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Information About Estuaries and Near Coastal Waters
December 2000 - Issue 10.6

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Tidal Marsh Restoration at the San Diego-Tijuana Border

The Tijuana Estuary lies within the most southwesterly corner of the United States. Its watershed drains a 1,700 square mile area of mountainous backcountry spanning the international border between San Diego County, U.S.A, and Baja California, Mexico. The Tijuana River is dammed in both countries and is contained by a concrete flood control channel through central Tijuana. Upon entering the U.S., the river leads to an estuary covering approximately 1,000 acres of open water and sinewy slough channels, comprising roughly half of the area of the Tijuana River National Estuarine Research Reserve ("Reserve").

The Reserve is a largely undiscovered area, and although it is adjacent to densely urbanized communities in the United States and Mexico, it contains some of the most fragile habitats found on this part of the Pacific coast. The arid climate results in sparse vegetation and naturally friable soils that are highly vulnerable to impacts; at the teeming California/Mexico border, soil erosion ranks among the worst found anywhere. Even light rains cause erosion and sedimentation in the lower watershed, and moderate rains bring massive flows of mud and trash to areas of the Reserve. The Tijuana Estuary Tidal Restoration Program (TETRP) was adopted in 1992 as a long-range plan to restore the estuary's tidal volume exchange, re-establish intertidal salt marsh lost to sedimentation, and control sediment input to the estuary.


Tidal channel Network With Tijuana Bullring in Background

The restoration program arose from a thorough assessment of estuarine hydrology by engineering consultants and extensive biological documentation by researchers from San Diego State University's Pacific Estuarine Research Laboratory (PERL). The program is being implemented in phases, using an adaptive management process whereby information derived from construction experience, project monitoring, and research influences the designs for subsequent phases of construction. Project funding partners include the California Coastal Conservancy, the U.S. Fish and Wildlife Service, and the Southern California Wetlands Recovery Project, a group of sixteen state and federal resource agencies organized to promote wetlands restoration in the region.

TETRP's first project, the Oneonta Tidal Linkage (a component of the Tijuana Slough National Wildlife Refuge), was constructed in 1997 and involved linking two existing water bodies to enhance tidal circulation over approximately 200 acres. During construction, the upland area was carefully excavated to minimize impacts to existing salt marsh, and all plants and sediments useful for wetland construction were saved. Salvaged marsh sediments were mixed with excavated upland soils to develop a suitable medium for salt marsh plants on the newly created marsh plain. The project area was planted using a number of different planting approaches and several different species. Quantitative and qualitative assessments in the second year indicated that the project met and exceeded the established five-year performance criteria.

A secondary TETRP objective was to demonstrate the beneficial use of excavated material for beach

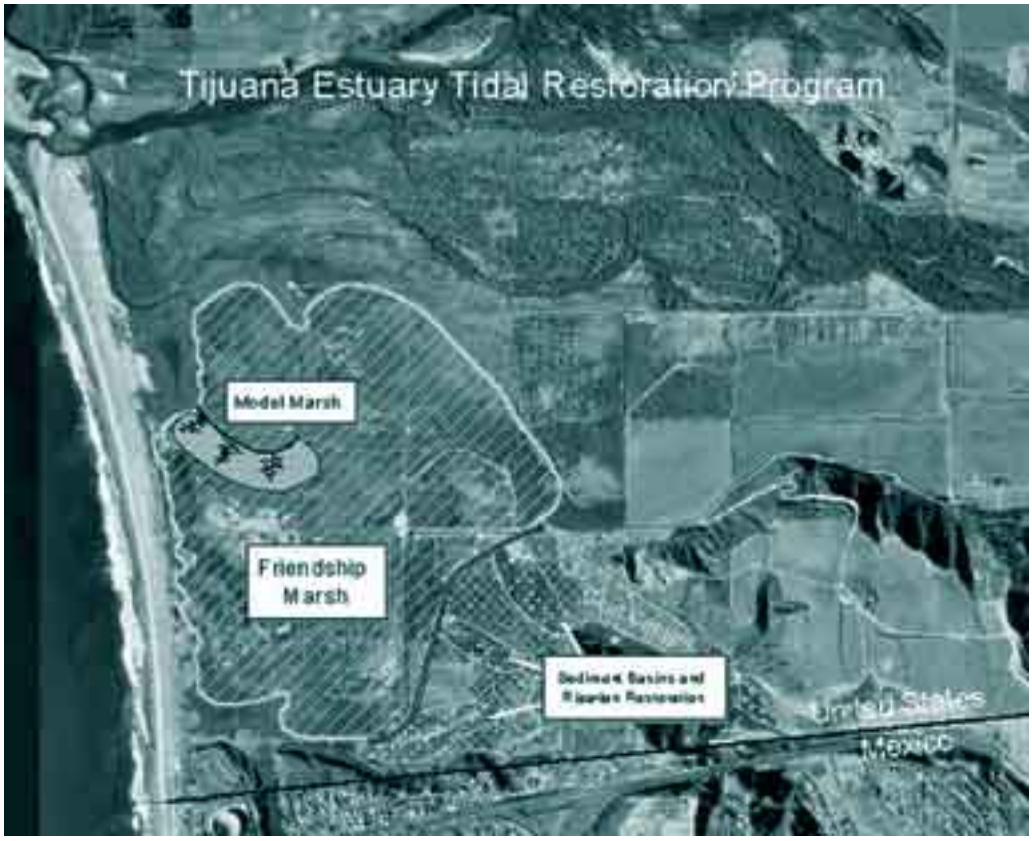
nourishment in severely eroded barrier beach areas. The southern California coastline suffers from a severe loss of offshore beach sand, which would otherwise buffer the effects of storm waves. This can threaten wildlife areas like the Tijuana Estuary, where storm-induced dune overwash can instantly smother acres of saltmarsh. Excavated Oneonta Tidal Linkage sediment that was compatible with local beach sand was discharged by slurry pipeline to the surf zone one mile from the construction site.

The program's second project, the 20-acre Model Marsh, is located within Border Field State Park in the south arm of Tijuana Estuary, just north of the US/Mexico border. The Model Marsh site is former salt marsh that was filled and diked in the early part of the 20th century to allow agricultural and military uses. Implementation of this project involved the excavation of approximately 100,000 cubic yards of soil from a filled salt marsh area, reconstruction of a tidal marsh plain, and the creation of a network of tidal channels. Because of the close proximity to viable habitat for the endangered light-footed clapper rail and several other protected species, construction at the Model Marsh site was restricted to the period between September 15 and February 15.

A combination of active and passive habitat development approaches were employed for this project. Large areas were sparsely planted with Pacific cordgrass (Spartina foliosa), and additional areas were planted with varying plant assemblages to assess species interactions and colonization rates. Almost 10 acres of the site, including tidal channel edges, were not actively planted but have been left to colonize naturally. These areas will function initially as tidal mudflats, now a declining habitat type within the Tijuana Estuary. A primary research focus in the Model Marsh is the role of tidal creek networks in the development of wetland habitats. Researchers will evaluate development of restored areas with respect to invertebrate establishment, fish use, and plant establishment and growth in areas with and without tidal creeks. Small-scale experiments within the site will evaluate the importance of soil amendments, planting combinations, and small-scale topographic heterogeneity. All of these factors can be manipulated at restored sites to fine-tune the restoration effort. The Model Marsh was successfully implemented during the fall and winter of 1999-2000, and was dedicated as the first phase of Friendship Marsh, a larger restoration area.

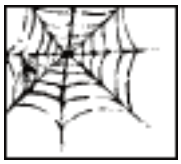
Severe sedimentation from the adjacent Goat Canyon Creek watershed threatens the TETRP restoration area. A key support project to control sediment inflows and re-establish riparian habitat in the restoration area - the Goat Canyon Enhancement Project - is scheduled for construction during summer 2001 and 2002. The Southwest Wetlands Interpretive Association completed the Goat Canyon Enhancement Plan

in June 1999, with funds provided by the U.S. Environmental Protection Agency, the Coastal Conservancy and California State Parks Department. The plan includes a series of sediment management basins to be located adjacent to a restored stream channel in the lower reaches of the creek, as well as an improved all-weather access road to Border Field Mesa and the beach. Guidelines for erosion control in the watershed, including extensive areas within Mexico, are also provided in the plan.



As the early stages of the TETRP are implemented, the construction site is already beginning to evolve. Bivalves and other invertebrates are colonizing restored areas, and juvenile striped mullet swim the channels. Adventurous egrets took an interest in Friendship Marsh with excavation equipment still on site! Bird monitors have been astonished at both numbers of birds and species diversity throughout the year, and now fall migrants are arriving in large numbers. TETRP planners are encouraged by this early success. The Reserve is now more than a secret wildlife sanctuary in a rough neighborhood; it is a place where human intervention has had a helping hand in restoring nature. With so many challenges in this international watershed, habitat restoration can feel like a Herculean task, but the rescue of Tijuana Estuary has begun.

For more information, contact Jim King, Project Manager, California State Coastal Conservancy, 1330 Broadway, 11th Floor, Oakland, CA 94612; Phone: (510) 286-4167; Fax: (510) 286-0470; Email: jking@scc.ca.gov.



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Human Viruses in the Coastal Waters of Florida

Aquatic ecosystems are under increased stress from human activities, particularly in heavily populated states such as Florida, with approximately 14 million people. On-site disposal systems (septic tanks) are used by 30% of the population in Florida, and they contribute an estimated 210 million gallons of waste every day to the subsurface. Microbes from this waste stream can migrate from the soils around septic system drain fields to groundwater and nearby surface water bodies. Over the last decade, microbial fecal pollution in fresh waters and near shore coastal waters has been evaluated by monitoring indicator bacteria and human enteric viruses. In recent years, viral tracers have been utilized to assess the impact of wastewater disposal by septic tanks on the subsurface and nearby surface waters.

Water quality surveys to evaluate the impacts of onsite disposal systems have been undertaken in Charlotte Harbor (one of the southernmost estuaries where shellfish is harvested in the Gulf of Mexico), Sarasota Bay and Phillippi Creek, Tampa Bay and its estuaries, and in the Florida Keys. These surveys indicated that water quality in many of the canals and tributaries in the study areas was impacted by nearby residential areas, which had septic tank densities as high as five per acre.

A high incidence of enteric viruses in nearshore waters and canals has been detected during strong rain events, like those that occurred as a result of the 1998 El Nino episode. Rainfall has been linked to a decrease in coastal water quality, using bacteria levels as a yardstick for evaluation, over a 25-year study period in the Tampa Bay region, and is statistically associated with enteric virus detection in shellfish

harvesting waters of Charlotte Harbor. Overall, between 70% and 95% of the sites surveyed along the West Coast of Florida to the Florida Keys tested positive for enteric viruses, which include coxsackie viruses, Hepatitis A viruses, and Norwalk virus, which are associated with diarrhea, aseptic meningitis, and myocarditis.

Recent viral tracer studies have involved flushing specific bacteriophages (viruses that infect bacteria), not normally found in human waste, down toilets or adding them directly to drain fields in study areas. These tracers were detected in nearby canals and surface waters in as short a time as three to eight hours after being added to the waste stream, indicating that viruses could also be traveling rapidly in the subsurface. Factors such as tidal flushing, soil type, and storm occurrence influenced the transport of the viral tracers. Studies on the two feet of soil required in Florida between septic system drain fields and the water table found only 99% reductions of viruses, with continual and slow release of viruses from the soil system over a two month period. While 99% may appear to be an effective reduction, microorganism removal from wastewater should be on the order of 99.999% to protect drinking water. Viruses are excreted at levels of more than a million per gram of waste, so that 99% removal still leaves more than 10,000 viruses per gram. Peaks in virus concentrations at the two-foot subsurface level were associated with rainfall.

While on-site wastewater disposal systems have been used successfully for many years, it is clear that the conventional septic tank and drain field design provides little treatment for viruses. In coastal areas of Florida, with sandy and limestone aquifers, high water tables, and tidal influences, viruses can readily migrate from the subsurface to surficial groundwaters and subsequently to surface waters. Recreational areas, vacation spots and some urban communities have grown dramatically in Florida in the last 10 to 20 years; associated with this population boom is an increase in homes, all using on-site wastewater disposal. The future of water quality in these areas remains at risk. One way to assess this risk is through monitoring and tracer studies, with the long-term goal of centralized sewers and treatment plants or improved treatment technology applied to on-site systems.

For more information, contact Joan B. Rose, Ph.D., Professor of Water Pollution Microbiology, College of Marine Science, University of South Florida, 140 7th Ave. S., St. Petersburg, FL 33701; Phone: (727) 553-3928; Fax: (727) 553-1189; Email: jrose@seas.marine.usf.edu.

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Envisioning the Future: A New Tool for Coastal Managers

The Maryland Coastal Bays Program has developed a 13-page document on how innovative planning tools can be used in coastal communities to address growth issues. "Envisioning the Future: A New Tool for Coastal Managers," authored by former director Steve Taylor, is based on the Program's own experience and offers "how-to" advice for using visioning and visual preference survey tools in community settings. The booklet is available to all estuary programs and coastal planners free of charge by contacting either the Maryland Coastal Bays Program, Phone: (410) 213-BAYS or the EPA's Coastal Management Branch, Phone: (202) 260-9103.

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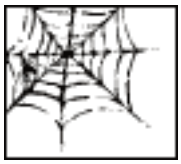
Beach Bill Signed into Law

On October 10th, 2000, President Clinton signed the Beach Bill into law. The law amends the Clean Water Act to improve the quality of beaches and coastal recreation waters through

- Establishing nationally consistent beach water quality criteria,
- Improving beach water monitoring programs, and
- Ensuring prompt public notification of contamination.

The newly enacted legislation requires all states with coastal recreation waters to adopt water quality criteria that protect public health and welfare, consistent with Environmental Protection Agency (EPA) criteria guidance for pathogens and pathogen indicators. The law requires the EPA, in cooperation with state and local governments, to publish performance criteria that provide guidance for state monitoring and assessment, and public notification programs. A total of $30 million will be provided over five years in grants to states and local communities for the implementation and development of these monitoring and notification programs.

For further information, visit the Surfrider Foundation website at http://www.surfrider.org/



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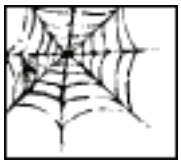
New Training Module from EPA's Watershed Academy

The Watershed Academy has added a new Academy 2000 training module, entitled "Watershed Ecological Risk Assessment" developed through the cooperation of EPA Office of Research and Development and Office of Water. The Watershed Academy offers an Internet-based Watershed Management Certificate, which is earned by completing and passing ten required modules, plus five elective modules of your choice. The new Watershed Ecological Risk Assessment module is considered an "elective" in the certificate program.

To find out more, visit the Academy's website at
http://www.epa.gov/owow/watershed/wacademy/acad2000/ecorisk/



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Bilge Socks Provided Free of Charge to Boaters in Buzzards Bay

When you walk along the boat docks of a marina, what are the chances you will notice a rainbow colored sheen on top of the water? Unfortunately it's a fairly safe bet. Oil discharges from commercial and recreational boats are a chronic source of oil pollution to coastal waters. Most boats have compartments inside their hull that serve to capture rain and seawater entering the hull of the boat. These compartments also capture fuel and engine oil that may leak within the boat. Inboard engine maintenance can also result in spills into the bilge. The pumping of bilge water laden with fuel and oil is a significant source of oil to the marine environment and is the cause of the oily sheen seen in some harbors and marinas.

In the fall of 1999, the Buzzards Bay Action Committee (BBAC), a nonprofit organization composed of municipal officials from around Buzzards Bay, and the Town of Dartmouth received a grant from the Massachusetts Coastal Zone Management office for $53,400 to fund a project, developed in partnership with the Buzzards Bay National Estuary Program, to provide free oil absorbent "bilge socks" to all recreational boaters in Buzzards Bay. The main goal of the initiative was to raise the awareness of the boating community to the significance of oil discharged through bilge water and to encourage boaters to use an oil-absorbing sock to capture oil and fuel before it is discharged. The grant also provided funding for the towns to pay for the establishment of collection sites for the bilge socks, and to pay for their disposal. In addition, the Buzzards Bay Project developed an educational flyer and outreach material to distribute with the bilge sock.

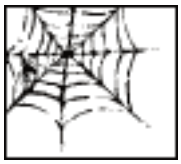
The Buzzards Bay Project provided technical assistance in the development of the request for proposals for bilge oil absorption devices, generally referred to as "bilge socks," "bilge pads," or "bilge pillows." They also tested the ability of bilge socks from different manufacturers to meet the needs of the project. Of the over 20 different absorbent bilge socks submitted by manufacturers, only three passed all the criteria. Bilge socks must meet the following criteria:

- Absorb and retain 1.5 quarts of a diesel-engine oil mixture without dripping or releasing oil when squeezed, to ensure that no oil is released when the sock is removed;
- Pass through a 3.5 inch diameter hole, so it may be used in cramped bilge compartments;
- Have a way to be secured, so it will not shift and interfere with the function of the bilge pump.

All three products, which met these criteria, were composed of hydrocarbon-absorbing polymers that combine with oil to form an insoluble plastic-like material. A written report on the results of the bilge sock tests can be found at the Buzzards Bay Project website www.BuzzardsBay.org.

In early April 2000, the chosen manufacturer delivered 8,000 bilge socks to coincide with the beginning of the boating season. The bilge socks were distributed by harbormasters in area towns and the Buzzards Bay Baykeeper throughout the summer. The harbormasters also maintained special disposal barrels for the bilge socks, which can then be disposed of at a conventional waste-to-energy facility. The bilge socks were supplied to boaters free of charge for a single season, to encourage boaters to purchase these devices in the future. The retail cost for such a bilge sock is estimated to be between $10 and $15. The disposal service will be continued by the municipalities to encourage proper disposal of the bilge socks.

For further information, contact Mr. Leonard Gonsalves, Buzzards Bay Action Committee; Phone: (508) 999-1131; Fax: (508) 999-0739, or Joe Costa, Buzzards Bay Project, National Estuary Program, Phone: (508) 291-3625 or visit the Buzzards Bay website at http://www.buzzardsbay.org/. EXIT disclaimer



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Girl Scouts Work for Clean Water

Girl Scout troops from around the country are working hard to earn a new patch to sew onto their patch jackets. The new Water Drop Patch Project is an innovative clean water partnership between the Girl Scouts of the United States of America and EPA's Office of Wetlands, Oceans, and Watersheds. The goal is to engage girls in local watershed protection activities, encouraging them to make a difference by becoming watershed and wetlands stewards, and to use their skills to educate others about the need to protect valuable water resources in their communities.

The Water Drop Patch Project provides 20 different watershed activities in which Girl Scouts can get involved, including (depending on age level) the following:

- Identifying ways to reduce water pollution at home and in the yard;
- Visiting local wetlands or wetland exhibits and learning about the importance of wetlands and

their basic characteristics;

- Learning about their local watershed, including the source of their drinking water;
- Stenciling storm drains with a reminder that storm drains dump directly to a local waterbody;
- Conducting "streamwalks" to monitor and survey local stream health;
- Hosting watershed and groundwater festivals to raise community awareness;
- Monitoring water quality; and
- Participating in stream, wetland, and beach cleanups.

After completing a prerequisite number of these activities, Girl Scouts earn a beautiful patch with an embroidered white egret on a lily pond. The program began in March, 1999, and already approximately 5,000 Girl Scouts nationwide have earned patches. Last Fall, the Project was selected by the National Environmental Education Training Foundation (NEETF) for an National Environmental Educational Achievement Award.

At Camp Shantituck in Kentucky, led by Camp Program Director Susan Lange, Girl Scouts learned about nonpoint source pollution while completing the patch project. As part of the Girl Scouts Day Camp Program, the girls conducted stream assessments, chemical testing, and biological monitoring of the two creeks that run through the camp. They sampled for nitrates, coliform bacteria, dissolved oxygen and pH; used a topographic map to locate farms, water sewage treatment plants, and other potential sources of nonpoint pollution further upstream, and identified several types of macroinvertebrates.

Now that the Girl Scouts have identified the types of pollution in the creeks, they are focusing on learning where the pollutants enter the creeks and how they can help keep them clean, such as providing buffers and community education. In the future, Tina Montgomery, a microbiologist at the University of Louisville, will assist the girls in performing another coliform test and a chlorine test to try to determine why the macroinvertebrate population was low in one stream.

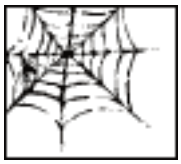
The Girl Scouts will continue to monitor the creeks quarterly and report their findings to the Kentucky Division of Water, which records their data. Through a Clean Water Act 319(h) grant provided to the Kentucky Waterways Alliance, the Girl Scouts received $250 to cover their supplies. While at Camp Shantituck, all Brownie, Junior and Cadettes campers received the Water Drop Patch. Senior Girl Scouts assisted the younger girls with many of the activities.

Troop Leader Patty Murphy's Brownie Troop Number 2260 in Hollis, Maine, learned all about the importance of watershed protection by doing the Water Drop Patch project. But best of all, she said, was the discovery that protecting the environment can be fun. Among a myriad of water-related activities, the brownies went on a streamwalk, put up a wall mural of water posters at their school, and visited a wildlife refuge, a hatchery, and a hydroelectric dam.

To help the Girl Scouts get started, the EPA has published a Water Drop Patch Project booklet providing background information on watersheds, nonpoint source pollution, wetlands, and groundwater/drinking water, a list of resources and helpful web sites, and a glossary. The project initially began as a pilot with the Girl Scout Council of Washington, DC, where it was championed by program specialist Karen Brown. To date, the booklet has been distributed to more than 3,000 troops (representing approximately 45,000 girls) in the Washington, DC, metropolitan area and all 318 Girl Scout Councils nationwide.

The Water Drop Patch Project is just one of the many innovative watershed partnerships encouraged by the nation's Clean Water Action Plan. Through the Clean Water Action Plan, EPA supports local organizations and citizens in locally-based watershed protection efforts, and encourages the organization of groups nationwide by increasing the availability of information and technical assistance. For more information on the Clean Water Action Plan, visit http://www.cleanwater.gov/.

For further information, the Water Drop Patch Project booklet can be ordered from EPA's National Service Center for Environmental Publications at Phone: (800) 490-9198, ask for EPA Publication Number EPA-840-B-99-004 or download it from the Internet at http://www.epa.gov/adopt/patch/.



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New Red Tide Discovered in South Carolina

Reports of harmful algal blooms (HABs) in South Carolina estuaries and coastal waters are rare. Prior to 1998, the only published record of an HAB in South Carolina marine waters was a 1988 *Gymnodinium* breve red tide that originated in the Gulf of Mexico and was transported with the Gulf Stream to continental shelf waters off North Carolina and then southward to South Carolina nearshore waters. It is not known whether the lack of HAB reports reflects the character of the state's estuaries (e.g., generally shallow and well-flushed, low-to-moderate nutrient levels) or a historical lack of effort in detecting HABs.

In the spring of 1998, a 30-year veteran commercial shellfisherman from McClellanville, South Carolina, observed an unusual rust color in a tidal creek. A sample was brought to the University of South Carolina Baruch Marine Laboratory, where it was categorized as a dinoflagellate red tide bloom, based on the high monospecific population abundance (more than 100,000 cells per ml). That event marked the first report of a "localized" (i.e., apparently originating within the estuary) red tide in a South Carolina estuary. The dinoflagellate was subsequently identified as a new species, *Scrippsiella carolinium* (see Figure 1). In the spring of 1999, the same red tide phenomenon reappeared at several sites in South Carolina ranging over 100 miles, including estuaries near Georgetown, McClellanville, Charleston, and Hilton Head. The red tide was long-lasting (approximately two months) and at times intense (more than 100,000 cells per ml), producing a deep orange-red color to the water. This was likened by one Hilton Head fisherman, who had never before seen the phenomenon in his 20 years of fishing that area, to the color of "Tabasco

sauce." The red tides recurred in the spring and summer of 2000.

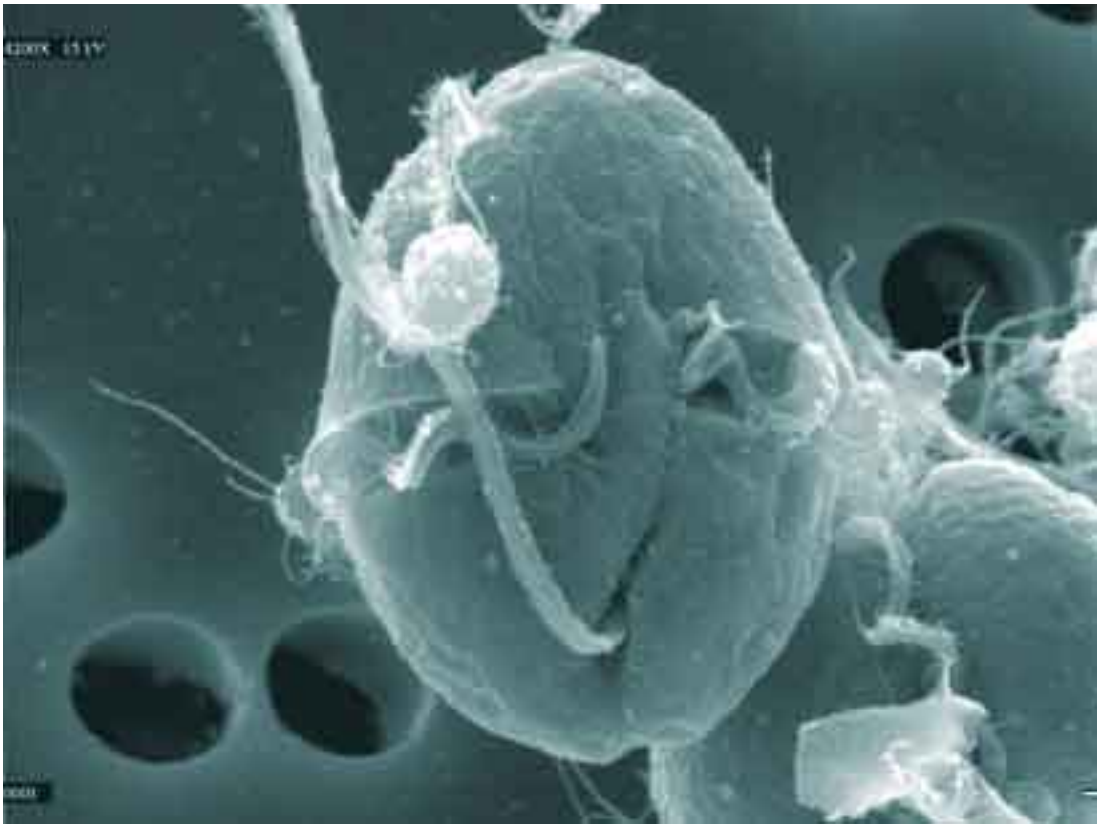


Figure 1.: Scanning electron micrograph of *Scrippsiella carolinium*. Contributed by Dr. Howard Glasgow at North Carolina State University's Center for Applied Aquatic Ecology.

Several members of the South Carolina Task Group on Harmful Algae have implemented a multidisciplinary research program examining the biology and environmental ecology of this species. Their goal is to understand factors causing its recent occurrence and widespread distribution in South Carolina estuaries. Some insights into the dinoflagellate's bloom ecology have emerged. The initial periods of bloom formation followed rain events, which resulted in low salinity (fresh) water containing high concentrations of dissolved organic material, such as dissolved organic nitrogen (DON) and dissolved organic carbon (DOC) (see Figure 2). Organic loading may be linked to red tide blooms by increasing trace metal availability or as a source of nutrients or carbon. Over the course of the bloom periods, dissolved organics decreased in concentration and were maintained at relatively low levels, while dissolved inorganic carbon (DIC) distribution exhibited the opposite pattern (lower panel of figure). These patterns in DOC and DIC likely reflect high respiratory rates during the blooms, and may indicate that *S. carolinium* has a high ability to use organic nutrients loaded into estuaries.

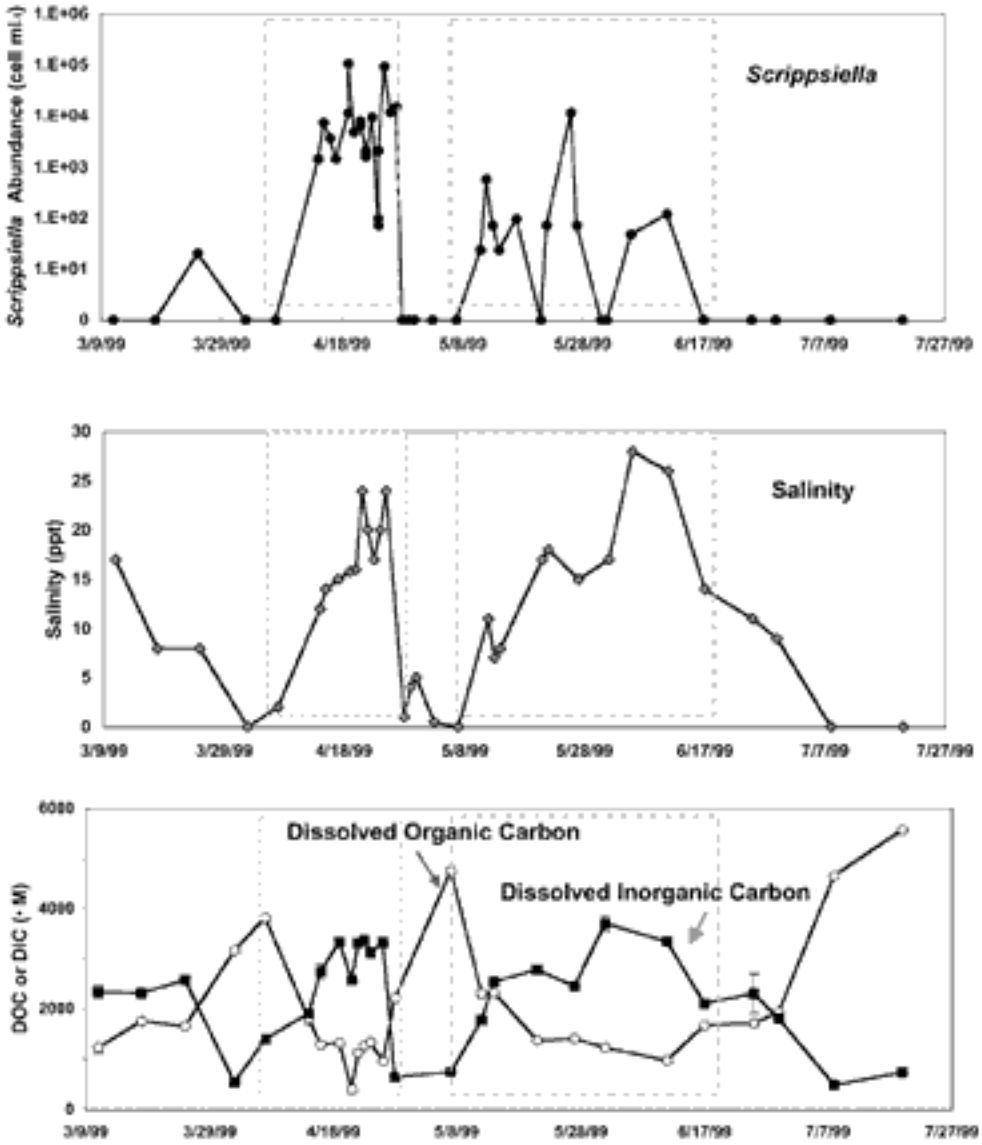


Figure 2: Distribution of *Scrippsiella carolinium* at a site in North Inlet estuary during the Spring of 1999.

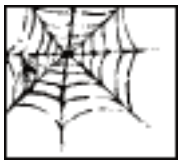
It is not known whether the *S. carolinium* blooms were "harmful" per se. Toxin assays suggest that the dinoflagellate is nontoxic. However, *S. carolinium*'s potential to cause adverse ecological effects needs further evaluation. A shellfish bioassay indicated that the growth of juvenile hard clams was substantially reduced in the presence of the dinoflagellate. The dinoflagellate also was found in high abundances in a blue crab shedding house in Charleston, coincident with a blue crab 30% mortality event. Even if they are nontoxic, organisms forming red tides can cause problems for finfish and shellfish because they may replace more nutritious algae, deplete oxygen, or clog gills.

These South Carolina red tides appear to be a new phenomenon and not just a function of increased surveillance. Besides the claims of fishermen, the observation was also new to researchers involved in long-term monitoring programs in South Carolina estuaries, including more than 20 years of intensive sampling in North Inlet estuary (where National Science Foundation Long-Term Ecological Research and ongoing NOAA National Estuarine Research Reserve programs are conducted), one of the estuaries where blooms occurred in 1999.

Where did the bloom come from? Growing rates of coastal zone development in South Carolina have a potential influence on estuarine water quality and HAB stimulation. In many of the bloom locations, nutrient loading has increased markedly over the last several years, including estuaries near McClellanville that have been affected by discharges of relatively untreated sewage from a local public school, dumping of crab shucking-house waste, and increased use of local waters by recreational fishermen. However, the dinoflagellate also formed pronounced blooms in North Inlet estuary, a protected site characterized by a lack of man made nutrient loading (although influence from atmospheric deposition cannot be discounted).

The recent and recurrent appearance of this widespread and often intense red tide raises important issues regarding the condition of South Carolina estuaries. Is this a natural cyclical or weather-driven event (e.g., el Niño/la Niña); the result of species introduction (e.g., through ship ballast water); a product of long-term climate changes (e.g., sea level rise); or a signal of changing water quality? The question has stimulated a statewide collaborative research effort between South Carolina Task Group scientists from University of South Carolina's Baruch Institute, South Carolina Department of Natural Resources' Marine Resources Research Institute, South Carolina Department of Environmental Health Concern, South Carolina Sea Grant Consortium, and NOAA's National Ocean Service-Charleston.

For further information, contact Alan Lewitus, Ph.D., Research Associate Professor, Belle W. Baruch Institute for Marine Biology and Coastal Research, University of South Carolina, and Associate Marine Scientist, SC DNR, Marine Resources Research Institute, Fort Johnson Road, Charleston, SC 29422, Tel: (843) 762-5415, Fax: (843) 762-5110; Email: Lewitus@belle.baruch.sc.edu.



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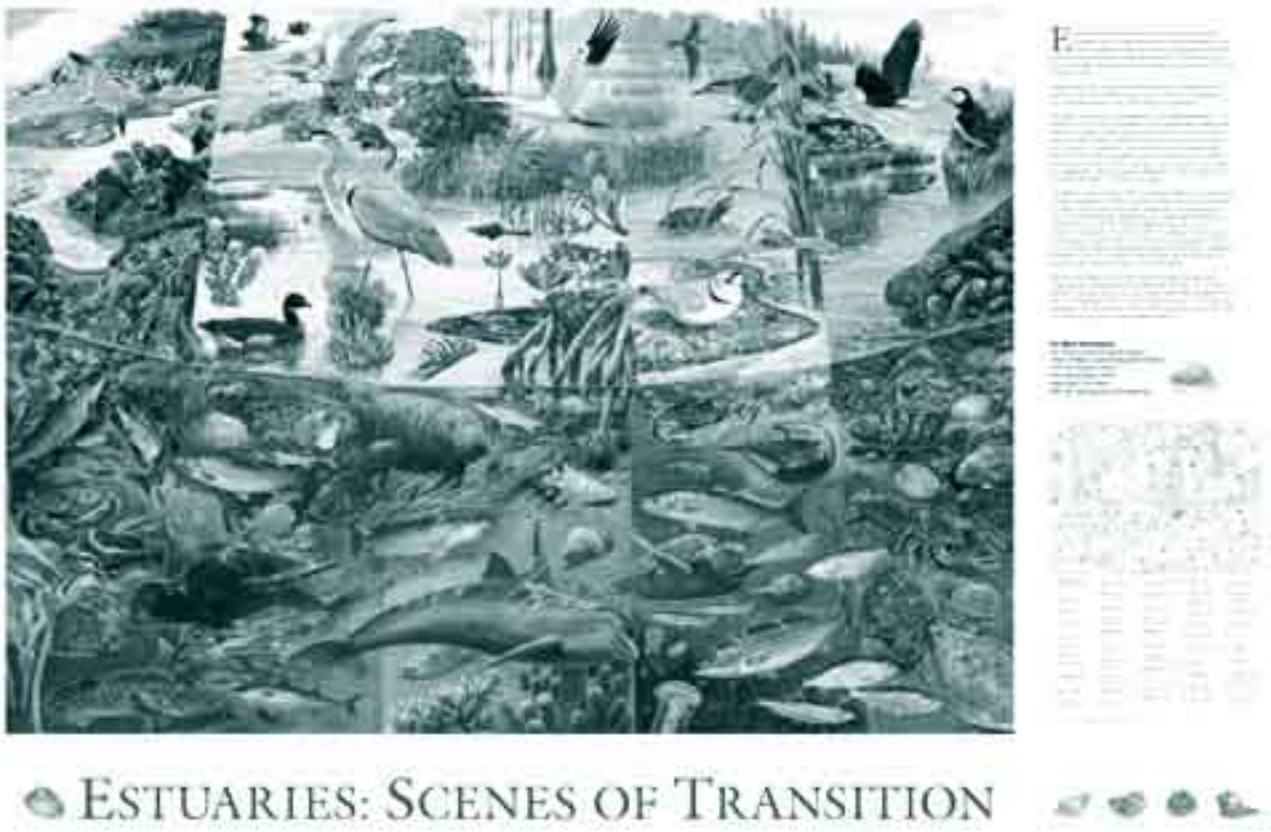
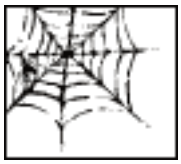
New Poster Available, "Estuaries: Scenes of Transition"



In conjunction with National Estuaries Day on September 30th, 2000, the USEPA unveiled a dramatic new poster featuring an original illustration by naturalist and painter John Dawson. The poster depicts the geographic and biological diversity of our nation's estuaries - ranging from the Pacific Northwest to the Northeast Coast.

With more than 100 different flora and fauna, the poster illustrates the rich abundance of life in estuaries. The poster also displays the range of different marine coastal environments, contrasting the rough terrain of the Northwest with the mangrove forests of the Gulf Coast. The poster serves as an educational tool with a key that highlights the common and scientific names for more than half of the species in the painting.

To obtain a copy of the poster, simply contact your local National Estuary Program at http://www.epa.gov/OWOW/estuaries/links.htm.



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Help Campaign for Estuaries US Postal Stamps!

This year the Long Island Sound Study Program requested the U.S. Postal Service create a series of postage stamps celebrating estuaries-areas of environmental, economic, and cultural importance. If selected by the U.S. Postal Service as a new series, "America's Estuaries" postage stamps would illustrate bays, inlets, and harbors from across the nation. The series would also highlight the most ecologically significant plant and animal life found in estuaries of national significance.

The Association of National Estuary Programs and the National Estuarine Research Reserve Association joined with the Long Island Sound Study in submitting the proposal to the U.S. Postal Service Citizens' Stamp Advisory Committee in Washington, DC. The Citizen's Stamp Advisory Committee will decide whether "America's Estuaries" is chosen to become a series of postage stamps. The U.S. Citizen's Stamp Advisory Committee meets quarterly to decide on stamp subjects and makes recommendations to the Postmaster General.

To show your support for this initiative please send a postcard or letter to Citizen's Stamp Advisory Committee, C/O Stamp Development, 475 L'Enfant Plaza SW, Room 4474E, Washington DC 20260 2437.

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Livin' La Agua Pura - Educating the Latino Community about Clean Water

Ricky Martin isn't the only Latino trend that's revving up teenagers lately. In Santa Barbara, California, a new effort to educate the Latino community on water quality issues has Latino youth leaders learning ways to get their friends and families involved in watershed protection.

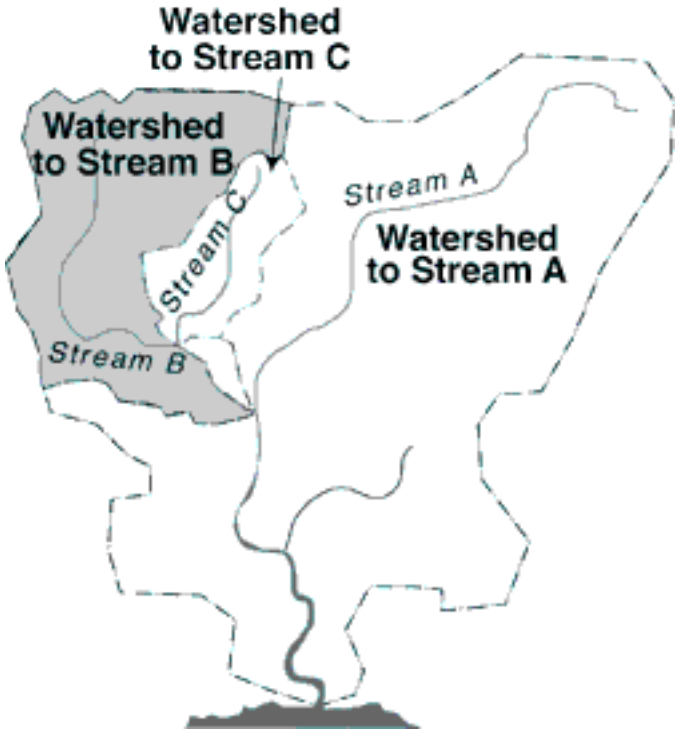
The University of Wisconsin's Cooperative Extension Environmental Resources Center (ERC), in Madison, Wisconsin, works to educate young people about water issues nationwide. The ERC recently conducted a workshop in Santa Barbara targeted at addressing the watershed education needs of the local, often overlooked Latino youth community.

Due to contamination from upstream sources, highly polluted creeks are flowing through Santa Barbara's most densely populated Latino areas. These polluted creeks drain into the Pacific Ocean off Santa Barbara, forcing beach closures that affect everyone. ERC is working in a variety of watersheds, including Mission Creek, Arroyo Burro, San Antonio Creek, and the Santa Maria River. Because many residents go to the beach and their children play in the creeks, members of the Latino community are interested in water quality issues. However, because of language and cultural issues, community members are often not engaged in water protection activities. Furthermore, people in charge of outreach often are not Latino and do not speak the language, making it difficult to effectively reach the Latino

community.

The ERC's Agua Pura workshop, officially known as the Watershed Education Leadership Institute, was a partnership effort involving the ERC, the California Aquatic Science Education Consortium, the University of California Cooperative Extension 4-H Youth Development Program, the Global Rivers Environmental Education Network, and the Adopt-A-Watershed Program. The institute was funded by a USDA Cooperative State Research Education and Extension Service (CSREES) grant, and its purpose is to improve understanding of how community educators and youth leaders can involve Latino youth in watershed protection, and create understanding of how resources need to be adapted to their needs and interests.

The June, 1999, leadership institute focused on gathering people who work with Latino youth on a regular basis, including teachers, scout leaders, park rangers, museum employees, and other youth leaders. The first day of the three-day institute was spent familiarizing youth leaders with local water quality issues, including problems, ongoing studies, and monitoring efforts. Youth leaders then participated in hands-on activities, including mapping a watershed, assessing erosion and other impacts along a creek bed, and sampling for water quality and macroinvertebate populations in a local stream.



The second day of the institute focused on teaching the youth leaders how to better understand the young people they work with and how to be more effective leaders. Discussions included the factors that affect adolescent behavior, the use of poetry and art to educate youth, and identification of outreach methods available to involve the Latino community in water education programs.

The third day of the institute focused in linking youth with education opportunities. Topics addressed the availability of watershed education resources and ways for youth leaders to conduct a community education planning activity. A series of discussions followed, which included characterizing the Latino community and assessing how school curricula and activities could be modified to suit the needs of Latino youth. Through this idea exchange, the youth leaders determined that the following actions for reaching the community are needed to better reach out and involve Latino youth in water programs:

First, the leaders noted from experience that the Latino community is very centered around the family. Latino youth do not tend to participate in many activities without other family members. Therefore, watershed activities must be family-oriented and designed so that parents and other family members can also participate. Moreover, youth leaders must communicate with parents about the activities.

Second, curricula must be appropriate for the Latino youth audience. The experiences of youth leaders and educators have shown that a number of educational resources written in Spanish are poorly translated or don't account for the many dialects and types of Latino backgrounds - Mexican, South American, and Central American - leading to a communication breakdown. Institute participants also noted that Latino youth seem to enjoy the inclusion of Latino history and graphics relevant to their culture in their curricula.

Workshop participants gave high ratings to all topics on the evaluation forms, but most noted that the Latino outreach discussion and the artistic connection topics on the second day were the most useful. Many participants also commented that the workshop gave them great insight into working with Latino youth and their families. The ERC is using the information gathered from this workshop to develop a guide to help other youth leaders provide watershed education to people in underserved Latino communities. ERC expects the guide to be available in late fall, 2000.

For more information about the workshop, contact Kate Reilly, Give Water a Hand Program Manager, University of Wisconsin Environmental Resources Center, Ag. Hall room 216, 1450 Linden Drive, Madison, WI 53706. Phone: 1-(800) WATER20; Email: erc@uwex.edu. For information about the Latino outreach efforts in Santa Barbara, contact Michael Marzolla, 4-H Youth Development Advisor, University of California Cooperative Extension Service Santa Barbara County, 105 East Anapamu, Suite 5, Santa Barbara, CA 93101. Phone: (805) 568-3330; Email: ammarzolla@ucdavis.edu.

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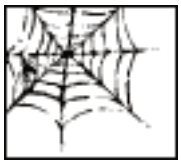
Partners in Flight Bird Conservation Plans Available

Partners in Flight, a nationwide bird conservation coalition, has completed almost 70 Bird Conservation Plans (BCPs) for the United States. The plans were developed on the basis of physiographic areas of the United States to provide for the great diversity of avian communities, natural habitats, human stresses, and resulting status of bird populations at a more local scale. Although the primary audience is land managers and wildlife program managers, these plans parovide important information for anyone involved in programs or projects that focus on habitat conservation (including restoration), water quality management, the control or use of chemicals that may affect bird populations (e.g., pesticides application), and other environmental protection actions. All BCPs are available on the Partners in Flight website at http://www.partnersinflight.org/pifbcps.htm. EXIT disclaimer On the web site, you can locate the BCPs of interest to you using the physiographic areas map and a companion table listing the plans. Each BCP is accompanied by a one-page summary of the plan and a series of maps. A summary of all the plans and the Partners in Flight conservation planning process is now available as well, and copies can be obtained from the American Bird Conservancy at P.O. Box 249; 4249 Loudoun Avenue; The Plains, VA. 20198.



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Building an Enforceable Coastal Nonpoint Pollution Control Program in Rhode Island

On November 5, 1990, Congress enacted the Coastal Zone Act Reauthorization Amendments, recognizing the link between coastal water quality and land use activities, and requiring states to address nonpoint source pollution affecting coastal waters through enforceable policies. State coastal zone management programs and nonpoint source programs were charged with jointly developing and implementing a state Coastal Nonpoint Pollution Control Program (CNPCP). State and federal agencies endeavored to improve coordination of efforts to address nonpoint source problems at all levels of government, from local watershed groups to the federal level.

Because Congress mandated that measures for controlling nonpoint pollution be broadly implemented through enforceable policies (as opposed to voluntary implementation on an individual basis), Rhode Island inventoried existing state policies, laws, regulations, and ordinances that could apply to the CNPCP. Congress did not intend for states to develop new enforcement programs, but rather to enhance existing state and local efforts to manage land use activities that degrade coastal waters and habitats. Consequently, an inventory of potentially applicable programs and the authorities under which they operated was conducted.

Based on these inventories, Rhode Island's approach to fulfilling the enforceable policies requirement

relied primarily on the authorities granted in the state's water pollution control statute, freshwater wetlands act, and coastal program enabling legislation. While the state asserts that these laws and their regulations provide adequate enforcement authority to ensure program implementation, Rhode Island also has a well-established and enforceable community planning program to support implementation of management measures. Accordingly, the CNPCP relies on this community planning program as a supplementary implementation approach. Rhode Island's State Guide Plan, a comprehensive planning program that contains binding state goals and policies for development of the state's resources, together with enabling acts related to land use planning, provides an integrated approach to state oversight of local land and water uses. Additionally, to strengthen the enforceability of this approach, the state's Nonpoint Source Management Plan, which was updated to incorporate the requirements of the CNPCP, was adopted as an element of the State Guide Plan.

A key concern of EPA and NOAA, the two federal agencies responsible for oversight, was assurance that the state water quality statute and implementing regulations were adequate to prevent and control nonpoint source problems associated with confined animal facilities and nutrient management as it relates to agricultural animal waste. To address this concern, the Department of Environmental Management submitted a legal opinion outlining the statutory authority under which water pollution from all sources is prevented and controlled, specific standards and regulations applicable to nonpoint source pollution related to confined animal facilities and nutrients from animal waste, and the relevant general authorities for enforcing the state's water quality regulations.

Under the General Laws of Rhode Island, it is unlawful "for any person to place any pollutant in a location where it is likely to enter the waters...", "for any person to discharge any pollutant into the waters" except as otherwise authorized under a permit, and "...to undertake any development which may result in the discharge of any pollutant into the waters of the state, unless the discharge is made to a system or means to prevent pollution approved by the Director [of the Department of Environmental Management]." Further, the state specifically includes agricultural waste or effluent in its broad definition of "pollutant." Therefore, the state clearly demonstrated its authority to prevent and control nonpoint source pollution related not only to certain agricultural practices, but also to a broad range of land use activities and potential pollutants.

On April 20, 2000, Rhode Island became the second state to have its CNPCP formally approved by NOAA and EPA. With this approval, Rhode Island must now ensure that the approaches proposed in the program for controlling and preventing nonpoint source pollution are implemented, and that the management measures required by the program are achieved. In practice, this means not only demonstrating adequate legal authorities, but also actually enforcing the policies and regulations that are based in these statutes. For it is only through diligent enforcement of the approaches and regulations implementing the CNPCP that nonpoint source pollution will be effectively prevented and controlled.

For more information, contact Laura Miguel, RI Coastal Resources Management Council, 4808 Tower Hill Road, Stedman Government Center, Wakefield, RI 02879; Phone: (401) 783-3370; Email: L_Migues@crmc.state.ri.us, or Jim Riordan, RI Department of Environmental Management, 235

Promenade Street, Providence, RI 02908; Phone: (401) 222-3961; Email: jriordan@dem.state.ri.us.

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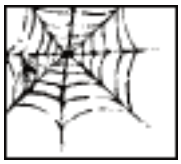
New ELI Report on State -- Enforceable NPS Mechanisms

The Environmental Law Institute (ELI) has just completed the third in a series of studies on state-enforceable NPS mechanisms, entitled "Putting the Pieces Together: State Nonpoint Source Enforceable Mechanisms in Context" (June 2000). Unlike the two earlier ELI studies, "Enforceable State Mechanisms for the Control of Nonpoint Source Water Pollution" (October 1997) and "Almanac of Enforceable State Laws to Control Nonpoint SourceWater Pollution" (1998), which surveyed the authorities existing in each state, the new 165-page volume is a set of eight case studies designed to "assess how enforceable mechanisms are used in practice."

The eight selected states are Georgia, Maine, Maryland, Ohio, Oregon, Texas, Virginia, and Wisconsin. These states were selected neither as a representative cross-section nor as a collection of the leading programs, but rather to study particular enforceable mechanisms that were identified in the prior studies. A watershed approach was used to assess how these mechanisms were integrated to help deliver and implement programs in one or more watersheds in each state.

ELI has a limited number of hard copies available. However, it can be downloaded from the ELI website at www.eli.org or through a link from the EPA's NPS website at http://www.epa.gov/owow/nps/.



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Chesapeake Bay Health Remains Stressed in 2000

In September, the Chesapeake Bay Foundation (CBF) released their State of the Bay Report for the year 2000. Unfortunately, little has changed since the 1999 report. The Report, issued for the first time in 1998, is a comprehensive measure of the bay's health. For the report, CBF analyzed 13 factors: oysters, shad, underwater grasses, wetlands, forested buffers, toxics, water clarity, dissolved oxygen, crabs, striped bass (rockfish), resource lands, phosphorus, and nitrogen. CBF scientists compiled and examined the best available historical and up-to-date information on each factor and sought direction and advice from other scientists who study the bay. Then CBF assigned an index number to each indicator. For example, the index value of 12 given to underwater grasses indicates that this key resource today covers only 12 percent of its historical acreage in the bay and tributaries.

This year's report cites positive trends in habitat restoration and improvements in shad populations, but the Chesapeake Bay's overall health did not improve since the past year. Problems with blue crabs, water clarity and pollution offset advances and left the bay's score at 28 out of 100, the same as in 1999. Major reasons cited for continuing poor ecological health were rapid development, farm runoff, and over-fishing.

For further information, contact Geoff Oxam, Phone: (410) 268-7742 (ext. 819) or David Slater (ext. 811) or view the report on-line at http://savethebay.cbf.org/sotb/2000/index.htm. EXIT disclaimer

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Broad Marsh River Stormwater Remediation Project

Introduction to Buzzards Bay

Nestled between the western-most part of Cape Cod (southeastern Massachusetts) and Narragansett Bay in Rhode Island is the Buzzards Bay National Estuary. The 228 square mile bay has a beautiful ragged coastline that stretches over 280 miles and provides many opportunities for fishing, boating and bathing, as well as critical habitat for a variety of plant and animal species. The economic resources of the bay are valuable, ranging from the harvest of its rich fisheries to its use as a transit route for both the New Bedford fishing fleet and for shipping through the Cape Cod Canal.

The Buzzards Bay watershed encompasses 432 square miles and includes all or part of 17 municipalities. Throughout the last century, the land use characteristics of the watershed have changed from a forested and agricultural environment to a more developed watershed, including industry and residential land use. Typical of many estuaries, the most intensive development has occurred along the coastal edge.

Buzzards Bay, as a whole, is still considered a relatively healthy waterbody. However, the waters of the smaller fringing embayments are being threatened by increasing amounts of contamination from both point and nonpoint sources of pollution. The primary impacts of point sources (industrial waste and combined sewer overflows) are concentrated in the Acushnet River/New Bedford Harbor estuary. Water quality in the remaining embayments is primarily affected by nonpoint sources of pollution, including stormwater runoff. As a result, protection and restoration of bays affected by stormwater discharges has been one of the top priorities of the Buzzards Bay Project (BBP) and watershed municipalities.

Restoration of Buzzards Bay water quality through stormwater remediation has been the focus of a number of BBP initiatives. Rainwater running off streets, parking lots and other impervious surfaces carries a number of contaminants into Buzzards Bay, including fecal coliform bacteria. High concentrations of fecal coliform bacteria have resulted in shellfish bed closures in many embayments, and the close proximity of some stormwater discharges to swimming beaches represents a potential threat to public health. The BBP addresses these concerns by working with local communities to prioritize and find solutions to their stormwater problems.

Special Characteristics of Buzzards Bay

Buzzards Bay formed as a result of the last ice age and the retreat of the glaciers about 16,000-18,000 years ago. The activity of the glaciers resulted in the formation of glacial moraine and sand outwash areas along the eastern shore, and drowned river valleys and shallow depths to bedrock on the western shore. This geologic activity produced the more than 30 major embayments that characterize the Buzzards Bay coastline.

Compared to other major estuarine systems, Buzzards Bay has a relatively large water-to-land ratio, with the area of the bay exceeding one half the land area. The relatively small watershed size, and the rapid flushing of the central bay waters (estimated to be less than 10 days) provide the excellent water quality observed in central Buzzards Bay. However, the near-shore system of embayments is more directly influenced by land-based coastal pollution. The sensitive waters in these embayments are also those most used by the public.

Precipitation to the watershed enters the bay via surface streams and groundwater. Of the eleven primary rivers emptying into Buzzards Bay, seven (Agawam, Wankinco, Weweantic, Mattapoisett, Acushnet, Paskamanset and Westport) are located on the western shore. The remaining four smaller rivers are located on the eastern shore, where most rainfall enters coastal waters via groundwater. The small size of the Buzzards Bay watershed results in low total freshwater inputs from the watershed, and salinity of most embayments is just slightly below offshore waters. This special feature also means that the water quality of many Buzzards Bay embayments is strongly influenced by overland runoff of stormwater.

Project Overview

Broad Marsh River has a relatively small subwatershed within the larger Wareham River estuary. The Broad Marsh River embayment is approximately 100 acres in size and contains a large soft- shell clam and quahog resource. In addition, a full-facility bathing beach (owned and operated by the Town of Wareham) and several privately owned beaches are located on the river's shore. The land surrounding the lower section of the river is densely populated with one-tenth of an acre to one-third of an acre house lots. Because of the high population density, a large area of the lower watershed consists of impervious surfaces, primarily roads, roofs, and driveways.

Stormwater from these impervious surfaces is removed through several storm drain systems. Prior to the Broad Marsh River Project fifteen storm drain pipes discharged directly into the river. The stormwater carried with it a variety of pollutants that impacted the river's water quality. The Town of Wareham, in consultation with the Massachusetts Division of Marine Fisheries, believed these discharges had a significant impact on the closure of Broad Marsh River to shellfishing. The close proximity of the stormwater discharges to public beaches also posed a potential threat to public health. Concern over these two issues prompted the town to take action.

The Broad Marsh Stormwater Remediation Project began in 1990 when the town of Wareham requested planning and technical assistance from the Buzzards Bay Project (BBP) regarding the stormwater discharges. In 1992, the Town of Wareham requested and received a grant of $88,450 from the Massachusetts Department of Environmental Protection's (DEP) 319 Nonpoint Source Program to implement the Broad Marsh River Project. The Town matched these funds with $71,020 in both cash and in-kind services. The DEP grant allowed the Town to improve water quality by redirecting the polluted stormwater into a series of infiltration structures. These structures are designed to handle the "first flush" of stormwater runoff and were placed beneath the existing road surfaces due to a limited amount of open land area.

Project Objectives

The BBP requested planning and technical assistance from the USDA's Natural Resources Conservation Service (NRCS) for the Project. NRCS put together an interdisciplinary team to work with BBP and town representatives to identify alternatives and select best management practices. The selected alternative, subsurface (under the road) infiltration structures, was considered to be the most feasible option. Instead of being discharged directly into the river through storm drain pipes, the stormwater was to be directed into the infiltration structures, allowing for the filtration of stormwater pollutants.

Narrow roads, existing gas, sewer and water lines and groundwater close to the surface made designing the system challenging. The final design, completed in April of 1995, included two different types of infiltration structures - concrete leaching galleys and plastic infiltration chambers. Concrete 4x4 galleys were installed in areas with adequate separation from groundwater, and shallower plastic chambers were used in areas with shallower groundwater. Construction began in December of 1995 and was completed by late April.

After completion of the project, the Buzzards Bay Project assisted the town in monitoring 3 of the 15 project sites. Although the focus of the monitoring program was fecal coliform bacteria, samples were also analyzed for metals. The three monitoring sites were selected based upon the technology used (i.e., galleys or plastic chambers) and groundwater separation. Groundwater monitoring wells were installed at the selected sites. The day before an expected rain, these wells would be purged using bailers to remove accumulated sediment and stagnant water. During rain events, water samples would be collected at the catch basin (as stormwater flowed into the catch basin from the road), from the monitoring well, and from the river. The day following the rain, the monitoring well would be sampled again. The Buzzards Bay Project also reviewed ambient water quality data collected within shellfish bed areas by the Massachusetts Division of Marine fisheries.

Success of the Project

- Sampling data from post-construction monitoring indicates that the infiltration systems effectively remove fecal coliform (>99.99% removal) and fecal streptococcus bacteria (generally >90%) from stormwater runoff.
- Ambient concentrations of fecal coliform bacteria over shellfish beds were lowered below FDA action limits.
- As a result of these findings, the Massachusetts Division of Marine Fisheries upgraded the status of the 64-acre shellfish bed from "prohibited" to "conditionally approved," enabling the taking of shellfish from Broad Marsh River for the first time in many years.
- As a result of the success of this initiative, the Town of Wareham committed to reducing other stormwater discharges into Broad Marsh River and in other areas of town. The Town applied for and received funding from Massachusetts Coastal Zone Management's Coastal Pollution Remediation Program to remediate discharges into the upper part of Broad Marsh River.

Lessons Learned

The Town of Wareham and the Buzzards Bay Project were very successful in quickly achieving the ultimate goal of reopening a shellfish bed, and demonstrated that water quality responds rapidly to reductions in untreated stormwater discharges. Two important lessons learned were:

- Get the key people and decision-makers (including a neighborhood representative) involved early and regularly. This will reduce design and construction delays.
- Know as much about the site conditions (soils, groundwater, location of utilities) as possible before applying for funding. A budget estimate for grant requests can be significantly different based on site conditions; pre-existing knowledge of site conditions can reduce design and

construction delays.

For further information, contact

Bernadette Taber, Natural Resource Conservation Service Buzzards Bay Project National Estuary Program 2870 Cranberry Highway, East Wareham, MA 02538; Phone: (508)291-3625

or you can visit our website at http://www.buzzardsbay.org/ EXIT disclaimer.