
THE WILDERNESS SOCIETY

RESPONSE: Comment accepted. Please see Generic Response A.

Roy

156 Dove Ave.
Tavernier, Fla. 33070
26 June 1980

Director, Sanctuaries Program
Office of Coastal Zone Management
3300 Whitehaven Street, N.W.
Washington, D.C. 20235

Dear Sir:

Enclosed are the comments I have made while examining the DEIS on Gray's Reef. The first section consists of detailed comments on the DEIS statements; the second section consists of my discussion and conclusions.

1 | page 21, para. 4 -- The idea of an advisory committee of all concerned is good, but this committee should have some regulatory power rather than be just advisory.

2 | page 39, para. 2, lines 6 & 7 -- The Gulf of Mexico Fishery Management Council is initiating a Fishery plan for the tropical fish fishery.

3 | page 39, para. 5, lines 6-9 -- By your own admission, the time and effort to complete the paperwork you would require would be a significant burden on these people. It would be especially onerous on hobbyist collectors.

4 | page 40, para. 2, lines 6-7 -- You state that no commercial collectors are known to fish Gray's Reef. How can you be positive, when no permits or licenses are presently required! Would you prohibit even one commercial collector by excluding him from the ranks of potential permittees, on the basis that he's too minor to matter! How about people who collect for their own aquaria! You don't allow for any collecting other than for research and education, under all but "status quo" alternatives. If the activity is as minor as you seem to think, what is the harm in allowing it!

5 | page 171 -- You are forgetting the hobbyist tropical specimen collector.

6 | appendix A -- the specific sanctuary boundaries should be itemized in the Designation Document.

OCZM still seems to have a blind spot about hobbyist specimen collecting. In the Gray's Reef area, OCZM admits that this activity is minor, but intends to prohibit it anyway as a convenience, even though it would not have a significant impact on the environment.

RESPONSE 1: Pursuant to the Marine Protection, Research and Sanctuaries Act of 1972, NOAA, through the Secretary of Commerce, has regulatory authority in marine sanctuaries. Advisory committees may be established to advise NOAA and recommend courses of action concerning sanctuary management, but they do not have any regulatory power.

RESPONSE 2: The Gulf of Mexico and the South Atlantic Fishery Management Councils have scheduled a Scoping Meeting to preliminarily determine the feasibility and desireability of developing a Joint Tropical Reef Fish Fishery Management Plan. A technical committee on tropical reef fish will meet to discuss what species, problems and issues, and regulatory options a plan should address. The committee may decide that only a Profile Study: A Description of the Fishery is needed at the present time, rather than a management plan (Leary, 1980, personal communication).

RESPONSE 3: The proposed Gray's Reef Marine Sanctuary Management Plan will address stategies to simplify the permitting process and to relieve any burden to applicants and permittees.

RESPONSE 4: A preliminary survey of Gray's Reef user groups indicates that there are no commercial marine specimen collectors fishing at the live bottom. A small number of local divers collect occasionally for home aquaria. The proposed regulation does not necessarily exclude the hobbyist collector. According to Section 938.8 of the draft regulations for Gray's Reef, in considering whether to grant a permit, the Assistant Administrator evaluates: (1) the general professional and financial responsibility of the applicant; (2) the appropriateness of the methods envisioned to the purpose(s) of the activity; (3) the extent to which the conduct of any permitted activity may diminish or enhance the value of the Sanctuary; (4) the end value of the activity; i.e., if the intended activity is (a) for research related to the resources of the Sanctuary, (b) to further the educational value of the Sanctuary, or (c) for salvage or recovery operations; and (5) other matters as deemed appropriate. Each permit application is judged on individual merit. Theoretically, if the hobbyist collector could justify how his activities might further the scientific understanding of the live bottom or promote the educational value of the sanctuary and if the proposed activity was amenable with other uses of the sanctuary, the Assistant Administrator might be inclined to consider the permit for approval. There are scientific and educational values which bear little present relationship to pragmatism, but which relate to man's appreciation of natural resources and science in a cultural sense.

RESPONSE 6: See Response 4 above.

RESPONSE 6: The ERRATA Sheet accompanying the DEIS acknowledges the unintentional omission of the specific sanctuary boundary in the draft Designation Document. The FEIS has been corrected to include coordinate values for the proposed sanctuary boundary.

I don't believe that the "wise use" advocated by OCZM needs to exclude minor tropical specimen collecting, because "minor" is automatically a use that has little impact on an environment, especially when the collecting is of members of a renewable resource. 7

As in the Looe Key DEIS, the Assistant Administrator has sole permit-granting authority, and the permit application seems excessively laborious for a hobbyist collector, in time and effort. If tropical fish collecting is allowed by permit in the Designation Document, then the permit should be given to all present users of Gray's Reef, upon their application. There is no reason to restrict tropical specimen collecting to research and education. 8

I think that you inadvertently omitted a whole section of References, those whose names start with "D" and "E." They should be between pages 180 and 181. In addition, there are some references in the text that do not appear in the "References" section, for instance: Powles & Stender, 1976 (page 69) and Ulrich et al, 1977 (page 93). 9

This is a good DEIS, and the area has value as a potential Sanctuary, as an example of that type of ecosystem. However, the regulations must be fair to everyone, and the user groups must take part in formulating and approving them. No one should be put out of business. 10

Yours truly,

Henry A. Feddern

Henry A. Feddern, PhD
Ichthyologist
Executive Director, Florida
Marine Life Association

RESPONSE 7: See Response 4 above.

RESPONSE 8: See Response 3 above.

RESPONSE 9: The FEIS has been corrected to include the references inadvertantly omitted in the DEIS.

RESPONSE 10: Comment accepted. Please see Generic Response A.

COMMENT

RESPONSE

LOGGED IN JUL 22 1980

Director, Sanctuaries Program
Office of Coastal Zone Management
[illegible] Whitehaven Street, N.W.
Washington, D.C. 20235
U.S.A.

8.Juli 80

Subject: Proposed Gray's Reef Marine Sanctuary

Dear Sir,

As foreign marine scientists, having worked several times in the offshore waters of the State of Georgia, we support the proposed Gray's Reef Marine Sanctuary very much. The area, indicated in the draft of the environmental impact statement on the proposed Gray's Reef Marine Sanctuary, is marked as a unique environment. As an environment where cold and warm water species meet it is highly necessary to establish a sanctuary and protect and preserve the live bottom ecosystem and insure the availability of the area as an ecological, research, and recreational resource.

Sincerely
yours,

(Prof. Dr. H.-E. Reinwald)

Sincerely
yours,

(Dr. Jürgen Dörjes)

RESPONSE: Comment accepted. Please see Generic Response A.

APPENDIX L

HARDBOTTOM IDENTIFICATION: A GLOSSARY OF TERMS

The scientific literature contains reports of various hardbottoms, live bottoms, patch reefs, black reefs, snapper banks, limestone reefs and algal reefs found scattered across the South Atlantic Continental Shelf. However, very little data are available to fully characterize these areas or to allow for comparisons. Preliminary data suggest differences in substrate composition, morphology and relief, geological origin and history, water depth and geographical location.

The following glossary has been prepared from descriptions of hardbottom areas appearing in the literature.

ALGAL REEFS - Algal rock composed of "lithothamnion balls" or coralline algal nodules formed principally by Lithothamnion, with a framework of calcareous algae and lesser amounts of bryozoans and worm tubes; and coquina rock (Menzies et al., 1966). Shelf edge algal prominences formed by relict calcareous sources deposited during lower stands of sea level mainly during the Holicene transgression (Menzies et al., 1966; Rona, 1969; Zarudiski and Uchupi, 1968) or by coralline algal sources (forming limestone) or calcareous sources (forming sandstone) in areas of low deposition and therefore not buried by recent sediments, rather than as a result of unique constructional processes (Macintyre and Milliman, 1970). Reef building activities of serpulid worms, bryozoans and limesecreting algae (occurring fairly continuously since the post-Wisconsin sea level rise) are interrupted periodically by chemical and physical submarine weathering, shifting sediments and boring and burrowing by other organisms (BLM, USDI, 1979).

BLACK ROCKS - Hardbottom areas composed of a base of Trent Marl with Vermicularia spirata (gastropod) and tubiculous polychaetes forming a reef cap (Pearce and Williams, 1951).

CORAL REEFS - Emergent substrate deposited by calcareous scleractinian (reef-building) coral and attendent coralline algae. Often considered "living" in light of their biohermal nature.

FISHING BANKS - Colloquial or local term for hardbanks which support finfisheries of commercial and recreational value.

HARDBANK - Longitudinal areas or bands of discontinuously exposed hardground found in inner, middle and outer continental shelf locations.

HARDBOTTOM - Hard layers of rock composed of various constructional materials which either outcrop on the seafloor or are covered by a veneer of sand of variable thickness. Exposed hardbottoms are probably always covered with epifauna and have an associated fish population though the quantity and quality may be quite variable. Sand covered hardbottom may also support variable biomass and number species depending on the thickness of the sand layer. If too thick, the area does not support attached epifauna (barren sandy bottom), but if the layer is thin, a relatively large number of attached biota and fish may be present (live sandy bottom) (BLM, USDI, 1979). Exposed hardbottom

or hardground occur as patch reefs or as part of more extensive hardbanks. Three morphotypes of hardbottom have been described: (1) low-relief hardgrounds (less than 0.5 meters of relief); (2) moderate relief reefs (0.5-2.0 meters of relief); and (3) shelf-edge reefs (2-10 meters or more in relief) (Henry and Giles, 1978).

HARDBOTTOM REFLECTOR - Surface or subsurface hard layer detected by high resolution seismic (geophysical) studies.

HARDGROUNDS - Hard layer of either sedimentary origin (lithified to semiconsolidated rock) or of biohermal origin (deposited by living organisms such as corals or algae). Somewhat synonymous with the term hardbottom.

HARD LAYER - Layer of consolidated or semiconsolidated material on the sea floor as opposed to soft bottom or sedimentary layer.

LIMESTONE REEFS - Emergent hard layer composed of various limestone-forming materials: (1) moderately to strongly dolomitized, sandy biomicrite, stratigraphically and lithologically similar to coastal (Georgia) Duplin Marl of Pliocene (?) age (Gray's Reef: Hunt, 1974); (2) coquina (bivalve shell) limestone of Pleistocene age (Raleigh Bay, North Carolina, Onslow Bay, North Carolina and Long Bay, North and South Carolina: Milliman et al., 1968); (3) phosphatic limestone (Onslow Bay: Milliman et al, 1968); (4) carbonate shell and quartz sand conglomerate limestone (Powles and Barans, manuscript); and (5) coralline algal limestone (shelf edge: Macintyre and Milliman, 1970).

LIVE BOTTOM REEF - "Islands" of broken relief consisting of outcrops of rock which are heavily encrusted with such sessile invertebrates as sponges and sea fans and which harbor a rich association of subtropical and tropical species of fish (Struhsaker, 1969). "Areas containing biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids anemones, ascidians, sponges, bryozoans and hard corals living upon and attached to naturally occurring hard or rocky formations with rough or smooth topography; and whose lithotope favors accumulation of turtles, pelagic and demersal fish. Other names given to these areas are hardbottoms, coral patches, fishing banks, snapper banks, block rocks and limestone or "lithathamnion reefs" (BLM, USDI, 1978).

PATCH REEFS - Emergent hardbottom of various constructional components which are very discontinuous and patchy in distribution.

SNAPPER BANKS - Colloquial or local term for hardbanks which support demersal (bottom dwelling) fish, such as snappers, groupers, black sea bass and other reef fish of recreational and commercial value. Migratory pelagic game fish such as king and Spanish mackerel, cobia and bonita are also encountered at these banks. Savannah Snapper Banks, Brunswick Snapper Banks and Fernandina Snapper Banks located in the South Atlantic off Georgia and northeastern Florida are probably part of a long, discontinuous middle shelf hardbank which extends from off Onslow Bay, North Carolina to off Jacksonville Beach, Florida.