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## **Information About Estuaries and Near Coastal Waters February 2000 - Issue 10.1**

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## **The Maryland Bay Game**

The Maryland Bay Game, an innovative and creative way to educate hundreds of thousands of children and motorists about one of the nation's greatest natural resources, the Chesapeake Bay, recently completed its third successful year. The Bay Game is designed to be played in the car while traveling from Maryland's Chesapeake Bay Bridge to the state's top summer vacation spot, Ocean City. Playing the game turns restless energy and a long car ride into an educational experience. The creative use of characters or mascots, Ol' Blue, Betty Lou and Baby Blue, help both youngsters and big kids alike identify with the Bay Game's environmental, historical and cultural messages while having fun! The success of this program is due to a multi-agency, intergovernmental and public/private collaboration. The Bay Game is published by Maryland state agencies, federal agencies and private corporate sponsorships.



Each summer, millions of people travel U.S. Route 50 to vacation in Ocean City, Maryland. Motorists using this route pass through a toll facility at the Chesapeake Bay Bridge, where Maryland Bay Game booklets are distributed and the activities in the booklet start. The trip to Ocean City from the Bay Bridge takes about 2 1/2 hours.

The Maryland Bay Game helps the general public understand the concept of a watershed and how daily activities affect the Chesapeake Bay. Sixty-four thousand square miles of land from 6 states and the District of Columbia drain into the Chesapeake Bay, including 95 percent of Maryland. The way people collectively use the land within the watershed poses the biggest threat to the health of the Bay, yet surveys continue to show that the general public does not feel connected to the Bay's health.

The Bay Game requires players to pay attention to their surroundings and take notice of things they see every day. A connection is made to the Chesapeake Bay to reinforce the message that although the Bay may not be visible from a certain location, land uses and activities within the watershed affect the Bay.



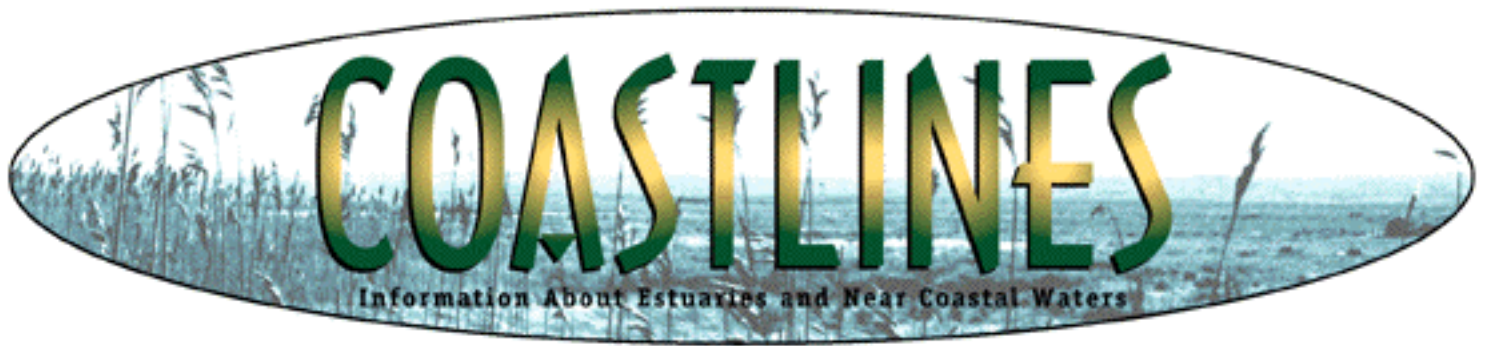
The game challenges players to look for specific Bay related items, such as osprey nests, wetlands and forest buffers. When players see these items, they take color stickers from the booklet's center sticker page and place them on matching illustrations in the game book. Another activity requires finding rivers and streams (Chesapeake Bay tributaries) crossed during the trip and locating them on a map in the game book. Bay Game sites are marked with temporary road signs and each site has an associated activity page, which includes information about the site. Other activities educate players about ways they can help the Bay, such as recycling, conserving energy, and planting trees.

Maryland's Department of Natural Resources manages the development and production of the Bay Game, publishing 300,000 copies, including 100,000 with survey cards. Survey statistics show that each player shares his or her game with at least three other people, increasing outreach to nearly 750,000 citizens every year. The survey indicates that 95 percent of Bay Game players said that they will personally do something to help the Chesapeake Bay because of what they learned while playing the game. The most outstanding survey result indicated that 80 percent of players think nutrients are the most harmful pollutants to the Bay.

To complement the Bay Game publication, a website was created to offer additional information and to deliver the game's important environmental stewardship messages to a broader audience. Plans for the Bay Game 2000 website include a virtual driving tour with digital photos of game sites, as well as increased links to other environmental organizations.

For further information, contact Alexis Grant, Special Projects Coordinator, Tawes State Office Building, 580 Taylor Avenue D-4, Annapolis, Maryland 21401, Phone: (410) 260-8016, E-mail: [agrant@dnr.state.md.us](mailto:agrant@dnr.state.md.us) or visit the web site at: <http://www.dnr.state.md.us/> [EXIT disclaimer ►](#)





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## The Buzzards Bay Atlas of Tidally Restricted Salt Marshes

The Buzzards Bay Project National Estuary Program has produced an inventory of tidally restricted salt marshes in nine towns within the Buzzards Bay watershed. The "Atlas of Tidal Restrictions-Buzzards Bay" documents salt marshes adversely impacted by human activities, especially transportation-related activities. The Atlas, currently in draft form, identifies tidal restrictions and prioritizes sites for remediation. The Buzzards Bay Project plans to use this document to help initiate salt marsh restoration projects, especially in areas where future road or bridge work is proposed. In many cases, tidal flow can be restored to degraded marshes simply by removing the restricting feature or by increasing the size of the structure to accommodate a full tidal flow.



Tidal restrictions can occur when roads and railroads are constructed over tidal creeks. Bridges and culverts are commonly installed to allow the movement of tidal waters. However, these structures are often too small to pass full tidal flows necessary to maintain natural salt marsh vegetation upstream. These hydrologic changes can cause a once-saline environment to become brackish or even fresh. Decreases in salinity cause a change in plant species, with native salt marsh grasses and rushes being displaced by upland or freshwater species. One common example of an adverse change in vegetation is growth of the common reed, *Phragmites australis*. This widespread species is particularly invasive and does not provide much habitat value. As salt marshes become fresher, *Phragmites* tend to invade, and what was once a low grassy meadow becomes a tall reedy thicket, causing shifts in wildlife use and fewer species using this habitat.

Identification of impaired salt marsh vegetation began in the winter of 1998. With the assistance of Wetland Conservancy Maps and a Global Positioning System (GPS), areas of habitat degradation within coastal wetlands were identified. Potential restoration sites were distinguished using aerial photographs and field checked to verify the existence of the restriction. In the field, information was collected on the potential cause of the degradation (tidal restriction, fill placement, etc.) and the effect of the restriction on the salt marsh. Stands of *Phragmites* were identified on 1:2,500 black and white orthophotos and a digital camera was used to document conditions at each of the sites.

The locations of tidal restrictions and *Phragmites* stands were transferred into a Geographic Information System (GIS) database, and a series of maps was created. Information on each restriction site was analyzed to prioritize sites for remediation. The first draft of the Salt Marsh Atlas was compiled and made available for public comment in May 1999.

The Buzzards Bay Project has already begun utilizing the data contained within the Atlas. Winsegansett Marsh was selected as the first demonstration project for salt marsh restoration. The Winsegansett Marsh system is a 30-acre coastal wetland on the western shore of Buzzards Bay in the Town of Fairhaven, Massachusetts. Located behind a barrier beach, the marsh is connected to the waters of Outer New Bedford Harbor and Buzzards Bay through a series of tidal creeks. The dominant plant communities within the marsh are *Spartina alterniflora* and *Spartina patens*.

Typical of many salt marshes in Buzzards Bay, the upper portion of Winsegansett Marsh has been separated from the remainder of the marsh by the construction of Winsegansett Avenue. The upper marsh receives saltwater flow through an insufficiently sized 18-inch culvert placed under the road. Also restricting the tidal flow are three privately owned culverts placed under footpaths crossing through the marsh to the beach. Due to restricted tidal flow, nearly half of the upper marsh has been converted to *Phragmites*, with the consequent loss of a healthy, productive salt marsh.

The Buzzards Bay Project, in partnership with The Town of Fairhaven, received funding through the Massachusetts Department of Environmental Protection's (DEP) 319 Non-point Source Pollution Program (\$22,500) and the EPA/NOAA 5-Star Restoration Challenge Grants program (\$9,700) to restore adequate tidal flow in Winsegansett Marsh. The funding will be used to remove the insufficiently sized

culverts from under Winsegansett Avenue and the footpaths and replace them with larger diameter culverts.

The culverts are scheduled to be replaced in the spring or summer of 2000. Biomonitoring is already being done to help evaluate the effectiveness of replacing the culverts to restore salt marsh. Buzzards Bay Project staff are currently mapping the extent of Phragmites in the marsh system using a GPS unit to assess changes in vegetative communities over time. Other parameters important to the establishment of salt marsh vegetation will be monitored, including salinity, tidal flow into and out of the marsh, and tidal height within the marsh. It is expected that yearly post-construction monitoring will reveal natural recolonization of *Spartina* as sufficient tidal flow is restored.

Matching funds (\$14,400) provided by Massachusetts Environmental Trust will be used to print and distribute a full color Atlas and create outreach and educational materials concerning the restoration project. To promote future restoration projects, the Buzzards Bay Project plans to develop an educational fact sheet describing the benefits of the Winsegansett salt marsh restoration project.

For further information on the "Atlas of Tidal Restrictions-Buzzards Bay," contact Sarah Wilkes, Phone: (508) 291-3625 or visit the Buzzards Bay Project's web site at <http://www.buzzardsbay.org/>.

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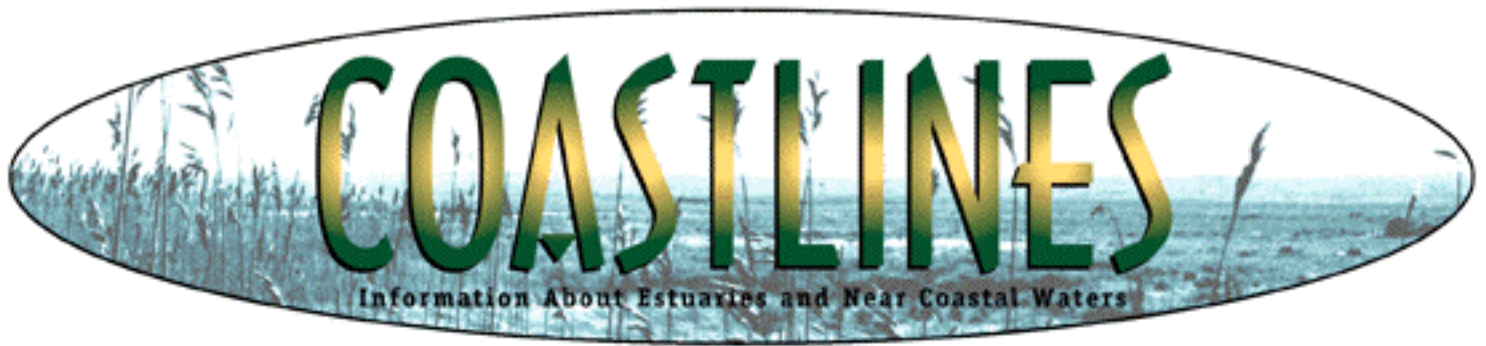
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## **USGS Announces Release of "Status and Trends of the Nation's Biological Resources" Report**

The U.S. Geological Survey announced the release of a report on the "Status and Trends of the Nation's Biological Resources." This two-volume report synthesizes current information within a historical perspective to document how the Nation's biological resources are changing. Volume One covers seven factors affecting biological resources nationwide: natural processes, land use, water use, climate change, nonindigenous species, environmental contaminants and harvest. Volume Two describes the status and trends of biological resources in 14 areas of the country and how they have been affected by these factors. Regions covered are the Northeast, Great Lakes, Southeast, Caribbean Islands, Mississippi River, Coastal Louisiana, Grasslands, Rocky Mountains, Great Basin-Mojave Desert, Southwest, California, Pacific Northwest, Alaska, and Hawaii and the Pacific Islands.

The 1000-page, peer reviewed report is written in non-technical language. For further information, visit the website at <http://www.usgs.gov/>. [EXIT disclaimer >](#)



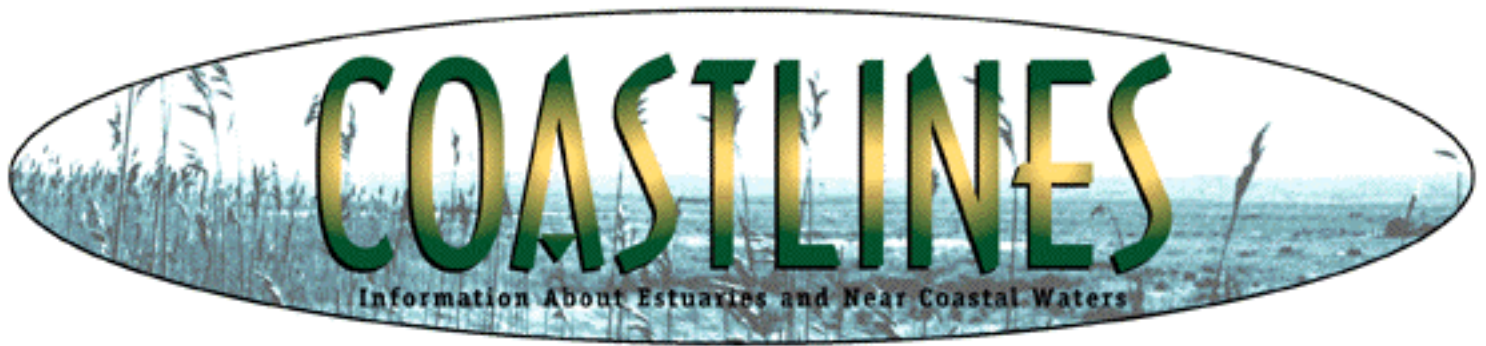
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## **"Better Backyard" Available from Chesapeake Bay Program**

The Chesapeake Bay Program has issued a new publication entitled "Better Backyard - A Citizen's Guide to Beneficial Landscaping and Habitat Restoration in the Chesapeake Bay Watershed." The Bay Program is joining with the State of Virginia and the U.S. Postal Service to promote BayScaping, citizen participation, and partnerships. The Postal Service has a new BayScapes poster and brochure on display at over a thousand Post Offices around the Chesapeake Bay watershed.

Copies of Better Backyard are available by calling 1-800-YOUR BAY or from the Chesapeake Bay Program web site at <http://www.chesapeakebay.net/> [EXIT disclaimer ►](#) under News & Info.



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## **New Websites!**


### ***National Showcase Watersheds Selected***

The Clean Water Action Plan was developed on the occasion of the 25th anniversary of the Clean Water Act to help revitalize the nation's commitment to water resources. One outcome of this plan is the selection of 12 National Showcase Watersheds, chosen on the basis of their ability to apply stream corridor restoration methods and to improve the community, the environment, and water quality, as endorsed in the Clean Water Action Plan. Selected projects represent a variety of geographic locations and conditions, a balance of management and design, strong local, tribal and state leadership, public and private land uses, and partnerships in stream corridor restoration.

EPA has developed a new website which highlights these successful projects as examples of accomplishments through restoration. The website features information on the sites, project descriptions, accomplishments and case study watersheds. In addition, photographs of the twelve sites have been incorporated into a downloadable calendar, available at <http://www.epa.gov/owow/showcase/>.

### ***Local Government Environmental Assistance Network Website***


A wide range of new tools for local governments are available online from the Local Government Environmental Assistance Network (LGEAN). LGEAN is a forum and clearinghouse for environmental information, providing 24-hour access to pollution prevention information, message boards, regulatory

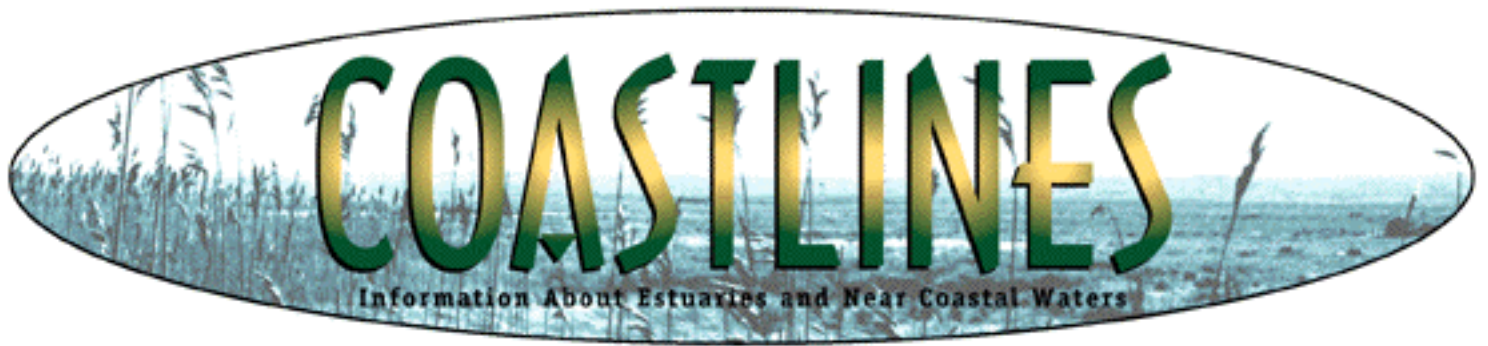
updates, grants and financing information for local governments. LGEAN also enables local officials to interact with their peers and others on-line. Visit the website at <http://www.lgean.org/>. 

### ***Mobile Bay National Estuary Program's Web Site***

Get connected to Mobile Bay with Mobile Bay's New Web Site. Find out about the estuary, discover the bay's habitats and inhabitants, review scientific studies and findings, and learn about estuaries and estuarine issues. Visit the website at <http://www.mobilebaynep.com/>. 

### ***New National Library for the Environment Website***

Visit the new National Library for the Environment sponsored by the National Institute for the Environment. This on-line library contains over 500 environmental reports, environmental news updated daily from ten sources, a population-environment linkage service, directories of higher education programs, and briefing books. Visit the website at <http://www.cnie.org/>. 



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## **Erosion and Sediment Control Workshops for Developers in the San Francisco Bay Area**

Control of sediment flowing into the streams, lakes and other waterbodies in California is a major challenge for developers building new homes and industries. Both the US EPA and the State Water Resources Control Board (SWRCB) have determined that sediment is a major pollutant in California waters and must be controlled. Because of this, the SWRCB has mandated its regional agencies to inspect new development sites and levy fines when sites are out of compliance with erosion control regulations. The San Francisco Bay Regional Water Quality Control Board (Regional Board) has designed a two-pronged approach to address the problem. First, the Regional Board has stepped up its inspections of construction sites and secondly, it has worked with the San Francisco Estuary Project to develop erosion control workshops to train developers and municipal inspectors in Best Management Practices (BMPs) to control erosion.





*A properly sized sediment basin.*

In California, any land that is graded or otherwise cleared of vegetation in the dry summer months must be protected from erosion in the rainy season, which lasts from mid-October to mid-April. In particular, slopes must be stabilized prior to winter rains. Many developers have been out of compliance with state and federal stormwater regulations governing sediment control because of lack of understanding of the regulations, or the erosion control methods used are inadequate or inappropriate for a site, or improperly installed and maintained.

The Erosion Control Workshops explain the regulations and civil liabilities involved in violating stormwater regulations, and teach the development community ways to comply with the regulations in a cost effective manner. Workshops are conducted in late summer and early fall to better prepare developers for the rainy season. In addition to explaining the federal and state laws that apply and penalties that can be accrued, Regional Board staff discuss the most up-to-date and cost effective BMPs that are available. This is done in an informal and lively format that speaks to the issues and concerns of the local developers and municipalities. Vendors are invited to display the latest erosion and sediment control measures, and the workshop includes a visit to a local construction site where samples of various control methods are installed. The participants see what methods work best on specific site situations and discuss in a more informal way the "do's" and "don'ts" of effective erosion and sediment control.

After three years of presenting these workshops, the results are very encouraging. Emphasizing enforcement along with education appears to be an excellent method for increasing compliance with sediment control requirements. In the San Francisco Bay area, compliance has increased to 90 percent in 1999, up from 30-40 percent in 1996. Because of the workshops success, requests have been made to present the workshops in other areas of the state from San Diego to Redding, including the highly impacted region surrounding Lake Tahoe.

Along with these workshop presentations, the San Francisco Estuary Project has published an Erosion

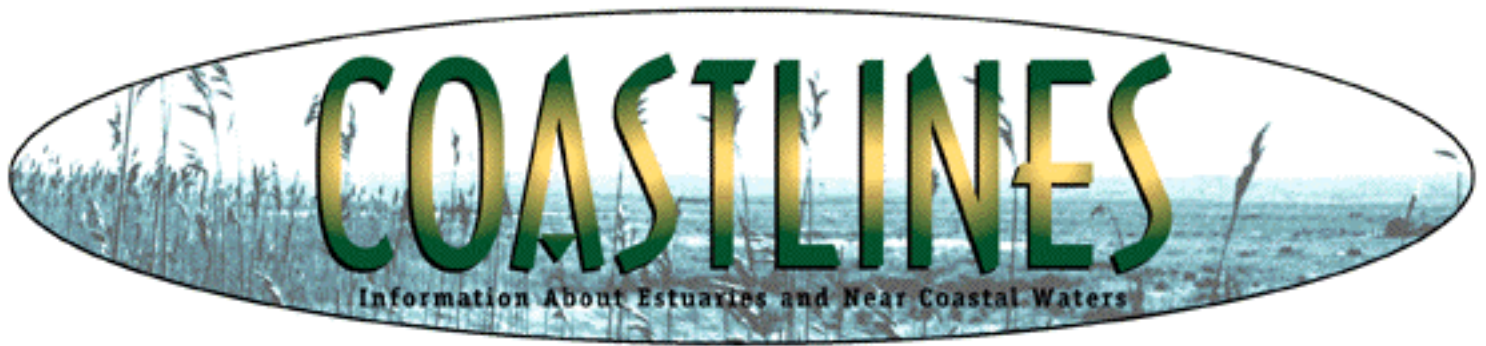
Control Field Manual prepared by the Regional Board field staff. This manual very clearly describes stormwater regulations; erosion and sediment control BMPs, as well as more general issues of site water conservation, hazardous waste management, and landscape management. There are easy-to-understand graphics and installation instructions. The funding for publication was derived in part from enforcement fines levied by the Regional Board against developers for sediment control violations.



*An improperly sized sediment basin is likely to fail in a storm event.*

Each construction site is required to perform sediment monitoring for the waterbody to which its stormwater flows. Results of area-wide monitoring have yet to be compiled in a comprehensive report. However, a sampling of individual reports show that sites that are in compliance with stormwater regulations and are implementing appropriate erosion and sediment control BMPs, have been able to keep construction site runoff near background (upstream) levels.

For further information, contact Carol Thornton, San Francisco Estuary Project, 1515 Clay Street, Suite 1400, Oakland, CA 94612, Phone: (510) 622-2419, E-mail: [ct@rb2.swrcb.ca.gov](mailto:ct@rb2.swrcb.ca.gov)



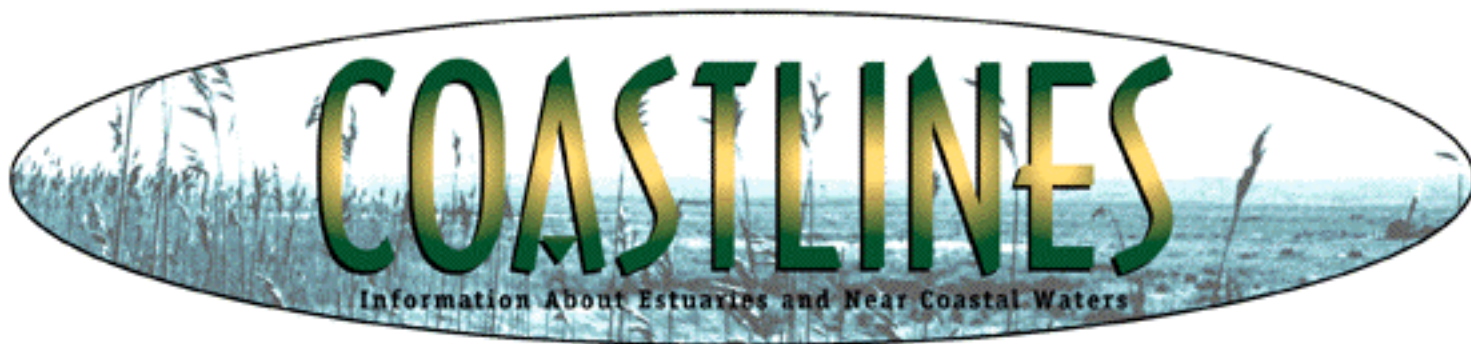
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## **Heinz Center Releases Report on U.S. Ecosystem Conditions**

The H. John Heinz III Center for Science, Economics and the Environment has released a study that provides a foundation for periodic reports on the state of the Nation's ecosystems. The document, "Designing a Report on the State of the Nation's Ecosystems", is a prototype intended to elicit comments on the project's initial approach and preliminary findings. In 2001, The Heinz Center will publish an expanded report covering all ecosystems of the United States. The prototype provides a framework of indicators to describe the extent of U.S. ecosystems, their basic condition, and the human uses of those systems. It draws upon data from public and private sources to describe croplands, forests, coasts and oceans. In addition to updating the 1999 report, the 2001 version of the "Report on the State of the Nation's Ecosystems" will analyze three additional ecosystems: freshwater, arid lands and rangelands, and cities and suburbs. Interested parties are encouraged to critique the prototype, which will be updated and modified as data on the additional ecosystems is compiled for the final report.

For further information or for a printed version, contact Robin O'Malley, Phone: (202) 737-6307 or view the article at <http://www.us-ecosystems.org/>. [EXIT disclaimer ►](#)



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## **Partnering for Stormwater Solutions Lessons Learned from the Brake Pad Partnership Project**

In 1994, the City of Palo Alto and the San Francisco Estuary Project (SFEP) identified copper in automotive brake pads as a potentially significant contaminant in the polluted runoff entering South San Francisco Bay. Each time brakes are used, a small amount of metal debris falls off and is flushed by stormwater off roads and into surrounding waterbodies. In 1995, the SFEP and the City of Palo Alto decided a collaborative approach with the brake pad industry was needed to help reduce pollution from this source. They invited Common Ground for the Environment, a joint effort of Sustainable Conservation (an environmental nonprofit organization) and Stanford Law School, to manage and facilitate the Brake Pad Partnership Project.

The Brake Pad Partnership Project recently reached a major milestone when the majority of brake pad manufacturers agreed to address environmental issues in their product design and to work collaboratively with non-industry stakeholders to develop a brake pad wear debris test to evaluate these effects. If the wear debris test shows that copper is a significant contributor to surface water quality impairment, these manufacturers will reformulate their brake pads. While the development of the brake pad wear debris test is just beginning, some initial lessons learned from the project may be applied to addressing polluted runoff in other coastal watersheds.

### **Lesson 1: A Local Watershed Issue May Need a National Solution**



Recent efforts to control or reduce polluted runoff emphasize local action and watershed-based solutions. The local watershed approach, however, may not work when products contribute to polluted runoff. Products such as automobiles, pesticides, outdoor cleaning products, and marine paint are designed for national and international markets. Regulating the way products can be used or banning the sale of a product locally may achieve only limited results. The alternative is often product reformulation, but it is highly unlikely that reformulation will occur on a local watershed level, nor does it necessarily make sense to do so. Therefore, stakeholders with a national perspective, such as the U.S. Environmental Protection Agency as well as environmental groups located near impacted water bodies should be involved in local watershed protection efforts.

## **Lesson 2: Understand the Industry**

Understanding the industry involved is critical to identifying potential opportunities for creating change in that industry. Initially, the Brake Pad Partnership project spent several months studying the brake pad industry's structure, economics, value chain, trends, and regulatory environment.

Solutions also have to address barriers to change within an industry. While brake pads themselves are not regulated, there are braking standards that must be met. Automobile manufacturers want low cost brake pads, but these pads must not cause consumer dissatisfaction (e.g., squeaky brakes). Understanding that cost, safety, performance, and customer acceptance are important criteria in developing brake pads allows stakeholders to focus on common desires for a product that both meets customers' demands and protects the environment.

## **Lesson 3: Be Prepared for Three Stages of Debate**

Linking polluted runoff to its sources can be extremely complex in coastal and urban settings. For example, urban areas contain large areas of impervious surface, such as pavement and roofs, where water quickly collects and runs off. As the water travels, it carries pollutants picked up along the way. There seem to be three stages in the debate over sources of nonpoint source pollution:

**Stage 1: It's not me, it's them.**

**Stage 2: Maybe some of the pollutants are getting into the "environment," but not into stormwater.**

**Stage 3: Maybe some of the pollutants are getting into stormwater, but they are not bioavailable or exceeding a water quality standard.**

Although it may seem as if these arguments hinder moving forward, each of these stages fulfills an important role in the stakeholder process, allowing the stakeholders to build trust and explain their points of view. After two years in Stages 1 and 2, the stakeholders in the Brake Pad Partnership were finally able to come to consensus that some brake pad wear debris is entering stormwater and to move forward



with finding a solution.

Experiencing these stages allows for stakeholders to recognize that a business is unlikely to act without a reasonable scientific basis linking their product to stormwater pollution. One way to ensure that this scientific basis is reasonable is to validate studies through peer review. However, while science needs to be sound, in the realm of polluted runoff, there will always be some scientific uncertainty. If businesses demand conclusive proof to justify preventive action, scientific uncertainty may be used to delay action indefinitely. It is necessary to develop on-the-ground strategies that require businesses to make decisions that minimize environmental impacts even in the face of this uncertainty.

#### **Lesson 4: Make Sure the Solution Solves the Problem**

Focusing stakeholders on potential solutions is important. Changing a product or a management practice in a way that also contributes to polluted runoff is not recommended. For example, when brake pad manufacturers were being challenged on the use of asbestos in the 1980s, lead was substituted in some brake pads. This proved to be unwise for both technical and environmental reasons, and ultimately lead was eliminated from almost all friction materials. The Brake Pad Partnership Project addresses this problem by the agreement to develop a brake pad wear debris test to evaluate the environmental effects, not just of copper, but of other materials that may be used in brake pads.

#### **Lesson 5: Managing a Partnership is Time-Consuming and Expensive**

- Partnership efforts can take a long time and the process cannot be rushed. Stakeholders must have enough time to develop trust, explain their points of view and hear others, and finally work together on a common consensus-based project or mission.
- While significant funds are required to manage stakeholders, often it is not easy to find funding for "process," even though these funds offer a high return investment towards achieving a solution.
- There must be an incentive to encourage certain stakeholders to engage in a dialogue, such as potential future litigation or regulation.
- The project manager must be explicitly clear about his/her role in the project. Common Ground's role in the Brake Pad Partnership project was to manage--coordinate, facilitate, and educate all stakeholders--and to create an exchange of information to generate solutions.

#### **Conclusion: A Partnership Was the Right Approach to Use with the Brake Pad Industry**

Collaboration and partnership are high priorities for many governmental and non-profit groups, as well as businesses. Partnerships have many advantages, including leveraging resources, allowing for creativity, avoiding confrontation, and improving communication between typically adversarial parties.

While partnerships are appropriate for some urban watershed problems, the approach may not be right for all. Many environmental groups question the wisdom of participating in partnership efforts, fearing that partnerships may mean "compromise" and drain limited resources that could be used on more traditional strategies, such as litigation and legislation.

Before the project was launched, a thorough industry analysis was conducted and various approaches were considered--partnership, legislation, regulation, litigation, one-to-one industry approach, or consumer education. Legislation, regulation, or litigation would be very costly and highly unlikely tools to achieve success, as there was not enough information to make a case for legislative change and substantial questions as to regulatory authority. Working directly with one or all of the companies in the brake pad industry did not appear viable, as there was no obvious strategic advantage for companies to reformulate their products. Although educating consumers is an important goal in understanding the critical impact that polluted runoff has on our environment, consumer education slogans like "brake less," or more appropriately, "drive less" would not be effective. Given these variables, the partnership approach presented the best opportunity for reaching a sustainable and long-term solution to the issue of copper pollution on a local, national and international scale.

For further information, contact Elizabeth O'Brien, Sustainable Conservation, 109 Stevenson Street, 4th Floor, San Francisco, CA 94105; Phone: (415) 977-0380, Fax: (415) 977-0381, E-mail:

[Lobrien@suscon.org](mailto:Lobrien@suscon.org)

This article was adapted from Sustainable Conservation's Fall 99 Newsletter at <http://www.suscon.org/>.

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## **Restoring the Flow Three Dams Removed in North Carolina**

In 1989, the Albemarle-Pamlico Estuarine Study (APES) and the US Fish & Wildlife Service (USFWS) investigated possible obstructions to anadromous fish migration in the 30,000 square mile Albemarle-Pamlico Sounds region of eastern North Carolina. Twenty-seven obstructions, including 18 dams, 4 storm gates on canals, 2 highway culverts, 2 vegetation blockages and 1 canal navigation lock, were identified. The USF&WS concluded that dams, the most common obstruction, effectively prevented all anadromous fish species from accessing significant areas of historical spawning habitat.

Historically, anadromous fish have formed a significant component of the fishery resources of the Albemarle-Pamlico Estuarine system. However, there has been an unprecedented decline in the populations of all anadromous fish species throughout much of their historic range in the basin. This has ultimately resulted in economic and environmental losses, because there are fewer adult fish available to commercial and recreational fisheries, and upstream fish communities are seasonally impoverished.

As a result of the study, the APES and USFWS staff began the process of determining how to best remove and/or modify low-flow dams obstructing anadromous fish migration in the Neuse River basin. The Neuse basin was the focus of this effort, as it provides habitat for a number of important anadromous fish, including striped bass, shad, alewife, herring and sturgeon.

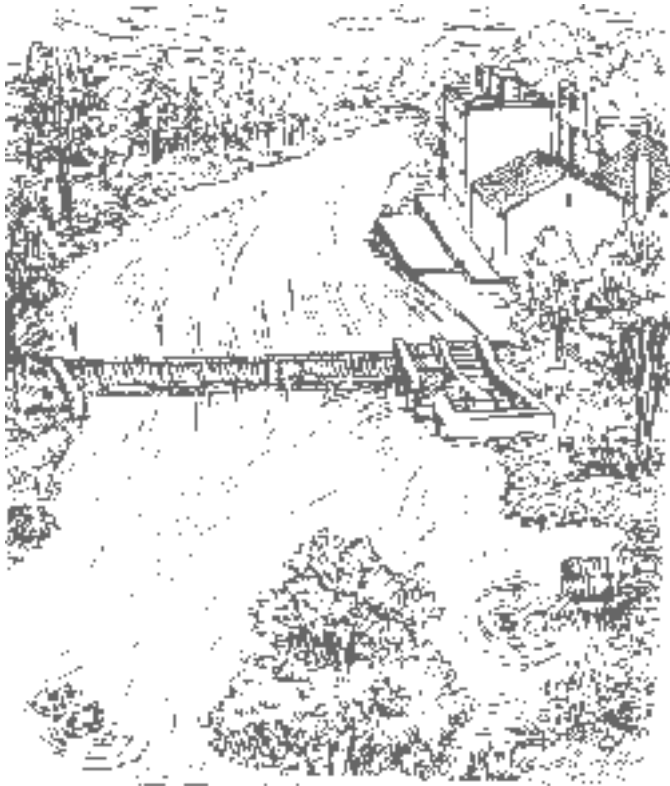
In 1990, the APES submitted a proposal entitled "Mitigation of Obstructions to Anadromous Fish Migration" to the Coastal America Program to support a project to remove barriers to anadromous fish migration in the Neuse River Basin. In 1991, Coastal America selected this proposal as a demonstration project and moved toward implementation.

The original site for the restoration project was the Quaker Neck Dam - a 7-foot high, 260-foot wide dam built on the Neuse River in Wayne County, North Carolina, to supply water for a coal-fired electric power plant. Prior to construction of the dam in 1952, landings of American shad in the basin exceeded 700,000 pounds. In 1996, only 25,000 pounds were landed. The area between Goldsboro and Raleigh, which would be made accessible by removal of the dam, contains most of the historically important upstream spawning habitat for anadromous fish in the entire Neuse River.



- USA (land)
- NEP study area
- major rivers
- state boundaries
- cities & towns

**1997**  
 Created by EPA and  
 the Center for Marine  
 Conservation.  
 Sources: EPA, NOAA,  
 USGS, National  
 Estuary Programs



In 1992, the North Carolina Department of Environment and Natural Resources received a \$100,000 grant from the US Environmental Protection Agency for removal of the Quaker Neck and Cherry Hospital Dams. The Cherry Hospital dam was located nearby on the Little River, a tributary to the Neuse.

The removal of the dams was completed in August 1998, restoring approximately 1,000 miles of spawning habitat in the Neuse basin to be restored. In all, 75 miles of the Neuse mainstem and 925 miles of tributaries were again available to American shad, hickory shad, Atlantic sturgeon, river herring and striped bass.

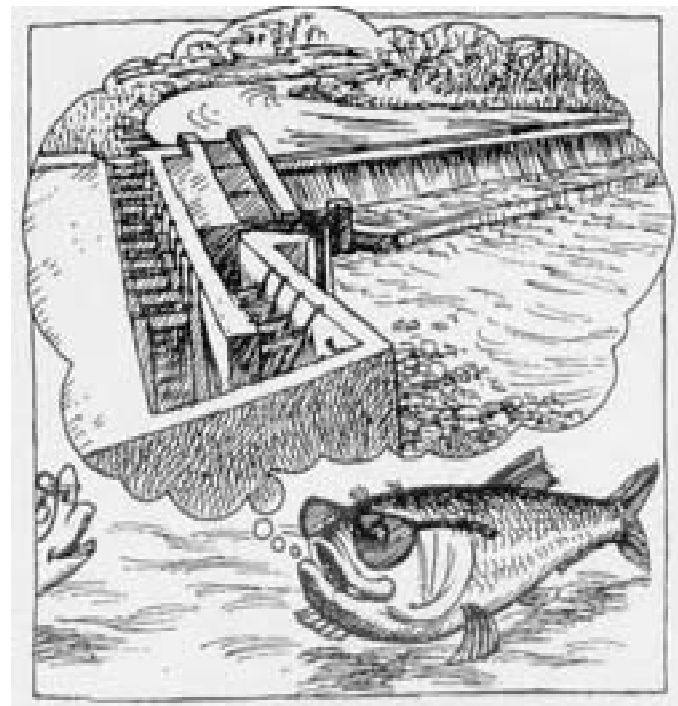
Although the removal of the dams took nearly five years due to liability concerns and other issues, it was successfully completed through a voluntary, cooperative partnership that will yield environmental and economic

benefits for many years to come. The American Sportfishing Association (ASA) has stated that the removal of the Quaker Neck Dam will create a better environment for fish, for the state's anglers, and for economic growth in the Goldsboro region of North Carolina. According to the ASA, the removal of Quaker Neck Dam could, "add several million dollars to the North Carolina economy, boosting the \$1.6 billion anglers already spend each year in the state on fishing trips and equipment."

While the economic benefits will take some time to be fully realized, the project has already yielded one significant environmental benefit: the removal of a third dam on the Little River in Johnston County, NC.

On December 1, 1999, the 71-year-old, 250-foot-wide Rains Mill Dam fell to U.S. Marine explosives, opening spawning areas along the Little River to several fish species. The removal of the dam--a Coastal America Partnership project involving the APNEP, the U.S. Army Corps of Engineers, the U.S. Fish & Wildlife Service, and the U.S. Fish & Wildlife Foundation--opened 49 miles of Little River streams and tributaries as spawning areas for American shad, hickory shad, short-nosed sturgeon, striped bass and alewife. Removal of the Rains Mill Dam also offers protection to tar spiny mussels and dwarf-wedge mussels.

The North Carolina Division of Water Resources (DWR) thoroughly reviewed the project and determined that it





would not cause environmental damage or increase flooding. Rather, DWR concluded that removal of the dam would actually lower flood levels upstream of the dam.

Unfortunately, many abandoned millpond and hydroelectric dams still remain in eastern North Carolina, and their presence prevents restoration of hundreds of miles of historic anadromous fish habitat and spawning areas. North Carolina hopes to continue to overcome the challenges presented by these impoundments.

For further information, contact Joan Giordano, APNEP Public Involvement Coordinator, North Carolina Department of Environment and Natural Resources, 943 Washington Square Mall, Washington, NC 27889, Phone: (252) 946-6481, Fax: (252) 975-3716, E-mail: [Joan.Giordano@ncmail.net](mailto:Joan.Giordano@ncmail.net)



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## **Partners in Restoration Help Prevent Erosion into Coastal Embayments**

Envision the central California coast: steep mountains plunging into the Pacific Ocean; steelhead and salmon runs in sparkling creeks; lush stream valleys meandering peacefully through a checkerboard of strawberry and lettuce fields. This is the California dream, as the casual tourist may perceive it while cruising down Highway 1. Meanwhile, farmers and public agencies are making significant efforts to deal with the unhappy reality: fields and streambanks rapidly eroding, covering spawning beds, degrading riparian habitat and burying estuaries under tons of pesticide-laden sediment.

One exciting new effort, called Partners in Restoration (PIR), helps farmers and landowners to adopt conservation practices on their lands – practices that both enhance the natural resources and help solve on-farm problems such as excessive erosion. This innovative program streamlines the permitting process for these conservation practices, essentially creating "one-stop permit shopping". Sustainable Conservation, a nonprofit environmental organization, teamed up with the Natural Resources Conservation Service (NRCS), the Water Quality Protection Program of the Monterey Bay National Marine Sanctuary (WQPP) and the Resource Conservation District (RCD) of Monterey County to implement the pilot program in the Elkhorn Slough Watershed in Monterey County. Sustainable Conservation advances the stewardship of land and water resources using innovative strategies that actively engage businesses and private landowners in voluntary conservation.

The Elkhorn Slough Watershed, California's second largest estuarine system, has some of the worst erosion on the West Coast. Covering more than 2,500 acres of mudflats and marshes and home to

increasingly rare coastal salt marsh habitat, the estuary is surrounded by intensive agriculture. Each year, an estimated 80,000 tons of soil erodes into the Elkhorn Slough Watershed and is transported into the waters of the Monterey Bay National Marine Sanctuary. Though the NRCS, the RCD and WQPP had programs in place to educate farmers and landowners about better management practices and to provide technical assistance and cost sharing to implement conservation practices, farmer participation was very low.

Sustainable Conservation discovered that the regulatory review process was a primary obstacle for farmers interested in conservation projects. In order to install a sediment control basin or protect a streambank, a farmer faced permits and review by eight or more local, state and federal regulatory agencies, hundreds of dollars in permit fees, and a timeline that could easily extend over a year or more. Not surprisingly, farmers frequently chose to steer clear of the whole process, either choosing not to do the project at all or doing it without the permits, often using techniques that were ineffective or which actually worsened the problem. In effect, the agency review designed to protect our natural resources had become a disincentive to positive, voluntary conservation action, stopping farmers from installing projects that prevent erosion, improve water quality and enhance the natural systems on and around their farms.

In concert with NRCS and WQPP, Sustainable Conservation designed a "one stop" permitting process for farmers willing to reduce runoff from their lands using ten proven conservation practices. The ten practices have been conditioned and authorized in advance by federal, state and local agencies. This approach eliminates one of the very big disincentives to private stewardship—the complex regulatory review process. It also bridges the gap between economics and environmental goals by building a sense of cooperation and trust between the community and the agencies in the process. An added benefit is that all public agencies waived permit fees for farmers participating in this effort.

In the fall of 1998, after more than two years of effort, the PIR pilot project began. Now, when a farmer walks in the door of the NRCS Elkhorn Slough Watershed Project to request technical and cost share assistance to deal with erosion, they can implement projects under one program. The major requirement is that the landowner must agree to implement the practices using the standards developed with the agencies.

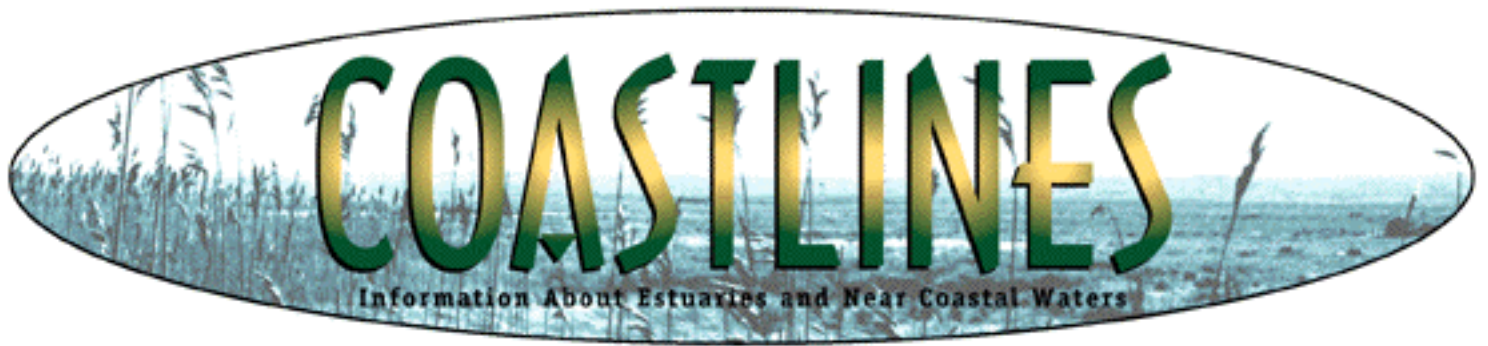
The results have been impressive. In the first year, fifteen farmers participated, enhancing nearly a mile of stream habitat and preventing the transport of more than 12,000 tons of sediment into the watershed. In 1999, another nine projects were completed under the PIR program, and more are being planned for the year 2000.

Because of the success of the pilot project in the Elkhorn Slough, Sustainable Conservation has been invited to bring the Partners in Restoration program to two more watersheds on the Central Coast, Salinas River and Morro Bay. In the Salinas River Watershed, resource issues and land uses are increasingly coming into conflict with environmental laws. The pressure to implement Total Maximum Daily Load (TMDL) programs under the Clean Water Act and the recent listing of many steelhead and salmon populations under the Endangered Species Act add to the potential for conflict. The PIR program fits well with these efforts to address polluted runoff and species concerns by emphasizing voluntary conservation

through local action and watershed based solutions.

In the Morro Bay Watershed, Sustainable Conservation has partnered with the NRCS and the Morro Bay National Estuary Program, which has included permit streamlining in its Comprehensive Conservation and Management Plan for the watershed. The Morro Bay estuary has lost more than a quarter of its soil volume over the past 100 years as a result of accelerated erosion in the watershed. Implementation of best management practices is essential for reducing erosion, yet the regulatory review process has again been identified as a significant obstacle by farmers and landowners.

For further information, contact Bob Neale or Carolyn Callahan, Sustainable Conservation, 109 Stevenson Street, 4th Floor, San Francisco, CA 94105, Phone: (415) 977-0380.



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## **NOAA, EPA Set To Approve First State Runoff Pollution Plan**

On December 16, Maryland became the first U.S. state or territory to receive a final federal seal of approval on a state "coastal nonpoint pollution control plan". Nonpoint pollution, also known as polluted runoff, is a significant problem throughout the nation and especially in coastal areas and watersheds that feed into sensitive estuaries and coastal environments.

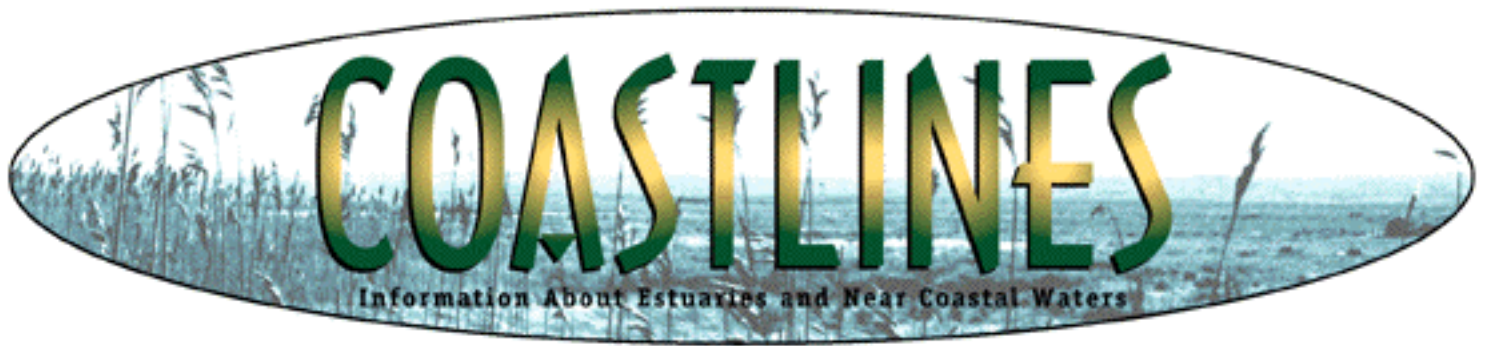
NOAA's National Ocean Service administers the national Coastal Zone Management program. Nonpoint pollution control plans are an important part of this program. The program is a unique partnership of federal and coastal state and territorial governments that encourages a balance between land and water uses in coastal zones and conservation of fragile coastal resources. The EPA, which oversees the nation's water quality, sees the adoption of the nonpoint pollution control plans as a key link in improving the health of the nation's waterways.

For further information on the coastal state nonpoint pollution control plans visit

<http://www.ocrm.nos.noaa.gov/czm/welcome.html> [EXIT disclaimer ►](#) or

<http://www.epa.gov/owow/NPS/coastnps.html>.





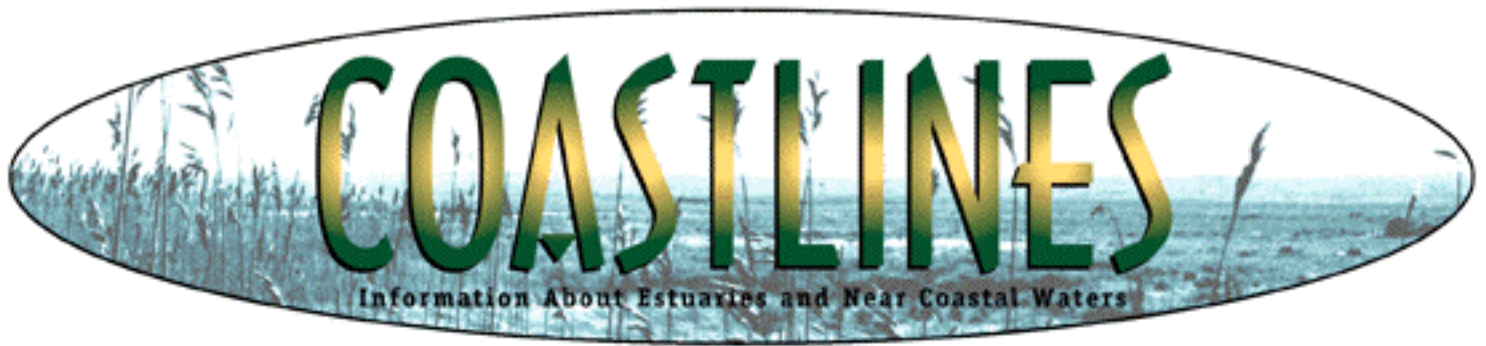
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## **Draft CCMP for Peconic Estuary Program, Final CCMPs for Maryland Coastal Bays, Tillamook and Lower Columbia River NEPs**

The Peconic Estuary Program on Eastern Long Island has released its Draft Comprehensive Conservation and Management Plan (CCMP) for public comment. The draft contains action items in six major areas: brown tide, nutrients, toxics, pathogens, habitat and living resources, and public outreach and education. For further information, contact Kirsten Prettyman, Phone: (202) 260-1434.

Maryland Coastal Bays (MCB), Tillamook (TEP) and Lower Columbia River (LCREP) National Estuary Programs have submitted their final CCMPs to EPA for approval. For further information, contact Gabriella Lombardi, Phone: (202) 260-5359 (MCB), Nancy Laurson, Phone: (202) 260-1698 (TEP) or Jamal Kadri, Phone: (202) 260-3848 (LCREP).



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## **Asian Green Mussel Thriving in Tampa Bay Potential Impacts, Solutions Discussed At Workshop**

The discovery in Tampa Bay of an exotic mussel native to Asia provided a timely focus for scientists and shippers who gathered recently in Tampa for a 2-day workshop on invasive aquatic species and the shipping industry. When planning first began for the invasive species workshop, introduction of invasive species to Tampa Bay via ships ballast water was not believed to be a problem. The discovery of the green mussel invader lent the workshop a sense of urgency.

The workshop explored ways to prevent unwanted plants and animals from entering the bay in ballast water taken on by a ship in one port and discharged into another. Bay managers suspect that is how the Asian green mussel, *Perna viridis*,



*Asian Green Mussel*

*Scientific Name:* *Perna viridis*

*Range:* Coastal areas of the Indian and Pacific Oceans

hitchhiked to Tampa Bay, where it was found last summer clogging intake pipes at Tampa Electric Company's Big Bend power plant. Since then, the mussel has been found by the thousands on three of the four bridges spanning the bay.

Researchers conducting the surveys report that many of the mussels are three inches long and encrusted with barnacles, indicating they have been in the bay for some time.

*Size:* up to 4 inches

*Uses:* A popular food, the green mussel is harvested in the wild and grown in aquaculture facilities in its native area

*Hitchhiking History:* The green mussel was first seen in the Caribbean at Trinidad in 1990, where it was apparently transported as larvae in the seawater ballast of large ships. It is suspected that this same mechanism brought the green mussel to Tampa Bay, where it was discovered earlier in 1999 by divers performing maintenance work at the TECO power plant in South Hillsborough County.

The Tampa Bay Estuary Program

organized the workshop in partnership with a host of public and private organizations. The goal of the workshop was to bring the scientific and shipping communities together to share knowledge and concerns. Topics included an assessment of the potential threats posed to Tampa Bay and similar coastal waters by invasive species, methods to prevent or eliminate exotic species invasions, and the implications of new policies governing ballast water exchange.

Shipping activities are the primary route of introduction for invasive aquatic species in coastal waters. A new policy being implemented by the U.S. Coast Guard calls for shippers to report the origin of their ballast water and what they expect to do with it. The policy also requests that shippers voluntarily discharge their ballast in the salty open ocean, where few hitchhiking plants or animals are likely to survive. At the workshop, emerging technologies were discussed that may eventually be helpful in "sanitizing" ballast water, including special filtering systems using UV light, biocides and shoreside treatment stations.

**Monthly Arrivals of Foreign Ships Containing Ballast Water into the Port of Tampa**

Month	Total Ships Arriving	#Ships w/Ballast
-------	----------------------	------------------

Once exotic species gain a toehold, they may outcompete more beneficial native species, introduce diseases to native stocks, clog water intake pipes and blanket dock and bridge pilings. The zebra mussel, an interloper from Southeast Europe that is now found in twenty Midwest and Northeast states, has caused billions of dollars in damage to pipes and water control structures. Florida's warm, moist climate provides ample opportunities for a variety of exotic, potentially harmful species to flourish. In fact, Florida is second only to Hawaii in total number of introduced plant and animal species.

Increased global trade heightens the potential for

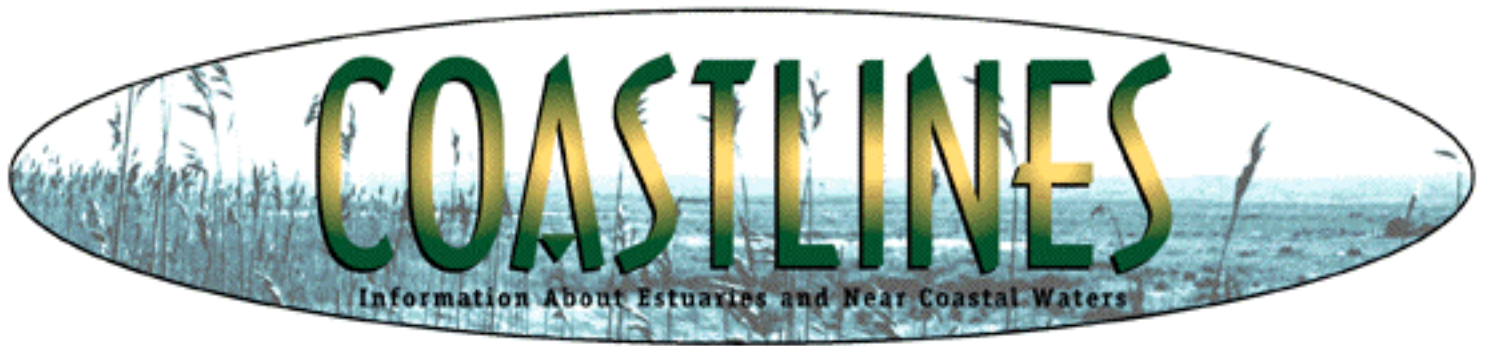
Jan	156	41	species to cross oceans, and continents. The shipping industry representatives at the workshop recognized the extent and seriousness of the problem, and supported fair and equitable measures to restrict the transport of species in ballast water.
Feb	123	40	
Mar	138	35	
Apr	118	34	
May	136	35	
Jun	110	30	
Jul	110	29	
Aug	106	25	
Sept	112	28	
Oct	113	29	
Nov	128	37	
Dec	126	33	
Total	476	396	Roundtable discussions allowed workshop participants to discuss specific issues, such as viable alternatives to ballast water, how to more accurately detect and assess the presence of exotic species, and whether a non-regulatory approach to ballast water management would be effective. A somewhat surprising response from all participants was that a regulatory mechanism was needed to drive both public and private participation in ballast water management and treatment strategies.

*Source: 1995 "National Biological Invasions Shipping Study," Carlton, et. al.*

The input provided by workshop participants will help the Tampa Bay Estuary Program to refine its monitoring program to more rapidly detect potentially harmful aquatic invasives, and to develop policies to minimize the risks posed by such species.

For further information on the workshop, visit Tampa Bay Estuary Program's web site at [www.tbep.org](http://www.tbep.org)  or Phone: (727) 893-2765.





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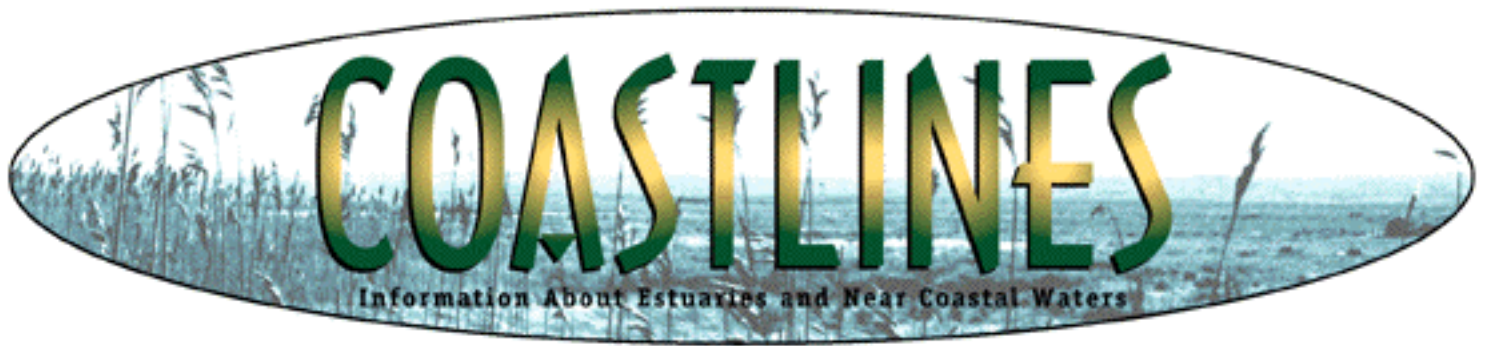
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## **Profiling Visitors to National Estuarine Research Reserves**

Researchers at Clemson University and South Carolina Department of Natural Resources recently profiled visitors to National Estuarine Research Reserves (NERRs). This study was developed to help determine visitors' preferences in activities and programs for new Interpretive Centers at NERR sites. The study found that most visitors are highly educated, married, an average age of 52, and visit between April and October. Guests usually stay less than 2 hours, and rarely travel more than 100 miles or stay overnight. Visitors cited an interest in exploring and discovering new things as their primary motivation for visiting the NERR site. Researchers found that the most popular activities are exploring the visitor center, encountering wildlife, and walking.

For further information, contact Bonnie S. Martin, Clemson University, Clemson, South Carolina, Phone: (864) 654-6916 or E-mail: [bonniem39@yahoo.com](mailto:bonniem39@yahoo.com)





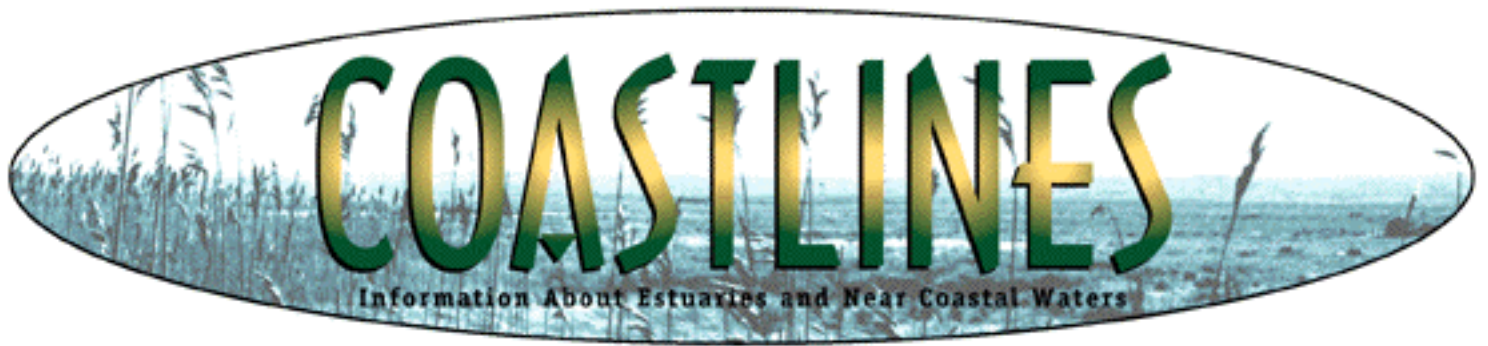
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## Report Released on Dam Removal

"Dam Removal Success Stories: Restoring Rivers through Selective Removal of Dams that Don't Make Sense," includes 25 detailed case studies of dam removals. The sponsors of the report, American Rivers, Friends of the Earth and Trout Unlimited, call it the most comprehensive review to date of the history and benefits of dam removal in the United States. A 26th case study, detailing the removal of the Fort Edward Dam on the Hudson River, while not a success story, provides lessons about some mistakes to avoid when removing a dam. The report examines dams that were removed in California, Colorado, Connecticut, Florida, Idaho, Maine, Minnesota, New Mexico, North Carolina, Ohio, Oregon, Pennsylvania, Vermont, Washington, and Wisconsin. Different types of dams are examined, including hydroelectric, water supply and irrigation. The report examines dams that were removed because their negative impacts on rivers and riverside communities outweighed their benefits. Many were blocking fish migration and degrading water quality, while others were abandoned and threatened public safety. The report found that dam removal is often less expensive than repair, particularly where the benefits of the dam were marginal or non-existent. The report is available on-line at

[http://www.tu.org/newsstand/library\\_pdfs/drss.pdf](http://www.tu.org/newsstand/library_pdfs/drss.pdf) (PDF, 7MB) [EXIT disclaimer ►](#) or by going to the Trout Unlimited website, <http://www.tu.org/pdf/newsstand/library/drss.pdf> [EXIT disclaimer ►](#)



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## **Punta Gorda Waterfront Juvenile Fisheries Habitat Project**

**Charlotte Harbor National Estuary Program**

### ***CHARACTERISTICS***

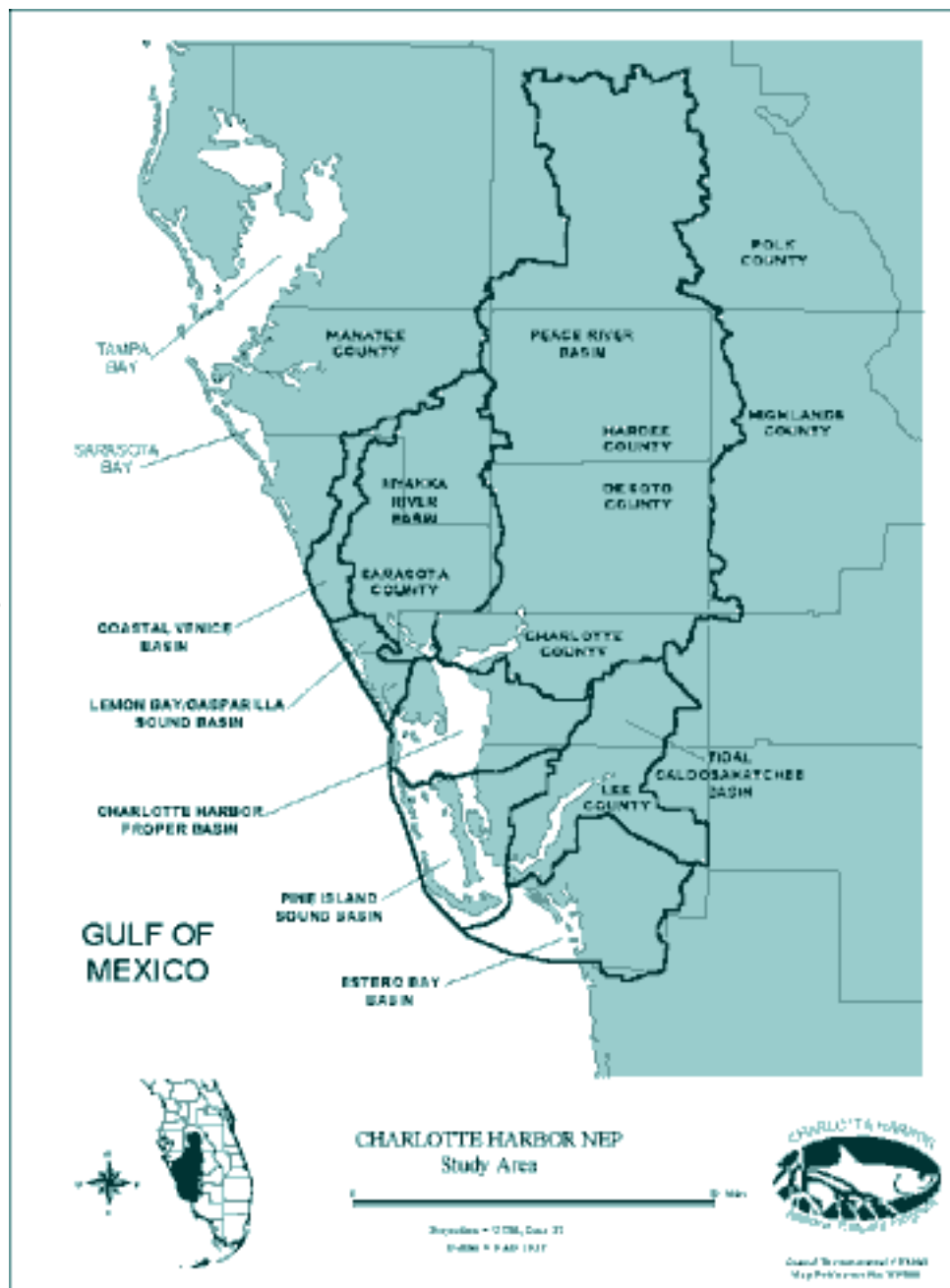
Charlotte Harbor and its major tributaries are located in Florida's southern central interior and southwestern coast. The Charlotte Harbor watershed is one of the largest watershed systems on the southwest Florida coast, covering more than 4,400 square miles, incorporating three major river basins within southwest Florida. The Peace and Myakka Rivers flow directly into Charlotte Harbor, while the Caloosahatchee River connects to Charlotte Harbor through Pine Island Sound and Matlacha Pass. In addition to these major rivers, the watershed includes the Winter Haven Chain of Lakes, Coastal Venice, Lemon Bay, and Estero Bay. Charlotte Harbor is the nation's 18th largest estuarine system and is an important part of the Gulf of Mexico watershed.

There are 23 local governments in the Charlotte Harbor watershed, including Lakeland, Venice, Fort Myers, and Arcadia. The area is divided into a number of districts and jurisdictions, creating significant political challenges in terms of managing the watershed as an entire system. Upland areas in the

watershed are dominated by agricultural activities and phosphate mining, while the coastal areas are more urbanized and undergoing rapid population growth. Maintaining water quality, wildlife habitat, and water supplies are concerns throughout the region as human populations grow and land use intensifies. Resolving these issues requires cooperative management in the private sector and across all levels of government.

## The Problem

The rate of development in Charlotte County has been increasing since the 1940s. This early development led to large areas of wetlands being dredged and filled for residences. More than 200 miles of navigable canals are now part of the residential landscape of the metropolitan area along Charlotte Harbor where the Peace River enters into the harbor.



Charlotte Harbor has important recreational and commercial fisheries, including important species such as the tarpon (*Megalops atlanticus*), snook (*Centroponus undecimalis*), and spotted sea trout (*Cynoscion nebulosus*). Estuarine species are threatened by loss of vital habitats such as seagrass beds and fishing pressures. Fisheries habitats can be damaged by boats, dredging, nutrient overloading, and conversion of wetlands to upland area. The importance of fish populations to the Charlotte Harbor system has resulted in efforts to enhance fish habitat, control damage to seagrass beds, improve water quality and implement significant restrictions on fishing methods.

## **Introduction to Charlotte Harbor**

Charlotte Harbor is located in sub-tropical climate and its watershed contains large tracts of undeveloped areas which provide habitat for a wide array of rare plants and animals. General characteristics of Charlotte Harbor and its watershed include:

- Several endangered species, including the Florida manatee, wood stork, Florida panther, and Atlantic loggerhead turtle.
- The current human population of 1.1 million (1997 census) is expected to grow to 1.65 million by 2020.
- The area supports a wide variety of economic uses such as tourism, ranching, citrus farming, phosphate mining, vegetable crops, and residential and urban development.
- More than 275 species of shellfish are found in the Charlotte Harbor estuaries, including oysters, clams, and scallops. However, large areas are closed to shell fish harvesting due to bacterial contamination and periodic red tide events.
- The total coastal population increases by more than 30 percent during the wintertime, due to seasonal business and vacationing tourists. Total annual tourism expenditures can exceed \$1 billion.
- Recreational fishing is a major attraction in both inland and coastal areas of the watershed.

## **Overview of the Project**

The Charlotte Harbor National Estuary Program, Florida Department of Environmental Protection, Reef Ball Foundation, Inc., and the Charlotte Harbor Reefs Association formed a partnership to improve existing water quality and creating new juvenile fishery habitats in these residential canals, as well as under piers around the mouth of the Peace River and in the main body of Charlotte Harbor. The partnership chose to construct and deploy five hundred Reef Balls in specified areas. Reef Balls are made of concrete, placed on the seafloor bottom, and provide a habitat for juvenile fish. Forty volunteers from the



Charlotte Harbor Reefs Association worked full time for nearly four months to construct the concrete modules, using molds donated by the Reef Ball Foundation, Inc. Three types of sites were chosen for fish habitat improvement through the introduction of Reef Balls, including existing artificial reefs, under private docks, and under public piers.

- 210 Reef Balls were placed in groups of three in the harbor on an existing permitted artificial reef site.
- Homeowners in the residential area of Punta Gorda Isles paid for the installation of another 180 Reef Balls to be placed under 90 private docks within neighborhood canals.
- Finally, the remainder of the Reef Balls were placed under piers along the mouth of the Peace River.

## Project Objectives

The primary objective of the project was to provide more habitat for fisheries and to improve fishery production in Charlotte Harbor. In addition to fish habitat enhancement, the Reef Balls encourage the colonization of oysters and other marine organisms, which filter the water and provide a forage base for certain species of fish.

The Charlotte Harbor project areas were chosen for fish habitat enhancement for the specific purpose of providing fishermen a fishing destination. Much of the damage to natural spawning grounds in the Harbor occurs when fishermen traverse seagrass beds looking for fish. Seagrass beds provide important habitat for fish by providing shelter and food, and are particularly important for nursery habitat. Providing fishermen a specific fishing destination will help to divert fishermen away from shallow waters and seagrass beds to an easily accessible location in deep water.

The placement of Reef Balls under the piers at the mouth of the Peace River in the upper portion of Charlotte Harbor and adjacent to downtown Punta Gorda, was done to create high quality habitat and attract fish to these sites. The three piers chosen for the project extend into the river from two parks along



the water and are heavily used by the public for nature watching and fishing. Fishermen and nature lovers alike will be able to enjoy the large populations of fish from these easily accessible piers.

## Project Implementation

The project was initiated by a group of conservation-minded fishermen who formed the Charlotte Harbor Reefs Association, Inc., a non-profit corporation. Driven by the desire to increase the number of fish in Charlotte Harbor, the group gathered information on how to best accomplish this goal and improve the aquatic resources of Charlotte Harbor. During the planning phase it was determined that concrete Reef Balls were the most environmentally compatible and appropriate type of fishery habitat for the project. With the support of many fishermen, as well as a number of public and private organizations, the Association set up a plan of action that included the construction and deployment of 500 Reef Balls in three distinctly different environments within Charlotte Harbor.

The Charlotte Harbor Reefs Association sought and obtained funding from a variety of sources, including the Charlotte Harbor National Estuary Program and Florida Department of Environmental Protection. In-kind support services were provided by Reef Balls Foundation, Inc., who donated the molds and assisted in placing the Reef Balls on site, and the Florida Sea Grant Extension office provided technical assistance.



The process for obtaining the necessary permits began in July of 1997. Placing Reef Balls under private docks in dredged canals within the Punta Gorda Isles residential area was a first of its kind project. Obtaining permits for this phase required considerable time and effort. It is expected that the great success of the project will encourage state agencies to allow this kind of project to be conducted in other areas of Florida.

Fisheries habitat enhancement in the east central part of Charlotte Harbor involved renourishing an already established artificial reef. Once permits and additional funding were obtained for this project, 210 reef balls were added in two phases to a marginally productive reef created 10 years earlier using construction rubble. The site, located in a more offshore environment than the other locations chosen for enhancement, is a mile in length and 150 feet wide, with water depths ranging from 13 to 16 feet.

The final project involved providing fishery habitat under public piers where it would be accessible to everyone. Three existing park areas on the Peace River were selected, and the Reef Balls were recently deployed.

## Success of the Project

- The project has united many interest groups, organizations and government agencies in fishery habitat development and enhancement. These groups included the Charlotte Harbor National Estuary Program, Florida Sea Grant Extension, Reef Ball Foundation, Inc., Florida Department of Environmental Protection, and the Charlotte Harbor Reef Association. Future projects are already being planned which include some of these same groups.



- The large group of volunteers, which dedicated many hours, is responsible for making this fishery habitat project a success. This group is now more educated about problems in the estuary and the value of its natural resources.
- Groups in other locations in Florida are interested in creating artificial fishery habitat under private docks. The response from the private residences to have Reef Balls placed under docks was overwhelming. More than 150 waterfront residents were willing to pay for Reef Balls to be placed under their docks. Not all of the requests could be fulfilled during this project; sixty of these residents were placed on a waiting list for future projects.
- Requests for further information regarding this project continue to come in. The State of Florida is looking at this project as a potential form of mitigation for wetland projects.

## Lessons Learned

Although the Reef Balls have only recently been deployed, ongoing monitoring has provided some initial observations:

- The Reef Balls colonized with oysters and other marine organisms much more quickly than expected under the private docks.
- Within weeks of deployment, large numbers of juvenile and adult fish were utilizing the structures deployed under private docks.
- Water monitoring efforts over the last twelve months around the Reef Balls under private docks have shown "better than expected" levels of dissolved oxygen.
- Reef Balls placed in the harbor were colonized quickly, but crab predation scoured larger organisms. However, regrowth occurred and different species of fish are now attracted to the area.

- Obtaining permits required considerable time and effort. The great success of the project has encouraged state agencies to allow this innovative project to be duplicated in other areas of Florida.

For further information, contact

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Charlotte Harbor Reefs Association  
33 Tropicana Drive  
Punta Gorda, FL 33950  
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Rich Novak, Marine Agent  
Charlotte County Marine Extension Agent  
Florida Sea Grant Extension Program  
6900 Florida St  
Punta Gorda, FL 33950  
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For further information on the Reef Ball Foundation, visit the website at <http://www.reefball.org/>

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