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Information About Estuaries and Near Coastal Waters

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Information About Estuaries and Near Coastal Waters
Summer 1998, Volume 8, Number 3

Table of Contents

Portland-South Portland Harbor Dredging Project

The Weeks Bay Shoreline & Habitat Restoration Project

National Estuaries Day

Mercury Pollution Increasing in Marine Ecosystems: Report

Treating Coral Diseases

Block Island Shellfishing Returns After 13 Years

NOAA Welcomes Georgia to the National Coastal Zone Management Program

Harmful Algal Blooms

Update on Jordan Cove

New Report from the Environmental Defense Fund on Environmental Effects of Aquaculture

Red tides devastate Hong Kong fisheries

A Helping Hand: Postal Service Efforts to Restore the Chesapeake Bay

Center Insert

The Weeks Bay Shoreline & Habitat Restoration Project

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Portland-South Portland Harbor Dredging Project

The Portland-South Portland Maine Harbor Dredging Committee was created in 1994 through the Waterfront Alliance and The Portland Harbor Commission. The goal of the Committee was to bring all stakeholders, including regulators, local government officials, private wharf owners, marinas and environmental groups together on a monthly basis throughout the process. A group of highly motivated people have been working quickly and efficiently to affect the dredging of the Portland Harbor shipping channel. Dedication, cooperation and just plain hard work by the more than 40 stakeholders who comprise the Portland-South Portland Harbor Dredging Committee has enabled the $7 million project's near completion in a fraction of the time normally associated with federal dredging projects. In addition, innovative and economically sound disposal methods for the 800,000 cubic yards of sediment have been identified, while ensuring economic prosperity and protecting against environmental mishap.

The Committee has experienced a tremendous advantage by having all the stakeholders at the table each month. Questions have been answered and opinions solicited at the time issues arise, rather than lengthy delays associated with interagency communications by phone and letter. Each month, Committee members were given "homework" assignments and participants were fully expected to produce answers at the next meeting.

Federal partners in this endeavor have commented on the efficiency of the system and have expressed

interest in trying to recreate it for other projects around the country. In fact, the Committee's efficiency caught the Army Corps of Engineers somewhat off guard. Since lengthy delays are common, the Corps did not budget the funds necessary to begin dredging this year. Again, the Committee's reputation paid off with extraordinary assistance from Maine's Governor King and Senator Olympia Snowe. Through their support, a special budget line item has been created and is currently in the process of being signed by the President so that dredging can begin as scheduled.

In the spirit of community, the Committee has also coordinated dredging for private wharf owners in Casco Bay. By piggy-backing private dredging with the federal dredging project and sharing common sites between wharves for sediment testing, local wharf owners have realized a great savings.

The Casco Bay Estuary Project (CBEP) has a seat on the Committee and has been closely involved throughout the dredging process. The CBEP funded a $90,000 offshore capping study and determined that ocean disposal is a viable option for some of the contaminated sediment. The level of independent, scientific integrity of the study served to raise the credibility of the CBEP in the eyes of the community and raised effective argument on the validity of ocean disposal. In addition, the CBEP has hired a local engineering firm to research upland disposal options for d redged material that is not suitable for ocean disposal.

Multiple rounds of sediment testing and analysis determined that most of the sediment to be dredged from the harbor's main shipping channel can be disposed of safely at sea. Ocean disposal has an economic advantage since the cost of land fill disposal is ten times that of disposal at sea and entails a long permitting process.

In addition, the committee has provided a unique solution for disposal of the contaminated material dredged from under the newly constructed Casco Bay Bridge. Sediment at this site had never been dredged and had collected contaminants for over 100 years. The worst of the contaminated sediment was removed from the site, while the remaining material was contained in large cylindrical bumpers. These bumpers were attached to the bridge and safely store the sediment while providing additional protection against the possibility of ships colliding with the bridge. This tactic sidestepped the need for expensive land disposal and utilized an unusual common sense approach. Should the bumpers become damaged (the material is encased in cement and the bumpers are reinforced with steel), the sediment will simply return to its original location.

One last hurdle remains. There is a deep concern among lobster fishers that dredging may disrupt lobster breeding grounds. A powerful lobby, the lobster fishers have the power to halt the dredging project, however, the commitment by the committee has encouraged them to work collaboratively. Once again, the CBEP has stepped forward to contribute and help raise funds to study the Casco Bay lobster populations. Divers were hired to study the small lobsters, called "shorts" and a plan is underway to arrange for relocating the shorts during the period of dredging. The Corps has agreed to condense the dredging schedule from 10 months to 5 months by using larger equipment and the dredging will be done during the winter and spring to avoid interfering with the summer lobstering.

While dredging may be necessary to keep the shipping channels deep enough to ensure safe navigation and allow vessels to enter the port to conduct business, many environmental issues are raised during the process. This process in many other parts of the country has resulted in 10 to 15 year delays in implementing dredging projects. The Portland-South Portland Dredging Committee in only four years has encompassed both a national and local perspective in dealing with complex dredging issues and has kept controversy to a minimum.

For further information, contact: Debra Bunting, Casco Bay Estuary Project, University of Southern Maine, phone: (207) 780-5774, E-mail: debrab@usm.maine.edu.

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The Weeks Bay Shoreline & Habitat Restoration Project

Characteristics:

The Mobile Bay watershed drains 44,170 square miles, making it the sixth largest drainage basin in the country. Although this watershed covers two-thirds of the state of Alabama, as well as parts of Georgia, Tennessee and Mississippi, the study area for the Mobile Bay National Estuary Program is limited to the state's two coastal counties, Mobile and Baldwin. Within this estuarine zone there are approximately 433 miles of shoreline. The Weeks Bay watershed, a 200 square mile sub-watershed, is located in Baldwin County on the eastern shore of Mobile Bay.

The Problem:

The Mobile Bay area, like much of the country, is characterized by loss of wetlands, especially salt marsh due to a variety of causes. Dredging to improve boat and ship access has resulted in the conversion of marsh to open water. Further marsh loss is caused by propeller wash and wave action from both high speed pleasure boats and large slow moving ships which erodes banks. This is in addition to shoreline loss from normal wave actions and seasonal storms. Historic trend data indicates that certain marshes in

the MBNEP area have been eroding at a rate of up to ten feet per year. To protect their waterfront property, an owner's typical response has been to construct a bulkhead which, of course, accelerates marsh loss and erosion of neighboring properties.

The Project:

The Weeks Bay Shoreline and Habitat Restoration Project is a joint project of the U.S. Fish & Wildlife Service and the Alabama Coastal Foundation and a private land owner, designed to bring partners together with the local public to test innovative solutions which stem the decline of and restore important habitat for marine life in Weeks Bay, a sub-estuary of the Mobile Bay Estuary.

Introduction to Mobile Bay

Mobile Bay has a surface area of approximately 248,000 acres with an additional 21,000 acres of tidal marsh, tributaries and connecting bays. The Delta, forming the northern border of the Bay, has an area of approximately 185,000 acres, including open water, fresh marshes and forested wetlands.

The national significance of Mobile Bay and Delta lies in the magnitude of its natural resources. The estuary provides important habitats for many commercially and recreationally important fishery and wildlife species, as well as for a number of rare and endangered species of plants and animals. Home to 310 species of fish, 15 species of shrimp, 57 species of mammals, more than 300 species of birds, 40 species of amphibians and 68 species of reptiles. The estuary also sustains significant recreational activities, a booming tourist economy, waterborne commerce and port related industries and other major industries.

Like most of the coastal United States, population growth throughout Mobile and Baldwin Counties continues to pose environmental management problems as development efforts encroach more and more on wetlands areas. Between the mid-1950's and the late 1970's, 34 percent of the wetlands in the northern Mobile Bay were lost compared to the national and southeastern average of eight percent.

Overview of Weeks Bay

The Weeks Bay watershed includes almost 126,000 acres in Baldwin County, Alabama on the eastern shore of Mobile Bay. It is representative of the greater Mobile Bay system. Primarily rural, the area is the fastest growing county in Alabama, fueling an increasing demand for waterfront footage.

Project Description

In 1997, EPA's Mobile Bay National Estuary Program sponsored The Weeks Bay Shoreline and Habitat Restoration Project, a joint project of the U.S. Fish & Wildlife Service, Alabama Coastal Foundation and other partners. A model for the project, the Louisiana Parish Coastal Wetlands Restoration Program, was discovered by a member of the Mobile Bay National Estuary Program Policy Committee, representing

the Mobile Area Chamber of Commerce.

The model consists of the construction in shallow water of a "brush fence," or wooden bin, parallel to the eroded shoreline, which holds discarded "Christmas" trees. The brush fence serves as a breakwater to heavy wave action and the Christmas trees work as a filter, to gently settle out sand and silt, rebuilding the shoreline and important safe habitat for juvenile marine life.

Project Objectives

The project objectives of the Weeks Bay Shoreline and Habitat Restoration Project were to:

Restore eroded shoreline.
Restore safe habitat for juvenile marine life.
Bring together members from each of the Mobile Bay National Estuary Program (MBNEP) committees (Policy, Management, Technical and Citizens) on one practical demonstration project.
Involve local partners and the public in a hands-on project, which would bring greater awareness of the priority problems facing the Mobile Bay National Estuary system and, highlight the activities of the MBNEP to stem those effects.

Project Implementation

Early on in the organization of the Mobile Bay National Estuary Program it became clear to all of the committees that two of the priority problems facing the estuary system were an eroding shoreline and the loss of important habitat for marine life and other wildlife. As the work of gathering data and characterizing effects continued in the technical work groups, such as those on Water Quality and Habitat Loss, these priority problems were confirmed and underscored.

The Mobile Area Chamber of Commerce, serving as a representative of the Policy Committee, became aware of an innovative model used to restore wetlands in Louisiana, and shared it with members of the Management Committee, the U.S Fish & Wildlife Service (USFWS) and Alabama Coastal Foundation (ACF). Working jointly, USFWS and ACF submitted the project as the MBNEP's first Action Plan Demonstration Project (APDP), which was approved. It was determined that USFWS would advise on the technical and scientific issues, while the ACF assisted in public outreach.

USFWS, also serving on the Technical Advisory Committee, convened a group of experts to visit some of the Louisiana sites and speak with conservation and regulatory officials there about successes and pitfalls. Accessibility was an issue in Louisiana with many sites requiring highly technical helicopter drops of Christmas trees into the bayous.

After the Louisiana visit, the US Fish and Wildlife Service, on behalf of the Technical Advisory Committee, served as the local site selection team. After considering a variety of sites in Mobile and Baldwin Counties, and with the help of the Weeks Bay National Estuarine Research Reserve, a

construction site was selected. The site, off the coast of Weeks Bay, an inlet of the Mobile Bay system, was chosen based on the USFWS' overall knowledge of Mobile Bay and after considering potential access problems.

The site was ideal: the shoreline was eroding at a rapid rate, was partially protected from direct storm events, was accessible, and, importantly, the property owner-Beckwith Episcopal Camp was eager to participate.

USFWS moved into action, working with Beckwith to draw up a plan for construction and seek the necessary permit with the U.S. Army Corps of Engineers. The permit was granted, based on the authorization by Nationwide Permit 27 (Wetland and Riparian Restoration and Creation Activities). USFWS then employed its summertime Youth Conservation Corps to construct the brush fence according to the plans, resulting in a wooden bin 5 feet wide by 170 feet long.

Prior to the location and installation of the Christmas trees, one of the areas' frequent storm events occurred: Hurricane Danny moved into the area for three days, pelting the coastline with heavy ran, winds and waves. The site held up well; with only minor damage, the brush fence remained intact, and is believed to have helped in protecting the area from storm erosion.

ACF then moved into action during August, partnering with local Christmas tree grower, McDavid Christmas Trees in Grand Bay (Mobile County), to supply unusable Christmas trees for installation in the brush fence. Alabama Power Company supplied the large trucks and manpower necessary to transport the trees to the site in Baldwin County.

The next step by ACF was a call for volunteers. All ages turned out for the "planting" event on Saturday, August 16, clad in waterproof shoes and boots, gloves, long-sleeved shirts and plenty of sunscreen. They were instructed in the process by representatives from the USFWS and ACF, who supervised the event. Just prior to planting, ACF took baseline photos of the site for monitoring purposes.

The weather was great for getting wet! Volunteers set to work, forming a human chain to pass the discarded trees along and place them, lengthwise, in the brush fence. When the bin had been filled, volunteers took heavy nylon twine, criss-crossed it and tied it securely over the surface of the brush fence to prevent floating tree hazards in the case of storms or high tides.

Success Stories

Beyond the many volunteers that turned out in person for the event, the media became enamored with the project. Coverage of the project appeared on local television, radio and in daily and weekly print newspapers, further meeting project objectives to enhance public awareness about the priority problems facing the Mobile Bay estuary system and the NEP's work to stem those effects.

In early November, just two and one-half months after the installation of trees, USFWS and ACF

returned to the site to determine if minor repairs were needed and were surprised to see a rapid rate of accretion in qualitative measures. In addition, partners discovered budding marine life in juvenile shrimp, crab and fish, breeding between the brush fence and the shore.

The project became high profile and was discussed by scientists and technical specialists at numerous environmental meetings and gatherings, most notable was a Symposium on Beach Erosion hosted by the Dauphin Island Foundation, Dauphin Island Sea Lab, Alabama Coastal Foundation and Alabama Department of Community and Economic Affairs Coastal Program Office, where noted experts on shoreline erosion from around the country had convened.

In January, USFWS and ACF conducted a semi-baseline survey of the site to better quantify the accretion rate, and ACF conducted a fly-over to take aerial photos. It was determined that quarterly surveys are sufficient to show accretion trends, and in early May, a second survey showed continuing rapid accretion in quantitative measures.

In the spring/earyl summer of 1998,the Youth Conservation Corps/United Stats Fish and Wildlife Services planted black-needle rush (Juncus roemerianus) between the brush fence and the shore line. The purpose of the marsh planting was to increase the rate of sediment entrapment, fruther protection the shore line from erosion and to increase the amount offish, shellfish, and wildlife habitat along one shoreline.

In short, all objectives were met. There has been clear restoration of marsh habitat, MBNEP members at all levels were involved in the project, and many partners and the public shared in the involvement of the project, as well as awareness of priority estuary problems and activities to stem those problem.

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National Estuaries Day

October 3, 1998 is National Estuaries Day - a celebration of our bays, sounds, and lagoons. The theme of this event is "Estuaries - Gateways to the Ocean", and its purpose is to highlight these vital transitional areas, and connect with the Year of the Ocean. EPA's National Estuary Program (NEP) and NOAA's National Estuarine Research Reserve System (NERRS) are coordinating this campaign to educate the public about estuaries and water quality issues, and provide opportunities to appreciate their cultural, economic, social and environmental importance. National Estuaries Day materials being produced include a poster, fact sheet, and stickers, which will be sent to each NEP and NERR site for use and distribution. A press kit will also be sent out with additional background materials and contact information.

While various NEPs and NERRs sites across the country are planning activities to commemorate the day, Narragansett Bay will be a focal point of the national celebration. The NEP and NERR programs in Narragansett are co-hosting a festival with an educational exhibit, a talk radio show, and a band concert in celebration of National Estuaries Day. For more information about National Estuaries Day, please visit our web sites at the following addresses:

National Estuary Program
National Estuarine Research Reserve System

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Mercury Pollution Increasing in Marine Ecosystems: Report

Mercury contamination in the marine environment is increasing at a rate of up to 4.8% a year, according to a paper in the journal Environmental Toxicology and Chemistry. The paper's authors analyzed mercury concentrations in feathers of seabirds breeding in the Azores, Madeira and Salvages islands, a subtropical sector of the northeast Atlantic remote from mercury emissions due to human activity. These were then compared to dated preserved study skins of birds collected at the same colonies and held in museum collections. This provided a time line sequence dating from 1886 to 1994.

The studies showed that concentrations of mercury in the feathers of birds which feed primarily on epipelagic fish (that is, fish which live in the top 100m of the ocean) increased by an average of 1.1%-1.9% per year. Concentrations of those which feed at the apex of the mesopelagic zone, the region immediately below the epipelagic, showed average increases of 3.5%-4.8% per year.

The increases in epipelagic concentrations are consistent with a three-fold increase of global mercury concentrations in the atmosphere and surface oceans since pre-industrial times (i.e., 1.3% a year over the past 150 years). However, increases in the mesopelagic food web are three times higher than predicted, but are probably related to the particular biogeochemistry of mercury in low-oxygen waters beneath the

thermocline. The authors conclude: "Large increases of mercury pollution, especially in mesopelagic organisms, are of concern because of the current public health problem resulting from widespread incidence of elevated levels of methylmercury in fish and the increasing importance of deep-sea resources as a source of protein for humans."

(Excerpted with permission from SeaWeb, Ocean Update) Source: L.R. Monteiro and R.W. Furness. Accelerated increase in mercury contamination in North Atlantic mesopelagic food chains as indicated by time series of seabird feathers. Environmental Toxicology and Chemistry 16(12): 2489-2493

Contact: Luis R. Monteiro, Dept. of Oceanography and Fisheries, University of Azores, 9900 Horta, Portugal

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Treating Coral Diseases

Throughout the western Atlantic, coral reefs have undergone dramatic changes as a consequence of human activity, natural disturbances, and a general deterioration of water quality. Hurricanes, white-band disease, and predator outbreaks in the 1970s and 1980s transformed flourishing thickets of elkhorn coral (Acropora palmata) and staghorn coral (A cervicornis) into fields of coral rubble or tissue-denuded skeletons, many still standing upright. In the 1990s, reports of coral diseases have escalated. Some diseases are being described for the first time, while others are appearing over a wider area, and among species previously believed to be resistant. Scientists have suggested that coral diseases are contributing to the accelerated destruction of coral reefs, and they are concerned that disease outbreaks may continue to intensify. At this time it is unclear whether the increase in number and severity of coral diseases is a natural short-term event or a human-induced degradation with serious long-term ramifications. Despite the recent interest in coral disease and efforts to assess the health of coral reefs, few studies have explored the possibility of treating infected corals to eliminate diseases.

Black-Band Disease: The Problem

Black-band disease (BBD) is the first reported coral disease, described 25 years ago on reefs off Belize, Central America. This disease primarily impacts massive reef-building corals in the western Atlantic, but has also been found in the Indo-Pacific and Red Sea. Black-band disease forms a circular or crescent-

shaped mat composed primarily of cyanobacterial filaments (blue-green algae) and bacteria, which separates live coral tissue from white, denuded carbonate skeleton. Death can be shockingly swift for corals which grow one centimeter or less per year; BBD may advance across the surface of its host at up to two cm/day, killing an entire coral during one season. In some cases signs of BBD may disappear, but infections often reinitiate, frequently in the same location.

Research on BBD conducted over the past seven years reveals that BBD has become a chronic problem which is spread by water currents and wave action. Once the disease invades a reef tract, it continues to advance from one susceptible coral to the next, year after year. On one of the most spectacular reefs in southwestern Puerto Rico, colonies of mountainous star coral (Montastraea faveolata) hundreds of years old and several meters in height and diameter suddenly became infected with BBD. Considered to be the major reef framework-building species on Caribbean reefs today, these corals were losing tissue each day at a rate which exceeded their total growth in a year.

Treatments

Three methods were designed and tested to eliminate BBD infections and save the remaining tissue of affected corals. One of those methods involves removal of the BBD material and then sealing the injury. A method was needed that did not require expensive equipment and was simple to perform, with the aim that it could be undertaken by community volunteers with minimal training. Because BBD is spread by water motion, care was taken to remove the bands without liberating filaments into the water column, which could result in additional infections downstream. These early trials demonstrated that removal of the band alone did not result in total elimination of the disease. A few cyanobacterial filaments remained firmly anchored in the coral tissue, and these eventually grew into a mat which continued to destroy the corals.

BBD removal was then supplemented with the application of a putty "bandage," and proved to be exceptionally successful. Corals were effectively treated by covering the disease site at the interface of live tissue with a two-part underwater swimming pool repair compound (putty), that, when mixed together, hardens within 15 minutes. Additional trials were conducted by simply covering the entire band with putty without first removing it, minimizing the risk of accidental infection. Both methods resulted in upwards of 90% success, and after three years the corals are growing back over the putty barrier. Putty proved to be a highly efficacious treatment which prevented further destruction of century-old colonies, however disease removal is time intensive, and reefs benefit on a relatively small scale.

Herbivorous Sea Urchins

A mass mortality of the long-spined sea urchin Diadema antillarum, first observed in Panama in 1983, spread around the western Atlantic, seriously impacting reefs throughout the area. Algae proliferated as a consequence, and corals began experiencing a progressive overgrowth and smothering. Areas most affected, such as Jamaica and Haiti, have also experienced a collapse of herbivorous fish populations from decades of intense subsistence fishing. Without the herbivores to control the algae, slow-growing

corals are outcompeted, and space for settlement of coral larvae is scarce. This stress makes corals more vulnerable to pathogens like black-band disease.

On a reef with abundant BBD and high macro-algae cover, healthy and BBD-infected corals were enclosed with various numbers of Diadema in order to determine the most effective urchin density for controlling BBD. At the optimal density, which depended on the size of the enclosure, the abundance of corals, and the biomass of algae, urchins consumed the disease and the algae surrounding the corals. The number of urchins required was dependent on the amount of food available. In cases where the amount of algae exceeded grazing pressures, the BBD was not always consumed; conversely, once the BBD and algae were grazed, urchins would feed on corals. Urchins also could not reach the disease in crevices between corals.

Reducing Ambient Light

The cyanobacteria involved in BBD require light for photosynthesis, and thus are restricted to shallow depths except on reefs with high water clarity. Because infections are often concentrated, it was believed that a reduction of the available light would be a viable method to eradicate a large number of infections simultaneously. Sun screening (nylon mesh used in gardening) which filtered out different amounts of light were attached to wire-frame cages and placed over corals infected with BBD. The densest screening, which allowed 20 percent light transmittance was the most successful; the rate of coral tissue destruction was immediately reduced and the disease was eliminated within two weeks. At 40 percent light transmittance approximately half the corals were successfully treated, primarily those located in slightly deeper water.

Conclusion

These treatments demonstrate that corals with black-band disease can be saved, and when used on a reef-wide basis can significantly reduce the spread of this pathogen. Treatment is a temporary solution at best to a growing problem, however. Scientists are working to determine what causes BBD to first appear on a reef, and develop management solutions to eliminate the source of the threats impacting coral reefs today.

For more information, contact Andrew Bruckner or Robin Bruckner, University of Puerto Rico, NOAA/NMFS, Office of Protected Resources,1315 East-West Highway Silver Spring, MD 20910, Phone: (301) 713-2319, Fax: (301) 713-0376, E-mail: andy.bruckner@ noaa.gov or robin.bruckner@noaa.gov

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Block Island Shellfishing Returns After 13 Years

Off the Rhode Island coast lies the popular summer resort of Block Island. Great Salt Pond is its largest harbor, 800 acres in size with four private marinas, public and private moorings, and a large public anchorage. In 1973, the Rhode Island Department of Environmental Management closed shellfishing in the Pond during the summer season due to the high potential for sewage contamination from boats. (Before and after the boating season, coliform counts drop so low that shellfishing is open from mid-October through mid-May.) In 1991, the town began providing mobile pumpout vessel service to anchored boats. By 1992, all marinas were required to install pumpout stations, at their own expense, connected to the town sewer line. Coliform sampling in 1992 showed that 11 out of 14 samples exceeded the shellfish standard during the summer season. By 1993, only six of the 14 samples exceeded the standard. That same year, Great Salt Pond was designated as a no-discharge zone. A second pumpout boat began operation in June of 1996. This combination of regulatory changes and availability of suitable support facilities led to significant improvements in water quality-with the result that shellfish beds were open for fishing all summer long in 1997.

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NOAA Welcomes Georgia to the National Coastal Zone Management Program

Georgia became the 32nd participant in the national Coastal Zone Management partnership when NOAA's Office of Ocean and Coastal Resource Management (OCRM) approved the state's Coastal Zone Management Program in January, 1998. With the approval of Georgia's program, all ocean-facing states are now included. Together, these programs include over 99% of the nation's 95,000 miles of oceanic and Great Lakes coastline. Georgia joins Texas and Ohio as states entering the national program in the past 15 months.

Georgia's Coastal Area

The influence of the ocean on Georgia's coastal plain extends approximately 60 miles inland. An eight-foot tidal range pushes seawater up coastal rivers twice daily, influencing their plants, fish, and ecology and, consequently, human activity. The Georgia Coastal Management Program encompasses all tidally-influenced water bodies and areas economically tied to coastal resources; the state's six coastal counties and five "second tier" counties, all tidal waters to the three-mile seaward limit of state jurisdiction, and all submerged lands under those waters.

The coastal area is an important economic base for a number of industries, including shrimping, crabbing, recreational fishing, tourism, and manufacturing. Pressures from increasing population and development, however, threaten the quality of life on the coast. The population of coastal Georgia is growing at approximately 20% per decade, and this trend is expected to continue.

Although there are clusters of intense development, much of the Georgia coast is presently relatively undeveloped; as of the mid-1980s, only 4% of the coast was considered developed. Approximately 32% of the coastal zone could be developed and so a need was recognized for better growth management and development planning. Georgia looked to the national coastal zone management program as a means of assistance.

The Georgia Coastal Management Program

The Georgia Department of Natural Resources (DNR) began its program development process in 1992. From the outset, Georgia officials realized that successful development of a Coastal Zone Management Program depended on extensive public involvement. An advisory committee, composed of private citizens and local officials, worked with DNR through the completion of the effort. The committee continues to function and will advise DNR on annual funding priorities and other matters. The DNR also used public meetings, a quarterly newsletter, speeches and presentations, and printed materials to gather public input.

In 1994, the advisory committee convened nine public task forces made up of 120 people. The task forces generated over 350 policy recommendations in the following topic areas:

Public Involvement
Public Service Facilities
Development and Manufacturing
Dredging
Transportation Facilities
Energy Facilities
Agriculture and Silviculture
Special Management Areas
Recreation and Tourism
Shorefront Access and Protection
Marine Related Facilities
Shoreline Erosion and Hazard Mitigation Planning
Fisheries, Aquaculture, and Wildlife

The legally-enforceable aspects of these policies are contained in existing state laws, rules, and regulations. The policies will also guide actions by state agencies and non-regulatory decisions in the future.

The Georgia Coastal Zone Management Program is administered by the DNR's Coastal Resources Division, along with a network of state agencies. Key state authorities include the Coastal Marshlands Protection Act, Shore Protection Act, and Revocable License authority, which together manage Georgia's coastal marshes, beaches, dunes, and tidal water bottoms. Other statutes, which focus on such activities as erosion and sedimentation control, and ground and surface water use are implemented by networked agencies.

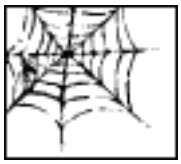
While the program relies primarily on state authorities, local governments play an important role. They create comprehensive plans, establish zoning rules and regulations, and set overall land use guidelines making their actions paramount in setting the pace of development. One significant role for the Georgia Coastal Management Program is, therefore, to assist local governments by providing technical and financial assistance in addressing planning and coastal issues.

Approval of the Georgia Coastal Zone Management Program

Federal approval did not come quickly or easily. In 1995, the state produced a draft Coastal Management Program document based on the premise that existing state laws and regulations were sufficient for federal approval of the program, and no new laws would be needed. The state Attorney General's office subsequently ruled otherwise, finding that new legislation would be required in order to seek federal approval of the Coastal Management Program.

In 1996, a state Legislative Study Committee looked at whether to introduce coastal management legislation into the General Assembly. The Study Committee asked DNR to revise the program document and hold two public hearings before issuing its recommendation. After reviewing the revised document and hearing records, the Committee voted unanimously to recommend the introduction of the Georgia Coastal Management Act into the General Assembly which passed the bill-with little opposition-in 1997 session, setting the stage for program approval.

For further information contact Josh Lott, OCRM; phone: (301) 713-3117 ext. 178; E-mail: josh.lott@noaa.gov or Dr. Stuart Stevens, Georgia Department of Natural Resources; phone:(912) 264-7218; E-mail: stuart@dnrcrd.dnr.state.ga.us.



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Harmful Algal Blooms

Harmful Algal Blooms (HABs) is a relatively new term used to describe a proliferation, or "bloom," of single-celled marine algae called phytoplankton. Once more commonly referred to as "red tides," these blooms occur when the algae photosynthesize and multiply. While there are thousands of phytoplankton species in existence, only a few dozen are known to be toxic. However, because phytoplankton serve as the base of the marine food web, the impact of these blooms can be devastating for consumers throughout the food web and for other marine flora or fauna in the affected ecosystem. Even blooms of non-toxic species can spell disaster for marine animals since the massive quantities of phytoplankton deplete the oxygen in the shallow waters where most phytoplankton blooms occur.

Recently, the world's coastal waters have experienced an increase in the number and type of HAB events. This is especially true in the United States, where virtually every coastal state is now threatened, in some cases by more than one species.

As to the causes of this trend, scientists say the jury is still out. Possibilities range from natural causes (species dispersal) to human-related causes (nutrient enrichment, shifts in global climate, or transport of algal species by ship ballast water).

Impacts of HABs

The species of marine phytoplankton that cause HABs-and their effects-vary dramatically. While some are toxic only when concentrations reach high densities, others can be toxic at very low densities (only a few cells per liter). Whereas some blooms discolor the water (thus the terms "red tide" and "brown tide"), others are undetectable by even highly sensitive satellite imagery techniques designed to pick up color differences.

While the bloom characteristics of HABs are highly variable, the effects of HABs generally fall into two major categories, public health and ecosystem effects and economic impacts.

Public Health and Ecosystem Effects

- filter feeding shellfish (clams, mussels, oysters, scallops) may accumulate algal toxins by feeding on the toxic phytoplankton, sometimes at levels potentially lethal to humans or other consumers and may decrease light penetration, an important consideration for many organisms;
- potential fish, shellfish, and bird kills, occasionally invertebrate and marine mammal kills;
- discoloration of water can be aesthetically unpleasant;
- toxins or other compounds released by the microalgae can kill marine fauna directly or result in low oxygen conditions as the bloom biomass decays (especially dangerous for aquaculture sites where fauna cannot easily escape); and
- blooms of seaweeds can be harmful to seagrass and coral reef ecosystems and the food webs that are dependent on those system.

Economic Impacts

- shellfish bed closures or quarantines, wild or farmed fish mortalities, loss of income due to closures and mortalities, and consumer fear of purchasing seafood are the most direct and costly economic impacts, but indirect impacts, such as fear of investing in aquaculture businesses, are also costly;
- lost marine recreational opportunities including tourism, fishing, shellfishing, swimming and sunbathing resulting from blooms, including dead fish or shellfish washing up on beaches, discolored water, noxious odors, and human respiratory problems caused by toxins released into the air;
- cost of maintaining monitoring and testing programs designed to detect algal toxins and costs associated with cleaning up fish or shellfish kills when they do occur; and
- medical costs and lost productivity of workers poisoned by HAB toxins is a significant and recurring annual impact.

Overall, preliminary estimates of the overall impact of HAB outbreaks on the U.S. economy, taking the above factors into account, are over $40 million per year, or nearly $1 billion over a decade.

HAB Research Directions Now Underway

HAB research has been taking place for over two decades. Unfortunately, due to the complexities of the individual species and the fact that identical species can behave differently region-to-region or under different environmental conditions, there remain many more questions than answers.

Research, to date, has focused primarily on the following:

- physiology and behavior of individual HAB species and toxins,
- causes of HABs, and
- predicting or detecting the occurrence of HABs and their toxins.

In 1995, a national, multi-agency research agenda was initiated to increase the understanding of impacts and population dynamics of HABs. The program, called ECOHAB (ECology and Oceanography of Harmful Algal Blooms), is supported by the National Oceanic and Atmospheric Administration (NOAA), the National Science Foundation (NSF), the Environmental Protection Agency (EPA), and the Office of Naval Research (ONR), and is administered by NOAA's Coastal Ocean Program and the National Sea Grant College Program.

What Do We Know?

Research over the past few decades has yielded a number of important results with respect to HABs. These include:

- In the northeastern U.S., the dynamics of toxic dinoflagellate blooms have been well characterized, including the identification of a "source" or initiation zone where blooms begin that eventually impact hundreds of miles of coastline, and the documentation of a transport pathway for these blooms via a coastal current originating in the freshwater outflow of two rivers in western Maine.
- Discovery of toxic dinoflagellate cysts in areas of Connecticut and Long Island where paralytic shellfish poisoning (PSP) had never been recorded. When state agencies began monitoring these sites, PSP toxicity was detected, necessitating annual shellfish testing programs that continue to this day.
- Development of antibody and DNA "probes" that are being used to detect HAB species and their toxins in natural waters more rapidly and accurately than is possible with conventional techniques. For example, an antibody probe to the brown tide chrysophyte Aureococcus anophageffferens is now used by all researchers conducting laboratory or field studies of this tiny, non-descript organism.
- Development of methods to utilize satellite imagery of coastal waters (through the NOAA Coastwatch Program) to follow HABs and the water masses with which they are associated.
- Research on a "phantom" dinoflagellate responsible for fish kills in laboratory aquaria in North Carolina led to the eventual discovery of Pfiesteria piscicida and related organisms, now known to be responsible for human illnesses, diseased fish, and massive fish kills in Florida, North Carolina, Delaware, Virginia, and Maryland.

- Field studies of toxic Alexandrium within Massachusetts Bay and waters to the immediate north provided critical information in the policy debate on the potential impact of Boston's sewage outfall relocation. Opponents to the outfall cited increases of blooms of toxic and noxious algae, and even increased mortality of the endangered right whale in their litigation to stop the outfall construction.
- Research on the factors regulating the recurrence of harmful "brown tides" in Long Island waters has identified a number of key factors, including the composition of the microzooplankton grazing community and the influence of the nature and composition of groundwater on brown tide growth and nutrition.

Where Do We Go From Here?

Three areas of HAB research that have gone largely unexplored, at least in the U.S., are now the focus of a NOAA initiative aimed at guiding federal, state, and local policy in dealing with the growing problem of HABs:

- management options for reducing the incidence of HABs,
- control of HABs, and;
- reduction in economic and resource losses and human health risks associated with HABs.

At the national level, a lot of attention has been given to the most recently discovered toxic dinoflagellate, Pfiesteria piscicida, (thus the term "Pfiesteria Hysteria"), but it is only one of many HABs that can have disastrous consequences for a region's economy, while threatening public health and safety.

Excerpted with permission from Sea Grant Focal Points, April, 1998 newsletter.

For further information contact: WHOI Sea Grant Program, Woods Hole Oceanographic Institution, MS#2, Woods Hole, MA 02543, phone: (508) 289-2398, fax (508)457-2172, e-mail: seagrant@whoi.edu

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Update on Jordan Cove:

Planning Green Development Takes Creativity, Flexibility and Cooperation

In the Autumn, 1996, issue of Coastlines, we described an innovative, planned residential subdivision to be constructed near Jordan Cove, a Long Island Sound embayment in Waterford, Connecticut. It is part of a select group of projects funded in part by the Connecticut Department of Environmental Protection (DEP) through the US EPA's National Monitoring Program under Section 319 of the Clean Water Act. Forty percent matching funds are being provided by other project participants and the developer/owner. The DEP has contracted with the University of Connecticut for project management.

A paired watershed approach is being applied to stormwater quality monitoring on two separate sections of the subdivision. One section is being developed in traditional grid or "cookie-cutter" style lots, featuring a constructed wetland and the latest in oil/grit separators, while the other utilizes a cluster approach with a wide variety of best management practices (BMPs) incorporated into the design. Grass swales; roof leader "rain gardens;" pervious driveways; "low-mow" and "no-mow" and conservation zones; a pervious road with a central bioretention garden; -you name it, it's all there!

The journey from design concepts to actual construction required concentrated efforts. Once an acceptable project was hammered out and committed to paper, the applicant appeared before Waterford's

Inland Wetlands and Planning and Zoning Commissions. As is typical of New England town government, both commissions paid close attention to planning decisions at a series of public meetings where many development alternatives were reviewed. Concerns raised included health, safety and general welfare of the town's people, and the social, economic, environmental, and political viability of the proposed plan.

After several wintry evening meetings in late 1996 and early 1997, the project was approved by both commissions. Technical modifications of existing standards were handled in four ways-as waivers, special design/operation controls, mitigation and discretionary actions. The attached table lists each of these categories with associated comments and concerns expressed by Waterford's professional staff and commissions. In the end, the willingness of all parties involved to work in concert, each "giving" a little and "taking" a little, has allowed this novel project to become a reality.

From the outset, it was recognized that finding a community willing to commit to the long-term goal of protecting water resources would be essential to the project's success. Green (vegetation) was a key design parameter used for the BMP/cluster layout. Around the country, communities are recognizing that conservation of open space can benefit their economic, as well as their environmental, health. Protection of environmentally sensitive lands, such as critical watershed areas, presents special challenges that usually require a combination of regulatory approaches with public and private sector support. This project is evidence that such support is possible-when participants are willing to work together and empathize with each other's concerns.

A year from now, this combination of traditional and innovative design for residential subdivisions should be fully constructed. Stormwater quality monitoring will be conducted for several years after build-out to determine the overall efficiency of the design. It should demonstrate that careful planning, landscaping, and use of vegetative BMPs can help protect and enhance the environment, while addressing other concerns that local planning and zoning commissions face.

Considerations

- BMP/Cluster Design
- Traditional Design
- Comments

Waivers

- alternative pavement
- Specified materials
- must be approved by police and public works department

needed

- reduced road width to 20 feet for travel lane
- typical road width = 28 feet, reduced to 24 feet

- no curb required
- curb required
- "pull off" capability required for safety, pavers installed to maintain road edge integrity

- grassed swales and sheet flow off road
- 50' paved/60' right of way turning radius

- one way cul de sac design to reduce road width and turn radius.
- further reduction in width and need for less snow plowing

Special Design/

- rain gardens
- planning and zoning standards
- retain roof runoff

Operational Control

- vegetative maintenance
- home owner discretion
- reduces fertilizer use

- pesticide management
- home owner discretion
- reduce pesticide use

- domestic animal management
- home owner discretion
- reduce pathogen runoff

Mitigation Required

- treatment of existing road runoff
- need to manage stormwater entering the site

- Creation of 13,400 sq ft wetland at sub-division entrance
- required to mitigate filling of 5,000 sq ft of wetlands within subdivision

Discretionary Actions

- cluster and zero setback from lot lines
- R-20 single family zoning
- allows more open space

- Open space layout, contiguous to all lots
- Open space not contiguous with all lots

- combined driveways
- a driveway for each home
- requires neighbor interactions regarding maintenance and snow removal

For further information contact: Stan Zarumba of the Nonpoint Source Program at the Connecticut DEP; phone (860) 424-3730;
E-mail stanley.zaremba@po.state.ct.us

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New Report from the Environmental Defense Fund on Environmental Effects of Aquaculture

"Murky Waters: the Environmental effects of aquaculture in the United States" is the title of a report released by the Environmental Defense Fund which suggests that most large US fish farms are "aquatic feedlots," similar to other forms of intensive animal production which can produce large quantities of wastes. These wastes are released directly into waterbodies and have the potential to contribute to nutrient overloading. The report also suggests that aquaculture may result in a net loss of fish protein, since feeding them can require catching more fish from the ocean than are ultimately produced on the farms. However, the report concludes that some forms of fish farming are less polluting than others, and a number of these technologies and practices are already being used by some fish farmers.

(Excerpted with permission from SeaWeb, Ocean Update). For a copy of the report, contact: Becky Goldburg; Environmental Defense Fund; phone: (212) 505-2100.

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Red tides devastate Hong Kong fisheries

Residents of Hong Kong have been advised not to eat shellfish from the Chinese Province's coastal waters following blooms of the toxic dinoflagellate Alexandrium excavatum that have devastated fishing and aquaculture in the former British colony. Over 1,500 tons of fish have been killed by the red tides, which began in March. The waters of some fish farms have reportedly become "choked" with dead fish, following what an Agriculture and Fisheries official called the "worst natural disaster" ever to hit Hong Kong.

In an attempt to beat the algal blooms, fishermen have been revving up their boat propellers to try and push the red tide back out to sea as soon as they spy any discoloration in the water.

The second species, A. excavatum, reported to be causing red tides in Hong Kong waters over the past few weeks. The other was Gyrodinium aureolum another dinoflagellate which, like A. excavatum, also produces neurotoxins. The Hong Kong red tides mark the first time G. aureolum has been reported in the region. It was previously known only from the Atlantic coast of the United States, and the North Sea.

Much of the blame for the emergence of the red tide has been placed on the practice of dumping raw sewage directly into coastal waters. Nutrient pollution from sewage, fertilizers, and runoff, among other sources, has frequently been flagged as a major contributor to what has been termed a "global epidemic"

of harmful algal blooms.

Writing in the journal Hydrobiologia, two researchers from Hong Kong have suggested that it is not so much the absolute amount of nutrients entering coastal waters, as their relative ratios, that is a more important regulator of red tide levels. Several researchers have previously noted that increases in the ratio of nitrates or phosphates to silicates in coastal waters can cause changes in the relative abundance of diatoms, phytoplankton with hard, silicate-based shells and dinoflagellates. Now the two researchers have found a correlation between even slight perturbations in the ratio of nitrates to phosphates and explosions in algal blooms. Accordingly, they argue, efforts to control pollution of nitrogen-based compounds is of only limited usefulness if not accompanied by similar restrictions on phosphate pollution.

(Excerpted with permission from SeaWeb, Ocean Update) Source: I.J. Hodgkiss & K.C. Ho. Are changes in N:P ratios in coastal waters the key to increased red tide blooms? Hydrobiologia 352:141-147

Contact: I.J. Hodgkiss, Department of Ecology and Biodiversity, The University of Hong Kong, Hong Kong, People's Republic of China

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A Helping Hand: Postal Service Efforts to Restore the Chesapeake Bay

If you live within the Chesapeake Bay watershed, you may notice some changes the next time you visit your local post office. Look closely and you'll see newly planted blueberry bushes, holly trees, or rhododendrons. These new plantings are part of the United States Postal Service's efforts to promote BayScaping. BayScaping is environmentally sound landscaping that preserves water quality and creates wildlife habitat, while saving time and energy by reducing maintenance and water usage.

The Postal Service BayScape projects are part of its greater efforts to restore and protect the Chesapeake Bay. Through a memorandum of understanding (MOU) signed in 1996 between the Postal Service and the Environmental Protection Agency's (EPA) Chesapeake Bay Program, the Postal Service is committed to assisting the EPA in protecting the ecosystem, partnering with other federal agencies to champion environmental stewardship of the bay, working with municipalities on improving coordination and involvement, and helping to increase public awareness.

The Chesapeake Bay drains freshwater from a 64,000-square-mile watershed that includes portions of seven states. Within the borders of the Chesapeake Bay watershed, the Postal Service operates approximately 3000 facilities, including processing and distribution centers, bulk mail facilities, vehicle maintenance facilities, air mail facilities, and local post offices. They range in size from less than 1 acre

to as much as 30 acres and are located on both urban and rural sites.

As part of their agreement with EPA, the Postal Service developed its first biennial Chesapeake Bay Program Action Plan in October 1997. The action plan, which contains the Postal Service's commitments to the EPA, will be updated every 2 years. It formalizes the actions needed to fulfill the agreements in the MOU, as well as the steps necessary for the Postal Service to support the protection and restoration of the Chesapeake Bay. The five goals of the action plan are as follows:

- Assist the EPA in ecosystem protection that can be directly influenced by action of the Postal Service.
- Partner with other federal agencies to champion the concept of environmental stewardship to preserve and protect the natural resources of the Chesapeake Bay.
- Work with municipalities on improving coordination and involvement with bay protection and restoration efforts at the state and local levels.
- Assist the EPA with efforts to increase public awareness of the Chesapeake Bay Program and bay restoration at local postal facilities.
- Develop an action plan for setting goals and implementing these commitments.

The first step the Postal Service took in accomplishing these goals was to inventory all postal facilities located in the watershed. This information is being entered into a geographical information system (GIS) and overlain with natural resource data. Because the watershed crosses states, as well as Postal Service district areas, it was important for the Postal Service to determine which facilities fall within the watershed's boundaries. The Postal Service intends to use the GIS data when making decisions or establishing programs regarding projects situated within the Chesapeake Bay watershed.

In another effort, the Postal Service is helping the Chesapeake Bay Program reach its goal of reducing the amount of nitrogen and phosphorus entering the bay by 40 percent by developing a generic grounds management plan (GGMP). Traditionally, grounds management plans emphasize landscaping techniques-the GGMP, however, is unique in that it is holistic, incorporating BayScapes (e.g., integrated pest management), natural resource conservation, stormwater management, and exterior maintenance. The GGMP focuses on the grounds management activities of both postal employees and contractors to ensure they are consistent with the overall goals and objectives of the Postal Service and the Chesapeake Bay Program. The GGMP will be based on existing Postal Service environmental policies, and new programs and procedures will be developed where appropriate. Once the GGMP is complete, it will be implemented at four model facilities and evaluated for implementation at other Postal Service sites.

The Postal Service is striving to educate both employees and the public who work and live in the watershed. In a partnership with the Alliance for the Chesapeake Bay, it is in the process of developing a poster to illustrate the benefits of BayScaping. The poster, which should be completed in August, 1998, will be used by the Alliance as an awareness tool and displayed at local postal facilities throughout the watershed. The goal is to emphasize to the public the benefits of incorporating BayScape techniques on their own property. The Postal Service is also designing a brochure geared toward employees that will include specific information on BayScaping practices.

Under the MOU with the EPA, the Postal Service has once again shown its commitment to being an environmental leader. As one of the largest businesses within the watershed, it can have a major impact on the restoration and protection of the Chesapeake Bay. The Postal Service will continue to look for opportunities to assist with the restoration and protection of the bay as well as inform the general public as to how they can protect this vital natural resource.

For further information contact: Sharon Marsh, Environmental Management Policy, (202) 268-6486, or Dawn Lebek, Baltimore District Environmental Compliance Coordinator, (410) 347-4277 or visit our web site at http://www.usps.gov/environ/

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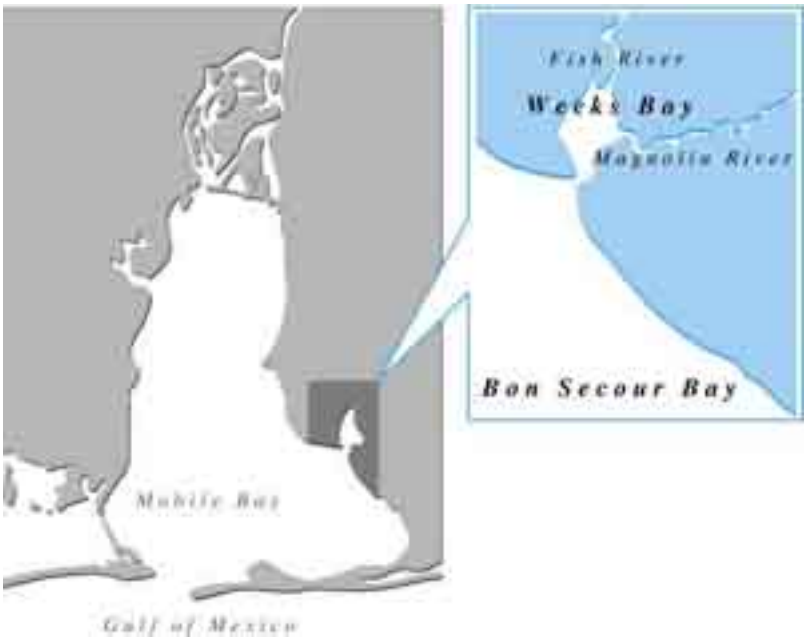
The Weeks Bay Shoreline & Habitat Restoration Project

Characteristics:

The Mobile Bay watershed drains 44,170 square miles, making it the sixth largest drainage basin in the country. Although this watershed covers two-thirds of the state of Alabama, as well as parts of Georgia, Tennessee and Mississippi, the study area for the Mobile Bay National Estuary Program is limited to the state's two coastal counties, Mobile and Baldwin. Within this estuarine zone there are approximately 433 miles of shoreline. The Weeks Bay watershed, a 200 square mile sub-watershed, is located in Baldwin County on the eastern shore of Mobile Bay.



The Problem:

The Mobile Bay area, like much of the country, is characterized by loss of wetlands, especially salt

marsh due to a variety of causes. Dredging to improve boat and ship access has resulted in the conversion of marsh to open water. Further marsh loss is caused by propeller wash and wave action from both high speed pleasure boats and large slow moving ships which erodes banks. This is in addition to shoreline loss from normal wave actions and seasonal storms. Historic trend data indicates that certain marshes in the MBNEP area have been eroding at a rate of up to ten feet per year. To protect their waterfront property, an owner's typical response has been to construct a bulkhead which, of course, accelerates marsh loss and erosion of neighboring properties.

The Project:

The Weeks Bay Shoreline and Habitat Restoration Project is a joint project of the U.S. Fish & Wildlife Service and the Alabama Coastal Foundation and a private land owner, designed to bring partners together with the local public to test innovative solutions which stem the decline of and restore important habitat for marine life in Weeks Bay, a sub-estuary of the Mobile Bay Estuary.

Introduction to Mobile Bay

Mobile Bay has a surface area of approximately 248,000 acres with an additional 21,000 acres of tidal marsh, tributaries and connecting bays. The Delta, forming the northern border of the Bay, has an area of approximately 185,000 acres, including open water, fresh marshes and forested wetlands.

The national significance of Mobile Bay and Delta lies in the magnitude of its natural resources. The estuary provides important habitats for many commercially and recreationally important fishery and wildlife species, as well as for a number of rare and endangered species of plants and animals. Home to 310 species of fish, 15 species of shrimp, 57 species of mammals, more than 300 species of birds, 40 species of amphibians and 68 species of reptiles. The estuary also sustains significant recreational activities, a booming tourist economy, waterborne commerce and port related industries and other major industries.

Like most of the coastal United States, population growth throughout Mobile and Baldwin Counties continues to pose environmental management problems as development efforts encroach more and more on wetlands areas. Between the mid-1950's and the late 1970's, 34 percent of the wetlands in the northern Mobile Bay were lost compared to the national and southeastern average of eight percent.

Overview of Weeks Bay

The Weeks Bay watershed includes almost 126,000 acres in Baldwin County, Alabama on the eastern shore of Mobile Bay. It is representative of the greater Mobile Bay system. Primarily rural, the area is the fastest growing county in Alabama, fueling an increasing demand for waterfront footage.

Project Description

In 1997, EPA's Mobile Bay National Estuary Program sponsored The Weeks Bay Shoreline and Habitat Restoration Project, a joint project of the U.S. Fish & Wildlife Service, Alabama Coastal Foundation and other partners. A model for the project, the Louisiana Parish Coastal Wetlands Restoration Program, was discovered by a member of the Mobile Bay National Estuary Program Policy Committee, representing the Mobile Area Chamber of Commerce.

The model consists of the construction in shallow water of a "brush fence," or wooden bin, parallel to the eroded shoreline, which holds discarded "Christmas" trees. The brush fence serves as a breakwater to heavy wave action and the Christmas trees work as a filter, to gently settle out sand and silt, rebuilding the shoreline and important safe habitat for juvenile marine life.

Project Objectives

The project objectives of the Weeks Bay Shoreline and Habitat Restoration Project were to:

- Restore eroded shoreline
- Restore safe habitat for juvenile marine life
- Bring together members from each of the Mobile Bay National Estuary Program (MBNEP) committees (Policy, Management, Technical and Citizens) on one practical demonstration project.
- Involve local partners and the public in a hands-on project, which would bring greater awareness of the priority problems facing the Mobile Bay National Estuary system and,
- highlight the activities of the MBNEP to stem those effects.

Project Implementation

Early on in the organization of the Mobile Bay National Estuary Program it became clear to all of the committees that two of the priority problems facing the estuary system were an eroding shoreline and the loss of important habitat for marine life and other wildlife. As the work of gathering data and characterizing effects continued in the technical work groups, such as those on Water Quality and Habitat Loss, these priority problems were confirmed and underscored.

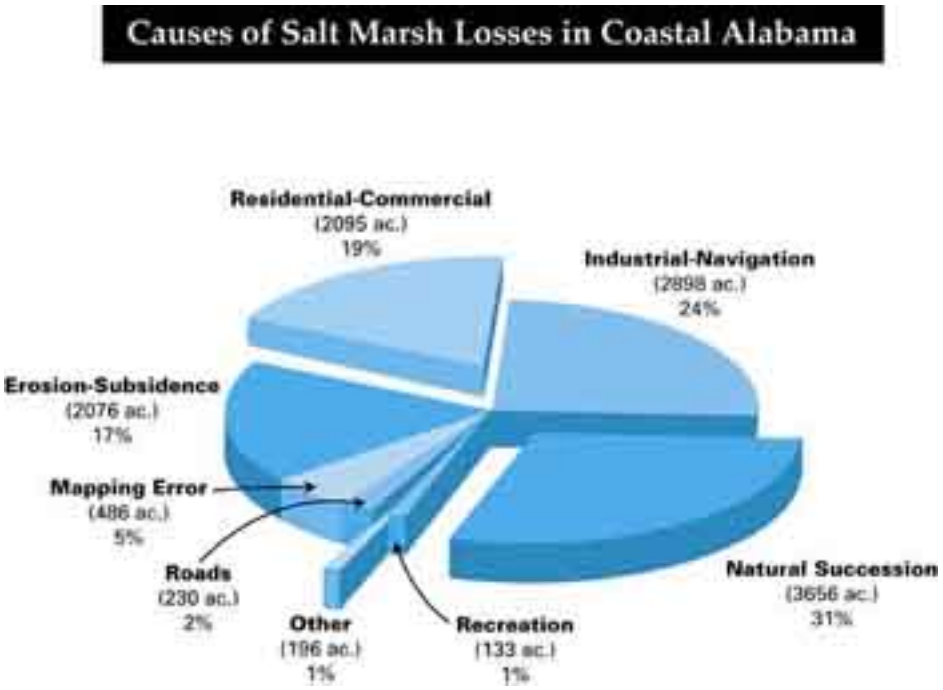
The Mobile Area Chamber of Commerce, serving as a representative of the Policy Committee, became aware of an innovative model used to restore wetlands in Louisiana, and shared it with members of the Management Committee, the U.S Fish & Wildlife Service (USFWS) and Alabama Coastal Foundation (ACF). Working jointly, USFWS and ACF submitted the project as the MBNEP's first Action Plan

Demonstration Project (APDP), which was approved. It was determined that USFWS would advise on the technical and scientific issues, while the ACF assisted in public outreach.

USFWS, also serving on the Technical Advisory Committee, convened a group of experts to visit some of the Louisiana sites and speak with conservation and regulatory officials there about successes and pitfalls. Accessibility was an issue in Louisiana with many sites requiring highly technical helicopter drops of Christmas trees into the bayous.

After the Louisiana visit, the US Fish and Wildlife Service, on behalf of the Technical Advisory Committee, served as the local site selection team. After considering a variety of sites in Mobile and Baldwin Counties, and with the help of the Weeks Bay National Estuarine Research Reserve, a construction site was selected. The site, off the coast of Weeks Bay, an inlet of the Mobile Bay system, was chosen based on the USFWS' overall knowledge of Mobile Bay and after considering potential access problems.

The site was ideal: the shoreline was eroding at a rapid rate, was partially protected from direct storm events, was accessible, and, importantly, the property owner-Beckwith Episcopal Camp was eager to participate.



USFWS moved into action, working with Beckwith to draw up a plan for construction and seek the necessary permit with the U.S. Army Corps of Engineers. The permit was granted, based on the authorization by Nationwide Permit 27 (Wetland and Riparian Restoration and Creation Activities). USFWS then employed its summertime Youth Conservation Corps to construct the brush fence according to the plans, resulting in a wooden bin 5 feet wide by 170 feet long.

Prior to the location and installation of the Christmas trees, one of the areas' frequent storm events occurred: Hurricane Danny moved into the area for three days, pelting the coastline with heavy ran, winds and waves. The site held up well; with only minor damage, the brush fence remained intact, and is believed to have helped in protecting the area from storm erosion.

ACF then moved into action during August, partnering with local Christmas tree grower, McDavid Christmas Trees in Grand Bay (Mobile County), to supply unusable Christmas trees for installation in the brush fence. Alabama Power Company supplied the large trucks and manpower necessary to transport

the trees to the site in Baldwin County.

The next step by ACF was a call for volunteers. All ages turned out for the "planting" event on Saturday, August 16, clad in waterproof shoes and boots, gloves, long-sleeved shirts and plenty of sunscreen. They were instructed in the process by representatives from the USFWS and ACF, who supervised the event. Just prior to planting, ACF took baseline photos of the site for monitoring purposes. The weather was great for getting wet! Volunteers set to work, forming a human chain to pass the discarded trees along and place them, lengthwise, in the brush fence. When the bin had been filled, volunteers took heavy nylon twine, criss-crossed it and tied it securely over the surface of the brush fence to prevent floating tree hazards in the case of storms or high tides.

Success Stories

- Beyond the many volunteers that turned out in person for the event, the media became enamored with the project. Coverage of the project appeared on local television, radio and in daily and weekly print newspapers, further meeting project objectives to enhance public awareness about the priority problems facing the Mobile Bay estuary system and the NEP's work to stem those effects.

- In early November, just two and one-half months after the installation of trees, USFWS and ACF returned to the site to determine if minor repairs were needed and were surprised to see a rapid rate of accretion in qualitative measures. In addition, partners discovered budding marine life in juvenile shrimp, crab and fish, breeding between the brush fence and the shore.

- The project became high profile and was discussed by scientists and technical specialists at numerous environmental meetings and gatherings, most notable was a Symposium on Beach Erosion hosted by the Dauphin Island Foundation, Dauphin Island Sea Lab, Alabama Coastal Foundation and Alabama Department of Community and Economic Affairs Coastal Program Office, where noted experts on shoreline erosion from around the country had convened.

- In January, USFWS and ACF conducted a semi-baseline survey of the site to better quantify the accretion rate, and ACF conducted a fly-over to take aerial photos. It was determined that quarterly surveys are sufficient to show accretion trends, and in early May, a second survey showed continuing rapid accretion in quantitative measures.

- In the spring/earyl summer of 1998,the Youth Conservation Corps/United Stats Fish and Wildlife Services planted black-needle rush (Juncus roemerianus) between the brush fence and the shore line. The purpose of the marsh planting was to increase the rate of sediment entrapment, fruther protection the shore line from erosion and to increase the amount offish, shellfish, and wildlife habitat along one shoreline.

- In short, all objectives were met. There has been clear restoration of marsh habitat, MBNEP

members at all levels were involved in the project, and many partners and the public shared in the involvement of the project, as well as awareness of priority estuary problems and activities to stem those problem.

Lessons Learned

The brush fence model clearly works to restore shoreline and habitat at appropriate, protected sites, though monitoring efforts are ongoing to determine any negative outfall, such as any associated erosion or other effect elsewhere on the adjacent coastline.

Expectations of success were modest, and though qualitative measures were employed initially, quantitative measures should have been included at the start as a true benchmark of success.

USFWS and ACF are scouring the Alabama coastline with to identify a different site with varying conditions that has a good expectation for survivability, in hopes of including the public on a broader scale.

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