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Information About Estuaries and Near Coastal Waters
April 2002 - Issue 12.2

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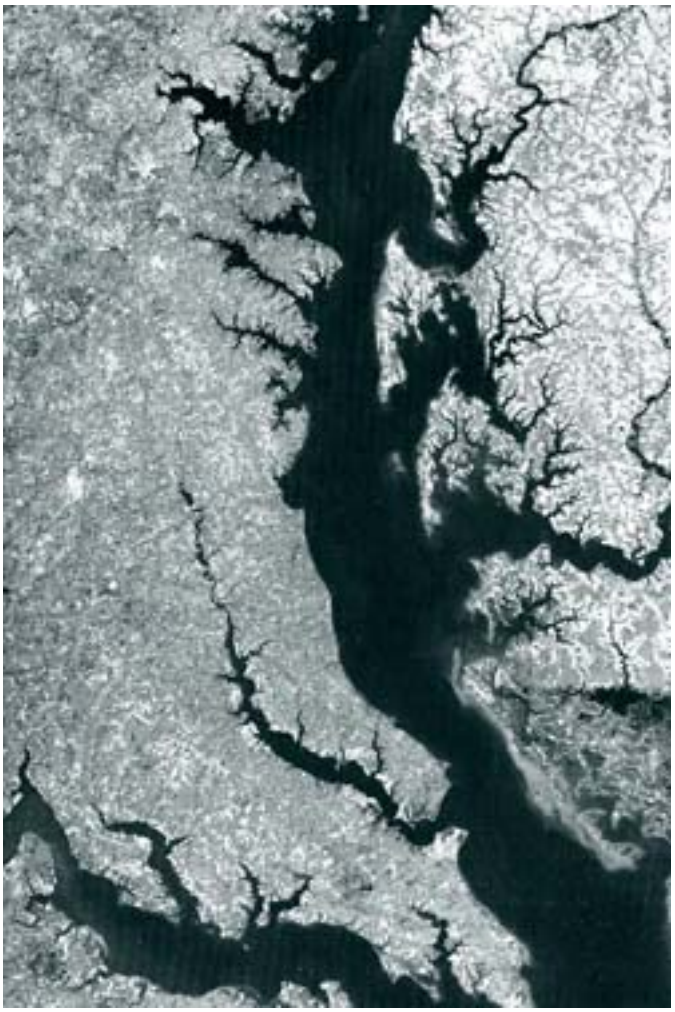
New Approach to Improving Water Quality in the Chesapeake Bay



As the nation's largest estuary, the Chesapeake Bay watershed covers 64,000 square miles of land across New York, West Virginia, Pennsylvania, Delaware, Maryland, Virginia and the District of Columbia. The bay is home to over 3,600 species of plants and animals, and more than 15 million people. The bay watershed's land to water ratio is extremely high (four acres of land for each acre of water), allowing a large quantity of water - and the nutrients and sediments it carries - to drain into the tidal waters of the bay. Since 1983, the Chesapeake Bay Program has coordinated efforts between bay states and the federal government to improve water quality and habitat throughout the bay watershed.

The Living Resource Based Approach and TMDLs

In 1998, the Chesapeake Bay and many of its tidal tributaries were added to the list of impaired waters, thus requiring the development of a TMDL to comply with the

1972 Clean Water Act. A TMDL is the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. It is calculated by totaling all the allowable loads of a single pollutant entering a body of water from all contributing point and nonpoint sources. TMDLs also allocate the amount each pollutant source is allowed to release while still attaining water quality standards set by individual states and approved by EPA.

Chesapeake Bay Program partners are developing a new process for setting and achieving nutrient and sediment load reductions necessary to restore bay water quality. This process requires Bay Program partners to continue to build on previous nitrogen and phosphorus reduction goals, but instead of measuring improvement against broad percentage reduction goals, they must now establish and meet specific water quality standards. Water quality standards combine water quality criteria and designated uses (described below) to produce a target numeric value for each criterion that, if achieved, will maintain the healthy water quality needed for the bay's living resources. This "living resource based approach" will accomplish the same restoration and nutrient reduction goals as a TMDL, but will do so more efficiently and effectively than its regulatory counterpart.

New Designated Uses

An area's designated use refers to a water body's function - such as fishing or swimming - and takes into account the use of the water body for public water supply, the protection of fish, shellfish, and wildlife, as well as its recreational, agricultural, industrial and navigational purposes. The existing designated uses for the bay's tidal waters do not fully reflect the wide variety of different habitats found throughout the bay and its tidal tributaries. Furthermore, where two state boundaries meet, different designated uses may apply for the same waterbodies.

To better position the states and the District to adopt new water quality standards

that relate to the needs of the bay's living resources, the Bay Program has developed five new designated uses for the Chesapeake Bay based on different types of habitat, rather than on human uses of the bay. These five habitats (described below) will guide water quality standards, based on the needs of the plants and animals that have adapted to life in specific parts of the bay.

Migratory Spawning & Nursery - This use promotes the growth of balanced populations of ecologically, recreationally and commercially important fish. Horizontally, it ranges from the upper extent of tidal waters to the lower reach of existing spawning and nursery habitats, and vertically from the water surface to the bottom. The designated use applies from mid-February to early June; during the rest of the year, the shallow water and open water designated uses apply.

Shallow Water - This use includes areas of the bay that are two meters deep or less. The most ecologically rich portion of the bay, the shallows are home to many species of finfish, shellfish and most importantly, the underwater grasses that serve as vital habitat to many bay inhabitants.

Open Water - Horizontally, the open water use begins where the shallow water use ends. Vertically, open water extends from the surface to the bottom, or to the upper boundary of the pycnocline in areas where it exists. The pycnocline is the transition zone between the denser, saltier waters of the deep and the lighter, fresher water flowing from the bay's tributaries.

Deep Water - The deep water use is delineated by the upper and lower boundaries of the pycnocline (or transition zone). In the absence of a measured pycnocline, this use is delineated below a certain depth that is based on the unique geographic conditions of that part of the bay.

Deep Channel - The deep channel use covers the water column below the lower pycnocline boundary to the bay bottom and provides refuge for fish species that depend on deep channel habitats for overwintering during the months of October through April. It also provides for the propagation and growth of benthic infaunal and epifaunal worms and clams that provide food for bottom feeding fish and crabs during the summer.

New Water Quality Criteria

Because conditions throughout the bay differ depending on depth, salinity and season, a uniform baywide water quality standard does not take into account the varying needs of different plants and animals. Additionally, current water quality standards vary from state to state. As a result, these state standards need to be

revised for consistency and to account for the natural variability in conditions found throughout the bay. The bay criteria will differ from one region of the bay to another, as determined by the plants and animals residing in that area. New standards will also remain constant for similar habitats across each of the bay states.

Prior water quality criteria applied to the Chesapeake Bay were based on the assumption that all areas in the bay were identical and did not take into account the natural variability found in the bay's waters. New water quality criteria - dissolved oxygen, chlorophyll a, and water clarity - will vary based on the needs of a healthy ecosystem. By analyzing the relationship between these three criteria, scientists will be able to understand and monitor the more complex processes of the bay ecosystem.

Achieving New Water Quality Standards

To determine the nutrient and sediment reductions necessary to restore the bay, Bay Program partners will use a combination of watershed and estuary models, along with monitoring data, to help determine new cap loads for nitrogen, phosphorus and sediment. The models, along with other information, will be used to allocate cap loads to the nine major tributary basins in the watershed, and then to thirty-seven sub-basins. Each state and the District will bear a proportional burden for achieving and maintaining the cap, based on their pollutant loadings and effects on different tributaries and the bay.

For further information, contact Christopher Conner, Chesapeake Bay Program; Phone: 800-YOUR-BAY; E-mail: conner.chris@epamail.epa.gov; Website: http://www.chesapeakebay.net/restoringwater.htm. 

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Remote Sensing for Coastal Managers

Remote sensing technology has a lot to offer coastal resource managers, yet it is one of the most underused tools in the toolbox. One of the roles of NOAA's Coastal Services Center is to help coastal managers effectively use this tool, through technical training classes, web sites, and publications. The CSC has interviewed several state coastal management officials to learn how they are utilizing remote sensing. The report is available online at http://www.csc.noaa.gov/crs/lca/. EXIT disclaimer

The CSC is also offering a new training course to help coastal managers increase their understanding of this technology. This two-day course explains the basics of remote sensing, and through hands-on computer training, illustrates how remote sensing data can be used in coastal management. Course details can be obtained at http://www.csc.noaa.gov/crs/rs_training.html. EXIT disclaimer

For information about the CSC's other remote sensing programs, such as Coastal Change Analysis Program (C-CAP) data handler, Light Detection and Ranging (LIDAR) data handler, Harmful Algal Bloom (HAB) Bulletins, and the Dune Hazard Assessment Tool, visit http://www.csc.noaa.gov/crs/. EXIT disclaimer

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Builders for the Bay: Making a Difference One Community at a Time

In a first-of-its kind collaboration, builders and environmentalists in the Chesapeake Bay region have joined forces, uniting both environmental and commercial interests. The Alliance for the Chesapeake Bay, the Center for Watershed Protection and the National Association of Home Builders have partnered to establish Builders for the Bay, a unique program aimed at reducing environmental impacts from new construction within the Chesapeake Bay watershed. Builders for the Bay will encourage local jurisdictions in the bay watershed to voluntarily adopt 22 site design principles that encourage more environment-friendly development, making it an important part of both the Chesapeake 2000 Agreement and regional Smart Growth efforts.

Builders for the Bay operates under the premise that making small design changes at the site level can, collectively, make a big difference in the impact new development has on the health of the Chesapeake Bay. The urban stormwater runoff that goes hand-in-hand with development is an increasing problem in the region; according to the U.S. EPA, stormwater runoff is responsible for impairing over 1,570 miles of streams in the bay watershed, threatening local seafood and tourism industries, wildlife, and quality of life along the way. Considering that 3 million new residents are expected in the bay watershed within the decade, making changes in the way that sites are designed is a critical step to retain the integrity of the bay's resources.

The 22 site design principles advocated by Builders for the Bay are designed to reduce both the quality and quantity of urban runoff by fostering residential and commercial development that creates less impervious cover, conserves more natural areas, and incorporates stormwater management techniques wherever possible. Originally developed as part of the Center for Watershed Protection's 1998 National Site Planning Roundtable project, the 22 principles provide guidance on three main areas of new development: residential streets and parking lots, lot development, and conservation of natural areas.

The application of these principles requires that designers scrutinize every aspect of a site plan street widths, parking spaces, driveways and sidewalks to minimize their use and size. At the same time, creative grading and draining techniques should be incorporated wherever feasible to mitigate the impacts of stormwater and improve infiltration. Finally, as much undisturbed land area as possible should be conserved as forests, meadows, stream buffers, and other natural habitat. Applied together, the 22 site design principles can increase open space, reduce pollutant loads, and raise property values.

The 22 principles are not intended to be strict mandates, but loose guidelines that provide a framework for smarter, better, more ecologically sound site development based on local conditions. With this in mind, each community that participates in Builders for the Bay will take part in a local site planning roundtable process to determine the best way to apply the 22 principles at the local level. Many communities find that the current development regulations inadvertently discourage

environment-friendly site designs, and the rules often confuse and frustrate developers who fear that innovative plans may cost more, or take longer to get approved.

Working cooperatively with local government officials, business owners, developers and other community stakeholders, Builders for the Bay will help communities navigate the often bewildering maze of codes, ordinances and regulations. Roundtable participants will critically examine these rules in the context of a variety of economic, environmental, aesthetic and safety concerns, and determine through a consensus process what revisions should be made. The local site planning roundtables are not intended to dictate a cookie-cutter application of the 22 site design principles; instead, they help stakeholders reach agreement on what will work under their own unique conditions.

The local site planning roundtable process that is central to the Builders for the Bay project uniquely demonstrates how a diverse group of government, business, and environmental interests can agree on regulation changes that can be made locally to promote Smart Growth and protect the Chesapeake Bay watershed. The process has also shown how application of the 22 site design principles simultaneously provides dividends for watershed advocates, developers and communities. With necessary funding, the Builders for the Bay team plans to expand their program into 12 jurisdictions in the bay watershed during the next two years.

For further information, contact the Center for Watershed Protection; Phone: (410) 461-8323; E-mail: center@cwp.org; Website: http://www.cwp.org/. 

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Amendments to Superfund Benefit Coastal Communities with Brownfields

In early January, an important piece of environmental legislation - the Small Business Liability Relief and Brownfields Revitalization Act (Public Law 107-118; H.R. 2869) - was enacted to encourage the cleanup and redevelopment of nearly 500,000 brownfield sites, many of which tarnish our nation's coastlines.

Brownfields are abandoned or underutilized industrial or commercial properties where redevelopment is hindered by environmental contamination. Under the federal Superfund law of 1980 (Comprehension Environmental Response, Compensation, and Liability Act), owners and operators of a contaminated property can be held liable for the cost of cleanup, regardless of whether they actually caused any of the contamination. This potential liability has been a strong incentive for businesses and communities to avoid redeveloping brownfield sites.

The new bill reforms Superfund by providing liability protection to prospective purchasers, contiguous property owners, and innocent landowners. It also authorizes approximately $225 million each year (FY 2002-2006) to be granted to local and state governments to assess, clean, and revitalize contaminated brownfield sites, and to establish and enhance brownfields cleanup programs.

This new legislation has the potential to assist coastal communities, such as many in the northeast and the Great Lakes regions, which are burdened with brownfield sites on their shorelines. For example, the Redevelopment Authority of Plymouth, Massachusetts has recently proposed a plan to purchase, clean, and resell a

contaminated site on the town's historic waterfront. Due to former liability concerns, the site has been vacant and for sale for nearly a decade, despite its prime harbor location.

For further information, visit the EPA's brownfields website at http://www.epa.gov/epahome/hi-brownfields.htm.

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Florida Leads the Way in Recycling Fishing Line

It's strong, thin and almost invisible. The same qualities that make nylon monofilament fishing line popular with anglers can make it deadly to wildlife that encounter lost or discarded strands. In Florida, manatees, marine turtles and pelicans are among the long, worldwide list of animals that are harmed by consuming or getting snared in monofilament. Developed in the 1930s, monofilament fishing line is made from a single, continuous strand of nylon and is believed to last 600 years in the marine environment.

Environmentally conscious anglers on Florida's northeast coast now find it easier to dispose of used line properly, thanks to the Monofilament Recycling Project, headed by Dr. Maia McGuire, extension agent for Florida Sea Grant. In November, 2001, McGuire began installing recycling stations at fishing spots in Nassau, Duval, St. Johns and Flagler counties. The stations are placed at both saltwater and freshwater fishing areas, primarily at boat ramps and fishing piers. Constructed from three-foot sections of six-inch diameter PVC pipe, the stations are mounted on 4 x 4 posts (or existing structures) and are labeled to tell people what they can and cannot place in the containers. In addition to monofilament line, anglers can also deposit nylon fishing line spools, nylon rope and nylon cast nets in recycling stations.

Volunteers empty the stations periodically and take monofilament and cardboard spools to collection bins at local tackle shops and marinas. These collection bins are provided free of charge by Pure Fishing, a sporting goods manufacturer that recycles monofilament to make artificial fish habitats, tackle boxes and other plastic fishing-related products. Pure Fishing also provides pre-paid postage labels for the bins, so when the box is full, it is simply taped shut and sent for recycling.

Funding for the program comes from individuals and groups who "sponsor" the recycling stations. Sponsorship covers the costs of building and installing the stations and signs, provides funds for maintenance and repair of stations, and helps cover production costs of educational materials. As of January, 2002, almost 50 stations had been sponsored. McGuire hopes to have 100 stations installed by the end of 2002.

Florida leads the nation with one of the most active monofilament recycling efforts, according to Leesa Souto, formerly an environmental scientist with the Brevard County Natural Resources Management Office in Melbourne, Florida. Souto helped start the Brevard County Monofilament Recovery and Recycling Program in 2000. In the first six months of the program, anglers in Brevard county recycled over 1,000 pounds of fishing line. The program in northeast Florida is modeled after Brevard's program, which was started due to increased manatee entanglements in monofilament fishing line. Since 1997, monofilament line has been the number one cause of manatee injuries in Florida. The endangered aquatic mammals may accidentally consume monofilament while feeding on plants or catch their flippers or tails on submerged line.

Manatees are not the only animal that is affected by discarded monofilament. Marine turtles sometimes mistake floating tangles of monofilament for jellyfish and eat them, causing intestinal blockage and death. Turtles that become entangled in monofilament line often drown. Pelicans and other sea birds may fly or dive into monofilament or eat fish that have been previously hooked and still trail line. Humans are also at risk - there are records of divers becoming entangled in fishing line and drowning, and incidents of boat propellers becoming tangled in monofilament are increasing.

Florida currently has active fishing line collection and recycling programs in eight

counties, and programs are under development in at least five others. Interest in fishing line recycling is not limited to Florida, nor is it limited to coastal counties. Since November, McGuire has had requests for information about starting monofilament recycling programs from people in three Florida counties, Rhode Island, two groups in Pennsylvania, a marina in Washington State and the Bermuda Audubon Society.

For further information, contact Dr. Maia McGuire, Florida Sea Grant Extension Program; Phone: (904) 824-4564; E-mail: mpmcguire@mail.ifas.ufl.edu.

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New Evidence That No-Take Marine Reserves Benefit Fisheries Benefit Fisheries

No-take marine reserves - areas of the sea where fishing is prohibited by law - are an important management tool to protect species from fishing and to reverse prior impacts of overfishing and habitat disturbances. No-take marine reserves also provide researchers with minimally disturbed reference areas for assessing human impacts on marine ecosystems. In addition, they can be utilized for non-extractive activities such as ecotourism, diving, recreation, and public appreciation of marine ecosystems. While they are primarily intended to protect marine ecosystem structure and function within their boundaries, there is new evidence that no-take marine reserves also benefit fisheries in surrounding areas.

The use of no-take marine reserves is controversial, in part because few studies have shown evidence of enhanced fish production compared to exploited areas. However, recent research in St. Lucia and Cape Canaveral, Florida has shown that marine reserves increase total fish landings. In St. Lucia, total fish biomass doubled

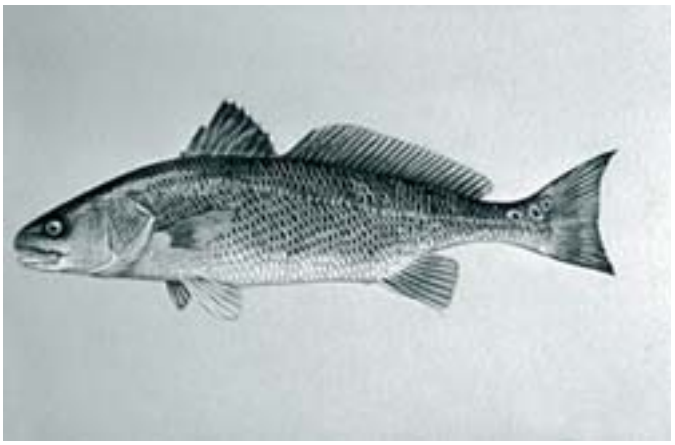
and landings increased 40 to 90% within five years of closing 35% of the coral reef to fishing. At Cape Canaveral, Florida, unintentional reserves were created in 1962 when two areas were closed for security of the Kennedy Space Center. This is the oldest, and until 1999, the largest no-take marine reserve in the North America. After 20 years of being off-limits, the areas inside reserves had significantly higher average fish biodiversity and more abundant and larger exploited fish species than in surrounding areas exposed to fishing. Researchers also found that 62% of all Florida gamefishing world records (of total biomass and number of landings) for black drum (Pogonias cromis), 54% for red drum (Sciaenops ocellatus), and 50% for spotted seatrout (Cynoscion nebulosus) occurred within 100 kilometers (60 miles) of the Cape Canaveral reserves.

Fishing impacts marine ecosystems by removing both the targeted species and unintended organisms (bycatch), and by altering or damaging important habitat. Fishing is size selective, and can have profound effects on average size, population genetics, and reproductive success. Certain biological characteristics, such as delayed reproduction and extreme longevity, make some species particularly vulnerable to fishing. In most cases, the full impacts of fishing on marine ecosystems are unknown.

No-take marine reserves function by preventing all directed fishery catches, bycatch mortality, and habitat damage within their boundaries. Although when first established, reserve areas may be depleted or damaged from previous exploitation, there is evidence that habitat and populations can recover. Reserves are initially

colonized by juveniles that either settle from the plankton or that immigrate from surrounding areas. Individuals can grow and persist in reserves while those that settle in fished areas tend to be removed. Abundance and biological diversity of exploited species increases in reserves as species that are rare and more vulnerable to fishing accumulate.

As seen in Cape Canaveral, no-take marine reserves also benefit fisheries outside their boundaries by spillover and increased reproduction. Spillover occurs when fish migrate from reserves into surrounding areas where population density and competition are lower and food is more available. Larger and more abundant fish significantly increase the number of offspring that are dispersed into fishing grounds by currents and oceanographic processes. While some offspring may disperse only short distances and eventually re-supply the reserve, others may disperse widely to supply more distant fishing grounds. Reserves also provide indirect benefits by protecting stock quality against detrimental genetic changes caused by selective fishing and make overfishing more difficult by providing fish populations places to recover more rapidly after human generated or natural disasters.



No-take reserves should be designed to create a self-sustaining network of geographically dispersed sites that represent all habitats. Scientific questions still remain to be answered about optimum size, number, and location, as well as which habitats and total area should be included in no-take marine reserves. Their effectiveness is likely to vary between species, habitats, and ecosystems and more studies are needed to examine fishery and ecosystem benefits. Social acceptance, compliance and enforcement are still major hurdles although recent technological advances in navigation, vessel monitoring, and surveillance have improved compliance and made enforcement a practical option.

No-take marine reserves are an essential ecosystem and habitat-based protection measure used to compliment other traditional fishery management tools; however, they are not a panacea or a substitute for other fishery management measures. Although fishery benefits can be significant, it is important to remember that the primary functions of marine reserves are to protect marine and coastal ecosystems and to increase human understanding about their management.

For further information, contact James Bohnsack, Research Fishery Biologist, Southeast Fisheries Science Center, National Marine Fisheries Service; Phone:

(305) 361-4252; E-mail: jim.bohnsack@noaa.gov.

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Report on Status, Trends, and Initiatives in Watershed Management

The EPA has released the report, Protecting and Restoring America's Watersheds, describing recent successes and ongoing obastacles to effectively using the watershed approach to manage the quality of the nation's water. This report brings together the ideas of local stakeholders, government employees, and academic evaluators who assess the current state of watershed management and suggest recommendations for improvement in areas such as awareness, monitoring and research, funding, and technical assistance.

The report is available online at http://www.epa.gov/owow/protecting/.

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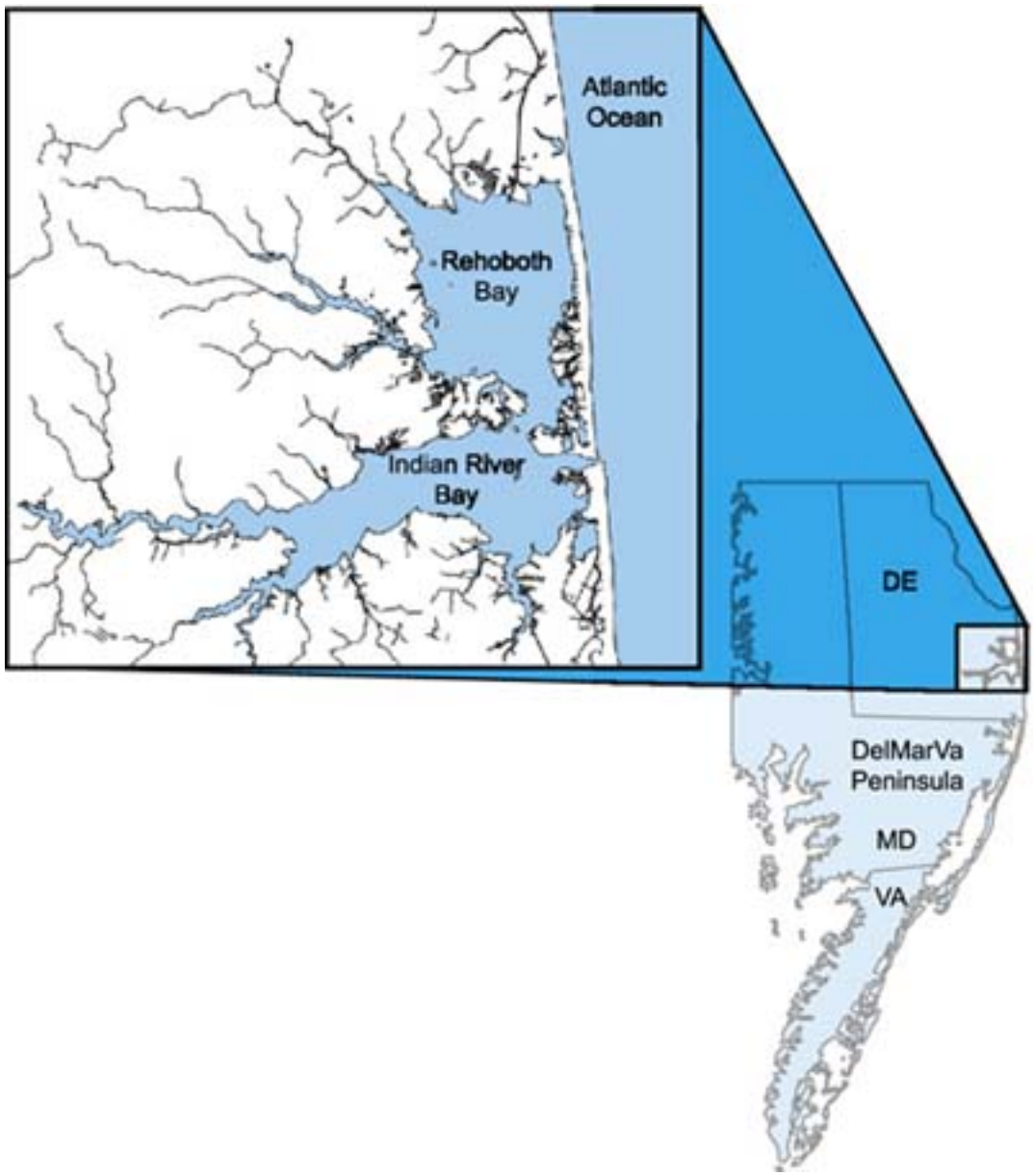
Delaware Inland Bays Estuary Program

Eelgrass Restoration in Delaware's Inland Bays

Introduction



Delaware's Inland Bays cover 32 square miles, and consist of three distinctly different tidal water bodies with unique hydrologic and physical characteristics. Indian River and Bay is a shallow drowned river valley system with freshwater inflow as well as a direct connection to the Atlantic Ocean through the Indian River Inlet. Rehoboth Bay is a shallow coastal lagoon system behind a narrow barrier island. It connects to the ocean by the Lewes and Rehoboth Canal on the north and the Indian River Bay to the south. The smallest and shallowest of the three bays is Little Assawoman Bay, which is located near the Delaware/Maryland border and connects to the ocean via the Ocean City Inlet.

An excessive level of nutrients is the most serious environmental problem facing Delaware's Inland Bays, and is exacerbated by a number of natural and man-made factors. Land use in the watershed (approximately 320 square miles) is largely agricultural, urban, and residential. An extensive network of engineered drainage ditches expedites the transport of nutrients from these land uses. A large ratio of land to water (10:1) allows little dilution of nutrients and other pollutants from runoff

and groundwater discharge. Furthermore, the Inland Bays are poorly flushed, with a flushing rate of approximately 90 days.

Background

Historically, Delaware's Inland Bays had healthy populations of submerged aquatic vegetation (SAV). Submerged aquatic vegetation consists of algae (both single cell and macroalgae) and rooted vascular plants such as eelgrass and other seagrasses. It provides excellent nursery and breeding habitat for aquatic life, including recreational and commercially important estuarine fish and shellfish species.

As with the other coastal bays in the region, eelgrass populations in the Inland Bays were decimated by the Atlantic pandemic eelgrass blight in the early 1930's. Populations were further impacted by a series of severe coastal hurricanes and storms in the following decades. Deteriorating water quality mortally impacted Delaware's eelgrass population, and ultimately caused it to become locally extinct by the late 1960's.

During the 1980's, water quality conditions in the Inland Bays improved enough to make the eelgrass restoration a viable goal. This improvement was the result of new environmental regulations (such as required conversion of septic systems to central sewer) and severe natural erosion that enlarged the Indian River inlet and subsequently increased the flushing rate.

Project Overview

The eelgrass restoration project began in 1997, with a $100,000 grant from the EPA. The first step in the project was to identify sites where habitat conditions were suitable for eelgrass growth. This required an analysis of parameters such as water quality, soil substrate, physical conditions (water depth, bottom slope, wave exposure, water current velocities and storm exposure) and locations of historic eelgrass beds. Replicated test plots were used to determine the validity of the site selection criteria.

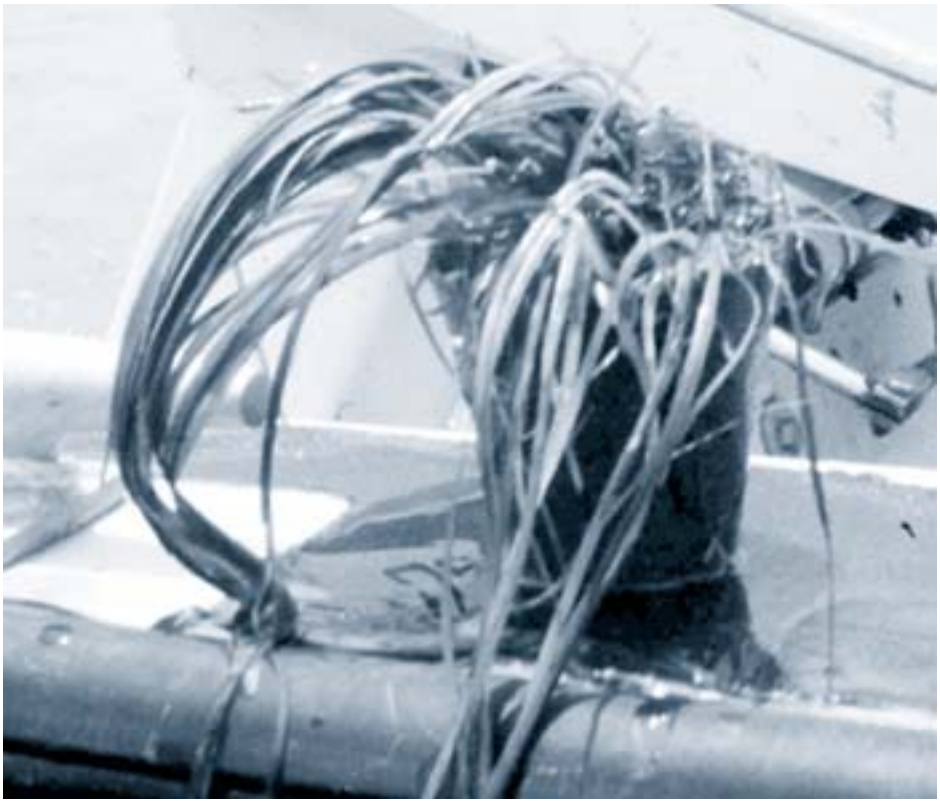
The next task was to determine the most suitable eelgrass transplant method for local conditions. With the assistance of SAV researchers at the Virginia Institute of Marine Science, various transplant methods were evaluated and tested. The most suitable method was to secure eelgrass shoots in small peat pots, and then plant the pots 0.5 meters apart in a grid pattern.

Finding eelgrass shoots to transplant was problematic because there is no

commercially available source for either plants or seeds. Researchers traveled to Chincoteaque Bay, Virginia, to harvest transplantable eelgrass shoots. Great care was used in the harvesting of the transplant shoots so that no damage was done to the donor bed. Harvesting locations were constantly relocated throughout the process, and each site was evaluated to ensure that donor beds were not impacted. Upon collection, the shoots were placed in 3-inch peat pots and then sealed in plastic containers to prevent sun exposure and to keep them from drying out.

After safely transporting the shoots to the restoration sites, divers (using snorkeling or SCUBA gear) carefully transplanted the potted eelgrass shoots, or "planting units". To ensure that the plants were evenly spaced, they used a submersible grid constructed of PVC pipe and high visibility cord.

Another important consideration for eelgrass transplanting is timing. Because high water temperatures can be harmful to eelgrass transplants, some experts caution against summer plantings. However, given the close proximity of the restoration sites to the cooler ocean waters, summer plantings were successful in the Inland Bays.



When Inland Bay researchers implemented this transplant method in suitable habitats, they found that plant survivability exceeded 95%, which illustrates the potential success of this transplant method and planting strategy. A more detailed description of the transplant method can be found in "Guidelines for the Conservation and Restoration of Seagrasses in the United States and Adjacent

Waters" by Fonseca et. al., (p. 119) which can be found on-line at: http://shrimp.ccfhrb.noaa.gov/library/digital.html. EXIT disclaimer

Project Results

The viability of the transplanted eelgrass shoots was tempered by many setbacks. Black Brant, a common waterfowl species, devoured some plots almost overnight. In the winter, pack ice pushed by high winds and tidal action eliminated other test beds by gouging out the plants by their roots. On more than one occasion hurricanes and severe coastal storms either up-rooted the transplants or smothered them with sand. Furthermore, commercial and recreational clammers uprooted many transplants even though the beds were in areas closed to shellfishing. Despite these setbacks, many of the transplanted eelgrass beds survived, expanded, increased in density, and even reproduced by germinating seeds. Many of the successful transplanted eelgrass beds increased their total area coverage by approximately 8-fold after one full growing season following seed germination.

Lessons Learned

Some problems continue to plague this restoration effort, such as inadvertent bed destruction, excessive macroalgae growth, and a sustainable supply of eelgrass transplants. Recreational and commercial clam harvesting continues to take its toll. In an effort to avoid clamming impacts, restoration beds are located, if at all possible, in designated 'No Clamming' areas to order to reduce user conflicts and bed destruction. Additionally, the beds are also delineated with tall posts made of 3-inch diameter white PVC, and signage informs the public of the significance of eelgrass and its habitat.

In an early attempt to keep clammers away from restoration beds, researchers enclosed the beds with plastic construction fencing. Although the fencing did not totally inhibit clammers, they found that it inadvertently attracted and trapped dense blooms of drift macroalgae that either robs the eelgrass of required light or smother the eelgrass under its overburden of decomposing biomass. Macroalgae continues to be a serious local problem impacting eelgrass beds in this watershed. Based on this finding, researchers later added a site selection criterion so that only areas with minimal macroalgae growth are selected for restoration sites.

Volunteers assisted with some aspects of the restoration process, and they undoubtedly played a role in helping to educate the public on the importance of seagrasses and other SAV. However, researchers found that trained, paid staff members yield a higher degree of consistency and success to the restoration process. Unlike volunteers, paid staff is available regardless of the time, weather, and adverse working conditions.

Future of the Project

In 2000, in an effort to better protect natural SAV beds in Chincoteaque Bay and elsewhere, Virginia established an SAV protection program that prohibits the harvesting of SAV for out-of-state restoration efforts. Since that time, transplanting has been postponed until the researchers at Delaware Inland Bays find another source of harvestable eelgrass for the restoration project.

Delaware Inland Bay researchers have considered harvesting eelgrass shoots from areas off the Delmarva Peninsula, but operational logistics would be prohibitive and donor shoot survivability would be at jeopardy. They have also considered raising their own eelgrass shoots via aquaculture, but the equipment and infrastructure needed for creating such a facility is expensive and the process is very difficult. Another issue is that genetic variability is important for sustainable restoration beds, and this can only be assured through importation of eelgrass from other regions. Despite this donor plant supply setback, researchers continue to monitor and maintain the existing restoration beds while they continue searching for an alternative source of eelgrass shoots.

Like many other natural resources, eelgrass and the species that depend on it do

not observe political boundaries. The inter-jurisdictional management of regionally significant natural resources poses unique challenges that are often complicated by regional priorities. Those involved in the Delaware Inland Bay's eelgrass restoration project believe the state officials from Delaware and Virginia can work closely together to restore, enhance and protect SAV resources because of their importance to regional ecosystems. They hope that ongoing productive communication between resource managers in Delaware and Virginia will reinstate the critical supply of eelgrass transplants, so they can continue their work to restore eelgrass populations to their historic levels.

For further information, contact:

Mr. Ben Anderson,
Division of Water Resources, Watershed Assessment Branch,
Delaware Department of Natural Resources & Environmental Control;
Telephone: 302-739-4590;
E-mail: Ben@dnrec.state.de.us;
or visit the website http://www.udel.edu/CIB/. EXIT disclaimer

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Great Strides to Protect the Great Swamp Watershed

The Ten Towns Great Swamp Watershed Management Committee (Ten Towns Committee) is an inter-municipal organization in New Jersey designed to facilitate regional watershed management in the Great Swamp watershed. The Committee is comprised of three representatives from each of the ten municipalities within the geographic limits of the Great Swamp watershed, located approximately 30 miles west of New York City. Formally established in 1995, the Committee was the first of its kind in New Jersey, and has become a model for inter-municipal watershed management.

The history of the Committee began in the late 1960s, when the New York-New Jersey Port Authority proposed construction of a regional airport in the watershed. There was strong opposition to this proposal by citizens who recognized the highly environmentally sensitive nature of the watershed and the value of this natural resource. A citizens' group was formed which resulted in the purchase or donation of more than 1,000 acres that was later designated as the Great Swamp National Wildlife Refuge.

Despite the public's concern over the Great Swamp, efforts to ensure protection of water quality in the watershed had limited effectiveness, primarily because early efforts utilized a "top down" approach with little involvement of the communities within the watershed. For example, in October 1994, legislation was proposed to establish an independent commission to oversee development and regulate environmental protection in the Great Swamp watershed.

Morris 2000, a non-partisan, county-wide volunteer organization dealing with regional issues, recognized that this top-down approach would be opposed by local municipalities who have authority for local land use decisions under New Jersey land use laws. Given the likely failure of the proposed independent commission, Morris 2000 contacted legislators, citizen groups, and municipalities in the Great Swamp watershed to develop an alternative course of action. The result was the establishment of the Ten Towns Committee through an inter-municipal agreement that was adopted unanimously by the

governing bodies of each community.

The Ten Towns Committee has developed a comprehensive program to implement its watershed management plan, which emphasizes:

- Inclusion and full participation of all interested parties;
- A "grass roots" organization of municipalities most affected by and responsible for environmental regulations;
- A partnership established by all four levels of government (municipal, county, state and federal) and with various private organizations;
- A systematic approach for setting goals and establishing priorities; and
- An action-oriented work plan that coordinates individual activities in the most cost effective manner possible.

The Ten Towns Committee consists of three representatives from each municipality, who are appointed by the municipal governing body. The recommended appointees are one elected official, one administrative official, and one citizen member (such as a member of the local conservation commission). There is also a four-member Executive Committee and a part-time Executive Director to handle daily tasks and coordinate program logistics. Perhaps the single greatest reason for the Committee's success has been active participation by Committee members at more than 70 meetings over 6 ? years.

The inter-municipal agreement mandated that the Ten Towns Committee develop a watershed management plan within the first two years of its existence. Using seed funding from the state legislature and grants from private foundations, the Committee created an education program to develop a common base of knowledge among all members, and hired a consultant to assist in preparing the watershed management plan. The plan was presented to each municipal governing body and was unanimously adopted by all municipalities by September 1997. Since that time, a comprehensive program of watershed management has been developed, and includes:

An ongoing education program for Committee members, municipal officials and the public on a variety of water quality issues;

- An analysis of environmental ordinances and preparation of model ordinances presented to each municipal governing body for adoption;
- Establishment of a water quality monitoring program to provide baseline data

on water quality in the Great Swamp watershed to provide an accurate basis for evaluating water quality in the future, particularly the impact of both positive and detrimental actions that occur in the watershed;
- Establishment of a macro-invertebrate monitoring program;
- Preparation of "environmental assessments" of each of the five sub-watersheds in the Great Swamp to provide more detailed information on nonpoint source pollution. As of January 1, 2002 three environmental assessments have been completed, with the remaining two sub-watersheds to be studied in the next two years;
- Preparation of a stream corridor analysis of the watershed to provide a defensible basis for stream corridor regulations adopted by Ten Towns municipalities; and
- Construction of best management practices (BMPs), including retrofitted stormwater detention basins, bioretention systems and stream corridor restoration projects.

One of the most important activities of the Ten Towns Committee is the development of model environmental ordinances that stress water resource protection as part of a community's development regulations. These ordinances were prepared with the financial assistance of a 319(h) nonpoint source pollution grant received from the New Jersey Department of Environmental Protection.

More than 60 different actions during the past 4 years to significantly improve or fully comply with the provisions of the model ordinances have taken place in participating communities. The Ten Towns Committee is in active communication with each Great Swamp watershed municipality to encourage further adoption of ordinances in the remaining areas that do not comply with the model ordinances. The Committee anticipates that eight or ten additional ordinances will be adopted during 2002, resulting in further "greening" of the ordinance compliance chart.

The achievements of the Ten Towns Committee represent one of the most successful examples of inter-municipal cooperation in the State of New Jersey. Although the Committee does not have regulatory power, the implementation of the watershed management program has been highly successful due to the high level of participation by elected officials, municipal officials, and community members from each of the municipalities.

For further information, contact J. Peter Braun, Executive Director, Ten Towns Great Swamp Watershed Management Committee; Telephone: (973) 984-2000; E-Mail: morris2000.judy@att.net; Website: http://www.tentowns.org/.

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Exciting On-line Resource for Water Quality Monitoring Groups

The Earth Force/GREEN (Global Rivers Environmental Education Network) website at http://www.green.org/ EXIT disclaimer offers an online monitoring database and community action tool for water quality monitoring groups. The site is adaptable to virtually any water quality monitoring protocol, and includes hundreds of free resources such as interactive maps, data sheets, monitoring guides, and data analysis tools. Registration is free, and grants you access to:

- A national database of locally-generated data for biological, chemical, physical, and land use information;
- Special project pages to create customized records of their water quality monitoring and action proj ects;
- Detailed Action Steps and Checklist system to lead users through a step-by-step monitoring and problem-solving process;
- Extensive resources to support monitoring and action taking;
- Ability for large water quality monitoring organizations to review and coordinate monitoring data from affiliated monitoring groups;
- Concise summaries and curricular resources for educators; and
- An on-line catalog to order water quality monitoring supplies.

Trained staff is available to help you customize the site to suit your water quality monitoring organization's needs.

For further information, contact Earth Force/GREEN; Phone: (703) 299-

9400; Fax: (703) 299-9485 ; E-mail: green@earthforce.org.

Happy Campers Enhance Florida's Spoil Islands

The Spoil Islands dotting Florida's Indian River Lagoon are an indelible part of the lagoon's scenic vista, and are a popular destination for recreation and education. These islands are unique because they were not created by nature, but rather by humans. From 1953 to 1961, the federal government created the Atlantic Intracoastal Waterway by dredging a 12-foot-deep channel in the lagoon. The dredge spoil created 137 islands throughout the 156 miles and 4 counties of the lagoon.

Now almost all of the islands are owned by the state, and are managed by the

Florida Department of Environmental Protection (FDEP), Office of Coastal and Aquatic Managed Areas. The FDEP has designated the islands by use categories, which are determined by accessibility, presence of native plants and animals, and historical human use. Currently, there are 47 conservation, 9 education, 56 passive recreation, and 12 active recreation islands. The top management concerns are that the islands have become overrun with trash, debris, and exotic species such as Australian Pine and Brazilian Pepper, which limit the island's plant and animal diversity. Furthermore, some islands designated for conservation and education are being harmed by recreationists.

To address these problems, the FDEP has developed a unique public-private partnership, known as the Spoil Island Enhancement Project, to protect and restore the islands. Over 1,000 volunteers have teamed up with FDEP, including individuals and interest groups such as boaters, campers, fishing clubs, scouting groups, and conservation organizations.

The Florida Inland Navigation District (FIND) provides funding for most of the island restoration and enhancement projects. The Spoil Islands Enhancement Project is guided by a steering committee that is composed of local environmental professionals, group leaders, and representatives of the associated government agencies (FDEP, FIND, local counties). The steering committee meets periodically throughout the year to discuss upcoming projects, work plans, funding opportunities, and conservation issues.

Volunteers undertake projects such as trash and debris clean ups, and constructing informational kiosks to educate the public about the islands natural resources, history, and preferred access points. They help convert open space into camping and picnicking areas by building firepits, picnic tables and benches. Volunteers also remove exotic species and re-plant sites with native vegetation to stabilize shorelines, out-compete invasive plants, and provide food and shelter for wildlife. They often mark exotic trees and encourage campers to cut them for firewood. Because commercial nurseries do not always have native species in the quantities they need, the volunteers are developing onsite nurseries where we can grow their own native

plants for restoration projects.

Volunteers meet one weekend a month (during the cooler time of year) to tackle the restoration and enhancement projects. Many of the volunteers turn the work project into a two-day event, which might include camping on Friday night, fishing Saturday morning, restoration projects on Saturday afternoon, and relaxing by the campfire on Saturday night. All volunteers are provided with food, beverages, tools, materials, safety equipment, insurance, and a t-shirt embellished with the Spoil Island Enhancement Project logo. There is also an annual appreciation day for Spoil Island Enhancement Project volunteers.

For further information, contact Jeff Beal, Aquatic Preserve Manager, Florida Department of Environmental Protection; Phone: (561) 873-6590; or Bill Frega, Volunteer Coordinator, Spoil Island Project Organization; Phone: (561) 332-0841; Website: http://www.spoilislandproject.org/. EXIT disclaimer

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Recommendations from the National Watershed Forum Released

NATIONAL WATERSHED FORUM
Building Partnerships for Healthy Watersheds

Recommendations from the National Watershed Forum, held June 28 - 30, 2001, were recently released. The National Watershed Forum, designed to give a voice to geographically, politically, and culturally diverse organizations interested in protecting and restoring aquatic resources, was attended by nearly 500 delegates. Key issues addressed in the recommendations report include: managing monitoring data; protecting source water; implementing total maximum daily loads; protecting endangered species and habitat; planning for watershed protection; funding watershed projects; and education and outreach.

The report is available online at http://www.epa.gov/owow/forum/.

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Ship Maintenance Also Prevents Invasive Species

Researchers at the Monterey Bay Aquarium Research Institute (MBARI) have found that a novel method for combating ship ballast tank corrosion may also be a cost-effective way to prevent the introduction of foreign aquatic species in coastal waters. Non-native organisms are infamous for causing environmental problems and threatening native communities when they are translocated (accidentally or intentionally) outside their normal range and into a new region. The method, known as deoxygenation, uses nitrogen gas bubbles to remove oxygen from the ballast water and results in toxic conditions for organisms. The method is unique and valuable because it presents a rare win-win solution for the shipping industry and environmentalists.

Ballast water from the global shipping industry inadvertently transports enormous numbers of aquatic organisms from one port to another. These non-native species introductions have caused changes in habitat structure, large economic costs due to factors such as biofouling and predation on commercial species, and are thought to have been involved in 70% of native aquatic species extinctions in the last 100 years. Because of these impacts, researchers from all over the world have been developing ways to clear the ballast water of aquatic organisms that may colonize new habitats. Solutions such as intensive filtration, heat treatments, and biocides are costly, can be dangerous to ship crewmembers, and can have negative effects on the surrounding environment where the treated waters are discharged.

International law currently does not mandate total mortality of ballast water organisms, and costly treatments are unlikely to be voluntarily employed by the shipping industry.

Deoxygenation may present the first solution that can safely and effectively remove the majority of organisms found in ballast water while also providing an economic benefit for ship owners. The method involves bubbling nitrogen gas into ballast water to remove oxygen, thereby preventing oxidation or rust in the tanks. While deoxygenation is expensive, the anticorrosion benefit of this technique is a strong economic incentive for the shipping industry because it reduces ship maintenance costs by combating the costly corrosion experienced in cargo vessels. The shipping industry currently uses expensive paints, which must be maintained over the lifetime of the vessel. Nearly $100,000 (US) per year can be saved for each new ship that uses this deoxygenation technique rather than paint to prevent corrosion.

Because aquatic organisms are also sensitive to oxygen levels, researchers at MBARI explored the nitrogen ballast water treatment as a deterrent to non-native species introductions. They found that the resulting low oxygen environment was toxic to larvae from three known nuisance invasive species found in U.S. waters: an Australian tubeworm, European green crab, and European zebra mussel. Toxicity resulted after only two to three days, while major ocean crossings by cargo vessels typically take weeks. However, some species with cyst stages or anaerobic bacteria may be able to survive the conditions found in a nitrogen treated ballast tank. While extremely effective, deoxygenation may not be the most comprehensive method for removing aquatic organisms from ballast water, but it has a high likelihood of being voluntarily implemented by the shipping industry due to its economic side benefits.

For further information, contact Dr. Mario Tamburri, Monterey Bay Aquarium Research Institute; Phone: (831) 775-1743; Email: mario@mbari.org; or Dr. Kerstin Wasson, Elkhorn Slough National Estuarine Research Reserve; Phone: (831) 728-2822; Email: research@elkhornslough.org.

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Virginia and North Carolina Cooperate to Restore Nation's Second Largest Estuary

Neighbors and longtime water foes, Virginia and North Carolina, have signed a cooperative mandate and agreement to help restore the Albemarle and Pamlico sound system, the nation's second largest estuary, located in North Carolina.

The sounds have suffered water contamination and massive fish kills in recent years, due in part to the high level of nutrients washing into contributing waterways, especially from agriculture and factory farming. The issue became glaringly apparent in the aftermath of Hurricanes Floyd and Fran in 1996, with extensive media coverage of flooded hog farms.

The agreement is the result of over two years of negotiations, and contains goals and objectives for comprehensive conservation management of the estuary's resources. For example, it calls for state officials to share scientific data and to meet regularly on issues such as pollution, water quality, development trends, and wetlands.

Cooperation between the two states is critical for resolving the estuary's pollution

problems. Although the waterbody is located in North Carolina, 16 Virginia counties and cities are located in the Albemarle and Pamlico sound watershed. State officials realize that any cleanup or monitoring of the estuary is useless without controlling the source of the contamination.

The new partnership will have the opportunity to learn from other inter-jurisdictional initiatives with similar objectives, such as those in the Chesapeake Bay and Long Island Sound.

For further information, visit http://h2o.enr.state.nc.us/nep/ EXIT disclaimer or contact the Albemarle-Pamlico National Estuary Program; Phone: (919) 733-5083.

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Web-based Clearinghouse for Chesapeake Bay Educators

ChesSIE (Chesapeake Science on the Internet for Educators) is a unique web-based clearinghouse designed by educators to broadly support watershed-wide K-12 Chesapeake Bay science education. The website (http://www.bayeducation.org/ EXIT disclaimer) provides a central contact point for all Chesapeake Bay Program education programs throughout the 64,000 square-mile watershed. While ChesSIE is a resource center and communications hub that is designed for educators, it also provides researchers, resource managers and other bay stakeholders with a venue for gathering and sharing information and connecting with K-12 classrooms.

Sections link users to teaching resources including field experiences, professional development opportunities, and communication techniques. There is also an interactive bulletin board that enables teachers and researchers to discuss projects and brainstorm ideas and innovations with their peers. In addition, the site serves as a portal to over 50 other web sites pertaining to the Chesapeake Bay.

ChesSIE is a joint project between the Bay Program and the Virginia Institute for Marine Science. It is one of the Chesapeake Bay Program Education Initiatives funded by the U.S. Environmental Protection Agency in 2001.

For further information, contact Susanna Musick, ChesSIE Project Manager, Virginia Institute of Marine Science; Phone: (804) 684-7609; Fax: (804) 684-7161; E-mail: sxmusi@vims.edu.