

chapter IV
special management
areas

A. GEOGRAPHIC AREAS OF PARTICULAR CONCERN

1. Introduction

Statutory Requirements

The Federal Coastal Zone Management Act of 1972, while recognizing the entire coastal zone of each state as an important and vital resource, also declares that certain areas are of even more, special significance, and warrant particular attention to their preservation and development. The Act requires, in Section 305(B)(3), that each state inventory and designate the "Areas of Particular Concern" within its coastal zone as part of the state's program.

Section 923.21 of the Coastal Zone Management Development and Approval Regulations (**Federal Register**, Vol. 44, No. 61, March 1979) defines the Federal requirements for Geographic Areas of Particular Concern (GAPCs). The subsection reads as follows:

- (a) **Requirement.** In order to meet the requirements of subsections 305(b) (3) & (5) of the Act, States must:
 - (1) Designate geographic areas that are of particular concern, on a generic or site-specific basis or both;
 - (2) Describe the nature of the concern and the basis on which designations are made;
 - (3) Describe how the management program addresses and resolves the concerns for which areas are designated; and
 - (4) Provide guidelines regarding priorities of uses in these areas, including guidelines on uses of lowest priority.

The major emphasis in the GAPC segment of a coastal management program, from the Federal viewpoint, is on the adequacy of the State's authority to manage those areas or sites which have been identified. To a lesser extent, the reasons specific areas are significant as coastal resources and the criteria which establish this significance are also important for inclusion. The individual states may inventory and identify those areas which are significant given the coastal problems or issues which are characteristic of that particular state. Guidance for this designation process is provided in the coastal legislation passed in South Carolina in 1977.

Section 8(B)(4) of the South Carolina Coastal Zone Management Act (Appendix B) mandates that this comprehensive program include the identification of special management areas. It reads as follows:

In devising the management program the Council shall:

- (a) Inventory and designate areas of critical state concern within the coastal zone, such as port areas, significant natural and environmental, industrial and recreational areas.

These "areas of critical state concern" parallel the geographic area of particular concern requirements mandated by the Federal legislation. The designation process and the areas identified as GAPCs can be devised so as to be consistent with policies for preservation and development of South Carolina's coastal resources, as stated in the South Carolina Coastal Zone Management Act.

Selected Approach

In order to meet both the Federal and State requirements, this report identifies, maps, and describes the Geographic Areas of Particular Concern in the eight-county coastal zone.

South Carolina has defined Geographic Areas of Particular Concern in its coastal zone in terms of four broad categories:

- Areas of unique natural resource value, including those exhibiting scarce or vulnerable natural habitats and physical features; those offering substantial recreational value; and those of vital importance in protecting and maintaining coastal resources.
- Areas where activities, development, or facilities depend on proximity to coastal waters, in terms of use or access.
- Areas of special historical, archeological or cultural significance.

For each of these categories, standards or criteria are defined, priority of uses within the area are specified, and the specific geographic sites or areas within the coastal zone are identified. Detailed descriptions of each designated site are found in the Appendix F.

In the earliest phases of coastal zone management in South Carolina, an extensive National Resources Inventory was completed. This inventory, the pertinent State and Federal regulations, and considerable assistance from the Heritage Trust Program were the initial basis for designation of Geographic Areas of Particular Concern (GAPCs) within each of the four categories.

When a first draft of the GAPC segment was completed and adopted in draft form by the South Carolina Coastal Council, it was mailed to the many individuals, and State and Federal agencies on the Council's mailing list. Numerous comments, corrections, and additions were received as a result, and subsequently these have been incorporated.

In addition, the County Citizens Working Groups, organized in each of the eight coastal counties, (described in Chapter V(E) received copies of the first draft of the GAPC document. Meetings were held to discuss the Geographic Areas of Particular Concern in detail with staff and Council members. As a result, substantive input from every section of the coastal zone was received in the designation of South Carolina's Geographic Areas of Particular Concern.

The areas included in this section are of such special importance and concern to South Carolina that the State has established regulatory and/or management controls over them. The inclusion of these areas within the scope of the management program combined with the critical areas designated by the S. C. Coastal Management Act — tidelands, coastal waters, beaches, primary sand dunes — effectively cover all those areas of specific resource concern in South Carolina's coastal zone.

The authority which assures adequate management of GAPCs is Sections 7(A) and 8(B)(11) (described fully in the Legal Analysis section) of the South Carolina Coastal Management Act. This coordination and certification authority is affirmed by Memoranda of Agreement (MOAs) executed between the South Carolina Coastal Council and each of the State agencies with authority over GAPCs. These MOAs specify the type and level of coordination as well as that programs will be administered in a manner consistent with Council policies for the coastal zone of South Carolina. Their management in the future will be coordinated to ensure consistency with the policies of the Coastal Council for Geographic Areas of Particular Concern.

Implementation

Special management consideration will be given to those areas designated as GAPCs through the process of issuance of permits in the critical areas, and review and certification of permits in the coastal zone. When a project overlaps with, is adjacent to, or significantly affects a GAPC, the Council will carefully evaluate the project based on the criteria listed as the priority of uses which specifically address each type of GAPC. A project would be prohibited if it would permanently disrupt the uses of priority for the designated area. A project would be strongly discouraged or the permit conditioned if the project would interrupt, disturb or otherwise significantly impact the priority uses of the designated area.

For example, in consideration of the permit for a project adjacent to a State Park which would significantly interfere with the primary recreational activities of that GAPC, every effort would be made to preserve this highest priority use of the park. Although all listed priority uses would receive protection, the Council would be committed to especially safeguard the highest priority use.

Future Designation of Geographic Areas of Particular Concern

As development and implementation of the coastal zone program continues, other areas which may deserve particular attention will be further studied. Nominations of potential GAPCs can be made to the South Carolina Coastal Council by other State agencies, Federal agencies, local governments, organizations, and interested private citizens. A new designation would be possible under any of the three existing GAPC categories.

When these potential areas of concern are identified, they will be reviewed by the South Carolina Coastal Council to determine the nature of concern, if they satisfy the appropriate designation criteria, and what type of management needs exist to ensure adequate preservation or control of the areas. The South Carolina

Coastal Council can designate additional GAPCs after the management program has received final approval without requiring formal amendment to the program. Future designations can be accomplished by a majority vote of the Council once the required management authority is determined and executed.

New GAPCs would be automatically added, for example, when Heritage Trust Preserves and Scenic Rivers are designated as parts of the Heritage Trust Program or as a result of the Scenic Rivers Act in South Carolina. In addition, if a new natural resource area is developed or if a significant new coastal dependent activity needs special attention, application to the South Carolina Coastal Council for designation as a new GACP would be appropriate. As new GAPCs are designated in South Carolina, the South Carolina Coastal Council will specify the priority uses for each new area.

Policies for Geographic Areas of Particular Concern

The South Carolina Coastal Council has designated the Geographic Areas of Particular Concern discussed in this document because of their unique importance as natural, aesthetic, recreational, scientific, or economic resources in the coastal zone. The existing State management authority for each GACP is identified, and the priority of uses within each area is specified. In addition, management policies and permitting Rules and Regulations of the South Carolina Coastal Council for certain specified activities or alterations shall apply to designated GAPCs, where relevant.

Goals

The goals of the South Carolina coastal zone management program for preservation and development of GAPCs are:

To give highest priority to the identified primary value of a GACP when considering the preservation or development of that area.

To ensure that management of GAPCs is consistent with other policies of the South Carolina coastal zone management program.

Objectives

The management of GAPCs shall be carried out in such a manner as to:

- prevent, where possible, the disruption of valuable coastal resources;
- protect the integrity of natural resource areas and preserve the unique and fragile areas;
- protect the habitats of wildlife and marine species, particularly those with special commercial, recreational or ecological value;
- improve access to and management of recreational areas;
- increase the usefulness of and access to economically important resources, without undue restrictions on the activities, while minimizing negative environmental impacts;
- avoid preemption of appropriate commercial growth where it is consistent with the use of the areas;
- encourage environmentally sound growth patterns and development practices where growth and development are priority uses of the area;
- discourage development in high-risk areas, where damage to life, property, and coastal resources is likely to be severe.

Areas of Preservation and Restoration

The Federal Regulations (§923.22, **Federal Register**, Vol. 44, No. 61, March, 1979) state that:

Designations may be made for the purpose of preserving or restoring areas for their conservation, recreational, ecological, or aesthetic values.

The categories of GACP's entitled Areas of Unique Natural Resource Value and Areas of Special Historic, Archeological or Cultural Significance include those designations of preservation and restoration areas. The criteria for designation are outlined above on pages IV-1 through IV-3. The priority of uses specified for each area will guide the protection of the areas once designated.

2. Geographic Areas

a. Areas of Unique Natural Resource Value

Unique natural resource areas include those exhibiting scarce or vulnerable habitats, living marine resources, and physical features; those offering substantial recreational value; and those of vital importance in protecting and maintaining coastal resources.

This category of Geographic Areas of Particular Concern (GAPCs) is especially significant because South Carolina's natural environmental attributes are a resource of great value, for ecological, aesthetic, recreational and commercial reasons. In the past, development has been relatively slow, so there are still unspoiled natural areas and abundant wildlife in the coastal zone to enjoy and protect. For example, over 400,000 acres of tidal marsh represent a vital link in the life cycle of a majority of commercial and sport fish species. The forests, marshes, streams, beaches, and coastal waters warrant critical attention in the State's coastal management program because of both their ecological and economic importance. It has become increasingly evident that these are finite and limited resources which need careful preservation and thoughtful management.

Management Authorities

Several different programs which involve State ownership, regulatory or management authority over natural resource areas exist in South Carolina. The specific authority is described in detail for each individual program in the following pages and is used in conjunction with the Council's authority as described in the implementation section on the preceding page.

Criteria for Designation

The criteria for designation of a natural area as a GAPC are that the area offers unique or important natural features which warrant special attention in the coastal management program.

To indicate the resource values which make these areas particularly significant, general criteria have been developed, drawing from the objectives contained in each of these programs. (Certain of the individual programs have further, specific criteria which are used to qualify areas for inclusion within the program, and these will be identified where such exist.)

The South Carolina Coastal Council recognizes the following criteria for designation of natural resource areas as Geographic Areas of Particular Concern:

1. The area consists of representatives of one or more coastal ecosystem types or habitats, is intact in the sense that essentially all of the expected species and ecological processes are present in normal numbers and vigor, and meets one of the following conditions:
 - a. Alteration or destruction of the area would substantially impair the ability of one or more ecosystem types to perpetuate themselves;
 - b. The area has qualified as critical habitat for an endangered or threatened species, under the Endangered Species Act of 1973;
 - c. The area is unusually large or undisturbed in comparison to others of a similar kind, thus affording a unique opportunity for scientific observations or recreation.
2. The area represents superior habitat for species, which, while not endangered or threatened, are of vital importance as commercial or sports-oriented coastal resources.
3. The area affords maximum recreational opportunities in the coastal zone because of access to beaches or other waterfront, presence of unique physical or cultural features or natural habitats (see #1 above), and/or wide range of active and passive recreation opportunities in a natural setting.

1) The Heritage Trust Program

Management Authority

The South Carolina Heritage Trust Program was established by passage of State legislation in April, 1976, (Act 600 of 1976). (An Advisory Board and initial staff efforts had begun subsequent to an Executive Order in 1974.) The Heritage Trust Advisory Board and Wildlife and Marine Resources Commission administer a system which provides for inventory, preservation, use and management of unique and outstanding natural or cultural areas.

The public policy stated within the Act is:

To secure for the people, both present and future generations, the benefits of an enduring resource of natural and cultural areas and features by establishing a system of Heritage Preserves and Sites.

This program provides for dedication of areas or sites by the owner to the Trust through transfer of fee simple title or lesser forms of ownership interest, such as open space easements. The Advisory Board and Wildlife and Marine Resources Commission review the proposed areas, which are nominated by the staff of the S.C. Wildlife and Marine Resources Department, other State agencies, and citizens of the State.

A major requirement of the program is provision of management criteria, rules and regulations, and "allowable use" guidelines for Heritage Preserves. A management plan must be developed for each property in the Heritage Trust. These management mechanisms are intended "to preserve the primary natural character of such areas or features and to provide the maximum public usage thereof which is compatible and consistent with the character of the area." (Section 4 (7))

Inventory

Staff of the Division of Natural Area Acquisition and Resource Planning of the South Carolina Wildlife and Marine Resources Department, with support from other experts in the field, have been actively engaged in thorough investigative surveys of the natural areas of the State. The objectives of this search are identifying "significant elements of the natural environment such as unique and outstanding features, rare and endangered plant and animal species, and natural areas representing the range of biological diversity found in the State." These data have been made available to the Office of Coastal Planning. As the Heritage Trust Program identifies priority areas for preservation or acquisition efforts, this information will also be reviewed by Coastal Council staff and considered for designation as GAPCs, or as future or potential GAPCs.

Priority of Uses

The following are the uses of priority for areas deeded into the Heritage Trust Program, beginning with the use of highest priority:

- 1) Uses which are consistent with the management plan developed for each property;
- 2) Uses which allow public enjoyment of the area as long as the primary natural character of the area is not disrupted;
- 3) Uses which are compatible with the area's wildlife and wildlife management.

Prohibited uses are any which jeopardize the integrity of the Heritage Trust Program.

Designated Sites

Because of their unique value as wildlife habitats and natural areas, Heritage Trust lands have been designated as Geographic Areas of Particular Concern.

Capers Island is the only site in the coastal zone which has been deeded into the Heritage Trust Program to date.

2) State Wildlife Preserves

The extensive system of wildlife preserves and game management areas owned or leased by South Carolina Wildlife and Marine Resources Department are irreplaceable resources, as both protected wildlife habitats and recreational hunting and fishing areas. Because of their value to residents and visitors of the South Carolina coastal area, they have been identified as Geographic Areas of Particular Concern.

Management Authority

The South Carolina Wildlife and Marine Resources Department (WMRD) is empowered to acquire land areas and enter into agreements with landowners and with the Federal government for purposes of managing wildlife species and establishing specific sanctuaries and game management areas (§ 50-3-100, Code of Laws of South Carolina, 1976). The areas owned and managed by WMRD are vital resources of the coastal zone, for

conservation of the State's wildlife and also for recreational hunting and fishing opportunities. As part of this management responsibility, a full management plan is prepared for each preserve, identifying short and long-term uses and guidelines for protection and use of the area.

Where critical areas, as defined in the South Carolina Coastal Management Act (Act 123 of 1977), occur within these preserves, additional control is afforded, since Coastal Council permits would be required for any alterations within the critical areas of these preserves.

Inventory

A complete listing of the wildlife and game management areas under ownership and/or management authority of the WMRD in the eight coastal counties was obtained through consultation with WMRD and by reference to **S.C. Public Land Ownership Inventory** (S.C. Land Resources Conservation Commission, 1977). These areas have been mapped into the Coastal Council's overlay mapping system.

Priority of Uses

The following are the uses of priority for areas designated as State Wildlife Preserves, beginning with the highest priority:

- 1) Uses which are consistent with the wildlife management plan for each preserve;
- 2) Uses which are compatible with the preserve's wildlife, wildlife habitats and wildlife management and simultaneously provide public recreational opportunities, such as hunting and fishing.

Designated Sites

Because of their significance as natural habitats and their inclusion under ownership and/or management authority of WMRD, the following areas are designated as GAPCs.

- 1) Turtle Island - Jasper County
- 2) Bear Island Game Management Area - Colleton County
- 3) Alexander Sprunt, Jr. Wildlife Sanctuary (Deveaux Bank) - Charleston County
- 4) Santee Coastal Reserve - Charleston County
- 5) Hatchery Game Management Area - Berkeley County
- 6) Moultrie Game Management Area - Berkeley County
- 7) Santee Delta Game Management Area - Georgetown County
- 8) North Island & South Island Plantation - Georgetown County
- 9) Samworth Game Management Area - Georgetown County
- 10) State-owned segment - Francis Marion Game Management Area (Santee-Cooper)

As new acquisitions are made into the State system of wildlife preserves and game management areas, these will be designated as GAPCs in the South Carolina coastal zone.

3) State Parks

State park facilities in the coastal zone are valuable resources for the recreational, scenic and educational enrichment of residents and visitors alike. Because of this significance, major existing parks have been recognized as Geographic Areas of Particular Concern.

Management Authority

The South Carolina Department of Parks, Recreation and Tourism (PRT) is mandated to control and maintain the State parks system, and can accept or purchase lands for this purpose, with approval of the State Budget and Control Board (§51-71, S.C. Code of Laws, 1976). PRT must prepare a master plan for each major park facility, identifying plans for development of facilities, and the preservation and use guidelines for the park.

On a more long-range basis, PRT is developing an update to the South Carolina State Comprehensive Outdoor Recreation Plan (SCORP). The function of SCORP is to provide a guide for statewide recreation planning and development, and to maintain eligibility for Land and Water Conservation funds from the Federal Heritage Conservation & Recreation Service.

Where critical areas form part or all of State park facilities, the Coastal Council will also have regulatory control. Any alterations within critical areas will require a Coastal permit. This authority will aid in assuring that the use and development of these cherished recreational resources remain consistent with policies and guidelines of the State's coastal zone program.

Inventory

The organization of studies for SCORP centers on six volumes, covering public and private outdoor and indoor recreation systems. Volume I of this planning process was a complete inventory of the State's physical characteristics, natural resources, and existing recreation facilities. This information has been made available to the Coastal Council. Consultation with staff of PRT has helped to identify the existing major parks in the eight county coastal zone (roadside parks, small neighborhood parks and the like have been exempted), and these have been mapped on 7½" U.S.G.S. quadrangle overlays.

Priority of Uses

The following are the uses of priority for State Parks, beginning with the use of highest priority:

- 1) Varied recreational activities open to the public;
- 2) Non-intensive uses which require minimal feasible alteration and maintain the natural functions of the area;
- 3) Provision of educational opportunities to visitors of the parks.

Designated Sites

The following existing State parks are designated GAPCs and are shown in the map index.

1. Hunting Island State Park - Beaufort County
2. Givhan's Ferry State Park - Colleton & Dorchester Counties
3. Old Ft. Dorchester State Park - Dorchester County
4. Edisto Beach State Park - Colleton County
5. Charlestowne Landing - Charleston County
6. Drayton Hall - Charleston County
7. Hampton Plantation - Charleston County
8. Huntington Beach State Park - Georgetown County
9. Myrtle Beach State Park - Horry County

As PRT and the Coastal Council identify other recreational resources which warrant particular State concern in the coastal program, these will be reviewed for designation. Proposed park sites should be included as priority or potential GAPCs. When new sites are added to the State parks system, these will be designated automatically.

4) Scenic Rivers

South Carolina is fortunate to have many river segments that still remain in a natural or near natural state. As such, these areas represent an important historical, cultural, and recreational resource. Rivers were the primary transportation system for early America, both for Indians and the later explorers and settlers. Consequently, archeological sites are found at waterfront locations.

Bounded by large expanses of swamp, several Lowcountry river segments have witnessed little development pressure and remain in primarily wilderness conditions. Other segments are good representatives of natural areas with wide species diversity.

As recreational resources, the rivers serve as a "one-way water trail," offering boaters a unique sense of adventure. The silent movement of a canoe affords the opportunity to observe numerous wildlife species which it would not be possible to approach in other modes of transportation. The recreational potential of South Carolina's coastal rivers is both impressive and unique.

In recognition of this tremendous resource, the Coastal Council recognizes river segments which have been designated as Scenic Rivers as Geographic Areas of Particular Concern.

Management Authority

In an effort to preserve and protect South Carolina's rivers, the 1974 South Carolina General Assembly passed the Scenic Rivers Act (Act 1106), which authorized the Water Resources Commission to designate scenic rivers. Proposals for designation may be made by State agencies, local governments, or citizens groups. To qualify, a river must possess unique and outstanding scenic, recreational, geologic, fish and wildlife, historic or cultural values, in addition to relatively unpolluted waters.

The Water Resources Commission is mandated to develop a comprehensive water and related use plan for designated rivers, with emphasis on protecting the significant resources of these scenic rivers. The Wildlife and Marine Resources Department assists the Commission in formulating and enforcing these plans and regulations.

The management plans for each river segment must address the following:

Class I — Maintenance of the wilderness character, with camping and river access allowed only at designated public access areas. Prohibiting new roads or buildings, mining and commercial timber harvesting.

Class II — Preservation of the scenic values, with riparian landowners allowed customary agricultural activities, silviculture, and construction of compatible farm-use buildings. Mining and construction of roads paralleling the river are prohibited.

Class III — Preservation of the scenic values, with landowners allowed agricultural, residential, recreational, commercial, and light industrial activities. Mining and construction of new roads paralleling the river are prohibited.

Where all or portions of a designated scenic river is located in the critical areas of the coastal zone, the South Carolina Coastal Council will also have management authority. A permit would be required for any activities or alterations in such a river segment.

The Federal Wild and Scenic Rivers Act (P.L. 90-542) was enacted in 1968. The three basic river classifications in that Act are 1) wild, 2) scenic, and 3) recreational. These classifications generally parallel the three categories in the South Carolina Act; however, rules for management in the Federal law are more rigorous.

There are presently no national wild and scenic rivers in the coastal zone of South Carolina. However, the Federal Heritage Conservation & Recreation Service has inventoried numerous rivers in the coastal zone of South Carolina.

Criteria for Designation

The following criteria are those established for a river segment to qualify under the South Carolina Scenic Rivers program:

Class I — Natural river

- i) it must be free-flowing (no impoundments or diversions)
- ii) the shorelines and scenic vistas must be essentially unchanged by man
- iii) there must be no extensive paralleling roads closer than one mile
- iv) in river gorges, there must be no extensive paralleling roads within one-quarter of the rim
- v) there must be only a limited number of road crossings and spur roads

Class II — Pastoral river

May be partially or predominately used for agriculture, silviculture and other dispersed human activities which do not substantially interfere with public use and enjoyment of rivers and the shores.

Class III — Partially developed

The adjacent areas may be affected by works of man, but still possess actual or potential scenic, recreational or historic values.

Inventory

The Water Resources Commission has inventoried several rivers in the eight coastal counties. They are: the Little Pee Dee, Black, Edisto, Combahee, Salkehatchie, and Ashley Rivers. These same rivers have been inventoried by the Federal Heritage Conservation & Recreation Service and are being considered as potential designations under the Federal program. Information collected by the Commission includes flow characteristics, water quality, vegetation and wildlife data, and recreational amenities.

Priority of Uses

The following are the uses of priority for Scenic Rivers, beginning with the use of highest priority:

- 1) Uses which are consistent with the management plans developed by the Water Resources Commission with the assistance of WMRD. Each plan will be a comprehensive water and related use plan designed to protect the significant resources of each river section designated;
- 2) Uses which maintain long-term natural functions of the river while affording public recreational activities, especially those of a passive nature.

The lowest priority uses would be those not related to the goals of the Scenic Rivers Program but which do not alter, reduce, or degrade the river resources or the integrity of the Scenic Rivers Program.

Designated Sites

To date, there are no Scenic River segments in the coastal zone. When designations are made and easements or titles donated, these rivers automatically will be considered to qualify as GAPCs.

NOTE: The Ashley River, in Dorchester and Charleston Counties, has been named as eligible for designation. It appears to meet the Class II qualifications, but various segments may be given different classifications. If and when donations are made, individual plans will be formulated for each donation. Since this river segment is particularly rich in historical resources, the South Carolina Department of Archives and History is assisting the Commission in assessing the intentions of adjacent landowners regarding donation.

3) Marine and Estuarine Sanctuaries

The coastal waters and wetlands of the State are valuable natural resources which have yet to be spoiled by development or real estate speculation. The preservation and protection of these resources is paramount in determining the growth of the seafood as well as the tourist industries. There are many citizen groups active in pursuing these goals; and State governmental agencies, in particular the South Carolina Wildlife & Marine Resources Department, have instituted research programs to document and inventory the marine environment. On this basis, the Coastal Council feels that any area designated by the State of South Carolina, in conjunction with the U.S. Department of Commerce, as a marine or estuarine sanctuary will be a Geographic Area of Particular Concern (GAPC).

a) Marine Sanctuaries Management Authority

Title III of the Marine Protection, Research, and Sanctuaries Act of 1972 (P.L. 92-532, 86 Stat. 1061), provides the Secretary of Commerce, with approval from the President, the power to designate those areas of ocean waters as far seaward as the outer edge of the Continental Shelf and all other coastal waters where the tide ebbs and flows, as marine sanctuaries. These sanctuaries are intended to preserve or restore such areas for their conservation, recreational, ecological or aesthetic values. The Secretary of Commerce, prior to designating a marine sanctuary, must consult with the Secretaries of State, Defense, Interior, and Transportation and give due consideration to the views of the responsible officials of the affected state. The designation becomes effective sixty days after it is published, unless the governor of the state involved certifies to the Secretary of Commerce that the designation, or a specified portion, is unacceptable to his/her state. In this

case the designated sanctuary will not include the certified unacceptable areas or become final until such time as the governor withdraws his certification of unacceptability.

On March 13, 1974, the Secretary of Commerce authorized the Administrator of the National Oceanic and Atmospheric Administration to exercise the authority granted under Title III. With this authority, NOAA has to develop proposed objectives, guidelines, criteria and procedures for designation of marine sanctuaries.

Potential marine sanctuary sites, where development seems imminent, are screened by the Federal Office of Coastal Zone Management (OCZM) and the National Marine Fisheries Service. Development includes potential offshore as well as onshore sites, and is considered "imminent" if it is likely to occur within 18 months, or if actions to be taken within 18 months will establish the likelihood of development. OCZM offers the opportunity for state coastal zone management offices, commercial fishing organizations, development interests, environmental groups and the public-at-large to submit recommendations for marine sanctuary sites.

If any marine sanctuary areas are designated by the Secretary of Commerce, the S.C. Coastal Council is mandated under the State coastal zone management law (Sec. 5(J), Act 123 of 1977) "to manage estuarine and marine sanctuaries and regulate all activities therein, including the regulation of the use of coastal waters located within the boundary of such sanctuary." The primary management authority would rest with the S.C. Coastal Council. Its regulatory authority would also apply since any marine sanctuary would be located within the State's critical areas.

To date, the general management principles for marine sanctuaries mainly address regulation of development to be harmonious with the overlying principles of preservation and protection of the sanctuary. The classification of these areas will not affect multiple use which may be permitted to the extent the uses are compatible with the primary(s) for which each sanctuary is established. The establishment of marine sanctuaries may be to complement public or private, local, State or Federal government lands which have been set aside for similar purposes. The overall management of the sanctuary must include an initial and comprehensive environmental assessment. (This should complete the original EIS which must be submitted upon nomination.) A continued monitoring program and guidelines to enforce the policies also must be formulated.

Criteria for Designation

The program objectives for marine sanctuaries emphasize the idea of preserving, restoring or enhancing these areas for their conservational, recreational, ecological, research or aesthetic values. Examples of coastal waters which might meet designation status include:

- (a) Areas necessary to protect valuable, unique or endangered marine life, geological features, and oceanographic features;
- (b) Areas to complement and enhance public areas such as parks, national or state monuments and other preserved areas;
- (c) Areas important to the survival and preservation of the nation's fisheries and other ocean resources;
- (d) Areas to advance and promote research which will lead to a more thorough understanding of the marine ecosystem and the impact of man's activities.

b) Estuarine Sanctuaries Management Authority

Section 315 of the Federal Coastal Zone Management Act of 1972 addresses the subject of estuarine sanctuaries and states that the Secretary may "make grants to any coastal state for the purpose of acquiring, developing, or operating estuarine sanctuaries..." Thus, the initiative for participating in the estuarine sanctuary program lies with the state, whereas nominations for marine sanctuaries can come from local, state or federal agencies or any interested persons.

The term "estuarine sanctuary," as defined in the Act, means "a research area which may include any part or all of an estuary and island, transitional area, and upland in, adjoining, or adjacent to such estuary, and which constitutes to the extent feasible a natural unit..." The purpose of establishing an estuarine sanctuary is to set aside an area which would serve as a natural field laboratory where studies of "natural and human processes occurring within the estuaries of the coastal zone" can be made by scientists and students. (Federal

Register, Vol. 39, No. 108, Part IV, June 4, 1974)

These sanctuaries would be areas which are relatively undisturbed by man at the time of acquisition and, therefore, could be used to make baseline ecological measurements. The designation of these areas would provide them with long term protection, and multiple use of the sanctuaries would be allowed to the extent that such use or uses are compatible with the primary uses of research and education.

The estuarine sanctuary program is intended to provide research data which would assist in coastal zone management decision-making. The State's coastal zone management program must be designed to protect the estuarine sanctuary. Management of estuarine sanctuary and land and water use regulations and planning considerations must be applied to adjacent lands. Management of estuarine sanctuaries is the responsibility of the applicant state, and the sanctuaries are intended to be incorporated into the state coastal zone management program. However, designation does not have to await the development and approval of a state's management program where operation of the sanctuary would aid in program development.

In South Carolina, the Coastal Council and the management program, which is its responsibility, would have authority for estuarine sanctuary planning and implementation of the necessary management policies and techniques. At this time, there are no designated estuarine sanctuaries in the South Carolina coastal zone.

Criteria for Designation

State applications for grants to establish estuarine sanctuaries are carefully reviewed and judged on the following criteria:

1. Benefit to the coastal zone management program;
2. The ecological characteristics of the ecosystem, including its biological productivity, diversity and representativeness;
3. Size and choice of boundaries (should approximate a natural ecological unit);
4. Cost (Federal share of the cost for each sanctuary is limited to \$2,000,000.);
5. Enhancement of non-competitive uses;
6. Proximity and access to existing research facilities;
7. Availability of suitable alternative sites already protected which might be capable of providing the same use or benefit;
8. Conflict with existing or potential competing uses;
9. Compatibility with existing or proposed land and water use in contiguous areas.

Inventory (1 and 2)

Inventories and studies have been accomplished, or are in the process of being completed, for most of the natural resources present in the coastal zone. Presently, "An Environmental Base Line Study of South Carolina Estuaries" is underway. Begun in February, 1973, by the S.C. Wildlife & Marine Resources Department (WMRD), this research is to determine basic biological, chemical and physical characteristics, and their interactions over a several year period. This study is funded by the Coastal Plains Regional Commission, WMRD and the U.S. Army Corps of Engineers. An inventory of South Carolina's coastal marshes has recently been completed by WMRD personnel, and research to determine major wetland plant species productivity is nearing completion. Both of these studies were funded, in part, by the S.C. Coastal Council.

Additionally, WMRD is funding studies dealing with recreational fishing, over-wintering shrimp management, shellfish resources and anadromous and ground fish stock assessments. The College of Charleston, under a grant from the U.S. Environmental Protection Agency, is beginning a study to document food webs, populations and productivity in a southeast coastal marsh. The University of South Carolina has recently finished and published a report through the Environmental Protection Agency entitled "The Dynamics of an Estuary as a Natural Ecosystem." The National Marine Fisheries Service has published a recent investigation by staff from WMRD and the College of Charleston entitled: "The Macrofauna of the Surf Zone off Folly Beach, South Carolina." The S.C. Water Resources Commission has funded many past studies including the "Port Royal Sound Environmental Study," "Wando River Environmental Quality Study," "The Cooper River Environmental Study," "The Tidelands Report," "Lower Santee River Environmental Quality Study,"

“Wando River Aerial Imagery and Marsh Productivity Study,” “Volumetric and Related Characteristics of the Black River Reservoir near Charleston, S.C.” Finally, the U.S. Fish & Wildlife Service is funding a 21 month study to characterize the sea islands of the South Carolina and Georgia coasts through WMRD.

Priority of Uses

Priority of uses will be determined for each sanctuary as it may be designated in the future. The priority of uses would be developed in accord with the Federal guidelines and monitoring program affecting the sanctuary and the Coastal Council’s regulatory authority over sanctuaries.

6) Shellfish Areas

a) Commercial Leases

Commercial harvesting of oysters and clams produced approximately one million dollars of direct revenue to the State of South Carolina in 1976. The annual catch of oysters was over 1,100,000 pounds of meat, and the clam harvest for the year totalled 172,000 pounds of meat. These constitute extremely important economic resources of the coastal zone, and as such, the areas suitable for shellfish production in the coastal waters of the State are very significant. The Coastal Council recognizes those bottom areas leased for commercial shellfishing as Geographic Areas of Particular Concern.

Management Authority

Section 28-811 of the Code of Laws of South Carolina, governing the Marine Fisheries Laws for the State, authorizes the Wildlife and Marine Resources Department to lease portions of the water bottoms owned or controlled by the State, for the purposes of commercial shellfishing. Any State resident licensed to do business and who makes his/her livelihood primarily or largely through the commercial shell-fishing industry may lease shell-fish bottoms, in areas totalling not more than 1,000 acres to any one individual. (Leases for other than commercial uses may be made to State residents for areas totalling as many as two acres. The adjacent upland landowner has preference for a two acre lease in adjoining tidewaters, if this application is made before other leases are granted.) These lease agreements are valid for a five year period. Once an application has been made and the Division of Marine Resources has determined the area capable of producing shellfish, the boundaries are surveyed and established within the terms of the lease. No other leases for gathering shellfish can be granted within the perimeter boundaries.

Each lessee is required to plant 65 bushels of shell or seed oysters for each acre, in an effort to prevent over-harvesting and depletion of this valuable resource. “Each lease or portion of a lease from which oysters are harvested must be replanted during the following planting season.” (Section 28-822, S.C. Code of Laws, 1976)

State permits for activities affecting State-owned bottoms are issued by the S.C. Budget and Control Board. For proposed activities within 1,000 feet of productive shellfish lease areas, lessees are given an opportunity to comment on permit applications. And through memoranda of agreement between the Budget and Control Board and the Department of Health and Environmental Control (DHEC), all activities such as discharges or dredging and fill within 1,000 feet of lease areas are carefully controlled. (DHEC determines water quality criteria and health standards for shellfishing, and the 1,000 feet criterion is a generally accepted standard.)

The South Carolina Coastal Council has authority over coastal waters and tidelands to mean high water, and above mean high water where wetlands are contiguous to coastal waters and integrally a part of estuarine systems. A Council permit is required for all activities or alterations in these “critical areas,” as defined in Section 3 of Act 123 of 1977. In assessing permit applications, the Council must consider “The extent to which the applicant’s completed project would affect the production of fish, shrimp, oysters, crabs or clams or any marine life or wildlife, or other natural resources in a particular area.” (Section 15 (3)) The Interim Rules and Regulations for the Permit Process (Chapter 28, r. 32-1 through 32-11, *State Register*), state specifically that consideration will be given to the rights of the lessee when permits are being evaluated for construction of docks or piers over shellfish lease areas.

b) Recreational Shellfish Grounds

Recreational shellfishing is a popular outdoor activity along the coast of South Carolina. Gathering oysters and clams is not only a unique form of recreation, but a source of fresh seafood for families of the area. As a valuable coastal resource and habitat of a significant living marine resource, recreational shellfish grounds are recognized as Geographic Areas of Particular Concern.

Public oyster grounds are areas along the South Carolina coast where State residents may gather shellfish for their personal use, and these areas must be designated with metal signposts. State shellfish grounds, also marked with signs, are open to all recreational shellfishermen, and by permit to commercial shellfishermen (who may obtain their shells or seed oysters from these State-owned beds).

Management Authority

The Division of Marine Resources is mandated to keep open shellfishing areas for the personal use of South Carolina residents, with approval by the County legislative delegations. These public shellfish beds are not to exceed 50 acres in any one county, and their maintenance and adequate marking is the responsibility of the Division. (Section 28-792. S.C. Code of Laws, 1976)

The regulations for shellfishing, Section 28-761 of S.C. Code of Laws, apply to recreational shellfishing, and establish the season and the limits for gathering. The Marine Resources Division, Office of Conservation & Management of the S.C. Wildlife and Marine Resources Department (WMRD) has jurisdiction over these areas and conducts numerous management activities, including maintenance of markers; planting of shell and seed oysters, and thinning of over-crowded beds; and periodic surveying of additional productive areas.

The same management authorities of the Budget and Control Board, Department of Health and Environmental Control, and the South Carolina Coastal Council apply to public and State shellfish grounds as are applicable in commercial lease areas. A detailed discussion is offered in Part 1 of **F. Shellfish Areas**.

c) Other State-managed Shellfish Grounds (Seed beds)

Certain especially productive submerged bottoms in the Wando River, North and South Santee Rivers and North Santee Bay have been designated by the Marine Resources Division of the South Carolina Wildlife and Marine Resources Department as seed bed areas. These vital resource areas serve as one of the major sources of seed oysters and, in the case of the Santee River, seed clams, for transport to other coastal waters, in order to restore and enhance shellfish resources.

Management Authority

The Marine Resources Division of the Wildlife and Marine Resources Department (SCWMRD) manages these seed bed areas. There is no specific legislation dealing with seed beds; however, SCWMRD is mandated generally to 1) manage the State's fishery resources, 2) protect and develop shellfish resources, and 3) manage State-owned submerged bottoms. (Sections 50-5-20, 50-17-1250 and 50-17-1210 of South Carolina Code of Laws, 1976, as amended).

A special permit is required for commercial taking of clams or oysters in these areas. The public is allowed the same rights of use as on other public shellfish grounds.

Inventory

Shellfish areas have been included on the Coastal Council's 7½" U.S.G.S. quadrangle overlay map system, and the information can be computerized readily. This data was made available partly through cooperation with the Division of Marine Resources. In addition, commercial leases must be recorded with the Clerk of the Court in the county of jurisdiction, and this was another source of detailed inventory information. As new areas are leased or assigned for public use, or as shellfish grounds are removed from production or closed to shellfishing, these changes can be made in the mapped data.

Priority of Uses

The following are the uses of priority for all commercial and recreational shellfish areas beginning with the use of highest priority:

- 1) Water-dependent uses which do not reduce or degrade the quality of shellfish lease area or

- limit access to the area;
- 2) Water-enhanced activities or nonwater-dependent uses which do not reduce or degrade the quality of the shellfish lease area or limit access to the area.

Designated Sites

There are sixty-four commercial shellfish leases, totalling approximately 5,500 acres in the South Carolina coastal zone. There are nine State shellfish grounds and another sixteen public grounds along the coast. In addition, there are state-managed subtidal seed oyster beds in the Wando River, and clam beds in the North and South Santee Rivers and North Santee Bay which are not leased, but are managed on an open and closed season basis. The map appendix in Volume II depicts these shellfish areas. Commercial leases, public shellfish grounds, State grounds, and other shellfish grounds (seed beds) are listed in Volume II, Appendix F.

7) Groundwater Resources

Groundwater is an abundant resource in the coastal zone of South Carolina; however, there are potential problems of quality and quantity. Proper management can ensure the continuing productivity of groundwater resources, but data collection and extensive study are necessary because this is a complex resource. Groundwater can flow vertically as well as horizontally, and vertical wells can pass through several aquifers. The water in each aquifer is likely to vary in quantity and quality. In such a case, it is difficult to determine which aquifer(s) might be responsible for the poor water quality or if the capacity of one of the aquifers might be exceeded, at the expected pumpage, to the detriment of other wells in the area.

Because groundwater serves as the vital water supply source for many coastal communities, and the resource may suffer from over-use or waste disposal problems (i.e., septic tanks and seepage from landfills), it is an extremely significant resource of the coastal zone. Those regions which have been identified as potential problem areas, requiring special regulation and coordination of groundwater use, are recognized as Geographic Areas of Particular Concern.

Management Authority

The Groundwater Use Act of 1969 (Section 70-31, S.C. Code of Laws, 1976) authorizes the Water Resources Commission to designate "capacity use areas" (CUA). The South Carolina Coastal Council supports the implementation of this act and designation of CUAs by Water Resources as significantly important. The designation process is as follows: A county, municipality or sub-division of State government may request a review by the Commission if it is believed that a situation exists, or is emerging, where the use of groundwater may require coordination or regulation to protect the interests and rights of residents, property owners or the general public. The Executive Director will then conduct an investigation and submit the findings and recommendations to the Commission. Recommendations will include identification of area groundwater problems, appropriate conservation measures, and boundaries of CUA.

Based on the report, the Commission may adopt an order declaring a CUA, give public notice of the declaration, and hold at least one public hearing. After the public hearing, the Commission will take final action on the CUA designation and publish that action as part of its official regulations.

Once a CUA has been designated, the Commission instructs the Executive Director to prepare proposed regulations commensurate with the degree of control which is needed. The Commission must hold at least one public hearing on the proposed regulations and publish the final action as part of the official rules. These regulations may be modified or revoked, subject to a public hearing.

These regulations may include the following provisions:

- 1) provisions requiring water users to submit reports concerning quantity and source of waters withdrawn and nature of use;
- 2) provisions concerning timing of withdrawals, to abate unreasonable adverse effects and salt water encroachment; and
- 3) provisions concerning well depth, spacing controls, prescribed pumping levels, and maximum pumping rates.

When adopting or modifying the regulations and when reviewing permit applications, the Commission will consider the following:

- 1) number of persons using an aquifer and their respective withdrawals;
- 2) nature and size of the aquifer;
- 3) physical and chemical nature of any impairment;
- 4) probable severity and duration of such an impairment;
- 5) injury to public health, safety or welfare which may result if such impairment were not prevented or abated;
- 6) kinds of businesses or activities related to groundwater uses;
- 7) the importance and necessity of the uses claimed by permit applicants and the extent of any injury or detriment expected to be caused to other water users; and
- 8) diversion or reduction in flows in other water courses or aquifers.

The South Carolina Department of Health and Environmental Control (DHEC) also has legal authority to protect groundwater resources, with regard to surface pollution. This is accomplished through a statewide permitting system for septic tanks and waste disposal by earth burial. (Acts 1157, 1094, 203 and 1492; Sections 32-8, 1202 and 1251, S.C. Code of Laws, 1976; regulations PC-SW-1 and 2; SCPCA-SWG-1, 2 and 3)

Criteria for Designation

The decision to designate a capacity use area is based on the report of the Executive Director of the Water Resources Commission, which describes the groundwater situation and trends. If the situation is poor or deteriorating such that the public interest is in jeopardy, a CUA is likely to be declared. Once this happens, no person shall withdraw, obtain or utilize groundwater in excess of 100,000 gallons per day (gpd) without first obtaining a permit from the Water Resources Commission. All permits will be subject to the CUA regulations adopted by the Commission.

Inventory

Presently, the Water Resources Commission is undertaking two capacity use area investigations and one reconnaissance level investigation in the coastal zone.

CUA Investigations

Lowcountry Area

Waccamaw Area

Regional Reconnaissance Investigation

Trident Area

Counties

Colleton, Hampton, Jasper, Beaufort

Horry, Georgetown, Marion

Counties

Charleston, Berkeley, Dorchester

The CUA studies have been funded jointly by the Water Resources Commission, the U.S. Geological Survey, and the Coastal Plains Regional Commission. In December, 1977, capacity use reports were completed for the Waccamaw Area recommending that the area be declared a capacity use area (#129, Spigner, Report on the Ground-Water Resources of Horry and Georgetown Counties; #8, Zack, The Occurrence, Availability, and Chemical Quality of Ground Water, Grand Strand Area and Surrounding Parts of Horry and Georgetown Counties). The area was declared a CUA by the Commission in November, 1978.

Among several serious ground water problems cited in the Waccamaw capacity use reports are problems related to regional water level declines, salt water contamination, and poor water quality. Procedures to implement capacity use regulations should be completed in early 1979.

Lowcountry capacity use reports are scheduled for completion in 1979 with the reconnaissance study of the Trident Area to be completed in 1980.

Priority of Uses

The Ground Water Use Act of 1969 is specific in the considerations which the Commission must make in determining whether and to what extent ground water use is permissible. Unreasonably adverse effects on the resource or on water users including public, potential and present users is not permitted. The Act provides that the water resources be put to beneficial use to the fullest extent capable to conserve and maintain conditions which are conducive to the development and use of the ground water resources.

In highest to lowest priority, the following priorities will apply to ground water uses in areas designated as capacity use areas within the coastal zone:

- 1) Ground water uses which are beneficial uses and are consistent with all provisions of the Ground Water Use Act and regulations promulgated by the Water Resources Commission.
- 2) Ground water uses which are wasteful, or not beneficial or are found to cause unreasonable adverse effects on other water users or the long-term condition of ground water resources in the coastal zone.

Designated Sites

Currently, only one area, the Waccamaw Area, has been declared a CUA. Several more steps, however, are required under the Ground Water Use Act, before capacity use regulations can be implemented. Investigations in other areas of the coastal zone may result in future CUA designations. As CUA regulations are adopted for specific problems within generally declared areas, all or a portion of declared CUAs in the coastal zone may be designated as GAPCs depending upon the relative extent of ground water use problems.

8. Threatened or Endangered Species Habitats

Policy has been affirmed by both the Federal government and State government in South Carolina that conservation of the natural ecosystem upon which endangered and threatened species depend is a high priority. Untempered economic growth and development can result in the depletion or extinction of various species of fish, wildlife and plants. These species of fish, wildlife and plants are of esthetic, ecological, educational, historical, recreational, and scientific value to our people, our Nation, and to the international community.

The United States has committed itself through numerous treaties with other countries to a pledge of conservation involving migratory birds, fisheries and wildlife preservation, for example. The scope of our responsibility as people and a Nation to protect the delicate balance of the natural ecosystem is demonstrated by these treaties of Federal and State legislation. As a result, the South Carolina Coastal Council will recognize all designated threatened and endangered species habitats as Geographic Areas of Particular Concern.

Management Authority

In view of the National and State concern for endangered species, the South Carolina legislature passed the Non-game and Endangered Species Act in 1974 (Chapter 15, Section 50-15-10 through 50-15-90, S.C. Code of Laws, 1976) The Act instructs the Wildlife and Marine Resources Commission to conduct investigations on non-game wildlife to determine population distribution, habitat needs, limiting factors, and management measures necessary for their continued existence. Based on such investigations, the Commission must issue appropriate regulations and develop management programs. The regulations may establish proposed limitations relating to taking, possession, transportation, exportation, processing, sale, offering for sale, or shipment of particular wildlife species.

The Commission is charged with the responsibility to establish programs necessary for the management of non-game and endangered wildlife. The programs may include research, census taking, law enforcement, education, and acquisition of land or aquatic habitats. The Endangered Species Program is coordinated closely with the Heritage Trust Program which allows donations of land or easements.

The Commission must issue a list of State endangered species, including the United States List of Endangered Native Fish and Wildlife and the United States List of Endangered Foreign Fish and Wildlife. The list will be reviewed and updated at least every two years. It is unlawful to take, possess, transport, export, process, sell, offer for sale, ship, or receive any of the identified species. The South Carolina Wildlife and Marine Resources Department (WMRD) is directed to enforce the Act and may issue special permits for scientific, educational, or other purposes.

The State lists current endangered species and, where appropriate, may designate critical habitat areas, according to the Federal Endangered Species Act. The State Heritage Trust Program and Endangered Species Program work in close coordination in assessing, acquiring and managing sites that constitute endangered

species habitat. If a critical area is formally designated, the effects of any Federally funded program in that area must be more carefully considered. This review by the State clearinghouse is an indirect extension of State management authority effectuated under the Federal Endangered Species Act of 1973. The Secretary of Interior makes the final conflict resolution in such a situation.

The Federal Endangered Species Act of 1973 (PL 92-205, December, 1973, amended by PL 94-32, June, 1976, and PL 94-359, July, 1976) was passed with the purpose of providing

“...a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved to provide a program for the conservation of such endangered species and threatened species (Sec. 2, (b)).”

The national policy is stated as follows:

“...all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act.”

The Secretary of Interior is authorized to publish a listing of endangered and threatened species based on the best available scientific data and, thereafter, to establish rules and regulations regarding the control of taking, sale, import, export, or other disruption of each species. Endangered species are those in danger of extinction throughout all or a significant portion of their range. Threatened species are defined as those likely to become endangered within the foreseeable future. The bases of the South Carolina and national programs are parallel, and the protective mechanisms similar in that impact on endangered species is considered.

The South Carolina Coastal Council is mandated to consider impacts on wildlife species in granting of permits for activities in critical areas of the coastal zone. The Council will also review and comment on other permits, applications, environmental impact statements and Federally-funded projects (A-95 process) throughout the coastal zone. The Council comments will include an evaluation of the potential impacts on any designated critical habitats for threatened or endangered species.

Criteria for Designation

South Carolina Endangered Species are any species of wildlife whose prospect for survival or recruitment within the State are in jeopardy or likely to become so in the foreseeable future. The causes may be: 1) destruction or modification of habitat; 2) species over-utilization for scientific, commercial, or sporting purposes; and 3) other natural or man-made factors. Species on the Federal endangered species lists for native or foreign fish and wildlife are included.

Inventory

An initial Endangered Species Symposium was held in Charleston in November, 1976, at which time committees of knowledgeable experts and concerned individuals were established. A list of endangered species and “species of special concern” was developed with the aid of these communities. These communities and the ongoing endangered species programs constitute the inventory required for periodic update of the State listing. The South Carolina Endangered Species list is in Appendix F.

Priority of Uses

The following are the uses of priority for all areas identified or designated as critical habitats for threatened and endangered species, beginning with the use of highest priority:

- 1) Uses which are compatible with all regulations and management programs developed to protect any designated habitat area under the Federal or State Endangered Species Acts;
- 2) Uses which maintain the natural functions of areas identified or designated as critical habitat areas of species listed on the State or Federal threatened or endangered species lists;

- 3) Non-structural, non-intensive uses which do not create irretrievable damage to any species listed as a threatened species.

Within an area officially designated as a critical area habitat under the State or Federal Endangered Species Acts, uses are prohibited which violate the integrity of the State or Federal legislation.

Designated Sites

Certain critical habitat areas have been identified but no formal designations have been made to date since most of these areas are already a part of Federal or State preserves or refuges on the coast. At such time as specific habitat areas are designated and management guidelines or rules and regulations are promulgated, these will be adopted as GAPC's.

b. Activities or Facilities Dependent on Coastal Location

This category includes those activities which are dependent on their proximity to coastal waters, in terms of use or access; or on proximity to specific coastal resources, such as minerals or other raw materials. (For initial purposes, port facilities and actively operating mining sites have been identified.)

Industrial and commercial uses are crucial to the economy of the South Carolina coastal zone. In addition to preservation and protection of natural areas, the State's coastal zone management program must address the development of coastal resources. It must provide the citizens of the State with guidance on the best manner in which to capitalize on development opportunities while minimizing negative environmental effects, disruption of other coastal resources, or infringement on the rights of other coastal property owners.

Uses and facilities dependent on coastal location, for water access or proximity to other coastal resources, are recognized as Geographic Areas of Particular Concern due to their unique independence on coastal location and because of the economic importance and possible environmental impacts of these activities.

Criteria for Designation

To qualify as a GAPC under this category, an activity or facility must meet one or more of the following criteria:

- 1) Significant quantities of water, such that it can only be obtained in a coastal location, are an absolutely necessary component of the process for a particular industrial or commercial activity;
- 2) Access to coastal waters, primarily for transportation purposes, not only enhances but is fundamental to the given activity; or
- 3) Minerals, energy-related resources, or other coastal resources occurring in the coastal zone are the primary purpose of an activity which is the major source of income for a given individual or company, and proximity to that resource is vital to success of the operation.

1) State Ports

Economists at the University of South Carolina estimate that the State Ports have an impact throughout the State of almost \$600 million per year, representing direct and indirect employment of about 35,000 jobs. State Ports facilities are a major attraction of industrial investments, and also play an important role for South Carolina agriculture, which exports 29 percent of its total production value.

These valuable economic assets are, by definition, dependent on their coastal location for access to the transportation corridor provided by coastal waters. While their maintenance and further development are vital to the South Carolina economy, these activities can have significant environmental impacts and also secondary development effects, particularly on other industrial and commercial uses and on public services, such as transportation.

Because of their importance as an economic resource and their dependence on a coastal location, the port facilities in South Carolina have been recognized as Geographic Areas of Particular Concern.

Management Authority

The South Carolina State Ports Authority (SPA) was created by Act 626 of the 1942 South Carolina General Assembly (Sections 54-1, -12, -15, and -20, S.C. Code of Laws, 1976). Under direction of a seven member board appointed by the governor, the SPA has the responsibility for development, construction, operation, and promotion of the State's ports. The SPA has jurisdiction over waters, shores, and tidal tributaries of the harbor at Charleston, Georgetown and Port Royal. It has the power to sue and be sued; the power of eminent domain; the power to acquire and dispose of property, and to take State property not otherwise in use; and the authority to issue revenue bonds.

Section II of the South Carolina Coastal Management Act (Act 123 of the 1977 South Carolina General Assembly) has mandated another requirement for the SPA. It reads as follows:

The South Carolina State Ports Authority shall prepare and submit to the Council a management plan for port and harbor facilities and navigation channels. Upon approval by the Council of such management plan it shall become part of the comprehensive coastal management program developed by the Council. The South Carolina State Ports Authority shall include in the management plan a designation of the geographical area appropriate for use by public and private port and harbor facilities and military and naval facilities and submit this to the Council for approval.

Joint development of this required port and harbor management plan, coupled with the Coastal Council's permit authority in the critical areas, including coastal waters and wetlands that might be part of a harbor area, will result in coordinated efforts between the SPA and the Coastal Council. And it will ensure that port modifications or expansion activities and management of the ports system remain consistent with the goals of coastal zone planning.

Inventory

Information on existing SPA properties and facilities was obtained through consultation with SPA staff and the publications which were made available. When submitted, the required ports plan will provide extensive data on existing port facilities and on likely, potential sites for future ports development which will be considered in identifying and designating additional port-related GAPCs.

Priority of Uses

The following are the uses of priority for all state ports created and operated by the South Carolina State Ports Authority (SPA) beginning with the use of highest priority:

- 1) Uses which require water access or uses for which the water orientation is the central purpose of the activity, such as maritime shipping, fishing, marine industry, and recreational boating. Included in the uses of highest priority for state ports are provisions to assure safety within the ports. These water-dependent uses should have no prudent or feasible alternative;
- 2) Water-related uses which do not reduce or degrade the natural value or resources within the port;
- 3) Nonwater-dependent or nonwater-related uses which retain future flexibility of the port for water-dependent needs.

Designated Sites

The South Carolina Ports Authority owns and manages the following facilities, which are designated as GAPCs: Beaufort County: Port Royal-State Pier 21; Charleston County: Port of Charleston; Georgetown County: State Piers 31 and 32.

2) Navigation Channels

Navigation channels are closely related to the preceding category in that they enable travel to and from

major ports, facilitate industrial and commercial activities and allow for recreational and commercial boating. Thus, channel maintenance and development are vital to the economy of the coastal zone and the state and the nation as a whole. Like port development, channel maintenance and development may have secondary effects of an environmental or developmental nature.

Because navigation channels depend upon a coastal location and are vital to the State's economy, they have been recognized as Geographic Areas of Particular Concern.

Management Authority

The provisions of Chapter 1, Title 49 of the 1976 South Carolina Code of Laws declare that "(A)11 streams which have been rendered or can be rendered capable of being navigated by rafts of lumber or timber by the removal of accidental obstructions and all navigable water courses and cuts are hereby declared navigable streams and such streams shall be common highways and forever free..." The section also prohibits the obstruction of waterways and provides for condemnation of land for rights-of-way and outlets for inland waterways.

Enforcement of this statute rests jointly with the Budget and Control Board and the Attorney General's office.

Section 15 of South Carolina's Coastal Management Act requires that the Coastal Council consider navigation channels in its permitting process. Permit applications for activities "in a waterway used for commercial navigation or shipping" must be reviewed by the South Carolina State Ports Authority prior to permit issuance for certification that the proposed project will not "unreasonably interfere with commercial navigation and shipping."

The Act also requires the Coastal Council to consider "the extent to which the activity would harmfully obstruct the natural flow of navigable water" and "the extent to which the activity could cause erosion (and) shoaling of channels."

Inventory

Information on existing navigation channels was obtained from the SPA staff and the draft SPA Ports Plan.

Priority of Uses

Existing navigation channels should be maintained and utilized, while at the same time conserving the natural environment. The following are the uses of priority for navigation channels in the coastal zone, beginning with the use of highest priority:

- 1) Beneficial uses which require water access or uses for which the water orientation is the central purpose of the activity, such as maritime shipping, fishing, and recreational boating, providing these uses are conducted in such a way as to minimize adverse environmental impacts;
- 2) Water-related uses which do not reduce or degrade the environmental quality of the waterway;
- 3) Nonwater-dependent or nonwater-related uses which do not obstruct navigation and do not impair the natural surroundings.

Designated Sites

All waterways within the coastal zone which meet the legal standards for navigability are designated as GAPCs.

3) Mining Operations

There are over 344 active mines in South Carolina, which in 1974 had an estimated mineral commodity value of \$120,000,000. Extraction of minerals by mining is a basic and essential activity, making an important contribution to the economic welfare of this State and the Nation.

While it is not practical to extract minerals required by society without disturbing the earth's surface and

producing waste materials, it is possible to conduct mining in such a way as to minimize its effects on the surrounding environment. Proper reclamation of mined land is necessary to prevent undesirable land and water conditions that would be detrimental to the environment and to the general health, safety, and welfare, and property rights of the citizens of the State.

As such, areas of ongoing mining operations qualify as Geographic Areas of Particular Concern (GAPCs), due to their geologic, economic, and environmental significance, and their dependence on a coastal location for access to particular mineral resources.

Management Authority

The provisions of Act 274 of the 1972 General Assembly are intended to allow the mining of valuable minerals and provide for the protection of the State's environment with the subsequent beneficial use of the mine and reclaimed land. The expressed purposes of the South Carolina Mining Act are as follows:

a) That the usefulness, productivity, and scenic values of all lands and waters involved in mining within the State will receive the greatest practical degree of protection and restoration.

b) That from the effective date of the Act, no mining shall be carried on in the State unless plans for such mining include reasonable provisions for protection of the surrounding environment and for reclamation of the area of land affected by mining.

The Act states that after January 1, 1975, mine operators must obtain an operating permit from the Land Resources Conservation Commission (LRCC). The permit application must be accompanied by a reclamation plan which must be approved by the LRCC, and the permit applicant must file a performance bond to ensure compliance with this reclamation plan.

As an advisory body to the LRCC, the South Carolina Mining Council serves to promulgate rules and regulations necessary to implement the S.C. Mining Act, and also serves as an appeal body for any LRCC decisions. Also serving in an advisory capacity are:

a) the State Technical Advisory Committee which is composed of State and Federal agencies, universities, and mining industry representatives; and

b) the County Technical Advisory Committee, which is composed of local members of the Soil and Water Conservation Districts, Soil Conservation Service, Clemson University, the S.C. Forestry Commission, and local government officials.

Assistance from these committees helps insure that the administration of the Mining Act is effective, reasonable, and technically sound.

The required reclamation plans must include:

1. practices to protect adjacent surface resources;
2. specifications for surface gradient restoration;
3. manner and type of re-vegetation;
4. method to prevent conditions hazardous to fish or animal life;
5. method of compliance with State air and water pollution laws;
6. method of rehabilitating settling ponds;
7. method of control of contaminants and mining refuse;
8. method of restoring stream channels and banks to minimize erosion, siltation and pollution;
9. maps as required; and
10. time schedule to be followed.

The LRCC shall deny a permit application if:

1. the operator violates the Act or regulations;
2. the operation has unduly adverse effects on wildlife or freshwater, estuarine, or marine fisheries;
3. the operation violates air quality, surface water quality, or ground water quality standards;

4. the operation constitutes a substantial physical hazard;
5. the operation has a significant adverse effect on a public-owned park, forest, or recreation area; or
6. the operator has violated commitments under the permit.

The LRCC may approve a permit application only when it meets the following minimum standards:

1. the final slopes have been minimized;
2. safety provisions to adjoining property are avoided;
3. placement of soil complies with accepted conservation practices;
4. no noxious, odious, or foul pools of water remain;
5. methods of re-vegetation and reforestation conform to practices established by the Agricultural Experiment Station of Clemson University and the South Carolina Forestry Commission.

The operator shall file an annual report with the LRCC that describes the reclamation carried out and estimates the acreage to be actively mined in the next twelve months.

The basic idea of the reclamation plan is to develop a strategy for mining a resource and returning the land to an economically useful, environmentally sound, and aesthetically pleasing form. In the coastal zone, ponds or lakes are the main reclamation practice. This is because of availability of water from streams or a high water table. These water bodies must have certain shoreline construction for long-term safety and stability, a certain percentage of shallow area for spawning, and certain minimum depths to control vegetation. The potential exists for a mining company to turn this reclamation process into a profitable real estate enterprise.

Inventory

Presently all mining operations in the coastal zone of South Carolina are required to have a mining permit and a reclamation plan filed with the Land Resources Conservation Commission. These mining operations have been located on aerial photos by the Coastal Council staff with assistance from LRCC personnel and the U.S. Bureau of Mines. The mine locations have been plotted on U.S.G.S. 7½ minute quadrangle map overlays. As new deposits are discovered or as new mining operations are proposed, the inventory file can be updated.

Priority of Uses

The following are the uses of priority for all active mining sites within the coastal zone in South Carolina, beginning with the use of highest priority:

- 1) The extraction of minerals in a manner consistent with all permit conditions and reclamation plans pertaining to the mining site;
- 2) Uses which do not interfere with the extraction of minerals for which mining permits have been acquired or with the reclamation plans for the site.

Specific Sites

Currently there are five minerals that are mined in significant amounts in the South Carolina Coastal zone. They are sand, gravel, limestone, peat, and clay.

A listing of mining operations presently permitted in coastal counties are found in the Appendix F.

c. Areas of Special Historic, Archeological or Cultural Significance

The coastal zone of South Carolina is rich in historic, archeological, and cultural features. The coastal area was the location of early colonial settlements and, prior to this, the territory of various Indian tribes. Both residents and visitors, alike, perceive these resources as valuable assets and their preservation and protection as an important issue in the growth and development of the Lowcountry. Historic societies are very active

throughout the area, and the value placed on the South Carolina heritage by its citizens cannot be over-emphasized. On this basis, areas of specific historic, archeological and cultural significance are felt to be important as Geographic Areas of Particular Concern (GAPCs) in the coastal zone.

Management Authority

To date, there is no specific legislation for historic preservation in South Carolina. However, since 1960 the State, through its Historic Preservation Officer, has developed "a program recognized nationally as an innovative and exemplary type of state-federal partnership in preservation and implementation." (**South Carolina Historic Preservation Plan**, Vol. III, 1977). Through 1975, this State led all others in an annual amount of federal funds received for preservation programs.

The National Historic Preservation Act of 1966 as amended, states that:

The Secretary of the Interior is authorized to expend and maintain a national register of districts, sites, buildings, structures and objects significant in American history, architecture, archeology and culture, hereinafter referred to as the National Register...

Executive Order 11593 of May 13, 1971, further emphasized the leadership of the Federal government in historic preservation efforts.

The National Register program is implemented and administered by State Historic Preservation Officers (SHPOs) who are responsible for the survey and nomination process, in conjunction with a review board of professionals in the field. Also, the SHPO and the State review board are responsible for preparation and review of the State's historic preservation plan, which includes background information on the State (Volume III).

Properties and sites listed on or eligible for listing on the National Register receive full consideration of their historic or archeological values through OMB Circular A-95 review process, whereby Federal, State, and local agencies comment on proposed Federal activities or funding. Section 106 of the National Historic Preservation Act of 1966, as amended, provides that:

The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally-assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation...a reasonable opportunity to comment with regard to such undertaking.

In South Carolina the Department of Archives and History, Historic Preservation Division, and the Institute for Archeology and Anthropology as well as the South Carolina Coastal Council are involved in the State Clearinghouse process for project proposals subject to A-95 review and also review Environmental Impact Statements (EIS), pursuant to the National Environmental Policy Act of 1969. The Historic Preservation Division estimated that they annually review over 500 A-95 project clearances, project notifications, and environmental impact statements for possible impact on the historic environment. While the review and comment process for Federal, federally-assisted, or federally-licensed projects affecting properties on or eligible for the National Register does not provide a veto power, it does ensure that historic values are thoroughly considered. Experience with the process has shown ample regard is given to relevant comments or objections by State agencies.

The S.C. Coastal Council is mandated to consider historic and archeological resources in implementation of its permitting authority in critical areas of the coastal zone. In evaluating applications for alterations in the critical areas, the Council must consider, among other factors, "the extent to which the development could affect....irreplaceable historic and archeological sites of South Carolina's coastal zone" (§15 (6), Act 123 of 1977).

Historic and archeological sites which have been to the National Register and sites selected from those which have been determined eligible to be named to the National Register will be designated GAPC's. The Department of Archives and History's on-going inventory will provide the Coastal Council's staff with complete information on all known historic and archeological sites for permit assessments and project evaluations. The Coastal Council may, in consultation with the State Historic Preservation Officer, apply the National Register Criteria to properties which may be eligible for inclusion in the National Register. If a property appears to meet the criteria, an opinion may be requested from the Keeper of the National Register who will determine the property's eligibility for inclusion in the National Register. As sites are listed, they will automatically be designated as GAPC's. As sites are determined to be eligible for listing, they may be designated as GAPC's.

Inventory

The State of South Carolina has had an active Statewide Historic Preservation Program since 1969, based on the National Historic Preservation Act of 1966, as amended. One of the major functions of the Historic Preservation Division of the Department of Archives and History has been an inventory identifying more than 6,000 sites in the State, reflecting 300 years of State history and over a thousand years of prehistory. Under contract with the Department of Archives and History as well as the Coastal Council, the regional Councils of Government also have been contributing to this inventory and research effort.

The University of South Carolina Institute of Archeology and Anthropology has an on-going statewide survey and mapping program for identification of both archeological and historic sites. (The Institute operates under contract to the Interagency Archeological Program, as mandated by the Federal Archeological and Historic Preservation Act of 1960, amended in 1974. This program under responsibility of the Department of the Interior contracts with qualified state and private educational and scientific institutions to perform necessary research and surveys to meet program needs identified by work with other federal agencies.)

All of this data for the eight coastal counties has been made available to the Coastal Council, and the historic and archeological sites have been added to the coastal map overlay system on U.S.G.S. 7½" quadrangle maps. For reasons of confidentiality to protect unmanaged sites from looting or destruction, the majority of this information will be limited to in-house use for review and evaluation of permits and project proposals. From this on-going inventory, sites which have been included in the National Register will be designated as GAPCs. Sites which are eligible for inclusion, may be designated as GAPC's.

Criteria for Designation

The following criteria are those adopted by the Secretary of the Interior and are used in nominating sites to or determining eligibility for the National Register. These evaluation criteria are recognized by the Coastal Council for designating GAPCs under this category.

The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- A. that are associated with events that have been made a significant contribution to the broad patterns of our history; or
- B. that are associated with the lives of persons significant in our past; or
- C. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- D. that have yielded, or may be likely to yield, information important in prehistory or history.

Ordinarily cemeteries, birthplaces, or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the National Register. However, such properties will qualify if they are integral parts of districts that do meet the criteria or if they fall within the

following categories:

A. a religious property deriving primary significance from architectural or artistic distinction or historical importance; or

B. a building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or

C. a birthplace or grave of a historical figure of outstanding importance if there is no other appropriate site or building directly associated with his productive life; or

D. a cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or

E. a reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or

F. a property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own historical significance; or

G. a property achieving significance within the past 50 years if it is of exceptional importance.

Priority of Uses

The following are the uses of priority for areas of special historic, archeological, or cultural significance which have been named to the National Register, beginning with the use of highest priority.

- 1) Uses which preserve the historical or cultural values for which the site was placed on the National Register;
- 2) Educational opportunities for the public regarding the historical, archeological or cultural significance of the sights as long as the site is not disturbed.

Designated Sites

The following historic and archeological sites in the South Carolina coastal zone are on the National Register of Historic Places. They are designated as Geographic Areas of Particular Concern and are shown in the map appendix. A brief description of each site appears in Appendix F.

Jasper County:	A1	Robertville Baptist Church
	A2	Gillisonville Baptist Church
Beaufort County:	B1	Sea Pines Shell Ring
	B2	Green's Shell Enclosure
	B3	Hilton Head Shell Ring
	B4	Church of the Cross
	B5	Charles Forte
	B6	Tombee Plantation
	B7	Hassell Point Shell Ring
	B8	Hunting Island Light House
	B9	Fort Frederick
	B10	Chester Field Shell Ring
	B11	Penn Center
	B12	Indian Hill
	B13	Beaufort Historic District
	B14	Tabby Manse
	B15	John Mark Verdier House
	B16	Barnwell-Gough House
	B17	The Marshlands
	B18	Robert Smalls House
	B19	John A. Cuthbert House

- B20 William and Elizabeth Barnwell House
- B21 The Anchorage
- B22 Coffin Point Plantation
- B23 Little Barnwell Island Shell Ring
- B24 Sheldon Church
- B25 Auldbrass Plantation
- Colleton County:
 - C1 Isaac Haynes Hall
 - C2 Pon Pon Chapel
 - C3 Colleton County Courthouse
 - C4 Walterboro Jail
 - C5 Walterboro Little Library
- Dorchester County:
 - D1 Middleton Place
 - D2 Old Fort Dorchester
 - D3 Summerville Historic District
 - D4 Cypress Methodist Campground
 - D5 Carroll Place
 - D6 Indian Fields Methodist Church Campground
- Charleston County:
 - E1 Middleton's Plantation
 - E2 The Presbyterian Manse
 - E3 Trinity Episcopal Church
 - E4 Fig Island Shell Ring
 - E5 Horse Island Shell Ring
 - E6 Brick House Ruins
 - E7 William Seabrook House (Dodge Plantation)
 - E8 Village of Rockville Historic District
 - E9 Hanckel Mound Shell Ring
 - E10 John Seabrook Plantation Bridge (Adm. George Palmer Bridge)
 - E11 Arnoldus Vander Horst House
 - E12 Willtown Bluff
 - E13 Johns Island Presbyterian Church
 - E14 Fenwick Hall Plantation
 - E15 Marshlands Plantation House
 - E16 Fort Johnson/Powder Magazine
 - E17 Stiles-Hinson-Thompson House
 - E18 Fort Sumter
 - E19 U.S. Coast Guard Historic District
 - E20 Fort Moultrie
 - E21 Battery Gadsden
 - E22 Battery Thomson
 - E23 McLeod Plantation
 - E24 Castle Pinckney
 - E25 Charleston Historic District
 - E26 Bethel Methodist Church
 - E27 William Blalock House
 - E28 Daniel Blake House
 - E29 Branford-Horry House
 - E30 Miles Brewton House
 - E31 Robert Brewton House
 - E32 Charleston's French Quarter District
 - E33 C & S National Bank of S. C. Building
 - E34 College of Charleston
 - E35 Dock Street Theatre

E36 The Exchange & Provost
E37 Farmers' and Exchange Bank
E38 Fireproof Building
E39 William Gibbs House
E40 DuBose Heyward House
E41 Heyward—Washington House
E42 Hibernian Hall
E43 Huguenot Church
E44 McCrady's Tavern and Long Room
E45 Joseph Manigault House
E46 Market Hall and Sheds
E47 Clark Mills Studio
E48 James Nicholson House
E49 Old Marine Hospital
E50 The Circular Congressional Church
E51 Powder Magazine
E52 Robert Barnwell Rhett House
E53 Robert William Roper House
E54 Thomas Rose House
E55 Nathaniel Russell House
E56 Edward Rutledge House
E57 Governor John Rutledge House
E58 St. Michael's Church
E59 St. Philip's Church
E60 Simmons—Edwards House
E61 S.C.N. Bank of Charelston
E62 S.C. State Arsenal
E63 Col. John Stuart House
E64 Sword Gates House
E65 Unitarian Church
E66 U.S. Customhouse
E67 U.S. Post Office and Court House
E68 Central Baptist Church
E69 St. Mary's Roman Catholic Church
E70 Old Bethel United Methodist Church
E71 Kahal Kadosh Beth Elohim Synagogue
E72 Mount Pleasant Historic District
E73 St. Andrews Parish Church
E74 Old Court House
E75 William Aiken House and Associated Railroad Structures
E76 Site of Old Charles Towne
E77 Magnolia Cemetery
E78 Paul Pritchard Shipyard
E79 Snee Farm
E80 Christ Church
E81 Auld Mound
E82 Buzzard's Island Shell Ring
E83 Oakland Plantation
E84 Stono River Slave Rebellion Site
E85 Ashley Hall Plantation
E86 John Drayton House
E87 Magnolia Gardens

- E88 Sewee Shell Ring
- E89 Harrietta Plantation
- E90 St. James Santee Episcopal Church
- E91 Fairfield Plantation
- E92 Hampton Plantation
- E93 Fort Pemberton
- E94 Bleak Hall Plantation Outbuildings
- E95 Edisto Island Presbyterian Church
- E96 Old House Plantation
- E97 Peter's Point Plantation
- E98 Windsor Plantation
- Berkeley County:
 - F1 St. James Goose Creek Church
 - F2 St. Thomas Episcopal Church
 - F3 Medway Plantation
 - F4 Middleburg Plantation
 - F5 Pompion Hill Chapel
 - F6 Strawberry Chapel
 - F7 Calais Mile Stone
 - F8 Tavon Church
 - F9 Thomas Broughton (Mulberry) Plantation
 - F10 Lewisfield Plantation
 - F11 Lack Dhu Plantation
 - F12 St. Stephen's Episcopal Church
- Georgetown County:
 - G1 Hopsewee Plantation
 - G2 Annandale Plantation
 - G3 Georgetown Lighthouse
 - G4 Georgetown Historic District
 - G5 Prince George, Winyah, Episcopal Church House
 - G6 Old Market Building
 - G7 Arcadia Plantation
 - G8 Pawleys Island Historic District
 - G9 Mansfield Plantation
 - G10 Prince Frederick's Chapel
 - G11 Brookgreen Gardens
 - G12 Chicora Wood Plantation
- Horry County:
 - H1 Hebron Church
 - H2 Old Horry County Jail

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ENERGY FACILITY PLANNING PROCESS

1. Introduction

The Federal Coastal Zone Management Act, as amended in July, 1976, requires in Section 305 (b)(8) that each state's management program must include:

A planning process for energy facilities likely to be located in, or which may significantly affect, the coastal zone, including, but not limited to a process for anticipating and managing the impacts from such facilities.

The South Carolina Coastal Management Act (Act 123 of the 1977 South Carolina General Assembly) (the Act) (Appendix B) states in Section 8 (B)(6) that in the development of the State's coastal management program the Council shall:

Provide for adequate consideration of the local, regional, state and national interest involved in the siting of facilities for the development, generation, transmission and distribution of energy, adequate transportation facilities and other public services necessary to meet requirements which are other than local in nature.

Therefore, the South Carolina Coastal Council has the Federal and State mandate to include in its management program a planning process to incorporate the siting of energy facilities in the coastal zone in a manner which is consistent with the other necessary uses of the coast. In addition, the Council is mandated to consider the national interest when making these decisions.

Section 923.13 of the coastal zone management development and approval regulations (**Federal Register**, Vol. 44, No. 61, March 1979) outlines the minimum requirements which the energy planning process must contain.

- (1) Identification of energy facilities which are likely to locate in, or which may significantly affect a State's coastal zone;
- (2) Procedures for assessing the suitability of sites for such facilities....;
- (3) Articulation and identification of enforceable State policies, authorities and techniques for managing energy facilities and their impacts;
- (4) Identification of how interested and affected public and private parties will be involved in the planning process.

The energy planning element of South Carolina's coastal management program will begin with a look at the existing energy demands in the State and the pattern of supply, followed by an explanation of the future alternatives for South Carolina to meet its energy needs over the next ten years. The various mechanisms for providing the necessary energy planning to the State will be presented and explained. Furthermore, some suggestions for consolidated forecasting efforts during implementation of the coastal management program will be made.

A brief description of the relationship between the use of coastal resources to provide for energy needs and the other vital demands for coastal resources will place the importance of siting decisions into a meaningful perspective. A legal analysis of the regulatory authority governing energy siting decisions, a look at the Coastal Council's participation in the decision making and the policies which will guide the Council's evaluations will demonstrate the consolidated, comprehensive approach which South Carolina is developing in order to accommodate growth while maintaining its precious heritage.

2. Overview

The South Carolina Division of Research and Statistical Services predicts that energy consumption in the State will increase at a faster rate than the national average. While the increase will slow somewhat during the

next decade, the rate will continue to outdistance the national average because South Carolina's economy is expected to continue to grow at a faster rate than that of the nation as a whole. Most of this demand has been met by coal and nuclear power. Oil and natural gas have become progressively displaced by nuclear power as fuel sources in South Carolina in recent years (Chart 1).

a. Existing Energy Demands

The most accurate figures available are, of course, those for current energy demands. In 1975, the last year for which accurate data are available, total residential energy consumption in South Carolina was 73.1 trillion BTU's. This figure can be further divided into energy supplied by natural gas (18.6 trillion BTU's), electricity (33.1 trillion BTU's) and petroleum (15.1 trillion BTU's as distillate heating fuel, .9 trillion BTU's as residual heating fuel and 5.4 trillion BTU's as kerosene).

Commercial energy demands are not as systematically articulated as residential demands. The total consumption in South Carolina in 1975 was 37.4 trillion BTU's. Of this total, 15.6 trillion BTU's were provided by natural gas and 21.8 trillion BTU's by electricity.

In 1975, total industrial consumption was 145.2 trillion BTU's, which can be further subdivided into demands for natural gas, (79.2 trillion BTU's), electricity (46.2 trillion BTU's), and oil (19.8 trillion BTU's). It is interesting that the demand for oil dropped from 25.4 trillion BTU's in 1974, presumably as a result of the energy crisis, yet immediately began to rise again in 1978.

Transportation sector energy demands for 1975 were 1,471 million gallons of motor fuel.

The electric utility sector's demand for fossil fuels in 1975 totaled 152.8 trillion BTU's. Of this, 100.6 trillion BTU's were supplied by coal, 30.1 by oil, and 22.1 by natural gas.

b. Energy Supplies

Figure 1 shows the relative importance of the various sources of energy production in South Carolina. Coal presently supplies the greatest proportion of the energy used in the State, with nuclear energy a very close competitor. Hydro-power is also a more important energy source than either oil or gas, but the production of hydro-power is primarily concentrated outside of the coastal zone, as is nuclear power.

As has been noted previously, the importance of oil and gas to the total energy balance of the State has declined dramatically in the past several years. This State trend is a result of declining national supplies coupled with rising national prices and the fact that there are no sources of oil or gas close to South Carolina. With the results of offshore Lease Sale 43 which took place in Savannah, Georgia, in March, 1978, this trend is even more likely to continue. Tracts off of the coast of South Carolina in the Southeast Georgia Embayment were included in the nominations for bids in Lease Sale 43. No actual bids, however, were made on the offshore lease blocks affecting South Carolina.

The next sale which could have affected South Carolina was Lease Sale 54. Sale 54 was scheduled to lease tracts in the Blake Plateau in November, 1979, but has been indefinitely delayed for a number of reasons including a lack of industry interest at the present time.

The only other sale planned at this time for tracts off South Carolina's coast is Lease Sale 56 presently scheduled for April, 1981. The tracts available for Lease Sale 56 are expected to be the same as those available in Lease Sale 43. Therefore, the likelihood of South Carolina experiencing any significant Outer Continental Shelf (OCS) related activity onshore in the immediate future seems slight. The exception would be in the case of pipelines across state or other OCS related facilities resuming from discoveries of oil or gas off of Georgia's coast or Florida's east coast.

CHART 1

SOUTH CAROLINA NUCLEAR POWER STATIONS

Current status of operation and construction dates
(Taken from August 1978 issue of **Nuclear News**.)

	Station (Power Unit)	Company	Date of Operation
In Operation	Robinson (2)*	CP&L	March 1971
	Oconee (1)	Duke	July 1973
	Oconee (2)	Duke	September 1974
	Oconee (3)	Duke	December 1974
Under Construction	Summer (1)	SCE&G	December 1980
	Catawba (1)	Duke	July 1981
	Catawba (2)	Duke	January 1983
	Cherokee (1)	Duke	January 1985
	Cherokee (2)	Duke	January 1987
	Cherokee (3)	Duke	January 1989

*Robinson (1) is fossil-fueled.

The ways in which a state's energy demands are met are determined as much by geological and geographical criteria as any other. For example, South Carolina's relatively large share of hydroelectric power generation may best be explained by the State's abundant water resources in manmade reservoirs. Likewise, the low utilization of oil and natural gas is explained in part by the absence of reserves and by the lack of oil refineries or other processing facilities in or near South Carolina at this time. While it is true that no coal is mined in the State, transportation networks and historical usage patterns make it the most important fuel source in South Carolina.

1) Electricity

As has been noted above, electricity is not only the most heavily utilized but also the fastest growing source of energy in the State. Per capital electricity consumption in South Carolina is 40 percent higher than the U.S. average, a fact which may be partially accounted for by the heavy use of air conditioners. The rapid growth in demands for energy, coupled with inflation and the high cost of environmentally acceptable technology, has led to rapidly increasing costs for electricity. The average annual bill for South Carolina residents has risen from \$150.61 in 1968 to \$454.88 in 1977, an increase of 200 percent.

Because of the projected increases in demand during the next decade, all four of the major electric utility companies serving the State are planning significant expansion of both generating facilities and transmission and distribution systems, with some of the expansion expected to take place outside the coastal zone.

Statistics from South Carolina Electric and Gas, Carolina Power and Light and Duke Power companies indicate that no new generating facilities are specifically planned for the coastal zone until at least the late 1980's. However, South Carolina Electric and Gas Company does plan to upgrade its Hagood (coal-fired, steam generating) station in Charleston County by 1984 and to construct three new facilities whose locations are as yet undetermined. The South Carolina Public Service Authority is currently expanding its steam generating facilities in Georgetown County, and further expansion within the coastal zone is likely during the next decade.

2) Natural Gas

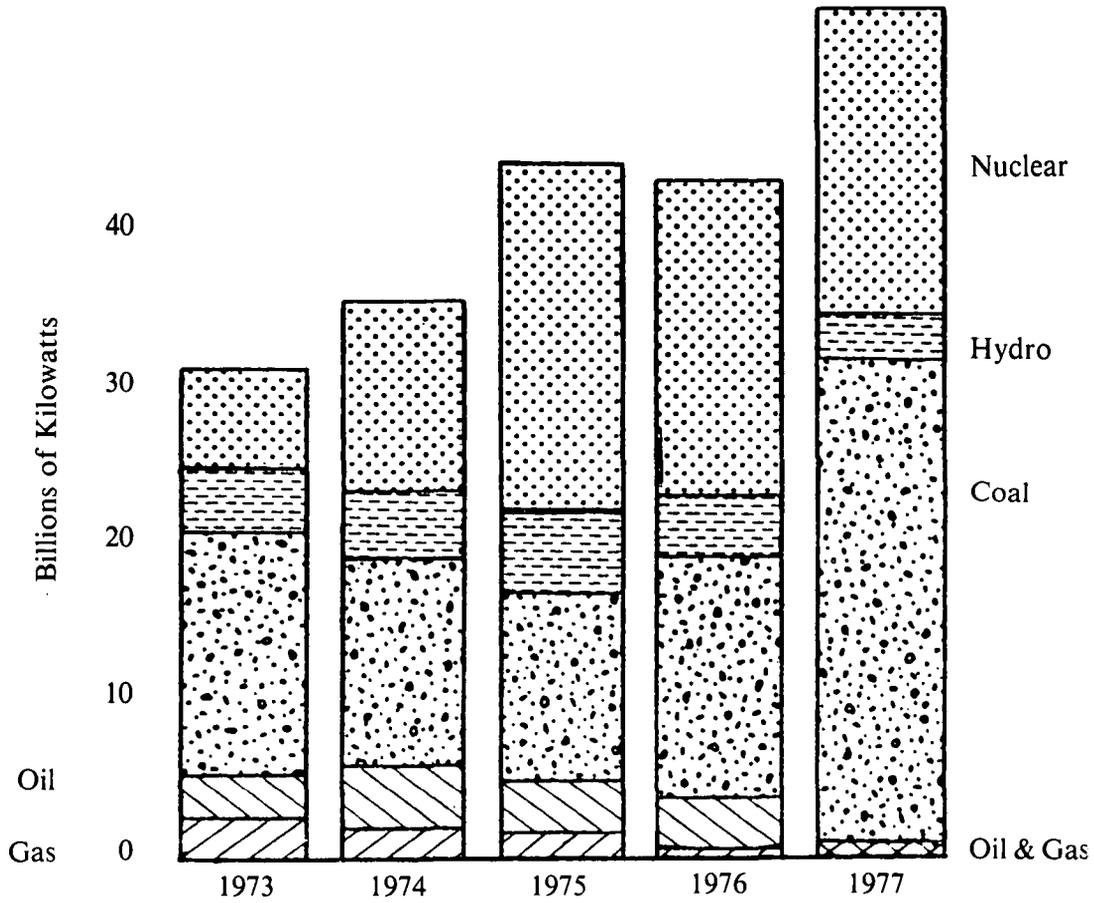
As pointed out in the preceding discussion, natural gas usage has been declining in South Carolina and is likely to continue to do so in the years ahead. The decline may be traced to limited supplies of the resource, as there is no natural gas produced within the State, and allocations to South Carolina are controlled by the Federal government. Allocations to the State are handled by two major pipeline companies in the Piedmont region of the State which distribute gas to their own customers, gas authorities, and private and municipal distributors.

3) Nuclear Energy

Estimates of nuclear energy's share of South Carolina's total energy supply range from 45 percent to 56 percent (Figure 1). Nuclear energy has been a major contributor to South Carolina's economy through related industries as well as through the plants themselves. At the present time there are two nuclear power stations with a total of four reactors in operation in South Carolina, with an additional six reactor units under construction or on order and scheduled to begin operation by 1989. None of these stations is in the State's coastal zone. A study conducted during the past year by the Southern States Energy Board identified five possible sites for a nuclear energy center in South Carolina. Two of these five possible sites were located in the coastal zone; however, a site in the northwestern part of the State was selected as the most promising for further analysis. Robert Hirsch, Energy Advisor to the Governor, former Director of South Carolina's Energy Management Office, has stated that no plans for additional nuclear facilities in the coastal zone have come to his attention.

In addition to the power plants themselves, South Carolina has four service/manufacturing facilities. These are the Westinghouse nuclear fuel manufacturing plant in Columbia, the Allied General Nuclear Services reprocessing facility located (but not operating) in Barnwell, the Chem-Nuclear Systems low-level waste management facility at Snelling (near Barnwell), and the Savannah River Plant, which is a

FIGURE 1
SHARES OF ENERGY PRODUCTION



SOURCE: S.C. Division of Research and Statistical Services
 1978 S.C. Economic Report, p. 63

government-owned facility operated by private industry under a Department of Energy contract. Of these four, the Savannah River Plant, which produces nuclear materials and performs related research, has the most potential to affect the coastal zone because of its proximity to Jasper and Beaufort counties.

c. Future Alternatives

At the present time, there are 26 energy facilities in operation or planned for the coastal zone. These range from hydro plants and combustion turbines to industry land holdings with no construction yet begun. (Tables 1 and 2).

Location of new facilities will depend in some measure on transportation and population centers, where the need for energy will be the greatest. Increases in industrial and commercial activity will also lead to additional energy demands.

The port facilities at Charleston, Georgetown, and Port Royal will require a great deal of energy. The Act (Appendix B) requires the South Carolina State Ports Authority to "prepare and submit to the Council a management plan for port and harbor facilities and navigation channels." Once the Coastal Council approves the Ports Authority plan, it will become a part of the coastal management program, thereby enabling the Coastal Council to assess and guide energy-related development in the State's port areas.

Forecasting energy supplies and demands is difficult, but forecasting alternative methods and sources of supply can be even more complex. Several points are well established: prices for all forms of energy will continue to increase, supplies of natural gas and, in all likelihood, oil will diminish steadily, as will deposits of low-sulfur coal. At the same time, South Carolina's population and industrial base will continue to expand, resulting in greater demands for energy.

Obviously, one alternative is to increase the State's reliance on nuclear power. However, in light of the environmental and safety questions currently surrounding nuclear energy, it is also prudent to consider other possible responses to the State's energy needs.

One alternative course of action, pursued on the national level, is substitution of fuels. The Department of Energy publication **Energy Supply Initiatives** suggests that as oil prices rise, substitution of synthetic liquid and solid fuels and oil shale derivatives for petroleum products will become economically attractive. Unconventional natural gas (i.e. from geopressurized sources or coal gasification processes) may also become economically feasible as current prices rise. Other sources of substitute fuel which may have a more direct impact on the State include the combustion of biomass — a technique currently utilized in the forest products industry; production of fuel from corn and other agricultural products; and possible local applications of geothermal energy from granitic rock beneath the Atlantic Coastal Plain (experimental geological/geophysical research under Department of Energy contract).

In addition to substitution of fuels, there are a number of new technologies with the potential to reduce demands on conventional resources. With the State's location, climate and forestry industry, renewable sources of energy and other soft energy technologies should be examined and developed in conjunction with historically important types of energy development and production. These include development of small hydroelectric generating facilities at existing dams, wind generated power, sea thermal power, geothermal, hydrogen as a fuel, photovoltaics, and passive solar heating and cooling. Photovoltaic cells convert sunlight directly into electricity, and can be used in either central or dispersed locations. Progress in this field has been made at the University of South Carolina College of Engineering, leading to the possibility that South Carolina may be in the vanguard of states utilizing this technology experimentally. Passive solar heating and cooling seem to hold the greatest promise for South Carolina, and are also being studied extensively by a number of researchers throughout the State, most notably members of the Clemson University faculty. Additional research is underway investigating the possibilities of numerous other energy alternatives.

What is perhaps most significant about these alternatives is that they lend themselves to decentralized application. The Department of Energy proposes to initiate a program to —

Encourage individuals and small business to develop and prove the feasibility of a variety of small-scale technologies...Emphasis will be placed on technologies that may not be universally applicable, but which are appropriate to markets characterized by unique regional, institutional and end-use conditions. (Department of Energy, **Energy Supply Initiatives**, May 15, 1978.)

TABLE 1

		Peak Construction Employment	Peak Operating Employment	Date Commercial Operation Began
I. South Carolina Public Service Authority				
1. Winyah Generating Plants, Georgetown County	#1	445	92	March 25, 1975
	#2	428	92	July 1, 1977
2. Jefferies Steam Plant, Berkeley County	#1	962	97	January 1, 1954
	#2	962	97	January 1, 1954
	#3	380	97	January 1, 1970
	#4	380	97	July 1, 1970
3. Jefferies Hydro Plant, Berkeley County		12,670	17	December 1, 1942
4. Spillway Hydro, Berkeley County		105	2	August 1, 1950
5. Granger Station fossil fuel plants, Horry County	#1	411	55	June 1, 1966
	#2	411	55	June 1, 1966
6. Combustion turbines, Myrtle Beach, Horry County	#1	38	1	May 1, 1962
	#2	38	1	May 1, 1962
	#3	38	1	August 1, 1972
	#4	38	1	August 1, 1972
	#5	38	1	June 1, 1976
7. Combustion turbines, Hilton Head, Beaufort County	#1	38	2	August 1, 1973
	#2	38	2	August 1, 1974
II. Amoco facility, Berkeley County <i>(No permits required until operation begins)</i>		1,500	170	July, 1978
III. Chicago Bridge and Iron, Beaufort County ^a <i>(Corps of Engineers, S.C. Budget and Control Board, and Beaufort County Building permit received. No other permits required.)</i>		100-150	600	1979 <i>(expected)</i>
IV. Chevron owns land, Jasper County, facility is planned.				
V. Cooper River Rediversion Hydro Plant, Berkeley County				
VI. South Carolina Electric & Gas (See Table 8 for detailed analysis.)				

^a Purpose as yet undefined.

TABLE 2**SOUTH CAROLINA ELECTRIC & GAS COMPANY
RESPONSE TO COASTAL PLANNING QUESTIONNAIRE**

County	Peak Construction Employment	Peak Operating Employment	Station	Net Installed Capacity (MW)	Date When Station Became Operational	Status of Present Projects Under Construction or Proposed
Horry						None
Georgetown						None
Charleston		37	Hagood Steam	96	1947 (1st Unit)	None
Charleston	5	0	Faber Place IC	9	1961	
Beaufort	5	0	Burton IC	30	1961	None
Jasper	5	0	Hardeeville IC	15	1968	None
Colleton	550	78	Canadys Steam	422	1962 (1st Unit)	None
Colleton	5	0	Canadys IC	15	1968	
Dorchester						None
Berkeley	925	54	Williams Steam	580	1973	None
Berkeley	5	0	Williams IC	54	1972	

Because the South Carolina coastal zone contains a wide variety of economic, demographic, geologic and geographic conditions, such an approach to meeting the State's energy needs may prove to be workable.

A final future alternative is increased conservation of energy. Actions such as retrofitting insulation on buildings and car-pooling can do much to reduce the State's energy demands. The institution of user fees and tax credits may also lead to significant conservation of our energy resources. Industrial use of energy has become increasingly more efficient since the middle of the century (Figure 2), and further conservation measures are being investigated extensively within the State. Richard W. Barnes of the Dow Chemical Company has estimated that with "very strong incentives" (increasing real energy prices, economic incentives for conservation investments and "practical accommodation within environmental protection requirements") industry could reduce the intensity of its energy use (hence increasing energy conservation) by an average of 0.8 percent per year over approximately the next decade. Therefore, as Figure 2 indicates, industrial expansion is not necessarily detrimental to the State's energy balance. It is entirely possible to have economic growth within the State without excessive consumption of our energy resources.

d. Energy Planning

Energy planning in its most rudimentary form began at the State level in 1973 with an Executive Order creating the Energy Management Office. The Energy Management Office was charged with developing a program of energy conservation for the State, as well as with providing a clearinghouse function for all energy information passing through the State.

In the fall of 1978, the Energy Management Office was replaced by the Office of Energy Resources, directed by Dr. Lamar E. Priester, Jr. The Office of Energy Resources is designed to carry out all of the functions of the Energy Management Office as well as to conduct assessments and evaluations, economic analysis and collaboration with the newly-formed joint legislative committee on energy to develop energy-related legislation. In addition, the Office will promote use of diversified energy sources throughout the State.

The Office of Energy Resources will make policy recommendations, but does not yet have any regulatory authority or authority to require implementation of its recommendations. The Office could serve the State in the future as a mechanism for energy planning if it receives statutory authority.

On July 25, 1978, the Division of Consumer Advocacy within the S. C. Department of Consumer Affairs was created to provide legal representation of the consumer interest before State regulatory agencies, such as the Public Service Commission. The Consumer Advocate at his sole discretion acts as a representative for the public before the PSC and utility siting proceedings and rate cases. The S. C. Consumer Advocate may petition to become a party of record under its legislation in these proceedings.

The Public Service Commission (PSC), which is the primary regulatory authority for energy facilities in South Carolina, is beginning to develop a forecasting capability. The PSC received a grant from the National Regulatory Research Institute for the South Carolina and North Carolina Commissions to develop a methodology for regional forecasting within their respective states for energy consumption and peak energy demands for electricity. The methodology developed will assist in determining the type of plant and best plant mix (base, peak or intermediate) which will best meet the anticipated needs for electricity.

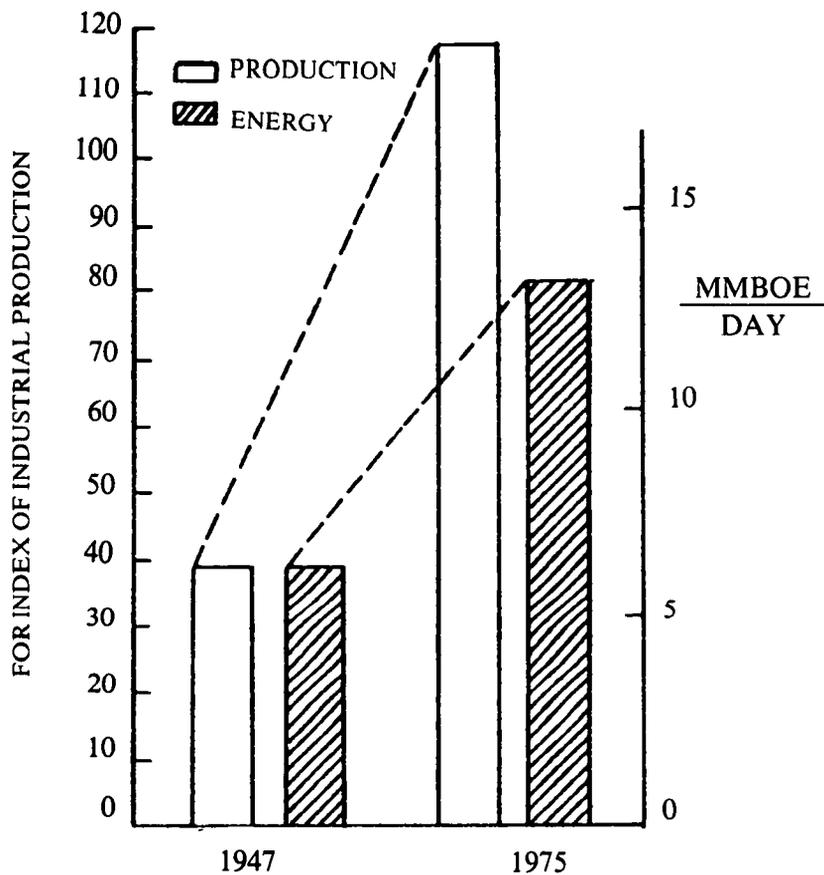
The PSC is attempting to obtain funding to develop a data base at the county level which would significantly increase their forecasting capability. Eventually the PSC would like to develop a State Energy Model to determine plant sites, types, and mixes. About a year and a half ago, the South Carolina Division of Research and Statistics prepared an energy demand study for the Energy Management Office. The data used in the study was accumulated on a statewide basis and has not been updated since that time. The usefulness of this for planning purposes may be significant if the data is accumulated at the county level and updated yearly.

A possible use for coastal zone management implementation funds could be to participate in the development of computerized energy forecasting for energy planning purposes for the coastal zone. If the data were available on the county level, it could also be extremely valuable to coastal governmental units.

It is logical to assume that local governments within the coastal zone will have to assess the impact of proposed energy facilities on their city, county or region. In many cases, local administrators will have little or no experience with such analysis, and consequently may require assistance. The Coastal Council office in Charleston has already compiled an annotated bibliography of materials which will be useful to the local planners responsible for energy impact analysis, and hopes to acquire many of these materials.

FIGURE 2

INDUSTRIAL GROWTH COMPARED TO ENERGY USE



Source: Testimony of Richard W. Barnes, Dow Chemical Company, before the Subcommittee on Advanced Energy Technologies and Energy Conservation RD&D of the Committee on Science and Technology, U.S. House of Representatives, April 4, 1977.

Local planners would then be able to utilize the Council library as needed.

The remaining sources of information available to the Coastal Council for energy planning will come from the A-95 process and from the individual energy suppliers. An Energy Facility Siting Advisory Committee has been organized by the South Carolina Coastal Council (Appendix J). All energy suppliers in the coastal zone, in addition to the State regulatory agencies and the Department of Energy, have representation on the Committee.

The energy planning process, because of its complexity, requires input from a variety of sources. Much of the necessary information is technical in nature, requiring the inclusion of experts in the planning process. Therefore, the Energy Facility Siting Advisory Committee met once before the first draft of the Energy Planning Process was written and has continued to meet throughout the various developmental writing stages. In this way the Committee members have participated in the formation of management program elements which most directly affect them.

It is likely that the Advisory Committee may be called upon regularly after the management program is approved in order to inform the Council of new energy developments, suggest areas requiring further research, and advise the Council on proposed amendments to the coastal program. Forecasting data from the PSC and Division of Research Statistics, and any additional energy prediction and demand studies, can significantly augment information available to the Coastal Council.

3. Demands For Coastal Resources

Among the General Assembly's findings in the Coastal Management Act of 1977 is that "basic state policy in the implementation of this act is to protect the quality of the coastal environment and to promote the economic and social improvement of the coastal zone and of all the people of the State." One of the specific State policies to be followed by the Coastal Council in implementation of the Act is:

To promote economic and social improvement of the citizens of this State and to encourage development of coastal resources in order to achieve such improvement with due consideration for the environment and within the framework of a coastal planning program that is designed to protect the sensitive and fragile areas from inappropriate development and provide adequate safeguards with respect to the construction of facilities in the critical areas of the coastal zone;...

Consequently, decisions concerning the siting of energy facilities, as well as all other resource allocation decisions, must be made by balancing the need for development which is essential to the economy of the State with the safeguarding of fragile coastal resources. The increasing concentrations of people along the coast require both energy supplies to provide for their personal needs and energy supplies to run the industries in which they are employed. At the same time, increasingly large numbers of people living along the coast reduce the amount of open land available for sites for energy facilities.

The production and transmission of energy can potentially bring negative impacts if siting decisions are not made carefully. A poorly located energy facility can bring to an area problems which can outweigh the tax revenues and other benefits which the community receives. Prime sites for energy facilities should be available for development since the development of poorly chosen sites could result in misspent funds, upheaval to a community, and frequently permanent environmental damage.

Numerous conflicting demands are placed on coastal resources to support such diverse economic activities as manufacturing, tourism and fishing. In addition, the people who work in the coastal zone must have space to live and play, thus requiring housing, recreational facilities, and open space. Energy facilities may require such coastal resources as port facilities. Moreover, the natural regeneration of the coastal ecosystem should be accommodated.

South Carolina has a unique opportunity to learn from other states whose coastal resources have been strained by more intense development and higher population density than this State has yet experienced. Energy facility siting decisions yet to be made provide us with one opportunity to maintain the quality of life we now enjoy and ensure it for our children and succeeding generations.

4. Regulatory Authority

The existing regulatory authority pertaining to energy facilities, as it relates to the South Carolina Coastal Council, is entirely different from the State regulatory authority for other activities. Whereas the Coastal Council's authority for other activities is implemented along a geographical boundary, with direct permitting authority within the critical area and networking authority throughout the remainder of the coastal zone, the State authority over energy facilities follows essentially no geographical boundary. Instead, the authority is primarily determined by the entity which regulates the supplier of energy rather than where the facility is located. A series of exemptions in several State statutes pertaining to energy facility siting further contribute to the complexity of the authority.

In the coastal zone of South Carolina, the primary regulatory authority is the Public Service Commission (PSC) whose regulated utilities provide approximately 89 percent of the electricity produced in South Carolina. The remainder is provided by either the South Carolina Public Service Authority (PSA), the rural electric cooperatives, or some combination of these. Chart 2 outlines the State agencies from which permits are required for major facilities.

An analysis of the PSC's authority and the role of the South Carolina Coastal Council in decisions by the PSC follows. Next, an analysis of the authority of the PSA and the rural electric cooperatives is given along with a description of the Coastal Council's networking authority in each case. Finally, a few general comments are presented regarding energy facility siting in the State.

a. Electric Facilities

1) Public Service Commission

Although the Coastal Council has direct permitting authority within the critical areas, the South Carolina Coastal Management Act (the Act) in Section 13 (D) (9) provides an exemption that a Coastal Council permit is not required for the "Construction or maintenance of a major utility facility where the utility has obtained a certificate for such facility under 'The Utility Facility Siting and Environmental Protection Act,' Sections 58-33-10 through 58-33-430 of the 1976 Code. Provided, however, that the South Carolina Public Service Commission shall make the Council a party to certification proceedings for utility facilities within the coastal zone." The Utility Facility Siting and Environmental Protection Act (the Siting Act) is the primary piece of environmental legislation under which the PSC operates, and it exempts the PSA from the requirement for a PSC permit. Thus, no Coastal Council permit is required within the critical area for an energy facility unless the facility is being built by the PSA or is otherwise specifically exempted from the Siting Act, such as a facility which is too small to be covered under the Siting Act.

The Public Service Commission (PSC) requires certificates for all major utility facilities which are defined as:

- (a) Electric generating plant and associated facilities designed for, or capable of, operation at a capacity of more than seventy-five megawatts.
- (b) An electric transmission line and associated facilities of a designed operating voltage of one hundred twenty-five kilovolts or more;... (§58-33-20, Code of Laws of South Carolina (1976)) (Code) (Appendix E(1))

The remainder of the section quoted above gives the exemption for any facilities leased to or operated by the South Carolina Public Service Authority in §58-33-20 (Code).

Two additional exemptions are granted in §58-33-110 (Code). In Section (4) an exemption for a PSC certificate is granted to any hydroelectric generating facility over which the Federal Energy Regulatory Commission has licensing jurisdiction. Because of the relatively low stream flow gradient hydroelectric generating plants will not typically be built within the coastal zone. Where hydroelectric generating facilities are built within the coastal zone, the Coastal Council will either directly permit the project or have the authority for review and certification through the South Carolina Budget and Control Board permit.

In Section (6) the PSC is given the authority to waive normal procedures and issue emergency certificates. However, because the type of facilities for which PSC certificates are issued are of such size

CHART 2

State Agencies From Which Permits/Certificates Are Required for Major Energy Facilities

Electric Generating Facilities provided by:	Facility (inside critical area)	Facility (outside critical area)
South Carolina Electric and Gas Company	PSC DHEC WR**	PSC B & CB* DHEC WR**
Carolina Power and Light	PSC DHEC WR**	PSC B & CB* DHEC WR**
Cooperatives	PSC DHEC WR**	PSC B & CB* DHEC WR**
Public Service Authority	SCCC DHEC WR**	B & CB* DHEC WR**
Oil and Gas Facilities	SCCC DHEC WR	B & CB* DHEC WR

- 1) B & CB - Budget and Control Board
- 2) DHEC - Department of Health & Environmental Control
- 3) PSC - Public Service Commission
- 4) SCCC - South Carolina Coastal Council
- 5) WR - Water Resources

* If below ordinary high water.
 ** In designated capacity use areas.

and significance to require long construction phases, this emergency certificate is not likely to be invoked.

The procedure which the PSC follows in consideration of applications is specified in the Siting Act. In brief, the application is submitted to the PSC; proof of service is issued to all municipalities, government agencies, and interested persons in the affected area; the application is forwarded to all "parties to the certification proceedings;" a hearing on the application is held; and the Commission makes a decision based on the record of the hearing proceeding.

The point of primary importance in this procedure, from the Council's point of view, is the definition and input of "parties to the certification proceedings." In §53-33-14D (Code) of the Siting Act, the various parties to the certification proceedings are identified as the Department of Health and Environmental Control; Wildlife and Marine Resources Department; Department of Parks, Recreation, and Tourism; and the Water Resources Commission. This act was passed in 1971 before establishment of the South Carolina Coastal Council; therefore, the Council is not mentioned as a party. However, assurance that the South Carolina Coastal Council is a party to the certification proceedings is confirmed in Sections 7(A), 8(B)(11), and 13(D)(9), of the Act (Appendix B).

Section 7(A) obligates State agencies to administer their powers in accordance with the Council's statute and rules and regulations. Section 8(B)(11) empowers the Council to develop a system of review for all State and Federal permit applications in the coastal zone and to certify that these do not contravene the coastal management program. Section 13(D)(9) specifically states, as already indicated, that facilities permitted by the PSC do not have to receive a Coastal Council permit provided "that the South Carolina Public Service Commission shall make the Council a party to certification proceedings for utility facilities within the coastal zone." The Memorandum of Agreement (Appendix D) between the South Carolina Coastal Council and the Public Service Commission affirms that the Coastal Council is a party to the certification proceedings of the Public Service Commission.

A practical affirmation that the SCCC is considered a party to the certification proceedings exists since the SCCC staff has already participated in a certification review. In early 1978, South Carolina Electric and Gas (SCE&G) Company submitted to the Council staff for review an application requesting a PSC certificate to build new transmission lines to Mt. Pleasant, S.C., in an area which would be outside the critical area. The application was received by the SCCC, and Council staff commented on the application. The PSC staff attorney, during the Commission hearing on the application, addressed specific questions to the applicant to assure that the SCCC's concerns would be addressed by SCE&G.

To carry out its statutory powers the SCCC plans to participate in the hearing directly whenever the pending application is of special significance to the Council. The Coastal Council's authority to condition a PSC certificate is affirmed in §58-33-160 (Code) of the Siting Act (Appendix E(1)).

Criteria to be used by the South Carolina Coastal Council for evaluating the Council's position on applications for PSC certificates are in this document. The criteria are an outgrowth of S. C. Coastal Council energy development policies and an outgrowth of the Council's rules and regulations pertaining to critical areas, including adequate provision for consideration of the national interest. In this manner an on-going procedure, compatible with the coastal management program, will evolve for the evaluation of energy facility siting.

2) Public Service Authority

The South Carolina Public Service Authority (PSA) was created in the 1930's. At that time, its primary function was to develop and maintain the Santee-Cooper hydroelectric project. The PSA is also empowered to manufacture, generate, transmit, distribute and sell electricity primarily in Berkeley, Georgetown and Horry Counties within the coastal zone. Section 58-31-10 (Code) defines the PSA as "a body corporate and politic." This description has been interpreted judicially to mean the PSA is, in fact, a State agency (Rice Hope Plantation v. S. C. Public Service Authority, 216 S.C. 500, 59 S.E. 2d 132 (1950).

Because the PSA is exempt from the Siting Act, the permitting exemption in Section 13(D)(9) of Act 123 of the 1977 South Carolina General Assembly does not apply. Therefore, any proposed alteration by the PSA within the critical areas would require a Coastal Council permit.

Outside of the critical areas, the PSA, as a State agency, is subject to Section 7(A) and 8(B)(11) of Act 123. It is anticipated that the criteria for review of PSA projects by the Council will be identical to those for review of PSC-regulated projects. Upon approval of the management program, Federal permits for all

energy projects will be subject to Federal Office of Management and Budget (OMB) Circular A-95 review, and frequently subject to EIS review under the National Environmental Policy Act.

3) Rural Electric Cooperatives

All electric cooperatives are separate corporate entities incorporated during the 1930's under the Rural Electric Cooperative Act of South Carolina (§58-27-10 - 58-27-230, 1976 Code). The South Carolina Electric Cooperative Association, Inc. represents the twenty-one electric cooperatives in this State on various issues. These cooperatives are enterprises set up to meet a common need and are owned and controlled by the people they serve. Cooperative leadership is provided by a board of trustees elected by the membership.

With rare exceptions, projects of the electric cooperatives are smaller in size than those projects covered by the Siting Act. Since the passage of the Siting Act in 1971, there has not been an electric cooperative project of a magnitude large enough to require a PSC certificate under the Siting Act, but large projects in the future would come under the Siting Act certification requirements. In addition, Rural Electrification Administration funds are expected to be used for any sizable projects and therefore come under the National Environmental Policy Act requirement for Environmental Impact Assessments and Statements. The Coastal Council would have the opportunity to evaluate such a project through the A-95 process and through Section 8(B)(11) of the Act to evaluate all State and Federal permit applications pertaining to the project.

4) Other Projects (not covered by the Siting Act)

Projects of less magnitude than those covered in the Siting Act are subject to normal State permitting requirements. If in a critical area, a Coastal Council permit is required. If outside of the critical area jurisdiction but below ordinary high water, a Budget and Control Board permit is necessary. Department of Health and Environmental Control (DHEC) water and air quality regulations also apply. The Council will use its certification powers with the Budget and Control Board and DHEC permit applications. If a project is not subject to the Siting Act and there are no State or Federal permit processes applicable, the potential impact on critical areas is thought to be slight. For example, if a transmission line below 125 KV were installed in a highland area, there might be no permit required nor would there be any significant impact of concern to the Council. In these cases the Council will not be evaluating the projects.

b. Oil and Gas Facilities

In addition to the supply of electricity, regulatory authority exists in South Carolina to manage the exploration and drilling for, transportation and production of oil and gas and their products. In June 1977, a bill, commonly referred to as the Oil and Gas Bill (Sections 48-43-10 et.seq., 1976 Code Supplement) (Appendix E(1)), passed the legislature, giving this regulatory authority to the Water Resources Commission (Commission) and DHEC.

The Commission is charged with permit jurisdiction over exploration and drilling operations within the State's legal jurisdiction and is to act as a leasing agent for the Budget and Control Board in the leasing of lands for drilling and producing oil and gas. The Commission is authorized to limit amounts that may be produced in each underground oil or gas reservoir (pool), establish spacing units within each pool and integrate separately-owned tracts embraced within a single spacing unit. The Department of Health and Environmental Control (DHEC) is responsible for controlling transfer of pollutants, registering terminal facilities and implementing plans and procedures to minimize and control spills (Sections 48-43-510 through 48-43-620 of the Code).

The Council will review and certify permit applications to the Commission for exploration and drilling and applications to DHEC for registration certificates. A DHEC certificate can be issued only if the applicant has shown that State and Federal plans and regulations for prevention, control and abatement of pollution discharges will be met. Any activity which would alter a critical area requires a Council permit in addition to clearances from the Commission and DHEC. Violations of the Oil and Gas Act carry both requires a Council permit in addition to clearances from the Commission and DHEC. Violations of the Oil and Gas Act carry both criminal and civil penalties (Sections 48-43-810 and 48-43-820 of the Code).

Other duties of the Council related to oil and gas development include directing, in coordination with DHEC, the development and implementation of an emergency contingency plan for oil discharged in the State's waters (Section 5(T) of the Act). Also, the Council is to monitor, in coordination

with the South Carolina Department of Wildlife and Marine Resources, the waters of the State for oil spills (Section 5(S) of the Act).

No regulations have as yet been promulgated but are presently being developed by the Water Resources Commission.

5. Energy Resource Policies

The policies which follow will be used by the South Carolina Coastal Council to evaluate proposed energy and energy-related facilities to ensure consistency with the coastal management program. Energy and energy-related facilities are defined in Section 304(5) of the Federal Coastal Zone Management Act as:

any equipment or facility which will be used or expanded primarily (1) in the exploration for, or the development, production, conversion, storage, transfer, processing, or transportation of any energy resources, or (2) for the manufacture, production or assembly of equipment, machinery, products or devices which are involved in any activity described in (1). This includes (i) electric generating power plants, (ii) petroleum refineries and associated facilities, (iii) gasification plants, (iv) facilities used for the transportation, conversion, treatment, transfer or storage of liquefied natural gas, (v) uranium enrichment or nuclear fuel processing facilities, (vi) oil and gas facilities including platforms, assembly plants, storage depots, tank farms, crew and supply bases and refining complexes, (vii) facilities, including deepwater ports, for the transfer of petroleum, (viii) pipelines and transmission facilities, and (ix) terminals which are associated with the foregoing.

The mechanisms for the implementation of these policies are described in the preceding section on the legal analysis of the Council's participation in energy facility siting decisions.

Policies

Throughout the coastal zone, Council issuance of permits or review and certification of applications for permits for energy facilities and energy-related facilities will be based on the following policies:

a. Nonwater-dependent energy and energy-related facilities are prohibited from locating along the shorefront unless no feasible alternative is available or an overriding public interest can be demonstrated, and any substantial environmental impact can be minimized. (A water-dependent facility is one which can demonstrate that dependence on, use of, or access to coastal waters is vital to the successful functioning of its primary activity.) All water-dependent structures should be designed and constructed so as to minimize encroachment on the aquatic ecosystem and minimize destruction to the wetlands, beach areas, and dunes. Inland siting of all but water-dependent facilities is preferred to water-front siting.

b. New water-dependent facilities should locate on already maintained channels or rivers to reduce the need for dredging of new channels. Where no presently maintained channel exists and one becomes necessary, the policies for dredging (VIII(A) of the Resource Policies) will apply.

c. Expansion of existing energy and energy-related facility sites by each energy supplier is preferred to the development of new energy sites by that supplier if applicable Federal and State air and water quality standards are not violated.

d. Energy and energy-related facilities must meet the applicable water quality and effluent limitation standards of the U.S. Environmental Protection Agency and the South Carolina Department of Health and Environmental Control, under the National Pollution Discharge Elimination System, Sections 401 and 402 of the Federal Water Pollution Control Act Amendments (Public Law 92-500). In some cases, pre-treatment of wastes may be required before introduction into public waste treatment systems, based on local 201 and 208 Waste Treatment Management Plans, as developed under the Federal Water Pollution Control Act.

e. Energy and energy-related facilities must meet applicable State and Federal air pollution standards and controls, as based on the National Clean Air Act, as amended (P.L. 91-604).

f. In instances where groundwater resources will be utilized either in the processing or effluent discharge stages of the production process, the project shall:

- 1) meet existing standards and/or management programs of the Water Resources Commission;
- 2) prevent saltwater intrusion and land subsidence, to the extent feasible;
- 3) wherever feasible, provide natural vegetated areas on the site where aquifer recharge or percolation can occur to mitigate the impacts of groundwater withdrawals.

g. The filling, dredging and/or drainage of productive fresh, brackish and saltwater wetland areas for energy and energy-related facilities will be prohibited, unless no feasible alternative exists or an overriding public interest can be demonstrated, and any substantial environmental damage can be minimized. These facilities should be directed away from ecologically sensitive areas such as marshes, forested wetlands, and pocosins.

h. Where other activities are associated with energy or energy-related activity sites, such as construction of navigation channels, docks and piers, parking, commercial buildings, or transportation access, the policies for that particular activity, found in the Resource Policies, shall apply.

i. Energy and energy-related facilities and sites should be designed and constructed to minimize erosion and sedimentation, and to limit the impacts from direct storm water discharge into adjacent water bodies and wetlands. Persons proposing to develop these sites are encouraged to contact and work closely with the local Soil and Water Conservation District in the county for assistance in developing site plans which reduce sedimentation and drainage problems. The following considerations shall be included in site location, construction and design whenever feasible:

- 1) provision of a buffer strip of natural vegetation between the facility and the water's edge. This vegetated area provides a visual screen, a purification system for storm water run-off, and a protective area for the more ecologically sensitive areas, especially fringing wetlands;
- 2) during site preparation, the controlling of storm run-off, soil erosion, and accidental placement of sediments in wetland areas;
- 3) the use of permeable surfaces in parking lots and bulk storage areas to provide water recharge areas and minimize the effects of storm water run-off;
- 4) retainment of open space or natural (undisturbed) areas around sites as buffer zones and recharge areas.

j. Unless a waterfront location is required for the operation of an energy or energy-related facility, major structures, such as electric generating facilities, should be located outside of flood prone areas. When energy and energy-related facilities must be located in flood prone areas, they must meet applicable flood management and construction requirements, as required by the Federal Flood Insurance Program. Inclusion of buffer areas and protection of salt, brackish and freshwater wetlands, which help absorb flood water surges, are strongly encouraged.

k. When electric generating facility applications are evaluated, the following considerations of need must be taken into account:

- 1) evaluation of forecasted need for the facility;
- 2) alternative means of meeting the energy demands, wherever feasible.

1. When the energy or energy-related facility applications are evaluated, the following considerations of available, alternative sites must be taken into account:

- 1) the extent and severity of environmental disruption at various sites;
- 2) short and long-range economic and social impacts on the community for various sites;
- 3) comparison of the degree to which the proposal could be modified at different sites if necessary to more fully meet environmental standards.

m. Permit applications for energy and energy-related facility proposals will consider the extent and significance of negative impacts on Geographic Areas of Particular Concern (GAPCs). Applications which will negatively impact GAPCs will not be approved or certified unless no feasible alternative exists or an overriding public interest can be demonstrated, and any substantial environmental damage can be minimized. The determination of significant negative impacts will be made in each case with reference to the specific priorities of use for each type of GAPC.

n. Prior to permitting and certification of energy and energy-related facilities, including oil refineries and petrochemical facilities, the extent and significance of negative impacts on the quantity or quality of these valuable coastal resources will be considered:

- 1) unique natural areas - destruction of endangered wildlife or vegetation or significant marine species (as identified in the Living Marine Resources segment), degradation of existing water quality in the area;
- 2) public recreational lands - conversion of these lands to other uses without adequate replacement or compensation, interruption of existing public access, or degradation of environmental quality in these areas;
- 3) historic or archeological resources - irretrievable loss of sites identified as significant by the Department of Archives and History or the South Carolina Institute of Archeology and Anthropology, without reasonable opportunity for adequate professional examination and/or excavation, or preservation.

o. "Excavation activities in critical areas are sometimes required for the installation of submerged cables, pipelines, and transmission lines. Excavation and filling are sometimes required to construct foundation structures attendant to the installation of overhead transmission line crossings. These installations should be designed to minimize adverse environmental impacts." (R.30-12(D)(L)) Outside of the critical areas these installations should also be designed to minimize adverse environmental impacts.

p. The following standards will be applied both within and outside the critical areas. "In addition to standards for dredging and filling, the following standards are applicable (for the installation of cables, pipelines, and transmission lines):

- 1) creation of permanent open water canals to install pipelines are discouraged since such projects generally interfere with drainage patterns and may adversely affect water quality through accelerated bank erosion;
- 2) dimensions of excavated canals for cables and pipelines should be minimal. Silt curtains are recommended for all excavations;
- 3) all excavations in wetland areas should be backfilled with the excavated material after installation of the appropriate structure, while being careful to maintain the original marsh elevation;
- 4) the appropriate erosion control measures shall be employed during the crossing of wetland areas. Where appropriate, revegetation with suitable wetland species will be required;
- 5) alignments of new projects should be designed to utilize existing rights-of-way and topographic features wherever possible." (R.30-12(D)(2,a-e))

q. Locations for new pipelines shall avoid offshore munition areas, chemical and waste disposal areas, and geological faults, as determined significant by authoritative sources, and wherever possible shall avoid heavily used waterways and significant and productive fish and shellfish habitats.

r. All transmission facilities and pipelines should follow existing roadways and railways and be attached to bridges and crossovers where applicable, especially in wetland areas, to prevent unnecessary alteration or disruption of adjacent wetlands or waterways. The number of pipelines and new transmission lines shall be limited as much as possible. All pipelines through the coastal zone will be laid in pipeline corridors to be developed in coordination with the Council.

s. Siting of nuclear power plants or liquified natural gas (LNG) facilities is strongly discouraged in hazardous areas such as:

- 1) geological faults as determined significant by authoritative sources, or;
- 2) flood prone areas.

t. Siting of nuclear power plants or liquified natural gas facilities is prohibited in or near areas of significant population, except where no feasible alternative exists or an overriding public need can be demonstrated.

u. The plans for temporary and permanent disposal of all types of nuclear waste which will be associated with a proposed nuclear power plant will be considered as a vital part of the evaluation of the facility application in determining the overall safety and environmental impacts of the nuclear power plant.

v. Transportation patterns associated with proposed liquified natural gas facilities will be considered a vital part of evaluation of the facility application in determining the overall safety and environmental impacts of the LNG facility. LNG should be regasified and moved as a gas by pipeline unless no other feasible alternatives are available. Where absolutely necessary to transport LNG over land, safety precautions as strenuous as those required over water must be followed in order to avoid subjecting South Carolina residents to unacceptable safety hazards.

Recommended Policies

The Council also **recommends** that the following policies be considered:

a. The location of new energy and energy-related facilities is generally preferred in already developed areas which are capable of accommodating additional development without significant expenditure of public funds for infrastructure or in areas which the local government and the Coastal Council deem to be both environmentally and economically compatible with the type of energy development proposed. Thus, onshore development is preferred where adverse physical, economic, and institutional impacts will be less than those which are likely to be experienced in less developed areas such as those which are more dependent on tourism and the resort industry. (The exception to this siting policy would be the locating of liquefied natural gas (LNG) and nuclear facilities. Specific policies included on the preceding pages shall apply in these two instances.) Care should be taken that proposed new facilities be located, wherever possible, in areas where they will minimize disruption of existing land use of the area.

b. Renewable sources of energy such as solar, wind, tidal power, geothermal and biomass, including experimental and demonstration projects, will be encouraged to locate in the coastal zone to the extent that they meet all Federal and State air and water quality standards and are consistent with other Council policies.

c. The use of recoverable energy sources such as co-generation (combined industrial production of electricity and heat) is also encouraged.

d. Upgrading of old generating facilities operated by each energy supplier is preferred to construction of new facilities by that supplier.

e. Recommendations of the U.S. Department of Energy to encourage the development of small-scale, diversified, dispersed industrial systems are encouraged.

f. A coordinated effort in consumer, commercial, industrial, governmental and recreational energy conservation and support for the Department of Energy Extension Service Concept is encouraged.

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C. EROSION CONTROL PROGRAM

1. Introduction

The widespread concern for effects of coastal erosion is reflected in the coastal management legislation passed on both the Federal and State levels. The Federal Coastal Zone Management Act, as amended in July, 1976, provides in Section 305(a)(9) for:

A planning process for (a) assessing the effects of shoreline erosion (however caused), and (b) studying and evaluating ways to control, or lessen the impact of, such erosion, and to restore areas adversely affected by such erosion.

In addition, the rules and regulations promulgated as a result of the Federal legislation by the Office of Coastal Zone Management, guiding program development and approval, require States to include in their coastal management programs an erosion planning process. Section 923.25, **Federal Register**, Vol. 44, No. 61, March, 1979, states that:

- 1) The management program must include a method for assessing the effects of shoreline erosion and evaluating techniques for mitigating, controlling or restoring areas adversely affected by erosion.
- 2) There must be an identification and description of enforceable policies, legal authorities, funding techniques and other techniques that will be used to manage the effects of erosion as the State's planning process indicates is necessary.

The South Carolina Coastal Management Act (Act 123 of the 1977 South Carolina General Assembly) mandates the Coastal Council to develop a comprehensive beach erosion control policy and gives authority to the Council for the implementation of the policy, including permitting powers for erosion control, authority to remove erosion control structures which have an adverse effect on the public interest, and the authority to accept and spend Federal and State erosion control funds in areas which provide full and complete access to the public. The Erosion Control Program is a close look at the existing South Carolina coast, the patterns of erosion and the interactive dynamics involved in those patterns, the policies which will guide the Council when evaluating alternative erosion control measures, the policies guiding the expenditure of public funds for erosion control, and the legal authority for implementation of the Program.

2. Process of Policy Development

Erosion is a result of the dynamics of the entire coastal region. Therefore, understanding the patterns of erosion and the most effective control has required thorough and comprehensive study.

The South Carolina Coastal Council contracted with two expert consultants to provide technical information specifically applicable to South Carolina's coastline, based on their extensive study and experience. The consultant reports are an integral part of the erosion inventory and policies contained in this document.

A Beach Erosion Technical Advisory Committee was formed by the Council. The members of the Committee represent varied expert approaches to erosion control—State agencies whose responsibilities are relevant to the subject; local, county, and State public officials from coastal communities; environmentalists; and Councils of Government from the coastal regions. To serve as a guide to the Council and staff the Committee met before and after the initial draft of the Erosion Control Program was written to discuss, from their unique perspective, erosion patterns, alternative control measures, and policies.

In addition, Citizens Working Groups were formed in each coastal county, and one inland group was formed composed of citizens outside of the coastal zone. Each group discussed the Erosion Control Program document, and their comments were considered to assure that the wealth of experience of citizens who live on and visit the coast was incorporated into the Program.

The Council and staff have had one full year of direct experience with implementation of the permit authority for all beach erosion structures for coastal South Carolina. This practical experience has been incor-

porated with the consultant reports and results of the Technical Advisory Committee and Citizens Working Group meetings. This process insures the validity, accuracy, and workability of the South Carolina Erosion Control Program.

3. Findings

a) Introduction

Erosion control on beaches must initially address not only the solution but clearly define the problem before any work or funds should be committed. Design of erosion control structures in the coastal zone should consider not only the materials to be employed and the forces they must withstand, but also the modification the works will cause in the natural sedimentation processes. Effective engineering for shore protection should include non-structural as well as structural alternatives. This type of approach depends on a clear understanding of the multiple interactive processes operating in the coastal zone. Objective information provided by good scientific data and engineering is a prime requirement for sound shoreline management, including erosion control.

The basic knowledge of long and short-term shoreline adjustment has been addressed in two comprehensive studies. This knowledge can be applied in decisions on how or whether to develop certain segments of coastline; design and location of shore protection structures or setback limits; and estimates of the frequency, nature and cost of maintenance of shore protection structures.

Whenever public funds are spent for erosion control measures, added considerations must become a part of the decision-making. Therefore, the effects of any erosion control measure upon the public interest or other affected areas must always be assessed closely, as the responsibilities are increased whenever public money is to pay for the erosion control.

In South Carolina, the Coastal Council has a statutory directive to use public funds only in areas which provide full and complete access. The Appropriations Bill authorized \$600,000 of revenue bonds to the South Carolina Coastal Council during 1978-79 to use for erosion control within the State in areas where public access is provided. This statutory directive is consistent with the overall coastal management program and the Council's sense of responsibility for using public funds with care.

b. The Erosion Problem

The South Carolina coast is fronted by approximately 158.5 miles of beaches comprising 10,701 acres. Studies of coastal morphology and physical processes in South Carolina have been few; however, Hubbard, et al. (1977) offers a functional classification of coastal types based on overall geomorphology, nearshore bathymetry, beach profiles, beach processes, and erosional-depositional history. The four types identified in this study are: 1) arcuate strand, 2) cusped delta, 3) beach-ridge barrier, and 4) transgressive barrier. The arcuate strand extends from Little River Inlet to Winyah Bay and is characterized by a stable, continuous beach interrupted by a few tidal inlets and swashes. The cusped delta, located between Winyah Bay and Bulls Bay and including Cape Romain, was formed mainly by deltaic sediments of the Santee drainage and is characterized by an eroding headland, elongating spits on the flanks of the headland, and an overall erosional nature. Beach-ridge barrier islands extend southward from Bulls Bay to the Savannah River and are composed of vegetated beach ridges fronted by a thin eroding beach and backed by extensive salt marshes. Transgressive barrier islands are Morris Island, Eddingsville Beach and Bay Point. These areas are characterized by straight beaches which are rapidly retreating landward over salt marsh through a washover effect.

Conclusions of the Hubbard, et al. (1977) study are as follows: 1) erosion rates along the South Carolina coast range from 30 cm. to 1 m. per year; 2) the area north of Winyah Bay is relatively stable since the underlying formation, Myrtle Beach formation, formed 100,000 years before the Pleistocene (2.1 million years ago) and is in itself eroding slightly; 3) beach-ridge barriers longer than 3.7 miles are composed of unstable, rounded updrift ends, stable or accretional central portions, accreting downdrift ends (recurved spits), yielding a "drumstick-like" shape; beach-ridge barriers shorter than 3.7 miles show large and sporadic changes along their entire length in response to changes in adjacent tidal inlets; and 4) the remainder of the coast exhibits varying degrees of instability directly dependent on the character of the backshore area and the size and frequency of tidal inlets. Beaches backed by well-developed beach ridges show lower short-term erosion rates than those where these ridges are absent.

Adding to the geologic erosional-depositional trends of the South Carolina beaches are four other factors,

several natural and several man-influenced. These factors are: 1) large annual rainfall – 46.61 in. annually,⁴ 2) rising sea level (from 1833-1903 = 9 in. rise; 1930-1940 = 6 in. rise; 1940-1950 = 4.08 in.),⁵ 3) interruption of the longshore (littoral drift) movement of sand due to jetty construction associated with inlet stabilization/navigation projects, and 4) loss of sediments which were originally transported by river systems now dammed for flood control of power generation, including the Santee River diversion project completed in 1941.

With consideration for all of these factors, some of the most highly eroding * beach areas in South Carolina can be identified. These areas are, proceeding from north to south: southern end of Waites Island; Garden City Beach; Magnolia Beach (Hunting Beach State Park); north and south ends of Pawleys Island; southern spit of Dubordieu Beach; north and south ends of North Island; all of South Island; eastern end of Murphy Island; central portion of Cape Island (Cape Romain); all of Raccoon Key; eastern end and central portion of Bulls Island; all of Capers Island; western end of Dewees Island; Sullivans Island side (western side) of Breach Inlet; all of Morris Island; eastern end and most all of the central portion of Folly Island; eastern end of Kiawah Island; western end of Seabrook Island; all of Eddingsville Beach; eastern and western ends of Edisto Island; all of Hunting Island; eastern and western ends of Fripp Island; eastern end of Pritchards Island; all of Capers Island (Beaufort County); all of Bay Point Island; western end and central portions of Hilton Head Island; and western end (Bloody Point) of Daufuskie Island.

Beach erosion can cause many problems in coastal areas. Primary among these is, of course, the destruction of coastal property and buildings. Large amounts of land (property) can be lost in a relatively short period of time, and beach-front property values have soared in recent years. In addition to the financial loss by private property owners, issues of public health, safety and welfare may arise with regard to beach erosion. In areas not served by centralized sewer systems, septic tank drain fields may be eroded, posing a health hazard on the public beach. The beach areas below mean high water are a public, recreational resource which may be lost. The erosion control methods or structures themselves may present obstacles to public access, and in some cases may involve physical hazards to swimmers or aesthetic nuisances. Finally, because public tax monies are often expended for control projects, erosion and its management are a paramount importance as one aspect of any comprehensive coastal program.

c. Alternative Control Measures

In areas where the decision is made to proceed with erosion control, it will be basically one of two types — structural or non-structural. Shore protection in South Carolina has focused on use of seawalls, bulkheads, and revetments (structural methods). These structures serve to separate the land from the sea and are used where it is necessary to maintain the shore seaward of or at its present position in areas where there is little littoral sand supply in addition to little or no protected beach area. These structures afford protection only to the land immediately behind and none to adjacent up or down coast areas. These structures also interdict the path of sand renourishment from dunes, berms, or ridges.

Seawalls and bulkheads are solid vertical barricades built to protect shorefront property or to prevent inland flooding. Seawalls and bulkheads are very expensive, and since they reflect energy they may compound erosion problems. Essentially, these structures are designed to absorb and reflect wave energy as well as to hold fill in place and to raise the affected areas above flood elevations. However, vertical seawalls and bulkheads reflect wave energy downward, causing sand to erode away at the base of the seawall, possibly undermining the footings and eventually causing collapse. It has been estimated that storm forces with one foot of wave height have the potential to scour the beach to a depth of two feet.

A revetment armours the slope face of a dune or bluff with layers of rock (riprap) or concrete. This type of shore protection acts to dissipate wave energy, having a less adverse effect on the beach than a vertical seawall. Revetments are less expensive than seawalls; however, they are hazardous to swimmers and are, in some cases, unattractive since they have a tendency to accumulate debris.

Another example of structural design for shore protection is the groin. A groin is a dam for sand built at right angles to the beach to interrupt longshore sand movement (littoral drift) and trap sand in order to stabilize or widen a beach. However, this trapping of sand by a groin can have severe impacts on the adjacent shoreline down the beach. Groins can be used to stabilize a beach which is subject to intermittent periods of erosion and accretion and build or widen a beach by trapping littoral sand or reducing the rate of littoral * “highly eroding” is defined in this instance as a short term change in excess of five meters per year.

transport out of an area. Groins act to stabilize this area by reorienting a section of beach to an alignment more nearly perpendicular to the prevailing wave direction.

Groins may be classified as permeable or impermeable, high or low, and fixed or adjustable. They may be constructed of timber, steel, stone, concrete, sand-filled nylon bags, or other materials, or combinations of these. Impermeable groins have a solid or nearly solid structure that prevents sand from passing through the structure. Permeable groins have openings through the structure of sufficient size to permit passage of appreciable quantities of sand (littoral drift). However, fouling by marine organisms may turn a permeable groin system.

When considering groins as a shore protection method, it is critical to assess several factors. These are: (1) availability of large volumes of sand via the littoral transport mechanism, (2) the extent to the downdrift beach will be damaged if groins are used, (3) economic justification for groins as compared to other alternatives, and (4) adequacy of shore anchorage of groins to prevent "flanking" as a result of shoreline erosion. The major factor determining groin use and placement is the supply of sand via littoral drift. If this supply is insufficient to permit the withdrawal from the littoral drift of enough material to fill the groin or groin system then damage will occur to downdrift areas. In some cases, artificial placement of fill with the groin can minimize the reduction of littoral drift to downdrift areas, but this can add substantially to the cost.

Finally, the last structural method of shore protection is the offshore breakwater. Offshore breakwaters have been constructed to provide safe passage through inlets and inhibit sand blockage. Breakwaters can have both beneficial and detrimental effects on the shore. When placed on the updrift side of a navigation opening, a breakwater may serve to impound sand, thereby preventing it from shoaling the navigation channel. The breakwater stops wave action and creates a quiet water area behind it, benefiting navigation. However, in the absence of wave action to move the sand stream, sand is deposited and builds up the shore, seaward toward the breakwater. This build-up actually serves as a barrier to littoral sand drift and deflects the sand stream seaward, depriving the downdrift beaches of sand.

In conclusion, there are many structural methods of shore protection; however, they may also have many complex secondary effects. Too often short-term erosion control solutions cause intensified long-term problems. Therefore, thorough and comprehensive study of an area to determine the best protection plan should be developed before structures are authorized.

Accompanying the many methods of structural shore protection are some non-structural alternatives. These non-structural alternatives involve use of native beach material or sand dune reconstruction. The most commonly used non-structural means of shore protection is beach nourishment. Artificial beach nourishment is a desirable method of beach protection in many situations and is very often preferable to structural methods. The reconstruction and restoration of beach slope through a beach renourishment effort will yield a beach much like the original beach prior to its erosion. The life-expectancy of a renourishment project is of primary concern in determination of the cost and feasibility of the project. Beach renourishment will generally be a temporary measure unless the causes of erosion in the area can be rectified. Estimates of the need for continued, periodic renourishment on a given stretch of beach which is subject to erosion must therefore be considered. A widened, resloped beach also has considerable value as a recreational resource.

Planning and design for establishment of beaches by artificial nourishment involves consideration of the following: (1) geometry of fill (beach berm elevation and width, adjusted foreshore slope, etc.), (2) determination of direction and volume of littoral transport, (3) determination of grain-size of native material in the active littoral zone, both temporarily and spatially, (4) identification of borrow material for initial and subsequent nourishment, (5) availability of borrow material (quality, quantity, location and cost), and (6) recreational function of the beach so as to allow a minimum of 100 square feet per bather, as determined by the U.S. Army Corps of Engineers. The cost of beach fill varies and depends on the exposure, proximity of suitable borrow areas, length of beach and degree of restoration required.

Possible sources of sand for beach nourishment are: bays, lagoons, estuaries, and nearshore areas. Since most sediments available in coastal bays, lagoons and estuaries contain large amounts of silts and clay and are very fine in texture, dredging in these highly productive areas may be ecologically harmful. These areas are usually not considered available for beach nourishment borrow areas. In the past, dune sands have been used as beach nourishment borrow areas. However, since the grain size of dune sand is extremely

small (fine) this material is unsuitable for beach nourishment. Also, dune removal threatens existing beach profile due to the reduction in storage capacity and subjects the adjoining upland area to a flood hazard. Sand taken from adjacent beaches, longshore bars, or nearshore submerged bottoms also ultimately will affect the existing beach profile, since these areas act in much the same way as dunes, that is, as sand storage areas.

Since dunes, nearshore areas, longshore bars, adjacent beaches, and estuaries may not be suitable to be used as borrow areas for beach nourishment, then one must consider the use of offshore deposits (beyond a depth of 30-50 ft.) or areas of accretion, such as inlets, where the supply of sand is constantly replenished by natural forces. Inlet sand removal for nourishment usually can be done in concert with navigation dredging. Selection of offshore sites should be done carefully so as to avoid vital habitat areas and prevent excess siltation of the water.

Finally, the beach's natural sand depository, the sand dune, can be a secondary non-structural method of shore protection. Dunes are mounds of drifting sand; their height and movement depend on the direction and intensity of the wind. The dunes that are located directly behind the berm are the most susceptible to the stress of wind and deterioration from airborne salt. (This is the primary dune, identified by the South Carolina Coastal Management Act as a critical area.) Mild summer waves add sand to the berm, and prevailing offshore winds move sand from the berm to the dunes. This berm moderates winter losses by providing a reservoir of sand available to either dunes or beaches as needed. During storms the berm may be completely eroded away by the ocean, at which time the dunes slump onto the beach, replenishing the lost sand.

The initial stress of storms is usually sustained by a broad beach. However, strong storms may succeed in eroding the beach face and primary dunes, whereupon the secondary dune will bear the brunt of the wave energy.

The fragile network of vegetation covering most dunes is adapted to withstanding wind, sand, high temperatures and salt. However, pedestrian and vehicular traffic as well as animal grazing will have detrimental effects on these dune areas. When the dune vegetation is lost, dune movement accelerates to a point where plant growth cannot keep pace with the shifting sand. The result is a chain reaction that leads to erosion and eventual loss of the dune.

In summary, dunes are very dynamic, valuable and fragile resources which man should not alter. Not only should they be protected and preserved but where possible buffer areas should be established to allow for their natural movement and growth.

Sand dunes can be constructed and/or stabilized to form a non-structural shore protection device. The proper use and placement of snow-type sand fences can stimulate dune formation. These sand fences can act as wind breaks, thereby slowing down offshore sand-bearing winds and causing these breezes to release some of their sand supply. The placement of old Christmas trees between sand fences increases the wind-breaking resistance, and the decaying trees add vital nutrients to the sand, promoting the eventual and necessary stabilizing plant growth. In all cases, dune construction should take place above the natural beach berm or in line with existing dunes, and the dunes should be stabilized by revegetation with appropriate native plant species.

Dunes should never be constructed with any other materials than sand, since materials other than sand will not erode at the same rate or offer proper beach renourishment as will sand. In fact, these non-sand dunes may eventually act as a seawall, reflecting wave energy and thereby accelerating erosion.

Related to the non-structural alternative erosion controls are "institutional" means for management of erosion problems. These are preventative measures which do not reduce the effects of erosion but seek to manage local growth and development so that hazards are not created or new property threatened. Of primary importance is the implementation of construction setback-lines in all ocean-front areas, particularly those prone to erosion. This mechanism is available as an option for local governments along the coast as well as private developers or land-owners and lends itself well to inclusion within local subdivision regulations as well as zoning and building codes. Another institutional-type mechanism is that of public expenditures and funding. Public construction monies should be expended and improved services provided only in stable or accreting beach areas, or in areas with adequate setback ordinances both to set an example for private development and to influence the extent and location of growth. Institutional issues are addressed as Recommended Policies in the following section.

4. Policies

a. FUNDING POLICIES

Regarding the expenditure of public funds for beach and shore erosion control measures throughout the coastal zone, it is Council policy that:

- 1) Public funds can be expended for beach or shore erosion control only in areas, communities, or on barrier islands to which the public has full and complete access (as defined in the shoreline access segment of the program).
- 2) Public funds can be expended only for beach erosion control measures which are deemed by the Council to be consistent with the Beach Erosion Control Policies in this section and any applicable rules and regulations promulgated pursuant to the Act.
- 3) Public funds can be expended only for erosion control measures which are consistent with the overall coastal management program.
- 4) Funding for particular erosion projects shall be approved by the Coastal Council only after adequate consideration has been given to the erosion control problems and needs of each coastal county and the relative benefits of the particular project.
- 5) Consideration will be given to the extent to which the proposal will maximize the protection of public health, safety, and welfare.
- 6) For expenditure of public funds, the full range of alternative erosion control measures which are possible, including no action, must be studied. Before decisions are made, consideration must be given to the long and short-range costs and benefits of the various alternatives.
- 7) Removal or modification of existing publicly-funded control structures will be authorized by the Council based on the applicable policies in this section and determination that the structure has an adverse impact on the public interest, as mandated by Section 12(C) of the Act.

b. GENERAL CONSIDERATIONS

The Coastal Council will consider the following before any erosion control projects are approved:

- 1) The type of materials employed, their useful life expectancy along with anticipated maintenance and replacement costs;
- 2) The economic justification of the proposed project in comparison with available erosion control alternatives including consideration of the anticipated damage and economic loss due to failure;
- 3) Rate of rise or fall of sea level at the location;
- 4) Sediment transport and sand budget in the project area;
- 5) Extent of up or downdrift damage due to installation or lack of installation of the erosion control structure;
- 6) The extent to which the project fits into a comprehensive shore protection program for that particular stretch of beach, aimed at preserving the beach profile in its present slope and configuration.

c. EROSION CONTROL POLICIES

The Coastal Council will apply the following policies in its review and evaluation of permits for the following erosion control activities:

Seawalls, Bulkheads and Revetments (Riprap)

- 1) Seawalls, bulkheads and revetments will be considered only as part of a comprehensive erosion control program to insure that these structures do not cause adverse effects to adjoining property owners or appreciably accelerate erosion in the general beach area.
- 2) These structures must not interfere with existing or planned public access unless other adequate access can be provided.
- 3) These structures shall not impede public use of beaches below the mean high water line (R.30-13(2)(C)).
- 4) These structures should be sloped seaward or concave with riprap at their bases to reduce the adverse effects of scouring where appropriate.
- 5) Applications for construction of a seawall in the beach or dune critical areas for the purpose of filling behind these structures to create land for private development shall be denied unless the applicant can clearly demonstrate to the Council that no feasible alternatives exist, that the individual circumstances are extenuating such that they demand an exception to the general policy and that the project would otherwise be consistent with the coastal management program.
- 6) Except under special circumstances, such as critically eroding shorelines that have a direct measurable effect on the economic well-being of an applicant or are a threat to the public safety, the Council will promote the use of natural features of the dune and beach system rather than artificial protection (R.30-13(2)(a)).
- 7) Additionally, all other regulations covering bulkheads and seawalls will be applied in the critical areas (R.30-12(C)).
- 8) Riprap must consist of appropriate materials.

Groins

- 1) Significant volumes of sand via the littoral transport system should be available.
- 2) The extent to which the downdrift beach areas will be damaged must be determined before construction.
- 3) The adequacy of shore anchorage of groins to prevent "flanking" as a result of erosion must be demonstrated.
- 4) The positive effect and applicability of a groin system in a comprehensive shore protection program must be demonstrated.
- 5) Care must be taken to insure that groins do not interfere with public access (R.30-13,C(2)(c)).

Offshore Breakers and Jetties

- 1) Since these structures tend to impound littoral drift on their updrift sides, provisions should be made so that sand is pumped at appropriate intervals to downdrift areas so as not to starve these areas of sand thereby creating or worsening an erosion problem.

- 2) Care must be taken to insure that jetties do not interfere with public access (R.-30-13, C(2)(C)).
- 3) Where appropriate, jetties should be designed to provide recreational fishing opportunities (R.30-13,C(2)(d)).
- 4) Construction activities should be scheduled so as not to interfere with nesting and brood-rearing activities of important seabird colonies or other wildlife species (R.-30-13,C(2)(3)).
- 5) These structures should be consistent with other erosion measures being undertaken as part of any comprehensive shoreline protection projects.

Artificial Beach Nourishment

1) A thorough study of littoral transport mechanics as well as beach slope, grain size, and berm geometry should be done before artificial nourishment is attempted.

2) Sand for artificial nourishment should come from offshore deposits or areas of active accretion and from bars or spits only where it can be clearly demonstrated that no negative impacts will result in downshore areas. Fill material should not come from dune fields, adjoining beaches or nearshore bars.

3) Dredging in the borrow areas should not be in conflict with spawning seasons or migratory movements of significant estuarine-marine species.

4) Dredging offshore shall be done in locations and in such a manner so as not to create anoxic sumps or uncover toxic or anoxic deposits.

5) All other policies concerning dredging and filling (R.30-12,G) will be applied to beach nourishment proposals.

6) Careful study must be given to the type (size, quality, etc.) of fill material most suitable for use in a particular beach area.

7) Nourishment of beach areas should be scheduled so as not to interfere with nesting or brood-rearing activities of important seabird colonies or other wildlife species.

8) The recreational and public access requirement of the affected beach area will be a major concern when determining the width of the beach fill.

9) Where possible, inlet stabilization and/or navigation projects shall be done in concert with artificial nourishment projects.

10) Structural control measures should be used, where appropriate and feasible, to complement artificial nourishment projects.

Sand Dune Management

1) Private and public projects to restore and stabilize dunes through non-structural means are encouraged.

- 2) To the extent possible, the secondary dunes should be kept intact to insure protection of adjoining areas against flooding during storms.
- 3) Buffer areas should be established, where feasible, to allow for frontal dune growth and movement.
- 4) All plans for dune restoration, reconstruction or stabilization should be part of a comprehensive shoreline protection program.
- 5) Dune reconstruction should be done only above the existing berm line or in line with existing frontal dunes. Dunes should be constructed using only native material (sand) of the appropriate grain size and stabilized with native vegetation. Consultation is encouraged with Soil Conservation Service advisory services in determination of plant materials most suitable for dune stabilization.
- 6) Walkover structures are encouraged over all frontal dunes (R.30-13, B.) However, these walkover structures should not interfere with public access or extend below the mean high water line.
- 7) Seawalls, bulkheads or revetments should not be placed in front of frontal dunes, except where severe erosion is indicated and unless there are no feasible alternatives or there is an overriding public interest.
- 8) Public access should be provided either over frontal dunes via walkover structures or by using natural breaks through frontal dunes. In no case shall access be provided by bulldozing or cutting openings through frontal dunes.
- 9) In all cases, the primary front-row sand dune, as defined in R.30-10(B), should not be permanently altered.

Recommended Policies

1) The Council recommends that local governments in shoreline areas institute shorefront construction setback lines as part of their land-planning activities and/or local building codes, subdivision regulations, or zoning ordinances.

2) Private property owners and developers are encouraged to consult with the Council or with technical consultants to learn the erosion trends and shoreline dynamics in their particular area before initiating construction.

5. Other Resource Policies Affecting Erosion

In addition to the policies listed above, a number of resource policies for activities subject to management pertain to erosion control. Generally speaking, filling in the critical areas is prohibited and construction over primary dunes and beaches is discouraged in order to protect upland property and from erosion and storm damage.

More specific erosion control policies are directed toward minimizing damage from storm run-off. Policies in this category include Roads and Highways 1(d), 2(e) and (h); Airports 1(b); Railways 1(e), 2(e); Parking Facilities 1(b); Agriculture 1(c); Forestry 1(c); Mineral Extraction 1(c); Manufacturing 1(c); and Commercial Development 1(d). In some cases specific methods are suggested, and in others, cooperation with the county Soil and Water Conservation District offices and the State Forestry Commission is recommended.

A number of other resource policies address the problem of construction technique and drainage plan design. Included here are the following policies: Residential Development 1(a) and (d); Commercial Development 1(d); Parks 1(c)(iv); Commercial Recreation 1(c); Public/Quasi-Public Buildings 1(c); and Dunes (2). Once again, approved techniques are often suggested.

A third broad resource policy area affecting erosion control is that of channelization, drainage and sedimentation control. Policies in this category are Navigation Channels (2); Sewage Treatment 2(b)(i) and

(iv); and Water Supply 2(c)(i) and (iv) which recommend that water supply and sewage treatment construction not interfere with existing drainage patterns, discourage the building of permanent open ditches through wetlands, and require the use of erosion control methods when construction must cross wetlands. Dams and Reservoirs 1(c) requires that the existing sediment budget be preserved whenever possible so as to reduce erosion problems in beach and shoreline areas downstream.

Two final policy areas are those discovered by Dredge Material Disposal policies 1(b) and 2(d) which require the stabilization of spoil disposal sites and related dikes, and the policies for Areas of Special Resource Significance which require that development plans for dunes and barrier islands be evaluated in light of the possible increase in erosion or storm drainage they may produce.

6. Management Authority

The S.C. Coastal Management Act of 1977 explicitly states that the regulatory program developed to control beach erosion is for the purpose of promoting the public health, safety and welfare, and the protection of public and private property from beach and shore destruction.

The Coastal Council has been granted very broad authority to study and control erosion in the coastal zone. Besides the permit program for the alteration of critical areas, which would encompass most erosion control activities, the enabling legislation gives the Council responsibility to develop and implement a **comprehensive beach erosion control program and permit jurisdiction over erosion control and water drainage structures** not otherwise covered by law (§48-39-120; 1976 S.C. Code of Laws). The Council has also been designated as the State agency to accept Federal money for erosion control in areas to which the public has full and complete access. State funds, if available, may be spent by the Council to alleviate emergency erosion conditions, as declared by the Council, in areas to which the public has full and complete access. Public access is a pivotal requirement for the allocation of funds by the Council under the erosion control segment of the coastal management program.

The specific policies for erosion (management control) are designed to accomplish this purpose. Through direct action, such as an order, or as a last resort, by seeking court intervention, the Coastal Council may enforce these policies and insure the implementation of this segment of the program.

Footnotes

¹ Stephen, M. F., P. J. Brown, D. M. Fitzgerald, D. K. Hubbard and M. O. Hayes, 1975. "Beach Erosion Inventory of Charelston County, South Carolina: A Preliminary Report." S. C. Sea Grant, Tech. Rept. No. 4 (SG-SG-75-4), 79 p.

² Hubbard, D. K., J. H. Barwis, F. Lesesne, M. F. Stephen and M. O. Hayes, 1977. "Beach Erosion Inventory of Horry, Georgetown, and Beaufort Counties, South Carolina." S. C. Sea Grant, Tech. Rept. No. 8 (SC-SG-77-8), 58 p.

³ Hubbard, D. K., M. O. Hayes, P. J. Brown, 1977. "Beach Erosion Trends Along the South Carolina Coast," pp. 797-814. **Coastal Sediments 1977**, ASCE Publ. NY. 1133 p.

⁴ Landers, H., 1970. "Climate of South Carolina." **Climates of the States, South Carolina, Climatology of the United States**, No. 6038, ESSA Environmental Data Service.

⁵ Kurz, H. and Wagner, K. 1957. "Tidal Marshes of the Gulf and Atlantic Coasts of Northern Florida and Charleston, South Carolina." Florida State University Studies. No. 24. 168 p.

⁶ "Highly eroding" is defined in this instance as a short-term change in excess of five meters per year.

D. BEACH AND SHORELINE ACCESS

1. Introduction

The South Carolina coastal zone boasts 158 miles of Atlantic Ocean shoreline — this wealth of beaches is an invaluable and irreplaceable resource for the State. The General Assembly recognized the increasing demands on **all** coastal resources in the passage of the South Carolina Coastal Management Act of 1977, which mandates development of a comprehensive coastal management program. Among the many findings and concerns expressed in the State legislation are those of protecting public access and preserving and expanding recreational resources. The following beach and shoreline access policies and existing management authority address these issues.

In order to receive Federal approval and thereby continued funding through the Department of Commerce, the State must also meet Federal requirements for shoreline access in its coastal management program. The rules and regulations from the Office of Coastal Zone Management for program development and approval read as follows:

- (1) The management program must contain a procedure for assessing public beaches and other public areas, including State owned lands, tidelands and bottom lands, which require access or protection, and a description of appropriate types of access and protection.
- (2) There must be a definition of the term “beach” that is the broadest definition allowable under state law or constitutional provisions, and an identification of public areas meeting that definition.
- (3) There must be an identification and description of enforceable policies, legal authorities, funding programs and other techniques that will be used to provide such shorefront access and protection that the State’s planning process indicates is necessary.

(Section 923.24, **Federal Register**, Vol. 44,
No. 61, March, 1979)

2. Definitions

a. Beach

The South Carolina Coastal Management Act (Act 123 of the 1977 South Carolina General Assembly) defines “beaches” as “those lands subject to periodic inundation by tidal and wave action so that non-littoral vegetation is established”. (Section 3(H)). This definition includes that area of sand between mean low and spring high water, in other words, the foreshore and the dry sand beach up to the line of vegetation. Beaches are included in the management program as “critical areas”, subject to the Coastal Council’s direct permitting authority.

b. Public Beach and Public Access

According to the Federal Regulations “public beach” must be defined within each management program. In South Carolina it is defined in terms of State ownership or of demonstrated public use sufficient to create public rights in the land. In South Carolina there is no specific statutory right for public use of the beaches. However, the doctrine of the public trust forms the basis for the public’s right to use the foreshore or wet-sand beach seaward or below the mean high water mark. Under this doctrine, title to the foreshore (below mean high water) is presumed to be held by the State in trust for her citizens unless title has been expressly granted to an owner out to the low-water mark.

Based on traditional concepts of law, or common law, the public has rights to use the foreshore for navigation and fishing. In recent years, this traditional interpretation has been expanding in other jurisdictions. In South Carolina, statutory expression in State legislation for coastal management and oil spill monitoring and control, and opinions of the S. C. Attorney General reflecting strong public interest in recreation, have to some degree broadened the common laws basis to include recreational uses within the public trust.

Upland access across to the wet-sand beach below mean high water is another important factor in identify-

ing public beach access. Unless the property landward of the wet-sand beach is owned outright by the State — through acquisition, express dedication from developers and owners, or through an express trust — assurance of public rights for use of the “dry-sand beach” or shoreline property adjoining the traditional public beach area below MHW can be made only on the basis of a case-by-case determination.

In South Carolina, confirmation through the courts of these so called “acquired” public rights for access-ways on shoreline property will probably be based on the legal theories of (1) prescriptive easement and (2) implied dedication. A prescriptive easement requires a clear showing of continuous and uninterrupted public use without permission of the owner, for a 20-year period. Implied dedication requires evidence of the land-owner’s intent to dedicate the property for public use and of the public’s acceptance by using the land. Under either theory, evidence supporting the extent of public use must be clear and convincing.

Litigation involving particular parcels of shoreline property is clearly an expensive, time-consuming, and cumbersome means for determining “public” versus “private” rights in a particular area. But in some instances where ownership is in question, it can be the only means for such determination. The S. C. Attorney General has brought several claims on behalf of public rights in the past; however, there is no clear statutory authorization for this role and no explicit duty for that office to undertake such an action. The viability of this course of action depends to a large degree on the ability or willingness of the Attorney General or of some concerned private party to initiate a public claim.

c. Existing Public Access (Full and Complete Access)

The South Carolina Coastal Council will use the following definition for “existing public access” for 1) determination of those areas eligible for public funds for erosion control and 2) as a basis for every permitting decision requiring consideration of public access. In addition, this definition fulfills the federal requirement that a definition of full and complete access be included in the State management plan.

The Council will find that a stretch of beach is accessible to the public if: (1) Reasonable provision is made for transportation facilities, including automobile parking, boat landings, bicycle racks and/or public mass transit. Facilities must be available on a year-round basis, and fees, if charged, must be nominal and serve only to offset actual costs. (2) Public walk-ways or access-points to the beach and lateral access to the dry-sand beach are open and readily apparent. (3) Access to the area is actually sought by members of the general public with reasonable frequency.

A “stretch of beach” may be delineated by such factors as physical or geographical boundaries (an inlet or marsh, for example) as well as by jurisdiction borders (municipal limits, for instance).

What constitutes “reasonable” for purposes of the preceding definition will be determined in part by the size and population of the surrounding area, the size of the stretch of beach itself, and the availability and nature of upland or marine rights-of-way to the general area of the beach.

3. Policies for Public Shoreline Access

a. Process of Policy Development

The South Carolina Coastal Council and its staff have worked throughout the period since their creation on July 1, 1977 on the background and study efforts for development of the shoreline access segment of the program. Prior to passage of the legislation which created the present Council, staff and gubernatorially-appointed Coastal Council members were working toward writing the various parts of the program. In 1976, an extensive study financed and coordinated through the coastal program and the S. C. Department of Parks, Recreation and Tourism was undertaken. This study on beaches and beach access, which formed the basis of the beach inventory presented at the end of this chapter, is entitled **Public Beach Access and Recreation in South Carolina** and was conducted by Hartzog, Lader & Richards. A special legal consultant to the Council has worked closely with the staff to fully explore the possibilities and problems regarding provision and protection of public beach access.

The Management Committee of the Coastal Council is one means for improved policy development. This sub-group of the full 18-member Council, which represents a wide range of interests and geographic areas, received draft material from the staff and gave it careful, in-depth examination and review.

A more technical form of input to the policy formulation process has been a Beach Access Advisory Com-

mittee. This working group of experts from the recreation field, local and State government representatives, and citizens who personally encounter or deal with beach access issues, met several times to assist staff of the Council in drafting this segment of the program.

In addition, a group of citizens in each of the eight coastal counties and one in the inland area met on a monthly basis during the latter stages of development of the program to carefully study draft segments of the document, including beach and shoreline access. The input from these County Working Groups, which consisted of both general and specific, detailed comments, proved invaluable in assuring that the real issues and concerns of coastal residents and others in the State have been addressed by the program.

b. Findings

South Carolina has a unique opportunity at the present time for preserving valuable coastal resources and for realizing great social and economic benefits from these areas. The relative wealth of beaches and other shorelines of the coast are an asset for residents of the coastal zone and the State as well as for the Nation in terms of the many visitors to the area.

Provision of sufficient areas for public shoreline access, especially to the beach, which include adequate facilities and maintenance are important not only to recreational users — day visitors and tourists — but to residents and private property owners as well. The interests of this latter group are also met because pressure for use of or infringement upon private beachfront and the associated trespass or damage is reduced when properly designated public areas exist.

The inventory contained at the end of this section demonstrates the extent of existing public access to South Carolina beaches. The significant number of public boat landings and public shellfishing areas, which provide another form of public shoreline access, have also been identified.

Roughly 30% of the State's Atlantic Ocean shoreline or beach areas, including the adjacent dry-sand or upland shorefront, is owned by the State or Federal government. The need to preserve these beach areas in the public domain and insure their protection both as natural assets and for recreational opportunities is clear. Many of these beach areas have limited transportation access, often by private boat only with no boat landing facilities. Thus, a primary criteria for acquisition or expansion of new public beach areas is provision of ample means for transportation access. An additional criterion is availability of facilities related to beach activities, such as restrooms or changing areas.

In ocean-front areas with predominantly private ownership of the adjacent uplands, existing lateral public accessways across to the beach below mean high water also need preservation, enhancement and maintenance. In developed beach areas, especially those near urban centers where demand is greatest and is increasing, the provision of adequate parking for day-visitors is one concern of coastal management for improved public access. Efforts to encourage local governments and private developers to consider provision of public access-ways in future development plans, such as subdivision or resort proposals, is another focus of public access planning.

Recreational boating in South Carolina's coastal zone is a growing and important economic enterprise as well as a recreational pursuit. While there are currently a number of public boat ramps in the coastal zone, distribution is relatively poor in some areas. The need also exists for provision of new public ramps to meet growing demand; these should be constructed in an environmentally acceptable manner and offer improved facilities (lighting, trash receptacles, parking). (Other boating-related activities which provide shoreline access such as marinas and docks and piers are more often private or commercial endeavors rather than public, and are covered by the coastal management program under the resource policy section for the respective activity. (Section VI A-C of the Resource Policies, (Chapter III)).

Improved public access to riverine or estuarine areas for recreational purposes other than boating, such as swimming, picnicing or camping, can help reduce the extreme demand on Atlantic Ocean beaches by offering alternative water-front destinations. Recreational fishing and shellfishing are also significant pursuits for coastal residents and visitors. The limited public oyster grounds along the coast receive heavy use. (See Table 4 for locations.)

Several beaches, both recreational areas and wildlife preserves, have been designated as Geographic Areas of Particular Concern (GAPCs) in the coastal zone. These beaches have been categorized as Areas of Unique Natural Resource Value, and as designated GAPCs, receive special management attention.

Additional considerations are made based on the priorities of use of these areas and possible negative impacts when decisions are made by the Council on permit applications in the critical areas or review and certification procedures in the coastal zone.

c. Policies

- 1) The S.C. Coastal Council fully endorses and will support, further, and encourage the protection of and, wherever feasible, the expansion of public access to shoreline areas in the coastal zone.
- 2) The Council's evaluation to determine whether or not permit applications for alterations in the critical areas are approved will be guided by the policies specified in Sections 1 and 2 of the S.C. Coastal Management Act of 1977 and:

The extent to which the development could affect existing access to tidal and submerged lands, navigable waters and beaches or other recreational coastal resources (Section 15(A) (5) S.C. Coastal Management Act of 1977).

- 3) The Council's review and certification of permit applications from other State agencies for projects in the coastal zone, including those outside the critical areas will consider:

The extent of impact on the following aspects of quality or quantity of these valuable coastal resources:

Public recreational lands—conversion to other uses without adequate replacement, **interruption of existing public access**, or degradation of environmental quality in these areas (emphasis added). (See Chapter III, (C) Resource Policies.)

- 4) Public funds can only be expended for beach or shore erosion control in areas, communities or on barrier islands to which the public has full and complete access.
- 5) The highest priority for expenditure of public funds for acquisition of new parks and recreational areas along beaches or shorelines in the coastal zone will be given to areas which offer full and complete access to the public.
- 6) The Council encourages the extension of better access to existing publicly-owned recreation areas, particularly barrier islands, which currently only afford access by private boat and are appropriate for more intensive use. This should include access to the area, via ferry or provision of boat landings and other facilities; and also access across or through the area to the beach-front via paths or walkways. The type and extent of public access must be determined based on the human "carrying capacity" of the area in its natural state in order to protect natural beach features and other environmentally sensitive areas.
- 7) Lateral beach access-ways should be walk-over structures or staggered pathways at natural breaks in the dunes, to prevent disruption of sand dunes or vegetation. Although structures of this type are specifically exempted from direct permit authority, Coastal Council staff will be available at any time to assist in their planning and design so as to assure suitability to the environment.
- 8) The provision of additional parking space in upland areas adjacent to beaches should be a priority for recreational planning by both local and State agencies. Alternatives such as remote parking sites connected to the beach by public transportation, off-island parking, and authorized weekend and holiday use of private, commercial parking spaces should be explored. As mandated in Section 10 of the Act, Council staff will be available to provide technical assistance whenever needed.
- 9) Local governments in the coastal zone, particularly beachfront communities, are urged to incorporate considerations for provision of public access into their local ordinances and comprehensive plans, especially into subdivision regulations which can influence the location and design of new development that might affect public access.

10) Private developers in beach areas, in considering the benefits not only for the public but for protecting private property interests, are encouraged to include provision of reasonable public beach areas and access-ways in their plans for new developments.

11) Recreational planning by State and local governments should include consideration of alternatives to actual ocean-front areas in order to offer other options for recreation and to relieve growing pressure on ocean-front communities. An example of such an alternative is the acquisition and development of recreational areas along rivers which provide for activities such as fishing, swimming or picnicing. Estuaries could also be utilized as recreational areas, provided that their development and use are compatible with the fragile nature of these areas.

12) The Council advocates the provision of joint-use public docks, public boat ramps and landings throughout the coastal zone in environmentally suitable locations, to meet the needs of recreational boating.

13) The Council advocates the provision of pedestrian access and fishing catwalks on all new bridges and roadways in the coastal zone, and recommends their addition to existing structures where possible.

14) The provision of new public oyster grounds, as well as the preservation of existing public grounds will be sought by the Council. (Public shellfish grounds are designated as Geographic Areas of Particular Concern.)

15) The resource policies for park facilities, as well as marinas, boat ramps, docks and piers will apply where appropriate to shorefront areas with public access. (See Resource Policies pertaining to these activities.)

16) The Coastal Council will coordinate planning and acquisition efforts very closely with the SCORP Exchange Council, as well as with State and Federal agencies concerned with public beach recreation.

17) The Council recognizes the overriding importance of good water quality as a recreational resource, and will strive to maintain and, where possible, improve existing standards. Chapter V, (D) details the procedure by which the Federal Water Quality Standards are incorporated into South Carolina's coastal planning process.

Recommended Practices

1) The Coastal Council recommends that legislation be introduced to limit the liability of property owners and municipalities in case of injury or accident associated with public access to the beach.

2) The Coastal Council strongly supports the proposal generated by the S. C. Department of Parks, Recreation and Tourism to alter the structure of the State Recreational Land Trust Fund (which may now only be used for State parks) to permit local governments to use the Fund for the purpose of developing land for any recreational purpose. Use of the Fund would enable State and local governments to provide more high quality public access to the beaches.

3) It is recommended that abandoned bridges and railroad trestles be left standing to serve as fishing piers when safety considerations permit. Costs of maintenance may be offset by leasing the structures to a county or local government. It has been suggested in the Resources Policies section that railroad rights-of-way be allowed to serve as access points whenever possible. (II (D) of the Resource Policies)

4) In the planning and design of all public access areas, full consideration be given to assure access opportunities to elderly and handicapped visitors.

4. Legal Basis for Management Authority/Legislative Mandate

a. Permitting Authority in the Critical Areas

Three means of protection for access and use of public shoreline areas are afforded by the Council's permitting authority in the critical areas as granted under the S. C. Coastal Management Act. (1) Existing public access and any disruption or negative impacts of this access must be considered by the Council in granting or denying permits for alterations in the critical area. (Section 15) (2) Where local ordinances affecting critical areas are not as stringent as those in the Act, these are augmented by provisions of the Act. Both local and State permits must be obtained, in other words. (3) Critical areas, including beaches and primary sand dunes, are regulated with particular care through the existence of the permitting authority.

coastal resources''. (Section 15(5)) The Council is further required to hold a public hearing on any permit application at the request of twenty affected citizens, and it may condition a permit "upon the applicant's amending the proposal to take whatever measures the Council feels are necessary to protect the public interest".

The Act requires that a party seeking a permit provide evidence of his interests in the affected property. When public rights of access are claimed on property for which a private owner seeks a permit, the State Attorney General is able to take appropriate administrative or judicial action to prevent the Council from issuing a permit for the activity until the rights in the property are determined. In the event that a permit is granted which does interfere with existing access rights in affected property, Section 15 allows persons adversely affected by the granting of a permit to appeal the initial decision to the Council. In addition, Section 18 of the Act provided that any person adversely affected by the permit may petition in the State circuit court having jurisdiction for review of the Council decision.

Another means of protecting and assuring public access rights in shoreline areas is the Council's authority to evaluate local ordinances affecting critical areas as part of the overall management program. (Section 10) In the critical areas, both local and State (Coastal Council) regulations apply. Where the requirements of the Act and the Permitting Rules and Regulations of the Council are more stringent than the local ordinance, the Council authority will augment the local ordinances, although all local requirements, including permit procedures, must be met as well. The Council also has a duty to cooperate with local governments and to make "(r)ecommendations to local and regional governmental units as to needed modification or alteration in local ordinances". (Section 10 (A)(4))

Finally, protection of the beach (as a critical area) from most construction activities can have the bonus effect of preserving dry-sand areas for customary recreational use. All Atlantic ocean-front beaches along South Carolina's coastline are, by definition, critical areas, and therefore subject to the direct permit jurisdiction of the Coastal Council. In most circumstances, only erosion control and similar structures will be considered as acceptable for permits in the beach critical area.

The primary ocean-front sand dunes adjacent to the Atlantic Ocean (within 200 feet of MHW) are also within the critical area. Development on this first row of sand dunes is subject to Council permit requirements, with consideration given to protecting against the destruction or disruption of these dunes which are fragile but important storm buffers and natural erosion controls.

The Council's policy for construction of nonwater-dependent structures on the beach or primary sand dunes is stated in R.30-13(D) of the Final Rules and Regulations for Permitting (Chapter 30, R.30-1-30-13, Code of Laws of South Carolina, 1976, as amended). It reads as follows:

Nonwater-dependent structures such as commercial and residential buildings have been constructed on primary sand dunes or beach areas in the past. Such construction may seriously disrupt the dune/beach system and its vegetation, hampering their effectiveness as a storm and erosion buffer. The sitings of nonwater-dependent structures on the primary dunes or the beaches will be discouraged where other feasible alternatives exist. Design and construction options which minimize destruction of the dunes and dune vegetation will be encouraged.

The Council's direct permitting jurisdiction also considers public access to shoreline areas other than the actual beach-front. Shoreline areas up to spring high tide along the rivers, bays and inlets seaward of the critical area boundary are also included within the Coastal Council's permit authority, being designated under the category of "tidelands" and "coastal waters". (Section 3, S.C. Coastal Management Act). The final Rules and Regulations for Permitting apply to any alterations in these areas. In addition to the general considerations made on all permit applications for protecting public access, there are specific project guidelines for each type of activity, many of which encompass considerations of navigational and recreational access.

Enforcement authority and penalty provisions, as well as the previously mentioned permit appeals procedure, are available under the Coastal Management Act. Construction in violation of the Act can be restrained by a circuit court with jurisdiction "at the suit of the Council, the Attorney General, or any person adversely affected". (Section 16)

b. Erosion Control

The Authority of the Coastal Council to develop and institute erosion control policy, to issue permits for erosion control structures, and to expend public funds for shore erosion control in "areas where the public has full and complete access" also will have the effect of protecting existing access and of preserving beaches for public use.

1) Erosion Control Policy in the Management Program

Section 12 of the 1977 Coastal Management Act mandates that the South Carolina Coastal Council develop and institute a comprehensive beach erosion control policy.

Among the policy concerns addressed in this section of the Act are that the expenditure of public erosion control funds be made only in areas with full and complete public access (see (B)(3) below), that the Council has authority to remove...erosion control structures which are not in the public interest, and that ocean-front property which accretes beyond mean high water and beyond original private property boundaries will remain in trust for people of the State (See (C) below)

The Federal Coastal Zone Management Program guidelines also require that each state include a beach erosion segment in its management program. These requirements are met by Chapter IV (C) of the South Carolina Program document.

2) Permitting

Express policy in the Coastal Council's Final Rules and Regulations for Permitting for erosion control structures states clear preference for the "use of natural features of the dune and beach system rather than artificial protection". Among the criteria considered in permit applications for jetties and groins is that "care... be taken to insure that they do not interfere with public access". Recognizing the importance of the beach and dune system "to storage of sand and shoreline stability... (and) as a barrier which protects adjacent inland areas, the Statement of Policy finds that "enough room (should) be allotted between structures and the shoreline so that if natural erosion occurs, natural deposition can restore the beach..."

In the event of natural or artificial accretion, provisions in the S. C. Coastal Zone Management Act defining the Coastal Council's erosion control authority (Section 12) require that land seaward of the mean high-water mark that existed at the time of development remain undeveloped. These erosion policies and their application should ensure erosion control devices and other structures that are consistent with existing public use and access.

3) Funding

Section 12 (D) of the S. C. Coastal Zone Management Act provides the Coastal Council with the authorization to accept and spend Federal funds for beach or shore erosion control only in areas to which the public has "full and complete access". Section 12(E) of the Act makes Council expenditure of emergency State funding for erosion control also contingent on "full and complete access" to the beach in question. Most recently, the 1978 S. C. General Assembly enacted an amendment to Act 1377 of 1968 relating to the issuance of capital improvement bonds which provides that the "Coastal Council shall endeavor to maximize public access to the beaches of the coastal counties" and that none of the \$600,000 bond revenue available for beach erosion or groin repair "shall be allocated to any project located in any beach not accessible to the public".

c. Networking Authority in the Coastal Zone

Section 8 of the South Carolina Coastal Zone Management Act of 1977 directs that in developing the management program, the Council must "consider all lands and waters in the coastal zone for planning purposes". Section 7(A) requires that "all other state and local agencies and commissions shall cooperate with the Council in the administration and enforcement of this act. All agencies currently exercising regulatory authority in the coastal zone shall administer such authority in accordance with the provisions of this Act and rules and regulations promulgated thereunder".

While the Council has no **direct** regulatory authority outside the critical areas, Section 8(B)(11) provides that the Council must "(d)velop a system whereby the Council shall have the authority to review all state and federal permit applications in the coastal zone, and to certify that these do not contravene the management plan".

The Council has actual authority through this indirect system to regulate activity in the coastal zone which

has a “direct and significant impact on coastal waters”. The particular activities designated for management in the coastal zone were selected on the basis of four criteria, including “disruption of existing public access to a coastal resource.” These activities are listed in Chapter III (C).

The “performance standards approach” of dealing with the impacts of an activity and the governing policies and processes are discussed in Chapter III (C), and legal authorities and networking among State agencies are addressed in detail in Chapter V (A) of the program document.

d. Accretion Policy

As part of the erosion control policy of Section 12 of the South Carolina Coastal Management Act, the General Assembly declared that property from natural or artificially-induced accretion along the ocean-front beyond the mean high water shall be “held in trust for the people of the State”. The effect of this section of the Act pertaining to beach access is to emphasize the importance of ocean-front beaches as a public recreational resource and recognize the public trust doctrine for beaches below MHW.

Section 12(B) reads as follows:

No property rebuilt or accreted as a result of natural forces or as a result of a permitted structure shall exceed the original property line or boundary. **Provided**, further, that no person or governmental agency may develop ocean-front property accreted by natural forces or as the result of permitted or non-permitted structures beyond the mean high water mark as it existed at the time the ocean-front property was initially developed or subdivided, and such property shall remain the property of the State held in trust for the people of the State.

e. Legal Actions to Determine Ownership

A major provision of the South Carolina Coastal Management Act of 1977 is contained in Section 22, which allows persons claiming title to lands between mean high water and mean low water in the coastal zone for file suit against the State of South Carolina to establish their claims. Under Judicial process, determinations would then be made of any existing right, title or interest to such tidelands.

Of significance here is that this section specifically **excludes** beaches from the definition of such tidelands. The effect of prohibiting such actions against the State in the case of beaches is to reinforce the presumed public ownership of beaches below mean high waer.

f. The Role of Local Government

Local governments are another existing authority which can enhance abilities to secure existing access rights. Outside the critical areas, the Council has no direct regulatory authority; however, Section 10 of the S. C. Coastal Zone Management Act creates a duty in the Council to cooperate with local governments and to make recommendations regarding modifications of local ordinances.

The most powerful tool of municipalities is subdivision regulation. South Carolina enabling legislation provides that subdivision regulations under local governing authority may “provide for the harmonious development of the municipality and the county”, permit “the dedication or reservation of land for streets, school sites and recreation areas”, and encourage “a distribution of population and traffic which will tend to create conditions favorable to health, safety, convenience, prosperity, or general welfare”. By considering beaches to be a necessary kind of open space and access-ways as essential to the enjoyment of that space, the Council will recommend that shorefront communities require developers to dedicate public easements to preserve rights-of-way to the ocean. The Council will suggest that municipalities encourage development plans that insure acquisition and maintenance of reasonable access routes, adequate dry-sand space, and adequate facilities, including parking.

In many cases these requirements will confirm existing rights in previously undeveloped property by incorporating frequently used beaches and pathways into development plats as dedicated public areas.

Through its recommendations, the Coastal Council can seek to influence the shape of local ordinances, not only to protect public rights, but to insure that private beachfront landowners and municipalities do not bear an unfair share of the costs of public use. Where beaches are especially popular and accessible so that traffic, trash, and safety become problems, the Council will recommend that local governments consider assessing

nominal fees to residents and visitors for parking or changing facilities. These additional funds should allow a community to provide better maintenance and necessary services where full and complete access is provided.

The preceding sections (A-F) outline those sources of authority relevant to beach access which are specifically provided for in the enabling legislation. The Coastal Council recognizes that the beaches are a State and even a national resource, and consequently require State assistance to supplement and coordinate local efforts to provide and maintain access.

5. Other Resources Policies Affecting Public Access

Resource Policies for each of the identified activities subject to management can affect shoreline access in a number of ways. Activities which would adversely affect existing public recreational areas are discouraged, and activities which can increase public access to public shoreline areas are encouraged. Policies affecting critical areas are enforceable under the permitting authority of the South Carolina Coastal Council. Policies for the coastal zone outside the critical areas are enforceable under Section 8 of the South Carolina Coastal Management Act which gives the Council authority to review and certify State and Federal permits.

In critical areas, filling is prohibited in most circumstances, and construction over primary dunes and beaches is discouraged, to be permitted only where no feasible alternative exists. These regulations will work to preserve beaches for recreational uses as well as for the protection of upland property from erosion and storm damage.

Every kind of activity subject to management in the coastal zone — residential development, transportation, coastal industries, commercial development, recreation and tourism, dredging, public services and facilities, erosion control, and energy and energy-related facilities — is specifically discouraged if the project is in question would significantly impact “public recreational lands” by “conversion of these lands to other uses without adequate compensation or replacement, interruption of existing public access, or degradation of environment quality in these areas.” Through its procedures for review and certification, the Council can refuse to certify any permit if the impact on existing public access to public recreational areas has not received adequate consideration.

Certain specific **enforceable** Resource Policies contained in the program will work to increase existing public access. For example, road and highway construction policy provides that “where appropriate, bridges and approaches should be designed to provide for the enhancement of public access by the utilization of fisherman catwalks, boat launching ramps and other structural features”. In addition, the reuse of abandoned railway bridges as fishing piers or as other recreational facilities is encouraged.

Commercial development policy encourages development which includes public access: “Developers of commercial property on immediate beach or river-front are urged to provide some area for general public use in their plans.” Boat ramp policy gives priority in justifying construction in critical areas or other environmentally sensitive areas to ramps intended for “public use, open to all citizens” over those ramps intended for restricted or private use.

Other **recommended** Resource Policies affecting access are articulated in regard to park, marina, boat ramp, and commercial recreation planning. Objectives of the State Outdoor Recreation Plan expressed by the S. C. Department of Parks Recreation and Tourism generally support increased recreational facilities and access to them. Recommended policy developed by the Council for parks in the coastal zone encourages the consideration of new scenic vistas to natural shoreline areas, the analysis of the recreational potential of surplus State and Federal lands, and the encouragement of park development along utility easements and abandoned rights-of-way.

Recommended policies for the siting of marinas and boat ramps encourage consideration of landward access, parking facilities, and comparable upland facilities to enhance recreational opportunities. Recommended policy for commercial recreation would increase accessibility and discourage remote strip development by locating tourist activities in areas convenient to population centers.

Both the Federal and S. C. Coastal Management Acts require the activities of regional benefit and concerns in the national interest be considered in the management program. Activities of Regional Benefit have been defined to include “Parks — recreational areas of State or regional significance”.

The protection of public recreation areas and shoreline access as valuable coastal resources is considered to

be in the national interest. These designations provide an additional protection for existing public access. (See Chapter III(C)(2) and (3) for a complete discussion of the management of these activities.)

6. Funding Programs

In order to increase or upgrade existing public access, various funding programs can be used. The Council strongly supports the tapping of these funding sources for this purpose.

The Heritage Conservation and Recreation Service (HCRS) is the primary source of funds to be used for acquisition, improvement, development, and planning for public recreation areas. Funds from HCRS come to the State through the South Carolina Department of Parks, Recreation, and Tourism or to localities, counties, and recreational planning districts by applying to the Councils of Government.

Section 315 of the Federal Coastal Zone Management Act, as amended in July, 1976, states that:

“The Secretary may, in accordance with this section and in accordance with such rules and regulations as the Secretary shall promulgate, make grants to any coastal state for the purpose of ... acquiring lands to provide for access to public beaches and other public coastal areas of environmental , recreational, historical, esthetic, ecological, or cultural value ...”

The legislation also specifies that any such grant may be made for no more than 50 percent of the cost of the project. These grants may be used for improving access to existing public areas by such means as acquiring easements and providing parking areas. However, no funds have been appropriated yet by Congress under Section 315.

An additional source of funds is the collection of nominal user fees for entrance, parking, and changing privileges. These funds can be used to cover the expenses of providing parking, life guards, restroom and changing facilities and clean-up for the public area. Shuttle bus services from remote parking areas can also charge user fees to cover their expenses in conjunction with any mass transit assistance grants available.

A final, although indirect, source of funds available for increasing or upgrading public access is the tax structure. Privately-owned land may be donated to a Federal, State, or local governing body, or to a charitable organization such as the Nature Conservancy. The donor may then deduct all or a portion of the appraised value of the land from his State and Federal income taxes. Although there is no provision for a carry-over at the State level, the tax advantage may be spread out over a period of years for Federal income tax purposes.

TABLE 1
SOUTH CAROLINA BEACH SURVEY

Beach Area	Length (Miles)	Approximate width above mean high tide (feet)	(Adjacent Land) Ownership	Public Access	Comments
Waites Island	2.3	93	Private	None	Only undeveloped maritime forest/dune area in Horry County.
North Myrtle Beach	9.3	125	Private	Excellent	Densely developed; good public access but limited parking; fishing pier.
Atlantic Beach	0.3	125	Private	Moderate	Limited parking facilities; fishing pier.
Myrtle Beach	15.7	70	Private	Moderate	Densely developed; active; active tourist economy, including numerous hotels, restaurants, attractions and 29 golf courses in the area; fishing pier.
Myrtle Beach State Park	1.2	100	State	Excellent	Camping, day use area, swimming pool and fishing pier, interpretive area.
Surfside Beach	2.1	50	Private	Moderate	Limited parking; beach access-ways not marked, some blocked by private structures. Community plans to improve situation in near future.
Garden City Beach	4.0	50	Private	Limited	Highly developed; fishing pier.
Hunnington Beach State Park	3.0	70	State	Excellent	Camping, nature observation, playground, arts center.
North Litchfield Beach	1.5	75	Private	Limited	Limited access obscured by unmarked easements and prominent "No Parking" sign at entrance to island.
Litchfield by the Sea	1.0	-	Private	None	International Paper co. developing a private residential community.
Litchfield Beach	1.5	75	Private	None	8 access-ways but only 1 visible and that is prominently marked "Private".
Pawleys Island	2.5	50	Private	Limited	No public parking except some on-street, only 8 ocean access-ways.
Dubordieu Beach	2.2	50	Private	None	Controlled by a major land holder; private development on portion fronting beach, remainder undeveloped at present.
Bell Baruch Beach	11,000 ft.	50	Private	None	Private foundation, with State cooperation and research facilities.
North Island	8.0	50	State	Supervised boat only	Wildlife preserve.
South Island	1.0	100	State	Supervised boat only	Wildlife preserve.
Cedar Island	2.5	50	State	Boat only	Part of Santee Coastal Reserve.
Murphy Island	4.2	50	State	Boat only	Part of Santee Coastal Reserve.
Cape Romain Wildlife Refuge			Federal	Boat only	One of the nation's most outstanding wildlife sanctuaries; some areas designated wilderness.
Cape Island	6.0	166			
Lighthouse Island	1.5	180			
Raccoon Key	6.0	150			
Bull Island	5.7	100		Boat only	
Capers Island	1.8	50	State	Boat only	Incorporated into Heritage Trust Program. Public access is encouraged.
Deweese Island	1.8	50	Private	None	Privately owned, but State holds a scenic easement over the island.

TABLE 1 (Continued)

Beach Area	Length (Miles)	Approximate width above mean high tide (feet)	(Adjacent Land) Ownership	Public Access	Comments
Isle of Palms	6.2	100	Private	Moderate	Municipal parking lot, some on-street parking, no formally dedicated easements, fishing pier.
Sullivans Island	2.6	138	Private	Excellent	On-street parking in certain areas; good easement provisions.
Folly Island	5.2	88	Private	Moderate	Severe erosion problems; very limited public parking; fishing pier.
Kiawah Island	8.0	150	Private	Limited but good facilities	Private resort - restricted entry beyond designated public access area, fee charged.
Seabrook Island	1.8	50	Private	None	Restricted access resort.
Eddingsville Island	2.0	120	Private	None	
Botany Island	1.5	150	Private	None	
Botany Bay Island	2.5	150	Private	None	
Edisto Beach	3.0	80	Private	Moderate	Limited parking, mostly on-street; fishing pier.
Edisto Beach State Park	1.5	80	State	Excellent	One of State's most popular parks; playground, picnicing, hiking and environmental observation areas.
Pine Island	1.5	25	Private	None	
Otter Island	2.0	75	Private	None	
Harbor Island	1.5	150	Private	None	
Hunting Island State Park	3.8	70	State	Excellent	Camping, boating facilities, wildlife observation areas, etc.
Fripp Island	2.3	75	Private	None	Restricted access resort.
Pritchards Island	2.5	75	Private	None	Undeveloped.
St. Phillips Island	1.0	75	Private	None	Undeveloped.
Hilton Head Island	11.4	150	Private	Extremely limited	Moderately developed, most areas restricted to residents or guests.
Daufuskie Island	2.0	-	Private	Boat only	Access to island at public boat launch, but access across island is limited to the few public roads.
Turtle Island	-	-	State	Boat only	Wildlife Management, very poor sand beach.

SOURCE: Public Beach Access and Recreation in South Carolina, 1976, Hartzog, Laders & Richards. Council staff update.

TABLE 2
AVAILABLE BEACH ACCESS IN SOUTH CAROLINA

Beach	Access Points
North Myrtle Beach	36 public streets end at beach; walkways clearly marked. 117 pedestrian easements, most of which are dedicated to city or recorded on plats.
Atlantic Beach	4 beach access-ways at street endings between 29th Avenue South and 32nd Avenue South.
Myrtle Beach	Access at some street endings, limited day-visitor parking.
Myrtle Beach State Park	Freely accessible, ample parking (400 spaces for day-visitors, space for each camp-site).
Surfside Beach	34 public access-ways, but none marked as public, none dedicated as easements.
Garden City Beach	
Huntington Beach State Park	Freely accessible; paved parking for 275 cars.
North Litchfield Beach	Although 6 streets and 10 footpaths end at the beach, none are marked or even clearly visible. Entrance to the island marked by "Warning: No public parking on North Litchfield".
Litchfield Beach	7 walkways and one path are shown on a plat of the community; however only 1 accessway is readily visible, and it is marked "private". No designated public parking.
Pawleys Island	Eight ocean access-ways. Public parking limited to the shoulder of the main road.
<p>Note: State-owned North, South, Cedar, Murphy, and Capers islands are accessible by private boat only with restrictions. Federally-owned beaches are "Federally excluded lands" for purposes of coastal management.</p>	
Isle of Palms	Relatively unrestricted access, although easements have never been formally dedicated except at pier where public parking is available for approximately 600 cars.
Sullivans Island	Access at the end of almost every block, public parking allowed on all streets.
Folly Island	Relatively unrestricted access. Parking in four privately owned lots and at metered spaces for approximately 275 vehicles.
Kiawah Island	Public access provided in designated area of the island only. Bath house facilities and parking for 160 cars available.
Edisto Island	Access between every 3 to 5 lots via unmarked footpaths. On-street parking available.
Edisto Beach State Park	Readily accessible. Parking facilities for 250 vehicles.
Hunting Island State Park	Readily accessible. Parking facilities for approximately 400 vehicles.
Hilton Head Island	Limited public access at some street ends.

SOURCE: Public Beach Access and Recreation in South Carolina, 1976, Hartzog, Lader and Richards.

TABLE 3

COASTAL BOAT LANDINGS

NAME	BODY OF WATER	PUBLIC	COMMERCIAL
A. Beaufort County			
Sugar Hill Boat Landing	Sugar Hill Creek	X	
Combahee Boat Ramp	Combahee River	X	
Wimbee Creek Boat Landing	North Wimbee Creek	X	
Beaufort County Boat Ramp	Whale Branch	X	
Beaufort Co. Boat Ramp	Broad River	X	
Beaufort Co. Boat Ramp	Battery Creek	X	
Beaufort Co. Boat	Battery Creek & Beaufort River	X	
Beaufort C. Boat Ramp	Brickyard Creek	X	
Sam's Point Boat Ramp	Lucy Point Creek	X	
Beaufort Co. Boat Ramp	Factory Creek	X	
Beaufort Marina	Factory Creek		X
St. Helena Is. Boat	Beaufort River	X	
Harbor Island Boat Landing	Harbor River	X	
St. Helena Boat Landing	Capers Creek	X	
Russ Point Boat	Fripp Inlet	X	
St. Helena Boat	Station Creek	X	
Fort Freemont	Beaufort River	X	
Chechessee River Boat Landing	Chechessee River	X	
New River Boat Dock and Float	New River	X	
Alljoy Ramp	May River	X	
Beaufort Co. Boat Ramp	Broad Creek	X	
Broad Creek Marina	Broad Creek		X
Bluffton Boat Ramp & Landing	May River	X	
Buckingham Landing	Mackay Creek	X	
Jenkins Island	Skull Creek	X	
Johnson Creek Boat Landing	Johnson Creek	X	
Butchers Island Boat Landing	Wards Creek	X	
Pigeon Point Boat Landing	Beaufort River	X	
Freedom Mall Boat Landing	Beaufort River	X	
Fort Frederick Boat Landing	Beaufort River	X	
Downtown Marina of Beaufort	Beaufort River		X
Daufuskie Island County Float & Dock	New River	X	
Paige Point Boat Landing	Huspah Creek	X	
Harbor Town Marina	Calibogue Sound		X
Hilton Head Harbor	Intracoastal Waterway		X
South Beach Marina	Calibogue Sound		X
Marsh Harbor Marina	Broomfield Creek		X
B. Berkeley County			
Somerset Point	Lake Moultrie		X
Camp Moultrie	Lake Moultrie		X
Wilsons Landing	Lake Marion		X
Bonneau Beach Resort	Cooper River		X
Lions Beach Recreation Park	Lake Moultrie	X	
Rembert Dennis Boat Landing		X	
Cypress Gardens	Cypress Gardens Canal	X	
Cypress Gardens Landing	Cypress Gardens Canal	X	
Biggens Ramp	Tailrace Canal	X	
Speres Landing	Lake Marion	X	
Jamestown Landing	Santee River	X	
Bushy Park Landing	Cooper River	X	
Quinby Landing	Cooper River	X	
Wando Boat Landing	Wando River	X	
C. Charleston County			
Robert E. Ashley	Jeremy Creek	X	
Buck Hall	Intracoastal Waterway	X	
Moore's Landing	Intracoastal Waterway	X	
Claude W. Blanchard	Wando River	X	
Wando Woods Boat Ramp	Ashley River	X	

TABLE 3(continued)

NAME	BODY OF WATER	PUBLIC	COMMERCIAL
C. Charleston County (continued)			
Isle of Palms Marina	Intracoastal Waterway		X
Sullivan's Island	Conch Creek		X
Fisherman's Place	Intracoastal Waterway		X
Shem Creek	Shem Creek	X	
J. Mitchell Graham	Cooper River	X	
Remley's Point Boat Landing	Cooper River	X	
Paradise Island Boat Ramp	Wando River	X	
Ralph N. Hendricks	Wando River	X	
Norton Bridge	Ashley River	X	
Municipal Yacht Basin	Ashley River	X	
Brittle Bank Park	Ashley River	X	
Pierpoint Boat Ramp	Church Creek	X	
Rantowles Boat Ramp (Bulow)	Rantowles Creek	X	
Lloyd Flemming (Plymouth Ave.)	Wappoo Creek	X	
R. E. Seabrook	Wappoo Creek	X	
Penny Creek	Penny Creek		X
Stono Marina	Stono River		X
Limehouse	Stono River		X
J. F. Seignious	Folly River	X	
Battery Island	Stono River	X	
Cherry Point	Bohicket Creek	X	
Dahoo Bridge	Dahoo River	X	
Fontains	Big Bay Creek		X
Flowers Sea Food	Big Bay Creek		X
Willtown Boat Ramp	Edisto River	X	
Edisto Island Boat Ramp	Edisto River	X	
Prison Farm Boat Ramp	Ashley River	X	
D. Colleton County			
Mars Old Field Boat Landing	Edisto River	X	
Good Hope Boat Landing	Edisto River	X	
Long Creek Boat Landing	Edisto River	X	
Sullivans Boat Landing	Edisto River	X	
Lowndes Boat Landing	Edisto River	X	
West Bank Boat Landing	Edisto River	X	
Public Boat Landing	Combahee River	X	
Cuckolds Creek Boat Landing	Cuckolds Creek	X	
Field Point Boat Landing	Combahee River	X	
Wiggins Boat Landing	Old Chechaw River	X	
Chessy Creek Boat Landing	Chessy Creek	X	
Price Bridge Boat Landing	Horsecreek Creek	X	
Brickyard Boat Landing	Ashepoo River	X	
Bennetts Point Boat Landing	Mosquito Creek	X	
Fee Farm Creek Boat Landing	Fee Farm Creek	X	
E. Dorchester County			
Ashley Fishing & Recreation	Ashley River		X
F. Georgetown County			
Staples Lake	Great Pee Dee	X	
Port Hill	Great Pee Dee	X	
Peters Field	Great Pee Dee	X	
Mingo Creek Bridge	Mingo Creek	X	
Cowhead	Mingo Creek	X	
Browns Ferry	Black River	X	
Rocky Point	Black River	X	
Peters Creek	Black River	X	
Shrine Club	Black River	X	

TABLE 3 (continued)

NAME	BODY OF WATER	PUBLIC	COMMERCIAL
F. Georgetown County (continued)			
Pringles	Black River	X	
Pump House	Black River	X	
Pee House	Black River	X	
Pole House	Santee River	X	
Collins Landing	Santee River	X	
South Island Ferry	Winyah Bay	X	
Belle Island Marina	Winyah Bay		X
Moultrie		X	
Boulevard	Winyah Bay	X	
Nautica Marina	Winyah Bay		X
Gulf Marina	Winyah Bay		X
Exxon Marina	Winyah Bay		X
Hazard's Dock	Winyah Bay		X
Dirleton	Pee Dee River	X	
Chapel Creek	Pee Dee River	X	
Hagley	Waccamaw River	X	
Altman's Chapel Creek	Waccamaw River	X	
Wacca Wache	Intracoastal Waterway	X	
Wacca Wache Marina	Intracoastal Waterway		X
Gulf Stream Marina	Murrells Inlet		X
Captain Dick's Marina	Murrells inlet		X
Captain Alex Marina	Murrells Inlet		X
Snug Harbor	Murrells Inlet		X
Anchor Marina	Murrells Inlet		X
Inlet Port Marina	Murrells Inlet		X
Pawley's Island (3)	Pawley's Inlet	X	
G. Horry County			
Lumber River Landing	Little Pee Dee River	X	
Punch Pole Landing	Little Pee Dee River	X	
Sandy Bluff Landing	Little Pee Dee River	X	
Gallivants Ferry Landing	Little Pee Dee River	X	
701 Bridge Landing	Little Pee Dee River	X	
Yanhannah Ferry	Great Pee Dee River	X	
S. C. 9 Landing	Waccamaw River	X	
Starr Bluff Landing	Waccamaw River	X	
Red Bluff Landing	Waccamaw River	X	
Hardees Ferry Landing	Waccamaw River	X	
Conway Marina	Waccamaw River	X	
Jackson Bluff Landing	Waccamaw River	X	
Cox's Ferry Landing	Waccamaw River	X	
Old Chimney Landing	Waccamaw River	X	
Horry Ramp	Waccamaw River	X	
Bucksport Marina	Intracoastal Waterway	X	
Socastee Bridge Landing	Intracoastal Waterway	X	
Hague Marina	Intracoastal Waterway		X
North Myrtle Beach Landing	Intracoastal Waterway	X	
Vereen Marina	Intracoastal Waterway		X
Palmetto Shores Marina	Intracoastal Waterway		X
Ron-Tom Marina	Intracoastal Waterway		X
Brainard Landing	Intracoastal Waterway		X
Campground & Marina	Intracoastal Waterway		X
Bernards	Intracoastal Waterway		X
Exxon Marina	Intracoastal Waterway		X
Gulf Stream Marina	Murrells inlet		X
H. Jasper County			
Bolan Hall Boat Landing	Bahaw Creek	X	
Dawson Landing	Coosawhatchie River	X	

TABLE 3 (continued)

NAME	BODY OF WATER	PUBLIC	COMMERCIAL
H. Jasper County (continued)			
B & C Landing	Savannah River	X	
Tutens Landing	Boys Creek	X	
Mill-Stone Landing	Savannah River	X	
Becks Ferry Landing	Savannah River	X	
New River Boat Landing	New River	X	
Corner Lake Boat Landing	Coosawhatchie River	X	
Union Boat Landing	Union Creek	X	
Turnbridge Boat Landing	Salt Water Creek	X	
Cook Boat Landing	New River	X	
Clasglow Boat Landing	Wright River	X	
I. Beaufort County Suspended Fishing Platforms			
Mackay Creek Fishing Platform	Rt. 278 Bridge Hilton Head Island	X	
Chechessee River Fishing Platform	Rt. 170 Bridge at Chechessee River	X	
Broad River Fishing Platform	Rt. 120 Bridge at Broad River	X	
Beaufort River Fishing Platform	Hwy. 21 Bridge Lady's Island	X	
Chowan Creek Fishing Platform	Hwy. 21 Bridge at Chowan Creek	X	
Harbor River Fishing Platform	Hwy. 21 Bridge Hunting at Harbor River	X	
Johnson Creek Fishing Platform	Hwy. 21 Bridge Hunting at Johnson Creek	X	

SOURCES: South Carolina Wildlife & Marine Resources Department, **A Guide to Saltwater Recreational Fisheries in S. C., 1977.**

Waccamaw Council of Governments

Berkeley-Charleston-Dorchester Council of Governments

Lowcountry Council of Governments

E. LIVING MARINE RESOURCES

(The Living Marine Resources segment was based on an initial draft provided by the Marine Resources Division, South Carolina Wildlife and Marine Resources Department, whose contribution is appreciated.)

1. Introduction

The extensive living marine resources of the coastal zone of South Carolina are extremely important in terms of biological, economic, recreational and aesthetic values. Although some of these attributes may be evaluated in terms of dollar value or extent of utilization, many cannot, and figures currently available with respect to economic impact and numbers of people benefiting from these resources must be considered grossly inadequate to express their total worth. At present, the great majority of the State's living marine resources have not been seriously over-exploited or depleted, although public utilization and demand is increasing rapidly. The future of these resources will depend to a large extent on effective environmental management programs as well as adequate consideration of these living resources and their habitat during all stages of the state's coastal zone planning and management process.

2. Physical Environment

In order to gain a further understanding of the various relationships between the State's living marine resources and their environment, the physiography and hydrology of the coastal zone must be considered. In addition, the major ecosystems comprising the marine-estuarine system have to be examined. Brief descriptions of these physical parameters are presented below.

a. Physiography and Hydrology

The coastal plain of South Carolina extends from the sand hills in the central portion of the State to the Atlantic Ocean. It is characterized by low-lying, pine-covered sand ridges and terraces, traversed by numerous rivers. The largest of these rivers may discharge enough fresh water to significantly alter the salinity in the vicinity of the river mouth.

The South Carolina coast possesses a rich variety of habitat types, ranging from sea islands and marshlands (discussed in Chapter I) to extensive estuarine systems and the open ocean. Hydrological parameters such as salinity, turbidity (impaired water clarity due to the presence of suspended particles), and tidal range vary widely as well. Within major river systems, the effect of the tides may be noticed even beyond the range of salt water intrusion. The most dramatic effects on salinity and turbidity are produced by weather — heavy rains increase surface run-off, leading to an influx of fresh water and sediments into the estuaries. Recent examples of this phenomenon include the snows during February, 1973, and the heavy summer rains of the same year. Turbidity is also increased by the presence of extensive agriculture.

b. Ecosystem Types

Coastal environments may be divided into three ecosystem types, defined and delineated on the basis of salinity. These three are the marine, maritime and estuarine systems.

Coastal Marine Ecosystem

Physical Description

The marine ecosystem may be defined as the oceanic environment wherein salinities do not fall (or rarely fall, as in the case of areas adjacent to major river systems) below 30 parts per thousand. (This means that the quantity of dissolved salts in the sea water does not fall below 30 parts per thousand.) The boundary between the marine ecosystem and the more inland maritime ecosystem is the extreme front beach high water line measured at spring tides. The estuarine/marine boundary is determined by drawing a line from headland to headland across a river mouth, bay, lagoon, or other estuarine environment.

Flora and Fauna

Life within the deep ocean is sparse; in fact, the area is often characterized as a biological desert. In contrast, the waters of the territorial seas (lying within 3 miles of shore and covering the inner continental shelf) are teeming with plant and animal life. Habitats such as reefs, banks, dropoffs and areas where currents converge are particularly rich due to the high nutrient concentrations present there.

The coastal marine ecosystem is comprised of two major subsystems, the subtidal and the intertidal. The former extends from the lowest point of the spring tides to the edge of the continental shelf — in other words, the subtidal environment is strictly aquatic.

Plants occurring in this zone include a variety of forms of plankton (microscopic plants and animals which drift in the surface currents) as well as bacteria, fungi, benthic algae, and floating Sargassum, which gives its name to the famed Sargasso Sea. Planktonic plants are very important as primary producers, and bacteria and fungi play an important role as decomposers. Detritus is considered important in the food chain of nearshore areas but much less so further offshore.

Many different groups of animals are represented in the coastal marine ecosystem. The zooplankton (the animal component of the plankton) are quite diverse, and include the larvae of many commercially and recreationally important species of fish and shellfish — most notably, shrimp.

Invertebrates are another important faunal group in the marine environment. (See Table 1 for a description of common invertebrates.) Among the most prevalent are crustaceans such as crabs and shrimp, polychaetes (bristle worms), mollusks, and echinoderms such as starfish and sand dollars.

Hard bottom areas, often called reefs or live-bottom areas, host a particularly diverse collection of invertebrates, including sponges, jellyfish, bryozoans and a variety of worms.

Other important species in the marine environment are the sea turtles (especially the loggerhead, which is the only true resident species in the State), the Atlantic bottle-nosed dolphin, several species of whales, and a number of bird and fish species. Most significant among the latter are spot, croaker, stardrum, kingfishes, menhaden, anchovies, spotted hake, flounder, tonguefish, bluefish, sharks, and rays.

The intertidal subsystem is alternately exposed and flooded by the tides. It represents a high stress environment, with typically strong wave and current action, wide fluctuations in salinity and temperature, and heavy predation. The few species which can survive under these harsh conditions occur in large numbers.

Sandy beaches dominate the intertidal zone of the coastal marine ecosystem in South Carolina. Most of the macroinvertebrates found in this habitat are mobile, enabling them to move with the ebb and flow of the tide, and are adapted to dynamic beach processes. Key species inhabiting the intertidal beach include burrowing amphipods, coquina clams, worms, isopods, mole crabs and ghost crabs. Fishes inhabiting the surf zone include Gulf kingfish, pompano, mullet sharks, and red drum. Nesting of Atlantic loggerhead turtles occurs on South Carolina beaches from mid-May through mid-August. Because of their size, marine mammals normally do not venture into the intertidal zone except for periodic and largely unexplained strandings, but many land mammals such as opossums, raccoons, mice, rats, bobcats, feral hogs and deer frequent the beaches.

Maritime Ecosystem

The maritime ecosystem is often called the upland ecosystem — characterized by beaches, dunes, transition shrubs and maritime forests. (See Figure 1.) The barrier islands are a major component of the maritime ecosystem in South Carolina, as are bird keys and banks.

Bird Keys and Banks

Bird keys are small isolated islands usually found in somewhat sheltered areas such as tidal inlets or bays. Their size and shape change yearly in response to tidal currents, storm damage, etc., and they are subject to frequent overwash. Because of their isolation and their proximity to food sources, bird keys and banks are ideal nesting sites for large numbers of birds. (See Table 2.) Deveaux Bank, located in the mouth of the North Edisto River south of Charleston, supports the largest colony of birds in the State. Approximately 15,000 pairs of royal terns, 5,000 pairs of laughing gulls and 1,100 pairs of brown pelicans breed here annually. (Deveaux Bank is under lease to the National Audubon Society as the Alexander Sprunt, Jr. Sanctuary.)

The plant life on bird keys and banks is primarily limited to such pioneer beach species as sea oats, panic

TABLE 1
Common South Carolina Marine Invertebrates

1 . (Phylum Porifera)

Sponges — Sponges of various types and sizes are found in the coastal waters of South Carolina. They are essentially loose aggregations of radially symmetrical cells which function more or less independently. Structural support is provided by spicules embedded in the tissue.

2 . (Phylum Cnidaria)

Jellyfish — Jellyfish are generally translucent, globular, and possess tentacles. Like other members of this phylum, they have a relatively simple level of tissue organization, without true organs. Food is digested in a central gastric cavity, which also fulfills the functions of a circulatory system. Food organisms are killed or stunned by batteries of stinging cells, called nematocysts.

3 . (Phylum Ctenophora)

Ctenophores — (Comb jellies) These are beautiful animals which superficially resemble jellyfish. They are transparent and often iridescent, making them a spectacular sight as they swim through the water.

4 . (Phylum Annelida)

Polychaete worms — These are complex segmented worms which often burrow into mud or sand. As a group, they are commonly called “bristleworms” because of their numerous appendages.

5 . (Phylum Mollusca)

Mollusks are the animals which originally inhabited the shells often found cast up on the beach. They are characterized by a soft body usually contained within a hard, calcereous shell. The shell may be in one piece (gastropods such as whelks, oyster drills and snails), in two pieces (bivalves such as clams and oysters), or absent entirely as is the case of Octopi and sea-slugs (nudibranches).

6 . **Class Crustacea**

The crustaceans are highly specialized invertebrates, characterized by a hard chitinous exoskeleton. The presence of this exoskeleton in turn necessitates other behavioral or structural characteristics which are diagnostic, such as periodic molting to allow the animal to grow and to mate, and jointed limbs. Common crustaceans in South Carolina include:

Copepods — tiny organisms, often found in the zooplankton, which feed directly on the primary producers and are in turn a direct food source for some of the largest marine dwellers — notably the blue whale and the basking shark.

Barnacles — colonial animals whose hard white shells are often seen blanketing rocks, pilings and hulls of ships. Barnacles close their shells tightly when they are left exposed by the receding tide, opening them again only when the incoming tide has covered them.

Amphipods and Isopods — These two groups are similar in that both are largely bottom scavengers which resemble miniature shrimp, yet are poor swimmers.

Decapod Crustaceans — This group includes the most familiar invertebrates — the crabs, shrimp, prawns, and lobsters.

7 . (Phylum Bryozoa)

Bryozoa—(Moss animals) Bryozoa are tiny animals with boxlike shells of hardened cuticle. They are colonial, and may encrust rocks, shells, etc. like barnacles or may form branching colonies resembling coral.

8 . (Phylum Brachiopoda)

Brachiopods — Brachiopods resemble clams or similar mollusks, in that they possess a bivalved shell. However, the animal which inhabits the shell is a member of a different phylum than the mollusks.

9 . (Phylum Echinodermata)

The echinoderms are characterized by radial symmetry based on five radiating arms or canals, and by rough or spiny coverings. (“Echinoderm” means “spiny-skinned.”) The echinoderms move by means of tube feet filled with water, which also carry food particles into the central oral cavity. Most common in South Carolina’s waters are the starfish, sea urchins (which resemble green or purple pincushions) and sand dollars.

FIGURE 1

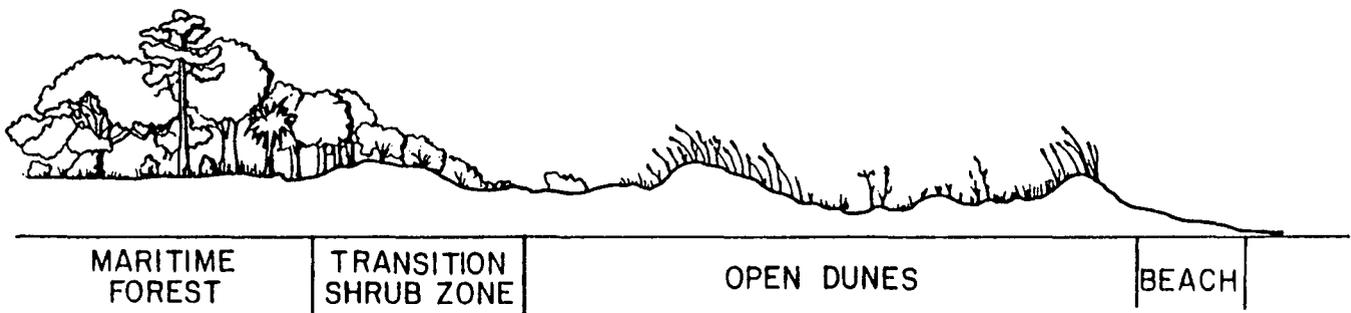


Figure 1. A profile of the maritime ecosystem.

Source: S. C. Wildlife & Marine Resources

TABLE 2

Species of colonial nesting birds which breed on South Carolina keys and banks.

DOMINANT		
Royal Tern	PR	
Laughing Gull	PR	
Brown Pelican	PR	
Louisiana Heron	PR	
Snowy Egret	PR	

MODERATE		
Black Skimmer	PR	
Gull-billed Tern	SR	mid-March - mid-Sept.
Sandwich Tern	SR	April - November
Oystercatcher	PR	
Common Egret	PR	

MINOR		
Least Tern	SR	mid-March - late Oct.
Common Tern	PR	
Caspian Tern	PR	
Wilson's Plover	SR	March - Oct.
Cattle Egret	PR	
Glossy Ibis	PR	
Little Blue Heron	PR	
Willet	PR	

KEY: U - Uncommon, small numbers irregularly
 PR - Permanent resident, present year round
 WR - Winter resident
 SR - Summer resident

SOURCES: Sprunt and Chamberlain, 1949 and 1970.
 Forsythe, In Press.
Audubon Field Notes, 1967 - 1977.
 Chamberlain, 1968.

grass, and saltmeadow cordgrass (*Spartina patens*), although in some cases smooth cordgrass (*Spartina alterniflora*) or even wax myrtle may develop.

Upland and Barrier Island Flora and Fauna

The biota of upland areas is significantly different from more inland communities due to the influence of salt spray from the marine environment.

Dune communities most obviously exhibit the effects of intensive salt spray, being completely treeless. Plant zonation on maritime dunes is directly dependent on the intensity and angle at which salt spray strikes the dune face. Table 3 illustrates five easily discernable floristic zones found in South Carolina's maritime dunes. Zone 1 is commonly referred to as the strand line; here sea rocket, seabeach orach, beach elder, and Russian thistle are common. Zone 2, the foreslope of the foredune, is dominated by sea oats and other plants that can tolerate high intensities of salt spray. Zone 3 is the backslope of the foredune where the influence of salt spray is less intensive as indicated by the number of common species present. Zone 4, the dune field, is low enough to avoid intensive salt spray and exhibits the highest diversity of the dune zones. Salt spray intensity is again high on the foreslope of the rear dunes — Zone 5. Zone 6 marks the beginning of the transition shrub zone.

The transition shrub zone is dominated by woody plants, indicators of the decreasing intensity of salt spray. The structure of this community is characteristically sheared, sloping up to the canopy of the maritime forest. (See Figure 1.) Wax myrtle, live oak (dwarfed), French beautyberry, and yaupon holly are trees and shrubs commonly found in this community. Cat brier and pepper vine are vines that are found growing over the top of the transition shrub thickets. The salt spray limits the growth of the trees in the transition shrub zone. Although this zone has the appearance of a young community, it has been determined that dwarfed live oaks less than 6 inches in diameter may be as old as 120 years.

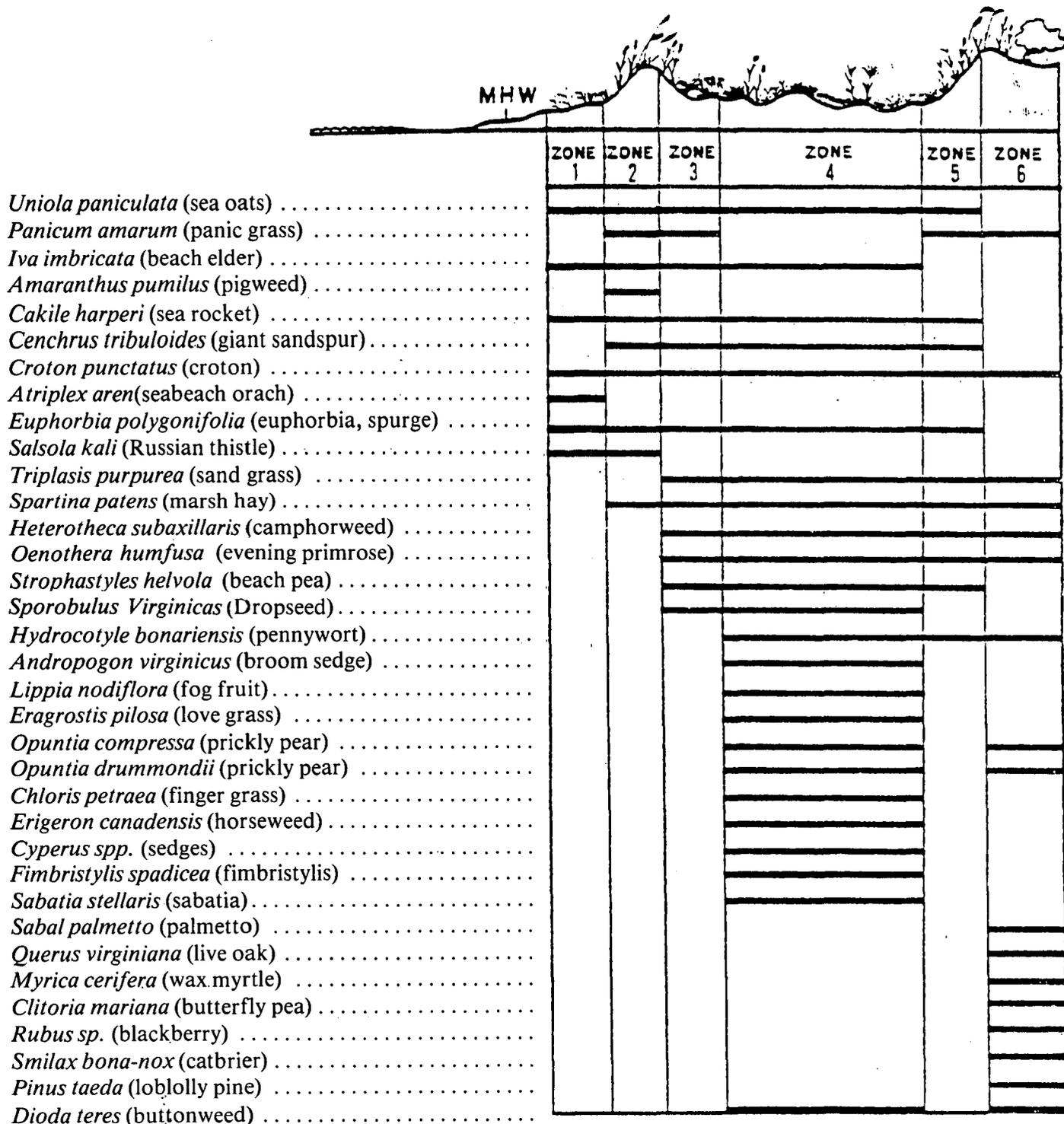
The maritime forest is the next floristic zone found as one moves inland from the dunes. Several communities are present within this zone, with the characteristic canopy species being: live oak, palmetto, laurel oak, loblolly pine, and magnolia. Red bay and yaupon holly are the most commonly-encountered understory species.

Along the rear of the barrier islands another transition zone often separates the maritime forest from the irregularly-flooded salt marsh. Many of the plants found in the dune-forest transition shrub community are found here, along with sea myrtle, southern red cedar, and marsh elder.

The fauna of dune communities is dominated by the ghost crab, the six-lined racerunner, the eastern mole, the Savannah Sparrow, the Ground dove, the Least tern, the Nighthawk, and the Tree swallow. Common Fauna of maritime forest and shrub communities include the Carolina Wren, the Boat-tailed Grackle, the Painted Bunting, the narrow-mouthed toad, the southern toad, the green treefrog, the eastern cottonmouth, the black racer, the mud turtle, the American alligator, the grey squirrel, the bobcat, the raccoon and the White-tailed deer.

TABLE 3

GENERALIZED ZONATION OF COMMON SOUTH CAROLINA DUNE PLANTS



MHW - Mean High Water

SOURCES: Coker (1905), Hosier (1975), Pinson (1973), and Stalter (1974).

Estuarine Ecosystems

Physical Description

The estuaries — the sheltered waters of the bays, lagoons and tidal rivers — are the richest of the coastal ecosystems, due to a combination of the following factors.

1. **Shelter** — wave action is subdued, and nutrients are retained, permitting plants and shellfish larvae to attach and flourish.

2. **Depth** — Shallow estuarine waters permit marsh plants to grow, improve water circulation and discourage entry by oceanic predators. They may allow greater light penetration and consequently increased photosynthesis. However, in many areas of South Carolina the turbidity found in shallow waters may negate this benefit.

3. **Salinity** — Fresh water flow from rivers dilutes the saltwater, leading to an especially diverse flora and fauna adapted to estuarine conditions.

4. **Circulation** — The combination of fresh water outflow, salinity gradients and tides creates conditions which are essential for suspended plant and animal life, which in turn support more advanced forms of animal life.

5. **Tide** — The tides bring in some nutrients, aid in exchange of dissolved gasses and transport suspended life into the estuaries, and in turn, carry other nutrients, often in the form of decaying plant and animal life (detritus) out into the open water.

6. **Nutrient storage and cycling** — Marsh grasses and other vegetation are highly effective nutrient storage mechanisms; the physical structure of an estuary also contributes to retention and rapid turnover of nutrients. (Clark, p. 29-30.)

Because of this unique combination of factors, estuaries are not only the most productive of coastal ecosystems, but the most vulnerable to outside disturbances. Consequently, special attention must be given to man's impacts on the delicate balance of factors present in the estuaries.

The estuarine ecosystem can be further subdivided into three major subsystems — (1) subtidal; (2) intertidal (comprised of flats, salt and brackish marshes); and (3) coastal impoundments. Each of these regions has its own characteristic plant and animal life. Zonation is further complicated by the presence of pronounced salinity gradients resulting from the mixture of salt and fresh water. Thus, certain species found in the lower reaches of an estuary may not be found in the uppermost areas and vice versa.

Subtidal Flora and Fauna

In spite of the often turbid waters in South Carolina's estuaries, plankton numbers and biomass may be high. Among the more abundant animals present in the zooplankton are copepods and the larvae of a number of other invertebrates, including barnacles, mollusks, polychaete worms, shrimp and crabs. The larval segment of the plankton is particularly important since over 85% of the landings (by weight) of commercial fisheries are either estuarine species or those which inhabit the estuaries at some stage of their life cycle.

Common macroinvertebrates include burrowing amphipods, polychaetes, and oysters, which occur both in large numbers and in a variety of species. Swimming (nektonic) invertebrates include crabs, shrimp and squid.

Fishes of the estuarine subtidal ecosystem include species such as star drum, bay anchovy, Atlantic croaker, spot, weakfish, silver perch, white catfish, hake, menhaden, hogchoker, striped mullet, striped bass, and white perch.

The diamondback terrapin is the only resident reptile of estuarine areas, although loggerhead turtles, alligators, and some snakes may also be encountered on occasion. The most common aquatic mammals frequenting estuarine waters include the bottlenosed dolphin and the river otter. Rarely, harbor seal and West Indian manatee are observed in estuarine waters of this State.

Intertidal Flora and Fauna

The estuarine intertidal environment is made up of sand and mud flats interspersed with broad expanses of salt and brackish marshes. Smooth cordgrass (*Spartina alterniflora*) dominates the regularly flooded "low marsh," while vegetation in the high marsh is a mixture of several grasses, forbs, and rushes. (See Figure 2.)

Giant cordgrass, bulrushes and cattails are very common in the brackish marshes, while giant

cutgrass and wild rice are frequently found along the transitional zone from brackish to freshwater marsh.

Estuarine intertidal environments are highly productive. Researchers have pointed out that in salt and brackish marshes, an intricate web of nutrients and energy holds together the ecosystem. Smooth cordgrass (living and decomposing), phytoplankton, and mud algae are all food producers in the estuarine intertidal environment. Herbivores (e.g. the salt marsh grasshoppers) and detritus-feeders (e.g. fiddler crabs) are consumers of these primary producers. In turn, the herbivores and detritus-feeders are themselves consumed by birds and mammals.

Common invertebrates in the intertidal region include grasshoppers and mosquitos, the marsh periwinkle, mud snails, oysters, ribbed mussels, polychaetes and fiddler crabs. Vertebrate life is dominated by the Carolina diamondback terrapin, the green heron, the common egret, the long-billed marsh wren, the great blue heron, the seaside sparrow, the clapper rail, the raccoon, the mink, the rice rat, the marsh rabbit, and the river otter.

Flora and Fauna of Impoundments

Impoundments with salinities that average greater than 0.5 o/oo are generally considered to be estuarine impoundments. Most impoundments are former rice fields in which dikes and water control structures have been maintained. Impoundment managers usually regulate water level and salinity to produce plant growth that will maximize waterfowl utilization, although salinity is regulated for maricultural purposes in some impoundments.

The dominant plants of carefully managed estuarine impoundments are: widgeon grass, salt marsh bulrush, and dwarf spikerush. Other common plants that are desirable for waterfowl management are: sago pondweed, dotted smartweed, muskgrasses, softstem bulrush, and common three square. Impoundment managers use several methods to produce dominance of the desired plant species. Cyclical fluctuations in water level favor dominance by salt marsh bulrush and dwarf spikerush; slow-rising water levels and permanent flooding both favor widgeon grass.

Birds, especially ducks and wading birds, dominate the fauna of estuarine impoundments. Table 4 lists the birds of South Carolina estuarine impoundments, giving the abundance and seasonal occurrence of each species.

Other fauna of estuarine impoundments include lower invertebrates and higher invertebrates such as oysters, the blue crabs, fiddler crabs, various species of shrimp, and mud crabs. Many species of fish are introduced into impoundments through flood gates (59 species of marine and estuarine fish have been identified in estuarine impoundments in South Carolina); however, the few that are year-round residents of impoundments include mummichog, sheepshead minnows, mosquitofish, sailfin molly, and silversides.

In estuarine impoundments with low salinities, the threatened American alligator is found. Raccoons and otters are the most common mammals of estuarine impoundments.

FIGURE 2

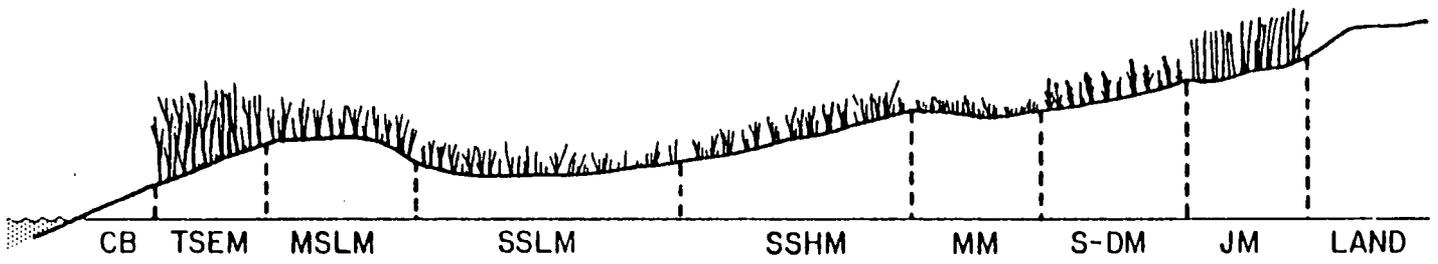


Figure 2. Diagram of salt marsh types. CB=Creek Bank, TSEM=Tall Spartina Edge marsh, MSLM=Medium Spartina Levee marsh, SSLM=Short Spartina low marsh, SSHM=Short Spartina High marsh, MM=Minax marsh, S-DM=Salicornia-Distichlis marsh, JM=Juncus marsh.

Source: S. C. Wildlife & Marine Resources Department

TABLE 4

Birds of Estuarine Impoundments in South Carolina
 DOMINANT MODERATE

Pied-billed Grebe	PR		Horned Grebe	WR	
Great Blue Heron	PR		Green Heron	PR	
Louisiana Heron	PR		Little Blue Heron	PR	
Great Egret	PR		Black-crowned Night Heron	PR	
Snowy Egret	PR		Least Bittern	SR	March - September
White Ibis	PR		Glossy Ibis	PR	
Blue-winged Teal	WR	August - May	Mallard	WR	September - April
Balpate	WR	November - April	Black Duck	WR	September - April
Scaup	WR	October - April	Gadwall	WR	October - April
Buffle-Head	WR	November - April	Pintail	WR	September - April
Hooded Merganser	WR	November - April	Green-winged Teal	WR	October - April
Red-breasted Merganser	WR	October - April	Shoveler	WR	October - March
Clapper Rail	PR		Ring-necked Duck	WR	October - April
American Coot	PR		Ruddy Duck	WR	October - April
Spotted Sandpiper	PR		Virginia Rail	WR	August - March
Willet	PR		Sora	WR	August - April
Greater Yellowlegs	PR		Common Gallinule	PR	
Herring Gull	PR		Semipalmated Plover	PR	
Ring-billed Gull	PR		Lesser Yellowlegs	WR	July - May
Laughing Gull	PR		Least Sandpiper	PR	
Forster's Tern	PR		Dunlin	PR	
Least Tern	SR	March - October	Semipalmated Sandpiper	PR	
Belted Kingfisher	PR		Western Sandpiper	PR	
			Bonaparte's Gull	WR	October - May
			Royal Tern	PR	
			Black Tern	SR	May - October
			Black Skimmer	PR	

KEY: PR - Permanent resident, present year round
 WR - Winter resident
 SR - Summer resident
 T - Transient

3. Environmental Perturbations and the Impact of Man

a. Natural Factors

Living marine resources may be affected by both natural and man-induced disturbances in the environment. Natural impacts include factors such as river discharge, rainfall, temperature and storms, all of which are interrelated to one degree or another.

Unusually high or low temperatures will have an obvious effect life just as they do on terrestrial life. The most recent example of the harmful effects of cold has been the massive shrimp kill occasioned by the unusually cold winter of 1977. High temperatures cause dissolved gasses to be released into the air, making respiration more difficult for aquatic life.

Precipitation may sharply increase river discharge and lead to a decline in estuarine salinities. Likewise, drought conditions can reduce river outflow to the point that salinities increase significantly. An additional problem during droughts is that pollutants present in river outfalls may not be diluted as much as they would normally be, leading to stressful conditions for estuarine organisms. In addition, residence time is increased because there is less water to carry pollutants away.

Storms — particularly hurricanes — also have a serious effect on living marine resources. Storms bring high winds, heavy rainfall, flooding, and unusually high tides, all of which disturb vegetation and bottom-dwelling organisms, and alter the aquatic environment.

b. Man-Induced Perturbations

Natural disturbances may be quite severe in their effects on living marine resources, yet their impact is far less than that of man-induced perturbations. Natural disturbances have been present as long as there has been life in the marine environment. As a consequence, marine life has adapted to the changes in weather and climate, and has gradually altered its mode of existence to keep pace with changes in the natural environment.

The effects of man-induced perturbations are often much more long-lived and devastating. An influx of fresh water after heavy rains and flooding may harm or even kill some estuarine species. The salts of heavy metals, to choose only one class of industrial pollutants, will harm some aquatic species immediately, and will persist in the waters of the estuary for an extended period of time, causing slow, long-term damage as well.

Duration of effect is only one crucial difference between natural and man-induced perturbations. The ability of the ecosystem to absorb and adapt to the change is another. Natural disturbances such as flooding, heavy rainfall or severe storms are simply exaggerated cases of normal events in the marine environment, and organisms have evolved mechanisms to cope with these fluctuations. Artificial perturbations, on the other hand, often introduce a foreign element into the ecosystem. Materials such as oil and mercury are not found in the marine environment except as minute traces, and even then their chemical composition differs from the form commonly utilized by man. The plants and animals of the marine and estuarine environment have had no chance to adapt to the new substance, and consequently may suffer serious harm.

Finally, the rate and intensity of natural perturbation has remained relatively constant over millennia, while the rate and intensity of man-induced perturbations is increasing steadily. As the population increases, demands for space to live, work, and enjoy leisure time increase proportionally. With these demands comes a need to dispose of wastes, obtain ever-increasing amounts of food and other essentials, and provide jobs for the expanding population. All of these functions place heavy demands on the environment, particularly in the coastal region where the attractive environment leads to accelerated development and sharp conflicts of interest.

The cause of man-induced perturbations can be categorized as follows: transportation and shoreline modification, commercial fisheries, agriculture and silviculture, mining, recreation, urbanization and housing, industrialization, water utilization and discharge. Each of these categories will be discussed in turn below, although they are inseparable in many cases.

Transportation and Shoreline Modification

Water transport has played an important part in the development of the coastal zone, since many of our cities were established as a result of commercial activity around a harbor or sheltered bay. As populations grew, more and better facilities were needed to keep up with the increasing demands. Often, meeting the needs of water transportation interests necessitates altering the natural environment in such a way as

to have an adverse effect on the resident marine life. These adverse effects may come from water transport activities themselves, or from shoreline alterations necessary to accommodate them.

The most obvious effect of transportation on marine life is pollution, which may range from gasoline spilled at a marine to a major oil spill of **Argo Merchant** proportions. In between are "environmental insults" and as the release of human wastes from pleasure craft, non-petroleum spills (for example, detergents which may be washed from the deck of a ship into the harbor) and pollution which results from the release of cargo hold washings into the harbor.

Toxic wastes, both organic and inorganic, affect marine life in a number of ways. Plants and animals may be poisoned by foreign substances which impair or prevent respiration. The presence of petroleum may also affect animal life indirectly by blocking sunlight, poisoning or smothering the plankton in the upper layers of the water. Substantial reductions in plankton numbers may jeopardize the marine environment.

The physical presence of marine transportation also has deleterious effects on living marine resources, in that valuable living space is preempted, noise and other disturbances drive animal life away, and excessive wave action may damage plants and erode the banks upon which they live.

Of greatest concern, however, is the shoreline alteration which accompanies marine transportation. Harbors and channels must be artificially deepened and widened in order to accommodate most modern commercial vessels; jetties are often constructed in order to preserve existing channels; and completely new channels are often created.

Jetties are structures of steel, concrete or rock which are built to control the formation of sand bars in navigation channels. They extend outward from shore to a depth equal to the desired channel depth and block the passage of sand to beach areas downstream. As a result, erosion may be severe, causing a loss of plant and animal habitat and concomitant loss in ecosystem productivity. Jetties alter the flow of currents to a certain degree and change beach communities in their vicinity. On the other hand, there are several beneficial effects associated with jetties: they attract sport fish, provide a substrate for various invertebrates and enhance the movement of fish and crustaceans into estuaries.

Another class of shoreline alterations is found in the upland areas, yet has dramatic effects on the coast. These include dams and flow diversion projects. Such projects disrupt the normal flow of fresh water, sediments and nutrients into an estuary and alter the mixing and deposition patterns. Salinity may be sharply increased or decreased, changing the species composition of an estuary significantly. In the case of a dam, release of fresh water may be irregular, causing wildly fluctuating salinities. Dams restrict sediment flow, leading to beach erosion and loss of habitat, while diversion projects may increase sedimentation, necessitating extensive dredging operations in order to maintain navigation channels.

In South Carolina, the most significant alteration of the coastline resulting from an upstream project is the Santee-Cooper diversion, completed by the Public Service Authority in 1942. Before the river was diverted, the annual freshwater inflow to Charleston Harbor was 72 cubic feet/second. There was essentially no salinity gradient from surface to bottom, and mixing throughout the estuary was good. After the project was completed, fresh water inflow increased to 15,000 cubic feet/second, resulting in a significant salinity gradient with a layer of essentially fresh water covering the surface. One source has estimated that sedimentation in the navigation channel has increased from 180,000 to 10,000,000 cubic yards per year, and density currents have developed which trap solid domestic and industrial wastes. (Ketchum, p. 141.)

Species composition in the harbor and estuary has been altered over the years, due to pollution and changes in the salinity regime, from both diversion and impacts of other growth and development. Migration patterns may also be altered by river diversion, since the element which stimulates entry into a river and subsequent spawning will be far less concentrated in the old river channel and highly concentrated in the new.

The subsequent change in vegetation in the Santee River due to increased salinities was a matter of concern to duck hunters, and in some cases financial settlements with landowners were necessary. (Bohlen, in Kjerfve.) These financial losses to the area have been somewhat mitigated by the very successful clam fisheries which have developed in the estuary. A final effect resulting from the Santee-Cooper project is the gradual erosion of the Santee Delta since only 15% of the river's flow now carries sediments into the Delta. (Kjerfve, p. 51.)

The Santee-Cooper Rediversion project is projected to have mixed effects on both the Santee and Cooper River estuaries. The decrease in fresh water inflow to Charleston Harbor will probably significantly slow

shoaling, and is projected to reduce the need to dredge. On the other hand, water quality in both the harbor and the Cooper River may be further lowered, due to less efficient flushing. There is also a possibility of salt water intrusion into the Bushy Park intake canal with increasing river salinities.

The Santee Delta may eventually revert to pre-diversion conditions, with a possible halt in erosion on Cape Romain, gradual succession of *Spartina* marshes by freshwater grasses, and loss of the valuable clam fisheries. This last is considered to be the most adverse effect of rediversion. (Kjerfve, p. 53.) Other potential effects are impacts on adjacent landowners along the Santee Cooper, due to increased water flow and salinity changes, and possible detriment to the world-renowned Santee-Cooper land-locked striped bass, due to loss of their food supply.

Dredging and channelization are often carried out simultaneously, and may have several adverse environmental impacts.

Channelization may lead to reduced levels of oxygen as a result of restricted circulation which occurs when the main part of the channel is significantly deeper than the tributary channels. (Water flowing into the navigation channel from shallower streams tends to remain near the surface and will not mix with the oxygen-depleted bottom waters.) When a channel is straightened, a formerly slow, meandering fresh water flow, entering a bay or estuary, becomes a swiftly flowing stream, increasing erosion and turbidity and leading to extremely high and low salinities. Finally, because salt water is more dense than fresh, it will flow into newly created depressions and will reach further up into an estuary than had previously been the case.

The Atlantic Intracoastal Waterway, completed in 1941, typifies the changes which may accompany channelization. Salt Water intrusion has led to depleted oyster populations since their primary predator, the oyster drill (which is restricted to high salinities), is able to move further into newly saline estuaries and marshes.

The plant population has also been altered, favoring more salt-tolerant species. The problem of erosion along the waterway is exacerbated by wave action from passing boats, causing loss of valuable marshland and a reduction in the total productivity of the estuary. Finally, the channel of the waterway must be periodically dredged in order to maintain navigability.

Dredging is detrimental to marine life because it increases turbidity, thereby interfering with respiration, feeding and photosynthesis (by reducing light penetration). This, in turn, reduces the total productivity of the ecosystem. Dredging also physically disturbs plants and animals by uprooting some plants and sessile animals and by burying others when the dredge spoil is deposited elsewhere.

Spoil deposition is by far the most damaging aspect of a dredging operation. Spoil may be dumped at sea, pumped onto beaches, marshes or other open areas, or used to fill diked upland areas. Because of the importance of marshes as food sources and nurseries, productivity of the coastal zone is impaired. The filling of impounded shallow areas may also destroy important bird and mammal habitats. Bostwick Ketchum reports that "(I)n one area of Florida, dredge and fill operations in estuaries alone are estimated to result in biological productivity losses of \$14 million annually." (Taylor, J.H. and Salomon, C.H., 1968, in Ketchum, p. 135.)

Because dredge spoil is of a finer texture than most sediments in spoil deposition areas, it fills in the tiny air spaces which are found between sand grains. This, in turn, leads to anaerobic (oxygen deficient) conditions that are harmful to marine life.

Dredge spoil from harbors or polluted areas near industrial complexes may contain heavy metals, pesticides or other toxic organic materials, which, when exposed to the leaching effects of weather, may recontaminate the water. Another problem results from the presence of high concentrations of organic wastes, which lead to reduced levels of dissolved oxygen as a result of bacterial action, and may cause suffocation for marine life.

Dredging and spoil disposal may have beneficial effects for living marine resources if the process is managed properly. Buried shell may be exposed by open-water dredging, enabling new oyster reefs to develop, while the creation of artificial islands from dredge spoil may provide additional wildlife habitats. (Ketchum p. 136.) If spoil is selectively disposed of in the open ocean it may in some cases enhance bottom conditions and improve sport and commercial fishing.

Commercial Fisheries

Commercial fishery activities affect living resources directly via capture of target species and coincidental capture of non-target species. Man has already decimated or hunted into extinction populations

of many marine species, including some which were native to South Carolina. In other cases, populations may simply have been depleted due to overfishing. When declining catches indicate overfishing, the usual response is to increase the fishing effort, either by improving the efficiency of gear or by spending more time on the water. Further research into fish population dynamics should lead to a better understanding of declining catches.

Commercial activities may have devastating effects on non-target species, as evidenced by the effect tuna fishing has had on porpoise populations. In South Carolina, the most damaging incidental catch comes from the shrimp trawls, which are relatively non-species-specific. Species captured along with the shrimp are generally discarded. Of the other important target invertebrate species in South Carolina — blue crabs, oysters, and clams — only clams tend to have a degree of environmental degradation associated with their harvesting. Crabs are harvested by pot, and oysters are selectively picked, causing little disturbance to other species. The hydraulic escalator dredges used to harvest subtidal clams in the Santee estuaries disrupt bottom communities; while the direct effect on the biotic communities is believed to be localized, the secondary effects caused by increased turbidity and sedimentation may be more widespread and longer lasting.

There are a number of indirect effects associated with commercial fishing operations. Commercial docking facilities concentrate boats and are point sources of petroleum, solid waste, and domestic waste. The effects of leached chemicals from treated pilings at piers and marinas also contribute to the chronic, low concentrations of dissolved foreign materials in estuarine waters. Fish processing plants discharge waste water high in organics and particulate matter to nearby waters, causing elevated oxygen demands and eutrophication. Thus, waters near processing facilities may experience temporary depletion of dissolved oxygen and subsequent fish kills. There is also a certain amount of pollution which can be directly traced to fishing vessels from such sources as garbage thrown overboard.

Agriculture and Silviculture

Agricultural and forestry practices can significantly decrease the quality of water flowing into coastal areas and cause drastic reactions in marine life. In addition, they may alter the water runoff cycle and, in the case of agriculture, contribute to the loss of coastal wetlands. Department of Agriculture statistics (1975) report that about one-fourth of United States cropland is excessively wet, leading to pressures for land drainage and resultant loss of marsh habitat.

Cultivation and improper forestry practices may also increase sedimentation loads in rivers running into marshes and estuaries. The increased turbidity impairs sight and smell in fish and other marine animals and may interfere with respiration and feeding in bottom dwelling invertebrates.

The sediment which erodes and flows into the estuaries carries with it many excess nutrients from fertilizers and toxins from various herbicides and pesticides. Any chemical substance which kills plants and animals on land will also kill aquatic life. Insecticides, for example, produce massive fish kills and also result in mortality to fish food organisms such as insects and other invertebrates. Pesticides and herbicides can be fatal in concentrations as low as several parts per million, and concentrations of parts per billion are known to cause behavioral and reproductive abnormalities. Pesticide residues may also be concentrated in marine animals and transmitted to higher levels in the food chain. Even the effects of fertilizers are not beneficial, for the excess nutrients encourage algae blooms which block sunlight from other plants and deprive animals of necessary oxygen.

Mining

Currently there are few extractive industries in coastal South Carolina, and those that are in operation (except coquina mining) have little adverse effect on living marine resources. Mining of peat, sand, and gravel are current activities, but these are primarily land-based operations, although peat is mined from wetland areas. Coquina is mined from marsh areas near Little River, and the resulting pits experience restricted water circulation which causes low dissolved oxygen. Drainage from these pits reduces the water quality of receiving waters. The potential exists for mining phosphate and washed oyster shell, but no such operations are underway at the present time. Runoff from phosphate mines could pose problems for water quality (as experienced on Florida's southwest coast), and mining oyster shell for use in chicken feed, pet foods, cement and as a building material may conflict with the oyster industry. Oil and gas operations have yet to be realized off the South

Carolina coast; routine petroleum-related activities, however, probably have greater impact on land rather than marine life.

Recreation

Recreation is one of the only uses of the coastal zone which consumes relatively low amounts of the natural resources upon which it depends. Even though resources are "used," they are generally left unimpaired. It has been said that:

The product of tourism and recreation is the individual experience. As such, it is composed not so much of natural goods as a psychological impact. Therefore, what one experienced today may be replicated day after day by thousands more with virtually no decay in the resource. (Ketchum, p. 93.)

An obvious exception to this rationale is the "consumption" of beach front property by hotels, campgrounds and other recreational facilities. In addition, certain recreational uses, such as power boating, do impair the coastal environment. Noise pollution, harassment of fauna and/or other people, and degradation of water quality as a result of necessary support facilities are all unfortunate side effects of the use of power boats.

The importance of water-oriented recreational activities to coastal communities cannot be overstated. Recreation and tourism often rank at least third in terms of income for even large, diversified, urban economies. In many of the non-industrialized areas of the coastal zone, they may be of even greater importance. However, every effort must be made to mitigate the effects of recreation and tourism on the marine environment, for if the living resources of the coastal zone are impaired, the recreational value of the area will be correspondingly degraded.

Urbanization and Housing

Population pressures on the coastal zone have increased dramatically during the preceding decades, with even greater increases expected in the future. Figures for the entire United States show that while coastal (particularly estuarine) areas have only 15% of the land area, they now have about 33% of the population. Obviously, this creates a need for housing. In addition, land will be needed for commerce, industry, transportation terminals, recreation, and waste disposal facilities.

The U. S. Department of the Interior estimated that as of 1975 the leading cause of loss of estuarine areas was the construction of housing developments. (Ketchum, p. 104.) Marshland may be filled to increase land available for waterfront housing, causing a direct loss of habitat for marsh flora and fauna. In addition, pesticides used to make formerly swampy areas more pleasant for their human inhabitants inflict severe penalties on the original residents. Toxic run-off from driveways and streets contributes to the harmful impact of housing developments on living marine resources; paradoxically, it is the cessation of nutrient-rich run-off from the marshes which may have the most detrimental effect on the estuaries.

In addition to the direct effects brought on by population increases in the coastal zone, there are several secondary effects which will be discussed below. One of these is an increase in the extent and degree of industrial development, brought about in part by the need for goods and in part by the need for jobs near population centers. Another is the fact that waste disposal and water use problems increase at an even faster rate than housing and industrialization.

Industrialization

Industries tend to concentrate in the coastal zone because of readily available water. Although industries vary widely in their effect upon the environment, such problems as oil spills, pollution by toxic chemicals, air pollution and waste disposal are endemic to industrialized areas and affect water and air quality.

Oil, as has been noted elsewhere, is damaging to marine life not only because of its inherent toxicity but because it smothers both flora and fauna and blocks sunlight necessary for plant photosynthesis. Air pollution is primarily damaging to marine plants, although air borne deposits may harm zooplankton as well. Industrial water use and discharge practices may, however, be the most detrimental to marine life.

Water Utilization and Discharge

As noted above, many industries locate in the coastal zone in order to take advantage of abundant water supplies. If water is used as a raw material (in other words, not returned to the ecosystem) the mixture of fresh and salt water in the estuary will be altered, causing a change in the species composition of the area. Of particular pertinence to coastal South Carolina has been the diversion of water from the Santee River to the Cooper River for hydroelectric power generation. This diversion resulted in reduced flow of fresh water into the Santee estuaries, causing salt-water intrusion. In the Cooper River, estuarine conditions were displaced seaward, reducing the area suitable for strictly marine organisms. The magnitude of these changes on the fauna and flora cannot be assessed, however, because no surveys of aquatic biota were conducted prior to diversion. Dead cypress trees standing on the banks of the North and South Santee Rivers are mute testimony to the effects of salt-water intrusion on this fresh-water species.

More common, however, is the return of altered water to the ecosystem. The use of coastal waters for cooling by industry and power-generating plants results in thermal pollution, especially when the power plant is a nuclear-fueled one. Thermal pollution results in lowered species diversity and subsequent loss of ecosystem stability. Temperature increases can also result in substantial alterations in the behavior of affected biota because water temperature may be a cue to organisms to migrate or to reproduce. Elevated water temperatures are known to cause developmental abnormalities in larval fish and to stress adult populations. Also, oxygen solubility decreases with increasing water temperature. In addition to physiological stresses, plankton, larvae, fish, and fish eggs may be killed directly by being drawn against intake screens or by drastic pressure changes once inside the cooling system. The loss of plankton is particularly detrimental since it may imperil the entire food web. The proposed offshore nuclear-fueled power generating plants may have drastic effects on near-shore biota as well.

Effluents from heavy industry result in acute as well as chronic sources of pollution. Such effluents often contain complex metallic and organic compounds which resist biodegradation and are highly toxic. These compounds may be discharged in dilute concentrations, but because of their nature they are assimilated into the food web and undergo biological amplification with each consumer level.

Increasing levels of water pollution in marine waters not only destroy the suitability of the habitat and kill marine life directly, but produce abnormalities. The abnormalities include reduction in weight, external lesions, exophthalmia, neoplasms, fin rot, jellied flesh, behavioral changes, morphological peculiarities, and reduced fertility.

Paper mills have been a primary source of industrial pollution in coastal areas. Effluents of paper mills can drastically alter the pH, dissolved oxygen, and turbidity of receiving waters and thus affect marine life directly and indirectly. Characteristically, pulp mill effluent exerts high demands on dissolved oxygen, and the suspended materials it contains reduce light, thereby inhibiting photosynthetic processes. Suspended materials may also settle out, forming sludge banks which render the bottom substrate unsuitable for benthic organisms. Finally, pulp-mill wastes have direct toxic effects upon the biota; especially damaging is the alkaline effluent which contains hydrogen sulfide, mercaptans, resin acids and soaps. The effluents may reduce surface tension of receiving waters and cause increased foaming although this has been alleviated by the use of settling ponds and aeration prior to discharge.

Nuclear reactors, fuel fabrication plants and reprocessing plants may cause water pollution in the form of radioactive materials released to the environment. There are two sources of radioactive contamination which may become problems in the coastal zone: tritium, which is released to the environment from reactor operation and fuel reprocessing, and plutonium. While tritium does not accumulate in living tissue, to any degree, and is of relatively low toxicity, plutonium is long-lived and extremely dangerous. Other sources of radioactive contamination include collisions of nuclear ships or submarines, collisions involving ships carrying nuclear wastes, and accidental releases from power plants. (Ketchum, p. 171.)

Radioactive materials released into coastal waters may produce four broad types of effects: physical damage or death among marine organisms, increasing rates of genetic mutation, increases in rate of growth and maximum size of organisms, and a reorientation of human uses of estuaries.

Urbanization is another cause of water pollution. In general, discharge of domestic sewage enriches the water's nutrient load not unlike fertilization from agricultural runoff, with one major difference. Whereas agricultural runoff predominates only during rainy periods, domestic discharge is relatively constant

(or increasing) regardless of water conditions. Urbanization of coastal areas results in greater discharge rates, and the estuary and nearshore waters may continue to be the ultimate jump of sewage and sludge discharges in the foreseeable future. These discharges contain not only nutrients which encourage eutrophication but also coliform bacteria and pathogenic viruses. Pathogenic organisms disperse outward from the point of waste discharge and either die or are consumed by filter feeding animals such as oysters and clams. Many productive shellfish beds are closed to harvesting because of domestic pollution which may contain pathogens causing typhoid, dysentery, jaundice or intestinal viruses such as infectious hepatitis. Areas closed to shellfish harvesting exist around Myrtle Beach, Murrells Inlet, Charleston, Beaufort, and Savannah. (See Table 5.)

Urban run-off is also a source of water pollution. Drainage from streets, service stations, and residential areas contains many organic and inorganic compounds toxic to marine life. Fallout from industrial airborne emissions, automobile exhaust, tire particles on highways, and leached materials from solid waste disposal sites are a few of the sources of pollutants found in urban runoff.

4. Commercially Significant Living Marine Resources

The principal commercial contribution of living marine resources to the coastal economy comes from the fishing industry. The major marine fishery resources occurring within South Carolina's coastal zone can be classified into three major types: (1) molluscan shellfish (oysters and clams); (2) crustaceans (shrimp and crabs); and (3) coastal finfish. Table 6 presents data on the commercial landings and values of these resources during the past several years in South Carolina. The following sections summarize the life histories, commercial and recreational significance, and present condition of these major marine fishery resources.

a. Molluscan Shellfish Resources

1) Oysters

Biological Aspects:

The Eastern or American oyster, *Crassostrea virginica*, is found in the marine and estuarine areas of South Carolina. This popular bivalve is found primarily in the intertidal region (i.e., the zone between high and low tides) and usually reaches market size (over three inches in length) in two years.

In late spring, when the water temperature reaches about 70° F., the oyster begins to spawn. Both sperm and eggs are released directly into the water. Usually each oyster functions as a male during its first two spawning seasons; afterwards, it may function as a female and may even alternate sexes. Fertilization is a chance union between sperm and eggs in sea water. A single female may produce a hundred million eggs in spawning, but many millions of these eggs are never fertilized. One or two days after fertilization, each egg enters the larval stage. About two weeks later, the larva develops a pair of transparent shells called valves. At this stage, it is now ready to find a firm surface to which it will attach. If a place for attachment is not found, the larva soon sinks to the bottom and dies. When a suitable place is found, the larva, now called a "spot," ejects a sticky fluid that cements the left shell to the place where it will remain for the rest of its life. Old oyster shells appear to be preferred "cultch" or resting place for the larva.

Finding the correct spot is particularly important because the oyster is a filter feeder, obtaining its food by drawing water through its gills which retain the edible material and pass it into the animal's mouth.

South Carolina oysters have a wide variety of shapes and sizes, but the most common type in South Carolina is the "cluster oyster" which is formed by successive yearly sets on the older intertidal oysters. Historically, steam canneries have preferred these cluster oysters because they can be more economically harvested and processed.

Another type of growth pattern found in South Carolina is the subtidal or deep water oyster which, as the name implies, spends its entire life submerged in water. Due to the subtidal oyster's high meat yield and shape, it is considered highly desirable without processing (e.g. half shell servings). Unfortunately, due to adverse conditions such as predators and an unstable substrate, these oysters comprise only a fraction of South Carolina's oyster resource.

TABLE 5

**SUMMARY OF FISCAL YEAR 1978 AND 1976
SANITARY SURVEY OF SOUTH CAROLINA'S COASTAL WATERS**

Segment Name	Best Use Classification	1978 Sanitary Shellfish Harvest Status	1976 Sanitary Shellfish Harvest Status
Little River Inlet	SA	Restricted (Relaying Only)	Prohibited 1968
Cherry Grove/Log Inlet	SA	Approved	Approved
Singleton Swash	SA	Restricted	Approved
Whitepoint Swash	SA	Restricted	Approved
Withers Swash	SA	Prohibited	Approved
Murrells Inlet	SA	Conditional Approval	Approved
North and South end public shellfish grounds, Parsonage Creek, and all other waters adjacent to mainland		Restricted Restricted Restricted	Approved Prohibited 1971 Approved
Midway Inlet	SA*	Prohibited	Prohibited 1968
North behind Litchfield Beach			
South behind Pawleys Island to Pawleys Inlet		Approved	Approved
North Inlet	SA*	Approved	Approved
Oyster Bay	SA*	Restricted	Restricted 1970
Sampit River	SC	Prohibited	Prohibited 1964
Winyah Bay	SB	Restricted	Restricted 1964
Mudd Bay	SB*	Restricted	Restricted
AIWW (Winyah Bay to South Santee River)	SA	Restricted	Restricted 1968
Santee Bay (North & South) from HWY 17 to 1000 ft. below the AIWW	SB	Restricted	Restricted 1968
Santee Bay (North & South) from 1000 ft. below AIWW to Atlantic Ocean	SA	Approved	Approved
Cape Romain and Bull Bay	SA	Approved	Approved
AIWW	SA	Approved	Approved
Jeremey Creek	SA*	Prohibited	Prohibited 1968
Awendaw Creek	SA*	Conditional	Approved
Tibwin Creek	SA*	Conditional	Approved
AIWW (Andersonville to Goat Island)	SA	Approved	Approved
AIWW (between Goat Is. & Isle of Palms)	SA	Prohibited	Prohibited 1970
Seque Bay	SA*	Approved	Approved
Bull Harbor	SA*	Approved	Approved
Mark Bay	SA*	Approved	Approved
Copahee Sound	SA	Approved	Approved
Bullyard Sound	SA*	Approved	Approved
Hamlin Sound	SA	Approved	Approved
Grays Bay Sound	SA	Approved	Approved
All creeks and marshes of Prices Inlet	SA*	Approved	Approved
Capers Inlet	SA*	Approved	Approved
Dewees Inlet	SA*	Approved	Approved

TABLE 5 (Continued)

Segment Name	Best Use Classification	1978 Sanitary Shellfish Harvest Status	1976 Sanitary Shellfish Harvest Status
All waters of Breach Inlet Estuary including: Hamlin Creek	SA*	Approved	Prohibited 1970
Swinton Creek	SA*	Approved	Conditional
Inlet Creek	SA*	Approved	Conditional
Conch Creek	SA*	Approved	Prohibited
AIWW	SA	Approved	Prohibited
to within 1000 ft. of Sullivans Island causeway and Ben Sawyer Bridge			Conditional to Breach Inlet & prohibited to Ben Sawyer Bridge
AIWW (1000 ft. above Ben Sawyer Bridge through Charleston Harbor)	SC	Prohibited	Prohibited 1970
"The Cove"	SC	Prohibited	Prohibited 1970
Wando River (headwaters to and including Duchman Cr. and Horlbeeck Cr.) (from Duchman Cr. & Horlbeeck Cr. to Cooper River Bridge)		Conditional Approval	Prohibited 1970
		Restricted	Prohibited 1970
Charleston Harbor & Cooper River	SC	Prohibited	Prohibited 1970
Shem Creek	SC	Prohibited	Prohibited 1970
Charleston Harbor & Ashley River	SC	Prohibited	Prohibited 1970
Schooner Cr. & bay between Fort Sumter & Cummings Point on Morris Island	SC*	Prohibited	Prohibited 1970
James Island Creek	SC*	Prohibited	Prohibited 1972
Wappoo/Elliott Cut	SC*	Prohibited	Prohibited 1972
AIWW (Charleston Harbor to SCL Railroad bridge over Stono River)	SC*	Prohibited	Prohibited 1975
Stono River (SCL Railroad bridge to Abbapoola Cr.)	SC	Prohibited	Prohibited 1975
Stono River (SCL Railroad bridge to Wadmalaw River)	SA	Approved	Approved
Stono River (Abbapoola Cr. to Folly River)	SA	Approved	Approved
Lighthouse Inlet Estuary	SA*	Approved	Conditional 1972
Clark Sound	SC	Restricted (1)	Prohibited 1972
(1) Clark Sound to be reappraised after upgrading and/or elimination of Westchester Subdivision's sewage discharge to Clark Sound new Seaside.			
Folly River Estuary	SA	Approved	Approved
Kiawah River and Sams Creek to and including Stono Inlet	SA*	Approved	Approved

TABLE 5 (Continued)

Segment Name	Best Use Classification	1978 Sanitary Shellfish Harvest Status	1976 Sanitary Shellfish Harvest Status
North Edisto River	SA	Approved	Approved
Wadmalaw River	SA	Approved	Approved
Wadmalaw Sound	SA	Approved	Approved
Bohicket Creek	SA	Approved	Approved
Church Creek	SA*	Prohibited	Prohibited 1973
South Edisto River	SA	Approved	Approved
All waters of Edisto Island	SA*	Approved	Approved
Fishing Creek	SA*	Approved (2)	Approved
(2) except from the "Neck to Freedman"		Restricted	Approved
St. Helena Sound	SA	Approved	Approved
Combahee River	SA	Approved	Approved
Ashepoo River	SA	Approved	Approved
Coosaw River	SA	Approved	Approved
Whale Branch	SA	Approved	Approved
Campbell Creek & 1000 ft. each side of junction with Whale Branch	SA*	Restricted	Approved
Huspa Creek (public shellfish grounds)	SA*	Approved	Approved
McCalleys Creek	SA*	Restricted	Approved
Whale Branch	SA	Approved	Approved
Middle Creek	SA*	Prohibited	Approved
Brickyard Creek	SA	Restricted	Approved
Albergottie Creek	SB*	Prohibited	Prohibited 1964
Beaufort River:			
(1) from Albergottie Creek to Ballast Cr. and Chowan Cr.	SB	Restricted	Prohibited 1964
(2) from Ballast Cr. to Chowan Cr. to Port Royal Sound	SB	Approved	Prohibited 1964
Chowan Creek	SA	Approved	Approved
Battery Creek	SB	Prohibited	Prohibited 1968
Archer Creek:			
(1) Port Royal to Parris Island Bridge	SB	Restricted	Prohibited 1970
(2) Parris Island Bridge to Port Royal Sound	SA	Approved	Prohibited 1970
St. Helena Sound		Approved	Approved
Morgan River Estuary	SA	Approved	Approved
Harbor River (St. Helena Sound to Fripp Inlet)	SA	Approved	Approved
Trenchards Inlet Estuary	SA	Approved	Approved
Station Creek	SA*	Approved	Approved
Port Royal Sound	SA	Approved	Approved
Lucy Point Creek	SA*	Approved (1)	Approved
(1) Rock Spring Cr. to its junction with Lucy Point Creek		Restricted	Prohibited 1975
Port Royal Sound	SA	Approved	Approved except for shore & marshes of Parris Island which were closed at USMC request in 1970

TABLE 5 (Continued)

Segment Name	Best Use Classification	1978 Sanitary Shellfish Harvest Status	1976 Sanitary Shellfish Harvest Status
Archers Creek from Parris Island bridge to Port Royal Sound	SA	Approved	Approved except for shore & marshes of Parris Island which were closed at USMC request in 1970
Broad River (1) except for 1000 ft. radius buffer zone at Laurel Bay S/D sewage treatment plant discharge	SA	Approved (1)	Approved
Chechessee River Hazzard Cr./Euhaw Cr. Colleton River including Okatee River and Chechessee Creek	SA*	Approved	Approved
May River	SA	Approved	Approved
Cooper River	SA	Approved	Approved
Bull Creek	SA*	Approved	Approved
Calibogue Sound	SA	Approved	Approved
New River	SB	Prohibited	Prohibited
Wright River	SB	Prohibited	Prohibited
Savannah River	SA	Prohibited	Prohibited
Calibogue Sound	SA	Approved	Approved
Mackay Creek	SA*	Approved	Approved
Skull Creek	SA*	Approved	Approved
Jarvis Creek	SA*	Approved	Approved
Broad Creek/Palmetto Bay	SA	Approved	Approved
Baynard Cove	SA*	Approved	Approved
Lawton Creek	SA*	Restricted	Approved
Note: Harbortown Marina Palmetto Bay Marina Baynard Cove Marina are closed for 1000 ft. radius each side and in front of the marina as a buffer zone.	SA*	Prohibited	Prohibited
Chechessee River	SA*	Approved	Approved

*tributary to listed class.

S.C. Department of Health and Environmental Control, 1978

TABLE 6

Volumes and values (in thousands of pounds and dollars) of seafoods landed in South Carolina during recent years.

	1975		1976		1977		January-July 1978	
	Pounds ^a	Dollars ^b						
Shrimp ^c (Heads-off)	5,647	10,803	5,511	11,043	2,508	5,615	909	2,043
Oysters ^d (Meats)	1,036	617	1,187	759	1,592	1,092	1,011	716
Clams ^e (Meats)	176	203	172	209	199	258	152	266
Crabs (Whole)	6,565	865	5,740	976	7,765	1,778	4,141	808
Finfish (Whole)	3,594	630	5,714	1,079	3,180	1,100	1,695	1,208

- a) Volumes should not be added due to differing units of measure.
- b) Values are those to the fisherman or gatherer.
- c) Rock shrimp are not included in Shrimp.
- d) Oysters are 3.18 pounds of meat per U.S. Bushel.
- e) Clams are 8.75 pounds of meat per U.S. Bushel.

Prepared by: Fisheries Statistics Section, South Carolina Wildlife and Marine Resources, September 26, 1978

Effects of Man-Induced Perturbations:

Obviously man's impacts on the marine environment may have a significant effect on the oyster in any one of a number of ways. For example, thermal pollution may give false cues to the spawning oyster, causing eggs and sperm to be released before the surrounding waters are warm enough to permit survival of larvae.

The larvae are much more susceptible to pollution than the adult oysters, and consequently may be harmed by even slight amounts of toxic effluent. Concentrations of toxins and pathogenic microorganisms in adult oysters may make them hazardous for human consumption, resulting in the closing of oyster beds. (See Table 5.) Of approximately 275,000 acres of coastal estuarine areas classified as shellfish growing waters by the South Carolina Department of Health and Environmental Control, approximately 28% of the acreage is closed ed due to fecal (coliform) pollution.

Pesticides are extremely harmful to marine life of all types. Organochlorine pesticides have been shown to "interfere with almost every level of biological function tested in marine life." (Lencer, in Clark, p. 743.) A significant reduction in oyster growth has been caused by levels of DDT as low as 0.001 ppm.

Oyster production may also be impaired by destruction or alteration of habitat, particularly the drainage of wetlands. Because the spat cannot settle without a suitably firm substrate, any activity which increases siltation or covers up old oyster shells or other clutch material is extremely harmful. Siltation also interferes with oyster feeding behavior, since the gills may become clogged with non-nutrient material. As noted elsewhere, large quantities of silt may also impair respiration.

Since empty oyster shell provides one of the most desirable substrates for oyster spat, the development and maintenance of South Carolina's oyster resources requires cultivation techniques dependent upon shell cultch. Consequently, the propagation of oysters, whether for recreational or commercial use, includes the responsibility of dispersing oyster shell capable of facilitating oyster larvae survival and subsequent growth. Those who lease oyster beds are required by statute to plant shell or seed oysters on the leased property. Public grounds intended for recreational use require similar cultivation techniques in order to remain in good condition.

Commercial and Economic Aspects:

Economically, the oyster is generally considered a very prolific organism in Georgia and South Carolina waters. However, despite the oyster's productivity, this resource is susceptible to over-harvesting. The over-harvesting in the leasing system has usually been associated with the lack of long-term oyster cultivation practices (discussed above) which will sustain commercial yields. The lack of significant cultivation effort has resulted in the cancellation of some leases by the South Carolina Wildlife and Marine Resources Department.

In contrast to some other seafoods, oyster consumption in the U.S. has not been very responsive to rising income levels. In addition, there has recently been a significant shortage of labor coupled with slow recruitment of new labor into the industry. Since 1968, the annual oyster landings have only been between 1 and 1.3 million pounds of shucked meat.

Before World War II, most oysters were harvested for steam canning, but today only one cannery in Beaufort County remains in the industry. This type of canning process uses large quantities of low yield cluster oysters for canning. About 50% of the total oyster landings in South Carolina are processed by this Beaufort cannery.

There are 60 commercial oyster leases in South Carolina (see Appendix F) accounting for over six thousand acres of oyster-growing bottoms. Harvesting techniques on the leases usually involve the use of grabs and other hand tools to dislodge oyster clusters. The picker's small boat is filled with oysters and then towed to the leasee's unloading dock. Conventional "box" or oyster scrapes are used in harvesting subtidal seed oysters from the Wando and Santee Rivers.

Recreational Aspects:

Public harvesting of shellfish (oysters and clams) for personal consumption is an increasingly significant recreational activity in South Carolina. Although the major portion of the State's productive shellfish growing areas is currently under lease to commercial oyster producers, there are a number of areas available for public harvesting. The State of South Carolina may provide up to 50 acres of oyster grounds in each coastal county for public recreational use.

These areas are designated under authorization of State legislation. At present, there are 15 public grounds (See Appendix D) throughout the coastal zone, ranging in size from a fraction of one acre to 10 acres. In addition, there are seven areas of State-owned bottoms which are not specifically designated as public oyster grounds, but which are marked for public utilization. The head of any household may, in person or by servant or employee, gather for private use not more than two bushels of oysters or one-half of one bushel of clams, or both, in any one day for not more than two days in any week from the public recreational oyster reefs or other State-owned bottoms not under lease.

Existing recreational shellfish areas are for the most part intertidal oyster reefs located along shorelines and on flats. In many cases, existing areas designated as public grounds are inadequate insofar as quality, acreage and accessibility are concerned. Since there are no license or permit requirements for gathering oysters or clams for personal use, no direct source of revenue exists for either maintaining public grounds or for obtaining data on the extent of this activity. The recreational harvest is known to be significant and to place heavy demands on the shellfish resource. However, the economic activity associated with recreational shellfishing along with participation rates and the magnitude of recreational harvest have never been defined.

Public recreational oyster and State shellfish grounds are for the most part in poor condition with few quality oysters remaining to be harvested. At present, neither State nor Federal funds are available to maintain these beds through a restocking program. With funding, nonutilizable oysters taken from polluted areas could be planted on public beds where, in a matter of weeks, they would become safe and suitable for harvest by the public. Such a program is desperately needed if South Carolina is going to continue to provide recreational shellfishing opportunities, since these marked public grounds are the only legal areas where individuals may recreationally harvest oysters and clams at this time.

2) Hard Clam (Quahog)

Biological Aspects:

The hard clam or quahog (*Mercenaria mercenaria*) is found in estuarine and shallow marine waters. Like the oyster and other bivalves, it is a filter feeder. In South Carolina, hard clam spawning usually begins in the late spring and continues to the fall. During a single release, millions of gametes are extruded by individual clams with fertilization occurring in the water. The fertilized eggs rapidly develop through several swimming larval stages lasting one to two weeks in all and then settle to the bottom. Once buried under the sediment, it generally takes two years for South Carolina hard clams to reach marketable size.

Effects of Man-Induced Perturbations:

Many of the factors harmful to oysters are also detrimental to clams. Water pollution is the greatest threat since pollutants and pathogens (agents of disease such as hepatitis and typhoid) may be contracted in the animal and subsequently transmitted to its human consumers.

Pesticides have wide-ranging adverse effects, ranging from immediate death to growth abnormalities. Pesticides and heavy metals are also dangerous because they slow larval growth dramatically. Since larvae are far more susceptible to disease and predation than adults, a prolonged larval stage significantly reduces the number of animals reaching reproductive age, with a subsequent loss in harvestable stocks. Thermal pollution is also a threat since it may compound the deleterious effects of other pollutants.

Siltation interferes with clam feeding behavior, just as it does with oyster and other bivalve feeding. Because the hard clams live only a few inches below the bottom sediments, dredge and fill operations which cover large areas of the underwater surface may bury clams so deeply that they are unable to feed. Likewise, dredging in areas populated by clams may kill the animals outright or redistribute them in areas unsuited to their growth.

Economic and Commercial Importance:

Historically, South Carolina fishermen have received lower prices for their hard clams than their counterparts in the Middle Atlantic or New England areas. Before 1974, clam harvesting was generally labor intensive and conducted incidental to oyster picking arrangements with the lessee. During the 1970-73 period, the average clam landings were 62,000 pounds (meat) with an average dockside value of \$29,000. Most of these clams were harvested with simple hand tools and were sold for local consumption as well as shipped to other states.

During 1974, there was a transition to mechanized harvesting with the opening of the Santee Delta clam beds. Since habitat alteration was considered insignificant, several escalator harvesters were issued permits in 1974. The escalator harvester consists of a blade which is pushed along the bottom by the forward motion of the vessel. The combined forward motion of the vessel and water jets near the blade move the clams across the blade and deposit them on a conveyor belt which takes them to the surface. Marketable clams are picked from the conveyor, and undersized clams and extraneous materials go back overboard at the end of the conveyor. (This method of harvesting may be harmful to oysters, crabs, and other marine life since they may become buried.)

With the development of the Santee Delta clam fishery, South Carolina clam landings have exceeded 100,000 pounds since 1973 and have created winter income for McClellanville's commercial shrimpers. During the 1974-75 season, a record 73% of the State clam harvest came from the Santee, generating a \$277,000 per year business. (Kjerfve p. 51.) In addition, the Santee clam fishery has probably improved the marketing situation for other clambers in the State.

Rotation of harvesting areas appears to be of primary importance to the continued success of the clam fisheries in South Carolina. Extensive harvesting of brood stocks may result in significant declines in future clam populations. That rotation is a viable means of stock control is borne out by statistics from the Santee Delta clam fishery. In 1974, about 59% (15,312 bushels) of the marketable clam population in South Santee River was harvested. In 1978, 64% (13,750 bushels) was harvested with less effort — in other words, lower cost. (Unfortunately, if the Santee River is diverted this highly productive resource may be destroyed. More will be said below regarding the proposed diversion.)

b. Crustacean Resources

1) Blue Crab

Biological Aspects:

The blue crab, *Callinectes sapidus*, ranges from Cape Cod to northern South America. In South Carolina, it is a common inhabitant of creeks, rivers, sounds and inshore waters. Juvenile crabs inhabit the shallow, low-salinity estuarine areas and mature in 12 to 14 months in South Carolina.

After reaching sexual maturity, males tend to remain in brackish areas, while females move into deeper and/or more saline waters. In South Carolina the major commercial gear, crab traps, are generally set in waters away from high female concentrations. Consequently, crab trap catches average about 70% mature males.

Mating occurs between early May and October when females return to brackish water areas to molt. Females are inseminated during their post-molt, soft shell period, before the new, larger shell hardens, making mating impossible. After mating, the females return to deeper water.

Two months after mating the fertilized eggs are extruded onto the female's abdomen, forming a "sponge" approximately one third her size. The "sponge" contains 700,000 to 2,000,000 eggs which hatch in about two weeks. The larva, called a zoea, is about one millimeter wide and grows rapidly, molting every three to five days and increasing up to one third its size with each molt. There may be 25 to 27 molts between the first larval state and the adult, with adult size being attained in the nursery grounds of the estuary.

Very little is known about blue crab population dynamics. It is generally felt that the annual fluctuations in blue crab abundance are associated with climatic factors which influence the distribution, growth and general survival of the larvae, rather than with the abundance of spawning adults. Blue crab survival, unlike that of some other crustaceans, does not seem to be severely affected by occasional low winter temperatures. Evidence for this is the fact that the 1977 blue crab catch was significantly higher than in previous years, despite the unusually low water temperatures of the 1976-77 winter. Recent interpretations of the decline in blue crab landings in the late 1960's indicate that there may be cyclical changes in annual blue crab abundance, although other theories suggest that pesticide pollution may have been the cause.

Effects of Man-Induced Perturbations:

As noted above, water pollution of various types may contribute to crab mortality. Death may occur during either adult or larval stages, although the larvae are more susceptible to small amounts of the toxic material than fully developed crabs. Juvenile crabs died when exposed to only one particle of mirex bait (used to con-

trol fire ants). (Lincer in Clark, p. 743.)

Since blue crabs are mobile, they are affected less by some forms of environmental perturbations than the sessile molluscs, such as oysters and clams. Crabs are able to move away from areas of increased turbidity, siltation, or underwater deposition of dredge spoil. However, because they require brackish water for mating, they are sensitive to alterations in the mixture of fresh and salt water brought about by channelization, impoundment or destruction of marshlands. In addition, any reduction in marsh acreage deprives blue crabs (particularly males, which comprise 70% of the crab trap catch) of valuable habitat.

Impoundments, bridge crossings, or other forms of construction may prevent mating if they interfere with female migration back into the estuary from deep water. Mating behavior may also be affected by thermal pollution, since artificially high water temperatures in any location may induce female crabs to begin their spring migration before estuarine waters are warm enough to support the larvae.

Economic and Commercial Importance:

The blue crab catch in South Carolina has generally increased since World War II as the demand for fresh blue crabs and crab meat has increased. Today, the commercial blue crab fishery ranks second only to the shrimp fishery, with nearly 80% of the catches landed in Beaufort and Colleton Counties.

South Carolina's commercial catch constitutes a major supply for the State's three crab processors. These processors annually produce crab meat products with an estimated value of \$4 million and employ nearly 200 residents during the summer months. The dockside value of blue crabs in 1977 was \$1.6 million for 7.3 million pounds of crabs.

Two methods are most commonly employed in commercial crabbing: trapping and trawling. Trapping, the most common technique, accounts for the majority of the catch, with 462 commercial crab trapping licenses sold in the 1977-78 fiscal year. Trap-caught blue crabs which are not sold to the processors are shipped to the Middle Atlantic States for restaurant (i.e. steamed crabs) and other fresh crab consumption. When crabs are shipped, they are sold according to size and/or sex.

In the 1950's, there was a small-scale soft-shell blue crab industry in South Carolina. Interest in developing a soft-shell crab fishery in South Carolina has recently been renewed. It has been estimated that such an industry could annually harvest 40,000 pounds of soft-shell crabs with wholesale prices ranging from \$4.00 to \$14.00 a dozen.

Recreational Aspects:

The extent of participation in recreational crabbing in South Carolina is currently undocumented, but all indications are that the number of individuals involved is substantial, as crabbing is a favorite family recreational activity along the coast. There is no closed season for recreational crabbing in the State, although crabs are caught primarily from April through November. A variety of methods are utilized, including baited drop nets, headline/dip nets and various crab traps. All reports have indicated that recreational crabbing is excellent, and has been over the past several years, with an abundance of blue crabs being available for recreational crabbers.

2) Shrimp

Biological Aspects:

There are two major species of shrimp caught in South Carolina: The white (***Panaeus setiferus***) which make up 70% of the catch and the brown (***Panaeus aztecus aztecus***) which account for 30% of the catch. Pink shrimp (***Panaeus duorarum duorarum***) are also found occasionally in South Carolina, but make up less than 1% of the catch.

White shrimp spawning generally takes place within two miles of the coastline, beginning in late March and continuing through the summer. The female lays 500,000 to 1,000,000 eggs directly into the water. The eggs (1/75 inch in diameter) hatch in 20 to 24 hours, and after 15 to 20 days, the surviving postlarval shrimp (about 1/5 inch long) drift into the brackish estuaries which serve as nursery grounds. From spring to early fall, growth is rapid. For example, a shrimp hatched on May 1 may measure over six inches by November. Growth is insignificant during the winter but resumes in the following spring.

Young white shrimp will move from the shallow estuarine waters into deep creeks, rivers and sounds dur-

ing June or July, when they are about two inches long. At this time, the young white shrimp are sought by cast netters and recreational seiners. In July and August they begin to migrate to inshore waters and are caught by commercial trawlers fishing for brown shrimp. In the fall, their commercially desirable size and concentration in the South Carolina sounds and bays usually result in the opening of these areas to commercial trawling. During October and November, a portion of the white shrimp population migrates parallel to the shoreline toward Georgia and Florida. Surviving white shrimp which have migrated will return during the early spring of the following year. Recent evidence also indicates that a portion of the white shrimp population overwinters in deep water coastal areas. This overwintering is important to commercial harvesting success in the following year.

Unlike white shrimp, brown shrimp do not overwinter in South Carolina. They spawn much further offshore than white shrimp, and much earlier in the year. Brown shrimp postlarvae usually begin drifting into the estuaries during February or March. Consequently, the young brown shrimp become available to recreational and commercial fishermen sooner than the white shrimp. Brown shrimp migrate from South Carolina waters during the fall and winter months.

Annual abundance of shrimp is dependent primarily upon various ecological factors and not significantly upon the previous year's population. Commercial shrimping has not been demonstrated to have had a significant effect upon the penaeid shrimp populations, although it might if an appreciable portion of the nursery grounds were destroyed.

White shrimp are often considered the most sensitive to temperature of the three species caught commercially in the South Atlantic states. There seems to be a positive correlation between the winter's severity and the spring and fall white shrimp catches. Low water temperatures (near 47°F) over an extended period of time can cause severe white shrimp mortality. The extended periods of low water temperature during the winters preceding the shrimp seasons of 1940, 1958, 1961, 1963, 1964, 1966, 1970 and, most recently, 1977, contributed to the relatively low abundance of white shrimp populations and the resulting poor commercial catches.

Effects of Man-Induced Perturbations:

Many factors other than climate contribute to shrimp mortality. Most important of these is the destruction of marsh and estuarine habitats which serve as nurseries for developing shrimp. Changes in salinity, turbidity and chemical composition of the water may all affect larval development. Water pollution of various types may have deleterious effects on shrimp, particularly during the juvenile stages when they are found closest to shore. Toxic materials such as heavy metals and pesticides may produce effects ranging from mortality to feeding abnormalities. Thermal pollution may cause larval growth to proceed faster than that of the necessary food organisms. If severe, it may also kill shrimp and shrimp larvae outright. Discharges of domestic sewage and fertilizer runoff from agricultural lands may produce algal blooms which deprive the shrimp of necessary oxygen and may kill the developing larvae. More importantly, oxygen depletion may discourage spawning or drive animals away from an area.

Shrimp, like blue crabs, are able to swim away from areas of high turbidity or dredge spoil deposition. However, the turbidity may destroy food sources by blocking light needed for plant photosynthesis. Adult shrimp also swim away from areas of lowered salinity. Thus shrimp production may be impaired by channelization or marsh destruction which allows a great deal of fresh water to enter an estuary.

Shrimp are also harmed by pesticides and other toxins released to the environment. Crustaceans are very susceptible to harm from insecticides since they are biologically closer to insects than are other marine invertebrates. A dose as low as one part per billion of a common insecticide, mirex, caused 100% shrimp mortality. (Lincer, in Clark, p. 743.)

Economic and Commercial Activities:

With the growth of world shrimp consumption after World War II, the commercial shrimpers have annually accounted for the highest total dockside value of all South Carolina commercial fisheries. In 1976 the South Carolina shrimp catch represented 51% of all fishery landings (8.7 million pounds) and over 78% of total dockside value (\$110 million). The South Carolina shrimp catch represented 12% of the weight and 32% of the value of total South Atlantic states' landings that year. Commercial shrimping and associated services are

also a source of significant employment in South Carolina's coastal counties.

White shrimp comprise about 68% to 80% of the normal South Carolina catch, with most being landed during the fall months. Large one year old white shrimp which overwinter are caught during May and June, and in recent years have made significant contributions to the shrimper's income. Unfortunately, winter conditions in 1976 and 1977 reduced overwintering white shrimp stocks to extremely low levels, resulting in unusually poor white shrimp catches in the spring of 1977 and 1978.

The remainder of the South Carolina shrimp harvest is mostly brown shrimp which are caught during the summer months. Shrimp are caught primarily by a double-rig trawler. Since the 1973 shrimp season, channel nets, which are basically stationary shrimp otter trawl nets, have been permitted in estuarine waters, but their catches only constitute a small percent of the commercial shrimp landings.

The number of licensed shrimp trawlers has increased dramatically since 1970. During the 1971-1975 period the annual average number of shrimp trawlers licensed was 939, compared to an average of only 428 licenses in the 1960-70 period. Concurrent with this trend has been an increase in vessel horsepower, electronic equipment and net size.

Recreational Use:

A 1974 survey of recreational shrimping indicated that 16,780 South Carolina residents participated in this fishery on a total of 115,117 days and harvested approximately 815,000 pounds of shrimp (heads-on) that year. This recreational shrimp harvest was equal to 10% of that harvested commercially during the same period.

Practically all of the tidal creeks throughout the coastal area provide excellent shrimping with cast nets, seines or baited drop nets. Shrimping is carried on from bridges, small boats and from the shore.

Unfortunately, because of the severe reductions in the South Carolina shrimp population in recent years, recreational shrimping has declined. Few catches have been reported during the past few years, although in the past several months recreational shrimpers have reported taking large numbers of small shrimp in the upper reaches of small creeks near Beaufort and Charleston.

c. Finfish

Finfish Resources:

More than 400 species of finfish inhabit the marine and estuarine waters of South Carolina. Many of these fish enter directly into the commercial and recreational fisheries while others serve primarily as forage (food) and are indirectly important to these fisheries. The South Carolina coastline contains many productive bays and estuaries. These shallow estuarine waters and the productive marshlands which border them are of primary importance for fishery resources. Several species, such as striped bass, grey and spotted sea trout and black sea bass spend at least a portion of their lives within these waters. However, many commercially and recreationally important species such as red drum (channel bass), Atlantic croaker, striped mullet, flounder, and American eel spawn offshore, and the larvae and juveniles are transported into shallow estuarine waters which serve as nursery grounds where these young fish feed and grow.

A 1968 survey of recreational fishing found that spotted sea trout, channel bass, spot, flounder, king whiting, Spanish mackerel, black sea bass, Atlantic croaker, bluefish, and drum were the preferred gamefish most often taken in South Carolina. These 10 fish along with menhaden, American eel, mullet, pigfish, grey sea trout, American shad and sturgeon were reported as part of the commercial landings in South Carolina during 1976 and 1977.

Biological Aspects:

The life histories of these fish generally fall within three categories — those which spawn offshore and utilize the coastal and estuarine waters as nursery and feeding grounds, those which migrate from offshore and nearshore waters into fresh water to spawn, and those which spend their entire life cycle predominantly within estuarine waters.

Of those species which spawn offshore, the American eel makes the longest migration, traveling to the Sargasso Sea area of the Atlantic Ocean off Bermuda to spawn. Spawning takes place in winter, and the larvae, called leptocephali, migrate to the coastal areas of North America during the following spring, traveling

up the estuaries and into fresh water. Here they remain to feed and grow. At maturity, they migrate back out of the estuaries during the fall and return to the Sargasso Sea.

Southern and summer flounder are the most common flounder species occurring in South Carolina. They spawn near the edge of the continental shelf during the winter months and during the following spring, migrate back to the coastal area to feed. Larval and juvenile flounder also move and are transported by water currents to the coastal estuarine waters which serve as a nursery ground for these small fish. White and striped mullet undergo a similar spawning migration each year, moving 5 and 20 miles offshore during spring and fall, respectively. The larvae and juveniles are pelagic and are abundant in the open waters of South Carolina's bays and estuaries throughout the summer. Adults move back into the marshes and mud flats and are more abundant in the shallow waters of the estuary. Juveniles and adults show a southward migration in fall and a northward migration in spring.

Bluefish, spots, northern and southern kingfish, Atlantic croakers and red drum also show a similar life history pattern. Each of these fish spawn offshore during the late fall and early winter months. The larvae and juveniles swim or are transported into the productive coastal estuarine waters the following spring, where they feed and grow. Following spawning, the adults overwinter in the deeper offshore waters and then also move back into the nearshore and estuarine waters to feed during the remainder of the year.

Spotted and grey trout spawn in the lower portion of estuaries or in shallow oceanic waters during the spring. The larvae and juvenile trout are transported to estuarine areas, and the adults move back into the estuary to feed the remainder of the year.

Several fish species undergo a reverse type of spawning migration with the adults moving from near and offshore waters into freshwater streams to spawn. These are called anadromous species, and include sturgeon, striped bass, American shad and blueback herring. Several of these species, such as sturgeon and American shad, undergo long oceanic migrations and spend several years at sea before returning to their natal (birth) streams to spawn.

Striped bass are thought to show different migratory habits in different parts of their range. Adult striped bass north of Cape Hatteras, North Carolina, are known to undergo long oceanic migration, traveling a thousand or more miles along the Northern Atlantic coast. Adult striped bass south of Cape Hatteras are believed to remain within a particular river system, spawning in the upper fresh water reaches and overwintering in the lower estuaries near the river mouths.

Environmental Perturbations:

It is obvious from the life histories summarized above that marshes and estuaries are of vital importance to the finfish of the State. Not only do the highly productive salt marshes provide detrital food for fish living in the estuaries and coastal waters, but they also provide food and shelter for larvae and juvenile fish. Therefore, any destruction of marsh habitat will produce a corresponding reduction in the population of fish which survive to maturity.

In addition to outright destruction of habitat, alterations in the marsh or upland areas bordering an estuary may have deleterious effects on fish populations. Channelization and construction of impoundments may alter marsh and estuarine salinities, leading to juvenile fish mortality. In addition, natural migration patterns may be disrupted by the presence of obstruction. The introduction of pollutants may also kill or retard development of young fish. Excessive nutrients from agricultural run-off or domestic sewage may produce algal blooms which deprive the young fish of necessary oxygen. Finally, thermal pollution may speed up development so that the fish fry are ready to migrate before coastal waters are warm enough to support them. Fish metabolism may also be altered, and the addition of excess heat may compound the effects of other pollutants. Finally, thermal pollution may provide miscues to adult fish ready to spawn.

Additional spawning miscues may be sent by altered salinities or chemical compositions in rivers. If pollution, heat, or new salinity gradients have made the natal river (the river in which the fish was hatched) unrecognizable to migrating fish such as sturgeon and striped bass, spawning may not occur. Physical barriers, such as bridge crossings and dams, may also prevent or interfere with spawning.

Predation by man may have a greater impact on fish than on other living marine resources. The 1976 Fishery Conservation and Management Act was designed to prevent overfishing and to ensure the continua-

tion of current fisheries under sound management.

Commercial and Economic Aspects:

The finfish fisheries in South Carolina are less significant than the shellfish fisheries. With the exception of mullet and spot, most marketed marine finfishes caught in South Carolina waters are captured incidental to shrimp trawling. This incidental catch includes croaker, flounder, king whiting, sea trout, shark and Spanish mackerel. Large quantities of spot and mullet are harvested by the beach haul seine fishery in Horry County. Other species like the red drum and sea trout are generally harvested by seasonal small-scale gill net operations in estuarine waters. These fisheries, compared to those in other Atlantic seaboard states, have generally been limited by marketing problems (e.g. undesirable product forms, seasonal availability, price differentials).

In contrast, harvesting of the anadromous species, shad and Atlantic sturgeon, have not been limited by serious marketing problems. Shad harvesting, whether by drift gill nets or fixed gill nets, has been regulated by localized statutes and represents a traditional fishery of South Carolina's coastal rivers. Demand for sturgeon roe (caviar) and smoked fish has perpetuated this gill net fishery. Both of these fisheries provide seasonal, supplementary income to residents of rural coastal areas.

Recent investigations of marine species (e.g. croaker, spot, flounder and king whiting) taken incidental to shrimp trawling activities show that these species are not being depleted. Similar studies in the Gulf of Mexico, where there has been a five-fold increase in fishing effort during the last 20 years, have indicated no decrease in these species groups.

Presently available data are not sufficient for assessment of the commercial anadromous fisheries for the Atlantic sturgeon and shad. Reported declines in catches for individual fishermen may be a function of increasing total fishing effort (more fishermen and gear) to annual fluctuations in the returning stocks.

Although information is insufficient to accurately assess the present status of eel stocks exploited in South Carolina, it is generally felt that the gradual expansion of the present fishery for elvers and subadults (yellow eels) would be commercially beneficial. Unfortunately, the environment in coastal rivers tends to exclude or inhibit the future development of such a fishery.

Recreational Aspects:

While current and complete information is not available on participation and the economic significance of all segments of the marine recreational finfish fishery, some data are available which provide an insight into the magnitude of saltwater sport fishing in South Carolina's coastal zone. During 1968, an estimated 174,000 South Carolina residents participated substantially in saltwater fishing. Of this number, 41,600 residents participated in the surf and bank fishery and 121,000 participated in the small boat fishery. If children under the age of 12 and occasional fishermen were included in this 1968 survey, the number of total participants would approach 250,000. A study conducted on South Carolina's fishing piers estimated that a total of 25,000 residents fished a total of 228,000 days from 13 piers during 1974, harvesting some 210,000 pounds of fish.

These estimates only take into consideration South Carolina residents. If one were to also count the number of non-residents who participate in this fishery, these figures would increase significantly. For example, a 1968 North Carolina survey indicated that 36,000 North Carolina residents fished in the marine recreational fishery in South Carolina during 1973-74. These figures indicate that the number of non-residents participating in the finfish segment of South Carolina's fishery is significant.

While data on the total recreational harvest of finfish for South Carolina are not currently available, there are data available which give some insight into the magnitude of this harvest for the South Atlantic region (Cape Hatteras to South Florida). This information, along with a comparison of the commercial harvest for the same area, is presented in Table 7.

The figures indicate that the recreational harvest represents a significant portion of the total finfish resource. (See Table 7.)

The economic impact of the marine recreational fisheries to South Carolina is considerable. The latest available (1970) published information on annual expenditures by saltwater anglers on the Atlantic coast gives a figure of \$127 per angler. If this figure is adjusted for inflation, the current estimate would be \$191 per angler. As mentioned previously, during 1968 there were an estimated 174,000 substantial resident anglers in

TABLE 7

The recreational and commercial harvests (in thousands of pounds) of selected species of saltwater fish for the South Atlantic region (Cape Hatteras to south Florida) during 1970.

Species	Recreational Catch (thousand pounds)	Domestic Commercial Catch (thousand pounds)
Sea trouts	25,063	3,872
Black drum	12,123	144
Whiting	14,533	2,095
Channel Bass	13,358	157
Spot	9,840	3,304
Croaker	5,947	866
Flounder	8,938	3,397
Pompano	153	248
Cobia	775	21
Bluefish	19,271	2,551
Spadefish	51	2
Spanish mackerel	14,623	3,639
King mackerel	34,942	4,351
Dolphin	27,806	21
Sharks	669	10
Snappers	26,580	1,090
Porgies	24,059	799
Grunts	25,962	51
Groupers	24,121	754
Sea Bass	12,381	2,024
	301,195	29,416
Grand Total (includes all finfish species harvested, not just sportfish cited above).	403,913	

Sources: Devel, D. G. (1973) **1970 Saltwater Angling Survey**,
National Marine Fishery Service, Current Fisheries Statistics, #6,000,2000, 54 pages.

U.S. Department of Commerce, (1973) **Fishery Statistics of the U.S., 1970**,
National Marine Fishery Service Statistical Digest, #64, 489 pages.

South Carolina. Published information for the South Atlantic region indicates an annual growth rate of four percent in the number of marine recreational anglers. Based on these data, the current estimated number of substantial resident anglers would be 248,000. If this figure is applied to the adjusted annual expenditure per angler, an estimated impact of \$47 million is generated. This figure does not take into account non-resident anglers (whose numbers, from all indications at least equal that of resident anglers) or other segments of the recreational fishery (shrimping, crabbing and shellfishing).

There is at present no on-going creel census or sportfishing survey which could be utilized in determining present conditions or evaluating the abundance of South Carolina's gamefish. Most fish populations naturally undergo long-term fluctuations in abundance with dominant year classes occurring somewhat regularly every so many years. At present, South Carolina sport fishermen indicate that there has been a general decline in in-shore fishing, particularly in the numbers of winter trout during the past two years. This may be a result of natural fluctuations in these populations or may be associated with the last two severe winters, which greatly reduced the shrimp population along South Carolina's coast, since shrimp serve as a major food item for many of these fish. Flounder fishing, however, has been reported as very good during the past two years.

5. Summary

The marine, maritime and estuarine ecosystems of the South Carolina coastal zone are extremely significant in terms of biological, economic and social values, especially those associated with living marine resources. The wetlands and subtidal areas of these ecosystems cover approximately 1,200,000 acres of the coastal zone, extending from the Little River southward to the Savannah River and from the upper limits of saltwater penetration in coastal rivers seaward to the three mile territorial limit in the Atlantic Ocean. Major habitats included within these ecosystems are: open ocean waters and bottoms (500,000 acres); beaches (10,700 acres); coastal marshes (430,000 acres); coastal impoundments (70,000 acres); and open estuarine waters and bottoms (242,000 acres).

These coastal waters and bottoms shelter many important species of fishes, invertebrates and other living marine resources, and support valuable commercial and recreational fisheries, research activities, and the interests of nature enthusiasts. Living marsh and dune vegetation not only accommodates fauna of the coastal marine-estuarine ecosystem, but serves man's interests as well. The marsh assimilates and purifies wastes from human activities, while both marsh and dune vegetation provide aesthetic beauty and protection from erosion and storm damage.

Biologically, the coastal marine-estuarine system is among the most productive areas known to man, both in terms of species diversity and biomass. This unique environment supports complex assemblages of plant animal life, including both resident and migratory forms.

The biological richness of the coastal marine-estuarine ecosystem is due in large part to the high concentrations of nutrients from upland sources. Marsh plants, algae and phytoplankton convert these nutrients into biomass which can then be consumed and utilized by higher levels of the food chain. Productivity is further increased by the decomposition of plant and animal matter into detritus and eventually into basic nutrients which repeat the cycle. Many of the organic materials and other nutrients from the near-shore environment are exported by currents to oceanic waters, and many species of fishes and invertebrates nurtured in estuarine areas migrate long distances, thereby increasing the biological productivity of areas outside of the coastal marine-estuarine ecosystem.

Coastal marshes, dominated in South Carolina by vast expanses of saltmarsh cordgrass, play an important role themselves in providing habitat and cover for many estuarine fishes and invertebrates such as shrimp and blue crabs. In addition, coastal marshes are significant habitat type for numerous species of birds and mammals, including clapper rail, wading birds, raccoons, mink and otters. Diked marshlands, many of which are vegetated by brackish-water plant species, provide some of the most important habitats for waterfowl in the United States and may be important for other species of birds, mammals, reptiles and amphibians as well.

In addition to the great ecological significance of the living marine resources of the coastal zone, there are a number of functions performed by these resources which are of specific utility to man. These functions are primarily recreational, commercial, and physical. (Examples of the last category include erosion control provided by dune vegetation and waste assimilation provided by the marshes).

The major recreational values provided by the living marine resources of South Carolina are those

associated with saltwater sport fishing, including angling, shellfishing, shrimping and crabbing. It has recently been estimated that over 250,000 State residents currently participate in recreational fishing activities in the coastal zone, resulting in annual expenditures directly related to their sport of over \$50,000,000. The total economic impact of saltwater sport fishing in the State is estimated to be over \$100,000,000 annually, including indirect benefits related to retail sales and tourism.

Other recreational uses related to living marine resources of the coastal zone are nature photography, shell collecting, bird watching and the like. In addition, there is the enjoyment to be derived from aesthetically pleasing surroundings, which include, of course, the beauty of dune and marsh vegetation as well as the fauna present in the marine environment. While not directly quantifiable, it is clear that such benefits are important, particularly as they pertain to tourism.

Commercial considerations are primarily tourist and fishery related, with the latter being of greater direct importance. Major commercial fisheries in South Carolina's coastal area are created around penaeid shrimp, molluscan shellfish (hard clam, eastern oyster), blue crab, and finfish (shad, spot, mullet and others). The annual dockside value of coastal commercial seafood landings ranges from \$10,000,000 to \$15,000,000. The total economic impact of commercial fishing in South Carolina is estimated to be approximately \$30,000,000, taking into consideration the wholesale and retail seafood trade, seafood processing and other aspects.

The total economic impact of commercial and recreational fisheries in the coastal region of South Carolina is therefore conservatively estimated to be \$130,000 annually. This includes values for commercial seafood landings and processed products, and estimated expenditures by recreational fishermen. As mentioned previously, many indirect economic benefits of the State's commercial and recreational fisheries are not known with certainty, since no comprehensive survey of the overall economic impact of these fisheries has been conducted.

There are other benefits provided by living marine resources for which there is no generally accepted economic equivalent. As noted above, these include such functions as erosion control and waste assimilation. In addition, there are social and aesthetic values associated with the living resources of the coastal region which are difficult or impossible to quantify. Such values include those related to natural beauty and a clean, healthy environment. The significance of the visual appearance of an undisturbed marsh, a dune vegetated by sea oats, bottlenose dolphins playfully surfacing near shore, a shorebird nesting colony, and the like, although unquestionably of considerable value to many coastal residents and tourists, cannot be expressed in economic or related terms. However, the trend in recent years toward increased protection of nongame, noncommercial species in living marine resources, especially more visible ones such as marsh and dune vegetation, sea turtles, marine mammals and eastern brown pelicans is an indication of the high value society places upon these resources.

In conclusion, two facts are apparent: South Carolina is blessed with living marine resources of exceptional diversity and abundance, and man's activities can severely threaten the continued existence of these resources. Evaluation of the impacts of man's activities should, therefore, take into account the immediate and long-term effects of his activities on **all** life in the coastal zone.

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NOTE:

The South Carolina Wildlife and Marine Resources Department Bibliography has been placed in the Appendix, Volume II, of the Management Program. The Appendix is not being reprinted at the time of the FEIS printing but will be included at the next printing of Volume II. The Bibliography remains unchanged from the printing of the DEIS, Volume I, pages IV-112 through IV-144.