



**Sapelo Island
National Estuarine Research
Reserve Management Plan
2008-2013**

*Island National Estuarine Research
Reserve*

**Management Plan
2008-2013**



Sapelo Island National Estuarine Research
Reserve Estuarine Research Reserve
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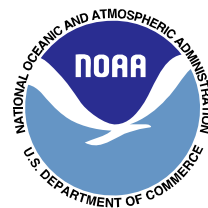


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Acronyms and Abbreviations

BMP	Best Management Practice
CDMO	Central Data Management Office
CFR	Code of Federal Regulations
CICEET	Cooperative Institute for Coastal and Estuarine Environmental Technology
CMP	Comprehensive Management Plan (Sapelo Island)
CRD	Coastal Resources Division (of Georgia DNR)
CTP	Coastal Training Program
CZMA	Coastal Zone Management Act (of 1972, and subsequently amended)
CZMP	Coastal Zone Management Program
DNR	Department of Natural Resources
EPA	Environmental Protection Agency
EPD	Environmental Protection Division (of Georgia DNR)
ERD	Estuarine Reserves Division
FOS	Friends of Sapelo
GCE	Georgia Coastal Ecosystems
GCEC	Georgia Coastal Education Group
GIS	Geographic Information System
GOES	Geostationary Satellite Server
GRF	Graduate Research Fellow
GRNMS	Grays Reef National Marine Sanctuary
IOOS	Integrated Oceanographic Observing Systems
LTER	Long Term Ecological Research
MAREX	Marine Extension Service (of University of Georgia)
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NADP	National Atmospheric Deposition Program
NERR	National Estuarine Research Reserve
NERRS	National Estuarine Research Reserve System
NMFS	National Marine Fisheries Service
NMS	National Marine Sanctuary
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPS	Non-Point Source Pollution
OCGA	Official Code of Georgia Annotated
OCRM	Ocean and Coastal Resource Management, Office of
PAGIS	Protected Area Geographic Information System
PRHS	Parks, Recreation and Historic Sites Division (of Georgia DNR)
RMP	Revised Management Plan
SINERR	Sapelo Island National Estuarine Research Reserve
SWMP	System-Wide Monitoring Program
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
UGA	University of Georgia
UGAMI	University of Georgia Marine Institute
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WMA	Wildlife Management Area
WRD	Wildlife Resources Division (of Georgia DNR)

Foreword

"As children of the past and parents of the future, we should pause to consider our heritage and what our legacies may be," a coastal Georgia historian wrote in 1881. Those words, articulated so many years ago, are equally appropriate today, and to them we might also add: Where do we go from here? Part of the answer, as we look introspectively, lies in the document before you.

On December 22, 1976, the U.S. Department of Commerce, under authority of the Coastal Zone Management Act of 1972, designated the Sapelo Island National Estuarine Sanctuary, now Research Reserve, as the second such site within a new National Estuarine Sanctuary System. As a federal-state partnership program, the Reserve is administered by the National Oceanic and Atmospheric Administration (NOAA) and managed by the Georgia Department of Natural Resources, Wildlife Resources Division. Located on the western perimeter of Sapelo, the Reserve is dedicated to research, education, stewardship, and the efficient management of coastal resources in Georgia. The national system (NERRS) includes 27 reserves in 22 coastal states and territories representing areas that are unique in their specific ecology, geology and biology. Sapelo NERR is an integral part of that System.

This Management Plan comprehensively describes the resources, management, and programs of the SINERR. It includes general and specific policies about the SINERR's resources and utilization of those resources that guide management of the Reserve. The plan also tells the public what the SINERR is and how Georgia DNR will manage it.

The Plan has undergone review by the Reserve's Advisory Committee, the Georgia DNR, and NOAA's Estuarine Reserves Division. In addition, and consistent with federal regulations, there has been a period of public review of the document. The final version of the Plan incorporates changes made as a result of comments received from individuals and organizations during the review period. Further public comment on this plan and the management and operations of the SINERR is welcome at any time.

It is most fitting and appropriate that much of the revision of the Management Plan was conducted amid the Reserve's 30th anniversary observance in 2006 and 2007. A great deal was achieved programmatically in the Reserve's first 30 years. Those achievements will be reviewed and documented in the following pages. In properly reflecting the vision, creative energy and outlook of the SINERR staff and its supporters, it may confidently be asserted that much more will be achieved in the next 30 years. That vision, and the means by which it will be promulgated, stands as the foundation of this document and hopefully it will serve as a useful and purposeful benchmark to both present and future stewards of the remarkable resource that is Sapelo Island and its National Estuarine Research Reserve.

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Executive Summary

The nation's estuaries are extremely valuable. Human activities such as industrial and commercial development, dredging and filling have damaged many estuaries in modern times. The United States Congress became concerned for these areas during the 1960s period of increased environmental awareness and the growing realization of the need for greater protection of America's natural resources. In 1972, Congress enacted the Coastal Zone Management Act, which, in part, offered federal aid to states to set up and manage natural field laboratories for research and education.

Georgia's Duplin River estuary lies in McIntosh County. Throughout its history, it has received protection by public and private landowners. It and nearby lands have been the focus of archaeological and ecological research since the early 1950s. In 1975, Georgia proposed the Duplin River estuary as a National Estuarine Sanctuary (later National Estuarine Research Reserve). The U.S. Department of Commerce studied and approved the Georgia proposal. The state completed land acquisition and, on December 22, 1976, the site was designated as the Sapelo Island National Estuarine Sanctuary, the second such designated Sanctuary in the new national System.

There are now a total of 27 reserves (Figure 1) in the National Estuarine Research Reserve System (NERRS). They comprise a multiplicity of diverse ecological estuarine zones. The National Oceanic and Atmospheric Administration (NOAA) administers this system for the Department of Commerce. As part of the national program, Sapelo Island represents the Carolinian biogeographic region and is the focus for NERR support of estuarine scientific research and education in Georgia.

The Duplin River estuary includes unspoiled coastal salt marsh and tidal creeks. Such areas are among the earth's most biologically productive systems. They began forming at their present location several thousand years ago. The ability of these marshes to produce food has attracted man since that time. More recently, other people have come for recreation and scientific research.

It is the intention of the Sapelo Island National Estuarine Research Reserve (SINERR) to (1) protect and monitor natural and cultural resources through effective application of academic disciplines and resource stewardship; (2) provide opportunities for scientists to investigate how such estuarine systems function; and (3) provide opportunities for public education and outreach through programs and workshops consistent with the overall mission of the Reserve. About 6,000 visitors a year now enjoy organized educational activities on Sapelo directly organized by the SINERR. The Georgia Department of Natural Resources (DNR), the University of Georgia and NOAA all provide effective conduits to public audiences for estuarine education programs and outreach. The SINERR is an excellent location to present these programs and, because of its remoteness and relative inaccessibility, Sapelo Island provides an ideal platform for the promulgation of educational on-site activities, as well as scientific studies and field investigations.

A total of 16,500 acres make up Sapelo Island, of which 10,900 acres are upland and about 5,600 acres are tidal salt marsh. The island is accessible only by a state-operated passenger ferry vessel, which makes three scheduled runs each day between the island and the mainland seven miles away.

The SINERR occupies just over one-third of Sapelo (Figure 8). Its 6,110 acres contain the Duplin River and its estuary, and several upland tracts. The Reserve comprises 2,110

acres of upland maritime forest and hammock land and 4,000 acres of tidal salt marsh. NOAA provided a grant of \$1.5 million to the State of Georgia in 1976 to assist in the acquisition of the original upland acreage of the SINERR. A smaller tract (39 upland acres and 166 acres of salt marsh) was added to the Reserve in 1993 (lighthouse island), also with NOAA grant assistance.

SINERR Management Goals/Coastal Zone Management Issues

Consistent with federal (NOAA) regulations, 15 C.F.R. 921.13(a), management goals for the SINERR, with issues related to the Reserve and coastal zone management, are summarized below and will be further elucidated in Chapter 3 of this document. Amplifying detail and specific objectives and strategies for implementation will be outlined in eight programmatic chapters following Chapter 3. These goals, and the salient issues to be addressed, include:

Goal 1—To provide of effective administration of the Reserve as necessary to fulfill the Reserve’s mission as established in state and federal law, administrative rules and interagency agreements.

Issues—Acquisition of the budgeting resources for the promulgation of the SINERR’s mission and programmatic objectives on a consistent basis is critical, as is seeking and achieving full state funding support for core staff positions on the Reserve, including the Research Coordinator.

Goal 2—To provide of the publicly-accessible facilities necessary to fulfill the Reserve’s mission as established in state and federal law, administrative rules and interagency agreements and to pursue the maintenance of existing infrastructure and the development of new permanent infrastructure as necessary during the 2008-2013 period.

Issues—Improvement and maintenance of existing Reserve facilities and infrastructure, including the new researcher dormitory in partnership with the University of Georgia on Sapelo Island, and the SINERR’s mainland Visitors interpretative center. SINERR conducts an extensive suite of water quality and weather monitoring initiatives and will acquire more suitable laboratory facilities for the implementation of the programs.

Goal 3—To provide effective management of public access on lands and waters within the Reserve to properly assess and mitigate critical needs and island stresses that impact the Reserve.

Issues—Afford educational and recreational opportunities to a degree and in a manner consistent with preserving the integrity of the Reserve as a platform for scientific investigation and monitoring. A critical management issue confronting the Reserve relates to public access and visitor impact on Reserve uplands and marsh areas, as well as adjoining, state-managed sections of Sapelo Island. Increasing public visibility of the island as a visitation destination has multiplied many-fold the pressures on the Reserve, potentially negatively affecting the

integrity of the SINERR's scientific research, monitoring, resource stewardship and educational missions.

Goal 4—To enhance and develop of research and monitoring to promote, foster and expand the scientific knowledge and field investigations of estuarine processes as related to the Reserve and the South Atlantic Bight, for the promotion of current research partnerships and the expansion of additional long-term partnerships.

Issues—With the rapid growth and development of coastal Georgia, the SINERR's scientific data acquisition and their interpretation have been, and will continue to be, significant and necessary in the assessment of population impacts on the coast.

Goal 5—To maintain and continue to restore the integrity of the natural dynamic processes of the SINERR's estuarine ecosystem, which is representative of the Carolinian biogeographic region.

Issues—The State of Georgia conducts, manages and administers an array of activities and initiatives both within and outside the boundaries of the Reserve. The impact of these activities must be carefully and thoroughly evaluated and assessed for the proper mitigation of impacts upon both the uplands and wetlands of the SINERR. Some of these activities include recreational hunting and camping by the public, commercial timber logging under state contract, forest resource management, ferry and barge operations at state docking facilities within Reserve boundaries and increasing impacts related to vehicular access within the Reserve by all the island's populations, including Georgia DNR, UGA Marine Institute and Hog Hammock civilian community. Consistent with these issues are those related issues noted in Goal 3, above.

Goal 6—To increase, through education, outreach and interpretive programs, the awareness, understanding and appreciation of estuarine systems and estuarine stewardship by facilitating access to information about estuarine systems.

Issues—Education and outreach initiatives and programs for public and school populations through enhanced use of existing Reserve facilities will ideally be effectuated with no increase in the numbers of visitors transported to Sapelo Island by SINERR or DNR. To do so would be detrimental and generally erosive of the natural well being of Sapelo Island, particularly in regard to maintaining the integrity of ongoing scientific research initiatives and field investigations. This issue has a direct correlation to issues identified in Goals 3 and 5 above.

Goal 7—To provide a Coastal Training Program to reach target audiences for the provision of reliable sources of science-based information related to coastal issues that can be beneficial to area decision makers.

Issues—With increased development and population growth projected on the Georgia coast over the next twenty years, it has become increasingly important to foster, promote and sustain responsible use and stewardship of coastal natural and cultural resources. Coastal Training programs implemented by the Reserve and its network of partnering agencies can be extremely effective in this regard.

Goal 8—To create of new opportunities for members of the public through effective volunteer programs, to contribute to, and benefit from, Sapelo Island NERR through direct participation in Reserve operations and educational initiatives.

Management Components of Sapelo Island Extraneous to SINERR

DNR's Wildlife Resources Division, Game Management Section, of which the SINERR is a component, has administrative offices within the SINERR for oversight of the Richard J. Reynolds Wildlife Management Area and its related programs and activities. In addition, the University of Georgia, School of Marine Sciences, has a laboratory and research center within the SINERR, the UGA Marine Institute.

DNR also operates several visitor-use facilities on the island, including the historic R.J. Reynolds Mansion (South End House) and the Cabretta Island campground facility. The mansion is within the Reserve on a tract adjacent to the UGA Marine Institute campus, while the Cabretta public campground is not within the Reserve. DNR's Wildlife Resources Division manages the wildlife and forest resources and enforces conservation laws on Sapelo Island. It also operates the island passenger ferry, which is the primary means of public access to Sapelo Island and the SINERR. In addition, the Reserve operates the Sapelo Island Visitors Center at the mainland ferry dock, from which the Reserve-conducted public tours of the island originate and interpretive exhibits and programs are provided six days per week.

Management Plan Review and Public Comment

This Management Plan was reviewed and approved by the National Oceanic and Atmospheric Administration's Estuarine Reserves Division in October 2007. Additional review of the Plan was facilitated by members of the SINERR Advisory Committee, the Wildlife Resources Division of Georgia DNR, and various Reserve partners in research and education. Following approval by NOAA and finalization of appended material, the requisite period of public review and comment for the Management Plan was conducted from May 15 to July 5, 2008. A Notice of Public Review was placed in the congressional Federal Register as well as local news outlets.

INTRODUCTION

The present Management Plan for the Sapelo Island National Estuarine Research Reserve (SINERR) supersedes the management plan prepared by the Reserve in 1999, which, in turn, was a revision of the original management plan completed in 1990, which established Sapelo Island NERR's basic management structure and described initial operational and facility development plans. Since the 1999 management plan revision, the Reserve has achieved, or otherwise resolved, a number of the objectives of that plan, which are outlined in Appendix A to this document.

* * *

Georgia's Duplin River estuary covers 4,000 acres of tidal salt marsh between Sapelo Island and the mainland in McIntosh County. In January 1975, Georgia proposed to set up a National Estuarine Sanctuary, using this estuary, as well as several tracts of adjacent uplands (Figure 8). To succeed, the state needed to acquire some privately owned lands. The Secretary of Commerce, with the help of the Georgia Department of Natural Resources, prepared an environmental impact statement, which described the proposal and several alternatives.

After reviewing the alternatives and the public comments on them, the Department of Commerce approved the state's proposal. In June 1975, the State received funds from the Department's National Estuarine Sanctuary Program to help purchase property and manage the Reserve. Georgia matched these funds with state funds and other federal monies. By December 1976, Georgia had acquired 5,905 acres on Sapelo Island, including water, salt marsh and upland (Figure 13), which the Department of Commerce then designated as the Sapelo Island National Estuarine Sanctuary, the second such Sanctuary to be so established in the United States. The Department designated authority to the National Oceanic and Atmospheric Administration (NOAA) to administer the program. Since its designation, NOAA and DNR have worked together to provide the resources needed to operate and manage the site. Since 1976, NOAA has provided federal funding to the State of Georgia for operations, continuous scientific monitoring, educational and outreach activities and land acquisition for the Sapelo Island NERR.

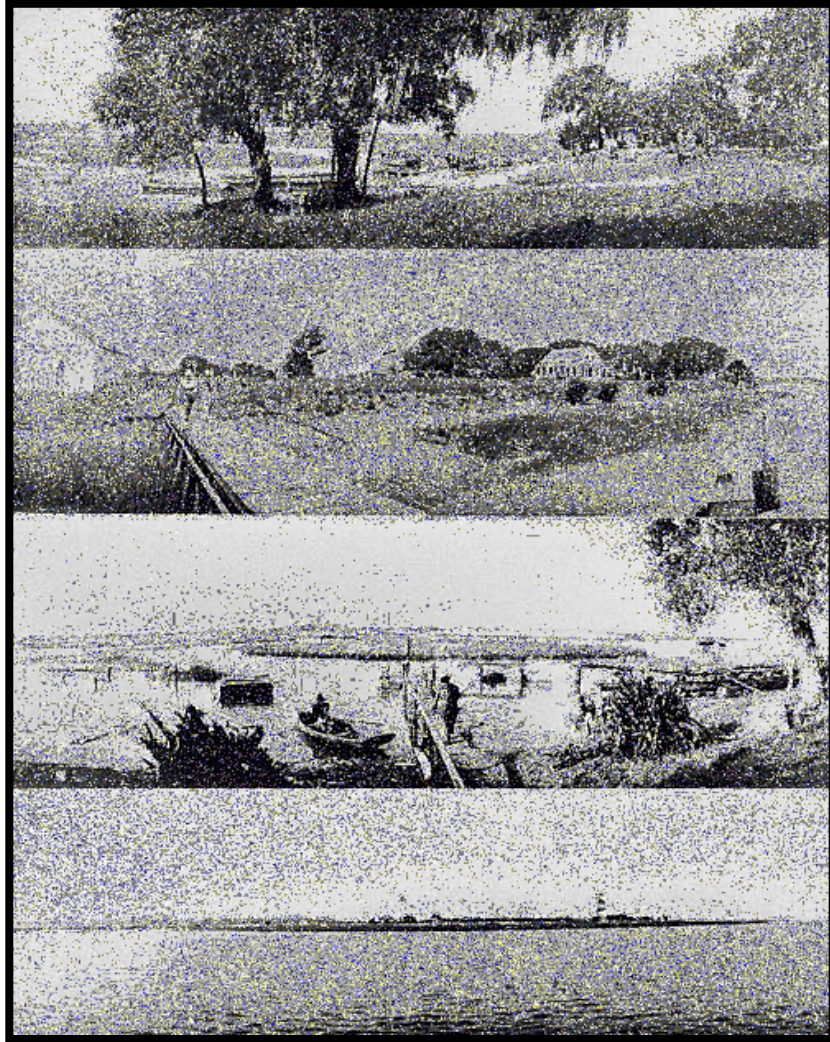
In the thirty-one years of its existence, the Sapelo Island National Estuarine Research Reserve has progressed toward achievement of a number of its goals with respect to administration, resource stewardship, research, education and interpretation, public involvement and facilities development. Under this Management Plan, the Reserve will build strong ties and partnerships with larger educational, governmental and scientific communities. Inter-Reserve operations (activities in support of resource stewardship, education, research and public involvement) will also be more closely integrated. Connections emphasized in this Plan include:

- (a) Resource protection of the Reserve as a part of shared watershed management;
- (b) Habitats under Reserve management as microcosms of the bioregion;
- (c) Reserve research as a tool for coastal policy making;
- (d) Reserve education programs as components of the state school system;
- (e) Reserve interpretive offerings coordinated with other agencies;
- (f) All aspects of Reserve operations as opportunities for public participation, and;
- (g) Reserve staff and facilities as components of the local community.

This Management Plan is organized into two primary components. The first section (Chapters 1 and 2) describes the national NERRS program and places the Sapelo Island NERR within the national context. It also outlines in detail the physical and cultural setting of the Reserve by describing its ecology and human history, as well as the Reserve's land use activities as they factor within the context of the state's management of Sapelo Island. The second part of the Plan (Chapters 3 through 12) identifies the Reserve's mission, goals and objectives, and describes specific strategies and methodologies for achieving these goals within each component of the SINERR's operations over the next five years.

The SINERR Management Plan was prepared completely in-house by Reserve staff and is in accordance with all relevant state, federal and local regulations. It is also consistent with the objectives of the Georgia Coastal Zone Management Program and with state, federal and local land use plans, policies and controls for the area under consideration.

1. The National Estuarine Research Reserve System.
2. Overview of the Sapelo Island NERR.



Scenes from yesteryear on lands and waters that became the Reserve.

(Top to bottom, images all circa 1924):

Sapelo South End (present Marine Institute site).

Dock and caretakers house on Little Sapelo Island.

Marsh-hen hunting on a spring tide.

Lighthouse complex on the South End, viewed from Dobby Sound.

Part One
BACKGROUND:
National and Ecological Setting

This section of the Sapelo Island National Estuarine Research Reserve Management Plan reviews the national framework and the physical/cultural setting within which the Reserve functions.

***1. The National Estuarine Research Reserve System:
The Need for a National Program.***

What's so valuable about estuaries?

Definition of *estuary*.

An estuary is an area in which upland drainage mingles with the waters of an ocean, bay or other large body of salt water. In their natural condition, estuaries are extremely productive biological systems. Along the southeastern coast of the United States, fresh water from rivers and streams enters salty ocean water. The brackish areas, where fresh and salt water mix, support plant species that tolerate salt. The plants vary, depending on such factors as salinity, tidal range, solar radiation, soils and annual temperature changes.

The specific plant and animal habitats that may be supported by an estuarine system are determined by conditions in the estuarine watershed and in the adjacent marine realm. The rate at which fresh water enters the estuary, the amount and type of waterborne and bottom sediments, the degree of tidal flushing, water depth (and hence temperature and degree of sunlight), all combine to produce habitat and food at interwoven micro- and macro-scopic scales. Different combinations of these factors can produce several estuarine habitats within a single estuary. A significant physical change in any of these factors can trigger dramatic changes in the estuarine biologic community, greatly enlarging or reducing the size of various species populations.

Estuarine productivity.

In a healthy estuarine system, the interaction of tides, unplugged fresh water and sediments concentrates nutrients more densely than in any other natural system on the planet. Sheltered shallow waters and soft mud or sand flats, regularly flooded by the tides, provide ideal conditions for abundant life.

Among the most important, but least understood, estuarine species are microscopic plants called "phytoplankton." Like other green plants, phytoplankton make the energy of sunlight available to animals as food. Though rarely noticed by the casual observer, phytoplankton are a critical element in the complex estuarine food web. Phytoplankton are consumed by microscopic and minute animals called "zooplankton." These tiny animals include the larvae of fish, crabs, clams and other species and are themselves part of the food supply for adults of their own or other species.

Marsh plants and eelgrass growing in shallow estuarine waters are critically important to estuarine animal life. Salt marsh vegetation, such as that which is abundant in the Sapelo Island estuary, not only provides cover for many animals, but also, as it dies back each season, creates detritus that feeds and houses the minute species on which larger species depend. The blades of marsh grass are homes for algae, snails and other food for larger animals. Juveniles of many commercially valuable species reach adulthood by hiding among estuarine vegetation.

In an undisturbed estuary, the wealth of food can support huge populations of immature and adult fish, crabs, shrimp and other species. Those animals provide essential food for populations of birds and mammals, including people. Some species spend their entire life cycles in estuaries. For other species, including waterfowl and several kinds of salmon, reproduction and growth depend entirely on the availability of an estuarine system. Many commercially valuable species need the shelter of an estuary for only some seasons of the year, or for a part of their life-cycles, typically egg-laying and juvenile stages.

Estuarine areas have great, but often unrecognized, economic value. A University of Georgia Marine Institute publication lists several important functions of Georgia's coastal marshlands:

- (a) Marsh provides a home for oysters, clams and other organisms that spend all of their lives in the estuary. Young shrimp, crabs and some fish use the estuary as a nursery ground.
- (b) Marsh protects the shorelines from erosion. It also cleans coastal waters by filtering out many pollutants.
- (c) The death and decay of marsh grasses provide food for plants and animals that live in the estuaries and just offshore.

Much of the nation's population lives within one hundred miles of the coast. In many places, people have filled estuaries to provide upland for development. Dredging has occurred in other estuaries to improve navigation and waterborne commerce. Water pollution has damaged yet others.

Need for coastal zone management.

The characteristically flat land of estuaries, and their sheltered access to the sea, and profusion of fish and other seafood, offers almost ideal conditions for human habitation, agricultural production and transportation. Estuaries on the East Coast of the United States supported native peoples and, more recently, settlers from other parts of the globe, for thousands of years.

By the 1970s, it had become apparent that estuaries were not isolated and valueless, but integrally related to ecological and human well-being. Destruction of estuaries was disastrously affecting water quality, commercial and recreational fisheries, and overall ecosystem health. Estuary-dependent plant and animal populations began to dwindle with lost habitat, food sources and reproductive sites. Affected species included not only salmon, crab and clams, but also birds such as eagles and falcons which feed on the tidflats. Increasing awareness of the value of estuaries triggered recent and current efforts to preserve, conserve and restore these fragile systems. Among the most significant of these efforts was passage of the Federal Coastal Zone Management Act in 1972.

Creation of the National Estuarine Research Reserve System.

The Coastal Zone Management Act.

By 1972, the United States Congress recognized the importance of estuarine areas and the growing pressure to alter them by developers and other commercial interests. To protect remaining estuaries, Congress enacted (and later amended) the Coastal Zone Management Act (CZMA) of 1972, 16 U.S.C. 1451 et seq. In the CZMA and in subsequent reauthorizations, Congress officially recognizes that the resources of the coastal zone are of national significance and are rapidly disappearing. The CZMA also recognizes the interrelationships between uplands and tidelands. The "coastal zone" was defined in the Act as including all uplands "to the extent necessary to control shorelands." An excerpt of the CZMA findings states:

"Competing demands upon the lands and waters of our coastal zone...have resulted in the loss of living marine resources, wildlife, nutrient-rich areas, permanent and adverse changes to ecological systems, decreasing open space for public use and shoreline erosion. The habitat areas of the coastal zone, and the fish, shellfish, other living marine resources, and wildlife therein, are ecologically fragile and consequently extremely vulnerable to destruction by man's alteration..."

In recognition of these growing problems, the CZMA established a national goal: To preserve, protect, develop and, where possible, to restore and enhance the resources of the nation's coastal zone for this and succeeding generations.

The CZMA also recognized that coastal waters are significantly affected by land uses. Land uses in the coastal zone, and the uses of adjacent lands that drain into the coastal zone may significantly affect the quality of coastal waters

and habitats, and efforts to control water pollution from land use activities must be improved.

Under the CZMA, coastal states can receive grant funds to develop and administer plans for coastal management. The CZMA also authorizes the provision of federal technical and financial assistance to support states' coastal zone management planning and plan implementation. A state's NOAA-approved CZM plan gives that state some control over federal actions affecting the state's coastal zone. Known as "Federal Consistency," this control includes actions proposed by any federal agency, or which requires federal approval or permits. In 1997, the Georgia General Assembly approved, and the Governor signed, legislation for Georgia's inclusion in the national CZM program. Georgia thus became the last seaboard state to become a part of CZM. Georgia's application completed a successful review by NOAA, and induction of the state into the CZM Program was formalized in January, 1998.

National Estuarine Research Reserve System.

The National Estuarine Research Reserve System was created by the Coastal Zone Management Act (CZMA) of 1972, as amended, 16 U.S.C. 1451 et seq. to augment the federal Coastal Zone Management (CZM) Program. The CZM Program is dedicated to comprehensive, sustainable management of the nation's coasts. The reserve system is a network of protected areas established to promote informed management of the nation's estuaries and coastal habitats. The reserve system, in 2007, consists of 27 reserves in 22 states and territories (Figure 1), protecting over one million acres of estuarine lands and waters.

Mission—As stated in the NERRS regulations, 15 C.F.R. 921.1(a), the National Estuarine Research Reserve mission is:

The establishment and management, through Federal-state cooperation, of a national system of Estuarine Research Reserves representative of the various regions and estuarine types in the United States. Estuarine Research Reserves are established to provide opportunities for long-term research, education and interpretation.

Goals—Federal regulations, 15 C.F.R. 921.1(b), provide five specific goals for the reserve system:

1. Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources;
2. Address coastal management issues identified as significant through coordinated estuarine research within the System;
3. Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for education and interpretation;

4. Promote Federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research; and
5. Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

National Estuarine Research Reserve System Strategic Goals 2005-2010.

The NERR System began a strategic planning process in 1994 in an effort to help NOAA achieve its environmental stewardship mission to “sustain healthy coasts.” In conjunction with the strategic planning process, Estuarine Reserves Division and reserve staffs have conducted a multi-year action planning process on an annual basis since 1996. The resulting three-year action plan provides an overall vision and direction for the reserve system. As part of this process, the reserve system developed a vision:

Healthy estuaries and watersheds where coastal communities and ecosystems thrive; and mission: To practice and promote coastal and estuarine stewardship through innovative research and education, using a system of protected areas. The following goals are outlined in the 2005-2010 Strategic Plan.

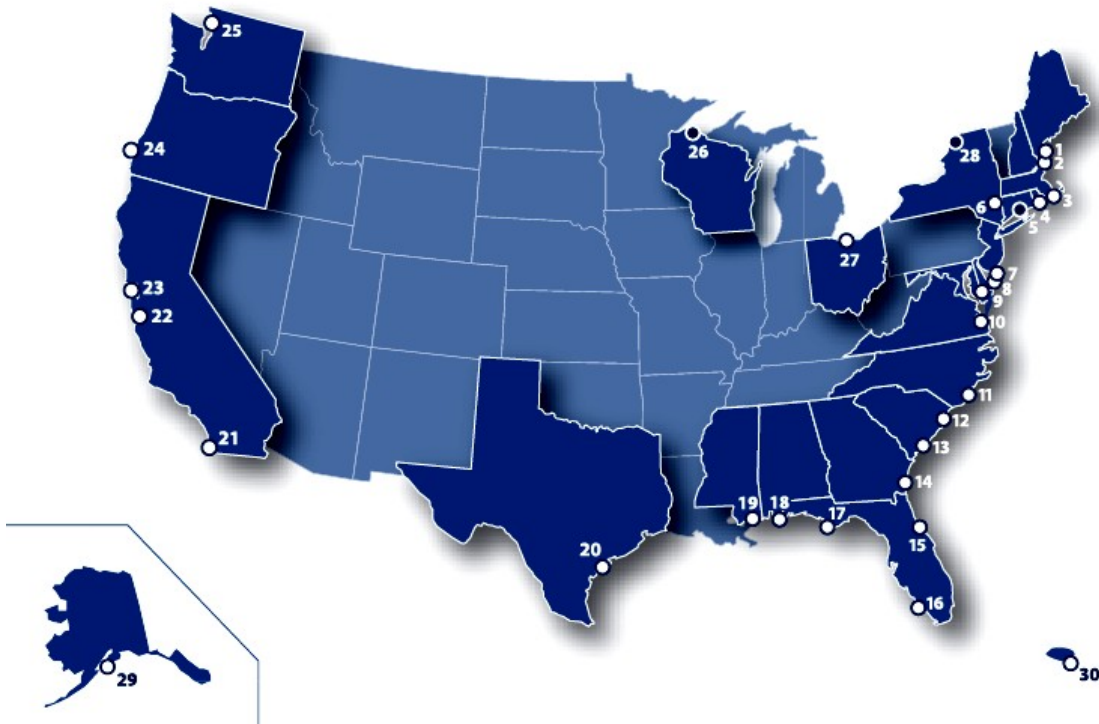
Goals:

1. Strengthen the protection and management of representative estuarine ecosystems to advance estuarine conservation, research and education.
2. Increase the use of reserve science and sites to address priority coastal management issues.
3. Enhance people’s ability and willingness to make informed decisions and take responsible actions that affect coastal communities and ecosystems.

Biogeographic regions.

NOAA has identified eleven distinct biogeographic regions and 29 subregions along the coastlines of the United States, each of which contains several types of estuarine ecosystems (see 15 C.F.R. 921, App. II, for NERR typology system, Appendix C to this document). When complete, the NERR System will contain examples of estuarine hydrologic and biological types characteristic of each bioregion with each Reserve responsible for conducting research and providing educational and interpretive services to its bioregion. As of 2008, the NERR System (Figure 1) includes twenty-seven designated reserves and three proposed reserves in various processes of designation. The reserves are listed below with their date of designation.

Figure 1. Reserve System Locations & Designation Dates.



- 1.** Wells, Maine (1984). **2.** Great Bay, New Hampshire (1989).
- 3.** Waquoit Bay, Massachusetts (1988). **4.** Narragansett Bay, Rhode Island (1980). **5.** Connecticut*.
- 6.** Hudson River, New York (1982). **7.** Jacques Cousteau, New Jersey (1998). **8.** Delaware (1993).
- 9.** Chesapeake Bay, Maryland (1985, 1990).
- 10.** Chesapeake Bay, Virginia (1991). **11.** North Carolina (1985, 1991).
- 12.** North Inlet-Winyah Bay, South Carolina (1992). **13.** ACE Basin, South Carolina (1992). **14.** Sapelo Island, Georgia (1976). **15.** Guana Tolomato Matanzas, Florida (1999). **16.** Rookery Bay, Florida (1978). **17.** Apalachicola, Florida (1979). **18.** Weeks Bay, Alabama (1986). **19.** Grand Bay, Mississippi (1999). **20.** Mission-Aransas, Texas (2007). **21.** Tijuana River, California (1982). **22.** Elkhorn Slough, California (1979). **23.** San Francisco Bay, California (2003).
- 24.** South Slough, Oregon (1974). **25.** Padilla Bay, Washington (1980). **26.** Wisconsin*.
- 27.** Old Woman Creek, Ohio (1980). **28.** St. Lawrence River, New York*.
- 29.** Kachemak Bay, Alaska (1999). **30.** Jobos Bay, Puerto Rico (1981).

***Proposed Reserve**

Under federal law 16 U.S.C. 1451 et seq. a state may nominate an estuarine ecosystem for Research Reserve status so long as the site meets the following conditions:

1. The area is representative of its biogeographic region, is suitable for long-term research and contributes to the biogeographical and typological balance of the System;
2. The law of the coastal state provides long-term protection for the proposed Reserve's resources to ensure a stable environment for research;
3. Designation of the site as a Reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation; and
4. The coastal state has complied with the requirements of any regulations issued by the Secretary of Commerce.

Reserve boundaries must include an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation.

If the proposed site is accepted into the NERR System, it is eligible for NOAA financial assistance on a cost-share basis with the state. The state exercises administrative and management control consistent with its obligations to NOAA. After designation, a Reserve may apply to ERD for funds to support operations, research, monitoring, facility construction and education and interpretation, development projects and land acquisition.

Reserve management planning.

Every Reserve is required to have a NOAA-approved management plan. The plan must describe the Reserve's goals, objectives and management issues, and must identify the Reserve's intended strategies or actions for research, education/interpretation, public access, construction, acquisition and resource preservation, restoration and manipulation. Staff roles in each of these areas must also be addressed. A new Reserve's initial plan, and any major proposed changes to the plan, is made available for public comment on national and local levels before receiving NOAA's final approval.

Management plans are important for providing a framework for the direction and progress in which a Reserve's programs are heading, enabling one to gauge how successfully a Reserve's goals have been met and to determine necessary changes in direction, and providing guidance for the Section 312 evaluations of the Reserve.

Reflecting these purposes, management plans are required by NERRS regulations to be updated every five years. This management plan has been

developed according to NOAA regulations, using resource material, public information and other data, including that from public involvement. It is consistent with the Congressional intent of Section 315 of the Coastal Zone Management Act of 1972, as amended, and the provisions of the proposed Georgia Coastal Management Program.

Reserve oversight.

Under the CZMA, a NOAA team periodically evaluates a Reserve's management and operations. The Reserve's education, research and land management must be in compliance with NERR objectives and with the Reserve's Management Plan. The NOAA team may identify areas needing improvement or increased emphasis, or may make suggestions regarding any aspect of Reserve management.

Reserve system national programs.

The three major elements of the Reserve System are:

- (a) Research on estuarine habitats and processes,
- (b) Education and interpretation of estuarine processes and
- (c) Resource stewardship.

Reserve system research and monitoring program.

The Reserve System provides a mechanism for addressing scientific and technical aspects of coastal management problems through a comprehensive, interdisciplinary, and coordinated approach. Research and monitoring programs, including the development of baseline information, form the basis of this approach. Reserve research and monitoring activities are guided by national plans that identify goals, priorities, and implementation strategies for these programs. This approach, when used in combination with the education and outreach programs, will help ensure the availability of scientific information that has long-term, systemwide, consistency and utility for managers and members of the public to use in protecting or improving natural processes in their estuaries.

Research at the Sapelo Island National Estuarine Research Reserve is designed to fulfill the Reserve System goals as defined in program regulations. These include:

- Address coastal management issues identified as significant through coordinated estuarine research within the System;
- Promote federal, state, public and private use of one or more reserves within the System when such entities conduct estuarine research; and
- Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

Reserve system research funding priorities.

Federal regulations 15 C.F.R. 921.50(a) specify the purposes for which research funds are to be used:

- Support management-related research that will enhance scientific understanding of the Reserve ecosystem;
- Provide information needed by reserve managers and coastal ecosystem policy makers, and;
- Improve public awareness and understanding of estuarine ecosystems and estuarine management issues.

The Reserve System has identified the following five priority research areas to complement the funding priorities outlined above:

1. Habitat and ecosystem processes
2. Anthropogenic influences on estuaries
3. Habitat conservation and restoration
4. Species management
5. Social science and economics

Reserve system research goals.

The Reserve System research goals are embedded in Goal 2 of the Reserve System Strategic Plan 2005-2010, 'Increase the use of reserve science and sites to address priority coastal management issues,' and are outlined in the 2006-2011 Reserve System Research and Monitoring Plan. They include:

- Biological, chemical, physical, and ecological conditions of reserves are characterized and monitored to describe reference conditions and to quantify change.
- Scientists conduct research at reserves that is relevant to coastal management needs and increases basic understanding of estuarine processes.
- Scientists have access to NERRS datasets, science products and results.
- The scientific, coastal management and education communities, as well as the general public, use data, products tools, and techniques generated at the NERRS.

There are two reserve system efforts to fund research on the previously described areas. The Graduate Research Fellow (GRF) Program supports students to produce high quality research in the reserves. The fellowship provides graduate students with funding for one to three years to conduct their research, as well as an opportunity to assist with the research and monitoring program in a reserve. Projects must address coastal management issues identified as having regional

or national significance, relate them to the Reserve System research focus areas, and be conducted at least partially within one or more designated reserve sites.

Students work with the research coordinator or manager at the host reserve to develop a plan to participate in the reserve's research and/or monitoring program. Students are asked to provide up to 15 hours per week of research and/or monitoring assistance to the reserve. This training may take place throughout the school year or may be concentrated during a specific season.

Secondly, research is funded through the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET), a partnership between NOAA and the University of New Hampshire (UNH). CICEET uses the capabilities of UNH, the private sector, academic and public research institutions throughout the U.S., as well as the 27 reserves in the reserve system, to develop and apply new environmental techniques.

System-Wide Monitoring Program (SWMP).

It is the policy of the Sapelo Island National Estuarine Research Reserve to implement each phase of the System-wide Monitoring Plan initiated by ERD in 1989, and as outlined in the reserve system regulations and strategic plan:

- Phase I: Environmental Characterization, including studies necessary for inventory and comprehensive site descriptions;
- Phase II: Site Profile, to include a synthesis of data and information; and
- Phase III: Implementation of the System-wide Monitoring Program.

The System-wide Monitoring Program provides standardized data on national estuarine environmental trends while allowing the flexibility to assess coastal management issues of regional or local concern. The principal mission of the monitoring program is to develop quantitative measurements of short-term variability and long-term changes in the integrity and biodiversity of representative estuarine ecosystems and coastal watersheds for the purposes of contributing to effective coastal zone management. The program is designed to enhance the value and vision of the reserves as a system of national reference sites. The program currently has three main components and the first is in operation.

1. **Abiotic Variables:** The monitoring program currently measures pH, conductivity, salinity, temperature, dissolved oxygen, turbidity, water level and atmospheric conditions. In addition the program collects monthly nutrient and chlorophyll A samples and monthly diel samples at one SWMP data logger station. Each reserve uses a set of automated instruments and weather stations to collect these data for submission to a centralized data management office.
2. **Biotic Variables:** The reserve system will incorporate monitoring of organisms and habitats into the monitoring programs as funds

become available. The first aspects likely to be incorporated will quantify vegetation (e.g., marsh vegetation, submerged aquatic vegetation) patterns and their change over space and time. Other aspects that could be incorporated include monitoring infaunal benthic, nekton and plankton communities.

3. Landuse, Habitat Mapping and Change: This component will be developed to identify changes in coastal ecological conditions with the goal of tracking and evaluating changes in coastal habitats and watershed landuse/cover. The main objective of this element will be to examine the links between watershed land use activities and coastal habitat quality.

These data are compiled electronically at a central data management “hub”, the Centralized Data Management Office (CDMO) at the Belle W. Baruch Institute for Marine Biology and Coastal Research of the University of South Carolina. They provide additional quality control for data and metadata and they compile and disseminate the data and summary statistics via the Web (<http://cdmo.baruch.sc.edu>) where researchers, coastal managers and educators readily access the information. The metadata meets the standards of the Federal Geographical Data Committee.

Reserve system education program.

The Reserve System provides a vehicle to increase understanding and awareness of estuarine systems and improve decision-making among key audiences to promote stewardship of the nation’s coastal resources. Education and interpretation in the reserves incorporate a range of programs and methodologies that are systematically tailored to key audiences around priority coastal resource issues and incorporates science-based content. Reserve staff members work with local communities and regional groups to address coastal resource management issues, such as non-point source pollution, habitat restoration and invasive species. Through integrated research and education programs, the reserves help communities develop strategies to deal successfully with these coastal resource issues.

Formal and non-formal education and training programs in the NERRS target K-12 students, teachers, university and college students and faculty, as well as coastal decision-maker audiences such as environmental groups, professionals involved in coastal resource management, municipal and county zoning boards, planners, elected officials, landscapers, eco-tour operators and professional associations.

K-12 and professional development programs for teachers include the use of established coastal and estuarine science curricula aligned with state and national science education standards and frequently involve both on-site and in-school follow-up activity. Reserve education activities are guided by national plans that identify goals, priorities, and implementation strategies for these

programs. Education and training programs, interpretive exhibits and community outreach programs integrate elements of NERRS science, research and monitoring activities and ensure a systematic, multi-faceted, and locally focused approach to fostering stewardship.

Reserve system education goals.

The National Estuarine Research Reserve System's mission includes an emphasis on education, interpretation and outreach. Education policy at the Sapelo Island National Estuarine Research Reserve is designed to fulfill the reserve system goals as defined in the regulations 15 C.F.R. 921.1(b). Education goals include:

1. Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;
2. Conduct and coordinate estuarine research within the system, gathering and making available information necessary for improved understanding and management of estuarine areas.

Reserve system education objectives.

Education-related objectives in the Reserve System Strategic Plan 2005-2010 include:

1. People are aware of the ecological, economic, historical, and cultural importance of estuarine resources.
2. People understand how human choices and natural disturbances impact social, economic, and estuarine ecological systems.
3. People apply science-based information when making decisions that could impact coastal and estuarine resources.

Reserve System Coastal Training Program.

The Coastal Training Program (CTP) provides up-to-date scientific information and skill-building opportunities to coastal decision-makers who are responsible for making decisions that affect coastal resources. Through this program, National Estuarine Research Reserves can ensure that coastal decision-makers have the knowledge and tools they need to address critical resource management issues of concern to local communities.

Coastal training programs offered by reserves relate to coastal habitat conservation and restoration, biodiversity, water quality and sustainable resource management and integrate reserve-based research, monitoring and stewardship activities. Programs target a range of audiences, such as land-use planners, elected officials, regulators, land developers, community groups, environmental non-profits, business and applied scientific groups. These training programs provide opportunities for professionals to network across disciplines

and develop new collaborative relationships to solve complex environmental problems. Additionally, the CTP provides a critical feedback loop to ensure that professional audiences inform local and regional science and research agendas. Programs are developed in a variety of formats ranging from seminars, hands-on skill training, participatory workshops, lectures and technology demonstrations. Participants benefit from opportunities to share experiences and network in a multidisciplinary setting, often with a reserve-based field activity.

Partnerships are important to the success of the Program. Reserves work closely with state coastal programs, Sea Grant College extension and education staff, and a host of local partners in determining key coastal resource issues to address, as well as the identification of target audiences. Partnerships with local agencies and organizations are critical in the exchange and sharing of expertise and resources to deliver relevant and accessible training programs that meet the needs of specific groups.

The Coastal Training Program requires a systematic program development process, involving periodic review of the reserve niche in the training provider market, audience assessments, development of a three to five year program strategy, a marketing plan and the establishment of an advisory group for guidance, program review and perspective in program development. The CTP implements a performance monitoring system, wherein staff report data in operations progress reports according to a suite of performance indicators related to increases in participant understanding, applications of learning and enhanced networking with peers and experts to inform programs.

2. Overview of the Sapelo Island NERR

The Sapelo Island National Estuarine Research Reserve lies in the midst of an estuary where the currents of Doboy Sound and the Duplin River converge. The Reserve encompasses ecologies typical of the Carolinian biogeographic region, which spans the south Atlantic coastline of the United States from North Carolina to upper Florida (Figure 1).

The Carolinian zone is characterized by vast expanses of tidal salt marshes protected by a buffer of barrier islands, so called because they absorb wind and wave energy that would otherwise strike the mainland. Sapelo Island is the fourth largest of a string of 13 barrier islands along the Georgia coast (Figure 2).

The State of Georgia owns most of Sapelo Island, a total of 16,500 acres.



Figure 2.

About 10,900 acres are high ground; the rest is salt marsh (Figures 6, 8, 9,13). Some 4 1/2 miles of salt marsh and estuarine and tidal creek systems separate Sapelo from the mainland. The Reserve is located in McIntosh County, 7 1/2 miles northeast of Darien, Georgia, the county seat.

Island population and access.

Sapelo's isolation has been perhaps the island's most identifying characteristic during more than two centuries of active human use. The mainland departure point for Sapelo Island is at Meridian Dock from which a state-operated ferry vessel departs several times each day to Sapelo, about seven miles to the east. The ferry represents the primary means of access to the SINERR, and to the island in general, for residents and visitors alike. The Meridian ferry dock is also in McIntosh County, Georgia, located on Hudson Creek, a tidal stream which flows into Doboy Sound. Access and parking facilities are located on an 18-acre parcel acquired by the State of Georgia in 1976. Also on this site is the Sapelo Island Visitors Center, the main interpretive center for the SINERR and operated by SINERR staff.

Four groups visiting the SINERR depart from this point. A one-mile entrance road connects the site to Georgia Route 99, about eight miles north of Darien and 23 miles from Brunswick, the nearest large municipality.

In 2007, about 100 persons had established permanent residence on Sapelo Island. Most of the island's population, about 70 persons, reside in the private Hog Hammock community on the south end of the island, about one mile from the Reserve. Other residents are state employees, either associated with the University of Georgia Marine Institute or the Department of Natural Resources (Game Management Section).

Georgia's coastline.

The barrier islands of the 100-mile Georgia coastline are, as a rule, relatively little affected by the heavy development seen in other areas of the south Atlantic coast in recent years. In general, the coastline in Georgia consists of a chain of barrier islands separated from the mainland by a four- to six mile wide band of coastal salt marsh (Figure 2). The islands consist of an ocean-facing sand beach, a series of sand dunes, and a slightly elevated upland interior that is forested and may be dissected by sloughs. The salt marsh adjoins the islands' western edges in most places. Penetrated by many winding tidal creeks, the marsh extends to the mainland shore. At its eastern edge, the mainland is only slightly elevated above sea level, but it is protected from the direct force of storms by the marshes and islands that lie seaward (Figure 3).

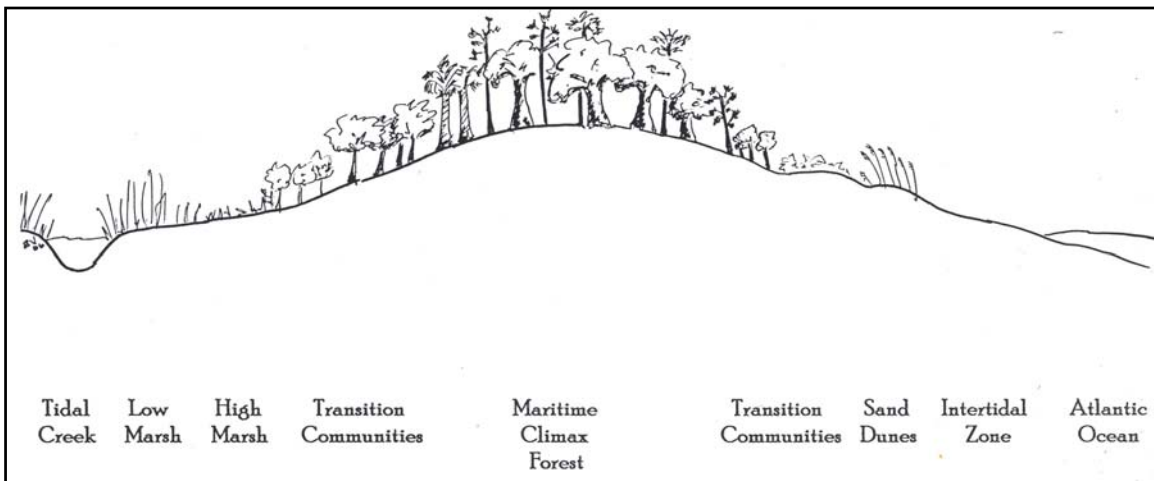


Figure 3.

At several points along the Georgia coast, major rivers (including the Savannah, Ogeechee, Altamaha, Satilla and St. Mary's) empty into the ocean through sounds, which separate the islands. A sequence of salt, brackish and freshwater marshes follow the river channels upstream into regions of decreasing salinity.

Georgia coastal winters are relatively mild and short and the barrier islands have an average annual rainfall of about 53 inches. The driest period is October through December. Most precipitation in the winter is of the frontal type, while

rainfall in the spring and summer comes as the result of afternoon thundershowers. Heavy rainfall in August and September is often associated with hurricane conditions. A number of recent (1996-2005) hurricanes have passed near the Georgia coast but few have caused serious damage. Most East Coast hurricanes tend to follow the warmer waters of the Gulf Stream. Brunswick, Georgia is farther (80 miles) from the Gulf Stream than any other place on the south Atlantic coast. Only ten storms between 1886 and 2005 carried hurricane force winds directly into the state. The worst hurricanes to directly affect Sapelo and its section of the Georgia coast occurred in 1804, 1813, 1824, 1854, 1893, 1896, 1898 and 1964. The most damaging of these was the October 2, 1898 tropical cyclone that left much of Sapelo and the surrounding lowlands under several feet of water due to extreme tidal surge and landfall that occurred on high tide (Sullivan, 2001).

The belt of tidal salt marshes is the "signature" of the Georgia coast. Despite its relatively short coastline, Georgia has roughly one third of existing tidal salt marshes along the U.S. east coast, almost 400,000 acres of salt marsh with water bottoms of about 700,000 acres. Georgia has 33 per cent of Atlantic coast marshes, followed by South Carolina, 30 per cent, North Carolina 11 per cent and Florida 8 per cent (Johnson, *et. al.*, 1974).

Economy of coastal Georgia.

Georgia's barrier islands and marshes have been less altered by human activity than is the case in most other coastal areas. The economic and legislative history of the state help explain this important fact (Sullivan, 2001).

Georgia's early economy depended chiefly on agriculture (primarily the cultivation of rice and Sea Island cotton in the colonial and antebellum periods) and the forest products industry. The collapse of agriculture during the Civil War led to an economic depression from which the region was slow to recover. The forest products industry has been important in coastal Georgia's recent growth in prosperity. So too have commercial fishing and, increasingly, navigation and waterborne commerce, especially through ports at Savannah and Brunswick.

Although the upland acreage on some of the barrier islands has been developed by government and private interests in recent years, the development has largely been of a residential or recreational nature and has usually had minimal effect on the salt marshes. This is due in large part to stringent marshland protection laws in the State of Georgia. However, in the antebellum period (1790-1861) there was considerable alteration of many marshes near the barrier island uplands in relation to the cultivation of Sea Island cotton, plus some Georgia marshes were utilized extensively as cattle pasturage throughout the 1800s and early 1900s. Prior to the Civil War there was also some diking of marshes several miles inland from the sea, to convert them for rice cultivation. After South Carolina, the Georgia coast was the world's leading producer of rice during the decade prior to the Civil War. With the decline in coastal agriculture after the Civil War, deliberate or accidental breaching of the dikes has led to the restoration of many of the altered marshes. Also to be noted in Georgia is the fact that many of the barrier islands have been permanently

preserved: as a National Parks System Seashore (Cumberland Island), as a National Estuarine Research Reserve (Sapelo), or as federal Wildlife Refuges (Blackbeard and Wassaw). Ossabaw is under state management, and St. Catherines is privately owned with future development highly unlikely.

U.S. Highway 17, which connects the northeastern United States with Florida, was completely paved through coastal Georgia in 1926 (Atlantic Coastal Highway). Despite the increased flow of tourists through the region during the post-World War II years, the Georgia coastal area gained few economic benefits from tourism, partly because many beaches were inaccessible to the general public. Most of the fourteen major barrier islands were in the hands of wealthy individuals who used them as retreats and maintained privacy by not building causeways. Today, only four islands—Tybee, St. Simons, Sea Island and Jekyll—have road access from the mainland. Seven of the major barrier islands are in state or federal ownership. They are used for public recreation and wildlife purposes. The estuaries of coastal Georgia include a range of habitat types distinguished by variations in conditions, such as bottom material, vegetation, slope, degree of marine influence, strength of current, or duration of tidal inundation. Georgia's vast salt marshes have been protected since the passage of the Marshlands Protection Act by the Georgia General Assembly in 1970. Georgia was one of the first states in the U.S. to enact this type of protective marshlands legislation. Through this act, strict permitting processes were implemented to closely regulate the development or alteration of Georgia's salt marshes. Estuarine areas have received substantial protection through state ownership and legislative actions. The various forces—from historical accident to deliberate regulation—that led to the protection of Georgia's coastal resources also created the opportunity to establish the Sapelo Island National Estuarine Research Reserve.

Physical aspects of the SINERR.

The Duplin River estuary: watershed and hydrology.

The core of the Sapelo Island NERR is the Duplin River estuary, a tidally flushed drainage system flowing into Doboy Sound from the north. The Duplin River watershed occupies most of the Reserve, which also contains various forest types, sand dunes, a section of ocean beach, and minor developed areas.

The Duplin River estuary covers 3,300 acres between Sapelo Island and the mainland in McIntosh County (Figure 6). It drains a tidal bay and an extensive network of salt marshes about six miles long, into which there is little upland runoff. It is more accurately described as a large tidal creek than a river (Kinsey, 1982). The six-mile long river has an estuary of 3,296 acres, of which 15 per cent is submerged at mean low water and with a tidal excursion of about three miles (Johnson, *et al.*, 1974). Rain falling directly on the estuary and groundwater are its only major sources of freshwater. Tidal flow creates most of the Duplin River's current.

Mean tidal range at Sapelo Island is 6.8 feet; spring tide range is about eight feet (National Ocean Survey, 1983). The twice-daily high tides differ generally by

less than a foot and a half. The difference between daily lows is usually less than half a foot.

As reported in Johnson *et al.* (1974), Ragotzkie and Bryson conducted a detailed survey of the Duplin River. They found the water surface to be relatively narrow at mean low water. When the water rises to six feet above mean low water, however, it begins to leave the banks and flow in a sheet across the marsh. Between one-third and two-thirds of the water pushed by a rising tide into the estuary flows into the marsh. Fairly small increases in tidal height impel significantly increased volumes of water into the estuary. The tidal flow of the Duplin is consequently turbulent, promoting turbidity and thorough mixing of fresh with salt water. Flushing is also incomplete, as there is little fresh water entering the system. Much water in the estuary merely oscillates back and forth, rather than draining away to be replaced (Wiegert and Freeman, 1990).

Doboy Sound is a tidal embayment that forms the southern boundary of the SINERR. The hydrography of Doboy Sound, into which the Duplin River alternately ebbs and floods on the tidal cycle, is influenced by the Altamaha River. This major tributary brings fresh water into the estuary from the interior regions of Georgia. During ebb tide, fresh water from the Altamaha flows seaward into Doboy Sound. During mid-ebb this water flows out of the mouth of the Sound along the south shore. Because of the limited fresh water flow, Doboy Sound is a mixed estuary, particularly during the summer months, with no recognizable salt wedge and little vertical stratification.

Geology, topography and soils.

Sapelo Island is the fourth largest of Georgia's barrier islands. These islands are composed of sands brought to the coastal area by rivers, such as the Savannah and the Altamaha, whose headwaters arise in the Georgia piedmont and mountains. Island formation begins when wave and tide action heap up sand in a ridge parallel to the shore. If the ridge is stable enough to endure inundation during warm climatic periods, when reduced glaciation raises sea levels, then a lagoon is formed between the dune ridge and the mainland, and sediments are trapped there (Johnson *et al.*, 1974). Under certain conditions, marsh develops in this lagoon, while part of the dune ridge remains above sea level and gradually becomes inhabited by plants and animals capable of surviving in this fairly rigorous environment (Figure 3).

Sapelo Island is approximately midway of the Georgia coastline, located about 40 miles south-southwest of Savannah and 49 miles north-northeast of the Florida-Georgia boundary. NOAA Chart No. 11510 (Sapelo and Doboy Sounds, Georgia) places the center of the island at approximately 81 degrees, 15 minutes West longitude and 31 degrees, 27 minutes North latitude. A number of smaller islands associated with Sapelo have been considered at different times to be part of Sapelo. These include the Holocene islands of Blackbeard, Cabretta and Nannygoat, and the Pleistocene formations of Little Sapelo Island and the Duplin River marsh hammocks (Mary, Fishing, Pumpkin and Jack). Sapelo, like most of Georgia's other barrier islands, formed during two consecutive high stands of the sea. Rising water, waves, winds and currents

moved the island's sediments inshore from the continental shelf. Carbon dating of shells found in Sapelo Island sediments indicates that the main part of the island formed some 30,000 years ago (Pleistocene epoch), while the seaward portions (Nannygoat Beach and Cabretta Island) are fairly young, dating some 4,000 to 5,000 years B.P. (Holocene). Sapelo Island shorelines and beaches change constantly, eroding in some places and accreting in others, in response to seasonal patterns of winds, waves, tides and occasional hurricanes (Figure 4).

There is a longshore movement of sand caused by southward moving littoral currents. A pattern of north to south movement of sand sediment on Blackbeard and Sapelo islands is well documented. Like many other Georgia sea islands, Blackbeard Island's north end is eroding and the sands are shifting to the south end of Sapelo in a process called accretion, or sand-sharing. This is evidenced by the sharply eroded and truncated dune ridges on the north end of Blackbeard Island. The sediment from this erosion is transported by wind and current southward and deposited at the south end of Sapelo Island where the beaches are prograding and the dunes are increasing in size. Thus, both islands are shifting southward at a rate of about 0.75 mile during the present (Holocene) high stand of the sea. (Johnson, *et al.*, 1974).

Sapelo Island consists of broad, nearly flat areas separated by gently sloping ridges. The island's elevation ranges from sea level to about 22 feet on the higher sand dunes on the south end of the island. These are generally classified as "ancient" sand dunes. (Johnson, *at al.*, 1974). Much of Sapelo is over eight feet above sea level.

The soils of Sapelo are derived primarily from quartz sands and generally have high permeability. This results in low water-holding capability and rapid leaching. Soils on the island range from deep, extremely well drained sands to very poorly drained thick black loam surface and subsurface horizons of gray sands. Salts from the sea directly affect the vegetation at the beaches and nearby sand dunes by excluding most species and often altering individual plants that are able to grow there. High salt concentrations in some dune sands inhibit vertical percolation of rainfall through the dunes, thus reducing the amount of vegetation through limited water supply. These salts also exert a profound influence on vegetation in and near the salt marshes, limiting species diversity. The abundant nutrients, however, allow the relatively few species present to be highly productive. Salt pans in the high marsh are so concentrated in salts (often two or more times that of sea water) that few, if any, vascular plants grow there. Plants are usually scattered in the margins of these pans. (Duncan, 1982).

Generally, the soils on Sapelo Island are somewhat poorly drained to very poorly drained and highly acidic. The soil pH on the island varies from 4.1 to 7.4. The U. S. Department of Agriculture Soil Conservation Service Soil Survey of McIntosh County, Georgia, which includes Sapelo Island (Byrd and Aydelott, 1961), describes 12 soil types on the island (Figure 5). Agricultural activities in the nineteenth century during the plantation era on Sapelo Island, and again in the 1920s and early 1930s, resulted in the clearing, ditching, and draining of much of the upland areas of the island, thus affecting some soil conditions. Drained and cleared lands on the island were used for agricultural crop growing and pasturage. The hydrology of Sapelo has been considerably altered by the man-made ditches, many of which are still in evidence on the island (Figure 6).

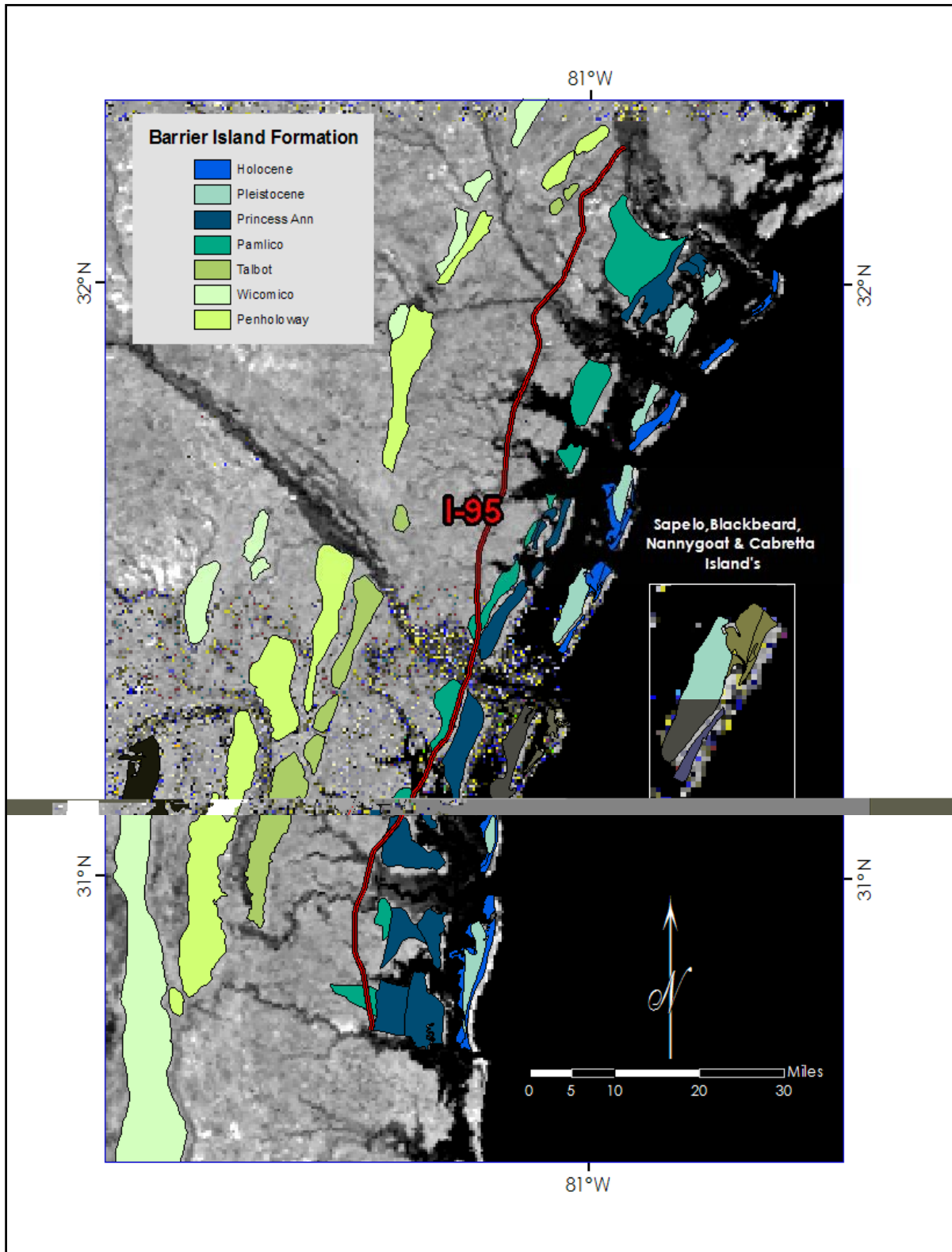


Figure 4.

Coastal beach is the predominant soil type on the seaward side of Sapelo Island and is constantly washed by the sea. Dunes are classified as the deep, barren white sands found on ridges that parallel the beaches. The prominent types of vegetation found on these soils include wax myrtle (*Myrica cerifera*), southern red cedar (*Juniperus silicicola*), Spanish bayonet (*Yucca aloifolia*), sea oats (*Setaria macrosperma*), scrub oak (*Quercus leavis*) and grasses.

Galestown fine sand is a deep, somewhat excessively drained and strongly acidic soil. The natural vegetation on this soil is loblolly (*Pinus taeda*), longleaf (*Pinus palustris*) and slash pine (*Pinus elliotii*), live oak and southern red cedar. Klej fine sand is moderately well drained, strongly acidic, and low in fertility. The natural vegetation is mainly oaks and mixed pines with cabbage palm (*Sabal palmetto*), saw palmetto (*Serenoa repens*) and gallberry (*Ilex glabra*). Leon fine sands on Sapelo are somewhat poorly drained to poorly drained and extremely acidic soils. These soils are highly leached, low in fertility and found on 0-2 percent slopes. The natural vegetation includes longleaf pine, pond pine, gallberry, running oak and wiregrass. Ona fine sands are somewhat poorly drained, heavily acidic and are found on 0-2 percent slopes. These soils are found in low areas and are usually wet in winter and early spring and are slightly droughty in summer and early fall. These soils are low in natural fertility and vegetation includes mixed pines and oaks with saw palmetto, gallberry, running oak and wax myrtle (Byrd and Aydelott, 1961).

Ona and Scranton fine sands are somewhat poorly drained, slightly acidic to alkaline and found on 0-2 percent slopes. These soils were once used to grow Sea Island cotton but are now forested, largely in pine. Palm Beach fine sand is deep and excessively drained, neutral to mildly alkaline and found on level parts of sand ridges. This soil type responds well to fertilization. The natural vegetation on this soil is mixed loblolly pine (*Pinus taeda*), southern red cedar and live oak (*Quercus virginiana*). Rutledge fine sand is very poorly drained and extremely acid. This soil is covered by water much of the year and is low in natural fertility. The natural vegetation is blackgum (*Nyssa sylvatica*), cypress (*Taxodium ascendens*) and scattered pines. If the soil has been adequately drained, as it has on Sapelo, the soil is well suited to the growth of pines. This is the predominant soil type on Sapelo Island (Byrd and Aydelott, 1961).

St. Johns fine sand is poorly to very poorly drained and extremely acid. This soil is found in ponds and other wet areas and is low in natural fertility. The natural vegetation is cabbage palm, saw palmetto, huckleberry (*Gaylussacia dumosa*) and gallberry, with a few scattered pines. This is the second most predominant soil type on Sapelo. High tidal marsh is vegetated by wax myrtle, salt grass (*Spartina patens*), marsh elder (*Iva imbricata*), saltwort (*Batis maritima*) and sea oxeye (*Borrchia frutescens*). Low tidal marsh is vegetated primarily by smooth cordgrass (*Spartina alterniflora*) and black needlerush (*Juncus roemerianus*), and is flooded twice daily by the tides. (Byrd, Aydelott, et. al., 1961).

**Soil, Sapelo Island
Based on 1959 Soil Survey
USDA, Soil Conservation Service**

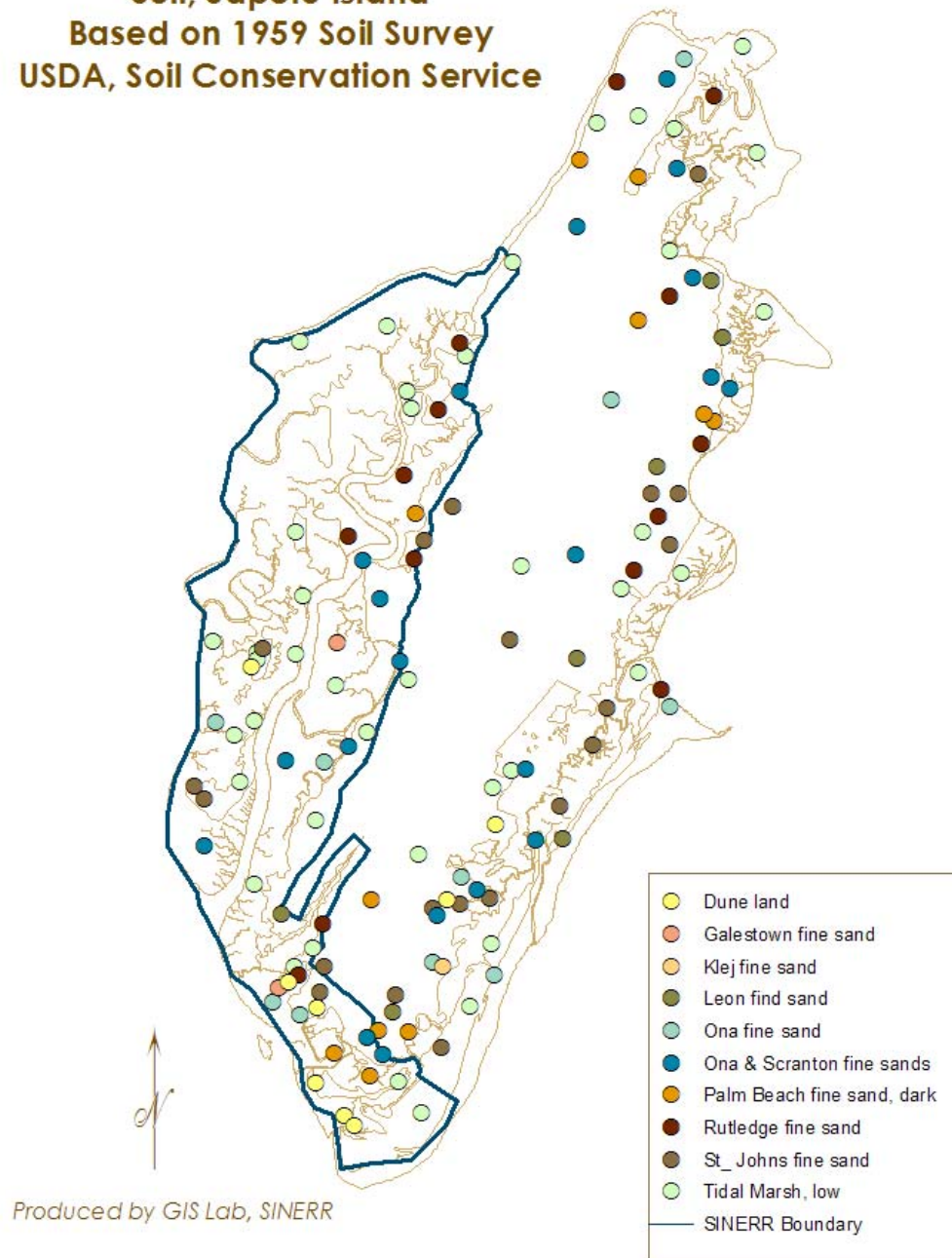


Figure 5.

Climatic effects on vegetation and soils.

Coastal Georgia's climate is classified as subtropical. It consists of brief, mild winters and humid, warm summers. In 1981, Brunswick's 30-year annual average temperature was 68.9 degrees F., according to U.S. Weather Service figures (National Climatological Center, 1981). Sporadic, intense summer showers account for much of Sapelo Island's annual precipitation, which averages 51.7 inches. The wettest months are generally June and July. Nearby Brunswick's precipitation averages 48.2 inches per year. The lowest amount of annual rainfall on Sapelo Island in recent years was 32.9 inches in 1954, while the highest was 75 inches of rainfall in 1964, a figure approached in 1992 with over 65 inches (Chalmers, 1997).

The climate of Sapelo is too cold in some winters to allow tropical or subtropical vegetation to persist. The climate is sufficiently mild, however, to allow some species characteristic of warmer areas to grow and reproduce naturally (Duncan, 1982). The average date of the earliest frost on Sapelo Island is December 3, with the latest being March 2. This allows for an average growing season of 276 days, the longest of any recording weather station in Georgia (Duncan, 1982).

Another climatic feature, hurricanes, has had a profound influence on the soils and vegetation of Sapelo Island (subsection 2, above). During some storms sea water has covered parts of the island and may have spread over the entire island for periods of a few hours on several occasions, particularly during the hurricanes of 1824 and 1898 when walls of water as much as six feet high covered parts of the island on each occasion (Sullivan, 2001). Plant species intolerant of seawater would be at least severely damaged and possibly even eradicated from the island under such circumstances.

Habitat types.

Aquatic.

Sedge grass ponds are found in several locations on Sapelo Island. These ponds are usually quite small, less than 1-2 acres, and are composed of grasses, sedges and other emergents. These ponds remain wet throughout the year.

Freshwater ponds are also found across the island, some man-made and others natural. The 90-acre Reynolds Duck Pond on the north end of Sapelo is the largest body of fresh water on the island. The water control structure is a flashboard riser that is constructed of tabby (inoperable in 2006), with a culvert that leads under a dike to a salt marsh. This pond was developed during the Howard Coffin era of ownership on Sapelo (1912-1934) and expanded during the R.J. Reynolds ownership period (1934-1969). There is presently no control of the water level on the pond, and the pond cannot be managed as a waterfowl impoundment. There are no fresh water streams or creeks on the island, excepting a number of man-made drainage ditches that were dug during the antebellum plantation era and expanded by Coffin in the 1920s.

On the fresh-water ponds there are generally heavy growths of cattails at the water's edge and, occasionally, the water turns a soft green color because of the growth of a layer of duckweed. The animal community at the large north end duck pond is diverse, including alligators, cottonmouth water moccasins and other water-adaptable snakes along the banks. In the brush and trees nearby may be seen a profusion of ibis, egrets, herons, ducks and gallinules.

There is a fairly sizeable man-made fresh water pond within the SINERR itself, that being the Coffin "water garden" near the Marine Institute on the south end of the island. Here there is considerable habitat for migratory waterfowl, including wood ducks, black crowned night herons and snowy egrets in the winters, and cattle egrets and blue herons in the spring and summer. Alligators also frequent this pond (Chalmers, 1997).

Sand-sharing system.

Fine quartz sands make up the beaches and dunes on Sapelo's seaward side. These sands are shared with offshore sand bars, which accumulate sand pulled off the island by storms and seasonal winds that return the sand to the beach and dunes at other times. Johnson, *et al.* (1974) identify four zones in the beach-and-dune area:



Shoreface: the narrow zone seaward from the low-tide shoreline permanently covered by water, over which the beach sands and gravels move with wave action.

Foreshore: the lower shore zone between ordinary low and high water levels.

Backshore: the upper shore zone beyond the reach of ordinary waves and tides, extending to the base of the dunes.

Dunes: ridges of windblown sand.

Waves, currents and wind constantly change the shape of these landforms (Figures 3, 4). Characteristic plant and animal communities have developed in response to the salt spray, soils, wind, strong sunshine and high temperatures which pose special challenges to life in these zones.

The Intertidal zone: SINERR's estuarine environment.

Salt marshes and marsh ecology.

The salt marsh-estuarine ecosystem is typically an area of high environmental stress. Tidal inundation becomes important for those flora and fauna inhabiting the intertidal zone. Salinity, drainage, desiccation and temperature are considered to be the major factors limiting the diversity of the salt marsh (Cooper, 1974). Despite the low diversity of the salt marsh, it is believed to be one of the most productive natural areas on earth (Schelske and Odum, 1962).

Two distinct layers of salt marsh sediments are revealed in cross-section. The aerated and leached sediments of the upper few centimeters are brown. The sediments below are black and rich in reduced organic end products including hydrogen sulfide, methane and ferrous compounds (Wiegert and Freeman, 1990).

The primary basis for the food chain in the salt marsh is detritus originating mainly from the dominant vascular plant, smooth cordgrass (*Spartina alterniflora*). Most of the marshes on the Sapelo Reserve appear to be composed only of smooth cordgrass. There are numerous other plants as well, but *Spartina* dominates the lower lying, tide-dominated areas. *Spartina* is taller and more luxuriant than other marshes and grows chiefly along creek and river banks and levees.

All life requires fresh water to carry on metabolic processes. The plants of the marsh have mechanisms which allow them to extract fresh water from the salty estuarine waters. Smooth cordgrass has a very efficient mechanism to handle salt and therefore can withstand twice-daily inundation by the tides. *Spartina*, like other plants, requires nitrogen and phosphorus to grow. The latter is available both in the marsh mud and in the tidal waters that flush the marshes. Blue-green algae on the marsh surface, and nitrogen-transforming bacteria within the soil, convert nitrogen into usable forms for the marsh (Wiegert and Freeman, 1990).

Other plants, particularly those in the marsh transition zone between the marsh and high ground, such as sea oxeye (*Borrchia frutescens*), groundsel bush (*Baccharis halimifolia*), and iva (*Iva frutescens*) prefer to grow in sandy areas which are inundated less often. Other common marsh plants include glasswort (*Salicornia virginica*), needle rush (*Juncus roemerianus*), and salt-marsh spike grass (*Distichlis spicata*). Glasswort often appears as patches amongst the stands of *Spartina*. The black needle rush (*Juncus*) forms thick stands, often amidst the shorter, higher *Spartina* cordgrass nearer high ground. Needle rush is characterized by its fine stalks, sharp points and greyish appearance. Also among the high marshes are saltpans, or salt barrens, highly-saline areas where nothing but diatoms grow. Hammocks within the salt marshes on the Reserve are areas of high ground above normal high tides and support tall vegetation, such

as red cedar, wax myrtle and yaupon holly. The hammocks stand out conspicuously from the low-lying marsh. Mary, Fishing, Pumpkin and Jack hammocks on the Duplin River within the Reserve are Pleistocene bases surrounded by Holocene salt marshes (Figure 13).

Tidal action is the most important factor influencing primary production in the marshes (Figure 3). Twice daily, tides of approximately seven feet carry essential nutrients into the marshes, export detritus and nutrients back into the estuary, and provide a large surface area for phytoplankton production. Tidal flushing maintains a desirable vertical distribution of nutrients and detritus. (Johnson, *et al.*, 1974). The base of the detritus food chain is dead *Spartina* which is attacked by microorganisms. Research at the University of Georgia Marine Institute on Sapelo Island has divulged that bacteria found in marsh mud may be an important link in the food chain. John Teal, in 1962 research at the Marine Institute, found the important detritus-algae feeders to be fiddler crabs, oligochaetes, periwinkle snails and nematodes among the deposit feeders. The utilization of organic matter in the salt marsh accounts for about 55 per cent of the total primary production, leaving about 45 per cent of the production available for utilization and support of an abundance of estuarine animals, including finfish, shrimp, crabs and oysters. (Johnson, *et al.*, 1974).

University of Georgia Marine Institute researchers noted in 1981 studies (Pomeroy, Wiegert, Dunn, *et al.*) that algae form a thin stratum poised "between a dark, nutrient-rich, anaerobic sediment and either an illuminated, aerobic, comparatively nutrient-poor water column or, at ebb tide, the atmosphere." Thus, the habitat of the algae is subjected to very rapid changes in light, temperature, pH, salinity, and nutrients that can have correspondingly rapid effects on the photosynthetic rate. In the Sapelo Island marshes, benthic productivity was found to represent about 12 per cent of the net primary production of the macrophytes in the salt marsh. About 75 per cent of this production occurs during ebb tide and the bare creek banks are the most productive parts of the marsh (Pomeroy, *et al.*, 1981).

Because tides are responsible for sedimentation in the salt marshes and because vegetation interacts with the tides, there are some topographical differences in *Spartina* marshes developing in areas of low, compared to high, tidal amplitude. The tidal amplitude on the south Atlantic coast reaches a maximum of 6-9 feet approximately in the middle of the Georgia coast at Sapelo Island, and decreases both north and south of this point (Chalmers, 1997).

On the Georgia coast the tendency is for big cordgrass to dominate the brackish tidal marshes wherever conditions permit it to replace *Spartina alterniflora* and *Juncus roemerianus*. The late Eugene Odum, almost universally regarded as the "father of ecology" (partly as a result of his significant estuarine research at the UGA Marine Institute on Sapelo Island from the 1950s to the 1970s), reviewed the distribution of mesohaline plants in the Georgia tidal marshes. The barrier island chain along the Georgia coast is breached at several points by the estuaries of several major freshwater rivers, forming extensive areas of brackish tidal marsh. A typical example of this community type is the estuary of the Altamaha River, whose mouth is immediately to the south of Doby Sound, the blind estuary bounding the southern end of Sapelo Island and the Duplin River marshes of the Sapelo Island National Estuarine Research Reserve. At

times of high freshwater discharge from the Altamaha (late fall to early spring), the fresh water can significantly lower the salinity of the tidal water on the marshes on the southern end of the Sapelo Reserve. (Wiegert and Freeman, 1990).

Non-vascular plants are also abundant in the salt marshes of Georgia. Most non-vascular plants are microphytes, with the largest groups being the pennalean diatoms, mainly *Navicula* species. The diatoms, which account for less than 10% of the primary production, give the marsh muds their distinctive golden-brown hue. Macrophytic non-vascular plants are uncommon in the marshes. The major types are *Ulva lactuca*, an *Enteromorpha* species, and several species of rhodophytes (Cooper 1974, Odum 1980).

A large number of consumer species inhabit the salt marsh-estuarine ecosystem. The major groups are zooplankton, benthic invertebrates, insects, fishes, reptiles, birds, and mammals. Benthic macroinvertebrates are the most conspicuous of the consumers. This group includes the fiddler crab (*Uca* species), marsh mussel (*Geukensia demissa*), marsh periwinkle (*Littorina irrorata*), and oyster (*Crassostrea virginica*). Consumers of economic importance are included within the invertebrates (oysters, crabs and shrimp), fishes (chiefly menhaden, shad, and red drum) and mammals (raccoon, mink and otter). All the consumers are important in an estuarine ecosystem's functioning and must be considered whenever plans are made to alter that system. Changing one component tends to have larger effects elsewhere throughout the system (Odum, 1980). For this reason, modifications within the Duplin River estuary will be made only after careful evaluation and assurance that they are consistent with the goals and objectives of the SINERR.

In the early decades of the twentieth century, the marshes of the Georgia coast supported a large industry centered on the oyster (*Crassostrea virginica*), but overexploitation and the failure to replace shell led to the collapse of this industry, and at present only a handful of oyster houses remain in operation (Sullivan, 2001). Presently, the only significant commercial use of the tidal salt marshes of the coast is by crabbers seeking the Atlantic blue crab (*Callinectes sapidus*). The majority of the crabs are taken in the sounds and the smaller tidal rivers and creeks directly associated with the marshes. Crabs use the marshes and tidal creeks as habitat during their juvenile and subadult stages. The marshes are also vital in the maintenance of the coastal shrimp (*Penaeus*) fishery, a multimillion dollar industry on the Georgia coast alone. In addition to the modest subsidy that the marshes provide to the nearshore zone where shrimp make most of their adult growth, the marshes and tidal creeks provide both the nutrients and protection necessary for the survival of the juvenile shrimp population (Wiegert and Freeman, 1990).

The Doboy Sound estuary.

Doboy Sound, which forms the southern boundary of the SINERR (Figures 6), is considered an estuary, not in the classical sense of a freshwater river entering the sea, but because it drains a substantial area of saltmarsh through a break in the barrier island chain. Also, its salinity is always less than that of oceanic water,

caused by a combination of local runoff and freshwater input from the Altamaha River immediately to the south of Doboy when heavy outflow backs up through the network of tidal creeks and the Atlantic Intracoastal Waterway. This input is often seen in Doboy Sound as a front of different colored water running northwest to southeast. The tidal fronts (varying levels of salinities) are usually marked by narrow lines of foam running crossways to the water flow.

The combination of wind strength and direction and the direction of tidal flow often produces local boating problems in Doboy Sound. At times the current flow may be substantial, and when there is an ebb tide with an opposing southeast wind (as is often the case in the spring and summer), steep waves can make small boat travel uncomfortably rough. Northwest winds opposing an incoming tide may also make conditions rough at any time of the year (Chalmers, 1997).

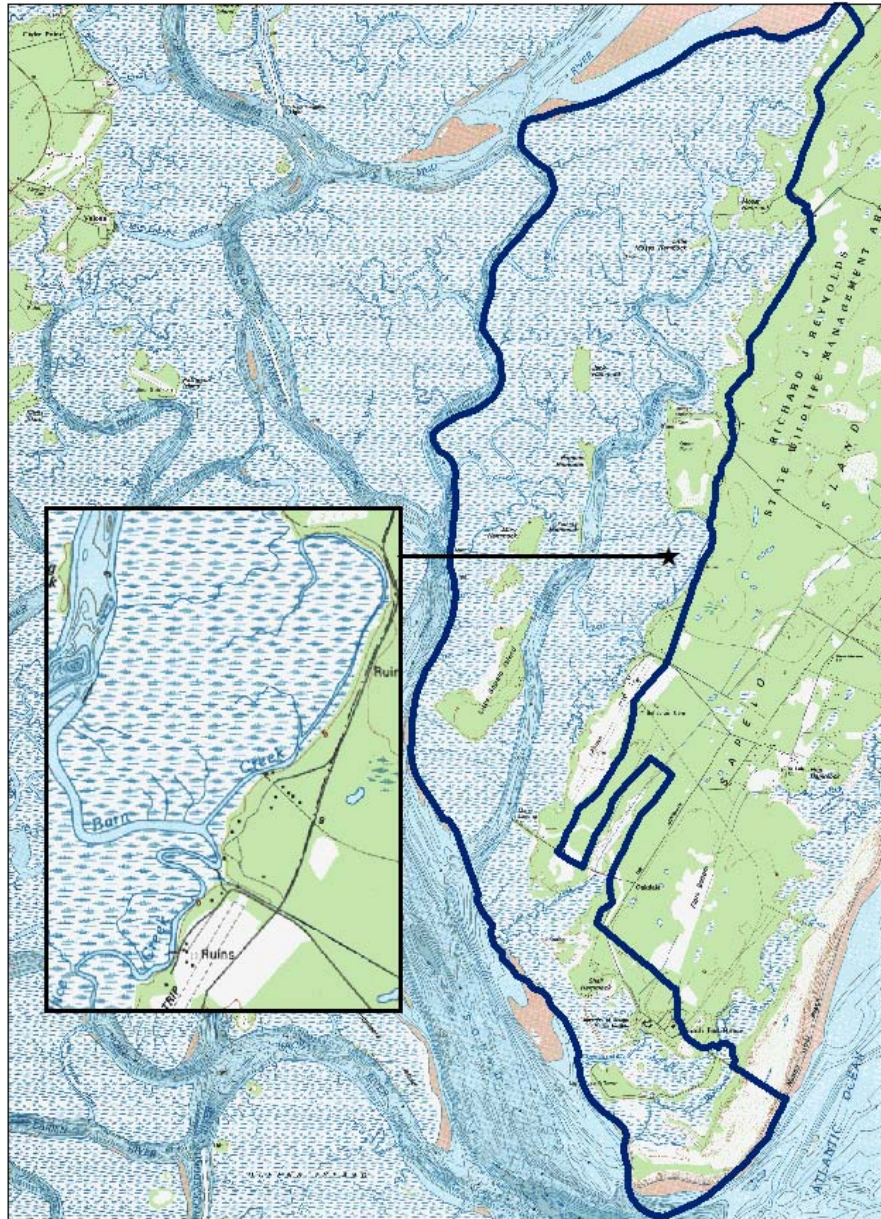
The bottom of Doboy Sound is composed largely of clays and silts, with sand present in the outer sound. There are a variety of animals in the waters, including crabs, white and brown shrimp, squid, jellyfish, catfish, drum, sole and flounder.


The Duplin River estuary.

The Duplin River, which flows entirely within the SINERR watershed, is not a true river, being rather a large tidal creek about six miles in length separating Sapelo Island from Little Sapelo Island and its associated hammocks, and entering Doboy Sound slightly south of Marsh Landing Dock (Figure 6). The water in the creeks is driven by tidal influence. Water is pushed onto the marsh by the pressure of high tide and drains from the marsh into the creeks on low tide. This does not mean that the water that returns in the next tidal cycle is "new." On the contrary, the water of the Duplin oscillates backward and forward. The effective exchange of nutrients and organisms is dependent upon such factors as water volume and velocity, local fresh water runoff and the active entry and departure of motile feeding organisms (Cooper, 1974). The sediments of the bed of the Duplin are low in mud content and contain large accumulations of shell material, much of which is deposited from the oyster banks along the river banks. At Little Sapelo Island and Pumpkin Hammock, both on the Duplin and within the Reserve, the river is eroding Pleistocene sandy deposits (Chalmers, 1997).

The University of Georgia Marine Institute has conducted much of its scientific ecological research along the Duplin River and its associated salt marshes, and the river's nutrient flows and its microflora and fauna have been intensively studied in the last 40 years. The accessibility of the Duplin, along with its oscillating water flow patterns, make the stream an ideal site as an estuarine research base. Microalgae are productive in the Duplin and these, and other organisms, serve as an important food source for juvenile menhaden, a plankton feeder. Menhaden, in turn, are preyed upon by larger fish and birds. Flounder, bluefish and yellowtail are other finfish predators in the river; mullet are deposit feeders, and mummichog live in the shallower creeks and headwaters where they are rarely threatened by the larger fish. Shrimp utilize the tidal creeks off the Duplin throughout the year, but are especially predominant in the summer. The larger

Watershed for SINERR



 Reserve Boundry



The Sapelo Island
National Estuarine Research Reserve
GIS lab prepared this map for the
Revised Management Plan.



Figure 6.

predators include dolphin and porpoise (often seen near Marsh Landing Dock), and mink and otters forage at the edges of the marsh. Pelicans, gulls and terns are prevalent on the lower Duplin nearer the Sound, while upriver may be found herons, egrets and osprey.

The tidal creeks.

Ecologist Eugene Odum described tidal creeks as a circulatory system driven by the "heart" of the tides (Odum, 1980). All of the tidal creeks on the Sapelo Reserve flow either into the Duplin River (western side of the Reserve), or directly into Doboy Sound (southern end of the Reserve). These creeks provide fresh input to the marshes on each high tide and remove many of the by-products of growth and decay with the ebbing tide. Creek banks are higher than the saltmarsh lying immediately beyond them, and these natural levees channel and distribute the waters of the rising tides (Figure 3). Some of the creeks are almost bare at low tide, leaving exposed mudbanks, which serve as habitat to a wide variety of consumers such as fiddler crabs, herons, egrets and marsh hens. As the tide rises mud snails become active, while marsh periwinkle and many insects may be found grazing on the stems of the *Spartina*. Plankton and juveniles of many species enter the creeks with the incoming tide, as do shrimp and fish when the water becomes deep enough. (Wiegert and Freeman, 1990).

One of the larger tidal creeks of the SINERR is Barn Creek, which enters the Duplin River just north of Little Sapelo Island. Offshoots of Barn Creek are Factory Creek (upper Barn Creek going north toward Kenan Field), and Post Office Creek (Figure 6). On the south end of the Reserve are South End (Lighthouse) Creek, which flows from the Marine Institute into Doboy Sound near the lighthouse, and Dean Creek, a small tidal stream which flows into the Sound just west of the southern tip of the island at the Nannygoat Beach mudflats (Chalmers, 1997).

Beaches and dunes of the SINERR.

Nannygoat Beach constitutes the lower, seaward side of the Sapelo Reserve and fronts on the Atlantic Ocean. This section of Sapelo Island is a Holocene formation (5,000 years B.P.) as opposed to the older Pleistocene soils of the major part of the island. The beach is characterized by shifting sands, sand bars, dunes and other nearshore formations, all constantly being altered by the actions of wind, tide, current and storms. Beach accretion and the so-called "sand-sharing" system of barrier island beach dynamics have been discussed at length earlier in this document.

The lower beach at low tide provides habitat for hermit crabs, amphipods, ghost shrimp and various types of burrowing sea worms. Higher up the beach are found horseshoe crabs and ghost crabs, which burrow under the dead *Spartina* marsh wrack washed up on the beach at the high tide line. Various other species of shells, corals and other animals are prevalent along the beach and frequent the shallow water in ripple marks and runnels (Johnson, *et. al.*, 1974).

The northern end of Nannygoat Beach, but not within the SINERR, is an area known locally as "Big Hole." It is separated from Cabretta Island by Cabretta Creek and is an area of erosion as evidenced by a number of uprooted trees and the exposure of old salt marsh muds due to the receding shoreline. Cabretta Island and its beach (north of Nannygoat and not within the Reserve) is another Holocene formation and also has natural beach erosion (Figure 4).

Sand dunes are formed when windblown sand forms around an obstruction. On Nannygoat Beach the primary dunes are undergoing constant change, depending on the vagaries of wind, tide and current. The primary dunes are generally eroded during periods of bad weather, particularly during spring tides and winter northeasters. Dune accretion generally occurs during periods of calm weather with onshore winds. The southern end of Nannygoat Beach on the Reserve is distinctive with its lines of dunes which swing around the southeast corner of the island. The road to the lighthouse just to the west lies on a former barrier spit, curving around an area of salt marsh. Roadside pools in this section are actually borrow pits from the construction of the lighthouse causeway earlier in the twentieth century. The lighthouse spit is also Holocene in composition.

The accretion of the dunes at Nannygoat Beach is further evidenced by the fact that the group of small wooden beach cabanas built near the water's edge on the high tide line during the early 1950s now well behind the primary dune line (Byrd, Aydelott, 1961).

Dune plants serve as "sea fences" as they trap blowing sand and allow the dunes to build up and gradually stabilize. These salt-tolerant plants are vital ingredients in the complex system of beach dynamics. The most noticeable beach plants are sea oats, which are protected by law in Georgia. Beach elder, wax myrtle, red cedar, morning glory, Spanish bayonet (*yucca*), sandspurs and prickly pears are other plants of the dunes. Animals that frequent the dunes include ghost crabs, rabbits and the eastern diamondback rattlesnake (Johnson *et. al.*, 1974).

Between the line of primary dunes and the older, more established "ancient" dunes of the Reserve about one-half mile west of Nannygoat Beach is the interdune meadow. Vegetation here includes wax myrtle, red cedar, dog fennel and prickly pear.

The upland maritime forest.

Sapelo Island has been extensively modified by the activities of man over the last two hundred years, primarily through agricultural operations, including cattle raising, and the diking and drainage of many of the island's low-lying areas. Many of these areas now comprise the island's maritime forests. Most of the upland maritime forest of Sapelo Island is developed on the older Pleistocene formations. The upland forests of the island include old and new pine stands. The Georgia Department of Natural Resources is removing diseased and stunted pine timber from these areas of pine forest planted in the 1950s in order to promote healthy growth of the remaining trees and to provide open ground habitat for white-tailed deer and turkey.

The maritime forest includes a mixed oak-hardwood forest dominated by live oak, laurel oak, bay, holly, magnolia, red cedar and sabal palm, with understories of saw palmetto, wax myrtle, broomsedge and panic grass. The live oak (*Quercus virginiana*) is perhaps the most characteristic and noticeable vegetative type on Sapelo Island. It is made distinctive with its relatively low and spreading crown and its huge trunks and giant branches draped with two major epiphytes (air plants) known more commonly as Spanish moss and resurrection fern. The northeast portion of Sapelo is almost entirely composed of live oak but the tree also occurs throughout the other wooded parts of the island. In regard to the number of species present the live oak type is one of the highest of the island (Duncan, 1982).

The lowland maritime forest is seen in the lower, wetter areas of the island. It is also a mixed community with live oak, water oak, loblolly pine, blackgum, sweetgum and sweet bay, with understories of saw palmetto, wax myrtle, muscadine grapevines and blackberry shrubs.

Pines, cabbage (*Sabal*) palm trees and saw palmetto are features of Pleistocene soils. Extensive pine forests on Sapelo today are largely the result of deliberate plantings in areas previously under agricultural cultivation in the plantation and postbellum eras. Longleaf pines are found in drier areas, with slash pine in the less dry regions of the island, while pond pines are associated with more acidic and poorly drained soils (Figure 5).

Mixed stands of live oak and pine timber are found in extensive areas of the island with the closed live oak canopy under many of the pines. Selective cutting of the pine timber stands by Georgia DNR has resulted in the development of cleared habitat for deer herds and wild turkey and has hastened the regeneration of natural live oak and other hardwoods in many parts of the timbered areas. (See discussion of timber management, ff.) Considerable areas of the island's maritime forest are dominated by pine-palmetto vegetation. The pine canopy is rarely closed and is often quite open. These pines are being cut selectively, but natural seeding is still good in some areas. Saw palmetto form dense thickets four to five feet tall amidst the pine forests and is often interspersed with other forms of natural vegetation (Duncan, 1982; Byrd and Aydelott, 1961).

In the central highlands of Sapelo are several open grasslands, probably the result of man-made modifications for crop cultivation in earlier times. An example is King Savannah (not within the Reserve), which has heavy stands of bahia grass planted earlier as forage for managed herds of cattle on the island.

Several areas of Sapelo, including some within the SINERR, are clear and open, having previously been used for agricultural purposes in the early 1800s. The large, open area now used as the island's airstrip (within the Reserve) was once the scene of extensive Sea Island cotton and sugar cane cultivation. Flora Bottoms north of the University of Georgia Marine Institute is another relatively cleared area, as is Chocolate Field immediately north of the Reserve.

The Richard J. Reynolds Wildlife Refuge, comprising roughly the upper two thirds of the island, is managed by the Georgia Department of Natural Resources and includes maritime forest within the boundaries of the SINERR. It extends north of the fence that crosses Sapelo Island from Post Office Creek on the west, across East Perimeter Road to just north of the First African Baptist Church in the

Hog Hammock community. This land was obtained in 1969 with a combination of state and federal funds. Its primary purpose is to manage the wildlife within its boundaries (Figures 9 & 13).

Points of Interest of Sapelo Island



Figure 7.

History, human habitation and land use.

Native American and Spanish Mission.

Based on archaeological investigations conducted in recent years, the human history of Sapelo Island dates back at least 4,500 years before the present. The Archaic Period of pre-history (2,000 B.C. to 500 B.C.) appears to have been a time of fairly extensive Native American activity on Sapelo Island. Subsistence activities of the Indians on Sapelo (a name which is Indian in origin) emphasized hunting wild animals, collecting plants and gathering shellfish in the waters of the estuary. Deer and turkey were important species taken on the uplands of Sapelo, while the nearby creeks and marshes provided oysters, clams, whelks, fish and turtles. Live oak acorns were also an important food source for the Indians. Archaic settlements were usually small and composed of family groups moving seasonally on to the island for hunting and fishing purposes. The larger, more permanent Indian settlements and villages were generally located on the adjacent mainland (Juengst, 1980).

Scattered finds of fiber tempered pottery occur on the high ground of Sapelo adjoining the Duplin River and the Mud River drainages along the western side of the island, and along Blackbeard Creek on the northeastern side of the island. The Sapelo Shell Ring on the northwestern side of the island overlooking Mud River (not within the Reserve) is exceptional. Its size sets it apart from all other Native American structures on the island and it is one of only six similar structures still in existence in the United States. The Shell Ring is ceremonial in nature and is about 240 feet wide and nine feet high. It is composed of oyster and clam shells and whelks and is thought to have been pre-designed and built over a considerable period of time (Thompson, et. al, 2004).

There are burial mounds and kitchen middens (refuse piles) scattered about other areas of the island, some at Kenan Field within the Reserve, and others at Bourbon Field and the South End near the greenhouse (Juengst, 1980). At this time, the primary Native American population in the middle Georgia coastal region were the Guale, a branch of the Lower Creek Nation (Larson, 1991).

The Spanish were the first Europeans to establish themselves on Sapelo Island. Recent scholarship has led to the possibility that the lost colony of Lucas Vasquez de Ayllon may have been situated in the Sapelo Sound region, possibly on the north end of Sapelo Island itself. No trace of this colony has yet been found, but its establishment in the fall of 1526 (only 34 years after the arrival of Columbus in the Antilles) would make it the first settlement by Europeans on land that would become the continental United States (Sullivan, 2001).

The Spanish mission of St. Joseph (San Jose de Zapala) was located on the north end of the island, possibly as early as 1573. There is strong evidence that a Spanish Franciscan mission was on the island at the time of Guale Indian revolt of 1597, based on Spanish archival records. The Sapelo mission would have been staffed by a resident Franciscan priest, and probably a detachment of soldiers. Their *convento* and residences were likely built of wood and palmetto. Theories that the tabby ruins on Sapelo were the remains of Spanish mission structures

were discredited in the late 1930s when evidence proved the ruins to actually be those of antebellum plantation buildings and sugar mills (Floyd, in Coulter, 1937). The primary Spanish mission of the Guale coast was that of Santa Catalina de Guale on St. Catherines Island immediately north of Sapelo. This mission was established in 1566.

No structural evidence of Spanish mission activity has been found on Sapelo, but sherds of majolica and olive jars attesting to the Spanish presence have been uncovered during archaeological investigations on the north end of the island (Juengst, 1980; Larson, 1991). More recent investigations (Thompson, et. al, 2004) have further demonstrated evidence of Spanish activity within and proximal to the Shell Ring. The 1760 survey map of Sapelo Island by the British military engineer William G. DeBrahm delineates structures in areas that would likely have been the scene of Spanish activity, including the Shell Ring, High Point, Bourbon Field and Kenan Field (known areas of Indian presence). The survey map also shows citrus groves on the north end of the island, which were likely planted by the Spaniards (Sullivan, 2001; Larson, 1991). English pirates and freebooters based at the new settlement of Charles Town up the coast began to apply pressure on the Spanish mission complexes on the southern coast in the 1670s and early 1680s. By 1686, all the missions along the Guale coast, including the one at Zapala, had been abandoned, and the Spanish had pulled back to St. Augustine in Florida.

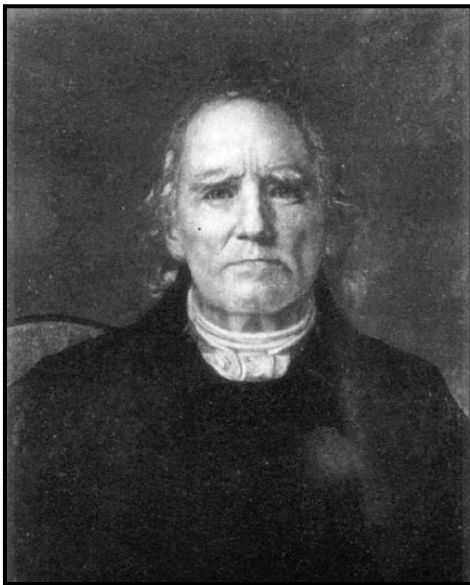
Plantation period: Thomas Spalding.

James Edward Oglethorpe and the English colonists arrived and established themselves at Savannah in 1733, acquiring through an agreement with the Creeks the land between the Savannah and Altamaha rivers, with the Indians reserving hunting rights on several coastal islands, including Sapelo. In 1757, another treaty with the Creeks resulted in the cession of Sapelo and other coastal islands to the English Crown. Sapelo was acquired in 1760 at public auction by Grey Elliott, a land speculator who, in turn, sold the island to Patrick Mackay two years later. Mackay was the first large-scale planter on Sapelo and is thought to have had agricultural operations on the north end of the island overlooking Blackbeard Creek. John McQueen acquired Sapelo in 1784. McQueen's estate sold the island, along with neighboring Blackbeard and Cabretta islands, to a group of French royalists in 1789. Blackbeard was subsequently acquired in 1800 by the federal government as a U.S. Navy live oak timber reserve. That island later served as the U.S. South Atlantic Quarantine Station from 1880 to 1910 and is now a federal wildlife refuge.

The French involvement on Sapelo represents what is arguably the most intriguing period of Sapelo Island's history. Sapelo was sub-divided between Dumoussay Delavauve, Joseph de Chappedelaine (North End), Christophe Poulain duBignon (South End), Pierre Cesar Picot de Boisfeuillet (Bourbon Field, High Point), Grandclos Mesle (Chocolate) and later, Nicholas Francois Magon de la Villehuchet (Thomas, 1998). These men were fleeing the Revolution in France. The French owners had plans to use the island for the cutting of live oak timber to sell to northern and overseas shipbuilders, as well as hopes of developing cotton-

planting operations. However, disagreements over the use of the island, mistrust over expenditures of funds and other problems soon arose and the French consortium broke up in 1794. duBignon sold his interest in Sapelo and acquired Jekyll Island to the south. Chappedelaine was shot and killed on Sapelo during an argument with his uncle, Boisfeuillet, who lived at Bourbon. Dumoussay died of a fever the same week in September, 1794, and the other owners, unable to adjust to life on a remote Georgia barrier island, gave up and returned to France (Thomas, 1998; Sullivan, 2001).

Another Frenchman, John Montalet, son-in-law of Boisfeuillet, acquired the High Point section of Sapelo in 1805 and lived there until his death in 1814. He grew Sea Island cotton and had business interests with the other two owners of the island at that time. These were Thomas Spalding, who acquired 4,000 acres on Sapelo's south end in 1802 following up on a transaction with the French estate begun by his father-in-law, Richard Leake, the year before; and Edward Swarbreck, an English coastal trader and slave merchant who acquired from the French interests much of the northern portion of Sapelo, including Chocolate plantation on Mud River (Thomas, 1998). It was Swarbreck who, during the period 1815-20, constructed many of the tabby buildings at Chocolate, the ruins of which are still in evidence. Later, this tract was bought by Charles W. Rogers who built the tabby barn in 1837. Thomas Spalding acquired the northern half of Sapelo in 1843. By then, Spalding owned all of Sapelo with the exception of 600 acres at Raccoon Bluff on the east side of the island overlooking Blackbeard and the Atlantic Ocean (Sullivan, 2001).



Thomas Spalding (1774-1851) was descended of the Spalding clan of County Perth, Scotland. His father, James Spalding, was a colonial Indian trader who lived at Frederica on St. Simons Island and was an English Loyalist who removed to British East Florida during the Revolution. In 1795, Thomas Spalding married Sarah Leake at Belleville Plantation in McIntosh County. He studied for, and passed, the bar in Savannah, traveled extensively in Europe, and served in the United States Senate from 1803-07. He returned to Sapelo Island and from 1807-10, designed and built his permanent plantation house on the south end of the island. He built a house

"strong enough to resist the most furious hurricanes that were given to sweeping in off the sea; it would be a house cool in summer and warm in winter. In carrying out these ideas, he constructed the house of tabby, a material and method he was often to use thereafter...He made the building with high ceilings and a flat roof, with concrete tabby walls three feet thick. He would make this mansion the Spalding seat for generations

uncounted...The mansion viewed from the south took a Moorish look but the front suggested the Greeks, for it had an unroofed portico thirty feet long and twenty feet wide with a row of Ionic columns...Back of this great becolumned entrance were glass windows which lighted the hall, and on each side were solid walls whose solidity was relieved only by two oval windows. On each side were wings [kitchen and plantation office] half the height of the main building. This mansion was one of the first with high columns to be built in Georgia and one of the very few ever built on the coast" (Coulter, 1940).

Spalding was regarded as an agricultural genius, even in his own day. He was an early advocate of such methods of crop rotation and crop diversification. He was the first planter on the Georgia tidewater to experiment with the cultivation of sugar cane and when he built his tabby sugar works in 1809 overlooking Barn Creek, he became the first sugar manufacturer in Georgia. He also had a part interest in a sugar mill and rum distillery with William Carnochan at the Thicket overlooking Doboy Sound on the McIntosh County mainland (built in 1816 and destroyed in the hurricane of 1824); his own animal-powered sugar mill on Sapelo Island was the model for similar establishments along the south Atlantic seaboard (Sullivan, 2001, 2008). Spalding's cultivation of Sea Island cotton, which grew exclusively on the sea islands and immediate coastal mainland, set the standard by which contemporary planters patterned their own cotton operations.

An amateur architect, one of Spalding's significant contributions was his perfection of the use of tabby as a building material. Tabby, used in the 1730s by the Georgia colonists, but later all but forgotten, was comprised of equal parts of crushed oyster shell, sand, water and quicklime extracted from burnt shell, and was adapted for use during the first half of the nineteenth century for the construction of plantation buildings in the Georgia and South Carolina tidewater region (Coulter, ed., 1937; Sullivan, 1999, 2001, 2008). Shells were plentiful and easily obtained from the tidal creek banks and from the extensive Indian mounds and middens on Sapelo. The Spalding tabby method called for pouring the wet tabby mixture into wooden forms, or courses, that were then allowed to harden. As the blocks of tabby hardened the courses were removed and a new layer of the wall of the building were ready to be poured. In this manner walls of up to twenty feet could be constructed, but Spalding did not advocate tabby buildings of more than two stories (Sullivan, 1999, 2001, 2008).

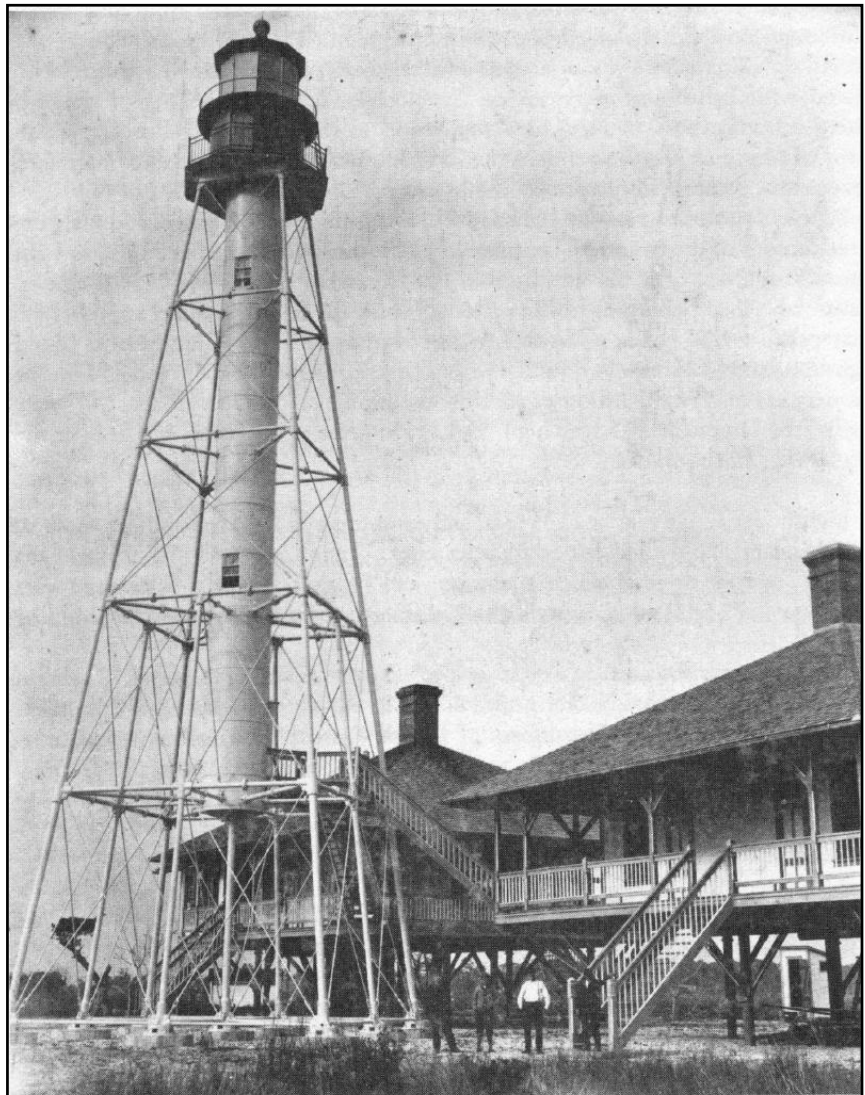
Spalding was a prolific writer and contributor to the farm journals of the antebellum period, chief of which was the *Southern Agriculturist* of Charleston, in which he freely shared his ideas and innovations with his fellow planters (Legare, 1833; Coulter, 1940). He deplored the system of slavery and envisioned its eventual abolishment, but nonetheless recognized it as a necessity in the Southern economy. In this regard, Spalding was noted for his benevolence and liberality as a slave owner. He had three-to-four hundred slaves on the island working various plantations on the South End, at Kenan Field and at Chocolate. Slave quarters were located along the cotton fields (present-day airstrip on the Reserve) and slave communities grew up in the 1840s and 1850s with names such as Behaviour, Hog Hammock and Hanging Bull. He was a political activist in coastal Georgia, and a staunch advocate of preserving the Union amid the

growing national turbulence of the early 1850s. Spalding was an astute businessman: he helped found the powerful Bank of Darien in 1818, promoted the development of Sapelo Sound on the north end of the island as a federal naval base (without success) and had financial interests among cotton and sugar factors at Savannah as well as rice plantations at Savannah and in McIntosh County (Coulter, 1940; Sullivan, 2001).

In 1820, the federal government contracted Winslow Lewis of Boston to construct a round-brick 80-foot lighthouse on the southern tip of Sapelo Island on a sand spit donated for the purpose by Thomas Spalding. The lighthouse had a 15-foot iron cupola with a light and lens to guide shipping into Doboy Sound and the then-important seaport of Darien. A Fresnel lens was installed in 1854, making Sapelo a fourth-order light (Thomas, 1997; Sullivan, 2001). This lighthouse still

stands (it is within the Reserve) and the State of Georgia is in the process of restoring the structure for use in public interpretation of the Reserve. The lighthouse, after being damaged in an 1898 hurricane was deactivated and a replacement, 100-foot steel pyramidal, kerosene-lit lighthouse was erected in 1905 a few hundred feet from the original tower. This light was deactivated in 1933 due to a decline in shipping coming to the Darien port, and the structure dismantled and removed from the island (Sullivan, 2001). The concrete foundations remain, as does the brick oil house.

Thomas Spalding died in 1851 at the age of 76. His sons continued agricultural operations on Sapelo Island for ten more years until the outbreak of the Civil War. During the War, Doboy Sound was under



*New steel Sapelo lighthouse and frame cottages for the keeper and assistant keeper, circa 1915
The steel tower was operated by the federal government from 1905 to 1933.*

Union naval blockade. The Spalding house was vandalized by sailors and contraband slaves and fell into ruins after the war (Thomas, 1998; Sullivan, 2001).

Reconstruction and postbellum.

After the War, several hundred freedmen remained on Sapelo and acquired title to property at Hog Hammock, Raccoon Bluff, Shell Point, Behaviour and Belle Marsh. In 1871, the William Hillery Company purchased 600 acres at Raccoon Bluff and here, Sapelo's largest African-American community developed, lasting nearly a century. Blacks engaged in subsistence agriculture or were hired as labor in small-scale cotton and cattle-raising activities. In 1866, the Spalding family sold the North end tract of almost 7,000 acres to northern investors who held the property until its eventual acquisition in 1912 by Howard E. Coffin. Spalding descendants retained ownership of most of the South end where several families resided during the Reconstruction and postbellum periods. They cultivated cotton without success due to the lack of capital and adequate labor (Sullivan, 2001). Two of Thomas Spalding's grandsons, Thomas and Bourke Spalding, and their brother-in-law, A.C. McKinley, moved to the island in 1868 and 1869 and lived at High Point and Long Tabby for a number of years. They raised beef cattle that roamed at free range over most of the island. The beef was sold to ships docked at Dobby Island and in the Sound, which were coming in during the 1870s and 80s to load yellow pitch pine timber and sawn lumber from sawmills around Darien. This was the boom period of sawmilling in this section of the coast. Rafts of pine timber cut from forests in the interior of Georgia were floated down the Altamaha River to the sawmills at Darien, Dobby and Sapelo. The shipping in the vicinity of Dobby Sound and Creighton Island was at times quite numerous, with as many as fifty or more schooners,

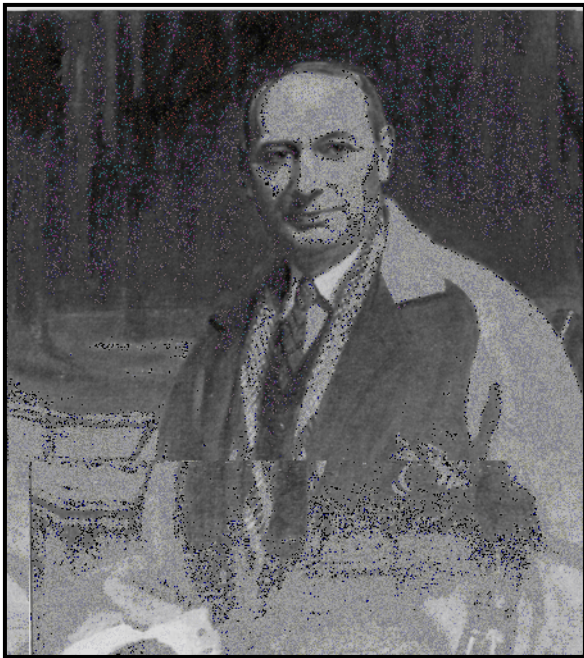


1912 Photo of A.C. and Sarah McKinley (top) with Mr. and Mrs. H.E. Coffin (right) on the front porch of the McKinley house at Post Office Creek, near Long Tabby.

barkentines and square-rigged vessels at anchor at one time depositing ballast stone in the salt marshes and taking on cargoes of timber and sawn lumber (Figure 8). A.C. McKinley kept a journal from 1869-77 and recorded these activities and details of other facets of Sapelo Island life (Sullivan, 2001, 2008). The journal is an account of the difficulties of the efforts to grow cotton and other crops, of the Spaldings' attempts to start a steamboat ferry service from Sapelo to Dobby Island and Darien, of storms at sea and of hunts and fishing expeditions around the island and its estuarine waters. McKinley also left correspondence with details of the earthquake centered on Charleston in 1886, which was considerably felt on Sapelo Island, and of the hurricane and tidal wave of 1898, which put much of the island under water for several hours. It was during the 1865-1912 period of time that Sapelo began to be divided up in its ownership and, in 1911, a group of sportsmen from Macon, Georgia (who had earlier acquired part of Sapelo's south end) began a partial restoration of the former Spalding mansion for use as a hunting lodge (Thomas, 1998).

The millionaire era I: Howard E. Coffin.

In 1912, Howard E. Coffin of Grosse Pointe, Michigan, purchased most of Sapelo from its various owners. Coffin was vice-president and chief engineer of



the Hudson Motorcar Company of Detroit and was a pioneer in the early American automotive and aviation industries. Coffin, for about \$150,000, acquired possession of most of the island, including Little Sapelo and Cabretta, but exclusive of small tracts in Hog Hammock, Shell Hammock and Raccoon Bluff where about 300 descendants of the Sapelo slaves still lived.

In 1913, Coffin made additional improvements to the south end mansion for use as a winter retreat. It was at this time that the outdoor reflecting pool on the front lawn was added. During World War I, Coffin was in Washington, D.C. serving the U.S. government as an automotive

and aviation consultant. A complete restoration of the Sapelo Island mansion was undertaken shortly after the war. From 1920-25, the house was almost completely rebuilt into the structure that is seen today. Only the outer walls of the main building were left standing and it was around these original tabby foundations that the house was rebuilt. The indoor swimming pool was added, as were the second floor ballroom and bedrooms, the basement game room and service areas and the South Wing residential section (Thomas, 1998). Also about this time the present two-story dormitory was built. Its use in the early 1920s was as

an administrative building and staff residence. The greenhouse was built in 1925 and a dairy and stable complex of wooden buildings was constructed at the quadrangle on the present site of the UGA Marine Institute. In 1922, the Long Tabby sugar mill boiling house was restored as a residence for the Coffins while the main house restoration was taking place. The Long Tabby, with a swimming pool added, became a guest lodge when the work on the main house was being done (Sullivan, 2001). Coffin built the Marsh Landing dock in 1928 to accommodate his palatial private 124-foot power yacht, the *Zapala*. He reactivated agricultural activities on the island, attempting for a time to grow Sea Island cotton before the boll weevil invaded and ended the effort. Other crops were grown, cattle were pastured, and a shrimp and oyster cannery and commissary were built on Barn (Factory) Creek where many of the island's blacks were provided employment. Coffin was greatly interested in boats and he opened a small boat-building yard on the south end of the island with a marine railway being put in operation at the present Marine Institute site. Shell roads were built on the south end of the island, the south end water garden and north end duck ponds were built, numerous artesian wells were drilled and a generating plant to provide the island's power was built. Timbering and sawmill operations were active. Biological studies were conducted on Sapelo and Blackbeard islands, and plants and birds, such as the chacalaca, were introduced to thrive in the sub-tropical coastal Georgia environment. Little Sapelo Island was established by Coffin as a hunting preserve for the enjoyment of his many guests to Sapelo (Sullivan, 2001, 2008). Sapelo was the scene of extensive visitation by guests of the Coffins. Some of the better known personages to visit the island during this period were two U.S. presidents, Calvin Coolidge at Christmas of 1928 and Herbert Hoover at Christmas of 1932; the famed aviator Charles A. Lindbergh landed in a cow pasture at Flora Bottoms on Sapelo in February of 1929 (he announced his engagement to Anne Morrow a week later in New York City); the novelist Ben Ames Williams, who wrote his well-known novel *Great Oaks*, while visiting the Coffins on Sapelo; and a host of other well-known political, business, financial and athletic figures.

During the energetic times of the 1920s, Coffin was assisted by his capable young cousin, Alfred W. (Bill) Jones. Jones became manager of Sapelo (spelled "Sapeloe" during the Coffin era) in 1923. Later, Jones helped Coffin found the Sea Island Company. Coffin developed the Cloister Hotel resort, opened in 1928 and which Jones and subsequent generations of his family have managed up to the present day.

The Depression created financial hardships for Coffin and, in 1934, Jones negotiated the sale of Sapelo Island to Richard J. Reynolds, Jr., of Winston-Salem, North Carolina, heir to the great tobacco fortune. Coffin died in 1937 and he and his wife, Matilda, are buried at Christ Church Cemetery on St. Simons Island.

The millionaire era II: Richard J. Reynolds.

Reynolds owned Sapelo from 1934 until his death in 1964. During this time he made several changes on the island. The electrical and communications systems were upgraded on Sapelo and the stucco dairy barn and the other present-day

buildings on the quadrangle were built in 1936 to replace the wooden structures built earlier by Coffin. The South End House underwent modernization as air conditioning was added, the South Wing was changed to a nursery and the upstairs ballroom was converted into the Circus Room. The muralist Athos Menaboni was brought in from Atlanta to do the murals of tropical birds and animals in the indoor swimming pool area (1939-1941), as well as the menagerie



scenes in the Circus Room and the pirates in the basement game room.

Reynolds, by purchase and land exchange, consolidated his holdings on Sapelo by moving all of the island's blacks from their scattered communities of Hog Hammock, Raccoon Bluff and Shell Hammock into one community at Hog Hammock (Figure 7). The black community was heavily dependent on Reynolds and his island operations for their livelihood. Many island blacks were employed by both Coffin and Reynolds in the various operations on Sapelo. The community continues to rely on the State of Georgia in areas such as employment, transportation and various community services. Severe problems are present in the Hog Hammock community today due

to indeterminate land ownership and sales of land to outsiders. About 65 permanent residents still live on Hog Hammock's 434 acres today, most of which is privately owned land.

In 1949, the Sapelo Island Research Foundation was founded by Reynolds and in 1953 the Marine Institute was established on the south end of Sapelo through an agreement with the University of Georgia. Through a series of meetings with UGA President O.C. Aderholt, ecologist Eugene Odum and others, Reynolds provided the use of the quadrangle buildings, the dairy barn and the dairy barn's upstairs theater for use by the UGA to conduct scientific ecological and estuarine research. Since the 1950s, significant marsh and estuarine research has been conducted at the Marine Institute by a number of well-known ecologists, including Odum, John Teal, Larry Pomeroy and others. (See following in this chapter for a more complete discussion of the work of the Marine Institute).

Reynolds died in Switzerland in 1964. His fourth wife, Annemarie Schmidt Reynolds, later negotiated the sale of Sapelo Island to the State of Georgia in two transactions, 1969 and 1976 (Figure 9).

Land Acquisitions of Sapelo Island

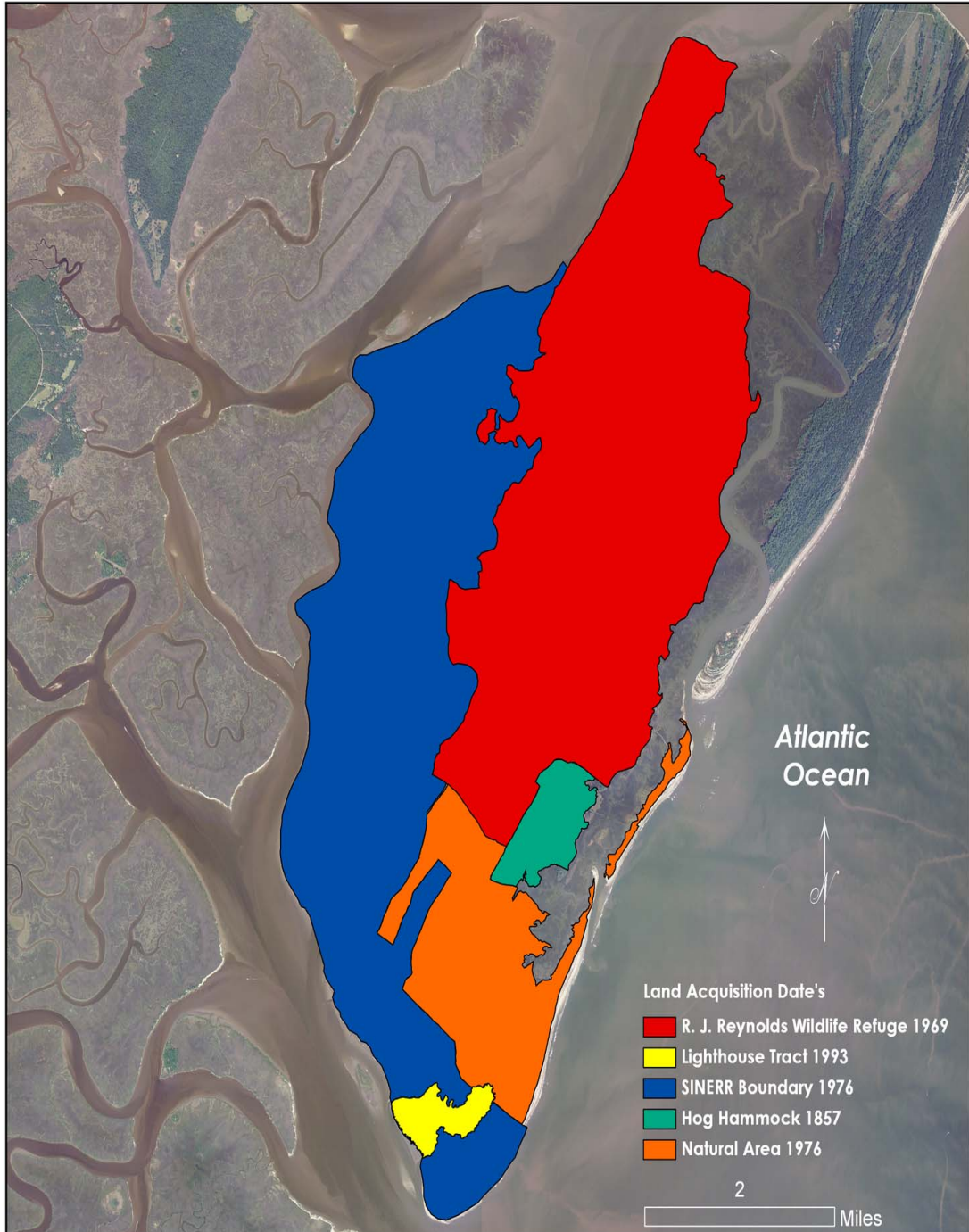


Figure 9.

State acquisition of Sapelo Island.

The properties of Sapelo Island were purchased from the Reynolds Estate at three different times with funds coming from three separate agencies. Each of the funding sources placed stipulations on the manner in which various portions of the property could be used.

The Richard J. Reynolds Wildlife Refuge, comprising roughly the upper two-thirds of the island, was purchased in 1969 with a combination of Pittman-Robertson Federal Aid funds (75 per cent) and state funds (25 per cent). Since the Reynolds Wildlife Refuge is a federal aid project, and the funds are derived from sportsmen, the primary use of this area of Sapelo Island is to provide wildlife enhancement programs and public hunting opportunities. Most of the active management is for game species such as white-tailed deer, eastern wild turkey and mourning doves. In addition to the game species, non-game and endangered species, such as loggerhead sea turtles and bald eagles, are actively managed on the island.

The Sapelo Island National Estuarine Sanctuary, now Estuarine Research Reserve, was established in 1976 on lands on the south and western sections of the island with funds from the Department of Commerce's National Oceanic and Atmospheric Administration (50 per cent) and state funds (50 per cent). The primary purposes of the SINERR are to protect the natural and cultural resources of the island, to provide research opportunities for scientists conducting marsh and estuarine system studies, and to conduct educational and interpretive programs for the public. The Reserve now includes the University of Georgia Marine Institute, the R.J. Reynolds Mansion, Kenan Field timber dock, the Long Tabby office complex for the Department of Natural Resources and the SINERR, the lighthouse and the mainland Visitors Center.

The Sapelo Island Natural Area was also acquired in 1976 with funds from the Land and Water Conservation Fund (50 per cent) and state funds (50 per cent). The primary uses of this area of the island (south end) are scientific research, education and interpretation. Other uses of the Natural Area include hunting, fishing, beach use and picnicking. The term "natural area" is somewhat of a misnomer as this section of Sapelo has been heavily impacted by human activities over the last 150 years.

The most recent purchase of land on Sapelo was completed in 1993 when, through a combination of state and NOAA funds, the state acquired full interest in the 205-acre lighthouse tract on the south end of the island. This includes the 39 acres of upland on which the abandoned lighthouse is situated. This property is within the SINERR.

Economic activities.

Agriculture.

Agriculture on Sapelo Island dates back to its introduction by Native Americans. Later, fields were known to have been cleared for the planting of crops and orange trees in the area around the Spanish mission of San Jose, probably as early as the 1590s.

Although some planting was done on a small scale on Sapelo during the period before and after the American Revolution, it was not until the ownership of the island by Thomas Spalding and his family from 1802 until the Civil War that agricultural activities made a significant impact. An article in a planters' journal noted about 3,000 acres of natural prairie on Sapelo (Figure 10), with the rest of the island occupied by live oak and pine (Legare, 1833). Spalding drained the prairies and cleared much of the upland forests for planting purposes. He sold live oak timber to the government for shipbuilding with a scattering of individual live oaks left in the uplands to provide shade for the workers in the fields. The fields were abandoned to natural succession after the Civil War. Spalding raised Sea Island cotton, corn and sugar cane as his primary staple crops. He experimented with grapes, olives, indigo and mulberry trees. He grew gama grass, which the animals wouldn't eat; bermuda grass, Spanish bayonet for use as fencing for cattle, and cherokee roses as fences. Bermuda grass, Spalding's favorite, is still abundant on the island.

At the height of Spalding's agricultural efforts the southern half of Sapelo, including Kenan Field, was cleared of most of its natural vegetation except for the dunes and a band of woods along the salt marsh on the western side of the island. Live oaks and other hardwoods were left standing in areas near buildings, particularly the South End mansion, some undrained wet areas, and the scattered trees in the fields. Spalding died in 1851 and shortly thereafter many cultivated areas were abandoned. After the Civil War, the island began a slow return to nature. Agriculture was never pursued as extensively on the north end of Sapelo as on the south, although cotton and other crops were grown in cleared fields at Chocolate, Bourbon and small areas at High Point.

Cattle grazing was pursued heavily on Sapelo during the Reconstruction and early postbellum periods. During the Coffin period of island ownership (1912-34) there was a brief return to agriculture on a fairly large scale (cotton and subsistence crops). Dairy cattle were raised on Sapelo from the 1920s to the 1950s, and R.J. Reynolds ran a dairy on the south end of the island at the present Marine Institute complex until those buildings were donated to the University of Georgia in 1953. In 1948-49 the Soil Conservation Service, with the cooperation of Reynolds, diked about twenty acres of salt marsh south and east of the Marine Institute buildings and installed tidal gates. The facilities were in full operation by 1954. The purpose was to exclude salt water and improve the area for pasture and possibly other agronomic uses. Instead, the area became highly acidic and completely devoid of vascular plants, the surface bleached to a nearly white condition. In 1958-59, tidal water began to reach the twenty acres and soon, clumps of *Spartina* cordgrass appeared, increasing in number and size as time passed.

Timbering and timber management.

The cutting of live oak timber for shipbuilding purposes occurred on Sapelo Island from the 1790s until the early 1820s. Live oak from the Georgia barrier islands was much in demand by merchant shipbuilders, as well as the U.S. Navy Department for the construction of wooden warships. Neighboring Blackbeard Island was purchased by the federal government as a live oak timber reserve in 1800. Thomas Spalding contracted with northern shipbuilders for the cutting of live oak and pine on Sapelo (Sullivan, 2001).

Little timbering, except for island use, was done on Sapelo until the early 1920s when, during Howard Coffin's ownership of the island, the cutting of pine timber on a commercial scale was begun. Coffin had a sawmill on the island to process pine timber while providing employment for many members of communities. This practice was continued by the island's last private owner, Richard J. Reynolds, particularly during the 1950s when a good deal of north end timber was cut and sold. The remnants of the Reynolds sawmill and sawdust pile are still in evidence at the Lumber Landing on the Duplin River, a section of the island that years later became part of the Sapelo Island NERR. The selective cutting of timber, and related timber management programs, has been continued by the Georgia Department of Natural Resources.



Hauling timber on Sapelo Island, circa 1928.

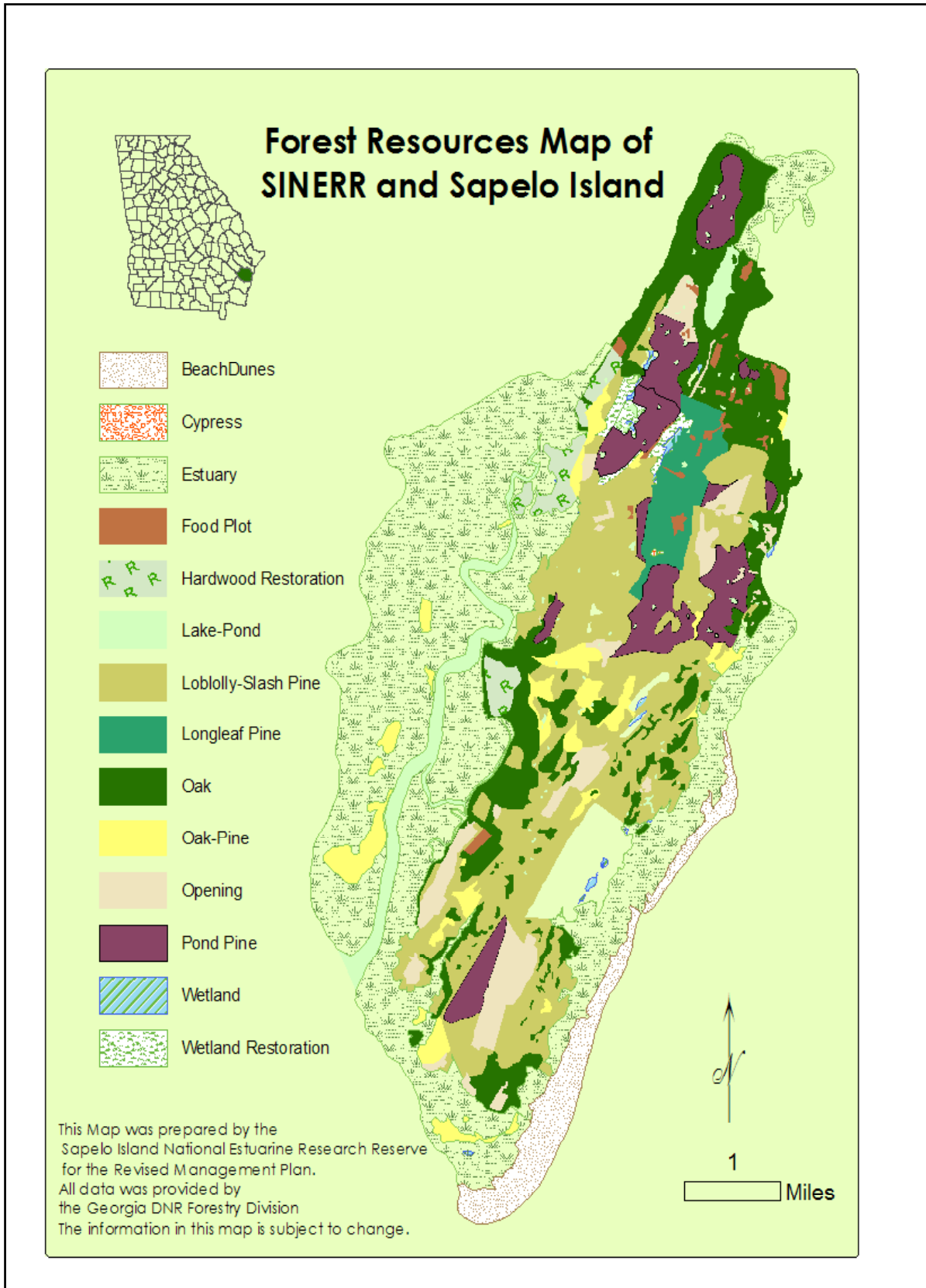


Figure 10.

Maritime culture: commercial fishing, boat building.

Boats were built on Sapelo by plantation slaves for fishing, transportation and recreational purposes during the first half of the nineteenth century. Wooden boats and dugout canoes were the only means of travel to and from the mainland and to the commercial center of Savannah via the inland waterway. Small coasting sailing vessels from Savannah and Charleston made regular stops at Sapelo Island to load baled cotton and tierces of raw sugar and molasses manufactured at the Spalding sugar mill. These boats usually came through Barn Creek from the Duplin River to load at the south end plantation complex. Sailing vessels, and later steamboats, stopped at High Point on the north end of Sapelo during the antebellum period to load with plantation goods from the Bourbon and Chocolate farm complexes. Small steamboats plying the inland passage between Savannah and the St. Johns River in north Florida regularly stopped at Sapelo High Point, Dobby Island and the town of Darien on the mainland both before and after the Civil War (Sullivan 2001, 2008).

The journal of Archibald McKinley, written on Sapelo Island during the 1870s, refers to small, but durable, sailboats being built on Sapelo for use by the Spalding family members in pursuit of their cattle business and agricultural activities on the island (Figure 10). The people who resided on the island at this time often visited the mainland by using the small sailboats built on Sapelo. Boats were built to withstand the rigors of navigating the often, rough, turbulent waters of Dobby and Sapelo sounds on either end of the island. These waterways provided the access to the mainland.

During the period of ownership of Howard Coffin, a boatyard was established at the south end of Sapelo near the present quadrangle complex. Small fishing craft (shrimp and oyster bateaux) were built in the 1920s on this site and a marine railway was installed to service the boats. Coffin also began a commercial shrimp and oyster cannery on Barn Creek (Sullivan, 2001). Island blacks built the boats, fished them and worked the cannery during the 1920s and 30s. Sapelo shrimp and oysters were marketed along the East Coast during this period.

In the R.J. Reynolds period on Sapelo, boat building continued. The best-known vessel to be built on Sapelo during this time was the *Kit Jones*, a 40-foot motorized wooden vessel built on the south end in 1939, which served as a ferry and utility boat for the island until the 1960s.

Archaeology.

The SINERR and its immediate environs are rich in archaeological resources. There are tabby ruins at Long Tabby and Hanging Bull, tabby slave quarters and other structures at Chocolate Field, and a number of prehistoric sites, particularly at Kenan Field, that have been investigated by archaeologists. Little Sapelo Island, the marsh, and Mary, Jack and Pumpkin hammocks, all within the Reserve, have not been surveyed for archaeological resources.

Prehistoric sites.

Kenan Field is the site of a 150-acre prehistoric village, featuring evidence of 589 shell middens, two earth mounds, and at least two complex community structures (Juengst, 1980). It has been extensively surveyed, but study of this site is not complete. No evidence of community structures such as those at Kenan Field has yet been uncovered elsewhere on the Georgia coast. This site provides a first view of a Savannah Phase aboriginal site and will be a point of comparison with similar sites that may be uncovered elsewhere (Juengst, 1980). Since Kenan Field had considerable agricultural use in the period of private ownership of Sapelo, archaeological evidence in the surface layers has been disturbed. DNR consults with the State Archaeologist to develop ways of managing the forest without further altering the archaeological record.

Another large archaeological site is located below the surface in a pecan orchard to the southeast of the Reynolds Mansion. Moses Hammock and the airfield also contain subsurface archaeological sites. These sites have been tested but not exhaustively studied. Current use of these tracts does not affect the archaeological resources. The uses of these areas are primarily recreational, including hunting, fishing, birding and hiking.

Historic sites.

Long Tabby, DNR's island administration building, and the Reserve's office headquarters, is built on the remains of Thomas Spalding's sugar works, which flourished during the first third of the 19th century (Sullivan 1999, 2001, 2008). The former tabby-built curing and boiling house was eventually adapted for office use. Ruins of the octagonal tabby sugar mill are located adjacent to Long Tabby. To its west lie the foundation of the storage house and the remains of Spalding's dock in Post Office Creek.

Past archaeological research.

Excavations were conducted at Kenan Field on the Reserve in 1976 and 1977 that documented the presence of several buildings that once stood in an Indian village on the site, as well as kitchen middens and burial mounds. Kenan Field is situated on an extension of land that juts out from the western side of Sapelo Island and fronts on the Duclin River. The site was mapped and extensively tested during the 1976 West Georgia College Archaeology Field School under the direction of the State Archaeologist Lewis H. Larson, Jr. No previous archaeological investigation at the site had been accomplished.

Archaeological investigations designed to test specific locational and cultural hypotheses were conducted at the site in 1977 (Juengst, 1980; Larson, 1991).

The most prominent feature at the site is a large mound, called Mound A, near the center of Kenan Field, with another, smaller, mound at the extreme southern edge of the field near the north bank of Barn Creek. There is a long, low earthen embankment that extends west to east across Kenan Field about 500 feet south of Mound A. The remains of middens (refuse heaps) are numerous throughout the Kenan Field village. These are recognized as low rises comprised

primarily of oyster shell. Almost 600 of these refuse piles are scattered over the village and they provide an important source of information about the diet of the Guale Indians. The 150-acre village is thought to have been occupied by the Guale between 1000 A.D. and 1600 (Juengst, 1980; Larson, 1991).

Archaeological research: Sapelo Shell Ring site, 2002-2006.

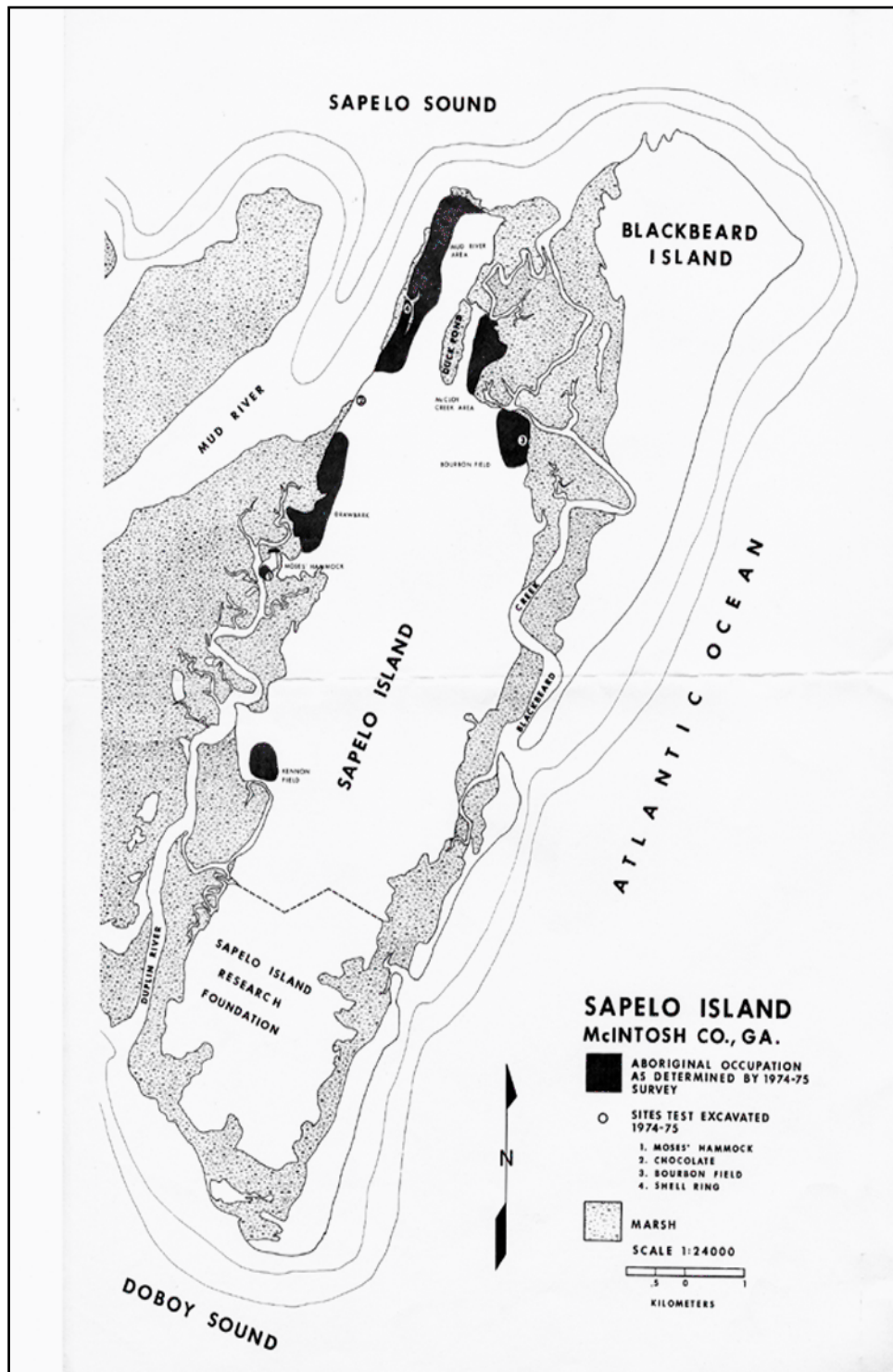
The Sapelo Shell Ring complex has received considerable archaeological investigation in the recent past (Thompson, et. al., 2004). While this unique site is not within the boundaries of the Reserve, the Reserve staff provided logistical support for the field investigations conducted over the course of three summers from 2002 through 2004, with follow-up work and data analysis conducted in 2005 and 2006. The Shell Ring complex is situated 1.4 miles north of the Sapelo Island NERR's uppermost boundary, off the West Perimeter Road overlooking Mud River toward the coastal mainland.

The salient finding from the results of this work established evidentiary proof of the presence of at least three distinct large ring-shaped shell mounds on the site, as well as smaller amorphous shell middens, whereas the earlier literature had consistently made reference only to the one large, predominant, shell ring.

The complex entails three distinct circular shell mounds, one of which is quite large and highly visible. Shell analysis and dating conducted from the 1950s onward (Juengst, 1980) determined that the use and construction of the Shell Ring complex dates to the Late Archaic Period, i.e. approximately 4,500-3,000 years B.P. Later groups also extensively utilized the site on Sapelo's north end during the Mississippian Period, as documented through investigations by Antonio Waring and Lewis Larson in the early 1950s. Waring and Larson excavated sections of the largest of the three shell rings, with Larson continuing similar work at the site over the next three decades.

More recently, the archaeological field investigations at the site from 2002 through 2006 yielded considerable data accrued toward an increased understanding of the Native American (Guale Indian) presence, not only on Sapelo Island during both the pre-Columbian period and the Spanish interregnum, but the Georgia coast as a whole. Native American influences on Sapelo Island, including within the boundaries of the SINERR, have been the subject of increased scrutiny by historians and archaeologists for over 130 years, but more so since 1975, shortly after State of Georgia acquisition of the island. The Shell Ring complex, as a consequence of the recent field work, was scrutinized for the first time with 21st century technology applied to the earlier concepts established by Waring and Larson (Sullivan, 2008).

Geophysical survey data were used to investigate the spatial distribution of the site's archaeological deposits and to evaluate appropriate geophysical techniques for use on shell-bearing sites (Jefferies, Thompson, et. al., 2004, 2005). Published reports divulged that the research at the Shell Ring site "has the potential to provide unique information on coastal hunter-gatherer community organization...remote sensing becomes not just a way to find buried deposits, but another line of data to examine behavior and social process (of Native American inhabitants of the island)..." (Jefferies, Thompson, et. al., 2004, 2005).



Sapelo Island archaeological sites, based on a 1975 survey.

Sites of Archaeological and Cultural Significance Within the SINERR

Site and Period, with Comments—

Moses Hammock, Indian site, prehistoric (has been investigated).
Kenan Field, Indian mounds, prehistoric (has been investigated).
Kenan Field, timber landing and abandoned sawmill, 1950s.
Hanging Bull, tabby ruins, ca. 1835, former cotton barn and African-American church, ca. 1865-1899.
Factory (Barn) Creek oyster cannery, 1920s (remnants of machinery).
Coffin Commissary, ca. 1920, former post office, (near cannery site).
Long Tabby mill (octagonal cane press), built 1809, oldest Sapelo tabby.
Long Tabby building (sugar boiling house), 1809, restored 1922 by Coffin.
Plantation docks, Long Tabby, ca. 1810, shipping point for cotton, sugar.
Slave quarters site (Behaviour, Bush field), early 1800s (some investigation).
Agricultural fields, early 1800s, island's largest cotton field, now airstrip.
Ashantilly (and other DNR residences), ca. 1922 (originally guest houses).
A.C. McKinley house, Post Office Creek (ca. 1880).
T. B. Spalding house (ca. 1880, Marsh Landing causeway).
Marsh Landing dock, 1928, present ferry dock, restored 1996.
Little Sapelo Island, tabby ruins (ca. 1830, probably cotton house).
Little Sapelo Island, caretaker's house, ca. 1925 (abandoned).
Jack Hammock, Duplin River, Reconstruction era, agriculture.
UGA Marine Institute, 1936-37, formerly Reynolds dairy complex.
Shell Hammock, Indian mounds, African-American community.
South end docks & marine railway, 1920s, 1930s, Coffin, Reynolds.
Coffin administrative building and dormitory, 1922 (abandoned).
South End House, 1810 (Spalding), rebuilt 1922-25 (Coffin).
South end Indian site, prehistoric (has been investigated).
Coffin greenhouse, south end, 1925 (restoration in progress).
Front range beacon, 1877, cast-iron structure, restored 1998.
U.S. Army gun emplacement, 1898, concrete foundations.
Sapelo lighthouse (1st site), built 1820, abandoned 1905, restored 1998.
Sapelo lighthouse (2nd site), 1905-1933, concrete foundations remain.
Brick oil houses (2), 1890 (1st site) and 1905 (2nd site), both restored 1998.

Contemporary Uses.

With the exception of the 434-acre Hog Hammock community and several small, scattered tracts of one or two acres each on the north end, all of Sapelo Island is a state-owned and state-managed property. The primary uses of Sapelo outside of the private community relate to scientific research and public education and recreation. All of these uses are managed and conducted by the State of Georgia.

Residential.

Sapelo's full-time resident population in 2007 numbered about 100 people. About a dozen permanent DNR employees, and their families, live on the island. On average, about 20 full-time island residents, including permanent staff, researchers and their families, are associated with the University of Georgia Marine Institute. Housing for the DNR and UGMI personnel lies within the SINERR. The population of the Hog Hammock community, which lies outside the SINERR, was 70 residents in 2007. A number of persons who live on the mainland, but who own property in Hog Hammock, have part-time residences in the community, primarily for weekend use.

Hog Hammock is a 434-acre tract of land, largely privately owned, in the south-central section of Sapelo Island (Figure 9). Hog Hammock and its relationship to the rest of Sapelo Island and the State's management thereof, are addressed in the Sapelo Island Comprehensive Management Plan prepared by the Georgia Department of Natural Resources in 1998.

Hog Hammock is isolated and remote by nature, hence its endurance as one of the most distinct centers of African-American culture left on the southern tidewater, particularly in light of heavy coastal development in other areas of the south Atlantic coast. However, the future of the community is threatened by lack of economic opportunities and employment on the island and the influx of new residents. The young people of Hog Hammock are moving off of the island to find jobs, and the new residents are buying and developing property, thereby changing the community's traditional identity. The Georgia Writers Project of the Works Progress Administration documented in 1939 and 1940 the legacy of African-American cultural and traditional values in an important and scholarly book still in print, *Drums and Shadows: Survival Skills of the Georgia Coastal Negroes*. The underlying theme of this significant work, much of which was researched and photographed in the black communities of Sapelo Island, is that the cultural and traditional legacies of Georgia coastal blacks should be preserved to the fullest degree possible.

Hog Hammock plays a role in the SINERR in several ways. A number of its residents are employed either directly by the SINERR or by the DNR's Wildlife Resources Division, which manages the SINERR, and by inclusion of the community in the cultural and historical interpretation of Sapelo Island during SINERR-conducted public, group and school tours of the island. SINERR-led tours regularly stop at one of several commercial establishments in the community to allow visitors to purchase snacks, drinks and island crafts. The crafts (sweetgrass

baskets, dolls, grapevine wreathes, etc.) are also sold at the Sapelo Island Visitors Center operated by the SINERR staff on the mainland. One of the key partners of the Reserve is the non-profit Sapelo Island Cultural and Revitalization Society (SICARS), based at Hog Hammock. This foundation provides much of the educational and outreach liaison with the mainland and conducts the Sapelo Island Culture Day festival each fall on the island, the major public event annually on Sapelo. SICARS has a seat on the SINERR's Advisory Committee.

It is the intention and future goal of SINERR management and staff to retain close ties to Hog Hammock through cultural interpretation, to give consideration of community residents when employment opportunities become available with the DNR, and in general, to provide support through effective and responsible communication between the community and the Reserve. The aforementioned issues facing Hog Hammock are addressed in more detail in DNR's Comprehensive Sapelo Island Management Plan.

Estuarine Research.

University of Georgia Marine Institute.

In 1953, the private owner of Sapelo, R.J. Reynolds, invited the University of Georgia to establish a program of scientific marine and estuarine research that could benefit from the island's resources. Reynolds provided the first facilities to UGA in his former farm complex on the south end of Sapelo, many of which continue to be in use today. Scientists from the world over have since come to the University of Georgia Marine Institute (UGAMI), attracted by the opportunity for studying estuarine and marine resources. Research at the Institute has generated over 1,000 scientific publications. In the fall of 2003, the University of Georgia School of Marine Sciences conducted a symposium in observance of the 50th anniversary of the founding of the Institute. During several days of proceedings a number of former scientists returned to Sapelo to reflect on their research on the island, particularly during the years of the 1950s, 1960s and 1970s.

By 1995, the Director of the Marine Institute, Dr. James J. Alberts, noted that 80 per cent of the UGAMI's scientific research by resident and visiting faculty members was being conducted within the Sapelo Island National Estuarine Research Reserve.

Many current theories about general ecology and the flow of energy in natural systems are based on research conducted here by the renowned ecologist Dr. Eugene P. Odum and others who have used the Marine Institute's facilities over the years. Important studies concerning the geological development of barrier islands and associated shoreline processes also were carried out at the Marine Institute. Other scientists who made significant research contributions in the early years of the Marine Institute were Robert Ragotzkie, Theodore Starr, Lawrence Pomeroy, Paul Burkholder, John Hoyt, Vernon Henry and John Teal. Bob Ragotzkie was the first director of the UGMI. George H. Lauff was the second director (1960-62), after which he became the first researcher for the Sapelo Island Research Foundation (1962-64). Vernon J. Henry was director of the Institute from 1964-70.

The ecological research on Sapelo Island has usually been directed toward field and environmental studies stemming from two important basic considerations: what are the water flow characteristics of the tidal salt marsh, and what is the importance of the vast expanses of salt marsh, *Spartina alterniflora*. (Ecological Site Profile, SINERR, 1997).

The early, foundational, research from the 1950s to the 1970s on Sapelo opened the window of understanding to the dynamics of the tidal salt marsh ecosystem in coastal Georgia, being conducted by biologists, chemists and geologists utilizing the Marine Institute as their investigative platform. Some of the early UGAMI scientists and their fields of study were John Hoyt and Vernon Henry (geological studies and barrier island migration); Milton B. (Sam) Gray, the first to systematically investigate the natural limestone ocean reef formation off Sapelo that later became his namesake; Eugene Odum, John Teal and Lawrence Pomeroy (marsh production and biological processes); Robert J. Reimold (vegetative changes through the use of high resolution aerial photography and imaging); Richard Wiegert (salt marshes and modeling systems); and Donald Kinsey (salt marsh outwelling produced by the tides from the ocean to the nearshore and inshore zones).

The Marine Institute is funded and staffed through the University System of Georgia. As with any other research facility, some of the financial support for the research is dependent upon funding which is available from sources such as the National Science Foundation and NOAA's Sea Grant and National Estuarine Research Reserve programs.

Staffing includes researchers, technicians, lab assistants, research vessel operators, administrative support staff and building and grounds crew. The staff now averages one visiting and seven full-time scientists, supported by five technicians. Students, researchers and visiting scientists also use the Marine Institute's facilities.

In 1976, the State of Georgia acquired from the Sapelo Island Research Foundation the south end lands which were designated as the SINERR and those acquired with Land and Water Conservation Funds. When DNR became the manager of these lands, it and the Board of Regents entered into a 50-year lease and an agreement whereby the Marine Institute's basic scientific research program could continue to use 1,500 acres of the SINERR without interrupting its research. In 1994, these documents were updated and extended, as well as amended, to transfer operation of the Main House from UGMI to DNR (Appendix F). The designation of the SINERR offered permanent protection for the Duplin River estuary, ensuring it would remain available indefinitely for applied scientific research and field investigations (Appendices F and G).

In 1997, the SINERR produced, through a contract with the UGA Marine Institute, a comprehensive Ecological Site Profile for the Reserve, which documents estuarine research conducted on the Reserve and outlines research needs for the future. This detailed field survey also applies to Sapelo Island as a whole (and Georgia barrier islands in general) and serves as a contiguous appendage to the Island CMP from the resource protection perspective. The preservation and protection of the salt marsh ecosystems of the SINERR is an underlying, and recurrent, theme throughout the SINERR Site Profile, which makes this document an important, and necessary, extension of the Island CMP.

Additionally, a review of the scientific estuarine and geological research on Sapelo, and within the SINERR itself, is reviewed in the SINERR Site profile.

Georgia Department of Natural Resources.

When the State of Georgia acquired the north end of Sapelo Island in 1969, DNR began wildlife and forest management activities designed to improve habitat diversity and increase populations of game and non-game wildlife species. DNR's Wildlife Resources Division has performed many survey, inventory and research tasks that are necessary for professional wildlife management. Wildlife Resources personnel have surveyed participants in managed hunts, regarding their satisfaction with the hunts. Deer and wild turkey are inventoried periodically.

DNR's Coastal Resources Division has at times sampled various fish and shellfish populations within the Duplin River estuary, conducting trawls to characterize the composition of the larger species of fish, crustaceans and larger bottom-dwelling animals in the Duplin estuary and, more recently (2001-04), to conduct field investigations relating to salt marsh dieback, with coordination and participation by the research staff of the Sapelo Island NERR (see Research and Monitoring plan, Chapter 8).

Recreation.

After the upper portion of Sapelo Island was purchased by the State in 1969, the Game and Fish Division (now Wildlife Resources Division) was given the responsibility of managing the island's resources. The vision of DNR is to manage, guide and promote the wise and responsible use of the state's natural, environmental, historic, archaeological and recreational resources, including hunting and fishing, for the benefit of Georgia's present and future generations. One of the management priorities of the DNR's Wildlife Resources Division on Sapelo Island is to meet the public's needs for wildlife-oriented recreation. By acquiring and developing lands such as Sapelo Island for wildlife management and recreation, DNR can meet these public needs. Lands within and adjacent to the Sapelo Island National Estuarine Research Reserve provide sites for a number of recreational and interpretive opportunities for the public. These areas include Cabretta Island Pioneer Camp and R.J. Reynolds Mansion. The Cabretta Camp is on the east-central section of Sapelo Island fronting on the Atlantic Ocean and is not within the boundaries of the SINERR. DNR's Parks Division operates Cabretta as a public pioneer campground facility. It is maintained by the staff of the R.J. Reynolds Mansion. The camp is a group use only campground. Groups of between 15 and 25 persons, primarily scouting and youth groups, utilize the camp the year around. The transportation to Cabretta from the Marsh Landing ferry dock is provided by Lodge staff. The camp includes public rest room facilities, with shower facilities, fresh water supply, fire rings, three Adirondack shelters and a trail to the beach. This camp is operated on a reservation basis with nominal user fees.

The R.J. Reynolds Mansion historic residence is the single most imposing structure on Sapelo Island and was built in the mid-1920s on the foundations of the original (1810) antebellum plantation house on Sapelo. The mansion is within the Reserve's boundaries. When the State of Georgia acquired ownership of the south end of Sapelo Island in 1976, it included possession of the house. From 1978 to 1994, the University of Georgia Marine Institute operated the Reynolds Mansion on a lease basis to educational, scientific and cultural groups for use as a conference center. Since April 1994, DNR's Parks Division (Lodge Authority) has managed and operated the Mansion. It has its own resident house manager and a housekeeping and grounds staff who are state employees and residents of the Hog Hammock island community. Although the house is within the SINERR, the Reserve Manager has no supervisory role with the Mansion operation. The Mansion is leased to groups for retreats, workshops and conferences. While on Sapelo groups utilizing the Mansion are occasionally provided lectures and interpretive tours by SINERR staff members. Groups also utilize the Reserve's two-mile Interpretive Nature Trail, which runs from near the mansion to the beach.

Public Tours: The SINERR coordinates the public tour program on Sapelo Island. Reserve and island tours are conducted by SINERR staff five days per week. Two to three days a week are generally set aside for public tours, with the other days reserved for school field trips and special group tours. The focus of the tours is on the ecological-environmental aspects of the SINERR. Barrier island ecology and geology in general are also emphasized, in addition to island history and archaeology. The tours are conducted in one of two Reserve tour vehicles, a 36-passenger air-conditioned bus acquired in 1994 with federal (NOAA) funds, and a 40-passenger school bus. Tickets for the SINERR tours are sold at the Sapelo Island Visitors Center on the mainland near the ferry dock. Tours of the Reserve originate from the mainland visitors center where visitors are able to gain insight on the natural and cultural history of Sapelo Island either before or after participating in their tour. The SINERR Education Coordinator has direct supervision of the public tour program, with assistance from the SINERR Interpretive Assistant (who is the primary tour guide), and summer interns. The Reserve Manager has overall supervision for the tour program and the operation of the Visitors Center.

Boating and Swimming: A federal navigational servitude extends over the waters surrounding Sapelo Island. Within the SINERR, the general public enjoys pleasure boating and recreational fishing. The public also uses for recreational purposes the beach on the south end of Sapelo Island. Swimming is permitted within the SINERR. The public tours of the Reserve include a short interpretive beach walk for shelling and wildlife observation.

Wildlife-Oriented Recreation: DNR conducts an average of eight managed in-season deer hunts (firearm and bow) on Sapelo Island each year in the fall and early winter. During two other periods (January through mid-March and mid-September through mid-October) hunters may freely travel in the portion of the SINERR that extends north of Barn Creek. The Moses Hammock campsite lies at the northern end of the SINERR and is used for hunters during the managed hunts on the island.

Sportsmen can hunt deer, turkey and small game on the Richard J. Reynolds Wildlife Management Area (Reynolds WMA), which DNR maintains as a wildlife

refuge on an 8,990-acre tract of upland comprising roughly the upper two-thirds of the island (Figure 9). A considerable portion of the SINERR's upland is located within the Reynolds WMA. The large white tail deer population leads to relatively productive hunter success rates. Fishermen use the creeks and marshes of the island, particularly those of the SINERR, for fishing, cast-netting and crabbing. Non-consumptive uses of the island include bird watching, boating, photography and outdoor research conducted by the Wildlife Resources Division.

Many visitors to the SINERR, whether they are on the public and special group tours or staying at the Reynolds Mansion facility, enjoy wildlife observation. Most visitors will see deer, alligators, turkey, squirrels, various forms of marine life and a abundance of birds. Many of these activities occur on the Reserve's Interpretive Nature Trail. Wildlife photography is also a significant recreational past time.

Commercial activities.

Timber Harvests.

At Lumber Landing on the western edge of the SINERR uplands fronting on the Duplin River, there is a commercial timber loading dock where harvested pine timber from Sapelo Island on state contract is periodically loaded on to a privately-operated barge and transported to the mainland, depending on weather and tide conditions. The selective cutting/thinning of pine forest timber was systematically conducted in various areas of the Reynolds Wildlife Management Area, including that small portion of the WMA that includes uplands within the boundaries of the SINERR. Georgia DNR's 50-year timber management plan (1995) outlined harvesting protocols and rationale and defined the timber cutting process as attendant to the ongoing restoration of Sapelo Island's natural live oak hardwood maritime forest, i.e. there would be no reforestation of pine timber in areas that had been thinned.

In 2005, it was established by the Wildlife Resources Division, upon the recommendation of the Sapelo Island Manager and the Reserve Manager, that DNR will no longer perform commercial harvest of pine timber on upland areas within the boundaries of the SINERR. Exceptions to the cutting of timber within the Reserve's upland boundaries will henceforth involve only unusual or extreme circumstances, i.e. pine beetle infestation, removal of diseased or dead timber, and routine prescribed burning attendant to effective forest management.

The Reserve Manager ensures that the SINERR forests are inspected as often as necessary to evaluate their health and the amount of combustible material on the forest floor. The DNR forester, after consultation with the Island Manager and the Reserve Manager, will schedule thinnings, major cuts, and controlled burns as required to minimize the risk of disease, insects or wildfire to Sapelo's forests and improvements. The hardwood forests within the SINERR will be excluded from harvest. Individual trees that die will be left as feeding, nesting and perch sites for the many types of wildlife that use them.

In addition, as part of the Reserve's research program, the Reserve will encourage scientists to submit proposals to study possible effects of the forest

management program on the reserve's aquatic resources. Such applied management studies are a major objective of the National Estuarine Research Reserve System.

Harvests of pine timber on lands outside the SINERR boundaries will be timed to prevent destructive outbreaks of disease, pests or fire. The forest resources are harvested on Sapelo Island using best management practices and in accordance with an approved timber management plan first adopted by DNR Wildlife Resources Division in 1974, and updated in 1995. This updated 1995 plan is a fifty-year habitat management plan that projects DNR's goals for timber management and habitat management on Sapelo Island, including lands within the Reserve. This plan says that following harvests of pine timber, the area harvested is to be managed with the objective of encouraging succession to a typical climax oak forest.

In addition to this 1995 habitat management plan, in 1992, Georgia Governor Zell Miller appointed the Forest Lands Technical Committee to review DNR's management practices on state-owned forested lands, including Sapelo Island and the SINERR. In its Executive Summary (1993), the Committee recommended that "timber cutting should occur only to further the management of the Sapelo Island ecosystem which includes the complementary practices which preserve and enhance the diversity of non-game species and ecological communities, as well as provide emphasis upon aesthetic surroundings for visitors to the island and remain within the Pittman-Robertson guidelines."

The state's (DNR) island management vision is further detailed in Chapter 4, "State Management Strategies for Sapelo Island, 2008-2013," particularly as it pertains to the Sapelo Island NERR.

Commercial fishing.

Commercial shrimping, crabbing and oystering from mainland-based fisheries, docks and packing houses take place in the waters of the Reserve and the nearshore Atlantic Ocean waters adjacent to Sapelo Island. Shrimp trawlers are frequently observed in operation from the beaches of the Reserve and transiting Dobby Sound en route to and from the fishing grounds offshore. Large fleets of shrimp boats are home-ported at nearby mainland communities such as Darien, Valona and Belleville. The commercial shrimping industry, and related activities such as marine railways, boat-building yards and ice houses, has been the economic mainstay of McIntosh County for several generations (Sullivan, 2001). For a period of years from ca. 1950 through ca. 1975, the county led coastal Georgia in the commercial harvest of shrimp. Commercial crabbing is particularly active in the Duplin River within the SINERR and in the waters of Dobby Sound adjacent to the SINERR. A minimal amount of commercial and recreational oystering is done in the area.

Maintenance Dredging.

A section of the federally maintained Atlantic Intracoastal Waterway (AICW) passes through a portion of the SINERR. Maintenance dredging is required to maintain the channel of the AICW bordering the Reserve at an adequate depth to support waterborne commerce. The Intracoastal Waterway is principally used by large pleasure craft transiting the coast from north or south, local recreational craft, commercial fishing vessels and commercial cargo-carrying barges towed by tugs. Dredging operations are conducted by private dredging companies under contract to the U.S. Army Corps of Engineers. In the waters adjoining the SINERR these activities occur on a periodic basis, usually every four to five years.

The Corps has maintained the Intracoastal Waterway in the area of Sapelo Island and along the Georgia coast since 1890. There is considerable documentation of maintenance dredging and dredge disposal operations in the area of the SINERR (Sullivan, 2001, 2008). The AICW transits the western side of the SINERR, from north to south, through Teakettle Creek at its juncture at the Dividings (east of the shrimping port of Valona). The AICW passes immediately west of Little Sapelo Island, the hammock lands and salt marshes that are part of the SINERR. The waterway then crosses Doboy Sound on the southern end of the Reserve before entering North River between Doboy Island and Rock Island (NOAA navigation chart No. 11510, Sapelo and Doboy Sounds).

Spoil material from maintenance dredging operations is not now being deposited on marshes or uplands within the SINERR. There are small spoil deposits along the eastern bank of Teakettle Creek, the southern portion of which is the western boundary of the Reserve, from dredging operations in the 1950s and 1960s. Some of these deposits bear the evidence of gradual plant succession, a few of which have evolved into small cedar hammocks that provide nesting habitat for various species of waterfowl and other nesting birds. Some short-term environmental effects, such as the temporary decrease in benthic populations, have been documented as the result of dredging operations in the past. However, the population usually returns over time to pre-dredge conditions. Turbidity, oxygen demand and nutrient concentrations in the water column also increase during dredging operations, but water conditions return to normal when dredging ceases.

3. Sapelo Island NERR: Mission and Goals.



Part Two

Mission, Goals and Objectives of the Sapelo Island National Estuarine Research Reserve

This section of the Sapelo Island NERR Management Plan identifies the basic mission of the Reserve and outlines eight overall goals and objectives that provide the framework for the work plans more fully reviewed in subsequent chapters of the document. Objectives and strategies for each of the eight overall goals are outlined in detail in the sector chapters following, specifically, Administration, Facilities, Public Access, Research, Stewardship, Education, Coastal Training and Volunteers.

3. Sapelo Island NERR Mission and Goals.

SINERR Mission:

To perpetuate the protection of the Sapelo Island National Estuarine Research Reserve and to provide a platform for conservation-based research, education and stewardship through the Reserve.

SINERR Vision:

A healthy estuary and coastal watershed for the Reserve where human and ecological communities thrive.

Goals and Objectives of the SINERR:

[NOTE: Goal-specific objectives, strategies and work plans for the Reserve are outlined in detail in the Administrative, Facilities, Public Access, Research, Stewardship, Education, Coastal Training and Volunteer components of this document, following].

Goal 1— To provide effective administration of the Reserve as necessary to fulfill the Reserve's mission as established in state and federal law, administrative rules and interagency agreements.

Objectives:

a. Ensure that all Reserve staff is state funded, with primary attention to the Research Coordinator position.

b. Develop a focused communications plan to ensure the effective flow of information and better programmatic understanding between the Reserve and Georgia DNR, the University System of Georgia and other partnering agencies affiliated with the Reserve.

c. Provide effective leadership structure for the Reserve while encouraging the development of effective staff skills commensurate with changing technology and enhanced training opportunities.

d. Ensure continuation of stable funding for Reserve programs.

Goal 2— To provide the publicly-accessible facilities necessary to fulfill the Reserve's mission as established in state and federal law, administrative rules and interagency agreements and to pursue the maintenance of existing infrastructure and the development of new permanent infrastructure as necessary during the 2008-2013 period.

Objectives:

a. To develop of a multi-use plan for the Reserve's portion of the on-island dormitory facility for accommodation of visiting researchers, educators and other persons conducting scientific or interpretive business within the Reserve, which require extended stays or multiple visits.

b. Increase the Reserve's available laboratory facilities for the enhancement of the SINERR's participation in the System Wide Monitoring Program, and for the additional purpose of providing the Reserve with its own lab rather than rely on continued use of facilities at the UGA Marine Institute.

c. Increase public awareness of the SINERR's educational and interpretive programs through greater, and more effective utilization of both the mainland Visitors Center facility and the on-island education laboratory.

Goal 3— To provide effective management of public access on lands and waters within the Reserve to properly assess and mitigate critical needs and island stresses that impact the Reserve.

Objectives:

a. Achieve consensus among Sapelo Island stakeholders, inclusive of DNR, UGA Marine Institute and island community entities, for the need to more effectively manage the degree of public access to the island.

b. Maintain the current (2008) levels of island access, with no increases, to the Reserve that fall under the direct jurisdiction and purview of the Reserve; encourage that similar approaches be adopted by other state (DNR, UGAMI) and civilian (Hog Hammock) entities on Sapelo Island that provide public access to and through the Reserve.

c. Achieve better knowledge and understanding of the growing impacts on island infrastructure and habitat created by the increased volume of visitation since 1998, as a means toward the effective, and sustained, mitigation of public access stresses.

d. Educate the general public as well as frequent user groups utilizing the island resource on the criticality of protecting the ecological resources of the Reserve and Sapelo Island and the need for preserving the resources for the furtherance and protection of scientific research and the provision of quality environmental education.

Goal 4— To enhance and develop research and monitoring to promote, foster and expand the scientific knowledge and field investigations of estuarine processes as related to the Reserve and the South Atlantic Bight, for the promotion of current research partnerships and the expansion of additional long-term partnerships.

Objectives:

a. To develop research and monitoring programs that promote program overlap through increases in partnership capacities, fiscal efficiency, educational and outreach foci and delivery into a cohesive understanding of coastal issues for dissemination to concerned public, and private and governmental entities tasked with developing collective programs that provide environmental issue resolution.

b. To promote and focus upon research and monitoring programs needed to qualify efficacy of restoration efforts in tidal areas of the SINERR, in addition to promoting long-term data acquisition of high quality habitats within the Reserve to be used as potential references sites for the broader coastal restoration practitioner audience.

c. To develop research and monitoring programs that provide natural resource management stakeholders with biological information related to the production, sustainability, impacts of harvest and management strategies and potential threats upon commercially important species within Georgia waters.

d. To develop research and monitoring programs promoting an enhanced understanding of mainland and coastal development contributions and impacts upon the chemical, physical and biological components of salt marsh ecosystem function.

e. To develop research and monitoring programs tailored to provide solutions to (1) the information needs of exotic species occurrence and control, (2) the effects of freshwater hydrological alterations and delivery upon the Reserve's estuarine systems, and (3) the extent of potential increases in pollution of Reserve waters, with each of these being examined within the context of climate change and sea level rise on local regional and national scales.

f. To promote and develop the SINERR SWMP program to include real-time viewing components for each SWMP station while meeting the overarching SWMP national goal of real-time International Ocean Observing System (IOOS) connectivity using GOES satellite telemetry for estuarine water and meteorological reporting to both the National Weather Service and the National Trends Network as a portion of the IOOS/SWMP buildout.

Goal 5—To maintain and continue to restore the integrity of the natural dynamic processes of the SINERR’s estuarine ecosystem, which is representative of the Carolinian biogeographic region.

Objectives:

- a. Protect Reserve resources for scientific research, monitoring and educational purposes,
- b. Reduce or minimize manipulative management control techniques for the promotion of unimpeded ecological processes.
- c. The restoration of Reserve habitats as designated by planning and improvement, and protection of degraded lands and aquatic areas, with their attendant flora and fauna, to a former, more natural condition.
- d. Develop and enhance the SINERR’s Geographic Information System (GIS) mapping and cataloging inventory and assessment of ecological habitat classification systems for availability on the Reserve’s website.

Goal 6—To increase, through education, outreach and interpretive programs, the awareness, understanding and appreciation of estuarine systems and estuarine stewardship by facilitating access to information about estuarine systems.

Objectives:

- a. To promote the message that Georgia’s coastal area is a product of natural forces, modified by human activities that require effective, long-term management and conservation.
- b. Concentrate SINERR’s educational/interpretive resources and training efforts on reaching audiences, including teachers and local media that will communicate their knowledge about estuarine and other coastal resources to many other people.
- c. Communicate with the general public through effective educational programming, interpretive exhibits, SINERR website, and printed literature.
- d. Extend the impact and reach of SINERR’s educational and interpretive program, both in the coastal region and statewide, by cooperating with other agencies and organizations that perform related tasks.

Goal 7—To provide a Coastal Training Program to reach target audiences for the provision of reliable sources of science-based information related to coastal issues that can be beneficial to area decision makers.

Objectives:

- a. Identify issues and areas of ecological and environmental concern for target audiences, with gaps in coastal decision-making processes regarding these concerns.

- b. Offer opportunities for program participants, including elected officials and other key constituents of target audiences, to network with area professionals and resource providers to foster information sharing and collaboration.
- c. Help target audiences understand and more effectively manage the impacts of human activities on Georgia's coastal resources.
- d. Document and evaluate coastal training programs to assist in the effectiveness and improvement of the SINERR training initiative.

Goal 8—To create new opportunities for members of the public through effective volunteer programs, to contribute to, and benefit from, Sapelo Island NERR through direct participation in Reserve operations and educational initiatives.

Objectives:

- a. Continue to nurture the Reserve's Friends of Sapelo volunteer organization to create knowledgeable "good will ambassadors" for the Sapelo Island NERR.
- b. Enhance and refine Reserve operational capacity as it pertains to education programming and administrative efficiency through volunteer interaction.
- c. Provide unique experiences and benefits to the Friends of Sapelo and other volunteer participants.

Strategic Initiatives for the Reserve, 2008-2013.

Five-year strategies and projections for the Reserve are elucidated in detail within the objectives of the respective sector chapters—Research & Monitoring, Education, Outreach & Interpretation, Stewardship, and Coastal Training Program, with accompanying strategic summaries.

State of Georgia (Department of Natural Resources, Wildlife Resources Division) management strategies for the island, as they affect the Sapelo Island NERR, are outlined in Chapter 4, Administration.

4. Administrative Framework and Plan.



View of Dobby Sound from the Lighthouse

4. Administrative Framework and Plan

Introduction.

The administrative framework for the Sapelo Island National Estuarine Research Reserve has been developed with recognition of the need for a high level of inter-and-intra-agency cooperation and coordination to achieve effective management of the Reserve. This framework is intended to foster cooperation by establishing avenues and regular opportunities for discussion and evaluation of Reserve management programs, issues and needs, as well as coordinating activities. It also identifies agency and staff responsibilities for the many Reserve management functions, including administration, research and monitoring, education and interpretation, stewardship, public use management, and land acquisition.

Each reserve is managed and administered through the dual partnership of federal and state entities. The Georgia Department of Natural Resources (DNR) manages the Sapelo Reserve in accordance with National Oceanic and Atmospheric Administration (NOAA) regulations 15 C.F.R. 921. Additionally, a memorandum of agreement between NOAA and Georgia DNR outlines the management responsibilities of both agencies (Appendix D).

Administering the SINERR is a complex task. The SINERR program interprets natural and historic resources, develops and delivers educational programs, performs and manages scientific monitoring and research, assists in the management of wildlife populations and forests, and carries out other operational activities required to deliver these services. No single work unit in state government has the expertise required to do all these things successfully.

National Estuarine Research Reserve System administrative framework.

The Estuarine Reserves Division of the Office of Ocean and Coastal Resource Management (OCRM) administers the reserve system. The Division establishes standards for designating and operating reserves, provides support for reserve operations and system-wide programming, undertakes projects that benefit the reserve system, and integrates information from individual reserves to support decision-making at the national level. As required by federal regulation, 15 C.F.R. Part 921.40, OCRM periodically evaluates reserves for compliance with Federal requirements and with the individual reserve's federally-approved management plan.

The Estuarine Reserves Division currently provides support for three system-wide programs: the System-Wide Monitoring Program, the Graduate Research Fellowship Program, and the Coastal Training Program. They also provide support for reserve initiatives on restoration science, invasive species, K-12 education, and reserve specific research, monitoring, education and resource stewardship initiatives and programs.

Sapelo Island administrative framework.

State laws, codes and regulations.

The Official Code of Georgia Annotated (OCGA), in Sections 27-1-6 through 27-1-20, empowers DNR to enforce conservation laws and protect resources on state property. The state, acting through DNR, "reserves to itself the exclusive right...of exploring, excavating, or surveying all prehistoric and historic sites" on state-owned lands, except for property under the jurisdiction of the Board of Regents (*OCGA* Sec. 12-3-52(a)). The State Archaeologist directs and coordinates archaeological research on state-owned lands and cooperates with the Board of Regents in research on land under its control (*OCGA* Sec. 12-3-53). DNR encourages archaeological research throughout the SINERR and Sapelo Island prior to any land-disturbing activity or any alteration to a structure or landscape. The 50-year lease and the operating agreements (Appendices D, E and F) between the Board of Regents and DNR guide the use of state-owned facilities leased to the Board of Regents. These documents and the SINERR goals and objectives establish the management and research responsibilities of the two agencies on Sapelo Island.

The State also regulates certain resource uses on lands in Georgia, whether state-owned or not. Several state environmental laws have special relevance to the SINERR.

The Coastal Marshlands Protection Act of 1970 authorizes DNR to regulate the alteration of coastal marshlands (*OCGA* Sec. 12-5-280 *et seq.*). This authority, plus the state's claim to own all marshlands except those for which a Crown or state grant can be proved, allows DNR to prevent detrimental alteration of marsh in the vicinity of the SINERR. The Marshlands Protection Act of Georgia is administered by Georgia DNR, which also manages the SINERR. The Reserve's natural resources (salt marshes, tidal creeks and embayments, etc.) receive close protection in this regard and any proposed alterations to marshes in the Reserve in whatever form must first be scrutinized and approved by the Marshlands Protection Committee of DNR.

The Shore Protection Act (OCGA Sec. 12-5-230 *et seq.*) regulates alterations of coastal sand dunes, beaches, sandbars and shoals to maintain their recreational value and their ability to protect real and personal property and natural resources from the damaging effects of floods, winds, tides and erosion.

The Game and Fish Code, a compilation of laws regarding fish, wildlife, and protected plants (*OCGA* Title 27), allows DNR to regulate the time and place of taking animals and fresh- and salt-water fish species. Another state law protects

sea oats, a species of plant that is important to the stability of the sand-sharing system (*OCGA Sec. 12-5-310 et seq.*).

Several state laws enacted by the Georgia Legislature protect water quality. The *Georgia Water Quality Control Act* (2006, as amended) delineates stringent requirements for protection of state waterways, lakes and streams and coastal waters, establishes requisites for permitting for discharge of pollutants into state waters and sets standards for wastewater treatment. The *Erosion and Sedimentation Act of 1975* requires permits for land-disturbing activities, defined as any land change which may result in soil erosion and the movement of sediments into state waters or onto lands within the state. The Georgia Health Code requires a permit to construct any type of individual sewage disposal system and regulates the kinds and designs of systems that may be used.

The State of Georgia claims ownership to the ordinary high-water mark (5.6 feet above mean sea level) in all navigable tidewaters. As authorized in *OCGA Sec. 50-16-61*, the Governor has general supervision over all the properties of the state, with power to make all necessary regulations for the protection of those lands.

The DNR Island Manager on Sapelo Island enforces the Game and Fish Code. The SINERR Manager enforces administrative policies of DNR pertaining to the Reserve and Reserve lands. The Reserve Manager and other SINERR staff travel throughout the SINERR on a regular basis. They observe human use and visible evidence, if any, of changes that such use may have on the SINERR. They recommend changes that may be required to protect SINERR resources adequately from overuse by residents and visitors.

Education is an important part of law enforcement. Brochures, signage and interpretive programs that the SINERR develops for the DNR describe the resources and the regulations that are in place to protect them. At present, the public visits the SINERR primarily on guided tours and managed hunts. Controlling public use and its impacts is not difficult under these conditions, but the SINERR's tour guides can teach visitors to minimize the local impacts of their presence at tour stops. The tour guides also learn much about visitors' awareness of estuarine resources—information that helps in designing brochures, signage and other educational tools.

State management of Sapelo Island and the Reserve.

The Game Management Section of the Georgia DNR Wildlife Resources Division has overall responsibility for the management, maintenance and operation of Sapelo Island. Its offices are located in the Long Tabby building with those of the SINERR. DNR provides the overall management for the Reserve. From December 1976 until August 1993, the Coastal Resources Division, followed by the Wildlife Resources Division, administered the SINERR. From September 1993 to May 1997, the Reserve was administered by the Parks and Historic Sites Division, after which it once again became part of the Wildlife Resources Division, Game Management Section. In May 1997, all of DNR's operations on Sapelo Island came under WRD, under the overall supervision of a resident island manager. The Commissioner of the Department of Natural Resources is the

overall SINERR coordinator and Advisory Committee liaison. He indirectly supervises the Island Manager to whom the SINERR Manager reports. The SINERR Manager's office is on Sapelo Island. This individual implements on a day-to-day basis the operations and activities of the Reserve.

State management strategies for Sapelo Island, 2008-2013, as they directly affect the Sapelo Island NERR are outlined at the end of this chapter.

Wildlife Resources Division.

The Wildlife Resources Division (WRD), Game Management Section, manages the wildlife and forests on Sapelo Island. It assesses wildlife populations and holds hunts for small game, turkey and deer. It censuses sea-turtle nesting and protects the nests from predators. It hatches, or rears, young bald eagles on the island, to which some will eventually return as adults to nest. Wildlife Resources also operates the passenger ferry and the supply barge, removes solid waste from the island, operates the Hog Hammock community's water-supply system, maintains the roads, performs many building repairs, repairs and maintains all of DNR's motor-vehicle equipment on the island, including the SINERR's tour vehicles, and operates the state-owned fuel facility for island vehicular needs.

The Reserve is a part of WRD, as are other DNR operations related to Sapelo Island, including the Visitors Center, Moses Hammock hunt camp and Cabretta Island, all of which are outside the boundary of the Reserve. Reserve full-time employees, whether state-funded or funded from the annual federal award, are state employees and part of WRD. The Reserve Manager and his staff are supervised generally by the Sapelo Island Manager. That position is responsible to WRD's Game Management Section (Region 7) Supervisor on the mainland in Brunswick, Georgia.

Coastal Resources Division.

The Coastal Resources Division developed the Coastal Zone Management Plan as described by the federal Coastal Zone Management Act of 1972. With Georgia's adoption of, and formal induction into, the nation's CZM Program in 1997-98, the CRD has the responsibility of ensuring that SINERR priorities are considered as the plan is implemented on the Georgia coast. The Reserve Research Coordinator will give preference to SINERR research projects which provide information useful in managing those coastal resources which the plan identifies as being critical.

The division also performs baseline monitoring of water quality and shoreline reconnaissance.

SINERR staff.

An adequate Reserve staff is essential to implement the Management Plan and to effectively achieve the Reserve's research, education and resource protection objectives. Reserve staff in 2007 included a core staff comprised of a manager, education coordinator, research coordinator, stewardship

coordinator, and coastal training coordinator. In addition, there are various support staff, including a Visitors Center manager and two clerks, interpretive assistant (SINERR tour guide), two monitoring technicians, a volunteer coordinator (part-time), a communications specialist (part-time) and two full-time office administrators who assist both the Reserve staff and the DNR Game Management Section staff on Sapelo Island staff. All Reserve staff interact closely with each other and with other DNR personnel on the island.

Staff Positions.

Reserve Manager—This full-time WRD position oversees administration of DNR's plans, policies and procedures for the SINERR, has day-to-day responsibility for managing the Reserve, and is supervised by the Island Manager. The Reserve Manager regularly consults with the NOAA/ERD program specialist and other NOAA personnel regarding NERRS policies and program guidance. The Reserve Manager acts as liaison to state and federal agencies, the SINERR Advisory Committee, and other interested groups to improve cooperation and coordination in implementation of the Reserve Management Plan; administers Federal and private grants and state contracts related to SINERR programs, including applications, performance reports and subcontracting; prepares annual budgets for Reserve operations, including monitoring of the annual NOAA grant award; is custodian of all Reserve property, including vehicles and other Reserve equipment; serves in a number of public relations capacities, including working with local, regional and state civic and governmental organizations and the news media; has overall supervision of the Reserve's research, continuous monitoring, education and resource protection programs; supervises the education coordinator, research coordinator, Sapelo Island Visitors Center manager, interpretive assistant, secretary and student interns, and recruits as necessary for these positions; additionally supervises the operation of the Sapelo Island/SINERR Visitors Center at the mainland ferry dock and the Reserve's tour, educational and public outreach programs; assumes chief responsibility for preparation and implementation of the SINERR Management Plan; and develops and manages Reserve facilities.

Education Coordinator—This full-time WRD position is under the direct supervision of the Reserve Manager and develops and distributes educational curriculum materials for use in schools, interpretive brochures and other publications; develops and coordinates special programming and activities related to education about estuarine processes among various public populations; supervises and oversees the interpretive assistant (SINERR tour guide) and volunteer coordinator; prepares film and audio-tape presentations; makes off-site presentations; assists with on-site tours and special events; conducts educational programs about SINERR, the NERRS and other estuaries that are oriented to teachers and other educators, students, local officials, coastal decision-makers and the general public; plans, promotes and implements teacher training programs; participates in as needed, the Reserve's Coastal Training Program; develops interpretive exhibits for the Visitors Center and other Reserve sites; recruits, trains and supervises student interns and coordinates the

Friends of Sapelo Volunteer Program; and participates in and supports national education efforts, attends NERRS educational workshops/meetings and incorporates national education guidelines.

Coastal Training Coordinator—This full-time WRD position was filled in 2003 in response to the Reserve's ongoing development and implementation of the NERR System's new Coastal Training initiative. The CTP Coordinator oversees the SINERR's training program in conformance with NOAA/ERD directives and protocols, and plans and coordinates all training workshops and related activities.

Coastal Training Assistant— This part-time assistant works under the direct supervision of the SINERR CTP Coordinator and assists with facilitation of workshops and training events, as well as the preparation for those events.

Research Coordinator—The Research Coordinator works under the direct supervision of the Reserve Manager and interacts with the University of Georgia Marine Institute on Sapelo Island, NOAA/ERD, and Georgia DNR to identify high-priority research projects to be accomplished within the SINERR. The Research Coordinator publicizes to research institutions and individual scientists the research opportunities within the SINERR and the high-priority research projects desired by NOAA and the Reserve; solicits research projects for possible funding by NOAA and coordinates all research and monitoring activities at the Reserve and develops and maintains working relationships with other research institutions and laboratories; directly supervises the continuous monitoring program in the SINERR; designs, conducts and supervises specific research and monitoring activities specified in the Reserve research and monitoring plan; trains and supervises research staff, interns and volunteers as needed; facilitates use of the Reserve for research by making available information, tools and resources for research and by coordinating access to research facilities; develops and disseminates information about the Reserve's research activities, opportunities and findings to researchers, coastal managers, educators and the public; and ensures that Reserve scientific equipment and data bases are properly maintained. This position directly supervises one fulltime and one part time monitoring technician at the Reserve.

Stewardship Coordinator—This position was filled on a fulltime basis in 2002 in response to new NOAA and NERRS initiatives to develop programs around wetland restoration efforts, habitat inventorying and Geographic Information System (GIS) programmatic development. The Stewardship Coordinator is responsible for all GIS initiatives, habitat cataloging and inventory, and restoration projects, while working closely with the Reserve Manager and Research Coordinator in implementing various initiatives.

Sapelo Island Visitors Center Manager—This full-time WRD position has day-to-day responsibility for the operation of the mainland interpretive center and is directly supervised by the SINERR Manager. This position supervises two clerks who work with the public to provide information to visitors.

Interpretive Assistant—This full-time WRD position has the primary responsibility of booking, coordinating and conducting public and special group tours and related events at the SINERR. This position also assumes various public relations and educational programming duties, and is supervised by the Education Coordinator.

Communications Specialist—This part-time (20 hours per week) position was filled in 2005 to facilitate public relations, marketing, media contacts and publications coordination for the SINERR and is supervised by the Education Coordinator.

Technical Assistant—This full-time position (initiated in 2004) reports directly to the Research Coordinator and is responsible for the collection, collation and transmittal of water quality and weather monitoring data to the Central Data Management Office, as well as the maintenance of all monitoring equipment at the four water quality monitoring stations and one weather monitoring station in the Reserve.

Monitoring technician—This part-time position works under the supervision of the Research Coordinator and assists the technical assistant.

Volunteer Coordinator— This part-time position manages the business and communications of the Friends of Sapelo, the SINERR's volunteer group, and works under the direct supervision of the Education Coordinator. The coordinator plans regular events and activities in support of the SINERR and prepares a quarterly newsletter for distribution among members.

Non-SINERR On-Island Support Staff—The *Island Manager*, a WRD employee, has overall supervision of DNR operations on Sapelo Island and supports the Reserve in various ways. This person devotes a portion of his duties to supervising DNR Game Management activities within the boundaries of the SINERR, specifically in the R.J. Reynolds Wildlife Management Area. These duties include coordination of managed hunts in the Reserve, directing maintenance and habitat manipulations, conducting forestry management activities and wildlife-related research. The Island Manager also coordinates public access to the island, approves or disapproves ferry and barge requests, supervises the island's ferry operation, the Hog Hammock community water system, the removal of solid waste from Sapelo Island and coordinates the state-operated barge between the island and the mainland.

The *general trades foreman* is a WRD employee who, along with a mechanic's helper, devotes part of his time maintaining and servicing the SINERR's vehicles, including tour buses, and is supervised by the Island Manager.

The *boat crews* include three ferry captains (one being a Senior Vessel Captain in overall supervision of boat operations) and several deck hands, all of whom are WRD employees, and who support the SINERR by operating the state ferry service from the mainland to Sapelo, thus facilitating public access to the Reserve for educational programs as well as transport of visiting researchers and their equipment.

DNR is the responsible agency for promoting and implementing coordinated enforcement of state regulations within the Reserve. A certified WRD *law enforcement ranger* resides on Sapelo Island and provides law enforcement protection for the island and its immediate environs, including the SINERR.

DNR Game Management is responsible for accomplishing maintenance tasks relevant to state-owned buildings, facilities, vehicles and other equipment on Sapelo Island.

SINERR Advisory Committee.

In order to facilitate effective coordination and cooperation among all interests involved with the Sapelo Island NERR, the Advisory Committee was reconstituted in 1994, after convening infrequently and irregularly from 1989 to 1994. Since 1994 the Committee has held regular meetings at least twice annually. In addition, meetings among members of the Committee's task forces on education and research are held at regular intervals. The purpose of the Committee is to provide information, advice and counsel for the Reserve staff in its programmatic activities, while also serving as a support entity for the Reserve within their own fields of expertise, particularly in areas of the state away from the Reserve. The Advisory Committee is comprised of individuals representing a variety of agencies, organizations and interest groups.

SINERR Advisory Committee Members, 2008:

Randal L. Walker, Ph.D., University of Georgia Marine Extension Service, Athens
Ben Hall, Sapelo Island (Hog Hammock) resident
Suzanne Forsyth, Citizen Member for commercial fishery, Valona
Clark Alexander, Ph.D., Skidaway Institute of Oceanography, Savannah
Kathy Chapman, U.S. Fish and Wildlife Service, Brunswick
Christi Lambert, The Nature Conservancy, Darien (Committee Chair)
Jerry McCollum, Georgia Wildlife Federation, Covington
Frank Tilton, Citizen Member for recreational fishery, Fairhope
Bill Landel, The Friends of Sapelo, Darien
Patty McIntosh, The Georgia Conservancy, Savannah
Steve McWilliams, Georgia Forestry Association, Forsyth
Bill Miller, Ph.D., University of Georgia Marine Institute, Athens/Sapelo Island
Margaret Olsen, UGA Marine Extension Service, Savannah (education)

Ex-Officio (non-voting) members:

James T. Hollibaugh, Ph.D., University of Georgia School of Marine Programs, Athens
Amy Clark, Estuarine Reserves Division (NOAA), Silver Spring, MD
David Mixon, Region 7 WRD/Game Management, Georgia DNR, Brunswick
Brad Gane, Georgia Coastal Zone Management Program, Brunswick
Fred Hay, Georgia Department of Natural Resources, Sapelo Island
Becky Shortland, Grays Reef National Marine Sanctuary, Savannah
Buddy Sullivan, Sapelo Island National Estuarine Research Reserve

The Commissioner, Georgia Department of Natural Resources, or his designee, appoints the members of the Advisory Committee based on recommendations of the Reserve Manager and the members of the Advisory Committee. Appointments to the Committee are for two-year terms with no limits for reappointment. The Advisory Committee meets two times annually on the third

Thursday of April and September. Meetings are advertised in advance and are open to the public. Extraordinary meetings of the Advisory Committee additional to the regularly scheduled meetings may be called by the Chairman of the Committee or by the Reserve Manager as necessary. Committee members and ex-officio members receive four weeks written notice of regular meetings and two weeks written notice of special or called meetings.

The Advisory Committee and its task forces serve in a strictly advisory capacity and are not responsible for the day-to-day operations of the Reserve. The activities of the Committee include several broad functions including advising on overall management practices and principles, research and monitoring at the Reserve, educational and interpretive programming, public access and public outreach for the Reserve and stewardship of the Reserve's natural and cultural resources. These activities include advising the Island Manager and the Reserve Manager on matters of policy relating to planning for and operation of the Reserve; providing guidance for establishing priorities for research and education efforts in the Reserve and review of information and educational materials generated by the Reserve; reviewing, monitoring and advising on specific program activities to be conducted in the Reserve to ensure they are consistent with the goals and objectives set forth in the management plan; advising on implementation of the acquisition strategy, and reviewing and providing guidance on management agreements; reviewing and advising on facilities development to ensure consistency with the management plan; appointing members of the research and education task forces, as recommended by the education and research coordinators, and establishing other task forces as deemed necessary; assisting in seeking support for funding for research and educational programs and other matters pertaining to the Reserve; conducting an annual review of the management plan, and representing the interests of the users of the Reserve, its neighbors and the users of information and educational materials generated by the Reserve.

The Advisory Committee meets at the Reserve or at pre-arranged alternate sites on the mainland with appropriate members of Reserve and island DNR staff. Meetings are scheduled to provide maximum opportunity to view seasonal variations at the Reserve. The Reserve staff makes available to the Committee appropriate reports and plans relating to operation of the Reserve and its educational and research activities for the period between each meeting. The Committee advises the Commissioner of DNR, or his designee, in writing of any recommendation resulting from each meeting. The Reserve staff serves as support and liaison to the Committee. Task forces will meet periodically and make recommendations to the full Committee.

The Research and Monitoring Task Force is comprised of appropriate SINERR Advisory Committee members and other technical representatives from the scientific and academic communities, and representatives from various state agencies including those from the fields of estuarine hydrology, wetlands ecology, wildlife biology and other fields as deemed appropriate by the Advisory Committee. This task force advises the full Committee and the SINERR Research Coordinator on research and monitoring and technical issues and activities relevant to the achievement of SINERR research goals and objectives. The task force provides advice on local issues and new opportunities for cooperative

research and monitoring, and evaluate overall progress toward achieving research and monitoring priorities and adjusting long-term directions. Task force members serve two-year terms with no limit on reappointments. The task force meets as frequently as needed at the call of the task force chairman and/or the SINERR Research Coordinator.

The Education Task Force is comprised of appropriate Advisory Committee members and other representatives from area institutions of education, including colleges, secondary schools, marine sciences programs and state agencies involved with education. The education task force is responsible for advising the full Committee and the SINERR Education Coordinator on annual priorities for education and interpretive activities at the Reserve, as well as public outreach activities on the mainland; providing guidance for the implementation of a comprehensive estuarine education program; working with the Education Coordinator to develop and refine the Reserve education program; helping promote Reserve educational activities and recruiting individuals and groups to use the facilities of the Reserve; helping develop sources of funding to sponsor educational activities; reviewing education proposals for programs, facilities, displays, media and curriculum publications; and monitoring progress of specific activities to ensure they are consistent with the goals of the Reserve program and management plan. Task force members serve two-year terms with no limit on reappointments. The task force meets as frequently as needed at the call of the task force chairman and/or the SINERR Education Coordinator.

Volunteers: The Friends of Sapelo.

In addition to regular staff of the Reserve, there are a number of local citizens of all ages and backgrounds who support the Reserve in various capacities as volunteers. Recruitment, orientation and work schedules for volunteers of the Reserve's educational, special programming and outreach activities are coordinated by the Education Coordinator. In 1994, the Reserve held public meetings in the local community for the purpose of organizing the Friends of Sapelo, the Reserve's official volunteer organization. During 1996 and 1997 the Friends of Sapelo made considerable progress in recruitment of members and delineation of support activities for the Reserve and have participated in a support capacity in a number of special events at the Reserve, such as building refurbishment on the Reserve, landscaping projects at the Visitors Center, construction of a salt marsh boardwalk on the Reserve and assisting SINERR staff when the Reserve hosted the national NERRS workshop and conference in November 1996. The FOS has its own treasury through the accumulation of membership dues, has its own officers and sets its own agenda with the advice and counsel of SINERR staff.

In 1997, the Friends of Sapelo developed a mission statement, which reads as follows: "The Friends of Sapelo is a non-profit volunteer organization created to support the research, education and outreach mission of the Sapelo Island National Estuarine Research Reserve (SINERR). In a broad sense, we are dedicated to the understanding, appreciation and stewardship of estuaries and associated coastal habitats. In particular, we are dedicated to the natural,

cultural and historical resources of Sapelo Island. Through our efforts, we seek to educate ourselves and others, thus securing a healthy future for our coast."

Administrative goal and objectives.

GOAL: Provide effective administration of the Reserve as necessary to fulfill the Reserve's mission as established in state and federal law, administrative rules and interagency agreements.

Objective: Ensure that all Reserve staff is state funded, with primary attention to the Research Coordinator position.

- **Strategy:** Continue to interact with Georgia DNR and impress upon the Department the viability and the desirability of full state support for the Research Coordinator position, stressing the contributions this position has made toward overall Wildlife Resources Division programs on Sapelo Island.
- **Strategy:** Impress upon Georgia DNR the desirability of full state support for the Education Coordinator position, based upon the statewide contributions evolving from the position over the last five years.

Objective: Develop a focused communications plan to ensure the effective flow of information and better programmatic understanding between the Reserve and Georgia DNR, the University System of Georgia and other partnering agencies affiliated with the Reserve.

- **Strategy:** Establish enhanced linkages for better exchange of ideas and information between the Reserve and Georgia DNR state management headquarters staff through consultations, visitation, workshops and programming; facilitate similar approaches to other partners.

Objective: Provide effective leadership structure for the Reserve while encouraging the development of effective staff skills commensurate with changing technology and enhanced training opportunities.

- **Strategy:** Provide funding for professional training and enhancement for staff members.
- **Strategy:** Provide a mutually supportive staff concept through the free exchange of ideas, information sharing and staff retreats for team building and programmatic planning.

Objective: Ensure continuation of stable funding for Reserve programs.

- **Strategy:** Work with Georgia DNR to acquire additional state funding as necessary for capital outlay and program enhancement.

- **Strategy:** Seek extraneous grant funding for special non-SWMP related research projects anticipated for the period 2008-2013.

State (DNR) Island Management Strategies.

Coordination between the SINERR, the University of Georgia Marine Institute (UGAMI) and DNR's Wildlife Resources Division (WRD) is essential to the success of each program on Sapelo Island. While WRD is primarily responsible for providing logistical operations and maintaining island infrastructure, SINERR and UGAMI have legitimate interests in how these activities are carried out. WRD has therefore implemented processes that ensure SINERR's direct input into WRD annual planning. Input is solicited at various times throughout the planning process to identify and avoid potential conflicts arising from on-island management activities.

Timber Management—Specifically, the Reserve Manager has been incorporated into the annual review of WRD's Forest Management Unit's Annual Harvest Plan for Sapelo Island. This plan is reviewed in late winter or early spring before being finalized by the Forest Management Unit. During the review, potential conflicts are identified by SINERR staff, through the Reserve Manager, and submitted to WRD through the Island Manager. Harvest plans show location and type of harvest to occur. Harvest areas are mapped over aerial photographs for easy identification of boundaries, existing research sites, etc. In a similar process, annual burn plans are submitted to the Island Manager and reviewed by SINERR staff to identify potential conflicts. On-going research interests in particular are protected through this review process. In a similar vein, scientific research initiatives implemented by the SINERR research coordinator, and field investigations conducted under the auspices of the SINERR, will be more fully integrated into the increased understanding and effectiveness of the management and stewardship of Sapelo Island's ecological resources.

Island Access—The Island Manager will continue to work with the Reserve Manager to deepen WRD's understanding of SINERR research and education objectives as set forth in the Reserve management plan. This will be done primarily through interactions between on-island management and WRD representatives at the Region and State levels. These interactions are deliberate but usually informal in setting. In concert with this interaction is, and will continue to be, the ongoing communication between the Island Manager and the Reserve Manager, and other island entities, in mitigating the stresses placed on Sapelo Island infrastructure and habitat occasioned by increased public access and visitation from venues outside the control and/or coordination of the Reserve and its staff. Many of the island access stresses have been accentuated by the increased visibility and public awareness of the island. These have usually occurred through various media venues, with the consequent growing interest of the general public in visiting Sapelo. Much of the increase in visitation has been precipitated by the growing and developing entrepreneurial ventures by civilian residents of the Hog Hammock community and by the frequent contracting by

private residents with outside firms, such as charter boat services, to bring increasing numbers of visitors to the island. One of the great challenges facing DNR/WRD management on Sapelo will be assessing and addressing the establishment of balances and protocols to reduce, or mitigate, island impacts on the natural habitat and scientific research areas, while also ensuring the economic stability, viability and community survivability of Hog Hammock.

In November, 2006, the Game Management Section of Georgia DNR/WRD placed into operation a new ferry vessel, constructed to DNR and island needs and specifications to incorporate the latest innovations in technology, operations standards and standards of safety and efficiency. A key consideration in the planning for this new vessel revolved around the clear understanding in discussions between the Island Manager, SINERR Manager and Vessel Operations Supervisor that the carrying capacity of both the new vessel and the island itself would not be increased, either by implementing a passenger load increase, or by instituting additional ferry runs. The new ferry, while slightly larger than the vessel it replaces, nonetheless has an identical Coast Guard-certified passenger carrying capacity of 149 persons maximum load per run.

Despite these and other considerations, the residual pressures for increased access to, and public use of, Sapelo Island continue to be critical issues of concern confronting virtually every aspect of the Sapelo Island community, including DNR, the UGA Marine Institute and the Hog Hammock community. Island managers and senior DNR management at the regional and state levels will continue in the next several years to explore effective ways to expedite the delicate, and occasionally contentious, balance between the responsibility to ensure the protection of Sapelo Island's environmental resources and the preservation of the island and its estuary as a primary platform for the conduct of scientific field investigations, while also providing the necessary (and, by law, mandated) public access to the island for education, outreach and recreational activities whether promulgated through DNR, SINERR and UGAMI personnel, or those of the private Hog Hammock community.

These and related island management issues are treated more in depth in Chapter 7, Public Access, of this Management Plan.

Interagency Cooperation—Coordination between the UGA Marine Institute and the Hog Hammock island community will be further enhanced through both formal and informal processes. The Conflict Resolution Committee has been reconstituted and is designed in part to address issues that involve multiple island interests. This Committee is comprised of the Sapelo Island manager, the SINERR manager, the Marine Institute director, the Reynolds Mansion manager and two representatives of Hog Hammock. Additionally, the SINERR and the Marine Institute have two Memoranda of Agreement for scientific interaction between the two agencies (Appendices F and G).

5. Facilities.



Long Tabby Complex

Sapelo Island NERR Administrative Offices,
Dock & Education Laboratory

5. Facilities.

The Sapelo Island Reserve's physical facilities consist of all buildings, utility and access roads, trails, and similar installations on the Reserve, together with related operations and maintenance equipment. This section discusses existing conditions, perceived needs, and management issues, and planning for facility management.

Facilities overview.

In 1995, the Sapelo Island NERR completed the construction of a self-guided one-mile (one-way) Interpretive Nature Trail on the south end of Sapelo Island, running from near the R.J. Reynolds Mansion through the upland maritime forest, salt marshes and dune and beach areas. Like the mainland Visitors Center, the new nature trail provided the Reserve with a valuable and much-needed educational and interpretive tool. This trail initiative was facilitated with NOAA construction grant award funds.

In 1996, the Sapelo Reserve staff occupied and began operations at its new Interpretive Visitor Center on the mainland at the Meridian ferry dock. This facility (described below) provided the SINERR with a much-needed mainland outreach center, a staging center for public and group tours of the SINERR and a facility to conduct on-site outreach educational programs and activities, roles it continues to play even more effectively in 2007. This was a state-funded facility.

A third facility development goal was achieved in 2000, that being the completion of the renovation of the former boys camp dining hall building at Long Tabby on Sapelo Island as an on-island education classroom and laboratory. The Reserve Manager and Education Coordinator, with the support and counsel of the Reserve's Education Task Force and Friends of Sapelo volunteer group, implemented these plans. NOAA construction grants totaling \$149,000, coupled with a \$64,000 matching grant from the state of Georgia, were utilized in 1997 and 1998 to achieve much of the work on this facility. The boys camp building received new public restroom facilities in 1996. Expansion of this facility included the installation of an audio-visual area and a wet lab with attendant scientific equipment, including microscopes and related items to enhance the Reserve's educational programs.

In 2003, SINERR received a \$400,000 NOAA construction award to be applied toward the construction of a new research dormitory and dining facility on the Reserve, in cooperation with the University of Georgia School of Marine Sciences. The University's Board of Regents approved the requisite matching funds, in addition to obtaining additional funds in the amount of \$1.3 million from NOAA. Ground was broken on this new facility in the spring of 2005, and the Reserve occupied this long-awaited and much-needed facility in 2007.

The Reserve anticipates seeking additional NOAA construction funds and state matching monies for the construction of a comprehensive research and monitoring laboratory on Sapelo Island at Long Tabby, near the existing Reserve administrative offices and educational laboratory.

General policies for facility construction.

Much of the building construction on the Sapelo Island Reserve is, and has been, facilitated by the design and construction unit of the DNR's Parks and Historic Sites Division. Architects, engineers and building contractors are secured by DNR through a standard bidding and selection process. Actual building construction is facilitated to follow design schemes and concepts that are compatible with the barrier island environment and aesthetically appealing to follow the coastal scheme and Sapelo Island in particular. This is particularly applicable through the uses of building materials that are synonymous with the coastal Georgia region, such as cedar and pinewoods and tabby construction. These building principles apply both to on-island structures constructed by DNR on the Sapelo Reserve as well as DNR mainland facilities. The latest in protocols reflecting environmentally friendly construction techniques and guidelines are strictly adhered to by the Reserve in all its facilities projects, regardless of the size or scope of the project.

It is also the policy of the SINERR to ensure that all construction/restoration conducted on the Reserve adhere to the local and state building codes and building safety codes. In all instances, including the new mainland Visitors Interpretive Center, Interpretive Nature Trail and new Long Tabby restroom facilities, SINERR's new construction and restoration is made to adhere and be compatible with state and federal ADA requirements regarding handicapped accessibility.

Existing facilities.

Sapelo Island Visitors Center.

In 1994 the Georgia General Assembly approved state funds in the amount of \$750,000 for the construction of a Visitors Interpretive Center for Sapelo Island to be built on the mainland near the Sapelo ferry dock. This Sapelo Island Visitors Center is the primary public outreach facility for the Sapelo Island National Estuarine Research Reserve. The SINERR staff is responsible for the design, management and daily operation of the center.

Construction of the 3,500-square foot elevated building was completed in late 1995. The Parks and Historic Sites Division of Georgia DNR provided an additional \$100,000 in state funding for the design and construction of ecological and cultural exhibits for the center, while another \$10,000 was provided by the Grays Reef National Marine Sanctuary for an exhibit. The new facility was formally dedicated and opened to the public in May 1996.

Facilities Inside the SINERR Boundary



- 1 Moses Hammock Hunt Camp
- 2 Kenan Field Timber Dock
- 3 Barn Creek Dock
- 4 DNR Residences
- 5 Fuel Facility
- 6 Post Office Dock
- 7 Long Tabby Education Laboratory and Administrative Offices
- 8 Landing Field
- 9 Marsh Landing Dock
- 10 University of Georgia Marine Institute and SINERR Research Dorm
- 11 R. J. Reynolds Mansion
- 12 Lighthouse and Lighthouse Trail

Figure 11.

The Sapelo Island Visitors Center is of construction compatible with the coastal Georgia environment and is situated adjacent to the salt marshes and tidal estuary overlooking Sapelo Island. It is within easy walking distance of the dock to the Sapelo Island ferry, which provides the primary public access to the Sapelo Reserve. The Visitors Center serves as the departure point for public, group and school tours of the Reserve and is also a primary outreach facility for the public. The Center includes an exhibit hall focusing on barrier island ecology and the natural history of Sapelo Island and the Reserve in particular, exhibits relating the management of Sapelo Island and the SINERR by DNR and NOAA, Gray's Reef National Marine Sanctuary, University of Georgia Marine Institute, the African-American Hog Hammock community, and a historic timeline tracing the human occupation of Sapelo Island is on display at the center.

The Center has a 50-seat audio-visual room for lectures, special programs, films and slide presentations, as well as public meetings relating to Sapelo and the SINERR, and handicap-accessible restroom facilities and entrance and exit ramps and boardwalks. Decks overlooking the marshes provide visitors with views of the Sapelo estuary.

Tickets for public tours of the SINERR are sold at the Visitors Center. The Center and its operations are under the overall supervision of the Reserve Manager. Three full-time persons, including a site manager who is responsible to the Reserve Manager, staff it.

On several occasions from 2001-2007, the interpretive exhibits at the Visitors Center have been modified and upgraded to reflect changing trends and dynamics associated with the programs, missions and activities at the Reserve and at Sapelo Island in general. The exhibit improvements also reflect the latest technologies and are partially funded from the annual NOAA educational award.

Visitors Center boardwalk and nature trail.

NOAA construction grant funds to SINERR in 1998 were identified, to be utilized for the construction of a \$60,000 handicap-accessible boardwalk and nature trail through the upland maritime forest and tidal salt marsh in and around the mainland Visitors Center. This project was completed in 2001 and has provided an enhanced educational experience for the public, particularly visiting school groups. Interpretative signs and an observation platform overlooking Hudson Creek and Doboy Sound were constructed, largely through the efforts and initiative of the Visitor Center manager.

Long Tabby Education Laboratory.

In 1996, DNR began the conversion of this building for use as an on-island interpretive center at Long Tabby, adjacent to the Reserve's administrative offices. New handicap-accessible public restrooms for this building were completed for visitors to Sapelo on the SINERR's guided tours of the island. In 1998, the Reserve was awarded by NOAA/ERD a construction grant of \$149,000, matched with state funds of \$64,000 to convert the building into an education laboratory. This project was completed in 1999 with restoration of the 3,000-

square foot building for use as (1) an audio-visual room classroom-meeting room, and (2) an educational laboratory equipped with appropriate scientific equipment, including microscopes, aquaria, work stations and other items for use in the SINERR's outreach and research/scientific monitoring programs.

The Reserve education staff is housed in this facility, which has had frequent use for on-site interpretation, study, conferences and lecture programs, a role that is expected to continue with the expansion and development of the Reserve's outreach activities (see education section of this document). School groups, particularly grades five through 12, utilize the lab during the Reserve's on-site marine and ecological interpretive programming several times each week.

SINERR research dormitory.

The Reserve and the University of Georgia entered into a cooperative agreement in 2002 for the construction of a joint-use dormitory facility to house scientific researchers and education groups. Upon application, SINERR received \$400,000 in construction funds from NOAA to be applied toward the dormitory project, with the University of Georgia School of Marine Sciences contributing a state match of \$175,000. Additional NOAA funds were acquired in a separate grant to the UGA School of Marine Sciences. Work began in the spring of 2005, with construction proceeding from that point. The new dorm, on the campus of the UGA Marine Institute (within the SINERR) was completed and ready for occupation in the summer of 2007.

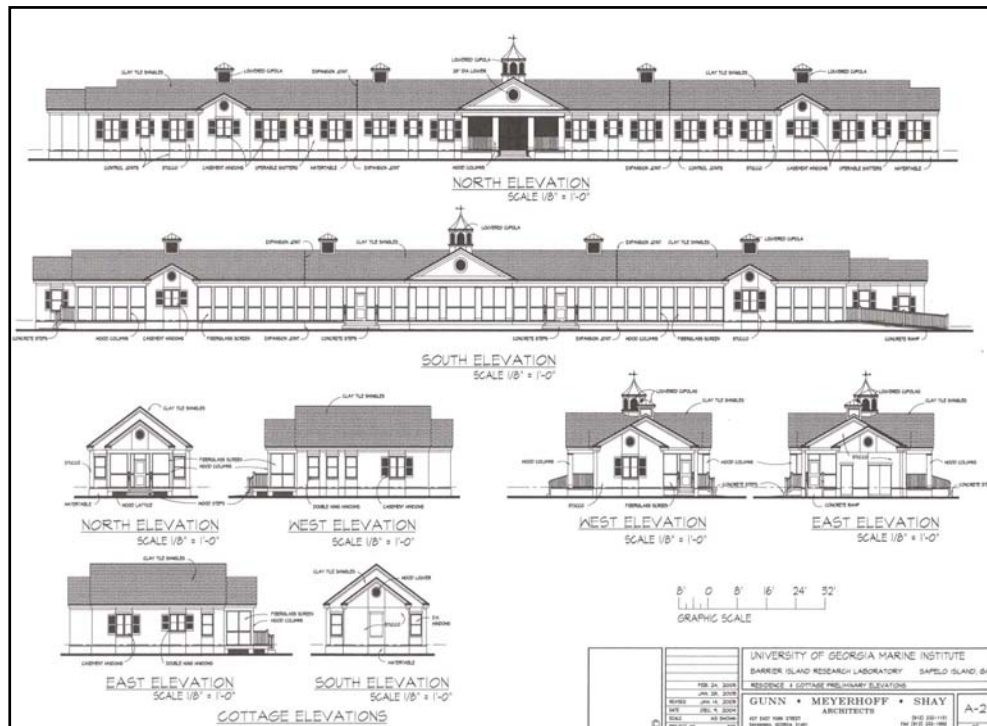


Figure 12.

Under the conditions of a Memorandum of Understanding (Appendix F) between SINERR and UGAMI regarding the joint use of the dormitory, SINERR will have permanent control and use of a two-bedroom, four-bed apartment with fully-equipped kitchen and bath and a furnished living area. The Reserve will also have use of the entire facility when needed to host NERRS meetings and workshops. Per the agreement, this facility will be managed and maintained by the staff of the UGAMI.

SINERR administrative offices at Long Tabby.

The Sapelo Island NERR administrative office, the DNR Wildlife Resources/Game Management Section office and several state residences occupy a 28-acre upland tract which lies between the northwest end of the landing strip and Post Office Creek, just south of Riverside Canal, within the Reserve. The creek takes its name from the Sapelo Island post office, which is located on this tract. The administrative center for the DNR and the SINERR are located in the Long Tabby building, a structure which is a restored sugar mill built of tabby by island plantation owner Thomas Spalding in 1809. Tabby ruins of the old sugar cane press are located immediately north of the Long Tabby office building, restored to its present configuration by island owner Howard E. Coffin in 1922. The DNR shares the building with the U.S. Post Office, also located in the structure. A garage/shop building, two additional DNR staff residences and two docks are other DNR facilities located in this section of the island.

Long Tabby, consisting of two stories, each measuring about 25 x 100 feet, is the main administration building. It contains the Reserve's Geographic Information Systems laboratory (see also UGAMI below), Stewardship Coordinator's office, Reserve Manager's office, Research Coordinator's office, Coastal Training Program office, DNR Game Management Section offices for Island Manager and Reserve/WRD administrative staff, and a ferry operations office. In addition, the Sapelo Island Post Office is located in the Long Tabby building, along with a two-bedroom upstairs apartment for use by visiting state employees, Reserve summer interns and others.

Island fuel facility.

Also in the Long Tabby vicinity, and within the Reserve near Barn Creek, is the DNR-operated island fuel facility, constructed in 1998. During this project, DNR shifted its island fuel operations to this location from their previous location in outdated facilities and tanks at the Marine Institute on the south end of the island (within the Reserve). The Barn Creek fuel facility is the only island fueling station and is utilized by state personnel and island residents alike. These facilities meet all requirements and regulations of the state Environmental Protection Division.

Consistent with findings in the 2000 Section 312 review of Reserve operations by OCRM, a comprehensive fuel spill response plan for the new facility was prepared by the DNR, copies of which were provided to NOAA/ERD, the U.S. Coast Guard, and the Georgia Coastal Zone Management Program.

Fuel for this facility is periodically barged from the mainland in conventional fuel tanker trucks, which are unloaded at the Lumber Landing timber dock.

The fuel facility is equipped with state-of-the-art monitoring devices that are programmed to provide alerts around the clock to island WRD staff and mainland DNR officials. This facility provides fuel for the Reserve's tour buses and staff vehicles, as well as for other DNR staff on the island, UGA Marine Institute and private residents of the Sapelo Island community.

R.J. Reynolds Mansion (South End House).

On the south end of the island, within the SINERR and adjacent to the Marine Institute complex, is the former R. J. Reynolds mansion, known historically as the South End House. It is the single most imposing manmade structure on Sapelo Island. The first house on the site was built by Thomas Spalding in 1807-10, with a complete restoration upon the original foundations implemented by Howard E. Coffin, 1918-1925. (For a history of this structure see the Sapelo Island historical overview in Chapter 2). The mansion is owned by the state and is operated by DNR's Parks Division. Day-to-day operations are overseen by a resident manager. The Reynolds Mansion is leased to groups for retreats, workshops and conferences and can provide lodging for up to 30 people. State employees, many of whom live in the island community, manage the mansions operations. DNR also utilizes the mansion for interpretive purposes, and it is open for viewing by the public on the SINERR-conducted tours of the island.

A paved road runs southeasterly from the Reynolds Mansion and ends on Nannygoat Beach beside a restroom, a boardwalk dune crossing, and a raised picnic pavilion. A prehistoric archaeological site lies just south of the road, below the surface in a pecan orchard southwest of the mansion. A short distance from the mansion is the start of the SINERR Interpretive Nature Trail, which runs approximately two miles through various barrier island ecologies to Nannygoat Beach (see below).

Since 1995, the Reynolds Mansion has undergone a phased restoration. A charitable citizens' organization (Sapelo Island Restoration Foundation, Inc.) raised \$4 million required for restoration of both the mansion and the brick lighthouse at Sapelo's south end. Since both the mansion and the lighthouse are located within the Reserve, SINERR management and staff have been involved in the planning of restoration activities on these structures.

University of Georgia Marine Institute (UGAMI).

The Marine Institute campus is located on a 1,500-acre tract of upland, salt marsh, sand dunes and beach, which encompasses much of the southern end of the Sapelo Island National Estuarine Research Reserve. This parcel also contains most of the major structures on Sapelo Island. It is subject to the 50-year lease between DNR and the Board of Regents, renewed in 1994 (Appendix E). The other 75 acres leased by the Marine Institute lie within the area acquired with Land and Water Conservation Funds. The lease provides that the Marine Institute will use the premises to conduct scientific research.

Several staff residences, a small trailer complex and a utility building occupy a tract of high ground known as Shell Hammock, which overlooks Dobby Sound just west of a diked enclosure built by R. J. Reynolds. To the east of this enclosure

lies the hub of research activity, the Marine Institute Laboratory, which occupies a large brick and stucco former dairy barn built by Reynolds in 1937. The laboratory building houses the primary research facilities for the UGA Marine Institute; also in this structure is a small theater, faculty offices and a marine science library. The Marine Institute campus is built around a quadrangle complex with most of the buildings constructed in the mid-1930s by R.J. Reynolds on the site of a former farm and stable compound.

Support facilities for the laboratory include general-purpose storage buildings; an inoperative power plant built in the 1930s; microwave building and tower; carpentry and machine shops; a marine railway built in the 1920s, currently inoperable; apartment residential building on the quadrangle; an administrative building; research and education dormitory (built in conjunction with the SINERR); a residential area (Shell Hammock) for permanent staff; and a trailer complex for interns and visiting students and faculty.

The SINERR maintains a GIS Laboratory in the main lab of UGAMI in partnership with UGA. The SINERR Stewardship Coordinator manages the GIS facility through a cooperative agreement with UGAMI.

The Marine Institute will continue to use and maintain the structures on this tract for scientific, educational and residential purposes as specified in the approved lease and operating agreement (amended) between DNR and the Board of Regents (Appendix E).

Residences.

Four DNR residences face the estuary's east side near Barn Creek within the Reserve, and another is located near the Marsh Landing ferry dock.

The Marine Institute operates the Azalea Cottage (Coffin era structure) for UGA officials, guests and visiting scientists, situated near the R.J. Reynolds mansion and just off the Marine Institute campus, in addition to several staff residences.

Lighthouse.

A 206-acre tract of high ground and salt marsh on the southern tip of the SINERR comprises the Sapelo Island lighthouse tract. This area represents the most recent land acquisition for the Reserve. In 1993, the State of Georgia, through the Governor's Preservation 2000 land acquisition program, private donations and a NOAA grant, acquired full interest in this tract. The lighthouse tract is largely comprised of salt marsh, flanked on the south by Doboy Sound, on the west by South End (Lighthouse) Creek, which flows to the Marine Institute, and on the north and east by a small tidal tributary known as Dean Creek. The 39 acres of upland within this tract is accessible by a sandy causeway and includes several abandoned man-made structures, the most prominent of which is the historic brick masonry lighthouse.

The Sapelo lighthouse was built in 1820 as one of a series of coastal navigational aids established by the U.S. Treasury Department. The brick tower rises 65 feet from ground level and is topped by a 15-foot iron cupola. A fourth-order Fresnel lens was installed in 1854. After being abandoned during the Civil

War, the lighthouse served maritime traffic entering and departing Doboy Sound to the port of Darien until 1898 when it was damaged in a hurricane. It was deactivated, and a second, steel pyramidal 100-foot lighthouse operated on the site until light operations were ended in 1933. The steel tower was removed from the island by the U.S. Lighthouse Service.

The abandoned brick lighthouse still standing has been deemed structurally sound. In 1997, the State of Georgia implemented plans to begin restoration of the lighthouse. Transportation Enhancement Authority (TEA) grant funds in the amount of \$400,000 were initially identified through the Georgia Department of Transportation to begin this project. Architects and engineers made detailed studies of the tower and premises during the first half of 1997 and work began later in the year. The major part of the restoration was completed in August 1998, with a new wooden spiral staircase added, restoration of two brick oil houses and cistern, repainting the tower in the original postbellum configuration (six alternating white and red bands) and construction of an historical trail with ten interpretive signs linking the various structures on the lighthouse island.

The lighthouse is currently used on the SINERR interpretive tours of the island. The new wooden stairs inside the tower provide public access to the top of the tower. Other work included repairs to the cast-iron range beacon several hundred yards east of the main lighthouse. The interpretive nature/history trail links the range beacon, the brick tower and the site of the concrete base foundations of the 1905 steel lighthouse just north of the brick tower.

In 2005, a comprehensive exhibit package was designed and prepared by a professional exhibit design firm, in consultation with, and direction from, Reserve staff to interpret lighthouse history on Sapelo Island, as well as provide ecological context for the lighthouse site. These exhibits were manufactured and installed in the restored oil house structure adjacent to the lighthouse tower in the summer of 2007. Funding was provided through the TEA grant program.

Archaeological investigations were conducted on the lighthouse site in 1997. It is known that there were frame lighthouse keepers dwellings located on both the lighthouse sites, one dating from the postbellum period until about 1900 adjacent to the brick tower and two others associated with the steel lighthouse (1905-1933) that were later dismantled. An abundance of wildlife frequent the lighthouse high ground and marshes, including waterfowl and shorebirds, white-tailed deer and a number of smaller non-game species.

Docks.

Meridian dock.

Development on this tract includes the Sapelo Visitors Center and paved visitors' parking lot, and a waiting room building with public restroom, facilities on the waterfront at the ferry dock itself, a 25x60-foot wooden platform on pilings with a floating dock attached. The docking facilities were renovated in 1995 with new pilings, ramps and floating docks. The parking lot was also repaved.

The Meridian Dock tract will continue to be the primary point of departure from the mainland. This purpose will guide its use and development. Parking and traffic flow have become less satisfactory as SINERR visitation has increased.

A contributing factor is the use of buses to transport some tour groups to Meridian Dock. DNR has taken steps to redesign parking to improve traffic circulation, primarily with the construction of a separate parking area to accommodate persons coming to Sapelo Island on the SINERR-conducted tours. This parking lot is located adjacent to the Visitors Center.

Marsh Landing dock and parking areas.

The Marsh Landing dock was originally constructed on the lower Duplin River near its juncture with Doboy Sound in 1928. DNR completely rebuilt this facility in 1995. It includes a covered dock house built on a wooden platform supported by wooden pilings, and connected by ramps to a floating dock for the two state-operated ferry vessels and a UGA Marine Institute research vessel. There are no public docking facilities or docking spaces for private watercraft at Marsh Landing. DNR enforces a policy of no private vessels docking at Marsh Landing unless prior arrangements are made with island management.

DNR will continue to operate Marsh Landing as the primary passenger access point for Sapelo Island. DNR will maintain in operational condition the residence, dock and support facilities at Marsh Landing. DNR has redesigned and paved the parking lot at Marsh Landing to improve traffic circulation.

Kenan Field timber dock.

This 10-acre tract of upland and marsh lies on the west side of Sapelo Island on the Duplin River, within the Reserve, about four miles north of Marsh Landing. It is the point from which timber harvested on the Reynolds Wildlife Refuge by private cutters on contract to the State of Georgia, leaves by barge for the mainland. The only improvement is a dock that extends 90 feet from shore, with a 15x50-foot working platform and two loading ramps. The barge loads timber harvested on the island at this area.

The timber barge travels at any stage of the tide. The privately operated tug and barge may vary in size and length, according to the contractor's daily requirements. Normally, the barge measures about 25x100 feet. The mainland off-loading point is a state-owned dock just north of Meridian Dock. DNR will continue using the Kenan Field timber dock to remove timber harvested on Sapelo Island.

Additionally, the Kenan Field landing, historically known as Lumber Landing, is the point on Sapelo Island at which vehicles, heavy equipment and the island solid waste trash truck and trash dumpsters (green boxes) are loaded and off-loaded during the periodic trips to and from the mainland.

Other docks.

Two other DNR-maintained docks are within the SINERR, one on Barn Creek near the maintenance shops and the other just to the south on Post Office Creek, adjacent to the Reserve and DNR Long Tabby office complex. Between these two docks are two additional docks, one on Post Office Creek for University of Georgia research boats, and the other at the confluence of Barn and Post

Office creeks, utilized as the "community dock" at which small boats owned by island residents and non-resident private land owners are allowed to access. An additional DNR dock is situated near the headwaters of the Duplin River at the Moses Hammock hunt camp, within the Reserve. This facility is irregularly used, primarily by seasonal hunters participating in state-managed hunts on Sapelo Island.

SINERR interpretive nature trails.

On-island trail.

In 1993 planning began for the Reserve's new Interpretive Nature Trail on Sapelo Island. SINERR staff determined the layout, location and general format of the trail, after which Georgia DNR trail construction designers visited the site and outlined details of structures, access paths and observation facilities. Applicable permits were obtained from Georgia DNR and the U.S. Army Corps of Engineers following surveys and inspection tours of the proposed trail site. Funding to build the trail was provided through a construction grant from NOAA, with materials and other in-kind services provided by the Parks and Historic Sites and Wildlife Resources divisions of Georgia DNR. Actual construction on the nature trail by Reserve personnel began in 1994, with the trail completed and formally opened for use in the spring of 1995.

The SINERR Interpretive Nature Trail is one of the most unique facilities of its type in the Georgia DNR system. It is the only trail in the state system to fully incorporate beach, forest and marsh ecologies within one trail unit. The SINERR trail is approximately one mile in length, running southeasterly from near the R.J. Reynolds Mansion to Nannygoat Beach, roughly paralleling the beach road. The trail passes through sections of maritime climax forest, tidal salt marshes and creeks, oak and cedar hammocks and three distinct lines of sand dunes before arriving at the beach. The trail is self-guided as it utilizes 30 interpretive signs spaced along its route to interpret the various species of plants, trees, marshes, dunes and wildlife, including birdlife. There are handicap-accessible boardwalks over the three sand dune systems on the trail. In addition, there is a 12-foot high observation tower with a 10 x 10 foot platform on the middle line of dunes which affords the visitor a panoramic view of the dunes, beach and ocean on the south end of Sapelo Island. This represents one of the highest spots on the south end of the island. There is also a 16 x 16 foot observation deck, with handicap-accessible boardwalk, extending through the salt marsh to a salt pan in which visitors can view at close hand marsh ecosystems and the plant and animal life associated with the salt marsh. Since 2004, the trail has undergone extensive renovation, improvement and maintenance, as needed, much of the work being expedited by volunteers.

The SINERR Nature Trail is used extensively on the public, school and special group tours of the Reserve. Reserve tour guides conduct nature walks along the trail and provide estuarine and ecological interpretation to supplement the information provided on the trail's signage. The trail is also utilized by guests staying at the Reynolds Mansion and by island residents and their guests. This facility is expected, in the next five years, to receive regular and increased usage

as the Reserve's educational and interpretive programs expand. The Friends of Sapelo volunteer organization, the Reserve's mainland support group, will be increasingly associated with the nature trail as the Reserve plans to incorporate persons with special knowledge in various areas of nature and ecology to provide interpretation for groups using the trail.

Lighthouse trail.

A triangular-shaped trail was completed at the lighthouse site in 1999 to interpret the cultural history of the various sites, restored structures and ruins there. A portion of the SINERR's annual grant from NOAA as well as state funding was utilized for the project. Interpretive signs and a brochure were developed for this trail, which, like the island nature trail, is a regular part of Reserve interpretive tours for the public.

Visitors Center (mainland) trail.

The Reserve, beginning in 2000, began to fully develop its interpretive nature trail at the Visitors Center on the mainland near the Meridian ferry dock. Funds were identified in NOAA grant awards to expedite construction, much of which was done by staff members of the Visitors Center. This trail is extensively utilized by school groups and individuals wishing to learn about coastal Georgia ecosystems who would not be actually going to Sapelo Island on one of the Reserve's guided tours. The trail parallels the salt marsh adjacent to the Visitors Center and winds its way through sections of wetland and maritime forest. Components of the trail include a boardwalk and observation deck fronting the salt marsh and overlooking nearby Hudson Creek.

Other Reserve areas.

Landing field.

This 170-acre tract lies east and south of Long Tabby. It consists of a north-south grass airstrip with landing lights, a short taxiway and a 75x75-foot steel hangar. The Federal Aviation Administration limits access to aircraft that have specific state business. Prior permission from DNR must be obtained to utilize the landing field. Occasional users of the airstrip are DNR personnel and University of Georgia Marine Institute staff. Because of its surface and length, the strip generally serves only helicopters and light, fixed-wing aircraft. The average number of flights using the strip is about two a month. This level of operation appears to have no adverse effects on the Reserve and its Duplin River estuary.

An untested archaeological site lies on and adjacent to the airstrip, this being the former site of a slave settlement dating back to the antebellum plantation period. The cleared area of the airstrip was at one time Sapelo Island's largest agricultural field, being the site of extensive cotton and sugar cane cultivation on the Thomas Spalding plantation. The State Archaeologist has determined that aircraft operation is not likely to harm this cultural resource. Testing would require digging, which would make the airstrip's surface unsafe for fixed-wing

operations. DNR will restrict aircraft traffic using the field to persons having DNR permission and having legitimate state business on Sapelo Island, when boat travel is not feasible. The grassed landing surface is regularly maintained in a usable condition.

Moses Hammock hunt camp.

Hunters on Sapelo Island stay at a camping area on Moses Hammock, a small island at the northern end of the SINERR on the upper Duplin River. Moses Hammock is within the R.J. Reynolds Wildlife Refuge and is connected to the main island of Sapelo by an earthen causeway. It consists of a grassy clearing under trees, where the hunters pitch their tents. Improvements include a floating dock and permanent pier to accommodate seasonal hunters arriving by personal boat, a hunter checking station, a generator house, a well, a cooler and restrooms with showers. DNR Game Management conducts periodic managed quota hunts from this site during the fall and winter months.

DNR will continue to use the Moses Hammock camping area for hunters.

Facilities goal and objectives.

GOAL: To provide the publicly accessible facilities necessary to fulfill the Reserve's mission as established in state and federal law, administrative rules and interagency agreements and to pursue the maintenance of existing infrastructure and the development of new permanent infrastructure as necessary during the 2008-2013 period.

Objective: Develop a multi-use plan for the Reserve's portion of the on-island dormitory for accommodation of visiting researchers, educators and other persons conducting scientific or interpretive business within the Reserve that requires extended stays or multiple visits.

- **Strategy:** Complete in 2008 final segments of the joint project with the University of Georgia Marine Institute of the on-island Barrier Island Research and Learning facility, and begin a regular, and systematic, schedule of bookings for use of the facility by SINERR researchers and education-affiliated persons, with identification of guidelines for facility-use and occupancy.
- **Strategy:** Work cooperatively with the Marine Institute in the operation and maintenance of the dormitory and participate as needed in the anticipated expansion of the facility to include development of a dining room and kitchen facility.

Objective: Increase the Reserve's available laboratory facilities for the enhancement of the SINERR's participation in the System Wide Monitoring Program (SWMP), and for the additional purpose of providing the Reserve with its own lab rather than rely on continued use of facilities at the UGA Marine Institute.

- **Strategy:** Develop with the assistance of NOAA construction grants and state matching funds, a scientific monitoring laboratory on the SINERR complex at

Long Tabby, either by expanding the existing wet laboratory in the Reserve's education building, or by building a separate facility.

- **Strategy:** Outfit the monitoring lab as the primary facility for the enhanced implementation of the SWMP program and other scientific research and monitoring initiatives on the Reserve.

Objective: Increase public awareness of SINERR educational and interpretive programs through greater, and more effective, utilization of both the mainland Visitors Center facility and the on-island education laboratory, and other Reserve educational infrastructure.

- **Strategy:** Provide improved public access opportunities through development of mainland and on-island facilities with technological improvements, particularly through enhanced audio-visual and interactive electronic capabilities for both onsite and offsite programming.
- **Strategy:** Upgrade and enhance existing nature trails with new interpretive signs and protected exhibits to accommodate improvements and refinements in environmental education techniques and innovations.
- **Strategy:** Seek NOAA construction grant funding with requisite state match to rehabilitate the public restroom facility at the Marsh Landing ferry dock for use by the day-trip visitors participating in SINERR-conducted ecological and cultural tours of the Reserve.

6. Boundaries and Acquisition.



The 'Heart' of the Reserve: Aerial view of Duplin River looking north at Pumpkin and Jack Hammocks

6. *Boundaries and Acquisition.*

Habitat representative of the biogeographic region.

Under federal regulations, the NERR System should reflect a biogeographical and typological balance of estuarine habitats. NERRS regulations identify a typology of estuarine ecosystems found in the United States, and a range of habitat types within each group, depending on various geologic, hydrologic, and chemical variables (see 15 C.F.R. Part 921). The ecological, topological and hydrological systems and habitats found within the Sapelo Island National Estuarine Research Reserve are described in detail in Chapter 2.

“Core” and “buffer” areas: NERRS regulations.

NERRS Regulations, 15 C.F.R. Sec. 921.13, outlines requirements for “identifying the ecologically key land and water areas of the Reserve, ranking those areas according to their relative importance, and including a strategy for establishing adequate long-term state control over those areas sufficient to provide protection for Reserve resources to ensure a stable environment for research...”

The ecological characteristics of a Reserve, including its “biological productivity, diversity of flora and fauna, and capacity to attract a broad range of research and educational interests,” must necessarily be defined to establish requirements for managing in the most effective way possible the entire Reserve, but particularly its most sensitive, or “core” areas. Assurance that the boundaries of the Sapelo Island National Estuarine Research Reserve “encompass an adequate portion of the key land and water areas of the natural system...[is defined] to ensure effective conservation...Reserve boundaries must encompass the area within which adequate control...will be established by the managing entity over human activities within the Reserve. Generally, Reserve boundaries will encompass two areas: Key land and water areas (or ‘core’ area) and a buffer zone. Key land and water areas will likely require significantly different levels of control...” (15 C.F.R. 921.11).

“Key” land and water areas are identified as that core area within the Reserve that is so vital to the proper functioning of the estuarine ecosystem that it must be under a level of control sufficient to ensure the long-term viability of the Reserve for research on natural processes. Key land and water areas are those ecological units that preserve for research a range of physical, chemical and biological factors contributing to the diversity of natural processes occurring within the estuary. The establishment of which specific areas are to be identified as “core” within the Reserve is determined by scientific knowledge of that area and the degree of scientific research occurring within that area.

“Buffer” areas of the Reserve are identified as those areas that are adjacent to, or surround, the key land and water (core) areas and are essential to

maintaining their integrity. Buffer zones protect the core area and provide additional protection for estuarine-dependent species.

SINERR core and buffer areas: Designation and rationale.

Water core area.

The water/wetlands core area of the Sapelo Island NERR is identified as the Duplin River, its tributaries and the tidal salt marshes on either side and to the north of the Duplin River, comprising the western portion of the Reserve (Figure 13). This area comprises more than half of the SINERR's total area of 6,110 acres, and entails that part of the Reserve from Doboy Sound on the south (mouth of the Duplin) to the Reserve's northernmost boundary on Mud River (Figure 13). It is within this water core area—the salt marshes, tidal creeks and embayments of the Duplin River (which flows through the central portion of the Reserve)—that the preponderance of the scientific investigations, and water quality monitoring activities, are conducted on a continuous basis.

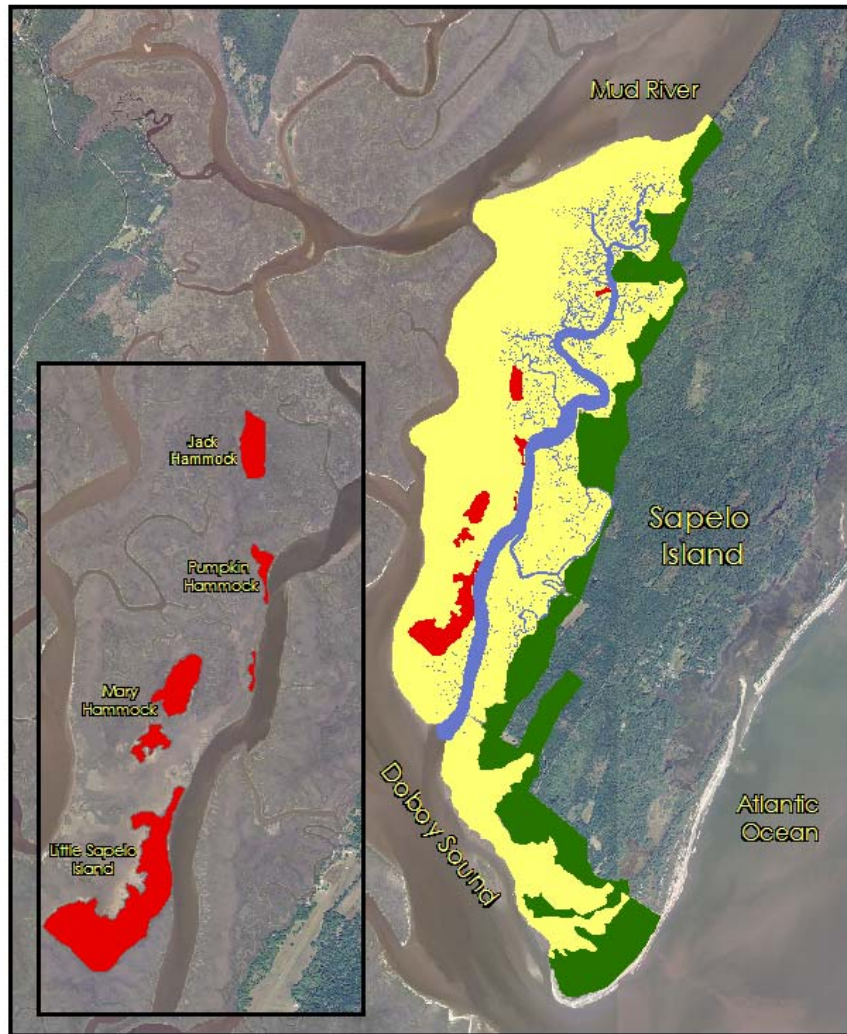
The water core areas in the SINERR were chosen based upon the levels of state control and existing long-term records and experience of scientific research. Since 1954, much of the estuarine research conducted by the resident and visiting faculty and staff of the University of Georgia Marine Institute has occurred within the core area of the SINERR. The research conducted under the auspices of the Sapelo Island NERR is also largely conducted in the core area. Additionally, the Reserve maintains three water quality monitoring stations within the Duplin River core, the data from which is apportioned as the SINERR's participation in the NERR Systemwide Monitoring Program. The locations of the Reserve's water core areas ensure adequate, and direct, applications of state control and management. State control provides sufficient protection to ensure the integrity of a stable platform for the continuation of ongoing scientific investigation of the core area of the SINERR, specifically within the tidal embayments and salt marshes.

Land core area.

There are several small sections of upland situated within the SINERR's water core, known locally as "hammocks", which form the land core of the Reserve (Figure 13). Specifically, these hammocks (from south to north) are Little Sapelo Island, Mary Hammock, Pumpkin Hammock and Jack Hammock, the largest of which is Little Sapelo. These hammocks are all situated on the west side of the Duplin River and, in the aggregate, comprise approximately 350 acres. With the exception of Jack Hammock, practically all of which is surrounded by salt marsh, all of the hammock land cores are accessible by boat via the Duplin River.

These areas are designated as a collective component of SINERR's land core based upon the fact that, outside of occasional scientific or archaeological investigation, there is no human activity on any of the hammocks. They also serve as protected habitat for a range of wildlife species, particularly waterfowl and other bird species, as well as being outstanding examples of typical Georgia

Sapelo Island
National Estuarine Research Reserve
Boundary



SINERR Boundaries

- Core
- Buffer
- Water in Core
- Hammock Area in Core
- Reserve Boundary



This map was prepared by the
Sapelo Island National Estuarine Research Reserve
GIS lab for the Revised Management Plan.

Figure 13.

coastal ecosystems embracing live oak, red cedar and pine thickets, saw palmetto, high marsh and mud flats. Additionally, on Little Sapelo Island, there are protected tabby ruins of structures dating from the antebellum plantation economy of Sapelo Island. The land core areas provide essential upland habitats and, consequently, the SINERR, through the Georgia DNR, places heavy constraints upon human usage and activity in these areas. The state thus provides sufficient protection for these areas to ensure a stable environment for ongoing scientific research.

Buffer areas of the Reserve.

Buffer areas of the SINERR are defined as those sections of the Reserve's upland (totaling about 2,000 acres) on the east side of the Duplin River and marshes that are adjacent to the core areas and which provide a zone of protection to a sufficient degree as to ensure the integrity of the core for scientific research (Figure 13). In the buffer areas of the Reserve there is a degree of human activity and permitted public access. Those areas of the Reserve which entail a higher degree of human activity and access, including the Marsh Landing and Lumber Landing dock areas, island fuel facility and community dock, etc., (Figure 13) are included as being among the buffer areas of the SINERR.

Buffer areas of the Reserve are thus delineated as those sections where, although there is a degree of human activity and public access, they are sufficiently marginal as to have little or no impact on the integrity of research and monitoring activities. These areas include upland sections north of Marsh Landing, Post Office Creek (Long Tabby and Riverside), and Barn Creek north to a point above Moses Hammock, where there are minimal impacts, these being entailed chiefly by seasonal recreational hunting and seasonal prescribed burns associated with timber management. As earlier noted, this upland buffer does not include those areas encompassed by public and commercial fuel and dock facilities within the Reserve. Additional buffer areas include the upland south and east of the Marsh Landing ferry dock to, and just beyond, the Marine Institute complex. These areas include the Oakdale and Shell Hammock areas and portions of the lighthouse tract between South End and Dean creeks where there is little or no public access or human activity except for occasional scientific research.

The state maintains these buffer areas for the protection of estuarine dependent species, while also permitting a controlled degree of public access for year-around interpretive estuarine education, scientific investigation, facilities for conducting administrative, research and education activities, and seasonal recreational hunting.

Not situated within the Reserve, but managed and maintained by Georgia DNR/WRD and thus ancillary to varying degrees to Reserve operations and activities, are the Hog Hammock private community, Raccoon Bluff historic area, the tabby ruins of Chocolate plantation and the Cabretta Island state-operated

public campground. It is important to note that access to all of these areas of Sapelo necessarily entails transit through the Reserve—the primary access point to the island is Marsh Landing ferry dock, situated within the Reserve near the mouth of the Duplin River. The causeway from Marsh Landing through the Reserve provides access to all other areas of Sapelo, including Hog Hammock, the Marine Institute, Nannygoat Beach, and the North End.

A large area of Sapelo Island's upland that might be described as an "exo-buffer" zone would be the state-owned and state-managed Richard J. Reynolds Wildlife Management Area (WMA), which entails approximately the upper (northern) two-thirds of Sapelo Island. A portion of the western side of the Reynolds WMA lies within the upland area of the SINERR while, conversely, much of the SINERR's 2,100 upland acreage lies within the WMA. Exceptions to this are the areas of the Reserve south of the East-West Autobahn and west of the Airport Road (including the extensive, cleared grass landing strip), and sections comprising the UGA Marine Institute and those uplands and marshes south and east of the Nannygoat Beach causeway.

Boundary expansion/land acquisition.

Pursuant to the aforementioned uniqueness of the situation by which the Sapelo Island NERR lies entirely within and amid state-owned and state-protected lands, the Reserve has no plans for boundary expansion or land acquisition at the present time, nor does it anticipate any in the ensuing five years addressed by this Management Plan. If additional acreage were anticipated to be brought into the boundaries of the Reserve at some point in the future, the uniqueness of the SINERR's geographical and political location would make such land acquisition and boundary expansion relatively easy and largely cost-free due to the status of state (public) ownership of the island.

7. Public Access.



Water access points for the Reserve

Clockwise from top left: DNR Barn Creek landing, Duplin River timber dock, Long Tabby dock at Post Office Creek, Community dock at Barn Creek, Marsh Landing ferry dock, UGA dock at Post Office Creek

7. Public Access.

This section of the Management Plan for the Sapelo Island NERR addresses those Reserve activities that are intended primarily to advance the Reserve's public access goal.

NERRS regulations stipulate that types and levels of public access and use must be consistent with the NERRS program mission and goals (Appendix D). The Memorandum of Agreement between NOAA and Georgia DNR provides these guidelines (Appendix D).

Introduction.

Estuarine education must be enjoyable to be effective. Recreation within the SINERR has teaching value, and the educational program has a recreational component. DNR will manage most recreational use of the SINERR to increase its educational value. Management will be designed to avoid adverse effects on the estuary and on scientific and other research projects.

Public visitation of the Reserve advances the NERR system goals by expanding citizen awareness of the System, and by increasing opportunities for the public to physically experience an estuarine setting. Visitors on guided tours to Sapelo Island are invited to explore the Reserve's interpretive visitor's center, with its ecological and estuarine-focused exhibits, and the island interpretive nature trail, according to established schedules, and to enjoy the sights and sounds of wildlife, forest, beach and salt marsh.

By the same token, increased public awareness of Sapelo Island in general, with an attendant growth of private tourist-oriented business ventures in the island's private community, has placed amplified access burdens and pressures upon the island generally, and the Sapelo Island NERR specifically. It is through the Reserve that the majority of the public access to Sapelo Island is achieved (see Chapter 6, Boundaries), and it is through portions of the Reserve that access to other sections of Sapelo outside the Reserve's boundaries, including the Hog Hammock community, must necessarily flow.

As previously noted (Chapter 3, DNR Island Management Strategies), some of the most critical issues facing both the island and the Reserve for the near term, as well as long-range, future are those relating to public access and island stresses attendant upon visitation impacts.

Existing public access policies.

Access to Sapelo Island's tidal salt marshes and uplands have been, and will continue to be, closely regulated. By the very nature of its geography, as well as the island being largely state-owned, Sapelo lends itself to controlled access

facilitation, the primary means of access being the state-operated ferry vessel which makes several daily runs between the island and the mainland seven miles away.

Georgia DNR, Wildlife Resources Division, has prepared access policies that generally allow island residents, their visitors, and individuals engaged in official state business to use the uplands. Official state business includes authorized SINERR tours, group leasing of the R.J. Reynolds Mansion on the Reserve, group camping, and public hunting. In addition, the University of Georgia Marine Institute often has student groups utilizing the island's research and natural resources at varying times of the year, usually on weekends. These are planned, coordinated activities, many of which occur within the Reserve, but with little or no involvement by Reserve personnel.

Traditional uses such as camping, hunting, fishing, hiking and wildlife observation that do not conflict with Reserve goals will be allowed to continue as permitted under state laws, and according to current access rules and schedules. Lands in private ownership on Sapelo Island, but not within the Reserve boundaries, are not open to the public unless expressly allowed by the owner, nor are they subject to Reserve access rules and schedules.

Barrier-free access.

Buildings and facilities within the SINERR will continue to be developed in accordance with the Americans with Disabilities Accessibility Guidelines (ADAAG), except where state building code requirements are stricter.

Federal regulations do not require every existing facility or part of a facility to be accessible to persons with disabilities, although state programs, when viewed in their entirety, must be in compliance with the ADAAG. Currently, no federal regulations have been adopted for natural areas or recreational sites, although efforts are underway to draft such standards and regulations.

The Reserve will seek to improve access at the Reserve by (1) making technically feasible enhancements where funding is available, and (2) applying federal standards and regulations for outdoor access as these are adopted.

Existing conditions and policies.

Wildlife-oriented recreation.

Recreational fishing, state-coordinated hunting (seasonal), birding, and other wildlife observation, will continue to be a part of state-provided programming involving either direct or indirect participation or coordination by members of the SINERR staff.

Boating.

Public access for recreational boating will continue to be allowed within the waters of the SINERR, entailing the Duplin River and its tributaries (Barn Creek, Post

Office Creek), New Teakettle Creek, and portions of Doboy Sound, including Oakdale Creek, South End Creek, Dean Creek and Nannygoat Beach.

Nature interpretation, trails and camping.

Use of the SINERR's Interpretive Nature Trail and the Lighthouse Interpretive Trail is by controlled access during guided tours of the Reserve, both for general public tours and special group events such as school field trips, teacher workshops and other groups. Reserve tour guides lead groups on the trails field trips and provide appropriate interpretation. These trails are also designed to be self-guided through the use of interpretive signage and brochures. Thus, the trails also receive use during non-tour hours from groups leasing the Reynolds Mansion, as well as island residents and their guests.

The Interpretive Nature Trail passes through upland forest, tidal salt marsh and salt flats and sand dune and beach areas, with interpretive signs at suitable locations. The trail serves groups who prefer a closer look at the SINERR than is possible on the driving (bus) tours.

The Reserve does not now permit, nor will it allow in the future, unguided or unsupervised recreational hiking within the SINERR by groups or individuals. Such use could damage estuarine resources and upland and high marsh habitat as well as adversely affect ongoing scientific research projects.

The Cabretta Island group camping area is operated by the DNR Parks Division in the Reynolds WMA and is not within the boundaries of the SINERR, although access to Cabretta is gained by passing through the Reserve. This access is facilitated by state-operated buses that transport camping groups from the ferry dock at Marsh Landing to Cabretta about seven miles away. The campground has been in use since 1995 following the reconstruction of the wooden bridge over Cabretta Creek. This area, in 2008, is showing signs of overuse, particularly in the fragile dune areas. DNR will maintain dune-crossing structures for use by educational groups. DNR Parks Division staff screen camping groups in advance before approving requests for reservations. This minimizes the risk of misuse by group members.

DNR hunt camp.

The DNR/Game Management hunt camp is on the Reynolds WMA at Moses Hammock, situated in the upper Duplin River barely inside the northernmost boundary of the Reserve. It has been managed by members of DNR/WRD Game Management staff on Sapelo Island, with gradual upgrading and improvement of facilities, since the mid-1970s. Reserve staff has no direct involvement with the operation of the hunt camp, nor direct involvement in the coordination of the hunting activities on Sapelo Island. The island manager keeps the Reserve Manager informed and up to date on activities related to hunting as well as the hunt camp itself.

A requirement of federal (Pittman-Robertson) funds being allocated by Congress for the state acquisition of Sapelo Island in 1969 was/is the provision of public recreational hunting activities on public lands covered by the federal funding, thus DNR allows seasonal managed hunting events six to eight

times per year on lands both within the Reserve and on those lands contiguous to the Reserve, primarily with the Reynolds WMA. The Moses Hammock hunt camp is provided for groups of hunters, usually limited to a maximum of about 40 at a time, coming to Sapelo Island on a seasonal basis, always during the fall months. There is a boat landing and floating dock on the Duplin River at Moses Hammock designed for use by those utilizing the hunt camp to transport gear by private boat rather than the island ferry. The majority of hunters, however, utilize regularly scheduled passages of the ferry to access the hunt camp from the mainland.

Swimming and beach use.

Swimming and beach use at the SINERR will continue at present (limited) levels, and DNR will not increase its emphasis on these activities. Neither the SINERR nor DNR/WRD provide lifeguard services at any of the island's beach areas. Ocean swimming is usually limited to island residents and their guests and guests at the R.J. Reynolds Mansion. Groups using the Cabretta Island group camp and the Reynolds Mansion will make more recreational use of the beach than those participating in the SINERR day tours and educational field trips. Typically, most of the beach use, including Nannygoat Beach in the Reserve and its covered beach pavilion and picnic area, is more frequently utilized by island residents and their guests.

Commercial fishery.

Private interests are permitted to conduct the commercial harvest crabs in the waters within the SINERR. Primary areas of commercial crabbing include the waters of Dobby Sound adjacent to the SINERR, the full length of the Duplin River and the lower portions of Barn Creek.

Existing access points.

Public access to the SINERR (and Sapelo Island) is provided by two docking facilities, both located within the Reserve. The most accessible, and by far the most heavily used, is the Marsh Landing ferry dock facility on the lower Duplin River within the Reserve. This is the primary access point for the vast majority of persons coming to Sapelo Island, including residents and visitors. Marsh Landing is the access point for arriving and departing Reserve tours, as well as groups utilizing the Cabretta group camp and Reynolds Mansion facilities, private tour groups conducted by Hog Hammock vendors, and UGA Marine Institute groups. A community dock for Hog Hammock property owners, residents and their guests is located on Barn Creek within the Reserve near Long Tabby. The small private boats of Hog Hammock property owners are permitted by DNR to use this access point. No docking of private boats is permitted by DNR at Marsh Landing, the Kenan Field timber dock, or the smaller docks at South End Creek (Marine Institute) and Barn and Post Office creeks. Georgia state law permits use of these tidal waterways for recreational and commercial fishing, as well as access to the barrier island beaches up to the high-water mark by the general public.

Island carrying capacity and access stresses: An overview.

The SINERR, in the next five years, envisions broadening the scope and substance of its public outreach programs. The Reserve's intent is to expedite this objective without increasing the numbers of participants in those programs physically accessing Sapelo Island.

Georgia DNR currently has no plans to increase public access to Sapelo Island in any measurable amount. The carrying capacity of the available transportation facilities on the island (Reserve tour buses and other vehicles), in addition to the obvious restrictions on island carrying capacity entailed by passenger ferry limitations, demonstrates that accommodating increased numbers of visitors to Sapelo Island is clearly not feasible at this time.

Additionally and significantly, increased visitation to Sapelo, unless carefully managed (i.e. "controlled"), would clearly have a deleterious effect on the integrity of the scientific estuarine research in progress on the Reserve and in areas contiguous to the Reserve. Field investigations and monitoring are conducted by University of Georgia Marine Institute scientists, along with other researchers who come to the island under Reserve auspices. This work necessarily must be expedited under the most pristine and undisturbed conditions possible, and done in areas of the SINERR that are off-limits to access by the general public, and which permit only the most carefully controlled and devised human activity.

Because of the growing public awareness of Sapelo Island, both regionally and nationally (partly as a result of greatly increased electronic and print media exposure), public access to the island has been at or near saturation levels since 1999.

The Sapelo Island NERR's education program, including public and school group tours and periodic special events sponsored by the Reserve, brings about 6,000 visitors a year to the island. Additional public access stresses are placed upon the island by a combination, often simultaneously, through the DNR's managed hunts in the fall, the overnight accommodations provided at the R.J. Reynolds Mansion and the Cabretta public campground (both at near full-capacity in 2007-2008), an increasing number of private businesses in the Hog Hammock community providing overnight guest accommodations, food services and island tours, and increased numbers of college level student groups coming to the island under the auspices of the UGA Marine Institute.

Rather than seeking increased access and visitation of Sapelo, the Reserve and the various public programs under its direct purview, has as its primary objective over the next five years to instead provide gradually improving outreach programs, services and activities for those who come to the island. Visitors coming to the Reserve will enjoy expanded educational programs, an increased number of special tour packages and activities, and greater and more effective use of volunteers with special skills and knowledge to enhance the outreach programs being offered. The SINERR intends now to pursue a goal of "quality rather than quantity" in the public access services it provides for those utilizing the island tours, its educational activities and the mainland visitors center and the activities at that facility.

One method to alleviate the growing sense of “overcrowding” on this controlled-access island is to figuratively “take the island to the mainland.” Among projected plans in this regard are increased utilization of the mainland Visitors Interpretive Center for educational programs and outreach. Additionally, the SINERR’s Coastal Training Program initiative has become a major component of the Reserve’s off-site educational efforts.

The increased access to Sapelo Island (not solely limited to those accessing the island under the auspices of the SINERR) by the general public since the late 1990s had led to a greater need for on-site regulation of the island in order to protect the fragile ecosystems of the resource. Scientific research and educational outreach are the two most visible, and active, missions of the SINERR. However, a third mission is equally important, that being protection of the resource and resource stewardship. Proper and meaningful stewardship of the SINERR and its contiguous areas can only come through effective monitoring and protective measures. This is the primary reason DNR closely manages access to Sapelo Island and why the SINERR conducts only guided tours of the Reserve. *Overuse*, which often leads to *misuse*, of the island, and the Reserve itself, would prove to be detrimental to the research being conducted on and around the SINERR, as well as prove potentially damaging to the fragile ecosystems of the Reserve.

Increased education and encouragement to the public about the value of protecting the SINERR's ecological resources will be a primary goal in the next five years. Increased use of Sapelo Island by persons and groups through access provided by private means (non-state-sponsored activities) may necessitate greater emphasis on enforcement of resource protection, and more stringent regulations regarding human activities that negatively impact the SINERR and Sapelo Island in general. These and related issues have been addressed in varying degrees in DNR’s overall Sapelo Island Comprehensive Management Plan (1998). DNR will closely monitor public access to the island in future years and incorporate as necessary changes in its island management plan compatible with effective and responsible protection and management of the Sapelo Island resource.

The state’s (DNR) projections for the overall management of Sapelo Island, particularly as pertains to public access, island carrying capacity and the Sapelo Island NERR, are outlined in Chapter 4, “State Island Management Strategies,” 2008-2013.

Public access goal and objectives.

GOAL: To provide effective management of public access on lands and waters within the Reserve to properly assess and mitigate critical needs and island stresses that impact the Reserve.

Objective: Achieve consensus among Sapelo Island stakeholders, inclusive of DNR, UGA Marine Institute and island community entities, for the need to more effectively manage the degree of public access to the island.

- **Strategy:** Conduct informational meetings among island stakeholders for discussion of roles by each group in contributing to mitigation of island stresses through visitor impacts.
- **Strategy:** Develop a more cohesive reporting system to DNR for advance-notice ferry reservation requests by island groups, including UGA, Hog Hammock entities, DNR, etc. Utilize and enforce strict protocols to ensure adherence to observing ferry reservation deadlines and ferry capacitance per group and entity.

Objective: Maintain the current (2008) levels of island access, with no increases, to the Reserve that fall under the direct jurisdiction and purview of the Reserve; encourage that similar approaches be adopted by other state (DNR, UGA) and civilian (Hog Hammock) entities on Sapelo Island which provide public access to and through the Reserve.

- **Strategy:** Utilize to a greater degree the mainland Visitors Center for group educational programs, especially those sponsored by the Reserve for K-12 school groups, thus reducing the stresses on island carrying capacity.
- **Strategy:** Prepare an annual and semi-annual projection of island access impacts and ferry use for all entities, including DNR, SINERR, UGA, Hog Hammock and Reynolds Mansion, for use as a planning tool for access control, thus enabling island management to apply a proactive, rather than a reactive, response to island stresses.

Objective: Achieve better knowledge and understanding of the growing impacts upon island infrastructure and habitat created by the increased volume of visitation since 1998 as a means toward the effective, and sustained, mitigation of public access stresses.

- **Strategy:** Update and amplify the DNR-sponsored ferry carrying capacity study begun in 1998 and ended in 2001 to include the 2002-2007 time frame for an up-to-date assessment of island access and visitation and to identify the various user groups coming to Sapelo Island and their sponsoring entities.
- **Strategy:** Computerize daily island ferry ticket sales for individuals and groups for more efficient documentation of passenger numbers and ferry usage, according to day of week, special events, and sponsoring entities; the Visitors Center would be the most appropriate control point for this initiative, with electronic linkage between Visitors Center staff and ferry vessel personnel.

This would effectively provide information to island managers about who is coming to Sapelo, how often, for what purpose and under whose auspices.

Objective: Educate the general public as well as frequent user groups utilizing the island resource on the criticality of protecting the ecological resources of the Reserve and Sapelo Island and the need for preserving the resources for the furtherance and protection of scientific research and the provision of quality environmental education.

- **Strategy:** Utilize the Reserve's Coastal Training Program and the education and outreach program to initialize a series of educational events to promote the rationale for effective island stewardship and how such an effort can be achieved through proper controls on island carrying capacity and observance of access protocols by DNR.
- **Strategy:** Conduct strategy and information sharing sessions with local and state officials, including middle-level and senior DNR management to educate them on the need to more effectively manage and regulate island access at current, or reduced, levels, as well as to secure support for island management in enforcing adherence to access protocols as set forth by DNR and SINERR.

8. Research and Monitoring.



8. Research and Monitoring.

Introduction.

The National Estuarine Research Reserve System (NERRS) provides a mechanism for addressing scientific and technical aspects of coastal management problems through a comprehensive, interdisciplinary and coordinated approach. Research and monitoring programs, including the development of baseline information, form the basis of this approach. Reserve research and monitoring activities are guided by national plans that identify goals, priorities and implementation strategies for these programs. This approach, when used in combination with the education and outreach programs, will help ensure the availability of scientific information that has long-term, system-wide consistency and utility for managers and members of the public to use in protecting or improving natural processes in their estuaries. The priority research areas listed below were identified with input from a variety of sources including reserve research staff and managers, the NERRS Strategic Plan, and national documents outlining national coastal research needs and priorities (NERRS Research & Monitoring Plan 06-11).

Research in the NERR System.

Research goals, objectives, and strategies found within the 2007-2012 NERRS Research & Monitoring Plan will assist the reserve system in meeting strategic goals outlined by the system as well as address the five research priority areas within the following five years. The NERRS has developed this research and monitoring plan to guide national, regional, and local research efforts that promote the protection and conservation of estuarine habitats through the provision of improved ecological information. The research goals outlined within the plan include (1) Biological, chemical, physical, and community conditions of reserves are characterized and monitored to describe reference conditions and to quantify change; (2) Promoting scientific estuarine research at reserves that is relevant to coastal management needs and increases basic understanding of estuarine processes; (3) Access to scientists of all the NERRS datasets, science products and results; and (4) The scientific, coastal management, and education communities use data, tools and techniques generated at the NERRS.

Research funding priorities are based on federal regulation 15 C.R.F. 921.50(a) which specifies the purposes for which research funds are to be used, including support for management related research that will enhance the scientific understanding of the Reserve ecosystem, provide information needed by reserve managers and coastal ecosystem policymakers, and improve public awareness and understanding of estuarine ecosystems and estuarine management issues.

Two Reserve System efforts exist to fund research on the previously described priority areas. The Graduate Research Fellowship Program (GRF) supports students (\$20K per student per year) to produce high quality research in the Reserves. These fellowships provide graduate students with funding for 1-3 years to conduct their research, as well as an opportunity to assist with the research and monitoring program at a reserve. Projects must address coastal management issues identified as having regional or national significance, relate to the Reserve System research focus areas, and be conducted at least partially within one or more designated Reserve sites. Acting as a Fellow, the students work with the research coordinator or manager at the host reserve to develop a plan to participate in the reserve's research and/or monitoring program. Students are asked to provide up to 15 hours per week of research and/or monitoring assistance to the reserve; this training may take place throughout the school year or may be concentrated during a specific season.

Secondly, research is funded through the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET), a partnership between NOAA and the University of New Hampshire (UNH). CICEET uses the capabilities of UNH, the private sector, academic and public research institutions throughout the U.S., as well as the 27 reserves in the Reserve System, to develop and apply new environmental technologies and techniques.

The Sapelo Island NERR research and monitoring program activity participates in each of these two areas.

Facilitating scientific investigations: SINERR's existing infrastructure.

To increase awareness within the scientific community of estuarine research opportunities at the SINERR, the Reserve markets the findings of its program within a number of standards including peer reviewed publications, newspaper articles, public radio, workshops sponsored by the Reserve through the Coastal Training Program (CTP) in addition to workshops developed by other management and research programs by request. Emphasis upon reserve research findings and needed CZMP studies and applications are a top priority for expanding involvement by the general public, scientific, resource management and policy communities. To validate the steps taken and the utility of the direction of the overarching mission of the SINERR research and monitoring programs, the following is included to describe the Reserve's commitment to expanding its role of applied research and information dissemination. Additionally, this section is included to showcase the efficacy and continuity of the Reserve's research and monitoring programs linkage with the scientific, resource management and policy communities.

Facilitating issue-driven applied research within the SINERR.

In tandem with the clarification of the NERRS national research and monitoring mission, the SINERR's research and monitoring goals have also undergone refinement. In support of these goals, the Reserve has embarked on several multi-year projects with distinct tasks and timelines, creating a broad spectrum of research and monitoring programs with the goal of enhancing the

structure and applications of data acquisition, thus enhancing the opportunities and linkages with the regional scientific, management and educational communities of the Southeastern Bight. The Sapelo Island NERR considers its top research priority (and its research mission statement) to be one of applied scientific programs directed at meeting conservation, management and policy information needs which support the sustainability and integrity of Georgia's estuarine and coastal marine environments. As reflected within this Management Plan, the SINERR's research planning and activities now extend far beyond the provision of logistical support for disparate investigators' on-site research needs. Since the issuance of the Reserve's previous management plan (1999), the research and monitoring programs have expanded through the efforts of the SINERR Research Coordinator, the Research Task Force of the SINERR Advisory Committee, and several regional partnering agencies including local, and national government, non-government, CZM and NERR partnering agencies.

The scope of research conducted within the SINERR now includes the work of both outside investigators and on-site scientists from an array of academic, government and conservation partners (Table 1). Prior to the hiring of the fulltime Research Coordinator in 1998, the Reserve's research and monitoring programs were conducted on the surrounding estuarine systems through the oversight of the University of Georgia Marine Institute (UGAMI, Collected Reprints; Chalmers, ed., SINERR Ecological Profile, 1997). Currently, all investigations conducted within the Reserve boundaries with any form of support from the SINERR are required to demonstrate how the intended data will be used to enhance or support the clearly identified national, local and regional priority topics relevant to the Reserve's research program mission statement. In this way the SINERR is focusing its support of estuarine research programs upon issue-driven, applied research of application to the sustainability and enhancement of coastal ecosystem processes and habitats.

Table 1.

Research and Monitoring Partner Programs of the Reserve
NOAA: National Oceanic and Atmospheric Administration; Grays Reef National Marine Sanctuary Coastal Services Center Restoration Center Central Data Management Office
University of Georgia Marine Extension Service Department of Marine Sciences Marine Institute Department of Genetics
Georgia Southern University Department of Biology Georgia Forestry Commission Savannah State University: Department of Marine Biology

University of Indiana: Department of Ecology
Alliance for Coastal Technology
West Georgia State University
The University of Kentucky
The Georgia Coastal Ecosystems: Long Term Ecological Research (GCE-LTER)
The Georgia Coastal Advisory Council (GCAAC)
The Nature Conservancy: Georgia Chapter: Altamaha Bio-Reserve
Little Cumberland Island: Scientific and research Committee
Little Saint Simons Island: Natural Resource and Conservation Programs
The National Atmospheric Deposition Program (NADP)
Georgia Sea Grant
The Georgia Department of Natural Resources
 Wildlife Resources Division
 Coastal Resources Division
 Environmental Protection Division
United States Fish and Wildlife Service
The United States Geological Survey (USGS)
 Water Resources Division: Georgia District
United States Fish and Wildlife Service (USFWS)
 Patuxent Wildlife Research Center
 Southeastern Ecological Services Branch
United States Department of Agriculture (USDA)
 ARS Bee Research Laboratory
Army Corp of Engineers
Sapelo Island Cultural Revitalization Society
The Altamaha Riverkeeper

The Sapelo Island NERR Monitoring Plan also reflects this new emphasis on regional service and NERRS interaction as evident within its recent peer reviewed publications including topics relating to analysis of large data sets with the *Journal of Coastal Research*, 2004 (Vol. 45, pp. 75-92 "Non-Parametric Harmonic Analysis of Estuarine Water-Quality Data: A NERR Case Study"), and exotic species encroachment in the *Journal of Shellfish Research*, 2004 (Vol. 23, No. 3, pp. 741-743, "First Occurrence of the Non-indigenous Green Mussel, *Perna viridis* in Coastal Georgia, U.S."). Likewise, the SINERR's continuous monitoring program has generated a comprehensive ecological site characterization profile of biotic and abiotic conditions in the Reserve. The compilation of pertinent scientific information found within the profile is also undergoing an updating which will advance the documentation and reinforce the Reserve's efforts in designing and reporting data acquisition and applications beyond the required NERR venue.

SINERR's System-Wide Monitoring Program (SWMP) participation.

It is the policy of the Sapelo Island National Estuarine Research Reserve to implement each phase of the System Wide Monitoring Program (SWMP) initiated

by ERD in 1989, and as outlined in the NERRS regulations and strategic plan. This plan is being implemented on the national level in the three phases outlined below:

- a. Phase I: Environmental Characterization, including studies necessary for inventory and comprehensive site descriptions;
- b. Phase II: Site Profile, to include a synthesis of data and information; and
- c. Phase III: Implementation of the System Wide Monitoring Program.

The SWMP provides standardized data on national estuarine environmental trends while allowing for flexibility to assess coastal management issues of regional or local importance. The principal mission of the monitoring program is to develop quantitative measurements of the short-term variability and the long-term changes in the integrity and biodiversity of the representative estuarine ecosystems and coastal watersheds for the purposes of contributing to effective coastal zone management. The program is designed to enhance the value and vision of the reserves as a system of national reference sites. The program currently has three main components of which the first is currently in operation within all of the reserves in the System. This first component (the monitoring of abiotic variables) is being met by SINERR's four water quality monitoring stations, two meteorological stations and the Reserve's nutrient monitoring programs. The second phase of SWMP, which focuses upon biological variables, is now "on the ground" with a majority of the reserves participating in vegetation monitoring. The remaining reserves were participants by the fall of 2006. SINERR has met, and is currently expanding, its participation in the Phase II biological monitoring effort into a holistic ecological approach within the studies concentrating on the tidal Dean Creek at the south end of the Reserve. The third SWMP expansion component is a combined program blending research with stewardship needs on the national level. The SINERR is using the development of this third component via the integration of the following initiatives into its research and monitoring programs: the characterization of habitats within and nearby Reserve holdings, GIS mapping components infused within SINERR's site oriented SWMP expansion, developing and infusing a GIS library and programs within the SINERR's management agency GA DNR: Wildlife Resources Division and its many academic partners (Chapter 9, Stewardship).

Approaches and applications within the SWMP phases.

Phase I: Abiotic Variables: The monitoring program, currently measures the water conditions of pH, conductivity, salinity, temperature, dissolved oxygen, turbidity, tidal amplitude and atmospheric conditions. The program also measures atmospheric conditions at a minimum of one station within each reserve, and includes the following parameters: wind speed, wind direction, relative humidity, barometric pressure, rainfall, Photosynthetic Active Radiation (PAR) and air temperature. In addition, the program collects water samples at each of the four SWMP stations including monthly nutrient and chlorophyll a samples and

monthly diel samples at one SWMP station data logger utilizing ISCO automated technology. Each reserve uses YSI automated instruments for water quality and Campbell weather stations to collect these data for submission to the NERRS Centralized Data Management Office (CDMO).

Phase II: Biotic Variables: The Reserve System will incorporate monitoring of organisms and habitats into the monitoring program as funds become available. The first aspect of bio-monitoring becoming infused into the SWMP on a reserve level is vegetation monitoring. The SINERR has been successful in applying to Estuarine Reserves Division (ERD) for a grant to support the long-term monitoring of vegetation within the Dean Creek study area on the south end of the Reserve. The Dean Creek study has been expanded into an ecological scaled investigation in which the Reserve is also quantifying the recovery process of the upper 58 acres of the marsh that has been fragmented from normal tidal laminar flow by the emplacement of a culvert pipe system. This study will also investigate long-term changes in this marsh system as a product of replacing the culvert pipe system with a spanning bridge. Table 2 and Figure 15 provide descriptions of this expanding, high priority research program. It should also be noted that the current head of NOAA, Vice-Admiral Conrad Lautenbacher, has used this study in a national context (2005) as an example of an ecological approach to science and management. Other aspects under consideration by the NERRS for incorporation in to the biological monitoring under SWMP include, nekton, faunal benthic and planktonic community enhancements and build-outs, all of which are elements of the Dean Creek study.

Phase III: Land-use, Habitat Mapping and Change: This component is under development within the SINERR toward identifying changes in coastal ecological conditions with the goal of tracking and evaluating changes in coastal habitats and watershed land-use from Reserve properties on Sapelo Island upstream to head-of-tide habitats found on the Altamaha River. The main objective of this Phase will be to examine the links between watershed land use activities and changes or effects upon coastal habitat quality. The Stewardship Coordinator has made great advancements in acquiring time-sequenced photo imagery for Reserve and greater Sapelo lands used within the Dean Creek Project and other management applications on Sapelo. The Dean Creek project incorporates a large-scaled habitat-mapping component that is serving as primer for piloting the recently adopted NERRS habitat classification system. This system is composed of a blending and modification of the currently used Andersen and Cowardin classification with modifications to accommodate estuarine and tidal habitats. This third phase of SWMP will become an increasingly higher priority to the Reserve's research and monitoring programs as funding mechanisms and partners are identified on national and local levels.

Data collected associated with Phase I of the SWMP are compiled electronically at the central data management office (CDMO) "hub", the CDMO at Belle Baruch Institute for Marine Biology and Coastal Research of the University of South Carolina. The CDMO provides additional control for the data and metadata and it compiles and disseminates the data and summary statistics via the web (<http://cdmo.baruch.sc.edu>) where researchers, coastal managers

and educators can readily access the information. The aforementioned metadata meets the standards of the Federal Geographical Data Committee.

Table 2.

List of Researchers and Project Specialties conducted within the Dean Creek Study Area

Christopher Craft: Indiana University: Sediment Elevation Table (4) data analysis, vegetation analysis associated with bio-monitoring community structure, pore water chemistry monitoring and analysis.

Dale Bishop: University of Georgia: Micro/ Macro Invertebrate characterization in high, inter-tidal and subtidal creek ecotones, invasive species monitoring, education and outreach development as faculty mentor of the GCE-LTER living-laboratory classroom.

Ross Britain: Indiana University: Stable Isotopes assimilation of Carbon and Nitrogen in avifauna toward assessment of relative habitat quality and usage among differing marshes by passerines.

Daniella Di Iorio: University of Georgia: Hydro-velocity and physical characteristics of water flow dynamics.

Justin Manley: Savannah State University: Oyster reef resource mapping and assessment of spatial and health status of existing reefs.

Dorset Hurley: Sapelo Island NERR staff: Water quality monitoring, vegetative monitoring and analysis, Aerial photography acquisition, vegetation analysis associated with bio-monitoring community structure, pore water chemistry, oyster reef mapping.

Aimee Gaddis: Sapelo Island NERR staff: Aerial Photography, acquisition and rectification, GIS mapping rectification and spatial analysis, vegetation analysis and development of vegetation community mapping overlays.

Lindsey Howell: Sapelo Island NERR staff: Ground truth surveys and mapping of entire vegetation community assemblages within the upper basin.

Patrick Hagan: Sapelo Island NERR staff: Water Quality monitoring and characterization of basin hydrology, oyster reef mapping.

Victor Thompson: University of South Florida: Survey of entire creek basin morphology.

John Schalles: Creighton University: Hyperspectral imagery acquisition and analysis of comparative vegetation components with ground truth surveys.

SWMP implementation.

Through strategic planning, the NERRS provides a mechanism for the conduct and coordination of estuarine research and development of baseline information for coastal ecosystem managers. SINERR research and monitoring activities are guided by national plans to ensure the availability of scientific information pertinent to the needs of coastal managers and members of the public for use in protecting or improving natural processes in their estuaries. This Management Plan reflects the increasing systematization of research activities and contributes to the scientific information for coastal managers and scientists to use.

SWMP technology deployment status.

The SINERR currently maintains four continuous water-quality SWMP stations, two real time satellite telemetry RASL units (Marsh Landing and Dean Creek) and one real-time atmospheric station (Marsh Landing) (Figure 14). These stations meet all SWMP protocol standards for deployment, data acquisition and quality control/assurance of the parameters monitored. Water quality parameters include pH, salinity, DO, turbidity, temperature and depth. Weather parameters include relative humidity, PAR, wind speed, wind direction, temperature, rainfall and total irradiance (an enhancement not sent to CDMO). Data is available by request to either the Research Coordinator or the CDMO.

Site selection for the locations for SINERR's SWMP were based upon:

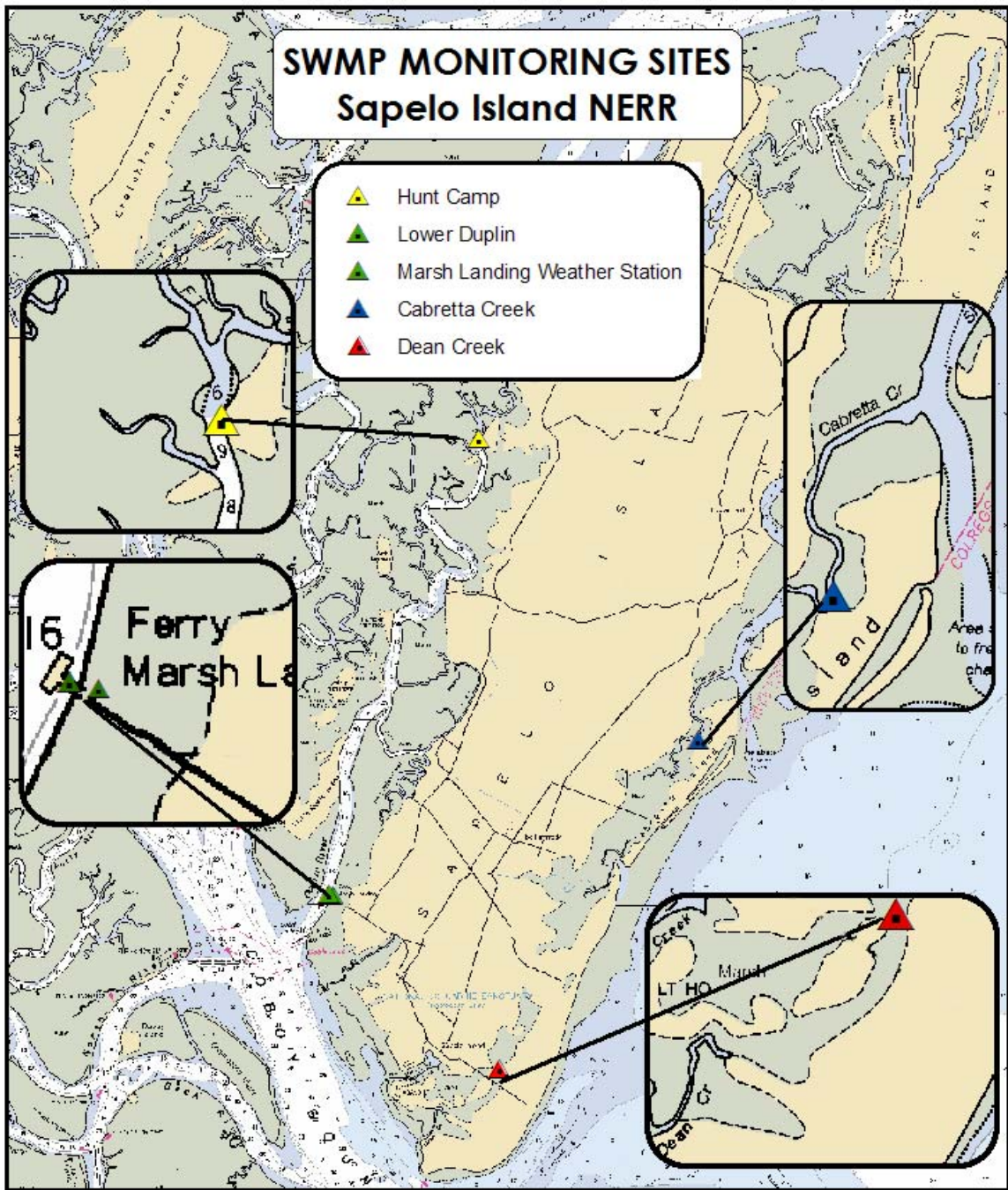
1. Establishment of long-term abiological and biological databases on a variety of salt marsh types (based upon salinity and hydrological regimes) as indicative of the wide scope of salt marsh types found within Georgia coastal waters.
2. Establishment of a long-term database for the potential use of the selected SWMP sites as estuarine water quality and marsh reference sites for potential coastal restoration and comparatives.
3. Supplying high quality, baseline environmental data within a varied array of estuarine conditions for promoting and enhancing scientific research of value to coastal managers and policymakers within a variety of marsh scenarios toward enhancing the scope of data applications generated from SWMP.

SWMP on-site enhancements within the SINERR.

Enhancements to the SWMP monitoring program include several site-specific developments and partnerships that continue to expand with each successive year of the Reserve's operation. It is hoped that the monitoring efforts currently infusing into a high quality national database (CDMO) will also provide information needed to assess national trends by the National Trends Network. Additionally, as several of the Reserve's monitoring efforts have been further promoted into local state and university programs, such as the SINERR relationship and co-sponsorships with the Georgia Coastal Ecosystems-Long Term

Ecological Research (GCE-LTER) programs, the monitoring data is now reaching wide and varied academic and management audiences. This type of collaboration far extends the scope of the information exchange and data utility of SWMP products beyond reserve initiatives. Utilizing the SWMP as an exemplary foundation, the SINERR has been designing alternative and specialized monitoring programs that have even more linkage with vested audiences as issue driven needs inspire the reserve to establish site and regionally specific monitoring efforts. These programs help in addressing the information needs appropriate within an applied scientific program landscape. The following extensions of SWMP within the SINERR are listed as examples of how the Reserve is developing partnerships and programs that link SWMP and other reserve technical expertise with issue driven monitoring needs.

1. **The National Atmospheric Deposition Station:** GA 33 (Figure 16). This station is the only one of its kind operating in coastal Georgia and relies on a partnership among the SINERR, GCE-LTER and the National Atmospheric Deposition Program (NADP).
2. **Beach Monitoring:** Testing water quality for swimmers' safety, and providing state and federal vested partners with a developed reference site for beaches in more developed areas of the Georgia coast. Partners include the SINERR, Georgia CZMP, Georgia Environmental Protection Division and the Environmental Protection Agency.
3. **Oyster recruitment monitoring in the Duplin River:** The Reserve has been collecting and analyzing a long-term data base of *Crassostrea virginica* (Eastern Oyster) larval recruitment at three stations with three independent collectors per station in the Duplin River as indicators of ecosystem health and sustainability. This information will eventually be used as a long-term biological monitoring component and trend data set that will supplement and correlate with SWMP water and atmospheric monitoring data. This data record set has been collected and analyzed for annual trends from 1999 to present (Figures 26, 27 a&b, 28 a&b).
4. **Hematodinium monitoring:** Monthly samples of adult blue crabs are caught in the Duplin River and then tested for Hematodinium prevalence to survey blue crab population densities. Partnerships include SINERR, Georgia Crabbers Association, Georgia Coastal Resources Division, UGA Marine Extension Service personnel.
5. **The Real-time Weather and Water Quality Monitoring Station:** A continuous data, real-time satellite telemetry station collecting 13 water and weather quality parameters is sited at the Georgia DNR's Hudson Creek ferry dock in Meridian. Partnerships include SINERR, DNR Wildlife Resources Division, GCE-LTER and USGS.
6. **Sediment Elevation Tables (SET) on the Dean Creek Restoration Project:** In partnership with the GCE-LTER and the University of Indiana (Dr. Chris Craft), the Reserve has co-sponsored sediment elevation tables (Figure 17) to assess hydrological restoration and historical upon sediment deposition and erosion within the Dean Creek marshes.



NOAA Chart No. 11510
(Sapelo and Dobby Sounds, Georgia)



Figure 14.

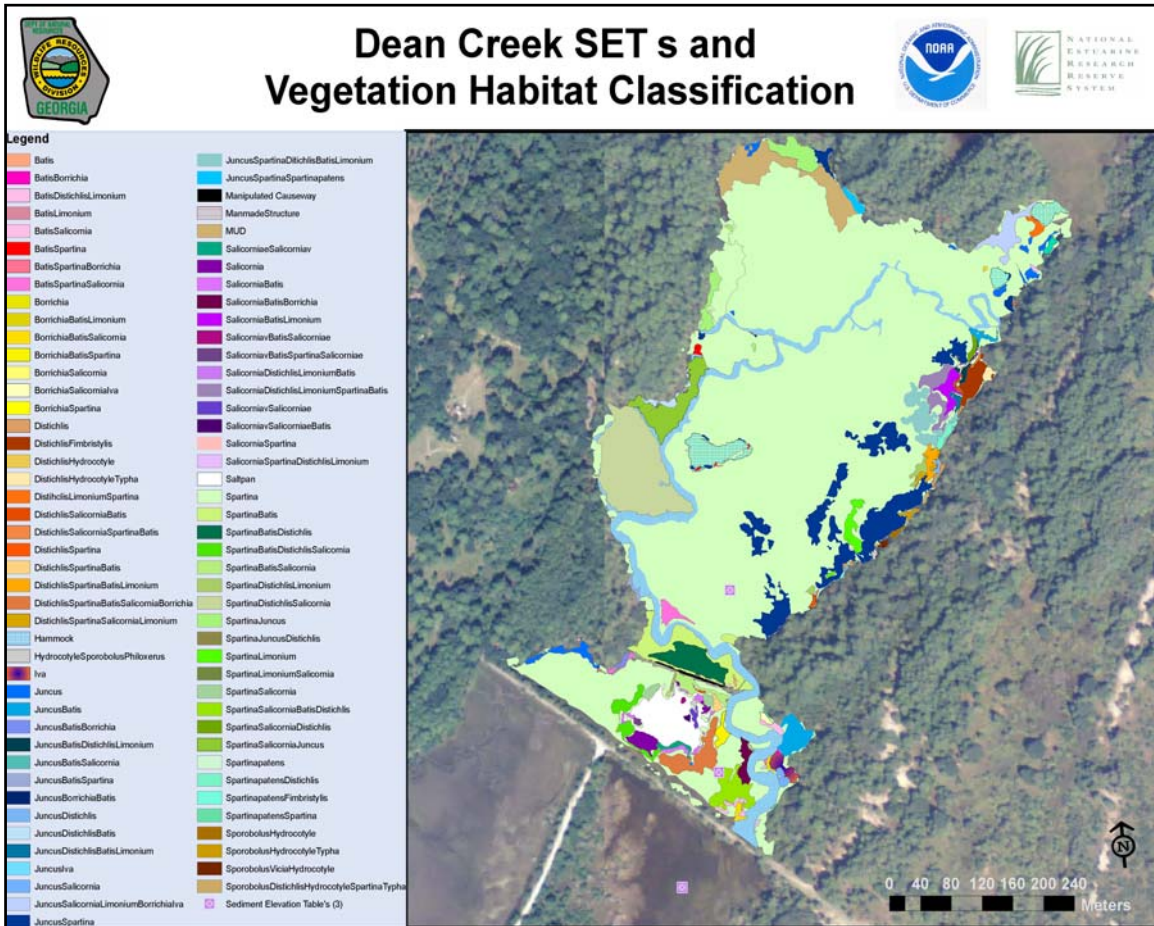
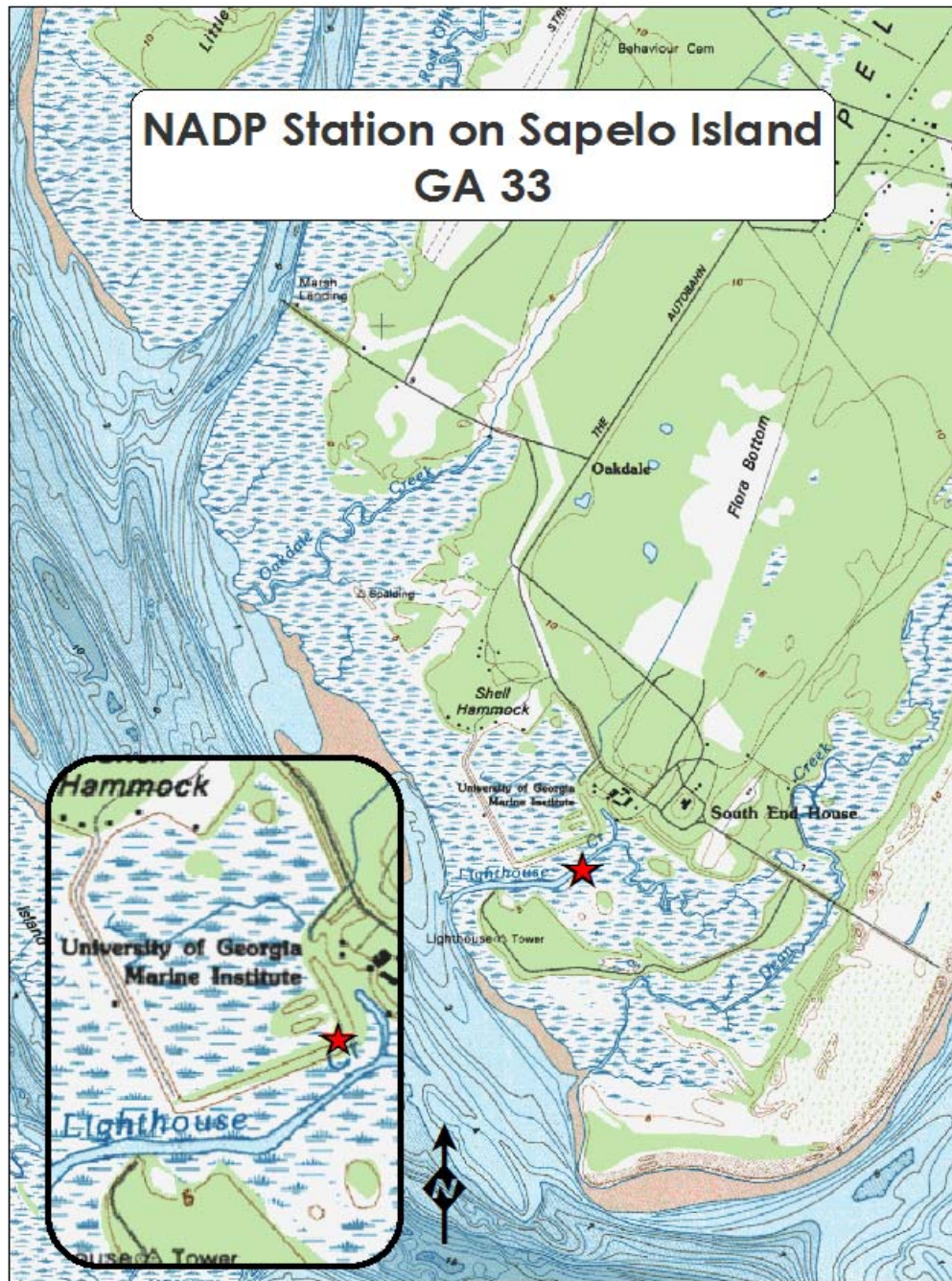


Figure 15.



Doboy Sound, Ga
 31081-D3-TB-024
 United States Geological Survey
 NAD 27
 UTM Zone 17



Figure 16.

Research & Monitoring Goal.

Goal— To enhance and develop research and monitoring to promote, foster, and expand the scientific knowledge and field investigations of estuarine processes as related to the Reserve and the South Atlantic Bight, for the promotion of current research partnerships and the expansion of additional long-term partnerships.

Additionally, to supply through applied research and monitoring, the scientific and management communities on the local, state and federal levels with high quality environmental databases for assessment of both short-term variability and long-term trends occurring within Georgia coastal estuaries.

This goal allows the Reserve to serve both as an information base for poorly funded monitoring programs and as a template for the establishment of high-quality estuarine reference sites. Additionally, focusing applied scientific programs to meet CZMP needs allows for the application of a broad range of research findings. These are generated within scientific and academic communities to infuse environmental benefits within agencies tasked with resource management while enhancing environmental policy interpretation within the regulation and policy communities of the State of Georgia.

Research and monitoring objectives and strategies.

The six primary research and monitoring objectives listed below are viewed as long-term continual targets that are critical to the utility of the SINERR's scientific programs. The objectives will be continually re-visited and vested within, as the Reserve's research and monitoring programming continues to develop over time. These objectives constitute the primary planning of the Reserve's research and monitoring programs. They are specifically defined for demonstrating both current efforts in the research and monitoring program and future program orientation with strategies for accomplishing these six, long-term research and monitoring objectives.

Objective:

The development of research and monitoring programs that promote program overlap through increases in partnership capacities, fiscal efficiency, educational and outreach foci and delivery into a cohesive understanding of coastal issues for dissemination to concerned public, and private and governmental entities tasked with developing collective programs which provide environmental issue resolution.

Background and Strategies: The genesis of this objective is grounded within the Reserve's educational programs and partnering agencies, which help to both construct programs for enhanced public awareness and direct the results of the research and monitoring programs within educational venues for broader

dissemination. Products of the research and monitoring programs (analyzed data and conclusions) should be incorporated into this educational venue, thus providing audiences linkage with a program of application, an understanding of the scientific process, expert contacts, etc. This strategy will enable interested audience members to further their understanding of a particular subject with an enhanced scientific perspective at a minimal effort level and maximum result.

- **Strategy:** Enhanced educational linkage between the research and monitoring programs and other SINERR programming with emphasis upon the Coastal Training and Educational Programs.
- **Strategy:** Enhanced educational and advisory linkage with external management and policy units including the GA CZMP, GA Sea Grant and GA DNR Coastal Resources Division.
- **Strategy:** Enhanced educational linkage with the practitioner agencies including The Nature Conservancy and RiverKeeper organizations.
- **Strategy:** Enhanced educational linkage with vested scientific communities using the Reserve as a natural laboratory for conducting scientific and academically related research including the GCE LTER and UGAMI.

Objective:

Promotion of and focus upon research and monitoring programs needed to qualify efficacy of restoration efforts in tidal areas in addition to promoting long-term data acquisition of high quality habitats within the Reserve to be used as potential reference sites for the broader coastal restoration practitioner audience.

Background and Strategies: Restoration of disturbed and impacted habitats in coastal areas is a new and growing discipline of science. Simply assessing coastal restoration efforts from engineering, hydrological and elevational models, upland vegetative communities etc., is no longer considered a viable approach to coastal restoration. Conversely, this newly developed field of science is in need of case studies with a wide spectrum of scientific results of application within each distinct bio-geographical region of the coastal United States. Additionally, having a wide range of scientific information on the mechanisms (natural and anthropomorphic) that collectively contribute to the integrity (or lack thereof) and function of physically and biologically restored coastal ecosystems is a fundamental goal of the NERR based stewardship initiative of the Restoration Science programming.

The Sapelo NERR has invested and partnered extensively in the previously described Dean Creek Project in order to meet this growing demand for information related to altered, coastal, saline ecosystems locally, statewide and nationally. This has been achieved by infusing partnerships ranging from several academic institutions to non-government organizations and policy and permitting communities such as Georgia CZMP and the Army Corp of Engineers. The Dean Creek project is directed at understanding anthropomorphic impacts of creek drainage alteration (hydrology) and potential practices that may help in the recovery of these areas. In order to use the information gleaned from the project most effectively, a multi-agency strategy has been formulated with the

following strategies targeting this SINERR research and monitoring program objective.

In addition to the Dean Creek study, the Reserve has also partnered with the UGA Marine Extension Service (MAREX) within its Generating Enhanced Oyster Reefs in Georgia's Inshore Areas (GEORGIA) program, The Nature Conservancy (TNC) within its Coastal Conservation Planning process and the Georgia Coastal Zone Management Program (CZMP) within its Shellfish Sanitation and Permitting and Coastal Restoration programs. Within these agencies SINERR research staff is collectively targeting oyster reef communities as keystone habitats within our coastal estuaries. Assessment of community condition, threats and threat abatement strategies will allow this partnership to target both conservation gaps and to promote the protection, enhancement and restoration of this habitat. This will be facilitated by optimizing on each agency's strengths including research, assessment, conservation promotion, education and policy development, which are all considered fundamental to effective adaptive management programming.

- **Strategy:** Promote and facilitate the development of a coastal Georgia restoration plan.
- **Strategy:** Produce technical reports and peer reviewed journal articles describing the efficacy of the study and information gleaned related to alteration and restoration of physically and biologically impaired salt marsh systems.
- **Strategy:** Develop and focusing of the scientific products and results generated within the study to enhance competitive granting opportunities thereby increasing the scope and application of these results within multiple user groups tasked with coastal policy development and habitat assessment and protection.
- **Strategy:** Infusion of the results of the project into coastal policy to further the protection and enhance the sustainability of similarly altered coastal systems through policy development related to culvert pipe replacement and emplacement. Promotion of the results through the GA CZMP Ecological Services section tasked with permitting and regulation of the Marshland and Shoreland protection Act in GA.
- **Strategy:** Generation of education and outreach materials and infusion of the results of the scientific efforts of this project into parallel objectives of this plans strategies.
- **Strategy:** Enhance the potential for expanding oyster reef restoration studies currently underway within reserve waters to applications of regional scope. Promotion of this developing technology to federal and state programs vested in both purely ecological function enhancements (i.e. the Superfund restoration effort at the LCP Honeywell site in Glynn County) and public resource enhancement sites (state, public shellfish programs).
- **Strategy:** Test Piloting of the NERR Habitat Classification System within the Dean Creek Study for promotion/ review of the systems applications up the salinity and tidal gradients of the Altamaha River riparian corridor. Investigate the potential use of the system to enhance and infuse within

the Nature Conservancy's Coastal, Bio-Geographical Assessment Program locally and potentially nationally.

- **Strategy:** Establish long-term reference sites and associated resource data acquisition within appropriate estuarine habitats that have been identified as critical restoration habitats for coastal ecosystems of the South Atlantic Bight.
- **Strategy:** Develop programming directed at educating and changing GA CZMP Marshland and Shoreland Protection Committee policy by tailoring a special permitting process for shellfish restoration efforts that are currently required to meet marina and dock permitting mandates. The current permitting process is viewed as highly restrictive and in cases, inappropriate and obstructive to beneficial habitat restoration and enhancement efforts by programs such as GEORGIA, sponsored by the Marine Extension Service.

Objective:

The development of research and monitoring programs that provide natural resource management stakeholders with biological information related to the production, sustainability, impacts of harvest and management strategies and potential threats upon commercially important estuarine species within Georgia waters.

Background and Strategies: Many economically important species of fish and shellfish in Georgia's coastal waters have been experiencing declines in harvest metrics even as technological advancements in fisheries practices have enabled better species and size efficient harvest methods. In most cases these naturally recruited marine and estuarine, inshore species are the subjects of state management programs associated with Georgia's commercial fishing section of DNR's Coastal Resources Division. This state government agency is not unlike most management entities in being very taxed in proportion to resource spatial domain/staff and funding for resource management.

Likewise, although this management section conducts some scientific studies, it is charged primarily with reporting landing statistics and other relevant information of resource harvest statistics. Lacking in a research component other than small, directed, discrete studies, many of the investigative programs and products are left to the development of scientifically oriented agencies such as universities and their extension and outreach units. The impasse in funding for natural history research of commercially important marine organisms is directly related to consumer awareness and the availability of an alternative consumable product regardless of its global origin. To this end, many commercially important estuarine resources and populations in U.S. coastal waters succumb to over-harvesting, resulting in long-term stock depletions that may preclude long-term stock recovery efforts.

Coupling the potential of over-harvesting with direct impacts related to upland and near shore development impacts upon fisheries' habitat quantity and quality and the difficulty in defining the separate and collective impacts of each upon a species over time are clearly outlined in both the Oceans Commission report commissioned and published in 2003 and the Pew Report a

private charitable trust report published in 2004. Declines in commercially important species related to over-harvesting and habitat degradation may be found globally, throughout coastal areas in marine vegetative communities, shellfish and finfish populations. In order to help meet the local and regional research needs in this important area of applied science, the SINERR's research and monitoring programs have developed the following strategies targeting the commercially harvested species that have demonstrated significant declines in landings (only statewide population scaled information related to landings is available) over the past several decades for both the blue crab (*Callinectes sapidus*), and the Virginia oyster (*Crassostrea virginica*). These organisms were selected based upon both their ecological importance to Georgia's estuaries (macro-predator, keystone community block/consolidated live-reef, respectively) and their recent population declines and the potential economic significance of each organism.

- **Strategy:** Develop a research and monitoring program targeting the best technique for sampling blue crab megalopal recruitment in Georgia's estuaries.
- **Strategy:** Infuse collated data products from the aforementioned strategy into a predictive model allowing for an understanding of impacts and contributions of physical, climatic, hydrological and biological factors upon occurrence, seasonality and densities of blue crab recruitment into Georgia's coastal waters.
- **Strategy:** Develop a research and monitoring program that collects information of recruitment, potential diseases as contributors to declines in the blue crab (*Hematodinium* sp.) and eastern oyster (Dermo, MSX diseases) populations.
- **Strategy:** Promote the R and M program findings to audiences vested in management of these bio-resources through the Georgia CZMP, Georgia Shellfish Sanitation Program, Georgia blue crab management programs, the UGA Marine Extension Service (MAREX) and the Sea Grant program.
- **Strategy:** Continue working with and building program overlap with local colleges and universities with graduate programs vested in manipulation and restoration of habitat and species of commercial significance via the UGA, UGAMI, Savannah State University and Georgia Southern University.

Objective:

The development of research and monitoring programs promoting an enhanced understanding of mainland and coastal development contributions and impacts upon the chemical, physical and biological components of salt marsh ecosystem function.

Background and Strategies: McIntosh County, within which the SINERR is located, is ranked by the Georgia government as being among the lowest in the state economically, based upon county population per capita income. The county contains significant forested landholdings, as greater than 90 per cent of the total lands fall into either private or commercial timber zoning. The county also contains large, state-owned, protected holdings associated with the

Altamaha Wildlife Management Area and the Sapelo Island R. J. Reynolds Wildlife Management Area (29,000 and 9,000 upland acres, respectively), federally-managed lands including Blackbeard Island and the Harris Neck National Wildlife Refuge, and privately owned conservation acreage through agencies such as TNC. Additionally, the State of Georgia has jurisdictional domain over several hundred thousand acres of salt marsh within the county.

These metrics demonstrate the rural extent and nature of local lands making McIntosh one of the least developed coastal counties on the Atlantic seaboard. Coastal land speculators and developers are rapidly becoming aware of these statistics and seek to develop the remaining uplands into rural residential, commuter and retirement housing for the rapid and growing human demographic influxes currently occurring. Some entities in state government are promoting growth on Georgia's coast toward bridging what it considers a disparaging gap of economic prosperity in comparison to other Georgia counties and the coastal areas of neighboring states of South Carolina and Florida. Not unlike most rural areas lacking in a sufficient tax basis to support growth-infrastructure that targets efficient growth planning such as sewage processing facilities, most of the new developments are being planned to utilize on-site septic systems and advantage currently emplaced drainage ditches and culverts developed by the waning forestry industry for wetland draining thereby allowing for the employment of conventional silviculture technology. The predicted growth will also bring an increase in non-permeable surface coverage, furthered increases in upland drainage and ditching density, decreases in the health and increases in the fragmentation of the area's natural communities.

The Sapelo Island NERR's SWMP program has been recording weather, water and nutrient parameters within nearby estuarine waters for seven years. As trends develop it will become increasingly important that the Reserve infuse this information into local government planning considerations as artifacts of the growing human demographic component and the effects of a growing human population upon the sustainability of nearby estuarine natural resources. Additionally, the Research and Monitoring Programs should strive to enhance the linkage between upland land use and its continuity and impact upon the health of estuarine systems. The following strategies are listed as mechanisms in which the R and M programs can achieve influence upon the manner in which local development proceeds in relation to planning for the protection of coastal watersheds and estuarine health while simultaneously contributing to balanced growth. This objective can be achieved by developing research strategies that focus upon best management construction practices in combination with educating professionals charged with planning environmentally friendly communities that promote the quality of life for coastal residents while providing for the future sustainability of the coasts living resources.

- **Strategy:** Utilize SWMP data related eutrophication issues and monitoring efforts within public forums related to coastal construction and zoning issues.
- **Strategy:** Promote and develop inter-program research and monitoring efforts that allow for the collection collation, and promotion of data related to watershed health.
- **Strategy:** Integration of research and monitoring program products and efforts into similarly focused programs, including the Georgia CZMP, CAC Ecological Services Section of CRD, GCE-LTER, UGAMI, Coastal Georgia Research Council, MAREX, Georgia Sea Grant, all of which are charged with science to management transfer and coastal resource management.
- **Strategy:** Deliver integrated products among Stewardship and Research and Monitoring program on-site sectors to assure that continuity and closely related objectives of both programs' assets, i.e. data, metadata mapping and habitat classification, are optimized for promotion to the SINERR's partners (TNC, CZMP) in these "needs" areas.
- **Strategy:** Perform advisory guidance and development for monitoring and mapping products tailored to meet the needs of local municipality partners engaged in the zoning and development of the currently large-scaled changes in county demographics.
- **Strategy:** Creation of, and training for, SWMP extension monitoring sites for NGO partners that extend up Georgia's primary fresh/brackish water corridors for enhancing the Reserve's SWMP program domain and partnerships toward providing similar, comparable baseline SWMP data while utilizing old, SWMP technology (YSI 6000 sondes) and providing for baseline data for establishing bio-research areas within these upper freshwater/saline gradient areas.

Objective:

The development of research and monitoring programs tailored to provide solutions to (1) the information needs of exotic species occurrence and control, (2) the effects of freshwater hydrological alterations and delivery upon the Reserve's estuarine systems (3) the extent of potential increases in pollution of Reserve waters and, (4) characterization of the current geophysical condition including a qualitative sediment survey for assessment of long-term shifts in the context of sea level rise, climate change and anthropogenic impacts on local, regional and national scales.

Background and Strategies: The aforementioned information needs focus on relevant, current problems that are not only local and regional, but also national in scope. These issues of needed research are found within the charter of the NERRS as critical and priority areas of emphasis for which the national NERR System is charged to provide solutions (15 C.R.F. part 921.50 (a)). In most cases, individual reserves and biogeographic regions place emphasis on different and particular components of each of these larger issues and charges to the national system. This diversity in emphasis and direction across the NERRS is an artifact of each reserve's natural history, setting, local demographic

processes and the diversity of issues that emerge as these primary components interact. The SINERR has chosen a number of priorities as areas of needed study and monitoring as they fit within local, regional and national program priorities.

Hydrological alterations upon fresh and estuarine water delivery processes; exotic species spread and encroachment and water borne pollution and the resilience of coastal habitats to dewatering and alterations of sediment loading are all considered factors directly attributable in origin to, or exacerbated by, human activity. Conversely, climate change and sea level rise although more likely affected by man's interaction with his environment, are viewed primarily as overarching natural processes which superimpose upon, and have the potential to synergistically affect, species range expansions, freshwater delivery, sediment accretion and deposition rates and the abundance and the processing of certain pollutants. Collectively, these factors and processes interact to form a complex and dynamic scope of environmental issues which express themselves with differing intensity and symptoms according to combinations of timing with influencing events, natural processes, human induced factors and the relative size of the perturbation in relation to the affected systems' resilience.

One of the SINERR's research and monitoring program overarching goals refers to the development of "issue-driven, applied research". This approach seeks to provide information on how to best manage the controllable factors related to human influences within an environmental research context. The following strategies are established to meet the growing information needs in the areas of exotic species monitoring and control and human impacts related to growth and development within the SINERR's larger Altamaha River watershed.

- **Strategy:** Develop research and monitoring programs that integrate into regional efforts among vested agencies in exotic species control, monitoring and research.
- **Strategy:** Develop educational and outreach components that demonstrate SINERR's commitment to advancing efforts and partnering capabilities toward both the science and public awareness needed for effective exotic species control in our region.
- **Strategy:** Facilitate the establishment of a chain of communication that will allow for both a statewide and regional approach for information dissemination and control of new Terrestrial and Aquatic Nuisance Species (TNS and ANS; respectively) of concern.
- **Strategy:** Promote and facilitate the development of an Early Detection (ED) and Rapid Response (RR) program within the state and region that will allow for earlier detection and a coordinated response to marine and terrestrial species of concern.
- **Strategy:** Continue to control and monitor *Sapium serbiferum* (tallow tree) within all of the encroached habitats of Sapelo Island.
- **Strategy:** Develop monitoring and research programs and partnerships for studying the invasive biology of marine invaders such as *Perna viridis* (green mussel) and *Petrolisthes armadas* (green porcelain crab). *Megabalanus coccopoma* (giant pink barnacle) and *Mytella charranus* (Charra mussel)

- **Strategy:** Enhance the Reserve's pollution monitoring programs with the inclusion of a mercury deposition component for the National Atmospheric Deposition station currently managed through the R and M programs.
- **Strategy:** Development of a high quality, volunteer oriented, water quality program that employs outdated YSI data sondes as training and development instruments for enhancing needed water quality monitoring and program development within the greater Altamaha River/Georgia estuarine watersheds potentially promoting upstream data record continuity with the Reserve and similarly charged programs in coastal Georgia.
- **Strategy:** Development of research and characterization studies that allow for assessment of the following geo/bio processes and resources related to long-term and event driven change within the reserve and greater Sapelo Island.
 - Organic carbon budgeting and flux rates within sediment resources.
 - Erosion rates at selected points within the reserve / Sapelo Island
 - Channel migration rates of selected waterways in the reserve
 - Distribution of accretion/deposition rates

Objective:

Promotion and development of the SINERR SWMP Program to include real-time viewing components for each SWMP station while meeting the overarching SWMP national goal of real-time International Ocean Observing System (IOOS) connectivity using GOES satellite telemetry for estuarine water and meteorological reporting to both the National Weather Service and the National Trends Network as a portion of the IOOS/SWMP build-out.

Background and Strategies: The worldwide effort to link and integrate remote sensing systems into a fabric of continuous, real-time information transmission and collection has been a growing effort and a targeted objective of international observatories for over a decade. Technological advances in sensor technology coupled with the availability of satellite transmission linkage has brought predictive modeling of major natural events such as storms, tsunamis and earthquakes into the mainstream of human communications enhancing the potential for protection of life and property especially for populations living in near-coastal areas. These systems also have the potential to provide scientists with useful predictive modeling capabilities that may have far reaching effects for improving global natural resource management of the oceans.

As continued advances in sensor technology, predictive modeling and data archiving and retrieval occur, multiple new applications for integrated observatories will precipitate from this growing field of data collection and reporting. In recent years NOAA has been placing emphasis upon the development of an integrated observing program for the nation, which is assuming several convergent developmental phases. The NERR SWMP program has recently achieved notable recognition for the development of a very high

quality, robust (water, meteorological, chemical and biological) data acquisition program that is largely developed around the employment of standardized tools using identical sensor technology systems, sensor deployment protocols, data review and archiving protocols. This sensor technology based program has demonstrated both its flexibility to secure high quality data among a variety of varied systems around the U.S. and its employment of standardized data depository and management program making this ideally suitable for wide range system data analysis. Coupling the SWMP programming with the NERR effort to achieve a forerunning position in real-time data transmission, the SWMP program has been used as a template for the demonstration of current efforts and potential to build a highly integrated, national ocean observing network. The SWMP has been promoted within this framework as a backbone system to which other IOOS efforts should strive to integrate. The current IOOS build-out efforts around the United States are taking convergent pathways toward integration. The developments of institutional processes are underway on regional levels around the U.S. within the context of the Regional Associations to assure interagency cooperation and program build-out among IOOS participants. These build-out, or linkage, agencies are typically managed by physical oceanographers and therefore are expected to initially incorporate sensor technologies involving physical and chemical parameters of importance to this discipline within each region. The ideal IOOS system will incorporate real-time water, weather and atmospheric data across a continuum spanning from offshore marine systems into near-shore and estuarine systems and up tidal gradients into freshwater observatories. It is the marine-into-freshwater IOOS niche that the SWMP program is ideally poised to fulfill on a national build-out basis. As a contribution to the local South Eastern Coastal Ocean Observing Regional Association (SECOORA) and the NOAA/IOOS effort the following strategies will be achieved by the Sapelo Island NERR to aid in this important role of the national NERR System, NOAA, as well as regional and ultimately the national and international efforts in developing global IOOS systems.

- **Strategy:** Achieve on-site operations, real-time viewing status for all four water quality stations currently employed as components of the SINERR's SWMP program.
- **Strategy:** Achieve GOES satellite transmission to the National Weather Service, the Central Data Management Office and the National Trends Network for the Marsh Landing SWMP estuarine water and weather stations as a portion of the IOOS backbone build-out.
- **Strategy:** Develop a public educational display of an explanatory water and weather quality, real-time data acquisition system of SINERR's SWMP and IOOS programs that is web accessible for both classroom and coastal resource management applications.
- **Strategy:** Develop an educational and interactive display of an explanatory water and weather quality, real-time data acquisition system of SINERR's SWMP that is available for viewing within the Sapelo Island Visitors Center by the general public audience.

Research and Monitoring Strategies Summary.

The mission of the research and monitoring program is to provide scientific, management, regulation and policy communities on the local, regional, state and federal levels with high quality, robust, environmental databases for assessment of both short-term variability and long-term trends occurring within the nation's estuaries. This mission allows the Sapelo Island NERR to serve both as an information base for poorly funded monitoring programs and as a template for the establishment of high-quality estuarine reference sites. Additionally, focusing the Reserve's applied scientific programs to the needs of the Coastal Zone Management Program is intended to positively impact the application of a broad range of research findings. These may be generated through the scientific and academic communities to infuse environmental benefits within the resource management sector while also enhancing environmental policy interpretation in the realm of both regulation and policy. Specific goals in this regard include, but are not limited to:

1. Development and enhancement of research and monitoring initiatives which promote program overlap through increases in partnership capacities, fiscal efficiency, educational and outreach foci and delivery into a cohesive understanding of coastal issues for dissemination to concerned public, private and governmental entities tasked with developing collective programs which provide environmental issue resolution.
2. Promotion of, and focus upon, research and monitoring programs needed to qualify efficacy of restoration efforts in tidal areas.
3. Development of research and monitoring programs that provide natural resource management stakeholders with biological information related to the production, sustainability and impacts of harvest and management strategies upon commercially significant estuarine species that are in decline in Georgia waters.
4. Development of research monitoring programs promoting an enhanced understanding of mainland and barrier island development impacts upon the chemical, physical and biological components of salt marsh ecosystem function.
5. Development of research and monitoring programs tailored to provide solutions to the information needs of exotic species occurrence and control; development and enhancement of integrated oceanographic observing systems; and documentation of the effects of freshwater hydrological alterations and delivery upon estuarine systems within the context of climate change and sea level rise on local, regional and national scales.
6. With completion of the new research dormitory on the Reserve, SINERR intends to achieve a full-time presence of researchers conducting field investigations within the Reserve in a multiplicity of academic disciplines, including both long-term and short-term work by visiting scientists from various academic institutions and graduate research fellows conducting applied estuarine research under the auspices of the Reserve.
7. Construction of a scientific research and water quality monitoring laboratory at Long Tabby in tandem with the existing education laboratory on site.

8. Further development of partnerships among local, regional and state entities, public sector (state and federal), academic institutions, scientific organizations and agencies, and non-profit (conservation-oriented) groups and organizations.

9. Production of an updated and expanded version of the existing Sapelo Island NERR ecological site profile in electronic format, in CD-ROM and with website access, so as to reach greater audiences in the scientific and academic communities.

10. Establish and develop a formal, catalogued research library on site.

SINERR research priorities.

The SINERR, as an extension of NOAA and a facilitator of site and regionally specific research and monitoring programs, is working within the federal framework of its charge to satisfy both the national program needs and the local/regional research and monitoring needs. By developing applied scientific programs directed at meeting the information needs of the local, regional and national interests, the Reserve is collaborating with its site-specific partners to enhance the recognition and development of applied management products within the NERR system, the SINERR and the Georgia DNR Wildlife Resources Division programs on Sapelo Island. The Reserve is also working within the scientific and management circles of the state and local programs to provide solution driven scientific results of importance to coastal Georgia. In operating within this diverse landscape of scientific needs and directives, the SINERR's programmatic solution to meeting this laminated program is through a tailoring of focused research efforts within the NOAA/ERD framework and listed below as SINERR scientific program priorities:

1. Anthropogenic influences upon estuaries;
2. Habitat protection, conservation and influences upon coastal processes;
3. Exotic and endemic species management;
4. Mechanisms for sustaining resources within estuarine ecosystems; and
5. Economic and sociological research applicable to estuarine ecosystem management.

SINERR research program currents within NOAA/ERD priority listings.

The following section, "program currents", is a necessary inclusion to the SINERR Research and Monitoring Plan as it establishes the foundation of current research efforts within the NOAA/ERD priorities listed above. Additionally, it should be recognized that as a foundation of information and efforts the programs listed below will retain continuity thereby expanding and infusing into the future planning and developmental directions of the SINERR's research and monitoring programs and planning processes. The studies and initiatives included within this section were not under development in the former (1999) SINERR Management Plan thus; these program advancements represent SINERR's commitment to enhance, facilitate and promote the applications of estuarine

science within the Reserve's many academic, federal, state and non-government partnerships.

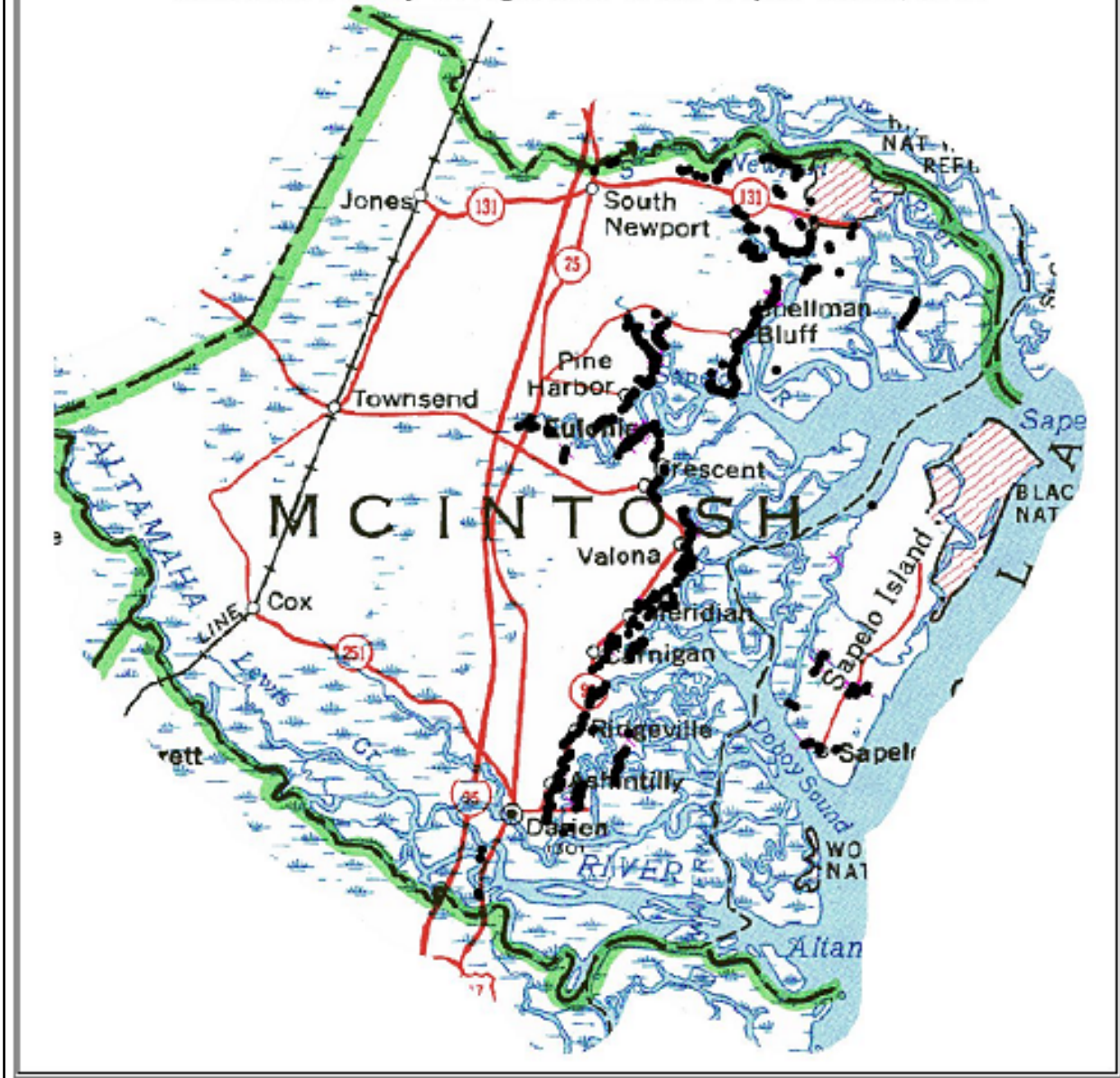
Non-point source pollution approaches.

The SINERR has been focusing on the establishment of a database and research program targeting septic system leachates found within the immediate mainland and island interfaces with Reserve waters. The nutrient monitoring program includes both fecal coliform and *enterococcus faecalis* culturing and assessment conducted in accordance with the EPA standards for water and wastewater chemistry. These are non-required NOAA/ERD parameters that will allow the Reserve to establish trends in septic system runoff which may eventually provide the Reserve with information related to anthropogenic influences that affect dissolved oxygen levels (DO as an indicator of hypoxia), eutrophication, pollution of Reserve waters and other biological processes contributing to potential declines in estuarine system integrity. In addition, the Reserve has been working for several years with other research and management units (McIntosh County Department of Environmental Health, UGA Department of Department of Crop and Soil Science MAREX, CZMP 315 council, GRF students) to assess the overall fecal budget of nearby waters using the following programs that focus the research effort to target this directive in accomplishing the long-term goal of assessment of estuarine health.

Current, or previous, relevant initiatives in this regard include:

1. A SINERR-sponsored Coastal Decision-Makers Workshop entitled "Septic System Construction and Function" was conducted;
2. SINERR committee membership within the CZMP/EPD 315 non-point source pollution program for coastal Georgia;
3. Participation in the EPD/CZMP beach monitoring program using Sapelo beaches and SINERR personnel to monitor fecal coliform related to swimming safety assessment, which qualified the Reserve waters to serve as a high quality reference site for state, marine water swimming advisories
4. A fecal coliform analysis study entitled "Field testing targeted sampling and *Enterococcus faecalis* to identify human fecal contamination in three NERRs" was prepared by Dr. Peter Hartel of the UGA Department of Crop and Soil Sciences through funding provided by competitive proposal submission to CICEET;
5. A comprehensive, near-water septic system mapping of McIntosh County with a visual inspection of system functionality used as a template for all of Georgia's first tier, CZMP counties was compiled;
6. A competitive proposal, authored by the SINERR Research Coordinator and facilitated through the UGA Marine Extension Service allowed the McIntosh County environmental health program high quality information on near water septic system functionality;
7. GRF student (2004-05) Sarah Hemmings prepared a study entitled "Combining Targeted Sampling Fluorometry to Identify Sources of Fecal Contamination to the SINERR". It included both fecal coliform and *enterococcus faecalis* as measured parameters within the nutrient sampling program under SWMP for all four water quality stations (2003-present).

McIntosh County Georgia Near Water Septic Tanks, 2002



- ✕ Disfunctional Septic Tank (53 of 1056)
- Functional Septic Tank (1003 of 1056)

Background Image: 1:500,000
Digital Raster Graph (USGS 1998)



1 0 1 2 3 Miles

1 0 1 2 3 Kilometers



Habitat restoration within the SINERR.

Habitat restoration efforts have been practiced in a diversity of venues within the SINERR that were either not underway or not included within the previous, 1999, version of the SINERR management plan. The scientific approaches to this directive have been focused on acquiring information related to restoration science and efficacy as dictated by habitat and management needs within the Reserve and its surrounding lands. These efforts have been largely facilitated through joint programming between the Reserve's stewardship and research coordinators and generally include a robust GIS mapping and archiving component within most of the conducted science. In many cases, "habitat restoration" is synonymous with exotic species control efforts that are described in richer detail within that section (see below, Biodiversity and Invasive Species Research). The programs listed below help to characterize recent efforts the SINERR has made in advancing both the federal priorities and site-specific management needs of enhancing and restoring high-priority habitats within and surrounding Reserve properties.

1. **The Dean Creek hydrological restoration program** (Figures 15, 17). An ecological approach to understanding effects of tidal creek hydrological alteration and restoration upon the vegetative, faunal, geological and hydrological processes and components of a fragmented, tidal salt marsh and creek system in coastal Georgia.
2. **Upland Maritime Forest Restoration** Studies involving a practitioners approach to enhancing the *Quercus virginiana* (live oak) dominated, climax forest community on altered habitats of a southeastern barrier island. (Figure 10).
3. **Reducing Chinese Tallow** (*sapium serbiferum*) within Sapelo's sensitive inter-dune meadow (see also section on invasive species research).
4. **Characterization of the Longleaf Pine Forests of Sapelo Island.** Perspectives of forest age, growth, species diversity and species density. Working to enhance and promote site-specific management of this rare natural habitat (Figures 19, 20, 21).
5. **GRF student Justin Manley, Savannah State University/UGA MAREX.** Cooperative student study entitled "Oyster Reef Restoration for Developing Essential Fish Habitat in Coastal Georgia." A project designed to test the feasibility and efficacy of restoring inter-tidal oyster reef resources within Georgia's inland waters (Figures 26, 27(a, b), 28(a, b)).

Habitat restoration within the Reserve and the promotion of NERR restoration initiatives has been practiced by the RC through his promotion of the developing NERR classification system within partnerships of the Reserve with TNC, UGAMI, GCE-LTER and other programs. Currently he is serving as a TNC sponsored Efronson Fellow tasked with the development of conservation targets, habitat integrity indexes and threats to coastal ecosystems found within the Carolinian (Southeastern coastal) Bio-geographic Region. Participation in the Efronson Fellowship program coupled with the joint TNC/GA CZMP efforts to develop a

statewide restoration inventory and plan have placed the SINERR in an influential position to provide guidance and support to these important programs tasked with tailoring federal, state and local efforts in meeting the habitat restoration needs within coastal Georgia. Additionally, the Reserve is participating on the reference-site workgroup charged with developing a white paper/proposal for promotion and establishment of a NERR system wide approach to restoration science reference sites which will serve to regionally qualify federally funded coastal restoration efforts for enhancing and restoring high-priority habitats. The projects listed below are examples of SINERR sponsored and coordinated habitat restoration efforts with the SINERR boundaries.

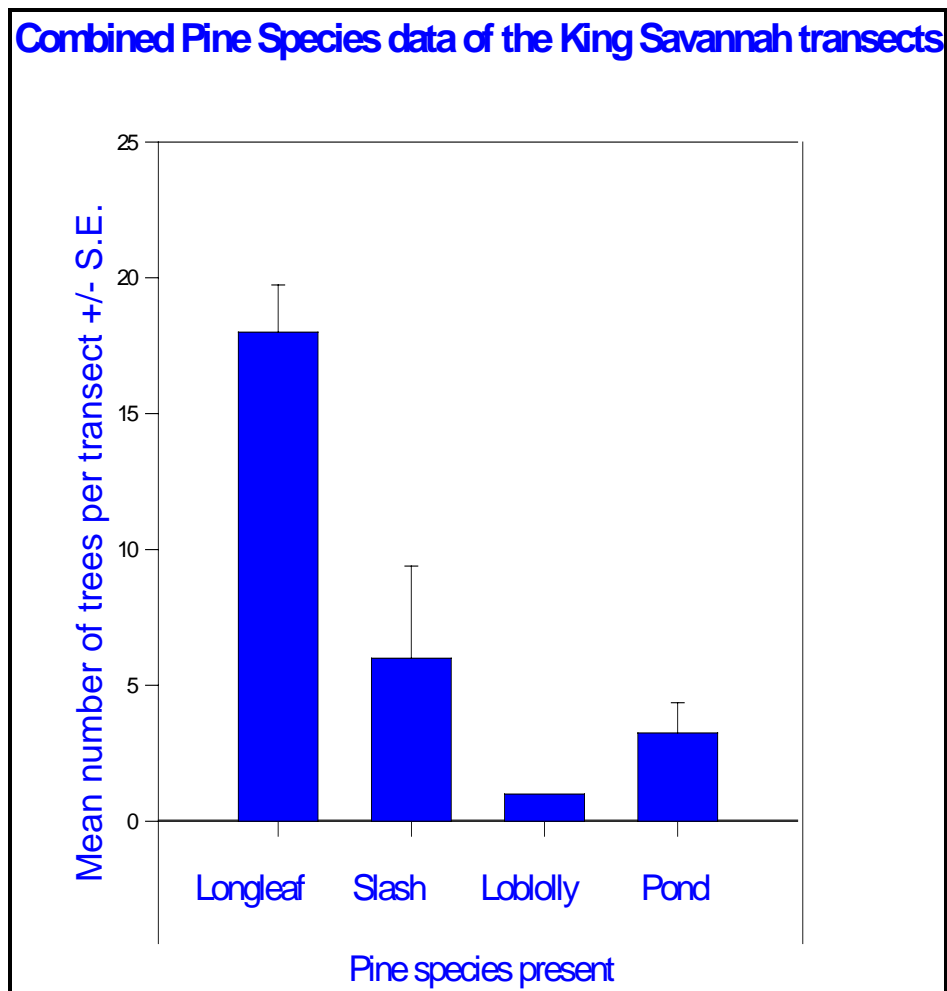


Figure 19.

Histogram describing transect data on pine species occurrence within the King Savannah area (barrier island sand hill habitat) of Sapelo Island. This data is being used to supplement the development of a 50-year forest plan for this specialized ecosystem.

Relative (n = 43), LLP distribution by age class(years) in King Savannah

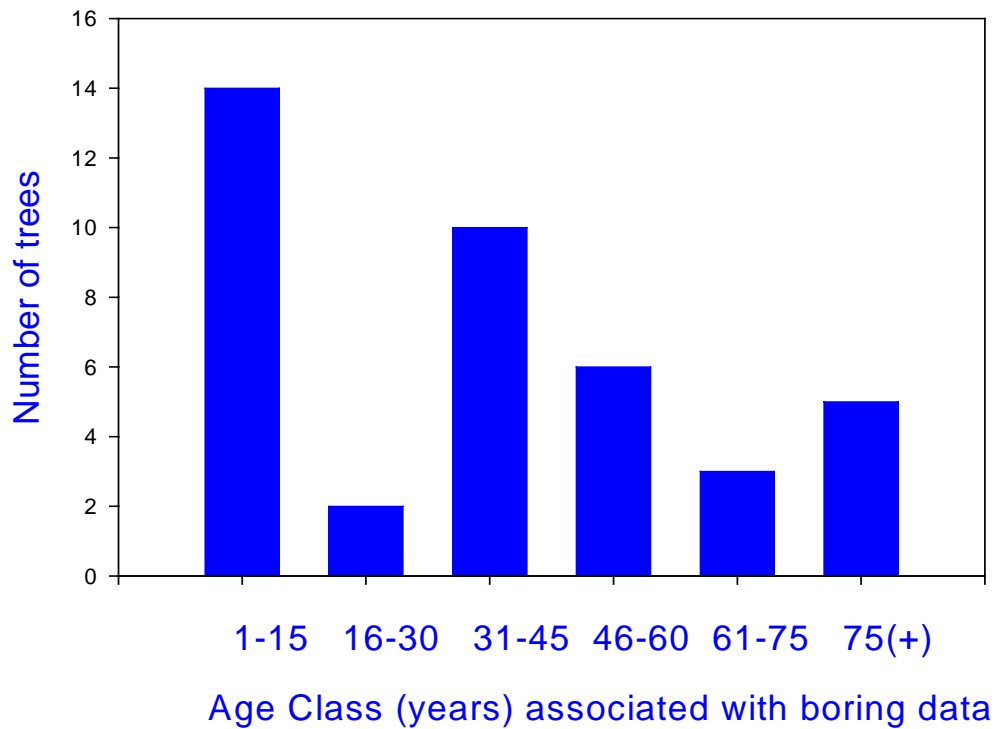


Figure 20.

This histogram demonstrates the age classes of Pinus palustris (longleaf pine) located with the King Savannah Area. Note the lack of recruitment within the 16-30 year class.

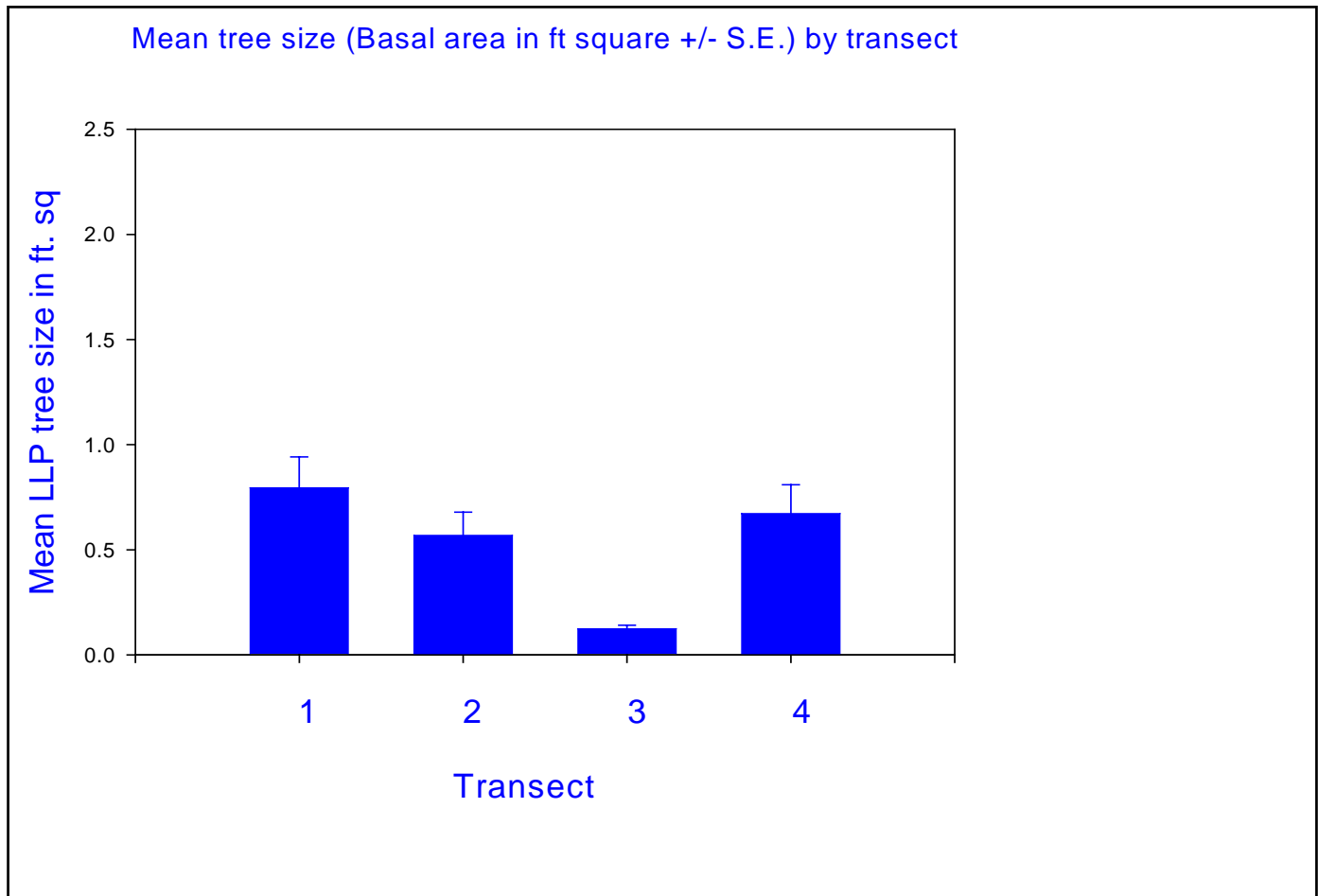


Figure 21.

This histogram describes the mean standing density of longleaf pine in the King Savannah area of Sapelo Island based upon 4, 300m. x 5m transects. Transect densities have been converted into basal feet/acre to allow for forestry management interpretation.

Biodiversity and invasive species research within the SINERR.

Invasive species have been globally recognized as chronic threats to natural habitats, biodiversity and endemic species. The SINERR's research, monitoring and stewardship programs have established a wide spectrum approach to facilitating research, policy and control of invasive species within the Reserve and the Carolinian biogeographical zone in which the Reserve is situated. From perspectives of biodiversity the NERRS is currently piloting an essential elemental tool to characterize biodiversity through the development of a national classification system. This classification system is designed to address the complexity of estuarine habitats that exist from submerged, emergent and upland habitats found in coastal marine dominated systems into freshwater tidal zones. This novel tool has been largely accomplished by merging standard existing classification systems (Cowardin and Anderson) into a tool with ubiquitous applications to all coastal systems. SINERR staff has further promoted the system to both the Georgia CZMP and the local Nature Conservancy Altamaha BioReserve toward enhancing the local and regional applications and potentials of this needed biodiversity-indexing tool. The Reserve's partners within this area of concern include a large array of academic institutions, non-government organizations and management and regulation agencies. The following represent previous or ongoing initiatives the SINERR research and monitoring programs have undertaken to meet these important federal and state goals.

1. Participation in the NERR sponsored Invasive Species Workshop held in the Asilomar Conference, Monterey California. This workshop initiated the construction of the NERR national invasive program participation.
2. SINERR's participation in a national NERRS-sponsored benthic decapod monitoring program in which the *Petrolistes armatus* (green porcelain crab) was discovered in the Duplin River (2001-2003)
3. Workshop on invasive species in coastal Georgia. Co-sponsored with The Nature Conservancy Altamaha Bio-Reserve. Marine and freshwater aquatic and terrestrial invasives were highlighted with invasive biology, current status, range and impacts. (2004)
4. Sponsorship and research and GIS mapping of the TNC/Reserve information pamphlet on invasive species of concern within the habitats of coastal Georgia (Figure 22).
5. SINERR, in partnership with UGA Department of Marine Sciences and MAREX, established a statewide monitoring program for estuarine invasive species using a standardized collection protocol. This program was in response to the recent documentation of the invasive *Perna viridis* (green mussel). Public flyer warnings and reported sightings were mapped (Figures 23, 24). This program was discontinued in 2004 due to lack of securing fiscal sponsorship.
6. Factorial study to test herbicidal efficacy and control of Chinese tallow (*Sapium serbiferum*) in sensitive habitats (interdune meadow) of the SINERR was initiated and continues to be researched with new applications and herbicides being implemented in the fall of 2005.
7. GRF student Amanda Hollenbone conducted a thesis study on the green porcelain crab invasive biology within the Duplin and Skidaway Rivers of coastal Georgia. (Figure 25).

Sustaining resources within estuarine systems.

Trends and shifts in human demographics into coastal settings over the past several decades have forced coastal areas to increase population amenities, infrastructure and industrial efforts exponentially. This increase in human activity is related inversely to habitat integrity and directly to impacts upon coastal resources. The SWMP is charged with data acquisition and assessment of long-term trends and short-term variability related to water and weather data. Through this vehicle the Reserve collects and archives information related to effects of local coastal growth over time.

However, the monitoring of abiological parameters of SINERR lands and waters alone will not address issues associated with cause and effect relationships affecting the integrity and sustainability of our coastal resources. In order to meet this federal charge and state need, the SINERR has developed a large spectrum of programs ranging from enhancing coastal habitat function, characterization of current salt marsh function, studies involving secondary production and recruitment trends, species specific disease prevalence and correlates, hypoxia trends, etc., as related to the sustainability of Georgia's coastal resources. Many of the highlighted programs below have expanded into much larger research initiatives that include active management ramifications. The data collections and results of these efforts are evolving into hallmark programs for enhancing and sustaining coastal resources by virtue of their integration into larger scientific, management and policy agencies charged with extending the work into applied programs.

Featured initiative: Dean Creek hydrological restoration project.

The state of Georgia is experiencing rapid growth and development within its coastal zone. Construction practices using culvert piping, ditching and causeway construction have adversely affected our nation's coastal marshes by altering the depth, duration and frequency of tidal flooding. These construction practices in most cases are designed to facilitate access across inter-tidal areas with little consideration of their effects on the hydrodynamics, ecological health, and function of adjacent marsh and estuarine habitats.

Dean Creek (Figure 15), a small tidal creek located on Sapelo Island's southern end, the largest portion of which is contained within the Reserve's boundaries, was impacted by the construction of a causeway and culvert pipe system in the 1940s under the direction of R.J. Reynolds, former private owner of the island. The causeway and culvert pipe system effectively fragmented the creek's uppermost 58-acre salt marsh from formerly contiguous marsh habitat south (downstream) of the causeway. In addition to habitat fragmentation, the causeway likely reduced tidal flushing and sediment transport in marshes upstream of its emplacement and altered the distribution of emergent plant communities and, perhaps other trophic levels including benthic infauna and macro-faunal communities. Recent tidal undermining of the culvert pipe system coupled with erosion of the associated causeway have rendered it impassable

to vehicles necessitating replacement of the historical structure with a new bridge.

Objectives: The objectives of this project are to develop an understanding of the impacts of the culvert pipe and causeway on tidal marsh hydrodynamics, sediment transport, plant communities and marsh fauna, and the potential reversibility of these impacts following replacement of the culvert pipe/ causeway with a bridge. We will measure changes in stream flow and morphometry, sediment deposition, emergent plant communities and macrofauna at temporal (prior to and following bridge replacement) and spatial (upstream and downstream) scales designed to identify the long-term effects of the existing culvert pipe/levee system on ecological integrity and to quantify whether the spanning bridge improves ecological health of marshes upstream of the bridge. We will also monitor water quality parameters within the creek during the construction phase to gain an understanding of the short-term impacts related to the construction process. It is hoped that this project will aid in the interpretation of the Georgia Marshland and Shoreline Protection Act of 1970 by helping to define Best Management Practices related to coastal roadwork construction.

In addition to meeting NERR System bio-monitoring requirements for emergent vegetation, the following initiatives and partners have added greatly to the scope of the overall Dean Creek project by including additional biological and physical measurements and comparative correlates within the study.

1. GIS point mapping of all oyster reefs within the creek system including triplicate sub-samples of oyster density and spatial morphology of each reef. (Partner: Justin Manley, Sapelo NERR GRF, Savannah State University)
2. Two continuous, 30-day deployments using velocimeter technology within the creek channel to quantify pre-construction tidal velocity. (Partner: Dr. Daniella Di Iorio, Physical Oceanographer, UGA Department of Marine Sciences)
3. High resolution, creek cross-sectional survey of velocimeter deployment site for assessment of flow (l/min) and amplitudes to characterize tidal hydrological exchange with the study area.
4. Creek survey transects upstream and downstream of the construction site at graduated intervals ranging from 5m (near the earthmoving area) to 100 m (near the basin's headwaters and creek mouth) for delineation of creek morphometry (Partner: Dr. Victor Thompson, UGA Department of Anthropology)
5. Establishment of a of a continuous System Wide Monitoring Program (SWMP) water quality station (Dean Creek) located approximately 100 m north of the bridge replacement site for assessment of pre- and post-construction water quality conditions within the creek.
6. Surveys of benthic infaunal and macro faunal communities in permanent plots established in the high marsh, low marsh, inter-tidal and sub-tidal habitats. Measurements will be made annually and compared with changes in flow and vegetative dynamics (Partners: Dr. Dale Bishop, Benthic Ecologist UGA department of Marine Sciences and GCE-LTER: Schoolyard)

Project Successes: The NERR bio-monitoring project for emergent vegetation has been expanded within this project to include a larger, ecologically-scaled effort to quantify the effects of culvert pipe engineering on salt marsh ecosystem function and to evaluate the effects of spanning bridge construction on restoration of tidal flows, sediment deposition, marsh vegetation and fauna. Culvert pipe construction is a standard practice for stream crossings in freshwater and tidal creek applications. From a resource management perspective it is important to know how different construction practices affect tidal marsh structure and function and which techniques are superior from perspectives of maintaining the health and integrity of tidal marsh systems. The multi-disciplinary approach that we have employed has attracted a wide range of interest and partners enabling us to expand the scope and potential applications of the study. Future studies may include a migratory bird habitat utilization component. We also hope to apply to the Army Corps of Engineers for restoration and enhancement credits should our monitoring efforts show significant improvement in the ecological integrity of marshes upstream once the bridge is replaced. SINERR monitoring efforts have also been recognized and promoted by NOAA's CEO, Vice Admiral Conrad Lautenbacher as "a good example of an ecosystem approach to management considering the number of variables under investigation and the scope of the partnerships" (Address, University of Georgia, Athens, April 2005).

Research opportunities: SINERR's role in promoting the Reserve as a platform for scientific investigation.

Graduate Research Fellowship (GRF) program participation.

Graduate and post-graduate students become aware of research opportunities at the Reserve through lectures by Reserve staff and through published studies, and are encouraged to use Reserve sites for thesis and doctorate work. The Research Coordinator has devoted a considerable portion of his time collaborating and fusing partnerships with researchers from a wide spectrum of academic disciplines and institutions from several states to conduct estuarine research within the SINERR. Currently, research conducted within the Reserve and DNR properties on Sapelo Island is dominated by the Reserve's issue-driven research venue, which is in sharp contrast to the island's prior research landscape abovementioned to the filling of the Research Coordinators position.

Infrastructural development.

The growth of the research and monitoring programs within the SINERR have precipitated the need for infrastructural enhancements of on-island facilities to accommodate this expanding scientific venue. In solution to this need the Reserve has partnered with the UGAMI and the UGA Department of Marine Sciences to co-sponsor the construction of a housing and meeting facility

designated as the Barrier Island Research and Learning (BIRL) center (Figure 12). The construction of this facility was completed in early 2007. A groundbreaking on UGAMI leased properties was held in April 2005, adjacent to the administration buildings of the campus. The dedication ceremonies for the facility were conducted in May 2007. The BIRL provides dedicated space (4 beds and efficiencies) to SINERR sponsored researchers. Additionally, this entire facility (27 beds) will be at the disposal of the SINERR for larger meeting agendas at no cost to the Reserve (Appendix F: Memorandum of Agreement between the SINERR and UGAMI).

Non-Staff research opportunities and requirements.

University of Georgia Marine Institute resident faculty, other qualified scientists, students, non-profit research organizations, and state agencies are among the entities that have conducted research at the Sapelo Island Reserve. Any researcher with adequate scientific qualifications and financial support may request permission to conduct estuarine research within the Reserve. Those who use the Reserve as a research site may investigate fundamental questions of broad application, or may address particular management issues on topics consistent with the purposes of the Reserve.

Projects that involve manipulation of habitat may require advance approval by NOAA (15 C.F.R. 921.1[d], Appendix C to this document), and must be approved by the SINERR Research Coordinator. By federal regulation, projects known to be destructive to habitat or otherwise counter to Reserve goals are not permitted. Projects that have been approved must be discontinued if they prove to be destructive. All visiting researchers are asked to complete a form briefly summarizing their proposed work and research site(s) within the Reserve to avoid duplicative projects, or incompatible projects at the same site. Within this venue, the Reserve is developing an interactive GIS mapping and metadata program. This information database will be updated with each approved research or management activity conducted on Sapelo Island and is being developed to assure that conflicts among and between management and research activities and agencies are avoided (Appendix G: MOA for the collective management and mapping of scientific research, monitoring and management activities on Sapelo Island).

Secondarily, but equally important, this database will allow for the efficient archiving and establishment of an historical data base of resource manipulation and metadata facts and fields for attribution to all lands and habitats of Sapelo. In this manner, researchers and managers will be able to review the historical practices associated with each area under consideration for scientific study allowing for a long term understanding of the effects of particular scientific projects and management applications to the habitats subjected to each.

Research coordinator's role in marketing the SINERR program.

The Research Coordinator disseminates research program information in a number of different medias including workshops, lectures and advisory roles. He has provided lectures on coastal processes, issues and scientific advances at

several prestigious institutions of higher learning and audiences including solicited lectures and participation with: the Skidaway Institute of Oceanography, Georgia Sea Grant Program, University of Georgia Marine Institute, Georgia Southern University, The Nature Conservancy: Altamaha BioReserve, Grays Reef National Marine Sanctuary, Coastal Resources Division, Georgia Coastal Zone Management Program, National Estuarine Research Reserve System: Restoration Science Program, and the UGA Department of Marine Sciences: Boyd Lecture Series, all within the recent past. Additionally scheduled lectures include Savannah State University and Armstrong State University. The Research Coordinator has achieved adjunct faculty status at Georgia Southern University and is applying for faculty status at Armstrong State University. The Reserve has published two scientific articles in the past year within peer-reviewed journals including *Journal of Coastal Research* and the *Journal of Shellfish Research*. The Research Coordinator prepared a manuscript for publication within the *Journal of Coastal Research* and submitted it for review in July, 2006. He has authored multiple articles for newspapers, newsletters that strive to build partnerships and express both the conservation and research roles and the directives of the SINERR and the Georgia Department of Natural Resources in meeting this charge.

Top 10 List

The Nature Conservancy and the Sapelo Island National Estuarine Research Reserve identified the following invasive species as potentially the most devastating to the ecological balance of south Georgia.

- **Asian green mussel (*Perna viridis*)** A large mussel with a sharp tapered beak. Vivid green to dark brownish-green near the outer edge and olive green near the attachment point.
- **Chinese tallow (*Sapium sebiferum*)** A small tree with aspen-like leaves and white fruit in the fall. Grows along rivers, creeks, ponds and wetlands; displaces native vegetation; toxic to wildlife and fish.
- **Chinese privet (*Ligustrum sinense*)** An evergreen shrub with small opposite leaves found in disturbed areas.
- **Common reed (*Phragmites australis*)** Found along roadsides, in ditches and marshlands; displaces native plants.
- **Feral hogs (*Sus scrofa*)** Wild boars dig up native vegetation, and eat food that native wildlife need to survive.
- **Flathead catfish (*Pylodictis olivaris*)** Voracious predator; preys on native fish species in large streams and rivers.
- **Green porcelain crab (*Petrolisthes armatus*)** Small, flattened marine crab which is thought to displace native crabs.
- **Kudzu (*Pueraria montana*)** A perennial deciduous vine with small purple flowers; destroys native vegetation.
- **Rattlebox (*Sesbania punicea*)** A shrub with a "hat-rack" shape and 10 to 40 leaflets on a branch with showy red flowers in late spring and early summer. Forms dense thickets and replaces native vegetation.
- **Water hyacinth (*Eichhornia crassipes*)** Native to South America, a floating aquatic plant with purple blooms. A fast growing plant; it clogs waterways, shades out native vegetation and reduces oxygen in the water.



Cover photo - University of Alabama, Center for Public Television and Radio

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NATIONAL
ESTUARINE
RESEARCH
RESERVE
SYSTEM

Fighting Back

A Guide to
Invasive Species in
South Georgia

Figure 22.

University of Georgia Marine Extension Service
and
Sapelo Island National Estuarine Research Reserve



Marine Extension Note 1

April 2003

Have You Seen This Mussel?

Georgia Invasion?

The green lipped mussel, *Perna viridis* (Linnaeus, 1758), is a commonly found mussel of the family Mytilidae widely distributed in tropical to subtropical waters of the Indo-Pacific region. They naturally occur from the Persian Gulf to south-west Pacific and from southern Japan to Papa New Guinea. It may occur in high numbers and is commercially harvested in many areas. It is one of two species of green mussels one finds being served in Chinese, as well as other fine restaurants.

This mussel is non-native to America, but has been found in Tampa Bay, FL and is considered an invasive species. It was first discovered in Tampa Bay in 1999 and has spread south along the Gulf of Mexico coast to Boca Grande outside of Charlotte Harbor, FL. It is believed to have been introduced when ballast waters of cargo ships were pumped into Tampa Bay, releasing larvae of the mussel.

In early 2003, the green lipped mussel was found in St Augustine, FL. It is likely that the mussel will spread northward into Georgia. These mussels will foul water intake pipes for coastal business, buoys and pilings. They may pose a threat to native shellfish species by out competing them for space and food resources.

IDENTIFICATION: Mussels may reach 150 mm (~6 inches) in shell length. Juveniles



have a brilliant green color, which darkens to a darker green to brown color in adults.

LIFE HISTORY: Mussels grow to 150 mm, reach sexual maturity in two to three months at 20 mm, have separate sexes, and have a life span of three years. They attach to pilings, buoys, etc. by byssal threads. They live in water of mid to high salinity (16 to 33 PSU) and in water temperatures of 10 to 35°C (50 to 95°F). They tend to occur in subtidal areas, but occasionally may be found in the lower intertidal zone. They feed on phytoplankton and detritus filtered from the water.

If found: Please contact Dr. Alan Power or Ms Mary Sweeney-Reeves of the Marine Extension Service at 912-598-2348 or alanpowr@uga.edu or Mr. Dorset Hurley of the Sapelo Island National Estuarine Research Reserve at 912-485-2251 or dhurley@darientel.net

Figure 23.

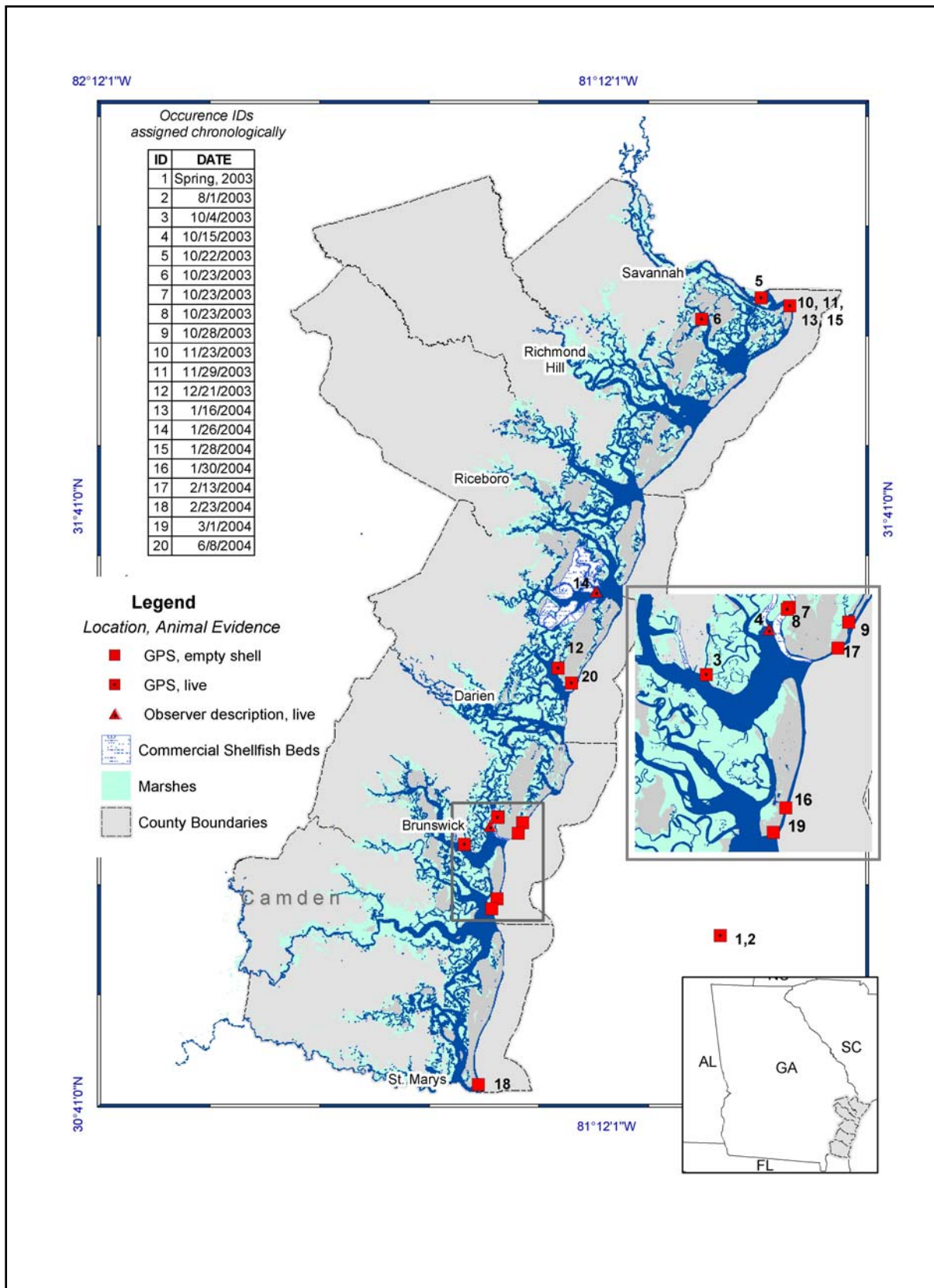


Figure 24.
Range Map of *Perna viridis*, Karen Payne, UGA.

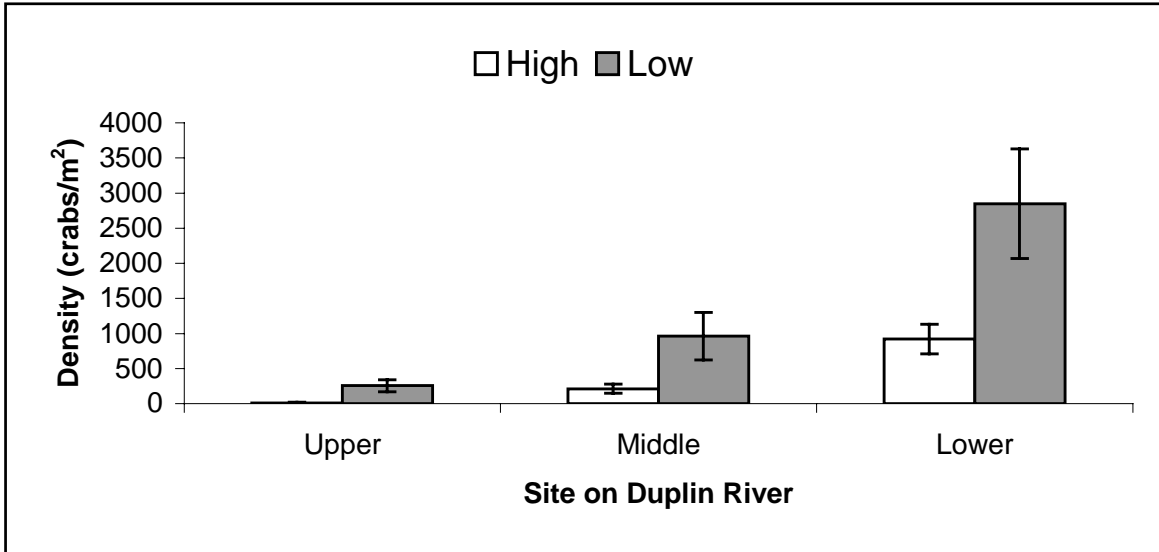


Figure 25.

This histogram depicts the green procelain crab (GPC) densities in varing environments within the Duplin River. This data demonstrates the GPC's inability to colonize either intertidal or low flow conditions within our Reserve. Data obtained and analyzed in fall 2003 by Graduate Research Fellow Amanda Hollenbone.

Oyster Recruitment Site Locations

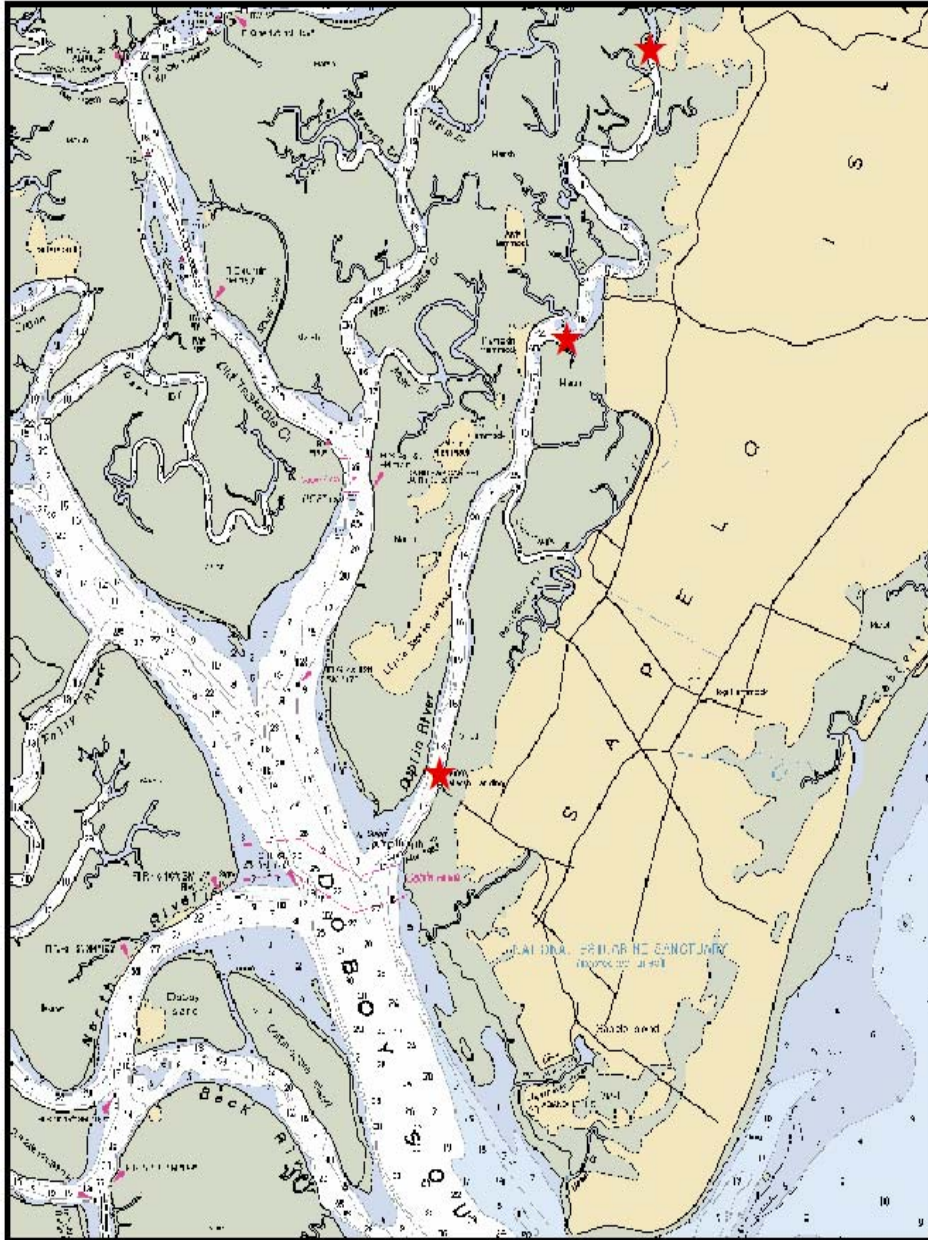


Figure 26.



Figure 27(a).



Figure 27(b).

Figure 27(a): oyster restoration treatments; 27(b): Optimal oyster reef restoration treatment that advantages natural spat settlement (9x9 French collector pipes at one year post deployment)(GRF student Justin Manley).



Figure 28 (a).

Photo of oyster size at time of termination of a 2 year GRF experiment.

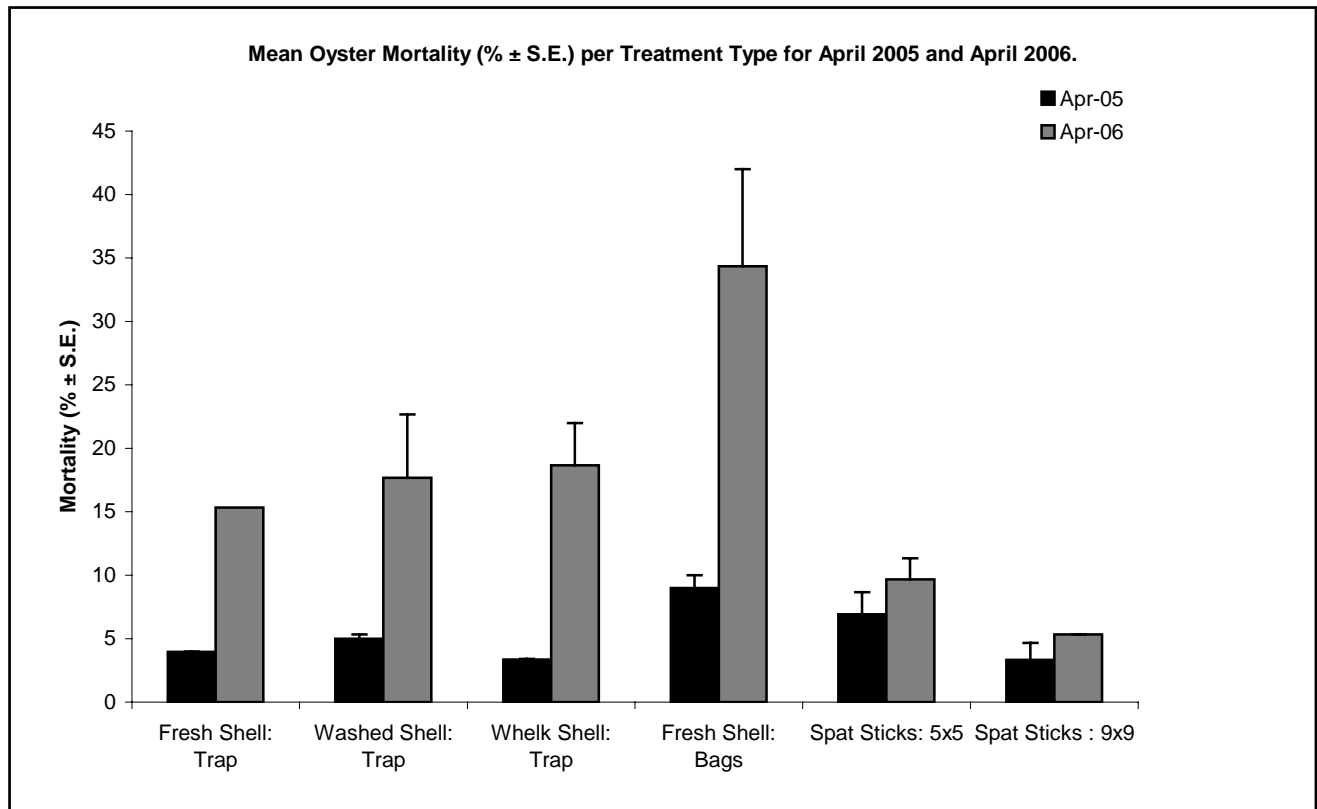


Figure 28(b).

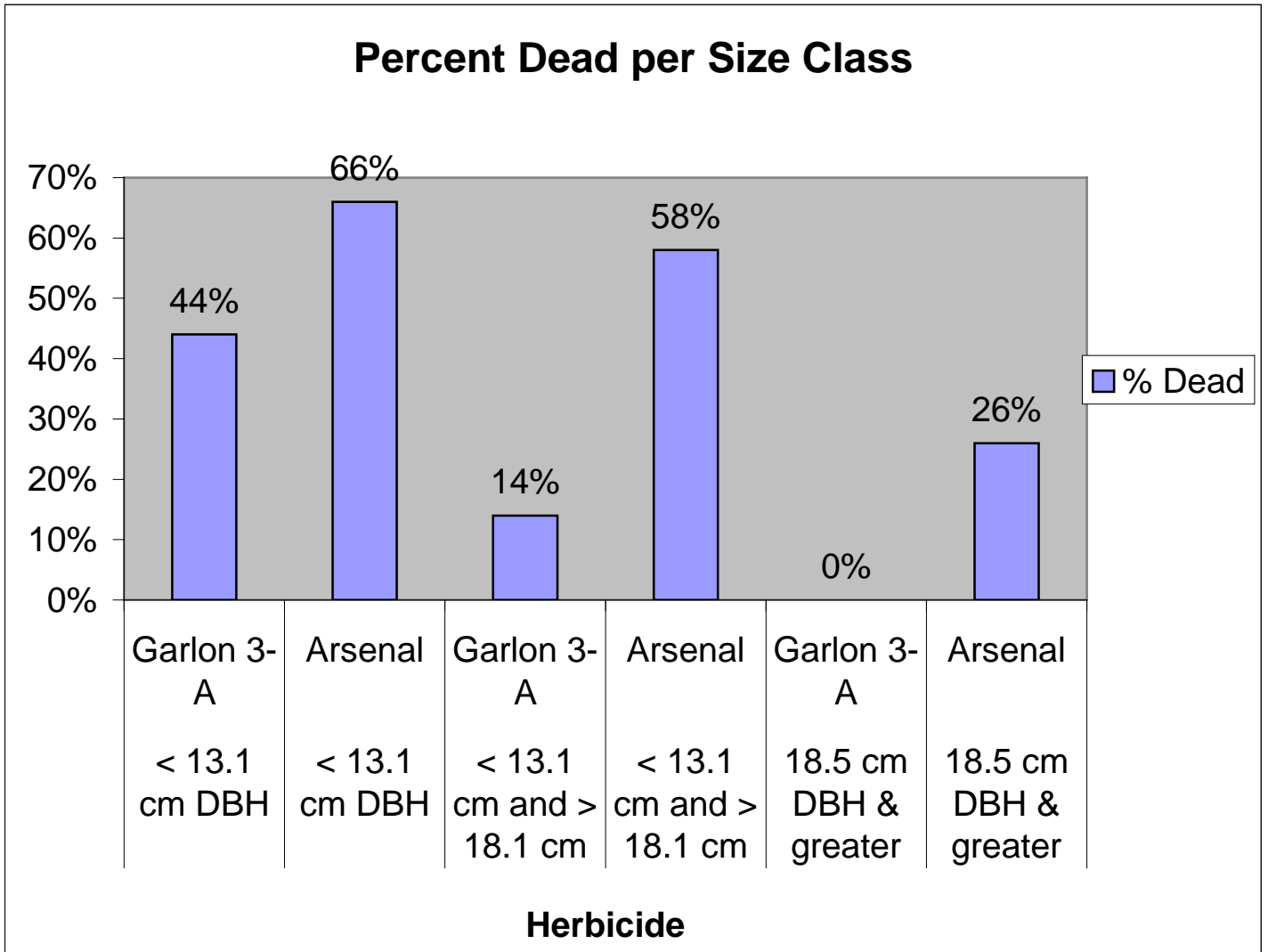


Figure 29.

Histogram depicts herbicidal efficacy upon tallow trees within the interdune meadow habitat of the Sapelo Reserve: 1-year post application, according to tree size, classes: <13 cm., 13.5 - 18.1cm., and >18.5 cm Diameter at Breast height: (DBH) and herbicide applied (Arsenal, Garlon 3-A).

9. Stewardship

Resource Protection: Managing the Ecosystem



View Looking North on Nannygoat Beach

9. Stewardship/Resource Protection: Managing the Ecosystem

Introduction.

Along with research and education, resource protection is a major programmatic component of the Sapelo Island National Estuarine Research Reserve. Estuaries are among the most biologically productive systems on earth. As such, the productivity and integrity of the Reserve's resources must be protected and, where necessary, restored in order to provide a stable environment for research and education programs that are used to address coastal management issues. The Reserve Stewardship Coordinator, working with all members of the Reserve and Georgia Department of Natural Resources Wildlife Resources Division staffs on Sapelo Island, has oversight of various resource stewardship initiatives. The Stewardship Coordinator works closely with the Reserve Manager and the Reserve's Education and Research coordinators in the implementation and projection to the community at large of stewardship programs and objectives.

General context for management.

The Reserve's resources must be protected to ensure that the area will continue to serve the scientific and educational purposes for which it was designated. The resource protection program includes:

- Publicizing and enforcing existing regulations which govern uses in the Reserve.
- Managing visitor use to minimize adverse effects.
- Restoring selected areas where former land uses have altered habitats.
- Revising regulations as needed, in light of new scientific knowledge about estuaries.

General policies and authorities.

Resource protection relies on the coordinated efforts of the research and education programs and Management Plan policies. It also relies on a number of existing federal and state laws and regulations, plus Reserve policies. It is also the responsibility of Reserve staff to be knowledgeable of, and involved with, land uses on Sapelo Island that could impact the Reserve, such as timber management and wildlife management activities.

The National Estuarine Research Reserve System regulations allow for multiple uses of reserves to the degree compatible with a reserve's management plan and consistent with the mission and goals of the Reserve System. The Reserve Management Plan focuses on maintaining areas as natural field laboratories and on developing a coordinated program for research and education.

The State of Georgia holds fee simple title to all the lands and waters within the Reserve. It therefore has broad administrative authority to regulate uses within the Reserve to ensure resource protection. In practice, the Georgia Department of Natural Resources regulates uses in the Reserve in accordance with guidelines to which the state and NOAA have agreed and with the applicable program regulations.

Resource stewardship and protection for the Reserve is based on the following sources of authority:

- Federal law including Coastal Zone Management Act;
- Reserve System program regulations and grant award conditions;
- Land and Water Conservation Fund grant;
- Pittman-Robertson Fund grant;
- Federal historic preservation requirements;
- State ownership and management of all SINERR lands;
- State regulatory authority over resource uses which could affect the SINERR.

Restoration.

The commitment of the Sapelo Island National Estuarine Research Reserve to safeguarding the natural integrity of the Reserve includes restoration as an element of both protection and enhancement. Restoration is defined as reinstating, to the greatest possible extent, natural habitats and their ecological contributions and services which have been significantly disrupted and/or displaced by human activity, toward the improvement of their natural character and ecological integrity. Manipulation of Reserve habitats for this purpose is governed by Reserve regulations, 15 CFR 921.1[e] (Appendix C to this document).

The most significant and readily apparent alterations of the Reserve's natural systems began after Euro-American settlers arrived on the island starting in the mid-eighteenth century. Much of Sapelo Island, including significant portions of the present-day Estuarine Research Reserve, were cleared for cultivation during the era of plantation development on the island, ca. 1790-1861. Additionally, roadwork construction associated with gaining access to areas of Sapelo Island which were surrounded by tidal processes have also created significant hydrological and ecological impacts to the marginal marine habitats of the Reserve. Within the last century, many of the disturbed upland areas of the island have undergone two phases of natural succession from old-field re-growth of pasturing agriculture and into naturally recruited forested systems dominated by loblolly pine.

In order to provide proper drainage of Sapelo Island's depressional wetlands needed for agronomy, significant hydrological changes simultaneously occurred within the Sapelo Island's uplands in the form of ditching and the nearby deposits of these efforts forming earthen dikes. These upland alterations have combined to convert many historic, isolated, wetlands into pine-dominated forests and many of the fringe marsh habitats of the island into hydrologically disrupted estuarine systems.

SINERR restoration projections, 2008-2013.

Future restoration efforts within the Sapelo Island NERR will be the development of a Sapelo Island specific, restoration strategy and/or plan which will serve as guidance documents for management efforts directed at reversing historical impacts to the islands isolated wetlands and fringe marshes. The Reserve's restoration goal is to review, prioritize, identify funding and acquire support among its partnering agencies for restoring identified areas of greatest ecological value within the Reserve and greater Sapelo Island. Additionally, the overall goal of providing scientific information, reference sites for restoration assessment and professional support for the development of a state-wide coastal restoration plan for Georgia are included as support tier restoration goals of the Sapelo NERR.

These restoration intentions will also be integrated within other Sapelo Reserve activities and sectors. Restoration work creates excellent opportunities for the infusion of scientific research results into management-oriented activities toward reversing impacts to these natural systems. It also creates opportunities for education and interpretive programs focused on restoration needs, techniques, and consequences. Restoration progress will be measured in part using baseline information gained from site research and monitoring projects and partner program participation into conservation planning documents and policy changes which have been identified as limiting or obstructing coastal restoration initiatives. Knowledge gained from scientific studies dealing with restoration efficacy such as the Dean Creek Project as well as conservation planning documents projects will be shared throughout the bio-geographic region (see Chapter 8, Research, for additional iteration of site-specific restoration initiatives, and the Dean Creek project).

Currently, the Reserve is partnering with several agencies toward accomplishing the development of a restoration plan for the entire coastal area of Georgia. This plan will provide both guidance and establish documentation of priority restoration areas within each coastal county of the state to ensure that long-term restoration targets and priorities are maintained even in changing administrations.

Within this ambitious agenda are several layers of processes that are necessary to complete to reach consensus within all of the participating agencies vested in developing such a plan. The following are brief examples of some of the broader restoration efforts in which Reserve staff and others are currently participating, both within and beyond the boundaries of the Sapelo Island NERR.

The Nature Conservancy (TNC) in partnership with the Georgia CZMP, Sapelo Island Reserve, Georgia DNR/WRD and the Georgia Forestry Commission are currently working toward developing a statewide-coastal restoration plan by initiating a pilot project to identify and prioritize coastal restoration sites within the state owned properties, located east of Interstate 95, within McIntosh and Liberty counties. Many of these sites lay within the boundaries of the Reserve and greater Sapelo Island. As these sites are reviewed for priority status information is also being acquired on specifics related to each site such as management considerations, scale, extent of impacts and potential restorability. This initiative will foster the development of a larger statewide restoration plan as funding is identified.

In concert with the development of a coastal pilot restoration plan is the cooperation of all of the regional, state, federal and NGO stakeholders (landowners and policy development personnel) in developing key ecological targets, attributes and threats to our coastal systems. This initiative is also led by the local Altamaha BioReserve (TNC) program, and includes representatives from the U.S. Fish and Wildlife Service, the Georgia CZMP, Georgia DNR Coastal Resources Division, Georgia DNR Non-Game Wildlife Program and the Sapelo Island NERR.

Ultimately, this assemblage of habitat and restoration representatives is developing the first-of-its-kind documentation that will guide the conservation process for tidal properties (coastal estuaries and bays) based upon key ecological attributes and integrity indexes. These conservation targets are being further integrated within the TNC regional approach for the Carolinian biogeographical region, which includes south Atlantic tidal habitats from North Carolina to northern Florida, including the coastal systems of five sites in the NERR System: North Carolina, Winyah Bay (SC), ACE Basin (SC), Sapelo Island and Guana-Tolomato-Matanzas NERR (FL). This effort further reinforces the quality and functionality of the natural resources that have been invested within the designation of these southeastern NERR programs and property holdings.

In addition to the above mentioned restoration initiatives underway, a number of science-based restoration initiatives were in progress during the compilation process for the current SINERR Management Plan. These initiatives are projected to be continued and enhanced during the five-year cycle of SINERR operations covered by this plan, 2008-2013. These projects, with attendant objectives and strategies, are identified and detailed in the Research and Monitoring section of this plan, Chapter 8.

Stewardship goal, objectives and strategies.

GOAL: To maintain and continue to restore the integrity of the natural dynamic processes of the SINERR's estuarine ecosystem, which is representative of the Carolinian biogeographic region.

Objective: Protect Reserve resources for scientific research, monitoring and educational purposes.

- **Strategy:** Establish a management policy that reduces, minimizes or avoids artificial or manipulative management control or techniques; promotes and protects natural processes and systems; and promotes and encourages attainment of scientific objectives.
- **Strategy:** Develop and implement a mentor program to provide information to interested parties who desire better understanding of long-term coastal trends, thereby facilitating appropriate coastal resource management within the context of scientific research and coastal stewardship.
- **Strategy:** Facilitate use of the Reserve as a natural field laboratory where information essential to coastal management decisions can be gathered and disseminated.
- **Strategy:** Enhance the SINERR's National Atmospheric Deposition site in partnership with the Georgia Coastal Ecosystems-Long Term Ecological Research (LTER) program, to include monitoring and testing for additional parameters such as mercury.

Objective: Reduce or minimize manipulative management control techniques for the promotion of unimpeded ecological processes.

- **Strategy:** Provide upland and estuarine areas of the Reserve to the general public for low intensity outdoor recreation, education and interpretation to the extent that the natural attributes of the areas will not be seriously impaired or lost.
- **Strategy:** Publicize and enforce existing regulations that govern activities upon, and uses of, the land and wetlands habitat within the SINERR.
- **Strategy:** Revise, amend and otherwise update regulations as needed, in light of new scientific knowledge about estuaries and changes in natural conditions within the Reserve.
- **Strategy:** Manage visitor use to minimize adverse effects.
- **Strategy:** Ensure that the SINERR forests are inspected as often as necessary to evaluate their health and the amount of combustible material on the forest floor. Schedule thinnings, major cuts, and controlled burns as required to minimize the risk of disease, insects or wildfire to Sapelo's forests and forest understory.
- **Strategy:** Encourage scientists to submit proposals to study possible effects of the forest management program on the SINERR's aquatic resources.
- **Strategy:** Manage and maintain as needed the grass airstrip, which is within the boundaries of the SINERR, by allowing for DNR mowings and seasonal burns pursuant to ensuring the safety of the landing field for continued occasional use by official aircraft traffic.

Objective: The restoration of Reserve habitats as designated by planning and improvement and protection of degraded lands and aquatic areas, with their attendant flora and fauna, to a former, more natural condition.

- **Strategy:** Restore selected areas where former land uses have altered habitats.
- **Strategy:** Preserve cultural and ecological resources that contribute to an understanding of human interactions with the estuarine system.
- **Strategy:** Facilitate use of restoration activities to enhance the research or education value of the Reserve.

Objective: Develop and enhance GIS mapping and cataloging inventory for availability on the Reserve's website.

- **Strategy:** Continue formal GIS training for the SINERR Stewardship Coordinator, including utilization of training through the NOAA Coastal Services Center and its dissemination of GIS-related educational tools and programs.
- **Strategy:** Expand the Reserve's GIS reference source library to provide Georgia coastal researchers and resource managers with additional tools for the advancement of academic understanding of coastal salt marsh and upland systems specific to Sapelo Island and to the Georgia coast in general.
- **Strategy:** Transfer data gathered on known archaeological, cultural and historic sites within the SINERR, including historic land uses, current roads and trails, and known plant species introduced by island residents, to USGS Topographic maps and GIS datasets.
- **Strategy:** Develop a long-term strategy to systematically survey and document the archaeological, historical and cultural resources of the island.
- **Strategy:** Expand the existing GIS laboratory on Sapelo Island at the Reserve complex to accommodate 1) equipment for Global Positioning Systems, 2) a database with digital historical and recently-created research-based maps and 3) displays of archived geographical records for Sapelo Island.
- **Strategy:** Update and reassess the ecological classification study using aerial photography (2003 CIR and True Color Aerial Imagery) from the National Geodetic Survey Service Division.
- **Strategy:** Implement the new Systemwide classification for Sapelo Island and the surrounding coastal Georgia area when the NERR Habitat Mapping and Change Committee finalizes the NERRS-wide habitat classification system.

Stewardship Strategies: Summary.

1. **Collection and distribution of information for a Geographic Information System (GIS)**—This project will serve all interested parties. The existing GIS laboratory on Sapelo Island at the Reserve complex will be expanded to accommodate equipment for Global Positioning Systems with devices and database with digital historical and recently created research-based maps. The

GIS database will visually display archival geographical records for Sapelo Island. Through the NERRS stewardship program SINERR's GIS laboratory will house these resources during the process of making these resources available in the form of an online database for visiting scientists, resource managers and other interested parties.

2. **Continuation of update of ecological classification study**—The SINERR has acquired two sets of aerial photography (2003 CIR and True Color Aerial Imagery) from the National Geodetic Survey Service Division for this reassessment and update. The NERR Habitat Mapping and Change Committee is in the process of creating a NERRS-wide habitat classification system. Upon completion of this project, the SINERR stewardship program will implement the new Systemwide classification for Sapelo Island and the surrounding coastal Georgia area.

3. **Mentoring program**—The stewardship program will develop and implement a mentor program to provide information to interested parties who desire better understanding of long-term coastal trends, thereby facilitating appropriate coastal resource management throughout scientific research and coastal stewardship.

4. **Stewardship program staff** will continue to utilize training and educational opportunities as they become available in order to incorporate the latest technologies and developments in GIS programs and concepts.

10. Education, Outreach and Interpretation.



**Teacher Training Program:
Field Based Learning Activities**

10. Education, Outreach and Interpretation.

Background.

The human dimension is an integral component of resource and ecosystem management. While much effort is spent researching the resource or habitat in question, little attention is paid to the users of the resource or habitat. Successful management programs understand the importance of the human dimension in assessing resource management problems and developing meaningful solutions based on these assessments. Education and outreach are tools managers can use to address the human dimensions of resource issues. Combined with research, regulations and habitat management, education and outreach can provide a comprehensive approach to resource protection.

Education and outreach efforts need to go beyond providing information to resource users. Information alone may not have sufficient impact to protect the resource in question. For long-term change in users' behavior, education strategies need to combine action with knowledge and attitudes. Research is needed to identify who is contributing to the misuse of the resource or habitat and why. Once these questions are answered, education efforts can be developed to address the specific target audience regarding the resource management issue.

In addition to achieving management objectives, the benefits of incorporating education and outreach into resource management plans include greater cooperation among the parties involved, long-term behavior change of users leading to long-term resource protection, and conflict prevention.

Locally, SINERR education programs serve a variety of audiences ranging from elected officials to high school students. Some programs, teacher training workshops and the Coastal Training Program (CTP) specifically, are developed based on needs and interests identified by members of those audiences through assessment and evaluation mechanisms. (For details on CTP, see Ch. XI)

Average Annual Program Participation	
Public/Group Tours	~3500
School Programs	~2500
Teacher Trainings	125-150
Visitor Center in Meridian	
Visitors	~18,000

On-island tours, school, and teacher training programs emphasize the natural and cultural history of Sapelo Island and the Georgia coast. Additionally, SINERR programs feature ongoing coastal research and monitoring efforts.

At this time, SINERR does not aim to increase program participation numbers. In fact, on-island program participation, due to the limited access nature of the island and transportation restrictions, has remained steady for over a decade. However, in recent years, a greater emphasis has been placed on teacher training workshops with the intention of integrating coastal stewardship, estuarine science, and current marine research concepts into classrooms statewide. By providing sound science training and effective resource materials, SINERR aims to

equip teachers to reach a much broader audience in schools on the mainland than we can accommodate on the island.

SINERR is fortunate to be situated in the midst of a "partnership oriented" education community. There is a keen interest among education providers in collaborating with state/federal agencies and NGO's statewide. Furthermore, the cooperative atmosphere on the Georgia coast has helped avoid duplication of efforts and has led to the joint development of resources aimed at shared target audiences.

The Reserve has been the primary producer of introductory materials about the island for visitors and the public in recent years. Information on public access, nature trails, local wildlife, and island history is made available through various brochures, digital media, and posters. Furthermore, interpretive signage and exhibits as well as an interactive website are maintained by SINERR staff to enhance outreach efforts.

Introduction.

The National Estuarine Research Reserve System (NERRS) was created in 1972 as part of the Coastal Zone Management Act (CZMA) to increase our ability to responsibly manage estuarine ecosystems. A critical aspect of this mandate for the NERRS is the education, interpretation and outreach component. In part, a reserve "...serves to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation" (16 U.S.C. 1451 [b][2]). Within the NERRS, each reserve is responsible for developing and implementing a program that links education to scientific research and stewardship. Each reserve's education program functions independently, but all have commonalities with other education programs in the NERRS.

Currently, the system-wide education community is developing a series of products that will be combined to form the NERRS K-12 Estuarine Education Program (KEEP). Teacher training programs, curriculum, and live broadcast events will be based on ongoing NERRS research, monitoring, and stewardship trends and findings. As these tools are developed, SINERR intends to incorporate several of them into its education efforts. SINERR is prepared to complete required needs assessment and market analysis work to lay the foundation for the KEEP program on the Georgia coast.

NERRS education goals.

The overall goals of the NERRS education program are to provide the crucial linkage between research and coastal management, i.e. translating the monitoring and ongoing research at the sites to appropriate audiences in a method that can be understood and applied by decision-makers, professionals and members of the public, and developing education programs that address resource management goals and objectives.

Guidelines and policies for education.

Education policy at the Sapelo Island National Estuarine Research Reserve is designed to fulfill the guiding principles for developing and implementing an education program as defined in NERRS guiding documents. These principles include:

NERRS Strategic Plan

- Develop education programs that will further the objectives of the System.
- Target a culturally diverse audience of educators and students, environmental professionals, coastal resource decision-makers and resource users.
- Function as a "system of sites" to nationally coordinate estuarine education efforts.
- Develop the NERRS reserves as resource centers specializing in estuarine and watershed education, taking into account the diversity of differences of each reserve site.
- Capitalize on the NERRS' ability to directly link education, research, stewardship, resource management and restoration.
- Ensure that education priorities are based on program evaluation results and continually assess education programs and implement changes as necessary.
- Encourage NERR education coordinators to be active participants in the education community.

NERR Education: A Field Perspective

- Link education programs with research, management and stewardship.
- Develop programs that encourage citizen stewardship of estuaries.
- Develop reserves as resource centers that address coastal issues of global, national, regional, state and local significance.
- Maintain a cadre of professional environmental educators in the NERRS.
- Evaluate program quality and program cost effectiveness. (Program effectiveness is measured as it relates to education objectives and resource management objectives).

SINERR education and interpretation plan.

The Education and Interpretation Plan at Sapelo Island NERR serves one objective of the NERR system by enhancing public awareness of, and understanding of, estuaries and estuarine functions (for objectives of NERR system, see 15 CFR 921.1(b), Appendix C to this document). Specifically, through its Education and Interpretation Plan, Sapelo Island Reserve gathers and makes available information necessary for improved understanding, conservation, and management of estuarine areas. The Reserve provides opportunities for all segments of the population to receive information and interpretive services that

focus on estuarine systems, with particular emphasis on the Carolinian biogeographic region.

The SINERR Education and Interpretation Plan is built on two basic premises: (1) that healthy estuaries and estuarine ecosystems are intrinsically and economically valuable to every member of society; and (2) that those who become aware of estuarine processes and products will be better equipped to protect estuarine ecosystems and assist and support coastal decision makers in development of wise estuarine management policy.

Everyone lives within an estuarine watershed. Anyone can influence an estuary's future. People are capable of sustaining, significantly altering, or inadvertently destroying estuarine ecosystems through individual actions, business endeavors, and governmental policy decisions. But without information about estuarine ecosystems, it can be difficult to understand why estuarine ecosystems matter, or to recognize when past or proposed activities will affect estuarine productivity.

The Sapelo Island Reserve Education and Interpretation Plan serves a geographically and demographically broad spectrum of people, providing access to accurate information about the biological and physical systems of estuaries. In addition to providing purely scientific information, the SINERR Education and Interpretation Plan expands opportunities for people to simply experience for themselves the aesthetic and ecological riches of an estuarine ecosystem.

To help us all become better stewards of estuaries, the Sapelo Island NERR Education and Interpretation Plan creates a public window to Sapelo Island NERR's continuing Research and Resource Protection activities. Under the Education and Interpretation plan, visitors can familiarize themselves with current Reserve research and link research results to estuarine stewardship policies.

The task of transmitting information begins with attracting an audience: public awareness of the Reserve is a prerequisite to public participation in its educational and interpretive programs. At present, SINERR manages public awareness efforts as an element of its Education and Interpretation Plan.

SINERR Education Target Audiences

- ~Public visitors
- ~Adult groups (elderhostel, etc.)
- ~Schools (grades 5-12)
- ~Teachers (K-12)

SINERR education goal, objectives and strategies.

GOAL: To increase, through education, outreach and interpretive programs, the awareness, understanding and appreciation of estuarine systems and estuarine stewardship by facilitating access to information about estuarine systems.

Objective—Content: Promote the message that Georgia's coastal area is a product of natural forces, modified by human activities that require effective, long-term management and conservation.

- **Strategy:** Describe the natural history of the Reserve in terms of:

1. The relationship between estuaries and the other elements of the coastal ecosystem.
 2. The similarities and differences between the SINERR and other estuaries.
 3. The natural forces, which have shaped and continue to shape the coastal area.
 4. The plants and animals of this ecosystem.
- **Strategy:** Describe human activities and resulting modifications to estuarine and upland systems within the SINERR, including:
 1. Cultural history of Sapelo Island.
 2. Land use practices, past and present.
 3. Archaeological and historical research into educational and interpretive products.
 - **Strategy:** Describe how decisions are made regarding the use of Georgia's coastal resources on a federal, state and local level, in terms of:
 1. Legislation that governs the coastal zone.
 2. Objectives and policies of the National Estuarine Research Reserve System.
 3. How coastal decisions are affected by economic considerations such as recreation and commercial fishing.
 4. How businesses, organizations and individuals affect such decisions.
 5. The challenges of coastal zone management and multiple use designation of coastal areas.

Objective—"Multiplier" Audiences: Concentrate SINERR educational/interpretive resources and training efforts on reaching audiences, including teachers and local media, who will communicate their knowledge about estuarine and other coastal resources to many other people.

- **Strategy: Teacher Workshops.** For teachers and other academic instructors:
 In 2000 the Sapelo Island NERR began to develop a teacher training workshop series that featured coastal Georgia ecology, barrier island dynamics, scientific research initiatives and Sapelo Island culture and history. That program has evolved into a multi-faceted professional teacher development program that offers a variety of workshops to teachers the year around. A minimum of five professional teacher development opportunities are provided annually for classroom instructors, grades K-12, consistent with NERR system-wide education program and state/national standards.

SINERR teacher workshops are typically held on Sapelo Island, within the Reserve itself, and involve two-to-four days of field-based programs. The Reserve absorbs many of the logistical costs of the workshops including the provision of lodging facilities on the island for the workshop participants. SINERR also provides for workshop materials and instructor costs. Certification credits are available for all SINERR teacher workshops. Most of the workshop participants are Georgia educators and represent elementary, middle and high school grades.

The Reserve is fortunate to have several education program partners, and SINERR frequently collaborates with other groups to promote, develop, host and conduct workshops. As NERR System-wide education programs and

products are developed, SINERR will incorporate national elements, issues and training tools into its workshop programs.

- **Strategy:** Provide curricula that teachers can utilize for classroom instruction and to prepare their students for field trips to the Reserve;
- **Strategy:** For leaders of groups interested in coastal resources and their conservation: develop training programs, and interpretive materials, which leaders can use for half-day or full-day guided tours within the SINERR.
- **Strategy:** For media representatives: develop a coastal wetlands briefing packet to educate journalists.
- **Strategy:** For "alumni" (individuals who have visited the SINERR and wish to remain involved in the educational and interpretive program): develop a periodic newsletter, which contains information about the SINERR and any special public programs.
- **Strategy:** Evaluate, through established NERRS performance measures and workshop evaluation surveys, the effectiveness of the educational and interpretive program.

Objective—The General Public: Communicate with the general public through effective educational programming, interpretive exhibits, SINERR website, and printed literature.

- **Strategy:** Develop a public relations/communications strategy for SINERR as outlined by the Reserve manager and the Education Coordinator.
- **Strategy:** Secure funding and contract a media/public relations representative to carry out communications strategy to work under the direct supervision of the Education Coordinator.
- **Strategy:** Re-evaluate on a regular basis the current schedule and content of guided public tours within the SINERR.
- **Strategy:** Develop printed materials and interpretive tools, including:
 1. Exhibits, graphic displays and signage. Update exhibits and discovery drawers at Sapelo Island Visitor Center .
 2. Nature trails, for use by visitors at the Visitor Center and on the island.
 3. Video, film and audiotape presentations.
 4. Publications.
 5. Off-site presentations.
 6. Publicity with press packets and news releases.
 7. Interactive CD and touch-screen computer program.
- **Strategy:** Maintain SINERR website www.sapelonerr.org.
- **Strategy:** Develop "fact sheets" for general public on current SINERR research efforts. Distribute at Sapelo Island Visitor Center.
- **Strategy:** Make available to all visiting groups (e.g. hunters, campers) educational and interpretive resources developed for general public tours.
- **Strategy:** Develop and coordinate a visitor impact study for SINERR.

Objective—Education Partnerships: Extend the impact and reach of SINERR's educational and interpretive program, both in the coastal region and statewide, by cooperating with other agencies and organizations that perform related tasks.

- **Strategy:** With members of Georgia Coastal Education Group (GCEG members include SINERR, Georgia DNR Coastal Resources Division, DNR Wildlife Resources Division, National Parks Service, Grays Reef NMS, University of Georgia Marine Extension, and UGA Cooperative Extension Service.)
 1. Develop resources and programs that promote the importance and value of Georgia's coastal resources and promote responsible stewardship.
 2. Collaborate in teacher training efforts.
 3. Distribute members' educational materials.
 4. Utilize GCEG as an educational advisory group. Solicit feedback from GCEG members on SINERR resources and programs.
- **Strategy:** With other operating units within DNR:
 1. Work with staff of state parks and historic sites in the coastal area to interpret the SINERR and distribute SINERR publications at these recreation areas.
 2. Work closely with Coastal Resources Division public relations/education personnel in the promotion of educational opportunities at the SINERR, and in development of cooperative programming.
 3. Work with educators at WRD Education Centers to develop programs and resources that showcase wildlife management efforts statewide.
 4. Develop partnership efforts in programming and product creation to maximize limited financial resources.
- **Strategy:** Work with the Southeast Center for Ocean Science Education Excellence (SECOSEE).
 1. Collaborate with SECOSEE staff to develop training opportunities and materials for teachers in Georgia, South Carolina and North Carolina.
 2. Continue to pursue partnership opportunities for SECOSEE and southeast NERR education programs.
- **Strategy:** Cooperative efforts with Gray's Reef National Marine Sanctuary.
 1. Develop cooperative educational programs and products that re-enforce the connection between Sapelo Island and Gray's Reef.
- **Strategy:** With Armstrong Atlantic State, University of Georgia, Savannah State and other local academic institutions:
 1. Explore the possibility of using graduate students for internships.
 2. Develop training workshops for formal educators and teacher candidates registered in education courses.
- **Strategy:** With Georgia Department of Education, Regional Educational Service Agencies (RESA), and Youth Science Technology Centers (YSTC):
 1. Obtain guidance in developing classroom materials and field activities, which are compatible with state educational requirements.
 2. Obtain guidance in developing teachers and administrators' training courses, which will offer staff development units.
- **Strategy:** With the McIntosh County Chamber of Commerce and Georgia Department of Industry and Trade:
 1. Continue placing informative materials in nearby welcome centers.
- **Strategy:** With the University of Georgia Marine Institute:
 1. Continue working to incorporate current research findings into educational and interpretive programming and products.
- **Strategy:** Work with other NERR programs in the southeast U.S.

1. Collaborate with educators at NERR sites in northern Florida, South Carolina and North Carolina to promote the NERR system and education opportunities/resources at each site.
- **Strategy:** With local conservation groups:
 1. Actively share SINERR efforts, through workshops and resources, to groups including, but not limited to: Coastal chapters of the Audubon Society, Coastal chapter of the Georgia Conservancy, the Nature Conservancy, the Georgia Wildlife Federation, Altamaha Riverkeeper, McIntosh County SEED (Sustainable Environment and Economic Development).
 2. Seek other program assistance from the above groups.

Education and Outreach Strategies: Summary.

Multiplier Audiences: Concentrate educational and interpretive resources and training efforts on reaching audiences that will communicate their knowledge about estuarine and other coastal resources to many other people. For academic instructors, SINERR intends to provide a minimum of five training programs annually while enhancing existing Professional Teacher Development opportunities for classroom teachers grades K-12, consistent with on-going NERR system-wide education initiatives and state/national standards. Further, the Reserve aims to provide teachers with preparatory curricula and materials for field trips to the island.

General Public Audiences: Update and maintain interpretive exhibits at Sapelo Island Visitors Center, nature trails, and Sapelo Island lighthouse; develop fact sheets for general public on current SINERR research projects and initiatives; utilize Visitor Center as a site for general public education programs.

Educational Partnerships: Work with Georgia Coastal Education Group members to develop resources (website, posters, etc.) that promote coastal stewardship and educational opportunities for teachers, schools and the general public. Also, work with other agencies and NGOs to distribute SINERR materials and advance coastal education efforts. Collaborate with educators at NERR sites in northern Florida, South Carolina and North Carolina to promote the NERR system and the education opportunities at each site.

Program Evaluation: Evaluate, through established NERRS education performance standards and teacher workshop participant surveys, the effectiveness of the educational and interpretive program and resources; develop and implement a tool for evaluating programming for visiting school groups to gauge effectiveness and needs of the program; develop and coordinate a visitor impact study for the SINERR. Report findings in SINERR annual report.

Outreach and Communications: Develop a public relations/communications strategy for the SINERR; maintain secure funding for the purpose of contracting a

media and public relations representative to implement Reserve's communications strategy on a professional basis.

Communications Specialist: A new part-time position filled in 2005, this individual coordinates the marketing and public relations aspects of the education program, as well as all other activities of the Reserve, including research and monitoring initiatives, stewardship and the Coastal Training Program. The communications specialist compiles and distributes news releases, public service announcements, the SINERR newsletter, and assists the Education Coordinator in the design and planning of special posters, brochures and related marketing tools.

Sapelo Island Visitors Center: Upgrade personnel positions in the Visitors Center and add a maintenance specialist (general trades craftsman) and grounds keeper to the staff; upgrade and replace as necessary interpretive exhibits; improve electronic capabilities, particularly for the security camera system; construct storage areas for resale items; increase utilization of the audio-visual room; create a safer, more efficient walking path from the Visitors Center to the ferry dock, possibly with a pedestrian boardwalk across the marsh.

Other Education Strategies: Expand and broaden the use and responsibilities of seasonal intern and volunteer programs, particularly the Friends of Sapelo volunteer organization; more fully develop educational/outreach efforts by taking programming into area school systems, increased dissemination of educational materials, including the SINERR educational curriculum guide; conduct lectures, special programs and interpretive activities at the mainland visitors center and to more fully market and promote the educational-outreach opportunities offered by the Reserve; develop closer ties with the Sapelo Island Hog Hammock community and the University of Georgia Marine Institute; establish and develop a formal, catalogued education library on site.

Interpretive message and themes.

Coastal Georgia is a product of natural forces, modified by human activities, which require effective, long-term management. To effectively communicate this message, the Reserve will use the following themes in its educational and interpretive programming: a description of the SINERR's natural history, the human activities which have occurred within the SINERR and how these activities have modified the natural system, how decisions are made about the use of the Reserve's and Georgia's coastal resources, as well as what we can and are doing to manage and conserve local natural resources.

Publications and printed materials.

Since the last iteration of the SINERR Management Plan, Reserve staff has developed a comprehensive suite of new printed educational and informational materials for distribution to multiplier audiences, the general public and special interest groups. A listing of the more significant publications follow:

Ecology as History in the Sapelo Island National Estuarine Research Reserve.

This 28-page large-format document with notes, maps and illustrations was prepared by Reserve Manager Buddy Sullivan in 2008 and published for distribution as an educational resource for teachers, scientists, coastal resource managers and others interested in the cultural history of Sapelo Island and its environs. The paper was written from an ecological perspective and relates human adaptation to the environmental conditions of soils, hydrology, tides and weather through lifeways associated with agriculture, maritime culture and archaeology. It is based on the author's "Life, Labor and Landscape" lecture series of 2006 in association with the 30th anniversary observance of the Reserve.

Sapelo Reserve: The First 30 Years was prepared by the SINERR staff in 2007 for general distribution to interested parties. The 12-page large-format, full-color booklet documents through words and images the history of the Reserve from 1976 to 2006 and represented the culmination of the year-long 30th anniversary observance by the Reserve of its designation as the nation's second NERR in 1976.

The preceding two documents are free and are available upon request to the SINERR Education Coordinator.

Brochures, maps and guides. Eleven brochures, printed by NOAA, SINERR and the Georgia Department of Natural Resources, presently highlight the Reserve's resources, history, research and education and interpretive opportunities. These publications include (listed in order of most recently produced to oldest):

Sapelo Island National Estuarine Research Reserve. A combination of several older brochures, this features the natural and cultural history of Sapelo Island as well as SINERR activities and the opportunities available for education and research. It targets NGOs and conservation groups as well as general audiences.

Sapelo Island Map. This multi-colored island map is a tri-fold brochure compiled from GIS mapping surveys and the latest data regarding roads, docks and facilities. There are also separate nature trail maps on one side of the brochure, detailing both SINERR trails: on the island and at the mainland Visitors Center. The island map brochure has proven popular with all user groups, especially island day-trip visitors, recreational hunters and campers.

COASTWEEKS. This publication is developed in collaboration with GCEG members. It features events and activities offered by area education organizations during September and October, and is distributed throughout Georgia's coastal counties.

SINERR Coastal Training Program. A general overview of the Reserve's Coastal Training Program, this provides details on the CTP mission, specifics about training workshops and target audiences, and contact information.

Georgia's Coast...It's the Nature of This Place. Designed by GCEG, this showcases the unique aspects of coastal Georgia including its geography, wildlife, and ecology.

A Tour of the Reserves. Produced by the Sanctuaries and Reserves Division, this brochure explains SINERR's role as one component in a national system of Reserves. Allows out-of-state visitors an opportunity to identify any reserves in their own state. This brochure was recently revised, updated and reprinted by NOAA (2005).

A Nature Trail Supplement. Guides visitors through the Reserve's Interpretive Nature Trail, explaining geologic formation, ecology and natural history.

Sapelo Island Reserve: An Opportunity for Estuarine Research and Education. Designed to inform scientists and educators of the opportunities available through the SINERR.

SINERR: An Ecological Introduction. An 8-panel brochure featuring the marshes, beaches, dunes and maritime forests of Sapelo Island. A basic introduction to the ecology of the Reserve. Marsh plants and animals, beach dune life, and flora of the maritime forest are discussed in layman's terms, with selected illustrations.

Where Rivers Meet the Sea. OCRM/NOS publication describing estuaries, their importance and detailing the National Estuarine Research Reserve System. General audiences.

Birds of Sapelo Island. Funded through donations to the Nongame-Endangered Wildlife Program of the Georgia Department of Natural Resources. Lists species and seasonal frequency, with sighting checklist.

Dune Conservation. Designed for island visitors staying in private accommodations in Hog Hammock or at the state-administered R.J. Reynolds Mansion, this brochure explains dune formation, their role in the sand-sharing system and protective measures that visitors can exercise.

Sapelo Soundings (Reserve newsletter) . Since 1994, the Reserve has published and distributed a semi-annual newsletter, *Sapelo Soundings* that serves to inform the public of Reserve happenings. Each issue focuses on current research efforts, educational programming, facility improvements and management related issues. Generally, a scientific research or educational feature article is included to focus on a particular aspect of Reserve activity. The newsletter is produced by the Communications Specialist, assisted by the Education Coordinator, with input from SINERR staff. The newsletter is professionally printed and distributed among a wide public audience, as well as other federal and state agencies.

Posters. In 2002, SINERR created a poster that featured the estuarine, maritime forest, and beach systems of Sapelo Island. The Reserve has developed posters with local partners, including Grays Reef National Marine Sanctuary ("Rivers to Reefs") and GCEG ("Make a Difference"), which are distributed to educators and other interested individuals. In 2007, SINERR developed a series of posters for the new ferry boat Katie Underwood.

Calendars. From 2004 through 2007 calendars were designed to show the beauty of the Reserve. Images taken by local photographers and SINERR staff were compiled, along with historically significant dates on Sapelo Island to create the Reserve calendars. The products were distributed to program partners, volunteers, schools, state and federal agencies. Plans call for this to become an annual offering subject to continued availability of funds in the education printing budget.

Curriculum – Sapelo Island: Georgia's Coastal Treasure. A comprehensive educational curriculum guide was compiled and produced by the Reserve through a contract with a marine educator in 1995-96. It was presented at the Georgia Science Teachers Association annual meeting in February of 1997. This

book is printed and bound in loose-leaf binder format and offers teachers the chance to use Sapelo Island and the SINERR as a basis for achieving educational objectives. The guide provides background information on coastal ecology, barrier island geology, and marine biology concepts as they apply to Sapelo Island and the Georgia coast. Further, this provides teachers with multiple activities for both the classroom and the field that demonstrate these concepts. Curriculum guides are distributed to teacher training participants and to teachers preparing to bring their students to the island. In 2007, SINERR's curriculum was digitized and posted at www.knowtheconnection.com

All of the publications and printed materials of the Sapelo Reserve are available upon request to the SINERR Education Coordinator.

Audio-visual materials.

The Reserve is developing new audio-visual materials as a means of reaching more people with existing staff. The Reserve's slide archives are being cataloged. PowerPoint presentations are developed for various programs and, in some cases, copies of the presentations can be made available to program participants. The following productions are distributed by the Reserve in both VHS and DVD format. They were prepared by the Georgia DNR Film and Video Unit with coordination by Reserve staff and funding provided by NOAA as part of the annual education award to the Reserve. Each of these is shown on Georgia Public Television on a recurring basis, thus promoting the Reserve and its programs in a highly effective and visible way.

Sapelo Island Lighthouse (2001) traces the history of the lighthouse, including its restoration, and its role in the maritime industry of Darien and McIntosh County. The lighthouse, which sits on the south end of the Reserve, was restored in 1998. This program has won several national production awards.

Sapelo: An Island in Time (2002) was produced by the DNR's Film and Video Unit, under the coordination and input by Reserve staff to specifically focus on the SINERR and its research and education programs. This 18-minute video program features the ecology of Sapelo Island and the research and monitoring efforts of the Reserve and UGA Marine Institute. The program, which has won several national awards for its production, editing and content, also briefly explores the wildlife and history of the island.

The Reserve developed an interactive computer program in a cooperative effort between SINERR, DNR and the University of Georgia's Continuing Education Department. The program, ***Explore Sapelo***, provides users with an opportunity to explore the island at their own pace and in accordance with their own interests. The video is a major segment of the interpretive exhibits and educational materials at the Sapelo Island Visitor Center. In 2002, the Reserve produced the ***Explore Sapelo*** program on CD-ROM for widespread distribution to schools, libraries and other resource centers. The program is available in both PC and Macintosh formats.

Websites.

In 2001, the first website was created to feature SINERR and its programs. The website offered basic information for visitors and links to program partners and to sites where monitoring data was available for viewing. In 2005, the site was completely redesigned with the option of making routine updates to the site. The new website (www.sapelonerr.org) offers a glimpse of the research, stewardship, education and volunteer programs as well as visitor center information and links to related programs and agencies. The website has been upgraded to incorporate new information, a more attractive presentation and broader scope of relevant links. The updated site reflects the increased focus of the national NERR System's reliance on electronic communications. While geared primarily to the casual visitor seeking information about the Reserve, the updated website is intended to provide useful and salient information to address scientific inquiries and research opportunities on the Reserve, as well as information for educators seeking data about the outreach opportunities afforded by the SINERR's programs.

In 2004, the SINERR staff developed a new and separate Coastal Training Program website (www.sapeloislandnerr-ctp.org) for the purpose of providing decision maker audiences with information about area training opportunities provided by SINERR and its partners. The site also offers links to other Coastal Training Programs in the southeast U.S.

SINERR and its GCEG partners teamed up to create a collaborative website featuring member programs as well as resources developed by the group. www.georgiacoastaleducationgroup.org was completed in 2006.

SINERR has contributed information and photos to other websites as well. Two sets of photos are available on-line at the NOAA Photo Library. The National Estuarine Research Reserve collection, which includes photos of most of the NERR sites, can be seen at <http://www.photolib.noaa.gov/nerr/index.html>. More photos of Sapelo and the Reserve can be seen in the "America's Coastlines" collection at <http://www.photolib.noaa.gov/coastline/index.html>.

Visitor Center.

SINERR's visitor center has been a high priority for the current Reserve management. At Meridian Dock, the new Sapelo Island Visitor Center opened at the end of 1995. This facility has extensive exhibits and offers many mainland educational opportunities. The center has audio-visual capabilities in various media: interactive video program, CD/DVD, movies, videos, slides, and television. The A/V room facilitates lectures, town-hall meetings, local interest exhibits, workshops and any educational programs developed by SINERR education staff. The exhibits are self-guided. However, SINERR staff working in the building are available for interpretation.

Signs and exhibits.

Visitors to the SINERR will have a thorough introduction to the SINERR and Sapelo Island at the mainland visitor center at Meridian Dock. Exhibits highlight barrier island ecosystems, including salt marshes, beaches and dunes, geological formations and offshore reef systems, the cultural history of Hog Hammock community, a Sapelo Island history timeline, UGAMI's scientific research activities, threatened and endangered species of Sapelo, the NERR system, Sapelo's natural history and the present management and administration of Sapelo Island by DNR and NOAA.

SINERR has constructed interpretive signs at several key locations around the Reserve. A marsh profile sign, identifying plant communities of the marsh, is located at the Long Tabby office. It is used, together with an island map sign, by the SINERR interpretive ranger in public and special tours of the Reserve.

SINERR has constructed a beach and sand dune profile sign at Nannygoat Beach on the south end of the Reserve. New signage is being developed, in partnership with Gray's Reef NMS, to show the ecological ties between Sapelo Island and offshore reefs like Gray's Reef.

The Sapelo Island nature trail has thirty signs that interpret the plants and animals found within the many different ecosystems the trail explores. Similar themed signage is also posted along the nature trails at the visitor center.

In 2001, an exhibit was designed for the Sapelo Island Visitors Center that told the story of the Sapelo Lighthouse – construction in 1820 to being damaged in the hurricane of 1898 to restoration in 1998.

Deem Loureiro, Inc. of Atlanta designed new exhibits and signs in 2005 for the Sapelo lighthouse grounds. The content and text for these products was provided by SINERR staff, and Georgia DNR Parks and Historic Sites Division coordinated the manufacture and installation of the new exhibits. In the spring of 2007, these interpretative panels were produced and installed in the restored oil house at the lighthouse, with new signs placed the grounds, for utilization by the public during regular SINERR-conducted tours of the Reserve. The lighthouse and the history of the surrounding area are the focus of annual on-site maritime history programs.

The SINERR exhibit portfolio has undergone a great deal of change with the construction of the Sapelo Island Visitors Center. New exhibits have replaced the inconsistent and scattered exhibits identified in the original SINERR Management Plan (1990). The environmental and ecological exhibits displayed at the University of Georgia Marine Institute, as identified in the 1990 Management Plan, are no longer incorporated in the interpretation of the SINERR. The Reserve tour does not stop at the UGMI unless specifically requested by the group. Permission is obtained from the Institute Director.

Projected interpretive signs to be developed:

- Marsh Landing dock continuous monitoring site—interpretive signs and displays.
- Nature trail supplement sign-Holocene communities and species.
- Sapelo Island NERR and Grays Reef NMS collaborative signs featuring

coastal systems from the beach to offshore reefs.

Program activities: Island education laboratory.

The Sapelo Island NERR, in 1997 and 1998, made application for, and was awarded by NOAA/ERD, two separate construction grants in the amount of \$149,000 to go with state matching funds in the amount of \$64,000 to fund the renovation and restoration of the former boys camp kitchen and dining room at the Long Tabby office for use as an on-island education laboratory. This project was completed in September 1998. The building was dedicated as a teaching/demonstration lab, with an audio-visual room. Additional funding was necessary to completely finish the building and purchase additional equipment. Operations and education grant funds from NOAA/ERD were identified in FY1999 to begin purchasing equipment, materials and supplies for the new education lab.

The project, completed in 2000, is now the Long Tabby Education Building. This education facility on Sapelo Island houses a 40-seat classroom with audio-visual capabilities and a wet lab equipped with workstations, microscopes, and aquaria. Lab-based programs include "Sapelo's Saltwater Systems," which incorporates field and lab activities that focus on local marsh and ocean habitats. This facility dovetails the SINERR curriculum very well. Many of the activities in the curriculum are best carried out on-site with proper laboratory equipment. The lab enables the education staff to develop programming that goes beyond field work and observation, although these are strong elements of programming.

The facility also serves as the main office for the SINERR Education Program and associated staff. In addition to hosting teacher workshops, visiting school groups, and the public, the facility is also used for special events including Sapelo Seastar Science Camp, Artist in Residence programs, and SINERR Advisory Committee meetings.

Current education: On-site activities.

The SINERR staff provides public education and interpretation at the SINERR, chiefly through tours guided by Reserve guides and volunteer personnel. At present, all visitors participate in some type of organized activity or program. Public tour and school program participation averages about 6,000 people per year.

SINERR tours.

Each Wednesday and Saturday morning, the SINERR interpretive ranger escorts visitors on a three-hour driving tour of the SINERR, with stops at points of educational interest. The guide provides an interpretive narration during the tour. These tours expose visitors to marsh, upland and beach environments, and the history of Sapelo Island. The public tours are an introduction to the SINERR, but they have a broader purpose as well: to acquaint visitors with barrier islands in general and with Sapelo's resources in particular. The discussion of upland

and beach ecosystems and of the Hog Hammock community takes place outside the SINERR, for the most part. A twenty-minute ferry ride aboard the state-operated passenger vessel before and after the on-island tour is part of the tour experience for visitors to the SINERR.

During the summer season (the first Friday after Memorial Day through the first Friday after Labor Day), a third public tour takes place on Friday mornings. From March through October, SINERR offers a special tour that lasts from 8:30 AM to 3:00 PM and takes visitors to the northern portions of the Reserve. The focus of this tour is stronger on history and upland ecology.

The SINERR offers special tours to groups such as school classes, civic organizations and elderhostels. These tours are conducted on Tuesdays and Thursdays and last approximately six and one-half hours. During these tours such subjects as marsh ecology, food webs, wildlife management, estuarine research, sand-sharing systems, and beach ecology are discussed in more detail than the half-day tours allow. Participants use equipment such as refractometers, cast nets, plankton nets, and seine nets to obtain a first-hand look at the estuary and beach systems. These tours are tailored to the members' ages and areas of interest.

SINERR must sometimes reschedule a tour, if it conflicts unavoidably with other management needs. When this occurs, SINERR notifies the affected individuals or group of the change.

SINERR teacher training program.

This highly developed educational initiative is described in detail above at Objective—"Multiplier" Audiences, Strategy 1.

Interpretive nature trails.

In 1995, SINERR completed the construction of a one-mile nature trail on the southern end of Sapelo Island. (For details on this project, see the Facilities Plan following). The trail is utilized in SINERR educational programming and field activities. Additionally, visitors to Sapelo that are not guests of the Reserve have full access to the nature trail. Thirty interpretive signs and a brochure assist trail walkers in discovering the many unique facets of the trail. Beginning near the Reynolds Mansion grounds, the trail takes visitors through typical barrier island ecosystems as salt marshes, maritime forests, dunes and the beach, as well as countless transition communities. An observation tower nestled along an ancient dune ridge affords a clear view of dune succession and associated plant communities. The trail's eastern border is the Atlantic Ocean. The trail, with its diversity of features, stands alone in its uniqueness along the Georgia coast. The trail was renovated in April 2001 and underwent further renovation in 2006 and 2007.

In early 2000, Visitor Center staff completed the first in a series of trails that weave through the maritime forest and along the marsh and salt pans surrounding the mainland facility. Nearly one mile of trails has been created to

date. SINERR has offered night hikes and ecological programs for schools that utilize the trails.

The wildlife observation tower, built on the 1905 lighthouse site, was completed late in 2000 and offers an elevated view of Doboy Sound, South End Creek, and the Atlantic Ocean. A trail, complete with interpretive signage, winds through marsh and wooded habitats between the 1820 and 1905 lighthouse structures.

Primitive camping.

Camping at the Cabretta Island campsite will continue to be offered, but with limited interaction of Reserve staff. Programming for camping groups is done on an individual arrangement basis and is limited by staffing levels and field equipment. The Reserve currently provides programming for school groups staying at the campground, provided Education staff time and resources are available. Teachers are required to make arrangements with the Education Office in advance.

Current Education: Off-site activities.

SINERR staff, including the Manager, Education Coordinator and the Interpretive Ranger, is often called upon to deliver presentations about the Reserve and Sapelo Island. Slide presentations and power point programs are the general formats. Presentations range from the general history and ecology of Sapelo Island to beach and estuarine processes. The limiting factor with this type of outreach is staffing levels.

The Education Coordinator also participates in educational programming for local schools and educational facilities. Topics include water quality issues, plants and animals of Sapelo Island, barrier island dynamics, estuarine processes and the culture and history of Sapelo Island. These programs are conducted upon request and are limited by staff availability.

SINERR staff members encourage media coverage of the SINERR and its programs. Many reporters and writers have visited Sapelo Island and the SINERR. Reserve staff regularly sends news releases to area news media, to provide feature articles about research and education programs at the SINERR.

11. Coastal Training Program.



**Quality Growth CTP Workshop held at the SINERR
Visitor Center**

11. Coastal Training Program.

Introduction.

In the past decade, the National Estuarine Research Reserve System (NERRS) has seized the opportunity to work directly with "decision makers" in coastal areas by providing thorough, science-based programming on issues ranging from water quality and land/wildlife management to environmental protection regulations and economic development. As the NERRS Coastal Training Program (CTP) has grown, so has the need for an initiative that would enhance a reserve's ability to assess the environmental science-based knowledge and skill needs of decision makers within its region, identify similar education efforts made by other regional environmental agencies, develop tools and materials based on audience needs, and evaluate program effectiveness.

The Sapelo Island National Estuarine Research Reserve began its work with Georgia decision makers in 1999 when it implemented the Coastal Decision Maker Workshop program. SINERR has partnered with numerous organizations to develop workshop programs for decision makers on the Georgia coast including non-profit, academic/university, and government agencies. More than 1,500 people have participated in SINERR sponsored decision maker programs since 1999.

Overview of the SINERR Coastal Training Program.

In 2001, SINERR began development of the Coastal Training Program as an expansion of its overall education program. The primary goal of the CTP is to provide a coordinated and strategic approach for training coastal decision makers. It is geared toward individuals, groups and organizations whose daily decisions (whether in a professional or volunteer capacity) impact watersheds and coastal resources. The intent is to enhance their decision-making competence and increase their knowledge of coastal issues by informing and providing them with current, science-based resources. The program is being developed at the Reserve through partnerships, including the University of Georgia Marine Extension Service (MAREX) and the Georgia Coastal Zone Management Program (CZMP) administered through DNR's Coastal Resources Division.

The SINERR CTP Action Plan addresses the role of the Reserve in providing programs and resources to the decision maker audience in coastal Georgia. Through training programs and interpretive materials, SINERR aims to reach communities on the Georgia coast and effectively promote good stewardship of its natural resources. It is SINERR's intent to reach decision makers so that they might apply current science-based information to their management decisions involving coastal resources as well as communicate their knowledge about

estuarine and coastal issues to a larger constituent base. From the inception of the Sapelo Island NERR's Coastal Training Program, the intent was, and continues to be, to:

1. Establish the Coastal Training Program in Georgia as a recognized and reliable source of current, science-based information on coastal resource issues for area decision makers;
2. Identify issues of concern and gaps in decision maker programming in coastal Georgia;
3. Develop and provide accurate science-based information and resources to those whose actions and decisions impact coastal resources;
4. Offer opportunities for program participants to network with area professionals and resource providers to foster and encourage information sharing and collaboration;
5. Continue to help people understand and manage the effects of human activities on coastal resources; and
6. Effectively document and evaluate CTP efforts.

In order to develop a training program that effectively reaches audiences and fosters partnerships with other program providers in coastal Georgia, an assessment of efforts being made by area education programs was essential. The market analysis data provided us insight on the recent history of decision maker programs on the Georgia coast, as well as audiences served by those programs and issues of concern to program providers. Based on market analysis findings, a needs assessment survey was developed and distributed to area decision makers to determine critical coastal issues and ideal workshop settings and formats and to identify what resources would be most helpful related to their work on the coast.

Each year, as development and resource-related pressures on coastal areas increase, so does the importance of decisions made by those in management and regulatory positions. Decisions made on the coast are critical, but in many instances, policy and actions upstream make a tremendous impact. To assess the needs of decision makers within the watersheds of the state's five major rivers (in southeast Georgia), surveys were sent to city and county officials within the 11 coastal county region designated by the Georgia Coastal Management Program. The results of both surveys will help SINERR develop a needs-based outreach program that, in turn, will effectively shape the Coastal Training Program in Georgia.

Market analysis results.

In the market analysis results, local training providers indicated that while a variety of audiences have been targeted for training workshops in recent years, attendance by several of those audiences has been low. Of particular concern are elected and municipal officials, noted by some providers as a group who would benefit from focused training. As such, SINERR's initial CTP efforts will be geared toward meeting the needs of elected and municipal officials in

Georgia's 11 coastal counties. Furthermore, additional groups including property owner associations, volunteer groups, government agency representatives and the research/scientific community were identified as potential target audiences for future CTP efforts. As the Coastal Training Program grows and expands, these audiences and their training needs will be incorporated into local decision maker outreach efforts.

Needs assessment results.

According to results of the needs assessment and market analysis of the target audience of elected and municipal officials the most preferred training methods were seminars and workshops. Websites and brochures were the most preferred method of receiving professional resources. The most preferred times for training were half day sessions in the morning during the week. The top three incentives to attend the trainings were effective (quality) speakers, food and demonstrations. The top three environmental issues facing the coast according to the respondents were economic development, aquifer/groundwater management and land use planning. Finally, some of the recognized gaps in coastal training were identified as needing more relevant information, not enough information provided at the workshops, most respondents had little to no training and more workshops were needed.

Coastal Training Program: Goal, objectives and strategies.

GOAL: To provide a Coastal Training Program to reach target audiences for the provision of reliable sources of science-based information related to coastal issues that can be beneficial to area decision makers.

Objective:

Identify issues and areas of ecological and environmental concern for target audiences, with gaps in coastal decision-making processes regarding these concerns.

- **Strategy:** Develop and maintain access to the most current science-based information relating to issues of coastal concern, and establish contact for information sharing with the Reserve's partnering agencies and coastal resource protection organizations; seek public input to the Reserve on issues of coastal concern.
- **Strategy:** Maintain a database of contact information regarding scientific experts on specific coastal resources.
- **Strategy:** Maintain contact with scientific coastal resource experts on a regular basis and attend professional scientific meetings and conferences to remain in touch with coastal issues.
- **Strategy:** Assess issues of concern and gaps in the programs provided to the decision makers according to the initial needs assessment; evaluate the issues and concerns that were addressed in previous workshops and training

programs; and identify remaining concerns and gaps in programs offered to coastal decision makers.

- **Strategy:** Analyze the remaining concerns in programs offered and construct another needs assessment and market analysis; revise the needs assessment and market analysis according to the new findings; analyze the needs assessment and market analysis according to the new findings; and implement the new findings in upcoming workshops, training programs and information updates on the website.

Objective:

Offer opportunities for program participants, including elected officials and other key constituents of target audiences, to network with area professionals and resource providers to foster information sharing and collaboration.

- **Strategy:** Create a marketing plan to promote the CTP among elected and appointed officials who administer programs that affect coastal Georgia.
- **Strategy:** Provide informational brochures about the Coastal Training Program to all elected and appointed officials; provide CTP contact information via promotion with the brochure, website and business cards and connections with partner organizations.
- **Strategy:** Invite officials to all workshops and training programs to enable them to access and use the science-based information provided by the CTP and its partner organizations.
- **Strategy:** Provide materials with CTP contact information to all decision makers, and attend the decision makers' meetings regarding coastal resources topics.
- **Strategy:** Seek opportunities for establishing a CTP certification program and inquire of all NERR CTP programs about their experiences with certification programs; contact the affiliations of the target audience members regarding certification requirements for their professions; and contact state universities regarding potential certification affiliations and processes.

Objective:

Help target audiences understand and more effectively manage the impacts of human activities on Georgia's coastal resources.

- **Strategy:** Contact all program participants on a quarterly basis with updates on the Coastal Training Program to ensure that providers are familiar with resource professionals in the area; provide workshop attendees with a list of contact information of all participants and speakers at the workshop; provide open table discussions and time for professional sharing as part of all programs.
- **Strategy:** Program participants to share contact information, initiate networking and establish e-mail contacts with other participants as well as with resource providers to provide effective and useful means of communication and understanding among participants and program providers.

- **Strategy:** In order to effectively serve as an educational “conduit” for scientific data and input from researchers and program presenters, stay current on local and regional issues through research and professional memberships, and provide information and explanations of current issues to target audiences through the CTP website, CTP email list-serve, flyers, workshops and attending local meetings.

Objective:

Document and evaluate coastal training programs to assist in the effectiveness and improvement of the SINERR training initiative.

- **Strategy:** Assess workshop evaluations, website and email questions and local media regarding current issues of concern; and strengthen the awareness of the CTP with the community as a resource for information on the effects of human activities on coastal resources.
- **Strategy:** Maintain a database of all performance measures for each workshop, program or training; document the number of programs, participants and contact hours; document the performance measures according to the standards created by the national CTP performance monitoring group; and continue to assess the efficacy of the performance measures and discuss adjustments as needed.
- **Strategy:** Maintain a log of personal contact hours with target audience members; document the name and affiliation of target audience members, and the topic and length of the conversation; and document the evaluation of each interaction with the target audience as part of the performance standards.

Coastal Training Program Strategies: Summary.

General Strategy: Establish SINERR’s Coastal Training Program in Georgia as a recognized and reliable source of current, science-based information on coastal resource and management issues for coastal decision makers; continue to provide information, tools and skills to people making decisions affecting coastal resources and issues; continue to increase networking and collaborating among training providers and coastal decision makers; continue to help people understand and manage the effects of human activities on coastal resources.

Specific Strategies: Conduct a minimum of ten (10) Coastal Training workshops annually; expand a project to jointly conduct regional workshops with the North Carolina, South Carolina and Florida NERRs; increase SINERR’s organizational partnerships by 25 per cent; expand development of web-based capabilities as a means of promoting training programs, distribution of science-based materials, on-line workshop registration, and providing information on programs and resources offered by partner organizations; expand the database of program partners, potential audiences and speakers; develop and distribute promotional materials featuring System-wide CTP as well as local programs; seek opportunities

for establishing CTP certification program; participate in national research conferences and studies.

12. Volunteer Program.



12. Volunteer Program.

Introduction.

The Friends of Sapelo is a non-profit volunteer organization sponsored and coordinated by the Sapelo Island NERR whose mission is to support and assist the Reserve in the implementation of special events and its various educational, interpretive and outreach activities. The Friend's mission is defined as follows:

"The Friends of Sapelo is a non-profit volunteer organization created [1995] to support the research, education and outreach mission of the Sapelo Island National Estuarine Research Reserve. In a broad sense, we are dedicated to the understanding, appreciation and stewardship of estuaries and associated coastal habitats. In particular, we are dedicated to the natural, cultural and historical resources of Sapelo Island. Through our efforts, we seek to educate ourselves and others, thus securing a healthy future for our coast."
(Friends of Sapelo Statement of Purpose, 1996).

The SINERR volunteer organization, in addition to directly supporting the work and mission of the Reserve itself, provides direct and indirect support for the Georgia Department of Natural Resources (DNR) on Sapelo Island.

Community contributions of time and talent can be among the most significant components of Reserve operations, and are recognized as such. It is the policy of the Sapelo Island NERR to provide those who volunteer with a working environment of at least the same quality as that enjoyed by paid staff. Individuals and groups who offer their services to the Reserve are entitled, at a minimum, to efficient administrative support, adequate workspace, and planning, orientation, scheduling, training and supervision as needed.

The Reserve also recognizes an obligation to provide interested volunteers with unique activity and learning opportunities. These may include learning new skills on the job, or participating in events such as "volunteers only" training programs and education opportunities. Ideally, Reserve volunteers grow in abilities and understanding in exchange for their contributions to the operations of the Reserve.

Existing Conditions and Needs.

Opportunities for public involvement.

The Reserve's activities encourage public involvement in educational activities associated with the Reserve and Sapelo Island have expanded since 1996 with the active support of the Friends of Sapelo volunteer organization. Through the Friends of Sapelo, volunteers have become an integral part of the SINERR educational and outreach program by allowing the Reserve to expand

its services and target audiences without a large expenditure of funds. The supervision of volunteers has, and will continue to be, a direct responsibility of the SINERR education coordinator, acting in liaison with the SINERR volunteer coordinator, a contracted, part-time staff employee.

Potential volunteers are recruited through presentations about the Reserve's education programs, press releases, brochures (available at the Sapelo Island Visitors Center), the DNR's Brunswick office, at state parks, nature centers, schools and colleges, and by word of mouth. In addition, scouting groups, cooperative extension 4-H groups and civic organizations are encouraged to participate in beach sweeps, island "clean-up" work parties, trail maintenance projects and other activities associated with the Reserve, under the supervision of Reserve staff or with written permission.

Training for volunteers consists of orientation activities that introduce volunteers to the NERR System and the SINERR programs. Advanced workshops will teach volunteers how to interact with the public, introduce them to ecology, and familiarize them with basic concepts of interpretation, environmental education, scientific monitoring and site management. A volunteer handbook will be prepared to supplement the training sessions, and will clarify the responsibilities of volunteers in terms of work schedules, the need for punctuality, time commitment and reporting, dress, appropriate behavior, training and evaluation.

Volunteer staff (SINERR volunteer coordinator assisted by Friends of Sapelo board members) serve in diverse roles and interact closely with the SINERR Education Coordinator as part of the overall Reserve outreach program. Volunteers from the friends group serve as docents in activities at SINERR's on-island education lab and with special events at the R.J. Reynolds Mansion during the Christmas season. They assist SINERR education staff with on-site interpretive activities (for example, marsh interpretation, microbial studies, beach seining) and with maintenance and operation of the SINERR's education laboratory on the island. Volunteers also assist the Reserve in conducting annual beach clean-ups, assist at special events such as the annual CoastFest in the fall, and participate in, and conduct on their own, several monitoring projects. Friends of Sapelo volunteers have achieved notable "success stories" in their work with the Reserve. They have constructed a storage building at the SINERR education lab for storage of equipment and educational materials, have built picnic tables for public use and expedited needed repairs on decks, boardwalks and other structures associated with the various SINERR nature trails.

Volunteer work assignments can range from a few hours to many years. Volunteers may become expert at routine operations, or offer their services for one-time only projects. Most volunteers work on the Reserve itself, but individuals have provided staff assistance at many off-site events and activities.

Volunteer work and support opportunities at the SINERR.

Under present staff levels, the following volunteer opportunities are available:

- **Administration**—assist in preparation of records, reports and FOS minutes; preparation of FOS newsletter, brochures and volunteer information packets; preparation of FOS monitoring publications.
- **Research & Stewardship**—assist the SINERR research coordinator in various projects (live oak planting, etc.) as needed; also participate in the following programs:
 1. Participate in a monthly beach sweeps as part or National Marine Debris Monitoring Program;
 2. Maintain Adopt-a-Stream water quality monitoring sites;
 3. Participate in Southeast Phytoplankton Monitoring Program;
 4. Conduct quarterly beach slope monitoring, and;
 5. Conduct shorebird surveys.
- **Education**—assist the SINERR Education Coordinator in conducting public tours ,and school programs associated with Reserve field trips; as needed assist in conducting teacher workshops and related training programs; and in special events at the Sapelo Island Visitor Center and various off-site special events.
- **Facilities and Reserve operations**—maintenance of nature trails, minor construction projects, cleanup of historic site areas including Sapelo lighthouse, beach and site clean-ups.

The Reserve seeks to have an internally motivated group of volunteers that will receive support from the education coordinator and the volunteer coordinator. Volunteers are encouraged to participate in lectures, workshops and seminars conducted by the Reserve, the Georgia DNR or the UGA Marine Institute and the Marine Extension Service.

SINERR Volunteer Coordinator.

Groups or individuals offering their services to the SINERR should be met with a comprehensive, efficiently run volunteer program. Under present staffing protocols, no permanent Reserve employee can effectively devote the time and resources to responsibly interview, schedule, train, plan and supervise any significant number of volunteers without abandoning primary job responsibilities directly associated with the Reserve's statutory mission. The greatest single constraint on increased public involvement in the SINERR in previous years (prior to 1993) was the lack of a full-time education coordinator to organize staff work related to the Reserve's volunteer goals. Since 1993, the Reserve has had a full-time, permanent education coordinator. A portion of this individual's job responsibilities includes the supervision of the volunteer program, specifically the Friends of Sapelo organization, as it pertains to Reserve-related activities.

In 1996, the SINERR engaged the services of its first volunteer coordinator, through a contractual arrangement. This individual is a part-time, paid, staff employee of the SINERR and works under the supervision of, and in conjunction with, the SINERR education program. The volunteer coordinator devotes approximately 10 to 20 hours per week in duties with the Friends of Sapelo.

Funding for the this position is identified each year under education and outreach grant funding provided by the National Oceanic and Atmospheric Administration (NOAA). The volunteer coordinator is a local (mainland) resident whose responsibility is to plan, coordinate and oversee all Friends of Sapelo activities in association with the Reserve and under the supervision of the SINERR education coordinator.

The volunteer coordinator is responsible for calling regular meetings of the Friends of Sapelo board of directors, as well as its general membership, handling FOS correspondence and record-keeping, coordinating publication of a semi-annual volunteer newsletter, recruiting new members into the Friends of Sapelo and working with FOS board members and SINERR staff in planning and implementing various volunteer-related activities in support of the Reserve and the Georgia DNR on Sapelo Island.

Volunteer goal, objectives and strategies.

GOAL: The creation of new opportunities for members of the public through effective volunteer programs to contribute to, and benefit from, Sapelo Island NERR through direct participation in Reserve operations and educational initiatives.

Objective: Continue to nurture the Reserve's Friends of Sapelo volunteer organization to create knowledgeable "good will ambassadors" for Sapelo Island NERR.

- **Strategy:** Provide first-hand experiences with Reserve operations for volunteers by creating public involvement opportunities in Reserve activities; develop "job descriptions" for public involvement opportunities in all appropriate parts of SINERR operations.
- **Strategy:** Involve groups and individuals of diverse backgrounds by publicizing opportunities for public involvement, designing and implementing strategies for involvement by local businesses, community service groups, youth and scout groups, and individuals with specialized skills or training.
- **Strategy:** Provide participants with an overview of the Reserve mission and its stated goals, programs and participants' roles by conducting orientation and training workshops, special tours and presentations about specific Reserve programs or projects, and provision of a periodic volunteer newsletter.
- **Strategy:** Maintain a group identity for the Friends of Sapelo through utilization of the FOS logo on letterhead, t-shirts, newsletter and brochure and providing a section of the SINERR newsletter "Sapelo Soundings" to activities related to the Friends of Sapelo and other volunteer activities.

Objective: Enhance and refine Reserve operational capacity as it pertains to educational programming and administrative efficiency through volunteer interaction.

- **Strategy:** Develop and administer volunteer involvement programs with minimal increases to full-time education staff workload by ensuring that the part-time volunteer coordinator staff position remains filled from the existing pool of volunteers.
- **Strategy:** Enhance existing Reserve educational programs and operations with volunteer input in the development of new ideas for on-site programming and continue to incorporate the Sapelo Island Visitor Center into SINERR educational plans.
- **Strategy:** Accomplish FOS and SINERR education administrative tasks more efficiently through the use of volunteers and work with staff to develop new initiatives and opportunities for volunteer involvement.
- **Strategy:** Through volunteers, continue the scientific monitoring of dynamic environments, including programs associated with beach and salt marsh ecologies.

Objective: Provide unique experiences and benefits to the Friends of Sapelo and other volunteer participants.

- **Strategy:** Provide opportunities for expanding existing skills by providing training in SINERR operations, the mission of the SINERR and the mission of the national NERR System in general.
- **Strategy:** Utilize local experts to offer educational sessions of ecology, cultural history and scientific research and offer training in public speaking, exhibit preparation and other programmatic support skills.
- **Strategy:** Encourage interaction and information exchange among volunteers through regular meetings, newsletters and group outings; expand the interaction and exchange of ideas and information with "Friends" groups from other Reserves in the southeast U.S., including the ongoing interaction with the Friends of ACE Basin NERR, and others.
- **Strategy:** Respect volunteers' interests and abilities by developing a system for appropriately matching volunteer interests and abilities to specific assignments and encouraging suggestions and proposals for innovations and additions to existing public involvement opportunities.
- **Strategy:** Acknowledge volunteers' contributions by offering special opportunities for volunteers through staff presentations, excursions and tours of remote, less accessible areas of the Reserve, and by providing a system for public recognition of outstanding volunteers and special volunteer projects.

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Appendix A. Program Accomplishments 2000-2007.

During the period 2000 through 2007, the Sapelo Island National Estuarine Research Reserve achieved, or exceeded, the goals iterated in the 1999 Management Plan (Revised). Some of the highlighted achievements, by sector, include:

Operations, Administration—

(1) Broke ground in May 2005 on a new research and education dormitory in cooperation with the University of Georgia Marine Institute on Sapelo Island through acquisition of NERRS construction award funds and a special earmark from NOAA/NERRS by the UGA School of Marine Sciences. The SINERR has full-time, dedicated, space in the new facility completed in early 2007 on the UGAMI campus (four beds, two baths and kitchen and dining facility).

(2) Compiled and distributed (2001) to all concerned parties a detailed fuel spill response plan for the Reserve, particularly as it applied to DNR's Sapelo Island fuel distribution facility located on the Reserve near Long Tabby.

(3) Expanded the Reserve staff from seven employees to 12 full-time and three part-time employees from 2000 to 2007.

(4) Through utilization of NOAA grant funds, undertook a systematic upgrade of Reserve infrastructure, including structural repairs and enhancements of the Long Tabby administrative building, mainland Visitors Center and visitor-use facilities at Long Tabby, Nannygoat Beach and the lighthouse tract.

Research and Monitoring—

(1) Implemented and expanded a comprehensive scientific research program based upon a multiplicity of disciplines and academic interests.

(2) Expanded the Reserve as a primary platform for ecological, estuarine and upland maritime forest field investigations, including development of concentrated archaeological field studies.

(3) Implemented and expanded well beyond required parameters the promulgation of the NERR Systemwide Monitoring Program (SWMP), adhering to NOAA protocols.

(4) Achieved full participation in the Georgia Coastal Long Term Ecological Research (LTER) program in cooperation and concert with the U.S. Geological Survey and the University of Georgia School of Marine Programs.

(5) A full-time monitoring technician was hired in 2004.

(6) Consistent with NOAA/NERRS protocols, initiated a full suite of monitoring initiatives related to nutrient analysis in the waters of the Reserve, and achieved

full participation in the Southeast Atlantic IOOS project in concert with NERRS and partnering agencies.

(7) A number of the recommendations of the Forest Lands Technical Committee for DNR's management practices on Sapelo Island's state-owned forested lands, including uplands of the SINERR, were met. A Comprehensive Management Plan for Sapelo Island was completed by the DNR with assistance and input by the SINERR, which is updated and amended as required to address changing issues impacting both to the island the Reserve; a comprehensive ecological characterization profile was developed for the Reserve that details the scientific aspects of the island through biological inventories and hydrologic studies; hardwood restoration has begun on Sapelo Island, including the Reserve; and a cessation of the commercial harvesting of pine timber on SINERR uplands was achieved, thus restoring the integrity of sensitive scientific research sites and potential future sites.

(8) Monitoring station upgrades were made on the Reserve from 2000 to 2005 to include new Sonde water quality monitoring units, and new weather monitoring station for SINERR's collection of data pursuant to the SWMP; also equipment related to the Reserve's participation in the LTER and National Atmospheric Deposition monitoring programs.

(9) Initiated, through staff planning and cooperative partnerships with other agencies, a series of research and restoration projects in the Reserve, including salt marsh dieback study, the Dean Creek project, oyster spat recruitment, blue crab population studies, live oak forest restoration and other projects, all of which are outlined in detail in the Research and Monitoring chapter of this document.

(10) Hosted the annual NERRS research coordinators conference and workshop on Sapelo Island in 2001.

Education and Outreach—

(1) Successfully planned, organized and implemented a comprehensive series of special programs and public observances throughout 2006 in recognition of the Reserve's 30th year of site designation (1976) with staff and volunteer support and participation by several thousand persons in a variety of venues in coastal Georgia.

(2) Implemented and continued to expand the Reserve's K-12 teacher training and workshop program for educators all over Georgia.

(3) Developed a comprehensive Reserve website; developed a variety of educational and information products, including: an educational CD-ROM for use by K-12 teachers; a new 20-minute Reserve video and DVD program geared to general audiences (with a focus on science and ecology); Coastal Training website and brochure; several new Reserve posters; a detailed general-purpose fold-out color map of Sapelo Island, the Reserve and its trails for public distribution; publication and distribution of an annual Reserve calendar; and annual reprints and distribution of the Reserve's Education Curriculum Guide.

(4) The Reserve's educational/interpretive/public outreach programs were expanded from 2000 through 2007 to include the offering of a wider range of programming, special events, tours, mainland outreach programs, K-12 teacher training workshops, and an array of workshops and training programs and seminars.

(5) An ecological nature trail was developed in 2001 at the Sapelo Island lighthouse site on the south end of the Reserve. This construction project was appended to the restoration of the lighthouse as a significant component of the SINERR education program. The trail includes a boardwalk through a salt marsh, a nature observation tower and interpretive signage. In 2006 work was completed on an exhibit housed in the restored lighthouse oil house, detailing the historical and ecological aspects of the lighthouse site.

(6) Outreach efforts at the Reserve's mainland Visitors Interpretive Center were expanded under the aegis of the SINERR educational program to include new interpretive exhibits and utilization of the facility to conduct workshop programs and symposia apportioned to the NERRS Coastal Training initiative.

(7) Restoration efforts were completed on an existing structure to house the Reserve's new Education Laboratory at Long Tabby. A NOAA construction award was utilized to expedite this project, which includes wet lab, audio-visual facilities and a 50-seat classroom. The SINERR education program has conducted numerous interpretive programs in this facility geared primarily toward estuarine/ecological education initiatives for K-12 school groups.

Stewardship—

(1) A full-time Stewardship Coordinator was hired in 2002.

(2) From 2003 through 2007, the Reserve researched and compiled extensive Geographic Information System (GIS) mapping data of Sapelo Island's ecological and cultural resources, including the inventory and cataloging of island habitats.

(3) The process of developing a long-term strategy to systematically survey and document through various academic disciplines, the archaeological, historical and cultural resources of the island began in 2003, including field investigations by university-level researchers of the Sapelo Island Shell Ring formations on the North End of the island.

(4) A GIS laboratory, with an oversize, large-scale, map printer, was established by the Reserve at the Long Tabby office complex with a second laboratory at the nearby UGA Marine Institute. The SINERR, through utilization of NOAA funds and under the coordination and supervision of the stewardship coordinator, developed a GIS mapping program that is ongoing and receives continual upgrading, enhancement and expansion in response to changing technologies and acquisition of new data.

(5) In a concerted effort for increased involvement in the national program, the Reserve hosted the annual NERRS stewardship coordinators conference and workshop in 2005.

(6) In partnership with Georgia DNR/WRD, the stewardship program coordinated and expedited as a demonstration project a new environmentally-friendly "gravel-pave" parking area east of the Marsh Landing ferry dock, for the purpose of relieving congestion and parking at the ferry dock itself.

Coastal Training Program—

(1) A full-time Coastal Training Program Coordinator was hired in 2004.

(2) A Georgia CTP logo was created; a CTP brochure developed, printed and distributed; promotional materials produced, including brochure, website and pencils; and web-based capabilities developed for the promotion of programs, as a distribution center for science based materials, for on-line registration, and to feature programs and resources offered by partner organizations.

(3) A database was built to track program partners, participants, speakers and workshop details.

(4) The Reserve's CTP program has created new partnerships with NOAA and Grays Reef National Marine Sanctuary, the Georgia Soil and Water Conservation Commission, the Georgia Coastal Zone Management Program, and the Georgia Department of Natural Resources' Non-game section. The program has maintained and strengthened its partnership with the Georgia DNR's Environmental Protection Division, Wildlife Resources Division and Coastal Resources Division as well as the University of Georgia's Marine Extension Service.

(5) Regional collaboration has been initiated and is strengthening with the Florida GTM, SC North-Inlet Winyah Bay and ACE Basin reserves.

Appendix B. Establishment of the National Estuarine Research Reserve System by the Coastal Zone Management Act.

U.S. Code Title 16, Chapter 33, §1451, Section 315—as amended through P.L. 104-150, the Coastal Zone Protection Act of 1996

Source: http://www.ocrm.nos.noaa.gov/czm/czm_act.html

(a) Establishment of the System. There is established the National Estuarine Research Reserve System

(hereinafter referred to in this section as the "System") that consists of:

- (1) each estuarine sanctuary designated under this section as in effect before the date of the enactment of the Coastal Zone Management Reauthorization Act of 1985 [enacted Apr. 7, 1986]; and
- (2) each estuarine area designated as a national estuarine reserve under subsection (b). Each estuarine sanctuary referred to in paragraph (1) is hereby designated as a national estuarine reserve.

(b) Designation of national estuarine reserves.

After the date of the enactment of the Coastal Zone Management Reauthorization Act of 1985 [enacted

Apr. 7, 1986], the Secretary may designate an estuarine area as a national estuarine reserve if--

- (1) the Governor of the coastal state in which the area is located nominates the area for that designation;
- and
- (2) the Secretary finds that--
 - (A) the area is a representative estuarine ecosystem that is suitable for long-term research and contributes to the biogeographical and typological balance of the System;
 - (B) the law of the coastal state provides long-term protection for reserve resources to ensure a stable environment for research;
 - (C) designation of the area as a reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation; and
 - (D) the coastal state in which the area is located has complied with the requirements of any regulations issued by the Secretary to implement this section.

(c) Estuarine research guidelines.

The Secretary shall develop guidelines for the conduct of research within the System that shall include--

- (1) a mechanism for identifying, and establishing priorities among, the coastal management issues that should be addressed through coordinated research within the System;
- (2) the establishment of common research principles and objectives to guide the development of research programs within the System;

(3) the identification of uniform research methodologies which will ensure comparability of data, the broadest application of research results, and the maximum use of the System for research purposes;

(4) the establishment of performance standards upon which the effectiveness of the research efforts and the value of reserves within the System in addressing the coastal management issues identified in paragraph (1) may be measured; and

(5) the consideration of additional sources of funds for estuarine research than the funds authorized under this Act, and strategies for encouraging the use of such funds within the System, with particular emphasis on mechanisms established under subsection (d).

In developing the guidelines under this section, the Secretary shall consult with prominent members of the estuarine research community.

(d) Promotion and coordination of estuarine research.

The Secretary shall take such action as is necessary to promote and coordinate the use of the System for research purposes including--

- (1) requiring that the National Oceanic and Atmospheric Administration, in conducting or supporting estuarine research, give priority consideration to research that uses the System; and
- (2) consulting with other Federal and State agencies to promote use of one or more reserves within the System by such agencies when conducting estuarine research.

(e) Financial assistance.

(1) The Secretary may, in accordance with such rules and regulations as the Secretary shall promulgate, make grants--

(A) to a coastal state--

(i) for purposes of acquiring such lands and waters, and any property interests therein, as are necessary to ensure the appropriate long-term management of an area as a national estuarine reserve,

(ii) for purposes of operating or managing a national estuarine reserve and constructing appropriate reserve facilities, or

(iii) for purposes of conducting educational or interpretive activities;

and

(B) to any coastal state or public or private person for purposes of supporting research and monitoring within a national estuarine reserve that are consistent with the research guidelines developed under subsection (c).

(2) Financial assistance provided under paragraph (1) shall be subject to such terms and conditions as the Secretary considers necessary or appropriate to protect the interests of the United States, including

requiring coastal states to execute suitable title documents setting forth the property interest or interests of the United States in any lands and waters acquired in whole or part with such financial assistance.

(3)

(A) The amount of the financial assistance provided under paragraph (1)(A)(i) with respect to the acquisition of lands and waters, or interests therein, for any one national estuarine reserve may not exceed an amount equal to 50 percent of the costs of the lands, waters, and interests therein or \$5,000,000, whichever amount is less.

(B) The amount of the financial assistance provided under paragraph (1)(A) (ii) and (iii) and paragraph (1)(B) may not exceed 70 percent of the costs incurred to achieve the purposes described in those paragraphs with respect to a reserve; except that the amount of the financial assistance provided under paragraph (1)(A)(iii) may be up to 100 percent of any costs for activities that benefit the entire System.

(C) Notwithstanding subparagraphs (A) and (B), financial assistance under this subsection provided from amounts recovered as a result of damage to natural resources located in the coastal zone may be used to pay 100 percent of the costs of activities carried out with the assistance.

(f) Evaluation of system performance.

(1) The Secretary shall periodically evaluate the operation and management of each national estuarine reserve, including education and interpretive activities, and the research being conducted within the reserve.

(2) If evaluation under paragraph (1) reveals that the operation and management of the reserve is deficient, or that the research being conducted within the reserve is not consistent with the research guidelines developed under subsection (c), the Secretary may suspend the eligibility of that reserve for financial assistance under subsection (e) until the deficiency or inconsistency is remedied.

(3) The Secretary may withdraw the designation of an estuarine area as a national estuarine reserve if evaluation under paragraph (1) reveals that--

(A) the basis for any one or more of the findings made under subsection (b)(2) regarding that area no longer exists; or

(B) a substantial portion of the research conducted within the area, over a period of years, has not been consistent with the research guidelines developed under subsection (c).

(g) Report.

The Secretary shall include in the report required under section 316 [16 USC § 1462] information regarding--

(1) new designations of national estuarine reserves;

(2) any expansion of existing national estuarine reserves;

(3) the status of the research program being conducted within the System; and

(4) a summary of the evaluations made under subsection (f).

Appendix C. National Estuarine Research Reserve System: Code of Federal Regulations.

Code of Federal Regulations, Title 15, Subtitle B, Chapter 9, Part 921, Revised as of January 1, 2002.

Source: http://www.access.gpo.gov/nara/cfr/waisidx_02/15cfr921_02.html

Subpart A—General.

Sec. 921.1 Mission, goals and general provisions.

(a) The mission of the National Estuarine Research Reserve Program is the establishment and management, through Federal-state cooperation, of a national system (National Estuarine Research Reserve System or System) of estuarine research reserves (National Estuarine Research Reserves or Reserves) representative of the various regions and estuarine types in the United States. National Estuarine Research Reserves are established to provide opportunities for long-term research, education, and interpretation.

(b) The goals of the Program are to:

(1) Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources; (2) Address coastal management issues identified as significant through coordinated estuarine research within the System; (3) Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation; (4) Promote Federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research; and (5) Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

(c) National Estuarine Research Reserves shall be open to the public to the extent permitted under state and Federal law. Multiple uses are allowed to the degree compatible with each Reserve's overall purpose as provided in the management plan (see Sec. 921.13) and consistent with paragraphs (a) and (b) of this section. Use levels are set by the state where the Reserve is located and analyzed in the management plan. The Reserve management plan shall describe the uses and establish priorities among these uses. The plan shall identify uses requiring a state permit, as well as areas where uses are encouraged or prohibited. Consistent with resource protection and research objectives, public access and use may be restricted to certain areas or components within a Reserve.

(d) Habitat manipulation for research purposes is allowed consistent with the following limitations. Manipulative research activities must be specified in the management plan, be consistent with the mission and goals of the program (see paragraphs (a) and (b) of this section) and the goals and objectives set forth in the Reserve's management plan, and be limited in nature and extent to the minimum manipulative activity necessary to accomplish the stated research objective. Manipulative research activities with a significant or long-term impact on Reserve resources require the prior approval of the state and the National Oceanic and Atmospheric Administration (NOAA). Manipulative research activities which can reasonably be expected to have a significant adverse impact on the estuarine resources and habitat of a Reserve, such that the activities themselves or their resulting short- and long-term consequences compromise the representative character and integrity of a Reserve, are prohibited. Habitat manipulation for resource management purposes is prohibited except as specifically approved by NOAA as: (1) A restoration activity consistent with paragraph (e) of this

section; or (2) an activity necessary for the protection of public health or the preservation of other sensitive resources which have been listed or are eligible for protection under relevant Federal or state authority (e.g., threatened/endangered species or significant historical or cultural resources) or if the manipulative activity is a long-term pre-existing use (i.e., has occurred prior to designation) occurring in a buffer area. If habitat manipulation is determined to be necessary for the protection of public health, the preservation of sensitive resources, or if the manipulation is a long-term pre-existing use in a buffer area, then these activities shall be specified in the Reserve management plan in accordance with Sec. 921.13(a)(10) and shall be limited to the reasonable alternative which has the least adverse and shortest term impact on the representative and ecological integrity of the Reserve. (e) Under the Act an area may be designated as an estuarine Reserve only if the area is a representative estuarine ecosystem that is suitable for long-term research. Many estuarine areas have undergone some ecological change as a result of human activities (e.g., hydrological changes, intentional/unintentional species composition changes-introduced and exotic species). In those areas proposed or designated as National Estuarine Research Reserves, such changes may have diminished the representative character and integrity of the site. Although restoration of degraded areas is not a primary purpose of the System, such activities may be permitted to improve the representative character and integrity of a Reserve. Restoration activities must be carefully planned and approved by NOAA through the Reserve management plan. Historical research may be necessary to determine the "natural" representative state of an estuarine area (i.e., an estuarine ecosystem minimally affected by human activity or influence). Frequently, restoration of a degraded estuarine area will provide an excellent opportunity for management oriented research. (f) NOAA may provide financial assistance to coastal states, not to exceed, per Reserve, 50 percent of all actual costs or \$5 million whichever amount is less, to assist in the acquisition of land and waters, or interests therein. NOAA may provide financial assistance to coastal states not to exceed 70 percent of all actual costs for the management and operation of, the development and construction of facilities, and the conduct of educational or interpretive activities concerning Reserves (see subpart I). NOAA may provide financial assistance to any coastal state or public or private person, not to exceed 70 percent of all actual costs, to support research and monitoring within a Reserve. Notwithstanding any financial assistance limits established by this Part, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be used to pay 100 percent of all actual costs of activities carried out with this assistance, as long as such funds are available. Predesignation, acquisition and development, operation and management, special research and monitoring, and special education and interpretation awards are available under the National Estuarine Reserve Program. Predesignation awards are for site selection/feasibility, draft management plan preparation and conduct of basic characterization studies. Acquisition and development awards are intended primarily for acquisition of interests in land, facility construction and to develop and/or upgrade research, monitoring and education programs. Operation and management awards provide funds to assist in implementing, operating and managing the administrative, and basic research, monitoring and education programs, outlined in the Reserve management plan. Special research and monitoring awards provide funds to conduct estuarine research and monitoring projects with the System. Special educational and interpretive awards provide funds to conduct estuarine educational and interpretive projects within the System. (g) Lands already in protected status managed by other Federal agencies, state or local governments, or private organizations may be included within National Estuarine Research Reserves only if the managing entity commits to long-term management consistent with paragraphs (d) and (e) of this section in the Reserve management plan. Federal lands already in protected status may not comprise a majority of the key land and water areas of a Reserve (see Sec. 921.11(c)(3)). (h) To assist the states in carrying out the Program's goals in an effective manner, NOAA will coordinate a research and education information exchange throughout the National Estuarine Research Reserve System. As part of this role, NOAA will ensure that information and

ideas from one Reserve are made available to others in the System. The network will enable Reserves to exchange information and research data with each other, with universities engaged in estuarine research, and with Federal, state, and local agencies. NOAA's objective is a system-wide program of research and monitoring capable of addressing the management issues that affect long-term productivity of our Nation's estuaries.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12540, Mar. 17, 1997;
63 FR 26717, May 14, 1998]

Sec. 921.2 Definitions.

(a) Act means the Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451 et seq.

(b) Assistant Administrator means the Assistant Administrator for Ocean Services and Coastal Zone Management or delegee.

(c) Coastal state means a state of the United States, in or bordering on, the Atlantic, Pacific, or Arctic Ocean, the Gulf of Mexico, Long Island Sound, or one or more of the Great Lakes. For the purposes of these regulations the term also includes Puerto Rico, the Virgin Islands, Guam, the Commonwealth of the Northern Marianas Islands, the Trust Territories of the Pacific Islands, and American Samoa (see 16 U.S.C. 1453(4)).

(d) State agency means an instrumentality of a coastal state to whom the coastal state has delegated the authority and responsibility for the creation and/or management/operation of a National Estuarine Research Reserve. Factors indicative of this authority may include the power to receive and expend funds on behalf of the Reserve, acquire and sell or convey real and personal property interests, adopt rules for the protection of the Reserve, enforce rules applicable to the Reserve, or develop and implement research and education programs for the reserve. For the purposes of these regulations, the terms "coastal state" and "State agency" shall be synonymous.

(e) Estuary means that part of a river or stream or other body of water having unimpaired connection with the open sea, where the sea water is measurably diluted with fresh water derived from land drainage.

The term also includes estuary-type areas with measurable freshwater influence and having unimpaired connections with the open sea, and estuary-type areas of the Great Lakes and their connecting waters (see 16 U.S.C. 1453(7)).

(f) National Estuarine Research Reserve means an area that is a representative estuarine ecosystem suitable for long-term research, which may include all of the key land and water portion of an estuary, and adjacent transitional areas and uplands constituting to the extent feasible a natural unit, and which is set aside as a natural field laboratory to provide long-term opportunities for research, education, and interpretation on the ecological relationships within the area (see 16 U.S.C. 1453(8)) and meets the requirements of 16 U.S.C. 1461(b). This includes those areas designated as National Estuarine Sanctuaries or Reserves under section 315 of the Act prior to enactment of the Coastal Zone Act Reauthorization Amendments of 1990 and each area subsequently designated as a National Estuarine Research Reserve.

Sec. 921.3 National Estuarine Research Reserve System Biogeographic Classification Scheme and Estuarine Typologies.

(a) National Estuarine Research Reserves are chosen to reflect regional differences and to include a variety of ecosystem types. A biogeographic classification scheme based on regional variations in the nation's coastal zone has been developed. The biogeographic classification scheme is used to ensure that the National Estuarine Research Reserve System includes at least one site from each region. The estuarine typology system is utilized to ensure that sites in the System reflect the wide range of estuarine types within the United States.

(b) The biogeographic classification scheme, presented in appendix I, contains 29 regions. Figure 1 graphically depicts the biogeographic regions of the United States.

(c) The typology system is presented in appendix II.

Sec. 921.4 Relationship to other provisions of the Coastal Zone Management Act, and to the Marine Protection, Research and Sanctuaries Act.

(a) The National Estuarine Research Reserve System is intended to provide information to state agencies and other entities involved in addressing coastal management issues. Any coastal state,

including those that do not have approved coastal management programs under section 306 of the Act, is eligible for an award under the National Estuarine Research Reserve Program (see Sec. 921.2(c)).

(b) For purposes of consistency review by states with a federally approved coastal management program, the designation of a National Estuarine Research Reserve is deemed to be a Federal activity, which, if directly affecting the state's coastal zone, must be undertaken in a manner consistent to the maximum extent practicable with the approved state coastal management program as provided by section 1456(c)(1) of the Act, and implementing regulations at 15 CFR part 930, subpart C. In accordance with section 1456(c)(1) of the Act and the applicable regulations NOAA will be responsible for certifying that designation of the Reserve is consistent with the state's approved coastal management program. The state must concur with or object to the certification. It is recommended that the lead state agency for Reserve designation consult, at the earliest practicable time, with the appropriate state officials concerning the consistency of a proposed National Estuarine Research Reserve.

(c) The National Estuarine Research Reserve Program will be administered in close coordination with the National Marine Sanctuary Program (Title III of the Marine Protection, Research and Sanctuaries Act, as amended, 16 U.S.C. 1431-1445), also administered by NOAA. Title III authorizes the Secretary of Commerce to designate discrete areas of the marine environment as National Marine Sanctuaries to protect or restore such areas for their conservation, recreational, ecological, historical, research, educational or esthetic values. National Marine Sanctuaries and Estuarine Research Reserves may not overlap, but may be adjacent.

Subpart B—Site section, Post Site Section and Management Development.

Sec. 921.10 General.

(a) A coastal state may apply for Federal financial assistance for the purpose of site selection, preparation of documents specified in Sec. 921.13 (draft management plan (DMP) and environmental impact statement (EIS)), and the conduct of limited basic characterization studies. The total Federal share of this assistance may not exceed \$100,000. Federal financial assistance for preacquisition activities under Sec. 921.11 and Sec. 921.12 is subject to the total \$5 million for which each Reserve is eligible for land acquisition. Notwithstanding the above, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be used to pay 100 percent of all actual costs of activities carried out with this assistance, as long as such funds are available. In the case of a biogeographic region (see appendix I) shared by two or more coastal states, each state is eligible for Federal financial assistance to establish a separate National Estuarine Research Reserve within their respective portion of the shared biogeographic region. Each separate National Estuarine Research Reserve is eligible for the full complement of funding. Financial assistance application procedures are specified in subpart I.

(b) In developing a Reserve program, a state may choose to develop a multiple-site Reserve reflecting a diversity of habitats in a single biogeographic region. A multiple-site Reserve allows the state to develop complementary research and educational programs within the individual components of its multi-site Reserve. Multiple-site Reserves are treated as one Reserve in terms of financial assistance and development of an overall management framework and plan. Each individual site of a proposed multiple-site Reserve shall be evaluated both separately under Sec. 921.11(c) and collectively as part of the site selection process. A coastal state may propose to establish a multiple-site Reserve at the time of the initial site selection, or at any point in the development or operation of the Reserve. If the state decides to develop a multiple-site National Estuarine Research Reserve after the initial acquisition and development award is made for a single site, the proposal is subject to the requirements set forth in Sec. 921.33(b). However, a state may not propose to add one or more sites to an already designated Reserve if the operation and management of such Reserve has

been found deficient and uncorrected or the research conducted is not consistent with the Estuarine Research Guidelines referenced in Sec. 921.51. In addition, Federal funds for the acquisition of a multiple-site Reserve remain limited to \$5,000,000 (see Sec. 921.20). The funding for operation of a multiple-site Reserve is limited to the maximum allowed for any one Reserve per year (see Sec. 921.32(c)) and preacquisition funds are limited to \$100,000 per Reserve. Notwithstanding the above, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be used to pay 100 percent of all actual costs of activities carried out with this assistance, as long as such funds are available.

[58 FR 38215, July 15, 1993, as amended at 63 FR 26717, May 14, 1998]

Sec. 921.11 Site selection and feasibility.

(a) A coastal state may use Federal funds to establish and implement a site selection process which is approved by NOAA.

(b) In addition to the requirements set forth in subpart I, a request for Federal funds for site selection must contain the following programmatic information:

(1) A description of the proposed site selection process and how it will be implemented in conformance with the biogeographic classification scheme and typology (Sec. 921.3);

(2) An identification of the site selection agency and the potential management agency; and

(3) A description of how public participation will be incorporated into the process (see Sec. 921.11(d)).

(c) As part of the site selection process, the state and NOAA shall evaluate and select the final site(s). NOAA has final authority in approving such sites. Site selection shall be guided by the following principles:

(1) The site's contribution to the biogeographical and typological balance of the National Estuarine Research Reserve System. NOAA will give priority consideration to proposals to establish Reserves in biogeographic regions or subregions or incorporating types that are not represented in the system. (See the biogeographic classification scheme and typology set forth in Sec. 921.3 and appendices I and II);

(2) The site's ecological characteristics, including its biological productivity, diversity of flora and fauna, and capacity to attract a broad range of research and educational interests. The proposed site must be a representative estuarine ecosystem and should, to the maximum extent possible, be an estuarine ecosystem minimally affected by human activity or influence (see Sec. 921.1(e)).

(3) Assurance that the site's boundaries encompass an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation.

Boundary size will vary greatly depending on the nature of the ecosystem. Reserve boundaries must encompass the area within which adequate control has or will be established by the managing entity over

human activities occurring within the Reserve. Generally, Reserve boundaries will encompass two areas: Key land and water areas (or "core area") and a buffer zone. Key land and water areas and a buffer zone

will likely require significantly different levels of control (see Sec. 921.13(a)(7)). The term "key land and water areas" refers to that core area within the Reserve that is so vital to the functioning of the estuarine ecosystem that it must be under a level of control sufficient to ensure the long-term viability of the Reserve for research on natural processes. Key land and water areas, which comprise the core area, are those ecological units of a natural estuarine system which preserve, for research purposes, a full range of significant physical, chemical and biological factors contributing to the diversity of fauna, flora and natural processes occurring within the estuary. The determination of which land and water areas are "key" to a particular Reserve must be based on specific scientific knowledge of the area. A basic principle to follow when deciding upon key land and water areas is that they should encompass resources representative of the total ecosystem, and which if

compromised could endanger the research objectives of the Reserve. The term buffer zone refers to an area adjacent to or surrounding key land and water areas and essential to their integrity.

Buffer zones protect

the core area and provide additional protection for estuarine-dependent species, including those that are rare or endangered. When determined appropriate by the state and approved by NOAA, the buffer zone may also include an area necessary for facilities required for research and interpretation. Additionally, buffer zones should be established sufficient to accommodate a shift of the core area as a result of biological, ecological or geomorphological change which reasonably could be expected to occur. National Estuarine Research Reserves may include existing Federal or state lands already in a protected status where mutual benefit can be enhanced. However, NOAA will not approve a site for potential National Estuarine Research Reserve status that is dependent primarily upon the inclusion of currently protected Federal lands in order to meet the requirements for Reserve status (such as key land and water areas). Such lands generally will be included within a Reserve to serve as a buffer or for other ancillary purposes; and may be included, subject to NOAA approval, as a limited portion of the core area;

(4) The site's suitability for long-term estuarine research, including ecological factors and proximity to existing research facilities and educational institutions;

(5) The site's compatibility with existing and potential land and water uses in contiguous areas as well as approved coastal and estuarine management plans; and

(6) The site's importance to education and interpretive efforts, consistent with the need for continued protection of the natural system.

(d) Early in the site selection process the state must seek the views of affected landowners, local governments, other state and Federal agencies and other parties who are interested in the area(s) being

considered for selection as a potential National Estuarine Research Reserve. After the local government(s) and affected landowner(s) have been contacted, at least one public meeting shall be held in the vicinity of the proposed site. Notice of such a meeting, including the time, place, and relevant subject matter, shall be announced by the state through the area's principal newspaper at least 15 days prior to the date of the meeting and by NOAA in the Federal Register.

(e) A state request for NOAA approval of a proposed site (or sites in the case of a multi-site Reserve) must contain a description of the proposed site(s) in relationship to each of the site selection principals (Sec. 921.11(c)) and the following information:

(1) An analysis of the proposed site(s) based on the biogeographical scheme/typology discussed in Sec. 921.3 and set forth in appendices I and II;

(2) A description of the proposed site(s) and its (their) major resources, including location, proposed boundaries, and adjacent land uses. Maps are required;

(3) A description of the public participation process used by the state to solicit the views of interested parties, a summary of comments, and, if interstate issues are involved, documentation that the Governor(s) of the other affected state(s) has been contacted. Copies of all correspondence, including contact letters to all affected landowners must be appended;

(4) A list of all sites considered and a brief statement of the reasons why a site was not preferred; and

(5) A nomination of the proposed site(s) for designation as a National Estuarine Research Reserve by the Governor of the coastal state in which the state is located.

(f) A state proposing to reactivate an inactive site, previously approved by NOAA for development as an Estuarine Sanctuary or Reserve, may apply for those funds remaining, if any, provided for site selection

and feasibility (Sec. 921.11a)) to determine the feasibility of reactivation. This feasibility study must comply with the requirements set forth in Sec. 921.11 (c) through (e).

Sec. 921.12 Post site selection.

(a) At the time of the coastal state's request for NOAA approval of a proposed site, the state may submit a request for funds to develop the draft management plan and for preparation of the EIS. At this time, the state may also submit a request for the remainder of the predesignation funds to perform a limited basic characterization of the physical, chemical and biological characteristics of the site approved by NOAA

necessary for providing EIS information to NOAA. The state's request for these post site selection funds must be accompanied by the information specified in subpart I and, for draft management plan development and

EIS information collection, the following programmatic information:

(1) A draft management plan outline (see Sec. 921.13(a) below); and (2) An outline of a draft memorandum of understanding (MOU) between the state and NOAA detailing the Federal-state role in Reserve management during the initial period of Federal funding and expressing the state's long-term commitment to operate and manage the Reserve.

(b) The state is eligible to use the funds referenced in Sec. 921.12(a) after the proposed site is approved by NOAA under the terms of Sec. 921.11.

Sec. 921.13 Management plan and environmental impact statement development.

(a) After NOAA approves the state's proposed site and application for funds submitted pursuant to Sec. 921.12, the state may begin draft management plan development and the collection of information necessary for the preparation by NOAA of an EIS. The state shall develop a draft management plan, including an MOU. The plan shall set out in detail:

(1) Reserve goals and objectives, management issues, and strategies or actions for meeting the goals and objectives;

(2) An administrative plan including staff roles in administration, research, education/interpretation, and surveillance and enforcement;

(3) A research plan, including a monitoring design;

(4) An education/interpretive plan;

(5) A plan for public access to the Reserve;

(6) A construction plan, including a proposed construction schedule, general descriptions of proposed developments and general cost estimates. Information should be provided for proposed minor construction projects in sufficient detail to allow these projects to begin in the initial phase of acquisition and development. A categorical exclusion, environmental assessment, or EIS may be required prior to construction;

(7)(i) An acquisition plan identifying the ecologically key land and water areas of the Reserve, ranking these areas according to their relative importance, and including a strategy for establishing adequate long-term state control over these areas sufficient to provide protection for Reserve resources to ensure a stable environment for research. This plan must include an identification of ownership within the proposed Reserve boundaries, including land already in the public domain; the method(s) of acquisition which the state proposes to use--acquisition (including less-than-fee simple options) to establish adequate long-term state control; an estimate of the fair market value of any property interest--which is proposed for acquisition; a schedule estimating the time required to complete the process of establishing adequate state control of the proposed research reserve; and a discussion of any anticipated problems. In selecting a preferred method(s) for establishing adequate state control over areas within the proposed boundaries of the Reserve, the state shall perform the following steps for each parcel determined to be part of the key land and water areas (control over which is necessary to protect the integrity of the Reserve for research purposes), and for those parcels required for research and interpretive support facilities or buffer purposes:

(A) Determine, with appropriate justification, the minimum level of control(s) required [e.g., management agreement, regulation, less-than-fee simple property interest (e.g., conservation easement), fee simple property acquisition, or a combination of these approaches]. This does not preclude the future necessity of increasing the level of state control;

(B) Identify the level of existing state control(s);

(C) Identify the level of additional state control(s), if any, necessary to meet the minimum requirements identified in paragraph (a)(7)(i)(A) of this section; (D) Examine all reasonable alternatives for attaining the level of control identified in paragraph (a)(7)(i)(C) of this section, and perform a cost analysis of each; and

(E) Rank, in order of cost, the methods (including acquisition) identified in paragraph (a)(7)(i)(D) of this section. (ii) An assessment of the relative cost-effectiveness of control alternatives shall include a reasonable estimate of both short-term costs (e.g., acquisition of property interests, regulatory program development including associated enforcement costs, negotiation, adjudication, etc.) and long-term costs (e.g., monitoring, enforcement, adjudication, management and coordination). In selecting a preferred method(s) for establishing adequate state control over each parcel examined under the process described above, the state shall give priority consideration to the least costly method(s) of attaining the minimum level of long-term control required. Generally, with the possible exception of buffer areas required for support

facilities, the level of control(s) required for buffer areas will be considerably less than that required for key land and water areas. This acquisition plan, after receiving the approval of NOAA, shall serve as a guide for negotiations with landowners. A final boundary for the reserve shall be delineated as a part of the final management plan; (8) A resource protection plan detailing applicable authorities, including allowable uses, uses requiring a permit and permit requirements, any restrictions on use of the research reserve, and a strategy for research reserve surveillance and enforcement of such use restrictions, including appropriate government enforcement agencies;

(9) If applicable, a restoration plan describing those portions of the site that may require habitat modification to restore natural conditions; (10) If applicable, a resource manipulation plan, describing those portions of the Reserve buffer in which long-term pre-existing (prior to designation) manipulation for reasons not related to research or restoration is occurring. The plan shall explain in detail the nature of such activities, shall justify why such manipulation should be permitted to continue within the reserve buffer; and shall describe possible effects of this manipulation on key land and water areas and their resources; (11) A proposed memorandum of understanding (MOU) between the state and NOAA regarding the Federal-state relationship during the establishment and development of the National Estuarine Research Reserve, and expressing a long-term commitment by the state to maintain and manage the Reserve in accordance with section 315 of the Act, 16 U.S.C. 1461, and applicable regulations. In conjunction with the MOU, and where possible under state law, the state will consider taking appropriate administrative or legislative action to ensure the long-term protection and operation of the National Estuarine Research Reserve. If other MOUs are necessary (such as with a Federal agency, another state agency or private organization), drafts of such MOUs must be included in the plan. All necessary MOU's shall be signed prior to Reserve designation; and (12) If the state has a federally approved coastal management program, a certification that the National Estuarine Research Reserve is consistent to the maximum extent practicable with that program. See Secs. 921.4(b) and 921.30(b).

(b) Regarding the preparation of an EIS under the National Environmental Policy Act on a National Estuarine Research Reserve proposal, the state and NOAA shall collect all necessary information concerning the socioeconomic and environmental impacts associated with implementing the draft management plan and feasible alternatives to the plan. Based on this information, the state will draft and provide NOAA with a preliminary EIS. (c) Early in the development of the draft management plan and the draft EIS, the state and NOAA shall hold a scoping meeting (pursuant to NEPA) in the area or areas most affected to solicit public and government comments on the significant issues related to the proposed action. NOAA will publish a notice of the meeting in the Federal Register at least 15 days prior to the meeting. The state shall be responsible for publishing a similar notice in the local media. (d) NOAA will publish a Federal Register notice of intent to prepare a draft EIS. After the draft EIS is prepared and filed with the Environmental Protection Agency (EPA), a Notice of Availability of the draft EIS will appear in the Federal Register. Not less than 30 days after publication of the notice, NOAA will hold at least one public hearing in the area or areas most affected by the proposed national estuarine research reserve. The hearing will be held no sooner than 15 days after appropriate notice of the meeting has been given in the principal news media by the state and in the Federal Register by NOAA. After a 45-day comment period, a final EIS will be prepared by the state and NOAA.

Subpart C—Acquisition, Development and Preparation of the Final Management Plan.

Sec. 921.20 General.

The acquisition and development period is separated into two major phases. After NOAA approval of the site, draft management plan and draft MOU, and completion of the final EIS, a coastal state is eligible for an initial acquisition and development award(s). In this initial phase, the state should work to meet the criteria required for formal research reserve designation; e.g., establishing adequate state control over the key land and water areas as specified in the draft management plan and preparing the final management plan. These requirements are specified in Sec. 921.30. Minor construction in

accordance with the draft management plan may also be conducted during this initial phase. The initial acquisition and development phase is expected to last no longer than three years. If necessary, a longer time period may be negotiated between the state and NOAA. After Reserve designation, a state is eligible for a supplemental acquisition and development award(s) in accordance with Sec. 921.31. In this post-designation acquisition and development phase, funds may be used in accordance with the final management plan to construct research and educational facilities, complete any remaining land acquisition, for program development, and for restorative activities identified in the final management plan. In any case, the amount of Federal financial assistance provided to a coastal state with respect to the acquisition of lands and waters, or interests therein, for any one National Estuarine Research Reserve may not exceed an amount equal to 50 percent of the costs of the lands, waters, and interests therein or \$5,000,000, whichever amount is less, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of all actual costs of activities carried out with this assistance, as long as such funds are available. [58 FR 38215, July 15, 1993, as amended at 62 FR 12540, Mar. 17, 1997; 63 FR 26717, May 14, 1998]

Sec. 921.21 Initial acquisition and development awards.

(a) Assistance is provided to aid the recipient prior to designation in:

(1) Acquiring a fee simple or less-than-fee simple real property interest in land and water areas to be included in the Reserve boundaries (see Sec. 921.13(a)(7); Sec. 921.30(d)); (2) Minor construction, as provided in paragraphs (b) and (c) of this section; (3) Preparing the final management plan; and

(4) Initial management costs, e.g., for implementing the NOAA approved draft management plan, hiring a Reserve manager and other staff as necessary and for other management-related activities. Application procedures are specified in subpart I.

(b) The expenditure of Federal and state funds on major construction activities is not allowed during the initial acquisition and development phase. The preparation of architectural and engineering plans, including specifications, for any proposed construction, or for proposed restorative activities, is permitted. In addition, minor construction activities, consistent with paragraph (c) of this section also are allowed. The NOAA-approved draft management plan must, however, include a construction plan and a public access plan before any award funds can be spent on construction activities. (c) Only minor construction activities that aid in implementing portions of the management plan (such as boat ramps and nature trails) are permitted during the initial acquisition and development phase. No more than five (5) percent of the initial acquisition and development award may be expended on such activities. NOAA must make a specific determination, based on the final EIS, that the construction activity will not be detrimental to the environment.

(d) Except as specifically provided in paragraphs (a) through (c) of this section, construction projects, to be funded in whole or in part under an acquisition and development award(s), may not be initiated until the Reserve receives formal designation (see Sec. 921.30). This requirement has been adopted to ensure that substantial progress in establishing adequate state control over key land and water areas has been made and that a final management plan is completed before major sums are spent on construction. Once substantial progress in establishing adequate state control/acquisition has been made, as defined by the state in the management plan, other activities guided by the final management plan may begin with NOAA's approval.

(e) For any real property acquired in whole or part with Federal funds for the Reserve, the state shall execute suitable title documents to include substantially the following provisions, or otherwise append the following provisions in a manner acceptable under applicable state law to the official land record(s): (1) Title to the property conveyed by this deed shall vest in the [recipient of the award granted pursuant to section 315 of the Act, 16 U.S.C. 1461 or other NOAA approved state agency] subject to the condition that the designation of the [name of National Estuarine Reserve] is not withdrawn and the property remains part of the federally designated [name of National Estuarine Research Reserve]; and (2) In the event that the property is no longer included as part

of the Reserve, or if the designation of the Reserve of which it is part is withdrawn, then NOAA or its successor agency, after full and reasonable consultation with the State, may exercise the following rights regarding the disposition of the property: (i) The recipient may retain title after paying the Federal Government an amount computed by applying the Federal percentage of participation in the cost of the original project to the current fair market value of the property; (ii) If the recipient does not elect to retain title, the Federal Government may either direct the recipient to sell the property and pay the Federal Government an amount computed by applying the Federal percentage of participation in the cost of the original project to the proceeds from the sale (after deducting actual and reasonable selling and repair or renovation expenses, if any, from the sale proceeds), or direct the recipient to transfer title to the Federal Government. If directed to transfer title to the Federal Government, the recipient shall be entitled to compensation computed by applying the recipient's percentage of participation in the cost of the original project to the current fair market value of the property; and (iii) Fair market value of the property must be determined by an independent appraiser and certified by a responsible official of the state, as provided by Department of Commerce regulations at 15 CFR part 24, and Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally assisted programs at 15 CFR part 11. (f) Upon instruction by NOAA, provisions analogous to those of Sec. 921.21(e) shall be included in the documentation underlying less-then-fee-simple interests acquired in whole or part with Federal funds. (g) Federal funds or non-Federal matching share funds shall not be spent to acquire a real property interest in which the state will own the land concurrently with another entity unless the property interest has been identified as a part of an acquisition strategy pursuant to Sec. 921.13(7) which has been approved by NOAA prior to the effective date of these regulations. (h) Prior to submitting the final management plan to NOAA for review and approval, the state shall hold a public meeting to receive comment on the plan in the area affected by the estuarine research reserve. NOAA will publish a notice of the meeting in the Federal Register at least 15 days prior to the public meeting. The state shall be responsible for having a similar notice published in the local newspaper(s).

Subpart D—Reserve Designation and Subsequent Operation.

Sec. 921.30 Designation of National Estuarine Research Reserves.

(a) The Under Secretary may designate an area proposed for designation by the Governor of the state in which it is located, as a National Estuarine Research Reserve if the Under Secretary finds: (1) The area is a representative estuarine ecosystem that is suitable for long-term research and contributes to the biogeographical and typological balance of the System; (2) Key land and water areas of the proposed Reserve, as identified in the management plan, are under adequate state control sufficient to provide long-term protection for reserve resources to ensure a stable environment for research; (3) Designation of the area as a Reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation; (4) A final management plan has been approved by NOAA; (5) An MOU has been signed between the state and NOAA ensuring a long-term commitment by the state to the effective operation and implementation of the area as a National Estuarine Research Reserve; (6) All MOU's necessary for reserve management (i.e., with relevant Federal, state, and local agencies and/or private organizations) have been signed; and (7) The coastal state in which the area is located has complied with the requirements of subpart B. (b) NOAA will determine whether the designation of a National Estuarine Research Reserve in a state with a federally approved coastal zone management program directly affects the coastal zone. If the designation is found to directly affect the coastal zone, NOAA will make a consistency determination pursuant to Sec. 307(c)(1) of the Act, 16 U.S.C. 1456, and 15 CFR part 930, subpart C. See Sec. 921.4(b). The results of this consistency determination will be published in the Federal Register when the notice of designation is published. See Sec. 921.30(c). (c) NOAA will publish the notice of designation of a National Estuarine Research Reserve in the Federal Register. The state shall be responsible for having a similar notice published in the local media. (d) The term state control in Sec. 921.30(a)(3) does not necessarily require that key land and water areas be owned by the state in fee

simple. Acquisition of less-than-fee simple interests e.g., conservation easements) and utilization of existing state regulatory measures are encouraged where the state can demonstrate that these interests and measures assure adequate long-term state control consistent with the purposes of the research reserve (see also Secs. 921.13(a)(7); 921.21(g)). Should the state later elect to purchase an interest in such lands using NOAA funds, adequate justification as to the need for such acquisition must be provided to NOAA.

Sec. 921.31 Supplemental acquisition and development awards.

After National Estuarine Research Reserve designation, and as specified in the approved management plan, a coastal state may request a supplemental acquisition and/or development award(s) for acquiring additional property interests identified in the management plan as necessary to strengthen protection of key land and water areas and to enhance long-term protection of the area for research and education, for facility and exhibit construction, for restorative activities identified in the approved management plan, for administrative purposes related to acquisition and/or facility construction and to develop and/or upgrade research, monitoring and education/interpretive programs. Federal financial assistance provided to a National Estuarine Research Reserve for supplemental development costs directly associated with facility construction (i.e., major construction activities) may not exceed 70 percent of the total project cost, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs. NOAA must make a specific determination that the construction activity will not be detrimental to the environment.

Acquisition awards for the acquisition of lands or waters, or interests therein, for any one reserve may not exceed an amount equal to 50 percent of the costs of the lands, waters, and interests therein of \$5,000,000, whichever amount is less, except when the financial assistance is provided from amounts recovered as result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of all actual costs of activities carried out with this assistance, as long as such funds are available. In the case of a biogeographic region (see appendix I) shared by two or more states, each state is eligible independently for Federal financial assistance to establish a separate National Estuarine Research Reserve within their respective portion of the shared biogeographic region. Application procedures are specified in subpart I. Land acquisition must follow the procedures specified in Secs. 921.13(a)(7), 921.21(e) and (f) and 921.81. [58 FR 38215, July 15, 1993, as amended at 62 FR 12540, Mar. 17, 1997; 63 FR 26717, May 14, 1998]

Sec. 921.32 Operation and management: Implementation of the management plan.

(a) After the Reserve is formally designated, a coastal state is eligible to receive Federal funds to assist the state in the operation and management of the Reserve including the management of research, monitoring, education, and interpretive programs. The purpose of this Federally funded operation and management phase is to implement the approved final management plan and to take the necessary steps to ensure the continued effective operation of the Reserve. (b) State operation and management of the Reserves shall be consistent with the mission, and shall further the goals of the National Estuarine Research Reserve program (see Sec. 921.1). (c) Federal funds are available for the operation and management of the Reserve. Federal funds provided pursuant to this section may not exceed 70 percent of the total cost of operating and managing the Reserve for any one year, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs. In the case of a biogeographic region (see Appendix I) shared by two or more states, each state is eligible for Federal financial assistance to establish a separate Reserve within their respective portion of the shared biogeographic region (see Sec. 921.10). (d) Operation and management funds are subject to the following limitations: (1) Eligible coastal state agencies may apply for up to the maximum share available per Reserve for that fiscal year. Share amounts will be announced annually by letter from the Sanctuary and Reserves Division to all participating states. This letter will be provided as soon as practicable following approval of the Federal budget for that fiscal year. (2) No more than ten percent of the total amount (state and Federal shares) of each operation and management award may be used for construction-type activities.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12541, Mar. 17, 1997]

Sec. 921.33 Boundary changes, amendments to the management plan, and addition of multiple-site components.

(a) Changes in the boundary of a Reserve and major changes to the final management plan, including state laws or regulations promulgated specifically for the Reserve, may be made only after written approval by NOAA. NOAA may require public notice, including notice in the Federal Register and an opportunity for public comment before approving a boundary or management plan change. Changes in the boundary of a Reserve involving the acquisition of properties not listed in the management plan or final EIS require public notice and the opportunity for comment; in certain cases, a categorical exclusion, an environmental assessment and possibly an environmental impact statement may be required. NOAA will place a notice in the Federal Register of any proposed changes in Reserve boundaries or proposed major changes to the final management plan. The state shall be responsible for publishing an equivalent notice in the local media. See also requirements of Secs. 921.4(b) and 921.13(a)(11). (b) As discussed in Sec. 921.10(b), a state may choose to develop a multiple-site National Estuarine Research Reserve after the initial acquisition and development award for a single site has been made. NOAA will publish notice of the proposed new site including an invitation for comments from the public in the Federal Register. The state shall be responsible for publishing an equivalent notice in the local newspaper(s). An EIS, if required, shall be prepared in accordance with section Sec. 921.13 and shall include an administrative framework for the multiple-site Reserve and a description of the complementary research and educational programs within the Reserve. If NOAA determines, based on the scope of the project and the issues associated with the additional site(s), that an environmental assessment is sufficient to establish a multiple-site Reserve, then the state shall develop a revised management plan which, concerning the additional component, incorporates each of the elements described in Sec. 921.13(a). The revised management plan shall address goals and objectives for all components of the multi-site Reserve and the additional component's relationship to the original site(s).

(c) The state shall revise the management plan for a Reserve at least every five years, or more often if necessary. Management plan revisions are subject to (a) above. (d) NOAA will approve boundary changes, amendments to management plans, or the addition of multiple-site components, by notice in the Federal Register. If necessary NOAA will revise the designation document (findings) for the site.

Subpart E—Ongoing Oversight, Performance Evaluation and Withdrawal of Designation.

Sec. 921.40 Ongoing oversight and evaluations of designated National Estuarine Research Reserves.

(a) The Sanctuaries and Reserve Division shall conduct, in accordance with section 312 of the Act and procedures set forth in 15 CFR part 928, ongoing oversight and evaluations of Reserves. Interim sanctions may be imposed in accordance with regulations promulgated under 15 CFR part 928. (b) The Assistant Administrator may consider the following indicators of non-adherence in determining whether to invoke interim sanctions: (1) Inadequate implementation of required staff roles in administration, research, education/interpretation, and surveillance and enforcement. Indicators of inadequate implementation could include: No Reserve Manager, or no staff or insufficient staff to carry out the required functions. (2) Inadequate implementation of the required research plan, including the monitoring design. Indicators of inadequate implementation could include: Not carrying out research or monitoring that is required by the plan, or carrying out research or monitoring that is inconsistent with the plan. (3) Inadequate implementation of the required education/interpretation plan. Indicators of inadequate implementation could include: Not carrying out education or interpretation that is required by the plan, or carrying out education/interpretation that is inconsistent with the plan. (4) Inadequate implementation of public access to the Reserve. Indicators of inadequate implementation of public access could include: Not providing necessary access, giving full consideration to the need to keep some areas off limits to the public in order to protect fragile resources. (5) Inadequate implementation of

facility development plan. Indicators of inadequate implementation could include: Not taking action to propose and budget for necessary facilities, or not undertaking necessary construction in a timely manner when funds are available. (6) Inadequate implementation of acquisition plan. Indicators of inadequate implementation could include: Not pursuing an aggressive acquisition program with all available funds for that purpose, not requesting promptly additional funds when necessary, and evidence that adequate long-term state control has not been established over some core or buffer areas, thus jeopardizing the ability to protect the Reserve site and resources from offsite impacts. (7) Inadequate implementation of Reserve protection plan. Indicators of inadequate implementation could include: Evidence of non-compliance with Reserve restrictions, insufficient surveillance and enforcement to assure that restrictions on use of the Reserve are adhered to, or evidence that Reserve resources are being damaged or destroyed as a result of the above. (8) Failure to carry out the terms of the signed Memorandum of Understanding (MOU) between the state and NOAA, which establishes a long-term state commitment to maintain and manage the Reserve in accordance with section 315 of the Act. Indicators of failure could include: State action to allow incompatible uses of state-controlled lands or waters in the Reserve, failure of the state to bear its fair share of costs associated with long-term operation and management of the Reserve, or failure to initiate timely updates of the MOU when necessary.

Sec. 921.41 Withdrawal of designation.

The Assistant Administrator may withdraw designation of an estuarine area as a National Estuarine Research Reserve pursuant to and in accordance with the procedures of section 312 and 315 of the Act and regulations promulgated thereunder.

Subpart F—Special Research Projects.

Sec. 921.50 General.

(a) To stimulate high quality research within designated National Estuarine Research Reserves, NOAA may provide financial support for research projects which are consistent with the Estuarine Research Guidelines referenced in Sec. 921.51. Research awards may be awarded under this subpart to only those designated Reserves with approved final management plans. Although research may be conducted within the immediate watershed of the Reserve, the majority of research activities of any single research project funded under this subpart may be conducted within Reserve boundaries. Funds provided under this subpart are primarily used to support management-related research projects that will enhance scientific understanding of the Reserve ecosystem, provide information needed by Reserve management and coastal management decision-makers, and improve public awareness and understanding of estuarine ecosystems and estuarine management issues. Special research projects may be oriented to specific Reserves; however, research projects that would benefit more than one Reserve in the National Estuarine Research Reserve System are encouraged. (b) Funds provided under this subpart are available on a competitive basis to any coastal state or qualified public or private person. A notice of available funds will be published in the Federal Register. Special research project funds are provided in addition to any other funds available to a coastal state under the Act. Federal funds provided under this subpart may not exceed 70 percent of the total cost of the project, consistent with Sec. 921.81(e)(4) ("allowable costs"), except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12541, Mar. 17, 1997]

Sec. 921.51 Estuarine research guidelines.

(a) Research within the National Estuarine Research Reserve System shall be conducted in a manner consistent with Estuarine Research Guidelines developed by NOAA. (b) A summary of the Estuarine Research Guidelines is published in the Federal Register as a part of the notice of available funds discussed in

Sec. 921.50(c). (c) The Estuarine Research Guidelines are reviewed annually by NOAA.

This review will include an opportunity for comment by the estuarine research community.

Sec. 921.52 Promotion and coordination of estuarine research.

(a) NOAA will promote and coordinate the use of the National Estuarine Research Reserve System for research purposes. (b) NOAA will, in conducting or supporting estuarine research other than that authorized under section 315 of the Act, give priority consideration to research that make use of the National Estuarine Research Reserve System. (c) NOAA will consult with other Federal and state agencies to promote use of one or more research reserves within the National Estuarine Research Reserve System when such agencies conduct estuarine research.

Subpart G—Special Monitoring Projects.

Sec. 921.60 General.

(a) To provide a systematic basis for developing a high quality estuarine resource and ecosystem information base for National Estuarine Research Reserves and, as a result, for the System, NOAA may provide financial support for basic monitoring programs as part of operations and management under Sec. 921.32. Monitoring funds are used to support three major phases of a monitoring program: (1) Studies necessary to collect data for a comprehensive site description/characterization; (2) Development of a site profile; and (3) Formulation and implementation of a monitoring program. (b) Additional monitoring funds may be available on a competitive basis to the state agency responsible for Reserve management or a qualified public or private person or entity. However, if the applicant is other than the managing entity of a Reserve that applicant must submit as a part of the application a letter from the Reserve manager indicating formal support of the application by the managing entity of the Reserve. Funds provided under this subpart for special monitoring projects are provided in addition to any other funds available to a coastal state under the Act. Federal funds provided under this subpart may not exceed 70 percent of the total cost of the project, consistent with Sec. 921.81(e)(4) ("allowable costs"), except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs. (c) Monitoring projects funded under this subpart must focus on the resources within the boundaries of the Reserve and must be consistent with the applicable sections of the Estuarine Research Guidelines referenced in Sec. 921.51. Portions of the project may occur within the immediate watershed of the Reserve beyond the site boundaries. However, the monitoring proposal must demonstrate why this is necessary for the success of the project. [58 FR 38215, July 15, 1993, as amended at 62 FR 12541, Mar. 17, 1997]

Subpart H—Special Interpretation and Education Projects.

Sec. 921.70 General.

(a) To stimulate the development of innovative or creative interpretive and educational projects and materials to enhance public awareness and understanding of estuarine areas, NOAA may fund special interpretive and educational projects in addition to those activities provided for in operations and management under Sec. 921.32. Special interpretive and educational awards may be awarded under this subpart to only those designated Reserves with approved final management plans. (b) Funds provided under this subpart may be available on a competitive basis to any state agency. However, if the applicant is other than the managing entity of a Reserve, that applicant must submit as a part of the application a letter from the Reserve manager indicating formal support of the application by the managing entity of the Reserve. These funds are provided in addition to any other funds available to a coastal state under the Act. Federal funds provided under this subpart may not exceed 70 percent of the total cost of the project, consistent with Sec. 921.81(e)(4) ("allowable costs"), except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs. (c) Applicants for education/interpretive projects that NOAA

determines benefit the entire National Estuarine Research Reserve System may receive Federal assistance of up to 100% of project costs.[58 FR 38215, July 15, 1993, as amended at 62 FR 12541, Mar. 17, 1997]

Subpart I—General Financial Assistance Provisions.

Sec. 921.80 Application information.

(a) Only a coastal state may apply for Federal financial assistance awards for preacquisition, acquisition and development, operation and management, and special education and interpretation projects under subpart H. Any coastal state or public or private person may apply for Federal financial assistance awards for special estuarine research or monitoring projects under subpart G. The announcement of opportunities to conduct research in the System appears on an annual basis in the Federal Register. If a state is participating in the national Coastal Zone Management Program, the applicant for an award under section 315 of the Act shall notify the state coastal management agency regarding the application. (b) An original and two copies of the formal application must be submitted at least 120 working days prior to the proposed beginning of the project to the following address: Sanctuaries and Reserves Division Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, 1825 Connecticut Avenue, NW., suite 714, Washington, DC 20235. Application for Federal Assistance Standard Form 424 (Non-construction Program) constitutes the formal application for site selection, post-site selection, operation and management, research, and education and interpretive awards. The Application for Federal Financial Assistance Standard Form 424 (Construction Program) constitutes the formal application for land acquisition and development awards. The application must be accompanied by the information required in subpart B (predesignation), subpart C and Sec. 921.31 (acquisition and development), and Sec. 921.32 (operation and management) as applicable. Applications for development awards for construction projects, or restorative activities involving construction, must include a preliminary engineering report, a detailed construction plan, a site plan, a budget and categorical exclusion check list or environmental assessment. All applications must contain back up data for budget estimates (Federal and non-Federal shares), and evidence that the application complies with the Executive Order 12372, "Intergovernmental Review of Federal Programs." In addition, applications for acquisition and development awards must contain: (1) State Historic Preservation Office comments; (2) Written approval from NOAA of the draft management plan for initial acquisition and development award(s); and (3) A preliminary engineering report for construction activities.

Sec. 921.81 Allowable costs.

(a) Allowable costs will be determined in accordance with applicable OMB Circulars and guidance for Federal financial assistance, the financial assistance agreement, these regulations, and other Department of Commerce and NOAA directives. The term "costs" applies to both the Federal and non-Federal shares.

(b) Costs claimed as charges to the award must be reasonable, beneficial and necessary for the proper and efficient administration of the financial assistance award and must be incurred during the award period.

(c) Costs must not be allocable to or included as a cost of any other Federally-financed program in either the current or a prior award period.(d) General guidelines for the non-Federal share are contained in Department of Commerce Regulations at 15 CFR part 24 and OMB Circular A-110. Copies of Circular A-110 can be obtained from the Sanctuaries and Reserves Division; 1825 Connecticut Avenue, NW., suite 714; Washington, DC 20235. The following may be used in satisfying the matching requirement: (1) Site selection and post site selection awards. Cash and in-kind contributions (value of goods and services directly benefiting and specifically identifiable to this part of the project) are allowable. Land may not be used as match.

(2) Acquisition and development awards. Cash and in-kind contributions are allowable. In general, the fair market value of lands to be included within the Reserve boundaries and acquired pursuant to the Act, with other than Federal funds, may be used as match. However, the fair

market value of real property allowable as match is limited to the fair market value of a real property interest equivalent to, or required to attain, the level of control over such land(s) identified by the state and approved by the Federal Government as that necessary for the protection and management of the National Estuarine Research Reserve. Appraisals must be performed according to Federal appraisal standards as detailed in Department of Commerce regulations at 15 CFR

part 24 and the Uniform Relocation Assistance and Real Property Acquisition for Federal land Federally assisted programs in 15 CFR part 11. The fair market value of privately donated land, at the time of donation, as established by an independent appraiser and certified by a responsible official of the state, pursuant to 15 CFR part 11, may also be used as match. Land, including submerged lands already in the state's possession, may be used as match to establish a National Estuarine Research Reserve. The value of match for these state lands will be calculated by determining the value of the benefits foregone by the state, in the use of the land, as a result of new restrictions that may be imposed by Reserve designation. The appraisal of the benefits foregone must be made by an independent appraiser in accordance with Federal appraisal standards pursuant to 15 CFR part 24 and 15 CFR part 11. A state may initially use as match land valued at greater than the Federal share of the acquisition and development award. The value in excess of the amount required as match for the initial award may be used to match subsequent supplemental acquisition and development awards for the National Estuarine Research Reserve (see also Sec. 921.20). Costs related to land acquisition, such as appraisals, legal fees and surveys, may also be used as match. (3) Operation and management awards. Generally, cash and in-kind contributions (directly benefiting and specifically identifiable to operations and management), except land, are allowable. (4) Research, monitoring, education and interpretive awards. Cash and in-kind contributions (directly benefiting and specifically identifiable to the scope of work), except land, are allowable.

Sec. 921.82 Amendments to financial assistance awards.

Actions requiring an amendment to the financial assistance award, such as a request for additional Federal funds, revisions of the approved project budget or original scope of work, or extension of the performance period must be submitted to NOAA on Standard Form 424 and approved in writing.

Appendix I to Part 921—Biogeographic Classification Scheme.

Acadian 1. Northern of Maine (Eastport to the Sheepscot River.)
2. Southern Gulf of Maine (Sheepscot River to Cape Cod.)

Virginian 3. Southern New England (Cape Cod to Sandy Hook.)
4. Middle Atlantic (Sandy Hook to Cape Hatteras.) 5. Chesapeake Bay.

Carolinian 6. North Carolinas (Cape Hatteras to Santee River.)
7. South Atlantic (Santee River to St. John's River.) 8. East Florida (St. John's River to Cape Canaveral.)

West Indian 9. Caribbean (Cape Canaveral to Ft. Jefferson and south.)
10. West Florida (Ft. Jefferson to Cedar Key.)

Louisianian 11. Panhandle Coast (Cedar Key to Mobile Bay.)
12. Mississippi Delta (Mobile Bay to Galveston.) 13. Western Gulf (Galveston to Mexican border.)

Californian 14. Southern California (Mexican border to Point Conception.)
15. Central California (Point Conception to Cape Mendocino.)
16. San Francisco Bay.

Columbian 17. Middle Pacific (Cape Mendocino to the Columbia River.)
18. Washington Coast (Columbia River to Vancouver Island.)

19. Puget Sound.

Great Lakes 20. Lake Superior (including St. Mary's River.)

21. Lakes Michigan and Huron (including Straits of Mackinac, St. Clair River, and Lake St. Clair.) 22. Lake Erie (including Detroit River and Niagara Falls.) 23. Lake Ontario (including St. Lawrence River.)

Fjord 24. Southern Alaska (Prince of Wales Island to Cook Inlet.)

25. Aleutian Island (Cook Inlet Bristol Bay.)

Sub-Arctic 26. Northern Alaska (Bristol Bay to Damarcation Point.)

Insular 27. Hawaiian Islands. 28. Western Pacific Island.

29. Eastern Pacific Island.

Appendix II to Part 921—Typology of National Estuarine Research Reserves.

This typology system reflects significant differences in estuarine characteristics that are not necessarily related to regional location. The purpose of this type of classification is to maximize ecosystem variety in the selection of national estuarine reserves. Priority will be given to important ecosystem types as yet unrepresented in the reserve system. It should be noted that any one site may represent several ecosystem types or physical characteristics.

Class I--Ecosystem Types

Group I--Shorelands

A. Maritime Forest-Woodland. That have developed under the influence of salt spray. It can be found on coastal uplands or recent features such as barrier islands and beaches, and may be divided into the following biomes:

1. Northern coniferous forest biome: This is an area of predominantly evergreens such as the sitka spruce (*Picea*), grand fir (*Abies*), and white cedar (*Thuja*), with poor development of the shrub and herb layer, but high annual productivity and pronounced seasonal periodicity.

2. Moist temperate (Mesothermal) coniferous forest biome: Found along the west coast of North America from California to Alaska, this area is dominated by conifers, has relatively small seasonal range, high humidity with rainfall ranging from 30 to 150 inches, and a well-developed understory of vegetation with an abundance of mosses and other moisture-tolerant plants.

3. Temperate deciduous forest biome: This biome is characterized by abundant, evenly distributed rainfall, moderate temperatures which exhibit a distinct seasonal pattern, well-developed soil biota and herb and shrub layers, and numerous plants which produce pulpy fruits and nuts. A distinct subdivision of this biome is the pine edible forest of the southeastern coastal plain, in which only a small portion of the area is occupied by climax vegetation, although it has large areas covered by edaphic climax pines.

4. Broad-leaved evergreen subtropical forest biome: The main characteristic of this biome is high moisture with less pronounced differences between winter and summer. Examples are the hammocks of

Florida and the live oak forests of the Gulf and South Atlantic coasts. Floral dominants include pines, magnolias, bays, hollies, wild tamarine, strangler fig, gumbo limbo, and palms.

B. Coast shrublands. This is a transitional area between the coastal grasslands and woodlands and is characterized by woody species with multiple stems and a few centimeters to several meters above the ground developing under the influence of salt spray and occasional sand burial. This includes thickets, scrub, scrub savanna, heathlands, and coastal

chaparral. There is a great variety of shrubland vegetation exhibiting regional specificity: 1. Northern areas: Characterized by *Hudsonia*, various erinaceous species, and thickets of *Myrica*, *prunus*, and *Rosa*. 2. Southeast areas: Floral dominants include *Myrica*, *Baccharis*, and lles. 3.

Western areas: *Adenostoma*, *arcotyphylus*, and *eucalyptus* are the dominant floral species. C. Coastal grasslands. This area, which possesses sand dunes and coastal flats, has low rainfall (10 to 30 inches per year) and large amounts of humus in the soil. Ecological succession is slow, resulting in the presence of a number of seral stages of community development.

Dominant vegetation includes mid-grasses (5 to 8 feet tall), such as *Spartina*, and trees such as willow (*Salix* sp.), cherry (*Prunus* sp.), and cottonwood (*Pupulus deltoides*.) This area is divided into four regions with the following typical strand vegetation:

1. Arctic/Boreal: *Elymus*;
2. Northeast/West: *Ammophla*;
3. Southeast Gulf: *Uniola*; and
4. Mid-Atlantic/Gulf: *Spartina patens*.

D. Coastal tundra. This ecosystem, which is found along the Arctic and Boreal coasts of North America, is characterized by low temperatures, a short growing season, and some permafrost, producing a low, treeless mat community made up of mosses, lichens, heath, shrubs, grasses, sedges, rushes, and herbaceous and dwarf woody plants. Common species include arctic/alpine plants such as *Empetrum nigrum* and *Betula*

nana, the lichens *Cetraria* and *Cladonia*, and herbaceous plants such as *Potentilla tridentata* and *Rubus chamaemorus*. Common species on the coastal beach ridges of the high arctic desert include *Bryas*

intergrifolia and *Saxifrage oppositifolia*. This area can be divided into two main subdivisions:

1. Low tundra: Characterized by a thick, spongy mat of living and undecayed vegetation, often with water and dotted with ponds when not frozen; and
2. High Tundra: A bare area except for a scanty growth of lichens

and grasses, with underlying ice wedges forming raised polygonal areas. E. Coastal cliffs. This ecosystem is an important nesting site for many sea and shore birds. It consists of communities of herbaceous, graminoid, or low woody plants (shrubs, heath, etc.) on the top or along rocky faces exposed to salt spray. There is a diversity of plant species including mosses, lichens, liverworts, and "higher" plant representatives.

Group II--Transition Areas

A. Coastal marshes. These are wetland areas dominated by grasses (*Poacea*), sedges (*Cyperaceae*), rushes (*Juncaceae*), cattails (*Typhaceae*), and other graminoid species and is subject to periodic flooding by either salt or freshwater. This ecosystem may be subdivided into: (a) Tidal, which is periodically flooded by either salt or brackish water; (b) nontidal (freshwater); or (c) tidal freshwater. These are essential habitats for many important estuarine species of fish and invertebrates as well as shorebirds and waterfowl and serve important roles in shore stabilization, flood control, water purification, and nutrient transport and storage. B. Coastal swamps. These are wet lowland areas that support mosses and shrubs together with large trees such as cypress or gum. C. Coastal mangroves. This ecosystem experiences regular flooding on either a daily, monthly, or seasonal basis, has low wave action, and is dominated by a variety of salt-tolerant trees, such as the red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia Nitida*), and the white mangrove (*Laguncularia racemosa*.) It is also an important habitat for large populations of fish, invertebrates, and birds. This type of ecosystem can be found from central Florida to extreme south Texas to the islands of the Western Pacific.

D. Intertidal beaches. This ecosystem has a distinct biota of microscopic animals, bacteria, and unicellular algae along with macroscopic crustaceans, mollusks, and worms with a detritus-based nutrient cycle. This area also includes the driftline communities found at high tide levels on the beach. The dominant organisms in this ecosystem include crustaceans such as the mole crab (*Emerita*), amphipods (*Gammeridae*), ghost crabs (*Ocypode*), and bivalve mollusks such as the coquina (*Donax*) and surf clams (*Spisula* and *Mactra*.)

E. Intertidal mud and sand flats. These areas are composed of unconsolidated, high organic content sediments that function as a short-term storage area for nutrients and organic carbons. Macrophytes are

nearly absent in this ecosystem, although it may be heavily colonized by benthic diatoms, dinoflagellates, filamentous blue-green and green algae, and chemosynthetic purple sulfur bacteria. This system may support a considerable population of gastropods, bivalves, and polychaetes, and may serve as a feeding area for a variety of fish and wading birds. In sand, the dominant fauna include the wedge shell *Donax*, the scallop *Pecten*, tellin shells *Tellina*, the heart urchin *Echinocardium*, the lug worm *Arenicola*, sand dollar *Dendraster*, and the sea pansy *Renilla*. In mud, faunal dominants adapted to low oxygen levels include the terebellid *Amphitrite*, the boring clam *Playdon*, the deep sea scallop *Placopecten*, the Quahog *Mercenaria*, the echiurid worm *Urechis*, the mud snail *Nassarius*, and the sea cucumber *Thyone*. F. Intertidal algal beds. These are hard substrates along the marine edge that are dominated by macroscopic algae, usually thalloid, but also filamentous or unicellular in growth form. This also includes the rocky coast tidepools that fall within the intertidal zone. Dominant fauna of these areas are barnacles, mussels, periwinkles, anemones, and chitons. Three regions are apparent: 1. Northern latitude rocky shores: It is in this region that the community structure is best developed. The dominant algal species include *Chondrus* at the low tide level, *Fucus* and *Ascophyllum* at the mid-tidal level, and *Laminaria* and other kelp-like algae just beyond the intertidal, although they can be exposed at extremely low tides or found in very deep tidepools. 2. Southern latitudes: The communities in this region are reduced in comparison to those of the northern latitudes and possess algae consisting mostly of single-celled or filamentous green, blue-green, and red algae, and small thalloid brown algae. 3. Tropical and subtropical latitudes: The intertidal in this region is very reduced and contains numerous calcareous algae such as *Porolithon* and *Lithothamnion*, as well as green algae with calcareous particles such as *Halimeda*, and numerous other green, red, and brown algae.

Group III--Submerged Bottoms

A. Subtidal hardbottoms. This system is characterized by a consolidated layer of solid rock or large pieces of rock (neither of biotic origin) and is found in association with geomorphological features such as submarine canyons and fjords and is usually covered with assemblages of sponges, sea fans, bivalves, hard corals, tunicates, and other attached organisms. A significant feature of estuaries in many parts of the world is the oyster reef, a type of subtidal hardbottom. Composed of assemblages of organisms (usually bivalves), it is usually found near an estuary's mouth in a zone of moderate wave action, salt content, and turbidity. If light levels are sufficient, a covering of microscopic and attached macroscopic algae, such as kelp, may also be found. B. Subtidal softbottoms. Major characteristics of this ecosystem are an unconsolidated layer of fine particles of silt, sand, clay, and gravel, high hydrogen sulfide levels, and anaerobic conditions often existing below the surface. Macrophytes are either sparse or absent, although a layer of benthic microalgae may be present if light levels are sufficient. The faunal community is dominated by a diverse population of deposit feeders including polychaetes, bivalves, and burrowing crustaceans. C. Subtidal plants. This system is found in relatively shallow water (less than 8 to 10 meters) below mean low tide. It is an area of extremely high primary production that provides food and refuge for a diversity of faunal groups, especially juvenile and adult fish, and in some regions, manatees and sea turtles. Along the North Atlantic and Pacific coasts, the seagrass *Zostera marina* predominates. In the South Atlantic and Gulf coast areas, *Thalassia* and *Diplanthera* predominate. The grasses in both areas support a number of epiphytic organisms.

Class II--Physical Characteristics

Group I—Geologic

A. Basin type. Coastal water basins occur in a variety of shapes, sizes, depths, and appearances. The eight basic types discussed below will cover most of the cases: 1. Exposed coast: Solid rock formations or heavy sand deposits characterize exposed ocean shore fronts, which are subject to the full force of ocean storms. The sand beaches are very resilient, although the dunes lying just behind the beaches are fragile and easily damaged. The dunes serve as a sand storage area making them chief stabilizers of the ocean shoreline. 2. Sheltered coast: Sand or coral barriers, built up by natural forces, provide sheltered areas inside a bar or reef where the ecosystem takes on many characteristics of confined waters-

abundant marine grasses, shellfish, and juvenile fish. Water movement is reduced, with the consequent effects pollution being more severe in this area than in exposed coastal areas. 3.

Bay: Bays are larger confined bodies of water that are open to

the sea and receive strong tidal flow. When stratification is pronounced the flushing action is augmented by river discharge. Bays vary in size and in type of shoreline. 4. Embayment: A confined coastal water body with narrow, restricted inlets and with a significant freshwater inflow can be classified as an embayment. These areas have more restricted inlets than bays, are usually smaller and shallower, have low tidal action, and are subject to sedimentation. 5. Tidal river: The lower reach of a coastal river is referred to as a tidal river. The coastal water segment extends from the sea or estuary into which the river discharges to a point as far upstream as there is significant salt content in the water, forming a salt front. A combination of tidal action and freshwater outflow makes tidal rivers well-flushed. The tidal river basin may be a simple channel or a complex of tributaries, small associated embayments, marshfronts, tidal flats, and a variety of others. 6. Lagoon: Lagoons are confined coastal bodies of water with restricted inlets to the sea and without significant freshwater inflow. Water circulation is limited, resulting in a poorly flushed, relatively stagnant body of water. Sedimentation is rapid with a great potential for basin shoaling. Shores are often gently sloping and marshy.

7. Perched coastal wetlands: Unique to Pacific islands, this wetland type found above sea level in volcanic crater remnants forms as a result of poor drainage characteristics of the crater rather than from sedimentation. Floral assemblages exhibit distinct zonation while the faunal constituents may include freshwater, brackish, and/or marine species. Example: Aunu'u Island, American Samoa. 8. Anchialine systems: These small coastal exposures of brackish water form in lava depressions or elevated fossil reefs have only a subsurface connection in the ocean, but show tidal fluctuations. Differing from true estuaries in having no surface continuity with

streams or ocean, this system is characterized by a distinct biotic community dominated by benthic algae such as *Rhizoclonium*, the mineral encrusting *Schizothrix*, and the vascular plant *Ruppia maritima*. Characteristic fauna which exhibit a high degree of endemism, include the mollusks *Theosoxus neglectus* and *Tarionus*. Although found throughout the world, the high islands of the Pacific are the only areas within the U.S. where this system can be found. B. Basin structure. Estuary basins may result from the drowning of a river valley (coastal plains estuary), the drowning of a glacial valley (fjord), the occurrence of an offshore barrier (bar-bounded estuary), some tectonic process (tectonic estuary), or volcanic activity (volcanic estuary). 1. Coastal plains estuary: Where a drowned valley consists mainly of a single channel, the form of the basin is fairly regular forming a simple coastal plains estuary. When a channel is flooded with numerous tributaries an irregular estuary results. Many estuaries of the eastern United States are of this type. 2. Fjord: Estuaries that form in elongated steep headlands that alternate with deep U-shaped valleys resulting from glacial scouring are called fjords. They generally possess rocky floors or very thin veneers of sediment, with deposition generally being restricted to the head where the main river enters. Compared to total fjord volume river discharge is small. But many fjords have restricted tidal ranges at their mouths due to sills, or upreaching sections of the bottom which limit free movement of water, often making river flow large with respect to the tidal prism. The deepest portions are in the upstream reaches, where maximum depths can range from 800m to 1200m while sill depths usually range from 40m to 150m. 3. Bar-bounded estuary: These result from the development of an

offshore barrier such as a beach strand, a line of barrier islands, reef formations a line of moraine debris, or the subsiding remnants of a deltaic lobe. The basin is often partially exposed at low tide and is enclosed by a chain of offshore bars of barrier islands broken at intervals by inlets. These bars may be either deposited offshore or may be coastal dunes that have become isolated by recent sea level rises. 4. Tectonic estuary: These are coastal indentures that have formed through tectonic processes such as slippage along a fault line (San Francisco Bay), folding or movement of the earth's bedrock often with a large inflow of freshwater.

5. Volcanic estuary: These coastal bodies of open water, a result of volcanic processes are depressions or craters that have direct and/or subsurface connections with the ocean and may or may not have surface continuity with streams. These formations are unique to island areas of volcanic origin. C. Inlet type. Inlets in various forms are an integral part of the estuarine environment as they regulate to a certain extent, the velocity

and magnitude of tidal exchange, the degree of mixing, and volume of discharge to the sea. 1. Unrestricted: An estuary with a wide unrestricted inlet typically has slow currents, no significant turbulence, and receives the full effect of ocean waves and local disturbances which serve to modify the shoreline. These estuaries are partially mixed, as the open mouth permits the incursion of marine waters to considerable distances upstream, depending on the tidal amplitude and stream gradient. 2. Restricted: Restrictions of estuaries can exist in any forms: Bars, barrier islands, spits, sills, and more. Restricted inlets result in decreased circulation, more pronounced longitudinal and vertical salinity gradients, and more rapid sedimentation. However, if the estuary mouth is restricted by depositional features or land closures, the incoming tide may be held back until it suddenly breaks forth into the basin as a tidal wave, or bore. Such currents exert profound effects on the nature of the substrate, turbidity, and biota of the estuary. 3. Permanent: Permanent inlets are usually opposite the mouths of major rivers and permit river water to flow into the sea. 4. Temporary (Intermittent): Temporary inlets are formed by storms and frequently shift position, depending on tidal flow, the depth of the sea, and sound waters, the frequency of storms, and the amount of littoral transport. D. Bottom composition. The bottom composition of estuaries attests to the vigorous, rapid, and complex sedimentation processes characteristic of most coastal regions with low relief. Sediments are derived through the hydrologic processes of erosion, transport, and deposition carried on by the sea and the stream. 1. Sand: Near estuary mouths, where the predominating forces of the sea build spits or other depositional features, the shore and substrates of the estuary are sandy. The bottom sediments in this area are usually coarse, with a gradation toward finer particles in the head region and other zones of reduced flow, fine silty sands are deposited. Sand deposition occurs only in wider or deeper regions where velocity is reduced. 2. Mud: At the base level of a stream near its mouth, the bottom is typically composed of loose muds, silts, and organic detritus as a result of erosion and transport from the upper stream reaches and organic decomposition. Just inside the estuary entrance, the bottom contains considerable quantities of sand and mud, which support a rich fauna. Mud flats, commonly built up in estuarine basins, are composed of loose, coarse, and fine mud and sand, often dividing the original channel. 3. Rock: Rocks usually occur in areas where the stream runs rapidly over a steep gradient with its coarse materials being derived from the higher elevations where the stream slope is greater. The larger fragments are usually found in shallow areas near the stream mouth. 4. Oyster shell: Throughout a major portion of the world, the oyster reef is one of the most significant features of estuaries, usually being found near the mouth of the estuary in a zone of moderate wave action, salt content, and turbidity. It is often a major factor in modifying estuarine current systems and sedimentation, and may occur as an elongated island or peninsula oriented across the main current, or may develop parallel to the direction of the current.

Group II—Hydrographic

A. Circulation. Circulation patterns are the result of combined influences of freshwater inflow, tidal action, wind and oceanic forces, and serve many functions: Nutrient transport, plankton dispersal, ecosystem flushing, salinity control, water mixing, and more. 1. Stratified: This is typical of estuaries with a strong freshwater influx and is commonly found in bays formed from "drowned" river valleys, fjords, and other deep basins. There is a net movement of freshwater outward at the top layer and saltwater at the bottom layer, resulting in a net outward transport of surface organisms and net inward transport of bottom organisms. 2. Non-stratified: Estuaries of this type are found where water movement is sluggish and flushing rate is low, although there may be sufficient circulation to provide the basis for a high carrying capacity. This is common to shallow embayments and bays lacking a good supply of freshwater from land drainage. 3. Lagoonal: An estuary of this type is characterized by low rates of water movement resulting from a lack of significant freshwater influx and a lack of strong tidal exchange because of the typically narrow inlet connecting the lagoon to the sea. Circulation whose major driving force is wind, is the major limiting factor in biological productivity within lagoons. B. Tides. This is the most important ecological factor in an estuary as it affects water exchange and its vertical range determines the extent of tidal flats which may be exposed and submerged with each tidal

cycle. Tidal action against the volume of river water discharged into an estuary results in a complex system whose properties vary according to estuary structure as well as the magnitude of river flow and tidal

range. Tides are usually described in terms of the cycle and their relative heights. In the United States, tide height is reckoned on the basis of average low tide, which is referred to as datum. The tides, although complex, fall into three main categories: 1. Diurnal: This refers to a daily change in water level that can be observed along the shoreline. There is one high tide and one low tide per day.

2. Semidiurnal: This refers to a twice daily rise and fall in water that can be observed along the shoreline.

3. Wind/Storm tides: This refers to fluctuations in water elevation to wind and storm events, where influence of lunar tides is less. C. Freshwater. According to nearly all the definitions advanced, it is inherent that all estuaries need freshwater, which is drained from the land and measurably dilutes seawater to create a brackish condition. Freshwater enters an estuary as runoff from the land either from a surface and/or subsurface source. 1. Surface water: This is water flowing over the ground in the form of streams. Local variation in runoff is dependent upon the nature of the soil (porosity and solubility), degree of surface slope, vegetational type and development, local climatic conditions, and volume and intensity of precipitation.

2. Subsurface water: This refers to the precipitation that has been absorbed by the soil and stored below the surface. The distribution of subsurface water depends on local climate, topography, and the porosity and permeability of the underlying soils and rocks. There are two main subtypes of surface water: a. Vadose water: This is water in the soil above the water table. Its volume with respect to the soil is subject to considerable fluctuation. b. Groundwater: This is water contained in the rocks below the water table, is usually of more uniform volume than vadose water, and generally follows the topographic relief of the land being high hills and sloping into valleys.

Group III—Chemical

A. Salinity. This reflects a complex mixture of salts, the most abundant being sodium chloride, and is a very critical factor in the distribution and maintenance of many estuarine organisms. Based on salinity, there are two basic estuarine types and eight different salinity zones (expressed in parts per thousand-ppt.) 1. Positive estuary: This is an estuary in which the freshwater influx is sufficient to maintain mixing, resulting in a pattern of increasing salinity toward the estuary mouth. It is characterized by low oxygen concentration in the deeper waters and considerable organic content in bottom sediments. 2. Negative estuary: This is found in particularly arid regions, where estuary evaporation may exceed freshwater inflow, resulting in increased salinity in the upper part of the basin, especially if the estuary mouth is restricted so that tidal flow is inhibited. These are typically very salty (hyperhaline), moderately oxygenated at depth, and possess bottom sediments that are poor in organic content. 3. Salinity zones (expressed in ppt):

a. Hyperhaline--greater than 40 ppt.

b. Euhaline--40 ppt to 30 ppt.

c. Mixhaline--30 ppt to 0.5 ppt.

(1) Mixoeuhaline--greater than 30 ppt but less than the adjacent euhaline sea.

(2) Polyhaline--30 ppt to 18 ppt.

(3) Mesohaline--18 ppt to 5 ppt.

(4) Oligohaline--5 ppt to 0.5 ppt.

d. Limnetic: Less than 0.5 ppt.

B. pH Regime: This is indicative of the mineral richness of estuarine waters and falls into three main categories:

1. Acid: Waters with a pH of less than 5.5.

2. Circumneutral: A condition where the pH ranges from 5.5 to 7.4.

3. Alkaline: Waters with a pH greater than 7.4.

**Memorandum of Agreement
Between the
National Oceanic and Atmospheric Administration
And the
Department of Natural Resources of the State of Georgia
Detailing the State-Federal Roles in the
Management of the Sapelo Island National Estuarine Research Reserve**

This Memorandum of Agreement (hereinafter referred to as "MOA") states the provisions for the cooperative management of the Sapelo Island National Estuarine Research Reserve in the State of Georgia, between the State of Georgia acting by and through its Department of Natural Resources (hereinafter referred to as "DNR") and the National Oceanic and Atmospheric Administration's Office of Ocean and Coastal Resource Management (hereinafter referred to as "NOAA").

WHEREAS, the State of Georgia has determined that the waters and related coastal habitats of Sapelo Island provide unique opportunities for study of natural and human processes occurring within the estuarine ecosystems of the state to contribute to the science of estuarine ecosystem processes, enhance environmental education opportunities, and provide scientific information for effective coastal zone management in the State of Georgia; and

WHEREAS, the State of Georgia has determined that the resources of the Sapelo Island National Estuarine Research Reserve, originally established as the Sapelo Island National Estuarine Sanctuary, and the values they represent to the citizens of Georgia and the United States will benefit from the management of these resources as part of the National Estuarine Research Reserve System; and

WHEREAS, NOAA has concurred with that finding and pursuant to its authority under section 315 of the Coastal Zone Management Act of 1972, as amended (hereinafter referred to as "CZMA," P.L. 92-583, 16 U.S.C. 1461) and in accordance with implementing regulations at 15 CFR 921.30 has designated the Sapelo Island National Estuarine Research Reserve (hereinafter referred to as "SINERR"); and

WHEREAS, DNR, as the agency designated by the Governor of Georgia, is responsible for managing SINERR and acknowledges the value of state-federal cooperation for the long-term management of the reserve in a manner consistent with the purpose of the designation; and

WHEREAS, the management plan describes the goals, objectives, strategies, actions, administrative structure, and institutional arrangements for the reserve, including this MOA and others.

NOW THEREFORE, in consideration of the mutual agreements herein, NOAA and DNR agree to the following:

ARTICLE I: STATE-FEDERAL ROLES IN RESERVE MANAGEMENT

A. DNR's Role in Reserve Management

DNR shall:

1. Be responsible for compliance with all federal laws and regulations, and ensure that the SINERR management plan is consistent with the provisions of the CZMA and regulations;
2. Ensure protection of the natural and cultural resources of the reserve, and ensure enforcement of the provisions of state law, including rules and regulations of the Georgia Coastal Zone Management Program;
3. Ensure adequate, long-term protection and management of lands included within the reserve boundary;
4. Annually apply for, budget, and allocate funds received for reserve operations, research and monitoring, education and stewardship, and, as necessary, land acquisition and reserve facility construction;
5. Conduct and coordinate research and monitoring programs that encourage scientists from a variety of institutions to work together to understand the ecology of the reserve ecosystem to improve coastal management;
6. Conduct and maintain programs that disseminate research results via materials, activities, workshops, and conferences to resource users, state and local agencies, school systems, general public, and other interested parties;
7. Provide staff and endeavor to secure state funding for the manager, education coordinator and research coordinator positions;
8. Secure facilities and equipment required to implement the provisions within the reserve management plan;
9. Ensure adequate funding for facilities operation and maintenance;
10. Maintain effective liaison with local, regional, state, and federal policy makers, regulators and the general public
11. Serve as principal negotiator in issues involving proposed boundary changes and/or amendments to the SINERR's management plan;
12. Respond to NOAA's requests for information, particularly cooperative agreement and grant progress reports and evaluation findings, including necessary actions and recommendations, made pursuant to Section 312 of the CZMA; and
13. Expend funds in accordance with federal and state laws, the reserve management plan, and annual funding guidance from NOAA.

B. NOAA's Role in Reserve Management

NOAA shall:

1. Serve to administer the provisions of the Sections 315 and 312 of the CZMA to ensure that SINERR is operated in accordance with goals of the reserve system and the its management plan;

2. Review and process applications for financial assistance from DNR, consistent with 15 CFR 921, for management and operation, and, as appropriate, land acquisition and facility construction;
3. Advise DNR of existing and emerging national and regional issues that have bearing on SINERR and the reserve system;
4. Maintain an information exchange network among reserves, including available research and monitoring data and educational materials developed within the reserve system; and
5. To the extent possible, facilitate NOAA resources and capabilities in support of reserve goals and programs.

C. General Provisions

1. Nothing in this MOA or subsequent financial assistance awards shall obligate either party in the expenditure of funds, or for future payments of money, in excess of appropriations authorized by law.
2. Both parties agree to comply with all applicable federal and state laws regulating ethical conduct of public officers and employees.
3. Each party will comply with all applicable laws, regulations, and executive orders relative to Equal Employment Opportunity.
4. Upon termination of this MOA or any subsequent financial assistance awards to DNR, any equipment purchased for studies to further this agreement will be retained by the party that made the initial purchase.
5. A free exchange of research and assessment data between the parties is encouraged and is necessary to ensure success of cooperative studies.

D. Other Provisions

1. Nothing in this MOA diminishes the independent authority or coordination responsibility of either party in administering its respective statutory obligations. Nothing in this MOA is intended to conflict with current written directives or policies of either party. If the terms of this MOA are inconsistent with existing written directives or policies of either party entering into this MOA, then those portions of the MOA which are determined to be inconsistent with such written directives and policies shall be invalid; but the remaining terms not affected by the inconsistency shall remain in full force and effect. At the first opportunity for revision of this MOA, all necessary changes shall be made by either an amendment to this MOA or by entering in a new superseding agreement, whichever is deemed expedient to the interested parties. Should disagreement arise on the interpretation of the provisions and/or amendments of this MOA that cannot be resolved by negotiations at the operating level of each party, the area(s) of disagreement shall be stated in writing by each party and promptly presented to a mutually approved mediator for non-binding mediation. If the parties cannot agree on the choice of a mediator or if the mediation does not resolve the dispute to the mutual approval of the parties, the parties are free to pursue any other legal remedies that are available.

ARTICLE II: PROGRAM EVALUATION

NOAA will schedule periodic evaluations of DNR's performance in meeting the terms of this MOA, financial assistance awards, and the reserve management plan. Where findings of deficiency occur, NOAA may initiate action in accordance with the designation withdrawal or interim sanctions procedures established by the CZMA, applicable regulations at 15 CFR 921.40-41.

ARTICLE III: EFFECTIVE DATE, REVIEW, AMENDMENT AND TERMINATION

A. This MOA is effective on the date of the last signature on this MOA and shall be in effect until terminated by either party.

B. This MOA will be reviewed periodically by both parties and may only be amended by the mutual written consent of both parties.

C. This MOA may be terminated by mutual consent of both parties, or by NOAA if NOAA withdraws designation of the reserve within the reserve system, pursuant to applicable provisions of the CZMA and its implementing regulations as described under 15 CFR 923 Subpart L, or if NOAA finds that DNR has failed to comply with this MOA. The MOA may be terminated by DNR with or without cause. Should this MOA be terminated, reimbursement of unexpended funds from financial assistance awards shall be determined on a pro rata basis according to the amount of work done by the parties at the time of termination. Additionally, reimbursement for land purchased and facilities constructed with NOAA funds shall be consistent with the terms and special award conditions of the applicable financial assistance award or grant.

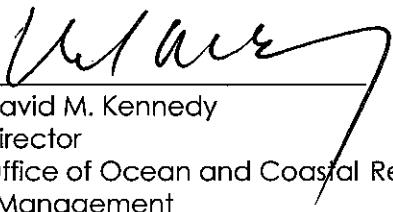
D. If any clause, sentence or other portion of this MOA shall become illegal, null or void for any reason, the remaining portions of this MOA shall remain in full force and effect.

E. No waiver of right by either party of any provision of this MOA shall be binding unless expressly confirmed in writing by the party giving the waiver.

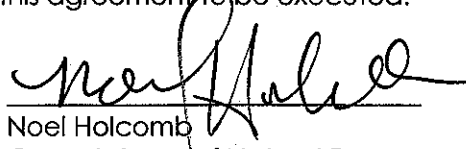
F. This MOA supercedes the previous "Statement of Agreement between the Department of Natural Resources of the State of Georgia and the National Oceanic and Atmospheric Administration Concerning the Administration of the Sapelo Island National Estuarine Research Reserve" attached as an exhibit to the 1999 SINERR Management Plan.

G. This MOA may be executed in three counterparts, all of which when taken together constitute a single agreement. The parties agree that a photostatic copy of an executed original will be admissible in evidence for all purposes as between the parties.

IN WITNESS THEREOF, the parties have caused this agreement to be executed.



David M. Kennedy
Director
Office of Ocean and Coastal Resource
Management
National Ocean Service
National Oceanic and Atmospheric
Administration
U.S. Department of Commerce
Date: 5/4/08



Noel Holcomb
Commissioner of Natural Resources
State of Georgia
Date: 4-11-08

***APPENDIX E: 1994 Amendments to Lease and Operating Agreements
Between Georgia DNR and Board of Regents of the University System
of Georgia Regarding Use of Properties on Sapelo Island.***

STATE OF GEORGIA

COUNTY OF FULTON:

FIRST AMENDMENT TO OPERATING AGREEMENT

THIS AGREEMENT, made and entered into this 13th day of July 1994 by and between the DEPARTMENT OF NATURAL RESOURCES, an agency of the State of Georgia, acting for and on behalf of the State of Georgia, (hereinafter referred to as "Department") and whose business address is 205 Butler Street, Atlanta, Georgia 30334 and the BOARD OF REGENTS OF THE UNIVERSITY SYSTEM OF GEORGIA, an agency of the State of Georgia, whose business address is 244 Washington Street, Atlanta, Georgia 30334 (hereinafter referred to as "Regents").

WITNESSETH:

WHEREAS, in 1976 the State of Georgia, acting by and through the Department, purchased certain real property, together with all buildings, structures, personal property, and improvements located thereon constituting a portion of what is known as Sapelo Island and, Meridian Dock Landing (except for that area known as Hog Hammock), all of said properties being hereinafter collectively referred to as "the South End Properties"; and

WHEREAS, since July 1, 1953, Regents, acting by and through the University of Georgia, a unit of the University System of Georgia, has conducted an institute for the purpose of scientific research and educational activities; said institute being located on Sapelo Island; and

WHEREAS, the real property, facilities and certain of the personalty currently utilized by the Regents in the conduct of said institute were included in the 1976 purchase by the State of Georgia; and

WHEREAS, subsequent to the purchase by the State of Georgia of said real property and facilities, as well as the personal property located thereon, and transfer of its custody, control and management to the Department, the Department, acting for and on behalf of the State of Georgia, as lessor, and Regents, as lessee, did on December 21st, 1976, enter into a lease agreement for a term of 50 years, leasing to the Regents certain premises, including real property, improvements and other facilities and personalty therein described, being hereinafter referred to as the "Lease Agreement", for the purpose of enabling Regents to continue to utilize said properties and facilities in the conduct of said institute for scientific research and educational activities; and

WHEREAS, both the Department, in the performance of its management, and custodial responsibilities with respect to Sapelo Island, and Regents, in its use and occupancy of the premises leased to it, benefit from certain mutual understandings and agreements regarding services which may be supplied by each to the other and further by agreements respecting the use by Regents of real property and facilities within the custody and control of the Department and not leased to Regents; and

WHEREAS, the parties did supplement the terms of the Lease Agreement with certain express understandings and agreements in order to establish a framework for their common occupancy of Sapelo Island, Georgia, which understandings and agreements were embodied in a document entitled "Operating Agreement" and dated

December 21st, 1976; and

WHEREAS, the Department and Regents have after seventeen years of mutual utilization and occupation of the South End Properties, reviewed the State's needs and plans for Sapelo Island and the institute and have, after determining that adjustments in the properties for which each is responsible and in the terms of the lease are desirable at this time, executed a new lease document entitled "First Amendment To Lease Agreement", which includes, among other things, an extension of the original term to fifty (50) years from the date execution by the parties of said First Amendment To Lease Agreement; and

WHEREAS: the Department and Regents do further desire to amend and alter the provisions and agreements contained in the Operating Agreement dated December 21st, 1976:

NOW, THEREFORE, pursuant to the authority vested in the parties by Article IX, Section III, Paragraph I of the 1983 Constitution of the State of Georgia, and in consideration of the mutual agreements and provisions herein contained and the benefits by each to be derived there from, the parties do hereby agree as follows:

i. TRANSPORTATION.

A. Department agrees that it will, at all times during the term of this agreement, provide regularly scheduled, non-exclusive boat transportation between Sapelo Island and the mainland of McIntosh County for commuting Regents personnel, personnel of Regents who are residents on Sapelo Island (and their families) and for visitors authorized by Regents to visit Regents' leased premises.

B. Department agrees that it will provide personnel necessary to restrict such passenger boat transportation as herein above provided and to oversee and control visitors to Sapelo Island in order to protect the fragile resource, the Estuarine Research Reserve, and Regents' research activities.

C. Department agrees that it will provide barging service for fuel, supplies and equipment for both parties hereto; said barging service to be supplied with such frequency as shall reasonably fulfill the needs of the parties.

D. Regents agrees to permit Department to have custody and use of the vessel Zapala, provided Department shall maintain said vessel in good operating condition and shall maintain sufficient insurance on said vessel to effect appropriate repairs in the event of natural disasters and accidents. Regents further agrees to transfer ownership to Department of the tank barge Sapelo and Regents' 80' X 30' freight barge.

E. Department agrees that Regents personnel and other persons authorized by Regents may utilize the airstrip located on the southern portion of Sapelo Island (designated as the Landing Field) on that certain August 1976 map of the southern portion of Greater Sapelo Island prepared for the Department of Natural Resources by S. Higgins, as revised on September 15, 1976 and September 28, 1976 and entitled "EXISTING FACILITIES", said map being labeled EXHIBIT "A" attached hereto and by reference incorporated in and made a part hereof)

F. Regents agrees that Department shall have use of its gasoline and diesel fuel storage tanks located in that building designated as Building No. 43 on Exhibit "A" attached hereto, together with access to and from said tanks.

II. DOCKAGE & STORAGE

A. Department agrees and gives its permission to Regents to dock its boats at the Meridian Dock and the Marsh Landing Dock, said docks being designated by the numbers "68" and "78" respectively on Exhibit "A" attached hereto.

B. Department agrees and gives its permission to Regents to possess and to use and occupy, exclusively, the large garage at Meridian Dock (designated by number "76" on EXHIBIT "A"). It is agreed by the parties that the maintenance of said Meridian Dock large garage in reasonable repair shall be the responsibility of Regents. Regents also agrees to maintain the water system connected with the garage and to permit Department to utilize the water system.

D. Department agrees and gives its permission to Regents to use that dock known as Ashantilly Dock (designated by the number "74" on EXHIBIT "A").

E. Department agrees that it will permit Regents to use and occupy storage areas within buildings and other facilities in the custody of the Department located outside of the premises leased to Regents under the First Amendment To lease Agreement, specifically including but not limited to the Airport Hangar (designated by the number "13 on EXHIBIT "A"). The parties area that arrangements for such storage space, including but not necessarily limited to, the location(s), the period(s) of occupancy, the materials and/or equipment to be stored, the exclusivity or non-exclusivity of such occupancy and security measures, if any, shall be such as shall be mutually agreeable to the parties' respective resident representatives.

F. Department agrees that it will permit Regents to utilize the parking areas adjacent to the Meridian Dock and the Marsh Landing Dock; the details of such usage to be such as shall be mutually agreeable to the parties' respective resident representative.

III. RESIDENCE FACILITIES.

Department and Regents hereby acknowledge and agree that, as of the date hereof, there are Regents personnel occupying that residence and outbuilding known as the Airport Residence and the Airport Residence Garage and Utility Building, respectively, (and designated by numbers "11" and "12", respectively, on said EXHIBIT "A") and that such occupancy may continue until the current occupant leaves.

IV. THE BIG HOUSE.

The provision of household staffing and food services in that building designated by number "48" on Exhibit "A" attached hereto, known as 'The Big House', shall be the subject of a separate agreement between the Department And Regents.

V. SANITATION SERVICES.

Department agrees that it will provide and maintain a site for the collection of trash and garbage and will be responsible for disposing of said waste.

VI. EQUIPMENT SHARING. It is understood and agreed by the parties that each may permit the other to use equipment and/or vehicles in order to facilitate either party in its respective operations on Sapelo Island.

VII. RESEARCH ACTIVITIES OF REGENTS.

A. It is agreed by the Department that personnel of Regents are permitted to conduct scientific research and educational activities at sites on Sapelo Island located outside of the boundaries of the premises described in the First Amendment To Lease Agreement. Department agrees that Regents personnel shall have, at all times during the term hereof, the right of ingress and egress to and from the leased premises over the lands within the Department's custody for purposes of locating suitable sites for the conduct of particular scientific research and educational activities. Regents may utilize such sites for such periods as may be necessary to complete the scientific research there undertaken.

B. Department agrees that it will take such action and measures as shall be reasonably necessary to provide and maintain security for the sites upon which Regents is conducting such scientific research projects and/or educational activities.

VIII. RESIDENT REPRESENTATIVES.

Department and Regents each hereby authorize and appoint the following named individuals as their respective resident representatives to carry out the responsibilities herein specifically delegated to them:

REGENTS:

Director
Marine Institute

DEPARTMENT:

Regional Supervisor
Wildlife Management Division

Either party may, by notice in writing to the hereinabove named resident representative of the other party, designate a new resident representative and/or a different address for said resident representative. It is the intent of the parties here under that said resident representatives shall cooperate with each other and work together in attempting to coordinate the mutual occupancy by the parties of Sapelo Island, Georgia and their respective activities thereon.

IX. TERM

This agreement shall be for a term running concurrently with the term of the First Amendment To Lease Agreement.

X. ANNUAL MEETING.

At least once annually the parties' respective resident representatives shall meet to discuss the working relationships of the parties, Housing, maintenance scheduled and other topics of joint interest. Recommendations, if any. To the governing authorities of the parties concerning modifications or amendments of this agreement. shall be made at said annual meeting. The intent of the parties in the execution of this First Amendment To Operating Agreement is to effectuate a change in the terms and conditions of. and to replace the provisions of, that Operating Agreement between the parties dated December 21st. 1976,so that the terms and conditions of this First Amendment To Operating Agreement

shall control over any conflict with the terms and conditions of the said Operating Agreement dated December 21st. 1976.

IN WITNESS WHEREOF. THE DEPARTMENT OF NATURAL RESOURCES and the BOARD OF REGENTS OF THE UNIVERSITY SYSTEM OF GEORGIA. each by their proper officers duly authorized thereunto so to do have caused these presents to be signed, sealed and delivered, all on the day, month and year first above written.

DEPARTMENT OF NATURAL RESOURCES

Signed, sealed and delivered in the presence of (as to the signature of Joe D. Tanner, Commissioner):

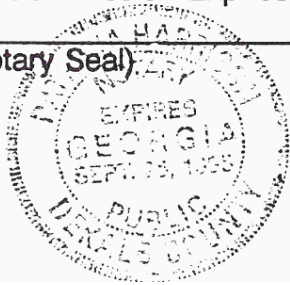
BY: Joe D. Tanner
Joe D. Tanner, Commissioner
of the Department
of Natural Resources

Maureen C. Gray
Witness

Patricia Damm
Notary Public

My Commission Expires:

(Notary Seal)



BOARD OF REGENTS OF THE UNIVERSITY SYSTEM OF GEORGIA

Signed, sealed and delivered in the presence of (as to the signatures of both Stephen R. Portch and Elizabeth E. Neely)

BY: Stephen R. Portch
Stephen R. Portch, Chancellor,
Board of Regents of the
University System of Georgia

Judith Wilber
Witness

Robb Linder
Notary Public

My Commission Expires April 4, 1975

ATTEST: Elizabeth E. Neely
Elizabeth E. Neely, Act'g Executive Secretary
Executive Secretary
Board of Regents of the
University System of Georgia

(SEAL)

STATE OF GEORGIA,
COUNTY OF FULTON;

FIRST AMENDMENT TO LEASE AGREEMENT

THIS AMENDMENT, TO LEASE AGREEMENT made and entered into this 13th day of ~~July~~ 1994, by and between the DEPARTMENT OF NATURAL SOURCES, an agency and department of the State Government of Georgia, acting for and on behalf and in the name of the State of Georgia, whose business address is 205 Butler Street, Atlanta, Georgia 30334 (hereinafter sometimes referred to either as "Lessor" or as "the Department") and the BOARD OF REGENTS OF THE UNIVERSITY SYSTEM OF GEORGIA, an agency of the State Government of Georgia, whose business address is 244 Washington Street, Atlanta, Georgia 30334 (hereinafter sometimes referred to either as "Lessee" or as the "Board of Regents").

WITNESSETH:

WHEREAS, by virtue of that certain December 8, 1975 Option To Purchase Properties, as amended, granted by the Sapelo Island Research Foundation, Inc. (hereinafter referred to as "the Foundation."), the State of Georgia acting by and through the Department, did purchase all of the real property described therein, together with all personal property located thereon; said real property constituting a portion of what is known as Sapelo Island and Meridian Dock Landing (except for that area known as Hog Hammock); all of said properties being more particularly described in said option, and being hereinafter collectively referred to as "the South End Properties.;" and

WHEREAS, since July 1, 1953 Regents, acting by and through the University of Georgia, a unit of the University System of Georgia, and pursuant to agreements between Regents and the Foundation, has conducted an institute being located on the southerly portion of the South End Properties which are located on Sapelo Island; and

WHEREAS, subsequent to the purchase by the State of Georgia of all said real property and facilities and the placement thereof in the custody of the Department, the Department and Regents did on December 21 st, 1976, enter into a lease of a portion of said property and facilities in order that Regents might continue to utilize said properties (both real and personal) and facilities in the conduct of said institute for scientific research and educational activities; and

WHEREAS, the Department and Regents have, after seventeen years of mutual utilization and occupation of tile South End Properties, reviewed the State's needs and plans for Sapelo Island and the institute and determined that adjustments in the properties for which each is responsible and the terms of the lease are desirable at this time, including an extension of the original term to fifty (50) years from the date of execution by the parties of this First Amendment To Lease Agreement:

NOW, THEREFORE, pursuant to the authority vested in the State of Georgia and the Department by O.C.G.A § 12-3-5(b), and in consideration of the mutual covenants,

conditions, obligations and agreements herein contained, the parties hereto do hereby agree as follows:

1. DEFINITIONS. The following words and terms, when used in this First Amendment To Lease Agreement, shall have the following meanings unless other meanings are otherwise clearly apparent from the context:

A. The word "land" shall mean the real property referenced in paragraph 2 hereof, and more particularly described in EXHIBIT "A" hereof, together with all structures and other improvements located under, on or above the land as of the effective date of this First Amendment To Lease Agreement.

B. The word "premises" shall mean the land, together with all and singular the rights, members and appurtenances thereunto belonging, or in any wise appertaining, and the facilities

(as the word "facilities" is defined herein) and the personalty (as the word "personalty" is defined herein), all as more fully described in EXHIBIT "A".

C. The word "facilities" shall mean any and all structures and other improvements which are now (as of the effective date hereof) or which may hereafter be located upon the land described in EXHIBIT "A".

D. The word "personalty" shall mean all of the personal property located on the land described in EXHIBIT "A" hereto.

E. The words "terminate" or "termination" shall mean the end of this lease agreement whether due to the expiration of the term hereof or to an earlier end of the term.

2. LAND AND PERSONAL TV LEASED. Lessor, for and in consideration of the rents herein reserved, and the covenants, agreements, duties and obligations herein made and agreed to be performed, observed and kept by the Lessee, and subject to the provisions, terms and conditions hereinafter set forth, and subject to those title exceptions set forth in said December 8, 1975 Option as amended, as "Permitted Title Exceptions" as well as to any other exceptions to title which were waived by the State of Georgia prior to its purchase of said South End Properties, has let, leased and demised and by these presents does let, lease and demise unto the Lessee and the Lessee does hereby take, lease and hire from the Lessor, upon the covenants, agreements, duties and obligations herein made and agreed to be performed,

observed and kept by the Lessee, and subject to the provisions hereinafter set forth, those facilities and the land more particularly described in EXHIBIT "A" attached hereto, incorporated in and by reference made a part hereof, together with the personalty.

3. TERM. The term of this lease shall be for a term of 50 years beginning on the date of execution of this First Amendment To Lease Agreement by the parties hereto, unless sooner terminated as hereinafter provided.

4. ESTATE FOR YEARS. It is the specific intent and agreement of the parties hereto that this First Amendment To Lease Agreement, as of the effective date hereof, grants and conveys from the Lessor and vests in the Lessee an estate for years in the premises.

5. RENTS. Lessee covenants and agrees to pay as rental during the full term of this First Amendment To Lease Agreement, the sum of \$1.00 per year, said sum to be paid on the effective date of this First Amendment To Lease Agreement and on or before the anniversary thereof for each year thereafter during the term hereof.

6. PURPOSES FOR WHICH THE PREMISES ARE LEASED. It is understood and agreed by and between the Lessor and the Lessee that the premises are leased for the purpose of enabling the Lessee to conduct scientific research and educational activities. Lessor agrees that it will cooperate with and will aid and assist Lessee's scientific research and educational activities by taking such action as shall be reasonably necessary to provide security for Lessee's scientific research and

educational activities against damage, destruction or other interference or interruption. Lessor further hereby agrees that Lessee may permit persons other than personnel of Lessee to use the premises on a limited basis; provided that any such use is restricted to uses in furtherance of the conduct of said scientific research and educational activities.

7. MAINTENANCE AND USE OF PREMISES.

A. Lessee accepts the land in its present condition as suited for the use intended by the Lessee. Lessee shall not commit or suffer to be committed any waste upon the premises and Lessee shall, at its own cost and expense, maintain the premises in reasonably good order and repair.

Lessee agrees that all personal property of Lessee on the premises is located thereon at Lessee's own risk and Lessor shall not be liable for any damage thereto or loss thereof.

B. Notwithstanding Lessee's obligations to maintain the premises, as set forth in subparagraph 7 (A) above, Lessee shall not be obligated to maintain the roads, road ditches, and bridges, all of which the Lessor hereby agrees to maintain in reasonably good order and repair during the term hereof.

C. It shall be the responsibility of the Lessee to cause the premises to be insured against loss or damage by fire or other casualty.

D. In the event the facilities shall be wholly or partially damaged or destroyed during the term of this First Amendment To Lease Agreement, Lessee shall, unless the parties shall mutually agree otherwise, within a reasonable period of time following such damage or destruction, repair, restore or replace the damaged or destroyed facilities in accordance with plans which shall be developed by the Lessee, but which shall be subject to the approval of the Lessor. In the event that Lessor and Lessee shall mutually agree that any such damaged or destroyed facilities should not be repaired or replaced, all insurance proceeds received by the Lessee on account of such damage or destruction shall be paid by the Lessee to Lessor.

E. It is understood and agreed between the parties that the term "waste" as used in sub paragraph 7(a) above, shall not include the felling of trees by the Lessee if necessitated by Lessee's scientific research and educational activities and so long as such felling is consistent with accepted (in the reasonable opinion of the Lessor) forestry management practices upon consultation with the Lessee. Lessor may enter upon the premises for the purpose of applying such accepted forestry management practices, including, but not limited to the felling of trees when, in the reasonable opinion of the Lessor, such entry and application of forestry management practices are necessary in order to protect the property within Lessor's custody, control and management.

F. In connection herewith, the parties acknowledge that certain document entitled First Amendment To Operating Agreement, also entered into by the parties on the date first above written, which First Amendment To Operating Agreement shall be effective as of the effective date hereof and which supplements the terms hereof in providing for, among other things, the rendering by each of the parties hereto to the other of certain services necessary for the mutual

enjoyment by the Lessee and the Lessor of the respective portions of the Sapelo Island area possessed, used and occupied by each. Said First Amendment To Operating Agreement is hereby incorporated and made a part hereof; a copy of the same being labeled EXHIBIT .C. and attached hereto. It is expressly understood and agreed by and between the parties that the terms and provisions of said First Amendment To Operating Agreement shall at all times be subject to and controlled by the terms of this First Amendment To Lease Agreement.

8. MUTUAL USES OF PREMISES.

A. Marine Laboratory Auditorium. Lessee hereby agrees that it will permit Lessor, upon request, and if available, to use the Marine Laboratory Auditorium.

B. "Big House". Lessor agrees that subject to Lessor's internal policies and regulations, it will permit the Lessee, upon Lessee's request and if available and upon payment by Lessee to Lessor of a user fee therefor, to utilize that building designated by number "48" on EXHIBIT "B" hereto, commonly known and referred to as the "Big House", for official functions of the Lessee.

C. South End Boat Basin and Bulkhead. Lessee covenants and agrees to permit Lessor at all times during the term hereof to use the bulkhead located at the South End Boat Basin for Lessor's docking purposes.

D. Residences. All housing facilities located on the leased premises shall be used and occupied exclusively by personnel of the Lessee (and their immediate families, if any), and by Lessee's official visitors (and their immediate families, if any) unless otherwise mutually agreed upon by the parties.

E. Wildlife Management. Lessor hereby reserves the right to enter upon the leased premises to conduct good wildlife management practices, which wildlife management practices shall not unreasonably interfere with Lessee's use of the premises for scientific research and educational activities.

9. LAW ENFORCEMENT. The Lessee hereby acknowledges that Lessor will patrol all of the Sapelo Island Area, including the leased premises, for law enforcement and security purposes.

10. DISPOSITION OF FACILITIES AND PERSONALTY. In the event that at any time during the term hereof, the Lessee shall determine that any of the leased facilities or personalty is no longer of any value to the Lessee's program of scientific research and educational activities, the Lessee shall notify the Lessor in writing of Lessee's determination and shall recommend to Lessor the disposition of such facility or such personalty or both.

11. INGRESS AND EGRESS. Lessor hereby expressly covenants and agrees that the Lessee shall, at all times during the term hereof, have the right of ingress and egress to and from the leased premises, over the Sapelo Island area.

12. TERMINATION BY LESSEE. In the event that at any time during the term hereof the Lessee shall determine that it is no longer feasible for Lessee to continue its program of scientific research and educational activities upon the leased premises, Lessee may terminate this lease agreement upon 90 calendar days written notice to Lessor of Lessee's determination. Upon the termination of this lease agreement, the Lessee shall promptly vacate the premises removing all of Lessee's personnel, personal property, and trade fixtures, if any, there from. Any holding over of the premises by the Lessee after the termination of this agreement shall cause the Lessee to be a tenant at sufferance and not a tenant at will.

13. DISPOSITION OF PROPERTY ON TERMINATION. Upon termination of this lease agreement all rights and interests of the Lessee in the premises shall wholly cease and determine and the premises, including but not limited to, all facilities and leased personalty, as well as all fixtures, objects and articles of whatever nature attached to the premises shall thenceforth constitute the unencumbered property of the State of Georgia, under the custody and control of the Lessor, without further act or conveyance by the Lessee.

14. GENERAL CONDITIONS. COVENANTS. AGREEMENTS, PROVISIONS. TERMS AND CONDITIONS OF THIS FIRST AMENDMENT TO LEASE AGREEMENT.

A. All time limits stated herein are of the essence of this First Amendment To Lease Agreement.

B. The word "notice" as used in this paragraph 14 (B) shall include not only notices in the general sense, but also statements, demands, requests, consents, approvals and authorizations. Any notice given by either Lessor or Lessee to

the other shall be in writing and shall be served by sending by United States Certified Mail, postage prepaid to the party to be notified addressed as follows:

To Lessor - Commissioner
Department of Natural Resources
To Lessee - President
University of Georgia

The day upon which any notice is so mailed shall be treated as the date of service thereof. Lessor and Lessee may from time to time by notice to the other designate a different address to which notice hereunder shall be sent.

C. The intent of the parties in the execution of this First Amendment To Lease Agreement is to effectuate a change in the terms and conditions of, and to replace the provisions of, that Lease Agreement between the parties dated December 21st, 1976, so that the terms and conditions of this First Amendment To Lease Agreement shall control over any conflict with the terms and conditions of the said Lease Agreement dated December 21 st, 1976.

15. ASSIGNMENT AND SUBLETTING. Neither of the parties hereto, without the prior written consent of the other party shall assign or sublet this leasehold or any interest herein except as provided in Paragraph 6 above.

16. ARBITRATION. Whenever during the term hereof, a disagreement or dispute shall arise between the parties arising out of or in connection with this First Amendment To Lease Agreement which disagreement or dispute the parties' respective resident representatives, after good faith negotiations, have been unable to resolve, the parties' respective resident representatives shall submit said disagreement or dispute in writing to the President of the University of Georgia and to the Commissioner of the Department of Natural Resources. In the event that said named individuals are unable, after good faith negotiations for a period of 30 days, to resolve such disagreement or dispute, either of said individuals may, by notice in writing to the other submit such disagreement or dispute to the Governor of the State of Georgia, who shall ad as arbiter and whose findings and conclusion the parties hereto agree shall be final and binding upon the parties.

17. DEFAULT. In the event that either of the parties shall fail or, pursuant to paragraph 16 hereof, be determined by the Governor to have failed, fully to perform all of the covenants, agreements, obligations, provisions, terms and conditions of this First Amendment To Lease Agreement by it to be performed, such failure shall constitute an event of default hereunder. Upon written notice of said default by the other party, the defaulting party shall have 30 days (or such other period as may be specified in said notice, but in any event not less than 30 days) from the date of said notice with in which to cure said default; provided however that in the event that a dispute as to whether a default has occurred has been submitted to the Governor for arbitration pursuant to paragraph 16 hereof, said period for cure shall not commence to run until that the party alleged to be in default has been determined by the Governor to be in default. Upon failure by the defaulting party to cure such default within the applicable period, the other party may l by notice to the defaulting party, immediately or at any time thereafter but only during the continuance of such default, terminate this First Amendment To Lease Agreement. Upon such termination, the non-defaulting party may avail itself of any and all remedies as are now or may hereafter by law be authorized, IN WITNESS WHEREOF, the DEPARTMENT OF NATURAL RESOURCES, acting for and on behalf of and in the name of the State of Georgia, and the BOARD OF REGENTS OF THE UNIVERSITY OF GEORGIA, each by their proper officers duly authorized thereunto so to do, have caused these presents to be signed, sealed and delivered, all on the day, month and year first above written.

DEPARTMENT OF NATURAL RESOURCES

Signed, sealed and delivered in the presence of (as to the signature of Joe D. Tanner, Commissioner):

BY: Joe D. Tanner
Joe D. Tanner, Commissioner

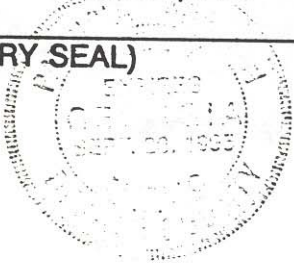
Judith C. Gay
WITNESS

Patricia Dorman
NOTARY PUBLIC

LESSOR

My Commission Expires:

(NOTARY SEAL)



Signed, sealed and delivered in the presence of (as to signatures of both Stephen R. Portch and Elizabeth E. Neely)

BOARD OF REGENTS OF THE UNIVERSITY SYSTEM OF GEORGIA

BY: [Signature]
Stephen R. Portch, Chancellor,
Board of Regents of the
University System of Georgia

[Signature]
WITNESS

[Signature]
NOTARY PUBLIC

ATTEST: [Signature]
Elizabeth E. Neely, Act'g Executive Secretary
Board of Regents of the University
System of Georgia

My Commission Expires April 4, 1995
Notary Public, State of Georgia
(NOTARY SEAL)

LESSEE

~~IN WITNESS WHEREOF, the State Properties Commission has caused these presents to be duly executed in its name this _____ day of _____, 1993 for the purpose of approving the terms and conditions of this First Amendment To Lease Agreement.~~

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~~Signed, sealed, and delivered in the presence of: (as to the signatures of both Governor Zell Miller, Chairman and Secretary of State Max Cleland, Secretary)~~

~~STATE PROPERTIES COMMISSION~~

~~BY: [Signature]
Zell Miller, Governor
Title, Chairman~~


~~ATTEST: [Signature]
Max Cleland
Title: Secretary of State~~

~~WITNESS~~

~~NOTARY PUBLIC
My Commission Expires: _____~~

~~(NOTARY SEAL)~~

IN WITNESS WHEREOF, Governor Zell Miller, as Governor of the State of Georgia, and under the provisions of O.C.G.A. § 50-16-61, as general supervisor of all of the property of the State of Georgia, has duly executed this First Amendment To Lease Agreement this 15th day of July, 199~~3~~⁴ for the purpose of acknowledging the terms and conditions of this First Amendment To Lease Agreement.


Zell Miller
Governor of the State of Georgia

Signed, sealed and delivered in the presence of:


Witness


Notary Public

My Commission Expires:
Notary Public, Clayton County, Georgia.
My Commission Expires July 17, 1994

(NOTARY SEAL)

EXHIBIT "A"

DESCRIPTION OF THE PREMISES LEASED

All that certain tract or parcel of land situate, lying and being on the southern portion of that island known as Greater Sapelo Island, McIntosh County, Georgia, containing 1,575 acres, more or less, of upland and marshland, together with all high tidal marshes, low tidal marshes, lowlands, coastal beaches, beachland, hammocks, bluffs, fields, patches, bottoms, bogs and waters appurtenant, adjoining and adjacent to each; said parcel being shown and delineated on that certain map of the southern portions of Greater Sapelo Island, prepared for the Department of Natural Resources, by S. Higgins, dated August, 1976, as revised on September 15, 1976 and on September 28, 1976 and entitled .EXISTING FACILITIES-, which map is labeled EXHIBIT "B" attached hereto and by reference incorporated in and made a part hereof; said parcel being more particularly described as follows: BEGINNING at the point of intersection of the centerline of Marsh Landing Road and the extreme east end of the Marsh Landing Dock, said POINT OF BEGINNING being designated by the letter .A. on EXHIBIT "B" hereof; thence in a southeasterly direction along and with the centerline of said Marsh Landing Road (being a paved road except at Central Canal) approximately 4,100 feet to the intersection of said Marsh Landing Road with a paved road; said point of intersection being designated by the letter "B" on EXHIBIT "B" hereof; thence along the centerline of said paved road in a generally southerly direction approximately 2,300 feet to the intersection of said paved road with the centerline of a road locally known and referred to as the Autobahn" ; said point of intersection being designated by the letter "C" on EXHIBIT "B" hereof; thence continuing along the centerline of a paved road locally known as Horse Pasture Road in a southeasterly direction approximately 3,400 feet to the intersection of the centerline of Horse Pasture Road with the centerline of Root Patch Road; said point of intersection being designated by the letter "D" on EXHIBIT "B" hereof and being a point approximately 600 feet north of Azalea Cottage (designated by the number "53" on said EXHIBIT "B"); thence due east approximately 2,000 feet to a point near the marsh, said point being designated by the letter .E. on said EXHIBIT "B"; thence due south approximately 3,000 feet to a point on the Nanny Goat Beach Road; said point being designated by the letter .F. on said EXHIBIT .B.; thence in a southeasterly direction with the centerline of said Nanny Goat Beach Road approximately 2,500 feet to the mean low water marsh of the Atlantic Ocean; said point being designated approximately by the letter "G" on said EXHIBIT "B"; thence continuing southerly, westerly, northwesterly, and northerly with the mean low water line of the Atlantic Ocean, Doboy Sound and the Duplin River, respectively, approximately 4.5 miles to the POINT OF BEGINNING, TOGETHER WITH: All those certain buildings, structures, fences, roads, equipment, fixtures, wells, pipelines, docks and other facilities located in, on or above the hereinabove described parcel of real property and waters adjacent, and adjoining thereto, (said facilities being designated by the numbers .21. through .66. inclusive and by numbers "71, "73, "79 and "80" on EXHIBIT "B" hereof) and, in addition thereto, the South End bulkhead, the South End boat basin, and various utility systems (said facilities not being designated by number on said EXHIBIT "B") and further in addition thereto, any other miscellaneous facilities located in, or upon the hereinabove described parcel of real property AND TOGETHER WITH all items of personal property located in, on, or around said hereinabove described buildings, facilities, other structures and improvements, including, but not limited to household furnishings, tools and equipment, EXCEPTING, however, from the

premises above described, that area of the above-described premises commonly known and referred to as the "Lighthouse Tract" AND FURTHER EXCEPTING from the premises above described, that building designated by number "48" on Exhibit "B" hereto commonly known and referred to as the "Big House", and an area surrounding said building number "48" being 50 feet in width, together with all items of personal property located in, on, or around said building number "48", including but not limited to household furnishings, tools, and equipment, AND FURTHER EXCEPTING those exceptions set forth as "Permitted Title Exceptions" in that certain December 8, 1975 Option to Purchase Properties, as amended, granted to the State of Georgia by the Sapelo Island Research Foundations, as well as any other exceptions to the title to the South End Properties waived by the State of Georgia prior to its purchase of the said South End Properties.

Appendix F. Memorandum of Agreement Between The Sapelo Island National Estuarine Research Reserve and The University of Georgia Marine Institute...

...for the management and use of The Barrier Island Research and Learning (BIRL) facility.

Provisions mentioned herein have been agreed upon by representatives of the University of Georgia Marine Institute: Dr. Bill Miller and the Sapelo Island National Estuarine Research Reserve: Dorset Hurley on March 24, 2003 for the construction and administration of the Barrier Island Research and Learning (BIRL) facility.

Provisions granted to the Sapelo Island National Estuarine Research Reserve by the University of Georgia Marine Institute as a part of this joint effort include:

1) The SINERR will retain permanent and priority control of the designated two-bedroom apartment in the MERC facility. Official UGAMI visitors on a short-term and limited basis may also use the apartment if its use is not in conflict with SINERR guests. Users of the NERR apartment will not pay a facilities fee to UGA and will also have access to a reasonable amount of laboratory bench and sink space (negotiable, dependent upon availability given other UGAMI commitments and on the research project), the UGAMI research library, UGA's remote teaching system and classroom space (negotiable and dependant on the needs of the SINERR guest).

Note: The NERR 2 bedroom, 4-bed apartment will include a fully equipped kitchen 2 bathrooms, a furnished living area, phone connections, access to UGAMI's broad-band internet and limited but suitable storage space for equipment. This apartment will be maintained as an integral part of the BIRL and the UGAMI campus, with UGAMI staff responsible for regular maintenance and day-to-day facilities management. Day-to-day cleaning is the responsibility of the SINERR guests.

2) SINERR will have the use of the greater BIRL facility to host NERR System meetings and workshops at no additional charge for basic housing and access to the UGAMI lecture halls. This condition will be limited to 7 days annually and on a negotiated basis 9-18 month's in advance. UGAMI will maintain a low-budget "self-service approach" to the facility during SINERR hosted meetings and events unless otherwise negotiated.

3) The UGA Marine Institute would retain the option to charge a standard facilities use fee or a negotiated fee if an official SINERR guest desires use of or access to laboratory space, analytical equipment, specialized vehicles or marine craft, use of any UGAMI cafeteria space (future development), or other services not normally considered part of basic housing and laboratory space. Given the above special conditions, access to the Marine Institute will be otherwise granted to SINERR guests under the same protocols and basis granted official guests of the UGA Marine Institute.

Accepted and agreed upon by the following program representatives on July 13, 2007


Dorset Hurley, Research Coordinator, Sapelo Island National Estuarine Research Reserve

Bill Miller, PhD., Director, The University of Georgia Marine Institute



Appendix G. Memorandum of Agreement Between The Sapelo Island National Estuarine Research Reserve and The University of Georgia Marine Institute...

...for the collective management and mapping of scientific research, monitoring and management activities on Sapelo Island

Provisions mentioned herein have been agreed upon by representatives of the University of Georgia Marine Institute (UGAMI): Dr. Bill Miller and the Sapelo Island National Estuarine Research Reserve (SINERR): Dorset Hurley on March 24, 2003. This agreement is co-sponsored to help insure the development of a research-tracking program on the publicly held lands of Sapelo Island. This agreement's primary objective is to establish a long-term record related to research, monitoring, education and resource management of Sapelo's natural resources and to use this record as a proactive tool for anticipating and reducing user conflicts related to these resources.

Until recently, the majority of research projects sponsored on the island were sited within close proximity to the salt marsh habitats of the island and were largely program artifacts and the responsibility of UGAMI. Likewise, habitat management activities conducted on Sapelo Island were largely confined to the GA DNR managed R. J. Reynolds Wildlife Management Area. The development of the SINERR research, monitoring, stewardship and educational programs, coupled with UGAMI research and educational programs and developments in GA DNR management of natural communities on the island, have necessitated an increased need to avoid resource and user conflicts within the natural habitats of the island. Additionally, increases in research programs requiring areas with minimal human disturbance have precipitated the need for the development of a mapping management system allowing both agencies to quickly identify user conflicts thereby avoiding potential issues related to these conflicts. A solution to this growing issue is the development of a updated reference resource for charting specifics associated with each agencies resource utilization including the following information: responsible parties, contact information, site location, objectives, spatial extent of work and expected project duration.

In order to create a library of every programs sponsored activities, a Geographic Information System (GIS) spatial map will be developed through the jointly sponsored SINERR/UGAMI GIS Laboratory. All programs will receive updated versions of this GIS product as new projects and activities are approved and reported by their sponsoring agency.

All agencies (SINERR, DNR and UGAMI) agree from this time forward to cooperatively share the specifics of studies and work mentioned herein related to resource utility on Sapelo Island and to jointly cooperate in the development of a resource use registry in the form a of a GIS mapping system that includes the specifics of each program for building an associated metadata file for the GIS product. The SINERR will update, reference map and distribute the reference product upon the reporting of each new project, to be initiated in the Spring of 2006. The GIS product developed will represent a

directed effort to accurately reflect the following parameters associated with each natural resource user:

- Responsible parties: name(s) of P. I. s or managers
- Contact information: phone number, email address, sponsoring agency
- Site location: GPS coordinates
- Objectives
- Spatial extent of work: approximate area and habitat(s) type(s)
- Expected project duration.

Accepted and agreed upon by the following program representatives on June 26,, 2007

Dorset Hurley, Sapelo Island National Estuarine Research reserve



Bill Miller, University of Georgia Marine Institute

