Rivers to Reefs

Altamaha River Watershed Education Module

by
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Gray's Reef
National Marine Sanctuary

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Everyone in the United States lives in a watershed.

US Commission on Ocean Policy Preliminary Report
Chapter Nine: Managing Coasts and Their Watersheds

The following text is excerpted from Chapter Nine.
For a complete unedited version, please visit
http://www.oceancommission.gov/documents/prelimreport/chapter09.pdf.

WHAT IS A WATERSHED?

A watershed is a geographic area that drains water into a larger water body, such as a stream, river, estuary, lake, or ocean. The nation's coastal and ocean resources are affected by activities in coastal areas and also by those in upland watersheds. A coastal watershed, as defined by the National Oceanic and Atmospheric Administration, is that portion of a watershed that includes the upstream extent of tidal influence. In the Great Lakes region, a coastal watershed includes the entire geographic area that drains into one of the lakes. Everyone in the United States lives in a watershed.

The pressures of continuing growth are acutely felt in coastal areas. While largely attributable to activities taking place at the coast, some pressures originate hundreds of miles away in inland watersheds. To more effectively manage coasts, states need a stronger capacity to plan for and guide growth—one that incorporates a watershed approach to govern coastal and ocean resources.

ATTRACTING CROWDS, CREATING OPPORTUNITIES

While coastal counties (located entirely or partially within coastal watersheds) comprise only 17 percent of the land area in the contiguous United States, they are home to more than 53 percent of the total U.S. population. A study of coastal population trends predicts average increases of 3,600 people a day moving to coastal counties, reaching a total population of 165 million by 2015. These figures do not include the 180 million people who visit the coast every year. Population growth and tourism bring many benefits to coastal communities, including new jobs and businesses and enhanced educational opportunities. Burgeoning industries associated with tourism and recreation in coastal areas (such as hotels, resorts, restaurants, fishing and dive stores, vacation housing, marinas, and other retail businesses) have created one of the nation's largest and fastest-growing economic forces.

Across the country, more than 89 million people a year participate in marine-related recreation, such as swimming, scuba diving, surfing, motor boating, sailing, kayaking, and wildlife viewing. In just four south Florida coastal counties, recreational diving, fishing, and ocean-watching activities generate $4.4 billion in local sales and almost $2 billion in local income annually and

more than 2.9 million people visit the Florida Keys each year. During the summer of 2000, beach activities in Los Angeles and Orange counties stimulated an estimated $1 billion in spending. The Hawaiian Islands and many U.S. island territories are particularly dependent on tourism for their economic health. Hawaii alone attracts some 7 million tourists each year. In 2001, over 8 million people took to the sea aboard cruise ships, and approximately 135 million people visited the nation's marine aquariums and zoos. Although golf and tennis are recognized as major U.S. industries, it is estimated that more Americans participate in recreational fishing than in both of these sports combined.

IMPLICATIONS FOR GROWTH

The popularity of ocean and coastal areas increases pressures on these environments, creating a number of challenges for managers and decision makers. Increased development puts more people and property at risk from coastal hazards, reduces and fragments fish and wildlife habitat, alters sedimentation rates and flows and contributes to coastal water pollution.

The rise in privately owned coastal land, coupled with the need to protect sensitive habitats, makes it increasingly difficult to provide public access to the shore. Every year, millions of dollars are spent replenishing sand at our nation's beaches and protecting coastal development from storms, waves, and erosion. And continued coastal development, coupled with rising sea level, results in ever-increasing wetlands losses.

Polluted waters limit fishing, swimming, and other water-related recreational and economic activities. One of the most serious impacts on ocean and coastal areas is the increasing amount of polluted runoff from urban, suburban, and agricultural areas, which is exacerbated by increases in impervious surfaces, such as roads, parking lots, sidewalks, and rooftops. Evidence indicates that ecosystem health is seriously impaired when the impervious area in a watershed reaches 10 percent.

If current coastal growth trends continue, many healthy watersheds will cross the 10 percent threshold over the next twenty-five years. Although the rate of population growth in coastal counties is not greater than in other areas of the country, the sheer numbers of people being added to fixed coastal land areas, combined with the fragile nature of coastal resources, create disproportionate impacts. In many cases, these impacts are destroying the very qualities that draw people to the coast.

The pattern of coastal growth—often in scattered and unplanned clusters of homes and businesses—is also significant. Urban sprawl increases the need for infrastructure such as roads, bridges, and sewers, degrading the coastal environment while making fragile or hazard-prone areas ever more accessible to development. Because of the connections between coastal and upland areas, development and sprawl that occur deep within the nation's watersheds also affect coastal resources.

STRENGTHENING COASTAL PLANNING AND MANAGEMENT

A complex combination of individuals and institutions at all levels of government make decisions that cumulatively affect the nation's ocean and coastal areas. These institutional processes determine where to build infrastructure, encourage commerce, extract natural resources, dispose of wastes, and protect or restore environmental attributes. Many of the decisions that affect the nation's coastal areas are made by local governments through land use planning, zoning, subdivision controls, and capital improvement plans. Local decisions are shaped in turn by state policies and requirements. Some coastal states have developed statewide goals and policies for transportation, land use, and natural resource protection, with a few states putting specific emphasis on coastal resources. Recognizing that sprawling patterns of growth are not sustainable, several coastal states have instituted programs intended to manage growth, including Maine, Oregon, Florida, Washington, and Maryland. By applying a variety of land use planning tools, techniques, and strategies, these programs attempt to steer population growth toward existing population centers and away from fragile natural areas.

THE SMART GROWTH MOVEMENT

For more than a decade, there has been a call for smart growth, characterized by more compact, land conserving patterns of growth, through infill and reuse of building sites, pedestrian-friendly and transit oriented development, and protection of green space. For example, in 1997, Maryland instituted its Smart Growth and Neighborhood Conservation Initiative, which tried to direct growth to more environmentally suitable areas and away from some of the state's most ecologically and economically important landscapes.
Under this initiative, state agencies limited funding for infrastructure outside of designated growth areas. The Maryland experience, which has since been scaled back under new budgetary pressures, provides one model of growth management for consideration by other state and local governments.

Existing federal, state, and local institutional processes have made substantial progress in managing activities that affect the nation's coastal resources. However, local and state governments continue to face a number of obstacles in planning and managing the cumulative impacts of growth, including: disincentives to long-term planning due to the pressures of short political and business cycles; lack of shared values or political will; inadequate information, including locally relevant socioeconomic indicators; difficulty in addressing problems that cross multiple jurisdictions including upland areas; insufficient resources dedicated to protecting coastal resources; and multiple institutions at different levels of government that address isolated aspects of connected problems. Improved policies for managing growth in coastal areas will be essential in protecting and restoring the natural resources that sustain the character and economies of coastal communities.

Although most coastal management activities take place at state and local levels, coastal decision-making is also influenced by federal actions, including funding decisions and standard setting. Of the many federal programs that provide guidance and support for state and local decision-making, some address the management of activities and resources within designated geographic areas, while others address the management of specific resources, such as fisheries or marine mammals.

LINKING COASTAL AND WATERSHED MANAGEMENT

In recent years there has been a growing interest in watershed management. This approach addresses water quality and quantity issues by acknowledging the hydrologic connections between upstream and downstream areas and considering the cumulative impacts of all activities that take place throughout a watershed.

Preliminary Report: Managing Coasts and their Watersheds

The environmental and political characteristics of the nation's watersheds vary tremendously. As a result, watershed management initiatives can differ widely in size and scope. Many watershed groups are formed at the local level by community members concerned about water quality or the health of fish and wildlife populations. Often, these groups work to improve watershed health through partnerships among citizens, industry, interest groups, and government. The value of a watershed approach was articulated by the National Research Council in a 1999 report: "[w]atersheds as geographic areas are optimal organizing units for dealing with the management of water and closely related resources, but the natural boundaries of watersheds rarely coincide with political jurisdictions and thus they are less useful for political, institutional, and funding purposes. Initiatives and organizations directed at watershed management should be flexible to reflect the reality of these situations."

The benefits of a watershed focus have been recognized at state, regional, national, and international levels. For example, Oregon has defined watershed groups in law, and has also created a process for their legal recognition and funding. The New Jersey government includes a Division of Watershed Management that provides coordinated technical, financial, and planning support for twenty watershed management areas within the state. New Jersey also participates, along with Pennsylvania, Delaware, and New York, in the Delaware River Basin Commission—a regional body authorized to manage activities within a river system that transcends political boundaries. The Chesapeake Bay Program, the California Bay-Delta Program (known as CALFED), and the Northwest Power Planning Council are other notable examples of current initiatives that aim to address natural resource issues on a watershed scale. Some existing bi-national watershed initiatives include the Great Lakes Commission, Shared Strategy for Puget Sound, and the Gulf of Maine Council on the Marine Environment. Federal agencies have also begun to adopt a watershed management focus. For example, beginning in the 1990s, EPA launched efforts to address certain problems at the watershed level, rather than on a source-by-source or pollutant-by-pollutant basis. As interest in watershed management continues to grow, so does the need for a framework to guide such initiatives and evaluate their effectiveness. The federal government can play an important role by helping to develop a framework and by providing technical and financial assistance to states and communities for watershed initiatives.

Altamaha River

Geologic and Cultural History

More than 20 million years old, the Altamaha River, unhampered by dams, traveled from its confluence in Wheeler County to its coastal terminus near Darien. As the seventh largest river basin on the Atlantic Seaboard, the Altamaha drains more than one quarter of Georgia's land surface, including half of Atlanta and all of Macon. With more than 100,000 gallons of water expelled into the Atlantic Ocean every second, the Altamaha is "Georgia's Mightiest River."

The waters of the Altamaha have woven quite a history since man first appeared in its basin 11,000 years ago. The name Altamaha, pronounced all´-ta-ma-haw´, is from an immigrant Yamassee Indian group descended from an interior chiefdom originally known as Altamaha or Tama. Their settlement located on the Oconee River just below Milledgeville was visited by Hernando de Soto in 1540. The Altamaha chiefdom was forced into slavery, but rebelled and eventually settled in St. Augustine until it evacuated with the Spanish to Cuba in 1763. The Spanish referred to it during the 1600s as Rio de Santa Isabel, referring to an early mission called Santa Isabel de Utinahica, established in the Timucuan chiefdom of Utinahica located at the forks of the river near present-day Lumber City. The ruins of more than 1,000 Indian sites along the river are evidence of how important the river was to Indians, who relied on it for food and transportation.

Hernando De Soto wrote about the river in 1539, and so did early naturalists who were fascinated by the New World flora and fauna found at "Georgia's Little Amazon." Fort Barrington witnessed military activity during the American Revolution, the War of 1812, and the Civil War. At Morgan's Lake, the Blue and the Gray faced off in a minor historic episode of Sherman's March to the Sea during the Civil War, in the south also known as the War Between the States.

Settlers from all corners of the globe have set foot along the Altamaha, leaving tokens of their culture and life surrounding the river. The river has carried dugout cypress canoes bearing flint and oyster shells, Spanish galleons with missionaries, and plantation boats. By the nineteenth century, rafts were used to transport lumber for shipbuilding and to carry cotton and tobacco downriver. In the year 1819, the first steamboat traveled up the Altamaha, ushering in a new era. The historic settlements, plantations, forts, trails and archeological mounds along the Altamaha proclaim the river's rich heritage.

While historically the river has been traversed by Indians in dugout canoes, Spanish in their galleons, timber workers on huge rafts of cotton and timber, and settlers on paddlewheel steamboats, today the watercraft that ply the river are mostly motor-powered bass boats that belong to sport fishermen.

Geography

The slow moving waters of the Altamaha River flow effortlessly through some of the South's last remaining hardwood bottomlands, cypress swamps, historic rice fields and tidal marshes. The

dark waters of the river, and actually of most southern rivers, are referred to as black water rivers. The relatively warm temperature of the southern climate coupled with a gently sloping landscape creates warm slow moving water. This situation sets up the perfect conditions to make “tea” from the vegetation that falls into the rivers. Unhampered by dams, the Altamaha River Watershed winds 250 miles from its beginnings in the north Georgia cities of Atlanta and Athens to its coastal terminus near the historic fishing town of Darien. At around 137 from the coast it truly becomes the Altamaha River at the confluence of the Ocmulgee and Oconee rivers. Further down river the Ohoopee River adds its compliment of freshwater to the Altamaha.

The watershed totals 250 miles from its headwaters to the coast. Encompassing 1.2 million acres and spanning 10 rural south Georgia counties, the Altamaha River watershed is the seventh largest watershed on the Atlantic Seaboard. Draining approximately one-quarter the state of Georgia, it pumps approximately 100,000 gallons of freshwater into the Atlantic Ocean every second to provide one sixth of the freshwater compliment to the South Atlantic Bight. The Altamaha River is truly "Georgia's Mightiest River."

Winding for 137 miles, the great Altamaha is a wetland wilderness. Crossed only five times by roads and twice by rail lines, the Altamaha's natural beauty is largely undisturbed. The soils, plants and trees of its floodplain filter and extract chemicals and pollutants, while the banks of the river, accentuated by a multitude of creeks, sloughs and oxbow lakes, are refuges for alligators, wood ducks and wild turkey.

Wildlife

At least 125 species of rare or endangered plants and animals exist along the Altamaha River. Birds such as the bald eagle and swallow-tailed kite, soar above its banks. The shortnose sturgeon and the manatee swim through the Altamaha's lazy meanders. The gopher tortoise and the eastern indigo snake coexist among its sand ridges, and the sandbars and sloughs are home to seven species of pearly mussels that live nowhere else in the world.

Among species native to the river basin perhaps the most fascinating case is *Franklinia alatamaha.* Named in honor of Benjamin Franklin and the Altamaha River, the rare flowering shrub was originally discovered in 1765 by naturalist and artist William Bartram. Although he is the only person known to have seen and described the plant in its natural state, some think it may still survive within the depths of the Altamaha ecosystem. A wealth of rare plant populations has been found along the Altamaha and more await discovery. Radford's dicerandra grows nowhere on earth but along the Altamaha's sand ridges. The only known Georgia population of the Florida corkwood thrives in the Altamaha basin.

The Altamaha River watershed ranks among the most biologically rich river systems along the Atlantic Seaboard. With a floodplain up to 5 miles wide at some points, the watershed sustains globally rare natural communities, including the only known example of old-growth longleaf pine-black oak forest in the county. The river supports 11 imperiled pearly mussel species, seven of which are found nowhere else in the world. At least 120 species of rare or endangered plants and animals are found in the Altamaha River Watershed - the largest documented cluster of globally imperiled plants and animals of any watershed in Georgia.

The rich biodiversity of the Altamaha includes:

Animals
- American Oystercatcher
- Atlantic and Shortnose sturgeons
- Georgia spiny mussel
- Gopher tortoise
- Piping plover
- Red-cockaded woodpecker
- Swallow-tailed kite
- West Indian or Florida manatee
- Eastern indigo snake

Plants
- Alabama milkvine
- Longleaf pine
- Greenfly orchid
- Radford dicerandra
- Georgia plume
- False dragonhead
- Hairy rattleweed
- Tickseed
- Florida corkwood

Pollution

The upper reaches of both the Oconee and Ocmulgee Rivers are in the top 10% of Georgia's most impacted watersheds. The sources of these pollutants are a combination of urban runoff, storm sewers, municipal point sources, and combined sewer outflows.

Only 6% of the sampled surface waters in the Altamaha River watershed have reported problems according to state and EPA data. Nonpoint source pollution in the watershed contributes to organic enrichment, metals contamination, and fish consumption advisories in the Altamaha and its tidal estuarine system.

Altamaha Riverkeeper (ARK)

The Altamaha Riverkeeper works to restore and protect the habitat, water quality and flow of the mighty Altamaha - from its headwaters at the confluence of the Oconee and the Ocmulgee along with the Ohoopee to its terminus at the Atlantic Coast. ARK has an active membership that keeps watch on the rivers and watershed. In the summer of 2004 a concerned citizen reported the discharge of plastic into the Oconee River near Dublin, which prompted the Altamaha Riverkeeper's investigation of the SP Newsprint Discharge pipe. Over many site visits, ARK consistently found plastics and paper being discharged underwater along with other substances creating a scum on the surface of the water. Working with the Georgia Center for Law in the Public Interest, ARK filed a 60 day Notice of Intent to Sue on August 5th.

On Wednesday, May 18th, the Altamaha Riverkeeper sent a *60-day Notice of Intent to Sue* to the City of Dublin for being in violation of the federal Clean Water Act. The notice informs the City of Dublin that it must stop polluting the Oconee River or face legal action. For a complete report visit http://www.altamahariverkeeper.org/spnews.asp.

Altamaha Riverkeeper works with citizens on the enforcement of laws and regulations to protect water quality, coastal marshes, forested wetlands, water flow and the prevention of sedimentation and erosion.

In 1970, the Georgia legislature enacted the Coastal Marshlands Protection Act (CMPA) to protect coastal marshlands as a –vital natural resource system." The CMPA created the Coastal Marshlands Protection Committee and provides that –[n]o person shall remove, fill, dredge, drain, or otherwise alter any marshlands in this state within the estuarine area thereof without first obtaining a permit from the committee." To receive a permit, an applicant must demonstrate that a proposed alteration is not contrary to the –public interest" and that –no feasible alternative sites exist." The –public interest" is deemed by the statute to include the following consideration: –Whether or not the granting of a permit and the completion of the applicant's proposal will unreasonably interfere with the conservation of fish, shrimp, oysters, crabs, clams, or other marine life, wildlife, or other resources, including but not limited to water and oxygen supply."

ARK attended meetings of the Committee and monitored its permit requests since 2001. It has seen the committee approve numerous permits, against the strong objections of citizens citing the CMPA provisions that the Committee must consider the impact of the permitted projects on the coastal marshland ecosystem. It has observed in disbelief as staffers watched the Committee act as if its primary responsibility was the granting of permits to accommodate development. Their position is that the state should unite with the vast majority of citizens who want to see the extensive and priceless resources of Georgia's estuary and salt marshes protected as nursery grounds for our commercial and recreational fisheries. They support the tenet that our natural resources should be protected to encourage the kind of economic development and tourism that allows people to learn about and respect our unique environment without destroying it for their convenience. They further contend that the state's resources should be used to put forth legal arguments that protect the marsh.

To address their platform, ARK joined with coastal groups who believed that the Committee

failed in its obligations to enforce the CMPC when it granted permits for bridges and marinas without consideration of how their related developments would impact the environment. The Southern Environmental Law Center (SELC) was asked to appeal two permits, Emerald Point in 2001 and Man Head Marina in 2002. The appeals were filed because there was no agree with the legal interpretation of the Coastal Marshland Protection Act that allowed the Committee to grant permits without looking at how the permitted projects would impact the marshlands. As these complex legal cases wound their way through administrative, superior, and appeals courts, it became apparent that citizen interpretation of the law had a firm legal basis.

In three separate rulings, Superior Courts in Fulton and Glynn County agreed with SELC and determined that the CMPA required the Committee not only to consider how proposed structures and activities in the marsh affected the marsh, but also how a projects' upland components impacted marshlands.

In December 2003, in the Emerald Pointe case, a Fulton Superior Court judge found that such an irreplaceable resource as Georgia's coastal marshlands –should not be altered without full consideration of the matter by the body charged with protection of the marshlands."

In early January 2004, both the state and the developer appealed the rulings of the Fulton County Superior Court and on January 30, the Georgia Court of Appeals denied the requests for appellate review. On January 9, 2004, the state appealed this decision to the Georgia Court of Appeals. As we go to press (2/4/04) the Court of Appeals denied their request for appeal. While the state was content to use our tax money to continue the appeals process in support of the developers, the Court of Appeals would will not allow it. The state has maintained that they will follow the courts in determining how to apply the CMPA. Still they have been reluctant to follow the superior court rulings in Emerald Pointe and Man head Marina, and have instead joined in the developers' appeals of the court orders. Now that the Court of Appeals has denied the appeals for discretionary review, the time has come for the state to follow the courts and to consider the entire project when evaluating whether or not a project will interfere with our protected marsh resources.

The Man Head Marina and Emerald Point developments were temporarily delayed as the court reviewed cases and related appeals. In granting of permits without adequate review, the committee costs citizens and developers significant time and money.

It must be noted that the vast majority of requests for permits in recent years have sailed through the Committee. In some of the larger projects, after court decisions, the CRD staff has taken positive steps and developed permit conditions to lessen impact on the marsh.

ARK's past experiences with a proposed waterfront condominium complex on the Darien River raised serious questions about the state's willingness to enforce permits once they are granted.

Darien residents appeared before the Committee on October 6, 2002 to express concerns about the development of a high-density condominium complex planned for Darien's waterfront. The proposed 42-unit condo waterfront complex is part of a public-private partnership created by the Darien Downtown Development Authority to promote economic development on Darien's

historic waterfront.

ARK raised permitting issues about this project when we learned that the 1993 CMPC permit originally granted for a public marina and boat storage facility was being transferred to the Settler's Bluff development group for the condominium complex and private docks without a review of the new project. Permit #227, which was renewed twice and expired on March 31, 2003, allowed the construction of dockage and boat slips. The CMPA allows for the transfer of a permit within 30 days to the new owner, as long as there is no change in the use of the land as set forth in the original application.

Because the new project was known to be totally different and of much greater impact to the site and estuary, SELC raised legal issues regarding the permit transfer in formal letters to the Committee on March 20, May 9, and again on July 15, 2003. After waiting for months with no reply, citizens were greeted at the October 6, 2003 meeting with copies of a letter faxed that morning to Commissioner Lonice Barrett from Deputy Attorney General Isaac Byrd. Regarding permit transfer, Byrd's letter states:

This provision allows a permittee to make a valid transfer of a permit upon notice within 30 days of such transfer. The language of this provision does not require an assessment of the use under the permit as a condition of transfer. This provision further provides that upon transfer with notice, a CMPC permit –shall be continued in forceÄ so long as there is no change in the use of the land as set forth in the original application. Thus, the viability of a transferred permit may be placed in issue upon a –change of use" but not upon a transfer alone. (O.C.G. A. 12-5-293).

Later in the letter Byrd cites O.C.G.A. 12-5-291: *All changes in permitted uses which increase impacts to any land subject to the provisions of the CMPA must be assessed by the committee to determine if the proposed change is consistent with the CMPA and the permitÄÄ If the permit holder is found not to be in compliance with (the CMPA), the committee shall take action as authorized under O.C. G. A. 12-5-291.*

Byrd further states *that under this language, a change of use requires CMPC assessment if it increases impacts to the marshlands. Whether a particular change increases such impacts and therefore is required to be assessed is a question of fact; whether action is required or not would be for the discretion of the CMPC and its staff. The CMPC would have to determine which changes of use or categories of use merit its attention and which unauthorized changes require enforcement.*

Ironically Byrd's letter supports the assertion that the CMPC acted in error when it transferred Permit #227 without considering the project's significant changes but still no action has been taken to evaluate the condominium project The docks and 42 boat slips were hastily constructed during the last two weeks of March, 2003 before the permit expired. Alocked gate was installed on the mainland access and the docks remain unused. Site plans, acquired through EPD, illustrate a five building condominium complex to be built on approximately 2 acres. Built to the very edge of the required buffer and surrounded by a retaining wall, this development will insure that the once scenic Darien waterfront will in the future feature three story condominiums and a sea of paving. There is no place for the extensive surface water run-off to be absorbed before it

reaches the Darien River.

We understood that the CMPAstipulated that permits could only be transferred if there was no change in use to prohibit this kind of nightmare scenario. A permit originally granted for a marina, clearly a –water dependent use" has been transferred to a private residential development, whose investors claim the project requires the density, height, and proximity to the water to meet their economic expectations. We urge the Committee and CRD to review this project in light of the recent court rulings. Please consider contacting them (Coastal Marshland Protection Committee, One Conservation Way, Brunswick, GA 31520-9687) and sharing your opinions.

To find out more about ARK visit their website at http://www.altamahariverkeeper.org/.

The Nature Conservancy
and
Altamaha River Bioreserve of The Nature Conservancy

The Nature Conservancy

Since 1951, The Nature Conservancy (TNC) has been working with communities, businesses and individual citizens to protect nearly 117 million acres around the world. The mission of TNC is to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

By working closely with communities, businesses and individuals, TNC achieves tangible results through a science-based plan that uses a non-confrontational approach.

In its annual survey of the largest U.S. charities, *Forbes* calculated The Nature Conservancy's fundraising efficiency at 91%, which is among the highest ratings for charities.

Fast Facts About The Nature Conservancy

Cumulative acres protected in the United States	**14,345,000 acres**
Cumulative acres protected in Canada	**39,700 acres**
Cumulative acres protected in Central America, South America, Mexico and the Caribbean	**83,464,000 acres**
Cumulative acres protected in the Asia-Pacific region	**18,393,000 acres**
Current number of Conservancy preserves	**about 1,400 preserves**
Conservancy members	**approximately 1 million members strong**

Letter from Steve J. McCormick, President and CEO, 2004

Protecting Our Oceans

Land conservation defined The Nature Conservancy for much of our history. We built our reputation by buying threatened land, mostly in the United States, to safeguard species and natural communities. Eventually, we recognized the need to expand our focus and broadened our mission in the early 1990s to include protection of both lands and waters. But even then, our attention was devoted mostly to freshwater systems.

Ultimately, we realized that our mission compels us to address conservation of marine systems. After all, oceans, covering roughly 70 percent of the Earth’s surface, support an incalculable

amount of the world's biological diversity. Moreover, they provide us with ecological services valued at $21 trillion annually, yielding 85 million metric tons of fish and other raw materials. And yet, beyond the narrow strip of nearshore waters, the world's oceans are the last unclaimed domain on Earth. They belong to no one, and to everyone. As a "commons," of sorts, the oceans are perhaps the most unprotected ecosystem on Earth.

This summer, a commission authorized by Congress released the federal government's first comprehensive assessment of U.S. ocean policy in 35 years. The report is a wake-up call, with ramifications for people around the globe. Not only have we neglected our ocean resources, but we are currently ill-equipped to mount the effort necessary to turn the tide.

Such dire warnings can induce a sense of hopelessness. But what the U.S. Commission on Ocean Policy recommends is positive—albeit urgent—and very much in line with where The Nature Conservancy has been moving. Although we may have come late to marine conservation, we have quickly mobilized to secure tangible and lasting results.

Making a commitment to protect our seas and oceans requires us to think—and act—in ways that go beyond how we have approached land and freshwater conservation. In 2002 we launched a Global Marine Initiative to provide leadership and coordination for our marine conservation around the world. Today, Nature Conservancy projects at more than 100 sites—from New York's Long Island Sound, the Florida Keys and Alaska's Pribiloff Islands to Micronesia, Belize and the Bahamas—pursue a holistic strategy of land and sea conservation.

We are working closely with public agencies and other conservation organizations to identify and, where appropriate, designate marine protected areas, and already our approach is yielding measurable results. In the heart of the Earth's "coral triangle" at Komodo National Park—co-managed by The Nature Conservancy and the Indonesian park authority—a combined strategy of park zoning, stepped-up enforcement of fishing regulations, community education and the establishment of viable alternative livelihoods has cut destructive fishing practices by 90 percent, with coral and fish stocks rebounding remarkably. Even those who were initially skeptical now praise this public-private experiment as an emerging model for the larger region.

The race is on by Nature Conservancy staff and partners to replicate variations of the Komodo example throughout the vast Indonesian archipelago, to establish a network of marine protected areas designed to survive, managed to last and connected like a string of pearls across the seas of Southeast Asia.

What the ocean commission prescribes—and what The Nature Conservancy is undertaking—is enormously challenging, daunting, expensive and dependent on collaboration between governments, industry, local communities and international conservation organizations. It requires a fundamental change in how we think about our relation to oceans. But the world's oceans offer an unprecedented opportunity to demonstrate the fundamental precept that the well-being—indeed, the very survival—of humankind depends on our integration, not our separation; on our cooperation, not our conflict; and on our willingness to transcend boundaries for the greater good of all.

Steven J. McCormick
President and CEO
Fall 2004

Global Marine Initiative

Although once considered a limitless and inexhaustible resource, the oceans of the world are increasingly in jeopardy. The cycle of influence between land and sea is delicate, and human activities are taking a heavy toll on the health of all ocean systems, from marshes and mangroves to reefs and the deepest reaches.

The Nature Conservancy's Global Marine Initiative develops innovative strategies in an effort to protect the rich array of plant and animal life and safeguard the tremendous benefits the oceans provide. This global initiative complements the over one hundred marine projects that the Conservancy has at sites around the world.

The Nature Conservancy defines its conservation priorities through the process of ecoregional planning. There are five steps in this process:

- **Identifying Conservation Targets**
  Ecoregional planning teams made up of Conservancy staff and partners identify the species, natural communities and ecosystems in a given ecoregion.
- **Gathering Information**
  The teams gather data about the conservation targets, such as location and health, from a variety of sources including the Natural Heritage programs, satellite images and rapid ecological assessments.
- **Setting Goals**
  Ecoregional planning teams set goals for each of the conservation targets. Setting conservation goals involves determining how much of a particular target—a population or ecosystem, for instance—is needed to ensure its long-term survival. A conservation goal also includes how the target needs to be distributed across the landscape.
- **Assessing Viability**
  The team also assesses the health of each occurrence of each conservation target to ensure survival over the long term by choosing the best and most healthy examples of each target.
- **Assembling Portfolios**
  All this information is analyzed by the teams and expert partners and often through computer modeling to design an efficient network of conservation areas (or portfolio) that if protected in its entirety will ensure the preservation of biodiversity within the ecoregion.

Altamaha River and The Nature Conservancy

Although The Nature Conservancy began to actively protect land in the Altamaha River Watershed in the late 1960s, the organization's focus on large landscape-scale protection efforts encouraged the formation of the Altamaha River Bioreserve project in 1991. At that time, The Nature Conservancy initiated an ecological survey of the lower Altamaha River Watershed, which yielded a set of 18 land cover maps, significantly increasing resource managers' understanding of the biological condition of lands adjacent to the river. The landscape-scale land cover classification methodology developed for this project became a model for other Conservancy efforts around the country.

In order to achieve its conservation goals in the Altamaha River watershed, The Nature Conservancy works with landowners, governments, communities and industry partners who share the common goal of protecting the Altamaha River and preserving traditional land and water uses that depend on a healthy river system. To date, The Nature Conservancy has played a role in protecting more than 37,000 acres of land in the lower Altamaha River watershed. Only through partnerships with the many government agencies, community groups, landowners (private, public and industrial) and other conservation organizations, can The Nature Conservancy achieve its goal to protect the Altamaha River system, one of the 75 Last Great Places.

Altamaha River Bioreserve of The Nature Conservancy

The Nature Conservancy has been working for the protection of the Altamaha River for more than 20 years. In 1969, The Nature Conservancy joined with the United States Fish and Wildlife Service to purchase Wolf and Egg islands, located at the river's mouth, for eventual inclusion in the Savannah National Wildlife Refuge. In 1972, The Nature Conservancy secured two more properties: a pristine 750-acre sandhill hammock that supports the largest population of the rare Georgia plume; and Lewis Island, a 5,633-acre swamp with majestic 1,000-year-old cypress trees, some measuring more than 17 feet in diameter. Then, in 1977, a 1,300-acre tract extending along the Altamaha corridor, known as "The Narrows", was donated to The Nature Conservancy and has become a popular destination for canoeists and wildlife enthusiasts.

Although The Nature Conservancy began to actively protect land in the Altamaha watershed in the late 1960s, the organization's focus on large landscape-scale protection efforts encouraged the formation of the Altamaha River Bioreserve project in 1991. At that time, The Nature Conservancy initiated an ecological survey of the lower Altamaha River watershed, which yielded a set of 18 landcover maps, significantly increasing resource managers' understanding of the biological condition of lands adjacent to the river. The landscape-scale landcover classification methodology developed at this project became a model for other Conservancy efforts around the country.

The unique richness and ecological value of the river have prompted The Nature Conservancy of Georgia to make this region a top conservation priority. However, instead of protecting just bits and pieces of the river, The Nature Conservancy is working on an extensive plan to protect the

entire ecosystem as a bioreserve. A bioreserve is a landscape, usually large in size with naturally functioning ecological processes, containing outstanding examples of ecosystems, natural communities and species which are endangered or inadequately protected.'The Altamaha River system will be a flagship bioreserve for Georgia.

To implement the bioreserve concept and guide The Nature Conservancy of Georgia in its protection initiatives along the Altamaha River, an ecological inventory, using a geographic information system and satellite imagery, will organize and analyze biological and socioeconomic data within the Altamaha basin. Supported by field inventory, computer analysis will identify and classify natural communities. Such intense research is necessary to understand the diversity and value of the Altamaha River ecosystem.

Major funding for the inventory and technical equipment was provided by the Woodruff Foundation with additional support from Georgia Power Company.

By the year 2000, the world could lose one plant or animal species every hour of every day. A world stripped of biological diversity is a diminished world.

To combat this escalating loss of wildlife and wild lands, The Nature Conservancy was founded. The Nature Conservancy has protected 153,000 acres around the state, including 48,000 acres along the coast. Efforts are being pursued to continue this work. Cooperation with private landowners, federal, state and local governments and corporations has created partnerships with the common goal of preserving traditional land uses while maintaining the integrity of the ecosystem.

The Altamaha River and its surrounding lands represent one of America's most notable natural resources. The ecological health of the Altamaha is critical to the economic health of the region. Uplands support evergreen oaks and pines sustaining forestry and agriculture. The basin's waterways host aquatic communities which are the basis for local fisheries. Recreational functions of the river include sport fishing for tarpon, bass and sea trout. Canoeing, kayaking and other types of boating, hunting, camping and photography are also popular.

Despite The Nature Conservancy's successes there are still many areas in need of protection. The Altamaha's bottomland hardwoods, sand ridges, hammocks and bluffs are outstanding examples of the diverse natural habitats remaining in the south. Migratory birds fly above centuries old cypress and fish and shellfish feed and spawn in the dynamic reaches of the river's floodplain. The Altamaha River promises to be a conservation priority for The Nature Conservancy of Georgia over the next several decades.

In order to achieve its conservation goals in the Altamaha River watershed, The Nature Conservancy works with landowners, governments, communities and industry partners who share the common goal of protecting the Altamaha River and preserving traditional land and water uses that depend on a healthy river system. To date, The Nature Conservancy has played a role in protecting more than 37,000 acres of land in the lower Altamaha River watershed. Only through partnerships with the many government agencies, community groups, landowners (private, public and industrial) and other conservation organizations, can The Nature

Conservancy achieve its goal to protect the Altamaha River system, one of the 75 Last Great Places.

Estuaries

An estuary is a partially enclosed body of water formed where freshwater from land originating rivers and streams flows into the ocean, mixing with the salty sea water. Estuaries and the lands surrounding them are places of transition from land to sea, and from fresh to salt water. Although influenced by the tides, estuaries are protected from the full force of ocean waves, winds, and storms by the reefs, barrier islands, or fingers of land, mud, or sand that define an estuary's seaward boundary.

Estuaries come in all shapes and sizes and go by many different names, often known as bays, lagoons, harbors, inlets, or sounds. (Note not all water bodies by those names are necessarily estuaries. The defining feature of an estuary is the mixing of fresh and salt water, not the name.) Some familiar examples of estuaries include San Francisco Bay, Puget Sound, Chesapeake Bay, Boston Harbor, and Tampa Bay. Locally our estuaries on the Georgia coast are from north to south Wassaw Sound, Ossabaw Sound, St. Catherines Sound, Sapelo Sound, Doboy Sound, Altamaha Sound, St. Simons Sound, St. Andrew Sound and Cumberland Sound.

The tidal, sheltered waters of estuaries support unique communities of plants and animals, specially adapted for life at the margin of the sea. Estuarine environments are among the most productive on earth, creating more organic matter each year than comparable-sized areas of forest, grassland, or agricultural land. Many different habitat types are found in and around estuaries, including shallow open waters, freshwater and salt marshes, sandy beaches, mud and sand flats, rocky shores, oyster reefs, mangrove forests, river deltas, tidal pools, sea grass and kelp beds, and wooded swamps. In coastal Georgia the habitat types do not include rocky shores, mangrove forests, sea grass or kelp beds. Our estuaries are a mix of fresh and salt water with mud and sand flats, sandy beaches, oyster reefs, river deltas, tidal pools, and wooded river swamps.

Estuaries are critical for the survival of many species. Tens of thousands of birds, mammals, fish, and other wildlife depend on estuarine habitats as places to live, feed, and reproduce. Estuaries provide ideal spots for migratory birds to rest and refuel during their journeys. And many species of fish and shellfish rely on the sheltered waters of estuaries as protected places to spawn, giving them the nickname "nurseries of the sea." Hundreds of marine organisms, including most commercially valuable fish species, depend on estuaries at some point during their development (1).

Besides serving as important habitat for wildlife, the wetlands that fringe many estuaries also perform other valuable services. Water draining from the uplands carries sediments, nutrients, and other pollutants. As the water flows through fresh and salt marshes, much of the sediments and pollutants are filtered out. This filtration process creates cleaner and clearer water, which benefits both people and marine life (1). Wetland plants and soils also act as a natural buffer between the land and ocean, absorbing floodwaters and dissipating storm surges. This protects upland organisms as well as valuable real estate from storm and flood damage (1). Salt marsh grasses and other estuarine plants also help prevent erosion and stabilize the shoreline.

Among the cultural benefits of estuaries are recreation, scientific knowledge, education, and aesthetic values. Boating, fishing, swimming, surfing, and bird watching are just a few of the numerous recreational activities people enjoy in estuaries. Estuaries are often the cultural centers of coastal communities, serving as the focal points for local commerce, recreation, celebrations, customs, and traditions (2). As transition zones between land and water, estuaries are invaluable laboratories for scientists and students, providing countless lessons in biology, geology, chemistry, physics, history, and social issues (1). Estuaries also provide a great deal of aesthetic enjoyment for the people who live, work, or recreate in and around them.

Barrier Islands

Barrier Islands

Barrier Island sometimes called barrier spits, are found on coastlines all over the world, but are most noticeable along the eastern coast of North America where they extend from New England down the Atlantic Coast, around the Gulf of Mexico and south to Mexico. Barrier islands are popular vacation spots including resort communities from Atlantic City, NJ to Miami Beach, FL. Many people own vacation homes or condominiums on barrier islands, and more barrier islands are being developed for tourism. However, barrier islands are fragile, constantly changing ecosystems that are important for coastal geology and ecology. Development has posed dangers to these ecosystems and has also increased the risk of property damage every year from hurricanes and Nor'easters.

The barrier islands of coastal Georgia, South Carolina and the northeastern coast of Florida are formed and managed by the same basic processes of the sand transport and sand sharing systems. In Georgia the sand transport system begins in the Appalachian Mountains some 200 plus miles from the coast. Forces of nature such as freezing and warming temperatures, ice and rain, wind and hot blistering sun, erode the rocky substrate that makes the mountains. The mountains erode or break apart into boulders and rocks. Over time these structures further break down into stones and pebbles and begin their journey to the coast in the water transport system of streams, creeks and rivers.

These waterways eventually transport the stones and pebbles further down the state, and as they travel they bump and grind breaking down as they collide with other stones and pebbles. By the time they make it to the coast they have been ground down into sand, silts and clay. The silts and clay are lighter than the sand sediments and drop out of the water column in the relatively quiet waters of the estuaries located between the mainland and the barrier islands. Heavier sand particles drop out of the water near the mouth of the rivers where it meets the sea.

Here the sand comes under the influence of the ocean currents and tides. As the Earth spins it creates the Coreolis Effect, which makes water in the Northern Hemisphere flowing along the southeastern coast of the USA move southward. As it flows southward it erodes sand from the north end of barrier islands and transports the sand south where some is deposited on the south end of the parent island. The rest is transported southward to other islands. While the overall movement of sand is southward it also undergoes immediate and long-term influence from the tides and seasonal wind patterns.

On a daily basis the tides flood and ebb approximately every six hours. Typically in a 24-hour day there are two high tides and two low tides. Due to the friction created by our atmosphere the waters rush to keep up with the Moon’s and to a lesser extent the Sun’s attractions; however, there is a lag of about one hour each day. For example high tide occurring on Monday at 2PM will occur on Tuesday at 3PM, and on Wednesday at 4PM and so on. With the tides moving ocean water in and out of the estuaries, suspended sand is also transported in and out of the estuaries. So not only does it flow southward it also moves in and out of the coastal areas with

the tides in a sort of zigzag pattern. Coupled with that movement is the influence of the seasonal wind patterns.

In the winter northeasterlies or nor'easters typically scour sand away from the beaches seaward to build offshore sand bars. The nor'easters make the winter configuration of the barrier island beaches narrow and steeply sloping. During the summer months the prevailing winds come from the southeast and are typically gentle. They remove sand from the offshore sandbars and push it onto the beaches to make the typical summer beach configuration broad and gently sloping, beaches that humans and animals alike use and love so well.

Sand, Silt, and Clay

Soil is composed of solid particles (minerals and organic matter) and pore space (air and water). The characteristics of the soil are determined by the size, distribution and shape of the solid particles in addition to the size and number of pore spaces. Texture of soil refers to the size of mineral particles, varying in size range from fine to coarse. There are three categories of sizes: clays, silt and sand. The proportion of particles of sand, silt and clay in the soil determines whether a soil is classified as sandy, silty or clayey. A balanced soil (loam) contains about 40% sand, 40% silt and 20% clay and is preferred for growing crops. Sandy particles are the only particles which may be large enough to be seen with the naked eye. Predominantly sandy soil has a gritty feel (coarse-textured) when rubbed between the fingers. Silt particles are smaller than sand particles. Predominantly silty soils feel powdery (like flour) and do not hold together well when wet, though they are more cohesive than sandy soils. Clayey soil has the smallest soil particles, and many small pore spaces. Soils with a high number of clay particles have a very high water holding capacity and are very fine-textured, making them feel smooth and sticky (like soap) when wet.

Dunes

Beach dunes are part of a delicate system to protect marshes, bays and land behind the beach from high water and stormy seas. Don't be fooled by dunes that appear to be shallow or have breaks in them. The height of a dune is determined by several factors, including the direction the dune is facing, wind velocity and direction, and rainfall. Those breaks in the dune are important, too. During storms, when waves repeatedly batter the dunes, the dune line can be breached. That is, water can funnel through these breaks without sacrificing the entire dune line. A dune system left in its natural state will eventually travel landward at a slow pace due to the continuing rise of sea level.

The reason it is important for people and large animals to stay off the dunes is to prevent damage to the plants growing there. The large barrier dunes would be highly unstable and would move landward even faster if it weren't for the beach grasses and other delicate plants that can grow under the incredibly harsh conditions confronting the upper beach.
Unless these grasses can develop a root long enough to reach the water table, they won't survive long. Because they are so delicate, walking over them can often kill them, leaving the dune that much closer to collapse.

Dunes extend beyond the initial beach berm. Those closest to it are the barrier dunes. Vegetation on these is limited. Smaller, more stable dunes are behind these barrier dunes and feature different vegetation, such as Sea Oats and Panicum Grass. Still further away, woody plants such as Southern Bayberry or Wax Myrtle and Yuccas or Spanish Bayonets begin to grow in lower dunes. All of this is important to the ongoing health of the dune, and why it is important to keep off the dune.

Gray’s Reef National Marine Sanctuary

History

Gray's Reef is one of the largest near shore live-bottom reefs of the southeastern United States. The sanctuary is located 32 kilometers (17.5 nautical miles) off Sapelo Island, Georgia and encompasses 58 square kilometers (17 sq. nautical miles) of live-bottom habitat.

Gray's Reef was first extensively studied by scientists in 1961 while surveying the near shore area off the University of Georgia's Marine Institute on Sapelo Island, Georgia. The first systematic collection from Gray's Reef, the Gray Collection, is housed at the University of Georgia, Athens. Researcher Milton B. “Sam” Gray was the first to record specimens collected from the reef, therefore his name was given to the area. In 1974, J.L. Hunt, Jr. studied its geology and origin, 1978 C.D. Harris reported resident fish populations, 1981 the South Carolina Marine Resources Research Institute and Georgia Department of Natural Resources studied living marine resources, and 1981 Bureau of Lands Management, and Searles made limited seaweed collections. Since January 1981, funded research has been directed principally towards management implications. Studies such as:

- Geological history of Gray's Reef
- Effects on Roller Trawling on A Hard Bottom Community
- A video transect method for estimating reef fish abundance
- Current Velocity Measurements at Gray's Reef NMS
- 1983 Overflight Summary Report: Visitor Use at Gray's Reef NMS
- Field and Laboratory seaweed guide
- Field guide to the fishes of Gray's Reef

The Gray's Reef National Marine Sanctuary (GRNMS) Management Plan developed in 1983, outlined strategies for the effective management of the areas resources. A stated goal of the plan is to promote and coordinate research to enhance scientific understanding of the sanctuary and improve management decision making. A main objective to achieve this was implementing of a resource studies plan based on existing knowledge of live bottom ecosystems and evolving management issues. This plan is outlined in the 1983 document and has provided the outlined areas of research needs since implementing the plan.

The Gray's Reef National Marine Sanctuary recognizes the importance of long term monitoring to understand and recognize the health and status of the significant resources found in the sanctuary. Long term monitoring of the resources also serves the management concerns of other state and federal agencies as Gray's Reef is one of the largest natural live-bottom reefs in the South Atlantic Bight (SAB) and serves as a good indicator of overall live bottom health here. The need for information on fisheries resources is especially evident as catches of snapper and grouper have declined 50% since 1980 in the SAB.

Geology and Biology

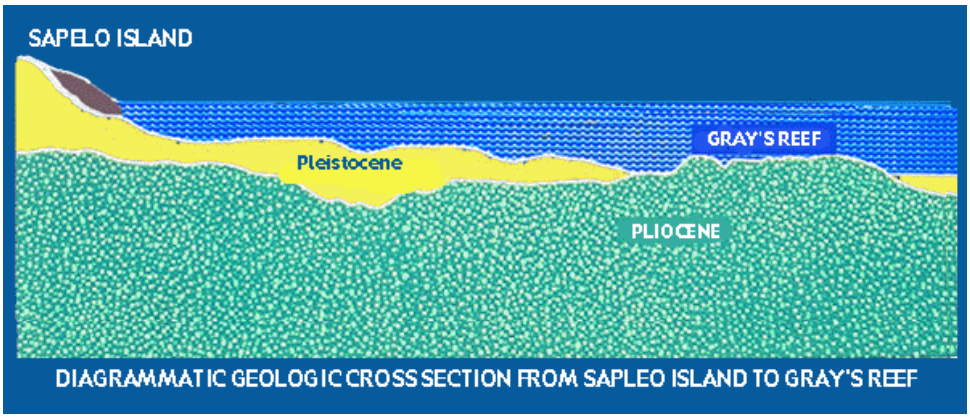
Gray's Reef is a submerged hard bottom (limestone) area that, as compared to surrounding areas, contains extensive but discontinuous rock outcropping of moderate (6 to 10 feet) height with sandy, flat-bottomed troughs between. The series of rock ledges and sand expanses has produced a complex habitat of caves, burrows, troughs, and overhangs that provide a solid base for the abundant sessile invertebrates to attach and grow. This rocky platform with its carpet of attached organisms is known locally as a "live bottom habitat". This topography supports an unusual assemblage of temperate and tropical marine flora and fauna. Algae and invertebrates grow on the exposed rock surfaces: dominant invertebrates include sponges, barnacles, sea fans, hard coral, sea stars, crabs, lobsters, snails, and shrimp. The reef attracts numerous species of benthic and pelagic fish, including black sea bass, snapper, grouper, and mackerel. Since Gray's Reef lies in a transition area between temperate and tropical waters, reef fish population composition changes seasonally. Loggerhead sea turtles, a threatened species, use Gray's Reef year-round for foraging and resting and the reef is part of the only known winter calving ground for the highly endangered northern right whale. Fossil bivalves and gastropods, and mastodon bones located in this area indicate that the reef was once a shallow coastal environment and an exposed land form as recently as 10,000 years BP. Because Gray’s Reef was a terrestrial environment there may exist extant prehistoric cultural resources.

Gray's Reef is a consolidation of marine and terrestrial sediments (sand, shell, and mud) which was laid down as loose aggregate between 6 and 2 million years ago. Some of these sediments were probably brought down by coastal rivers draining into the Atlantic and others were brought in by currents from other areas. More of these sediments accumulated until a dramatic change began to take place on Earth during the Pleistocene Epoch, between 2 million and 8,000 years ago. It was during this time that the area which is now Gray's Reef was exposed land and the shoreline was as much as 80 miles east of its present location. As a result of this exposure, the sediments there became solidified into porous limestone sandstone rock. As the glacial ice melted, the water flowed back towards the sea, filling the basins back to their original levels.

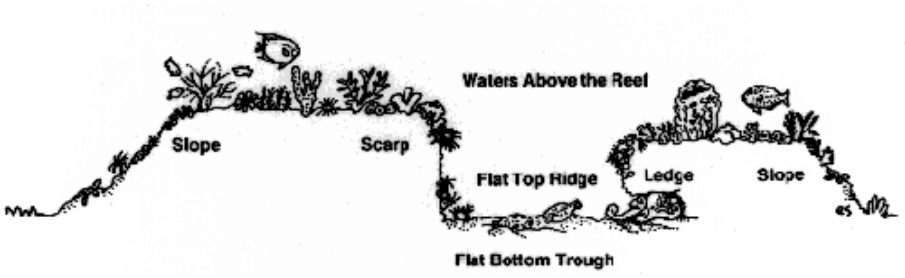
Boundary

The Gray's Reef National Marine Sanctuary (Sanctuary) consists of 16.68 square nautical miles (NM) of high sea waters off the coast of Georgia. The Sanctuary boundary includes all waters within a rectangle starting at coordinate 31 deg.21'45"N, 80 deg.55'17"W, commencing to coordinate 31 deg.25'15"N, 80 deg.55'17"W, thence to coordinate 31 deg.25'15"N, 80 deg.49'42"W, thence to coordinate 31 deg.21'45"N, 80 deg.49'42"W, thence back to the point of origin.

Profile of Gray's Reef Geological cross-section



Profile of Gray's Reef Habitat's



Waters above the Reef
Planktonic (drifting) and nektonic (swimming) invertebrates are found in the waters above the reef. Planktonic species include large medusae such as the sea nettle and the cannonball jelly. Squid exemplify a nektonic species that actively pursue prey in these waters.

Flat Top Ridge
Horizontal reef tops provide habitat for sessile (attached) benthic (bottom dwelling) invertebrates which rely upon ocean currents for food, gas exchange, waste removal, and egg dispersal. Examples include hard corals, soft corals, sponges, and hydroids.

Scarps
Little sediment accumulates on the vertical reef surfaces known as scarps. As a result, the bare substrate supports colonies of encrusting sponges and bryozoans (mossy animals). Barnacles, tunicates, and sea anemones are also found on these exposed surfaces.

Ledges and Crevices
Both predators and prey seek out good hiding places within the reef. Diurnal (active at day) species find refuge within the reef during the night. Nocturnal (active at night) species seek to conceal themselves within the reef during the daylight hours. Lobsters, crabs, sea urchins, and octopods prefer this type of habitat.

Slopes and Sandy Areas
Shifting sands and a lack of firm substrate preclude most sessile forms from settling along slopes and in sandy areas of the reef. Burrowing clams, mobile snails, sea stars, and burrowing polycheate worms are better adapted to life in these loose sediments.

Flat Bottom Troughs
Among the rock rubble, coarse sands, and shell fragments of the flat bottom troughs are found brittle stars, fan and tube worms, burrowing crustaceans, small crabs, and snails. This habitat is also preferred by certain burrowing echinoderms such as the sea cucumber.

Invertebrates of the reef have adapted to the specific resource characteristics of habitats described above. This ability to adapt to different, specific resources helps to decrease competition for food and space among the residents of the reef, thus allowing for a greater diversity of species within the community.

Current Research and Plans

In recognition of the need and value of long term monitoring for sound management decision making and evaluating the effectiveness of these decisions, GRNMS began long term monitoring of fisheries resources in 1993. This is accomplished through the assistance of the Marine Assessment Monitoring and Prediction (MARMAP) program conducted by the South Carolina Marine Resources Research Institute. Surveys have been conducted annually since 1993.

In 1995 Gray's Reef initiated a long term monitoring assessment of its natural resources. The monitoring program encompasses the following resources and topics of concern determined to be of significant importance to GRNMS during the planning of the designation and subsequent establishment of the management and research studies plan; Fish populations, benthic invertebrates, oceanographic conditions, sediment transport and visitor use. 32 permanent reference points were established and marked with numbered goat ear tags mounted on 1m stainless steel rods. The study site has a 250 meter extent in water depth of about 60 feet. Assessments began as two comprehensive sampling efforts are studied seasonally and will provide a picture of seasonal changes in reef fish abundance measures. Additionally these survey's are supplemented with diver video assessments. This technique was developed by Dr. Richard O. Parker of the National Marine Fisheries Service in 1986 and is still in use today to monitor the status of reef fish in the sanctuary.

To supplement these fishery monitoring efforts with long term monitoring of invertebrate populations by photo-quadrat and physical oceanographic conditions such as temperature started in 1995. May of 1997, data buoy 41008, from the National Data Buoy Center (NDBC), was placed within Gray's Reef National Marine Sanctuary boundaries (31*24'00"N, 80*52'30"W). The buoy records real time data including: speed and gust; air and sea temperature; and wave energy spectra from which significant wave height, dominant wave period, and average wave period are derived. Through the collection of this data GRNMS will be able to provide up to date reports on the status of the health of the sanctuaries resources to the public through education and outreach programs as well as to resource management agencies at both state and federal levels.

Site characterization studies to map the bottom of the ocean, such as sidescan sonar and bathymetry have also been collected at Gray's Reef by the United States Geological Survey in 1994. Gray's Reef has also used Remotely Operated Vehicles to verify the sidescan data and have a visual record of all the areas within the sanctuary.

Archaeological Findings

Gray's Reef National Marine Sanctuary may have been a site of ancient human settlement during the last geologic time period and thus may hold the key to ancient culture and history along the coast. Dr. Erv Garrison, University of Georgia marine archeologist, is attempting to document the reefs' existence above sea level some 15,000 years ago when Georgia's shoreline extended more than 60 miles eastward. Off the coast, divers have turned up fossils of now-extinct land-dwelling animals, such as ground sloths, mastodons and early camels, horses and bison. "Where you find the animals, you most likely are going to find humans, " says Garrison.

Fossils and plant life discovered in our underwater sanctuaries may give us vital clues and insight into future climate changes and sea level rise.

The following is a list of fossil bones found by researchers at the Gray's reef National Marine Sanctuary during studies beginning in April,1995 to August, 1998. This project is led by Dr. Erv Garrison, Univeristy of Georgia marine archeologist

1995:

- 1 bone fragment; mammal
- 1 non-bone, marine worm burrow cast; Radiocarbon date of 18,000 + years

1996:

- 4 bone fragments, mammal; 2 are rib-like and quite large - over 150 mm in length; one is less mineralized and identified as an extiinct species of bovine animal. This bone was radiocarbon dated to 8000 years.
- 1 tooth, Pleistocene horse; heavily mineralized

1997:

- 1 bone fragment, mammal; small less than 100mm in length; found on NPR- National Geographic Radio Expedition
- 2 bone fragments, mammal; one may tooth fragment

- 1 antler or bone fragment, heavily mineralized; possibly worked by humans as a tool
- 2 non-bone,marine worm burrow casts

1998:

- 2 unidentified fossil fragments; one does not appear to be bone - horn or antler?
- 1 bone fragment, mammal; appears to be limb bone fragment - over 135 mm in length
- 1 non-bone, burrow cast fragment

Human Use and Values

Gray's Reef is a popular recreational fishing and sport diving destinations along the Georgia coast. Sport fishing occurs year-round but at different levels of intensity. Commercial fishing is restricted, as are military, mineral extraction, and ocean dumping activities. Little commercial shipping occurs at Gray's Reef. While the site has supported a variety of studies it currently supports reef fish and invertebrate programs. A resource characterization is in progress.

Site Designation and Regulations

Gray's Reef was made an Active Candidate in 1979. Final designation as a National Marine Sanctuary came in January 1981. The Sanctuary was named in recognition of Milton B. Gray, who studied the area in the 1960's as a biological collector and curator at the University of Georgia Marine Institute on Sapelo Island, GA.

Regulations prohibit alteration of the seabed; use of wire fish traps, bottom trawls, and explosives; damage to or removal of bottom formations and other natural or cultural resources; and discharge of substances or materials. Gray's Reef enforces these regulations to promote compatible resource use through interagency agreement with the U.S. Coast Guard and the National Marine Fisheries Enforcement Division.

Prohibited or otherwise regulated activities

(a) Except as may be necessary for national defense (subject to the terms and conditions of Article 5, Section 2 of the Designation Document) or to respond to an emergency threatening life, property, or the environment, or except as may be permitted by the Director in accordance with Sec. 922.48 and Sec. 922.92, the following activities are prohibited and thus are unlawful for any person to conduct or to cause to be conducted within the Sanctuary:

(1) Dredging, drilling, or otherwise altering the seabed in any way nor constructing any structure other than a navigation aid.

(2) Discharging or depositing any material or other matter except:

(i) Fish or parts, bait, and chumming materials;

(ii) Effluent from marine sanitation devices; and

(iii) Vessel cooling waters.

(3) Operating a watercraft other than in accordance with the Federal rules and regulations that would apply if there were no Sanctuary.

(4) Using, placing, or possessing wire fish traps.

(5) Using a bottom trawl, specimen dredge, or similar vessel-towed bottom sampling device.

(6)(i)(A) Breaking, cutting, or similarly damaging, taking, or removing any bottom formation, marine invertebrate or marine plant.

(B) Taking any tropical fish.

(C) Using poisons, electric charges, explosives, or similar methods to take any marine animal not otherwise prohibited to be taken.

(ii) There shall be a rebuttable presumption that any bottom formation, marine invertebrate, tropical fish, marine plant, or marine animal found in the possession of a person within the Sanctuary have been collected within or removed from the Sanctuary.

(7) Tampering with, damaging, or removing any historic or cultural resources.

All activities currently carried out by the Department of Defense within the Sanctuary are essential for the national defense and, therefore, not subject to the prohibitions in this section. The exemption of additional activities having significant impacts shall be determined in consultation between the Director and the Department of Defense.

Permit procedures and criteria.

(a) Any person in possession of a valid permit issued by the Director in accordance with this section and Sec. 922.48 may conduct the specific activity in the Sanctuary including any activity specifically prohibited under Sec. 922.91, if such activity is

(1) Research related to the resources of the Sanctuary,

(2) To further the educational value of the Sanctuary, or

(3) For salvage or recovery operations.

(b) Permit applications shall be addressed to the Director, Office of Ocean and Coastal Resource Management, ATTN: Manager, Gray's Reef National Marine Sanctuary, 10 Ocean Science Circle, Savannah, GA 31411.

(c) In considering whether to grant a permit, the Director shall evaluate

(1) The general professional and financial responsibility of the applicant,

(2) The appropriateness of the methods envisioned to the purpose(s) of the activity,

(3) The extent to which the conduct of any permitted activity may diminish or enhance the value of the Sanctuary,

(4) The end value of the activity, and

(5) Other matters as deemed appropriate.

(d) The Director may observe any permitted activity and/or require the submission of one or more reports of the status or progress of such activity. Any information obtained will be made available to the public

Activity: Rivers – Go with the Flow

Learning Objectives

- Students will differentiate between natural and human altered river systems.
- Students will research and report on watersheds.
- Students will create models of natural and human altered river systems.

Materials Provided

- Posters – "Rivers to Reefs" and "Land to Sea"
- DVD – "Rivers to Reefs"
- Data sheet template
- Background information on components of a natural river system

Materials Needed

- ✓ 3' X 2' sheet of cardboard or heavy poster paper for each team
- ✓ 3' long section of pipe insulation cut in half lengthwise
- ✓ One roll of heavy tape (duct tape) per team to affix labels to pipe insulation halves to cardboard
- ✓ A set of sticks, small pieces of sod, leaves, etc. per team
- ✓ One quarter cup oregano per team
- ✓ Two equal water containers (one pint bottle) filled with water per team
- ✓ Catch basin for water (bucket, basin, etc.) per team
- ✓ Block of wood to elevate cardboard off table at one end per team
- ✓ Stop watch or a watch with a second hand per team
- ✓ Table space per team to conduct activity

Total Teaching Time

Three 45-minute periods

Period #1: 45 minutes

Seating Arrangement

Sufficient space for each student to draw comfortably

Activity Instructions

Ask your students to draw what they think a natural river system looks like on a blank sheet of paper with either regular leaded or colored pencils. Let them know that their assignment is to draw what they think the features of a natural river system looks like.
Next discuss their drawings and make corrections by referring to the background information provided.

Period #2: 45 minutes

Seating Arrangement

Sufficient table space for individual teams to conduct activity while standing up and moving around all sides of their tables

Activity Instructions

Divide the class into teams of two or three. Distribute sheets of cardboard, pipe insulation segments, rolls of tape, sets of natural materials, water containers, catch basins, and blocks of wood to each team. Ask the students to separate the pipe insulation into two halves lengthwise, if that has not already been done. Have the students affix the two pipe insulation halves, rounded side down, to the cardboard making one straight and the other with curves. This configuration will simulate a natural (curved) and a human altered (straight) "river system". Have the students place the block of wood under the head of their "river systems" to elevate the cardboard base to facilitate water flow and the catch basin at the end of their "river systems" to catch the water as it comes down river. Have the students place a pinch of oregano at the head of each of their "river systems" and pour water down the human altered straight river system first. Timing begins when the water first hits the oregano and ends when it leaves the end of the pipe insulation. This one will go quickly and may only last a second if that long. Next repeat the procedure with the natural "river system" with curves. Record each time trial on the data sheet. Ask the students to add natural elements (sticks, leaves, sod, etc.) into their natural "river system". Each time they add elements ask them to conduct another timed trial and record their results. When the natural elements are exhausted ask students how else their systems may be altered. Most students will intuitively know to increase the speed with which the water is sent down their rivers to simulate floods from storm rains and/or by elevating the head of their "river systems" to simulate a steeper elevation in the more mountainous portions of our state.

Period #3: 45 minutes

Seating Arrangement

Sufficient spaces and surfaces for each team to display their data sheets

Activity Instructions

Ask each team to give the results of one aspect of their timed trials. Lead the discussion on how our natural river systems are critical in keeping our inland waterways and coastal waters as well as offshore waters clean and healthy.

Extension Activities:

#1. Ask students to keep a track of how much water they use themselves in their homes for a day. Have them figure out the average amount of water that comes out of their faucets by timing how long it takes to fill up a gallon of water from each faucet by using an average flow speed. Ask students to record how long each faucet runs per task per day.

#2. If there is a dripping faucet, ask students to record how much water is wasted per day by again determining how long it takes to fill a gallon jug and extrapolating to a 24 hour period.

#3. Ask students to record what chemicals (household cleaning products, laundry detergent, bleach, dishwashing liquid, hand and bath soaps, etc.) in their homes are used on a weekly basis and how much of each is used. Add the results from each household and multiply that by the number of households in your area to get an idea of the volume of chemicals washed down our drains and put on our lawns weekly during the growing season.

#4. Visit your local sewage treatment plant, preferably in person with your students. If that is not an option, ask students to visit their website to find out how the chemicals and human waste from our households are handled. Ask your students to write a report of their visit or research and offer alternate ideas to deal with sewage.

Activity: Do-It-Yourself Ocean Floor

Learning Objectives

- Students will describe the ocean floor as having many features of varying elevations and depths.
- Students will describe specific ocean floor features.
- Students will sculpt a model of their ocean floor feature and combine them to make a complete model of the ocean floor.

Material Provided

- Ocean Floor Topography Poster
- Ocean Floor Topography Background Information
- CD of Ocean Floor Features Images

Materials Needed

- ✓ 1 package of multi colored modeling clay per team or 1 package of white Crayola modeling clay that can be colored with magic markers per team
- ✓ One set of non-toxic magic markers per team
- ✓ 3' X 2' sheet of cardboard or heavy poster paper for each team
- ✓ Toothpicks and labels or small pieces of paper to serve as labels – allow 25 of each item. The markers are to be placed in each feature for identification purposes.
- ✓ One roll of clear tape per team to affix labels to ocean floor feature markers
- ✓ One pair of blunt nose scissors per team to use to cut paper for labels and to affix labels to toothpicks

Total Teaching Time

Three 45-minute periods

Period #1: 45 minutes

Seating Arrangement

Sufficient space for each student to draw comfortably

Activity Instructions

Ask your students to draw what they think the ocean floor looks like on a blank sheet of paper with either regular leaded or colored pencils. Let them know that their assignment is to draw what they think the features of the ocean floor look like.

Next discuss their drawings and make corrections by referring to the poster provided that highlights the dominant features of the ocean floor off the Georgia coast.

Period #2: 45 minutes

Seating Arrangement

Sufficient spaces and surfaces for each team to create ocean floor models

Activity Instructions

Divide the class into teams of two or three. Distribute sheets of cardboard, modeling clay and magic markers. Ask the students to create a model of the ocean floor and include the following major features: southeastern coast of the USA including the barrier islands of Georgia, Gray's Reef, Sapelo Scarp, Charleston Bump, Continental Slope and Shelf, Blake Plateau, Tongue of the Ocean, Grand Bahamas Bank, North American Basin, Hatteras Abyssal Plain, Mid Atlantic Ridge, Great Meteor Seamount, Canary Islands, and the northwestern coast of Africa. When all teams have completed their models, allow all the students to view each others models. Lead a discussion on the ocean floor based on the poster.

Please display the poster during this activity for reference purposes.

Period #3: 45 minutes

Seating Arrangement

Sufficient spaces for students to sit at their desks

Activity Instructions

Lead a discussion as to why the various aspects of the ocean floor are important. Ask if they think the organisms that inhabit the various features are dependent on them and how. Ask how the organisms might be interdependent on those features close by.

Extension Activities:

#1. Visit a public aquarium with your students and observe the various ocean bottoms represented in each of the tanks. Discuss the various features. Include geologic composition, depth and major characteristics of each feature.

#2. Assign or ask the students to choose a specific ocean floor feature and write a report on it. The students should be able to use the internet to research most of the features and to download images.

#3. Ask students to research an exploration cruise that focused on an ocean floor feature(s). An excellent website to use is NOAA Ocean Explorer at www.oceanexplorer.noaa.gov.

#4. Ask students to research technologies used for ocean exploration such as remotely operated vehicles, autonomously operated vehicles, submersibles, autonomous underwater listening stations, passive acoustic monitoring stations, telepresence, etc.

#5. Ask students to design a vehicle they would use to explore the ocean bottom. The model should be to scale. The students will need to specify dimensions of and materials that comprise their vehicles' various parts.

#6. Have students write a newspaper article describing an imaginary expedition to a specific area of the ocean floor using the vehicle they designed. They will need to include all features they are likely to encounter, their geologic compositions and the organisms that inhabit them.

Glossary for Watersheds

Barrier Islands are long, relatively narrow islands that run parallel to the mainland, are built up by the action of waves and currents and protect the coast from erosion by surf and tidal surges. Barrier Islands are found on coastlines all over the world and are formed by the basic processes of the sand transport and sand sharing systems.

Beaches occupy zones above the water line at a shore of a body of water and are marked by an accumulation of sand, stone, or gravel that has been deposited by tide or waves.

Charleston Bump is an ocean floor feature found 80-100 miles offshore of Charleston. The Bump consists of a series of ridges, where the bottom rises from about 2,300 feet to about 1,200 feet in a short distance. The Bump is important because the ridges cause warm Gulf Stream waters to move inshore to bays, attracting many warm water fish.

Currents are a part of a fluid body (of water) moving continuously in a certain direction.

Dunes are mounds, ridges, or hills of wind-blown sand. Dunes are part of a delicate system to protect marshes, bays and land behind the beach from high water and stormy seas.

Estuaries are partially enclosed bodies of water formed where freshwater from land-originating rivers and streams flows into the ocean, mixing with the salty water.

Headwaters refer to the water from which a river rises. It is the source of a river.

The **Intertidal Zone** is where the land and sea meet, between the high and low tide zones.

Islands in the Stream-South Atlantic Bight was a project conducted by National Oceanic and Atmospheric Administration to collect information in order to identify potential Marine Protected Habitats and critical habitats from Belize to North Carolina.

Maritime Forests are the stable community of trees and shrubs occurring along the southern barrier islands. The flora and fauna of these communities are well adapted to the elevated salt content, limited availability of freshwater, soil erosion and dune migration, and damage resulting from oceanic storms. Maritime forests provide refuge to a variety of wildlife and stabilize the soil of the barrier islands.

Marshes or **salt marshes** are transitional areas between land and water, occurring along the intertidal shore of estuaries and sounds where salinity (salt content) ranges from near ocean strength to near fresh in upriver marshes.

Oceans make up the entire body of salt water that cover more than 70 percent of the earth's surface. Earth’s oceans are divided into four major portions: the Atlantic Ocean, the Pacific Ocean, the Arctic Ocean and the Indian Ocean. Though these oceans are distinct in their own ways, they are all interconnected; the same water throughout all of them.

Rivers are a large natural stream of water emptying into an ocean, lake, or other body of water.

SABSOON is an acronym for South Atlantic Bight Synoptic Offshore Observational Network. It is a real-time observational network developed on the United States Southeastern continental shelf. This system provides oceanographic and meteorological observations important for many scientists.

Sandbars are ridges of sand formed in a river or along a shore by the action of waves or currents.

Sapelo Scarp consists of deeper calcitic sandstone outcroppings located in 200 feet of water that are covered with encrusting tunicates, sponges, and soft corals.

Streams are steady currents, or it may also be a flow of water in a channel, such as a brook or small river.

Swamps are shallow bodies of water in low-lying, poorly drained depressions, usually containing abundant plant growth dominated by trees, such as cypress, and high shrubs.

Tides are the rhythmic, alternating rise and fall in sea level with respect to land, occurring twice a day over most of the Earth. Tides are produced by the gravitational attraction of the Moon and the Sun.

Trenches are depressions along the sea floor. They are also the lowest parts of the ocean floor and occur between tectonic plates, along convergent plate boundaries.

Watersheds are areas of land that contain a common set of streams and rivers that all drain into a single larger body of water, such as a larger river, a lake or an ocean.