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Information About Estuaries and Near Coastal Waters Fall 1998, Volume 8, Number 4

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Corpus Christi Bay NEP Bays Plan Completed

Corpus Christi Bay National Estuary Program (CCBNEP) has become the first of 28 programs nationwide to complete a Comprehensive Conservation and Management Plan under an abbreviated four-year scientific characterization and planning schedule. Management Conference approval for the Coastal Bend Bays Plan was granted July 9, 1998, at a joint meeting of the CCBNEP Policy and Management Committees. The Committees' unanimous approval of the final revisions paves the way for printing and submission to the Texas Governor and EPA Administrator for approval.

Measuring Success

On June 12, Vice-President Gore announced a new public right-to-know initiative, an EPA Internet site for citizens interested in checking the health and environment of their favorite beaches. Through the Internet site, located at: <http://www.epa.gov/ost/beaches> , citizens can get information on whether their

beach is monitored for microbial pollution and on advisories and closings for those beaches. The information is limited to those beaches that have responded to EPA's survey. The site currently has information on more than 1,000 beaches and continues to expand as responses are received. A similar website has been developed to provide access to state fish advisories, available at:

New National Water Quality Inventory is Available

If community involvement were the only measure of the Bays Plan's success, it would be an outstanding achievement. The creation of the Bays Plan was an especially intensive, stakeholder-driven process including 40,000 volunteer hours from more than 350 individuals representing over 100 organizations.

The effort to gather the best scientific information to help shape public policy has resulted in an outstanding guide for bay resource protection. The biggest challenge now is to instill a broader commitment among all local governments and organizations within the region, and to find partnership opportunities and funding to fully implement the Bays Plan.

Perhaps the truest measure of the Bays Plan success will be community support for implementation. In typical South Texas style, and before the ink was even dry on the plan, many community leaders were looking toward the next phase and garnering support and advocacy from the entire regional community for implementation of the plan which will make a significant contribution towards ensuring the sustainable use of these valuable resources for generations to come.

With 50 actions detailed under six separate chapters, the Bays Plan was submitted to Governor Bush in late August. Upon final approval by EPA Administrator Carol Browner, the program will be eligible for continued federal funding to begin implementing the actions contained in the plan.

Program Name Changed

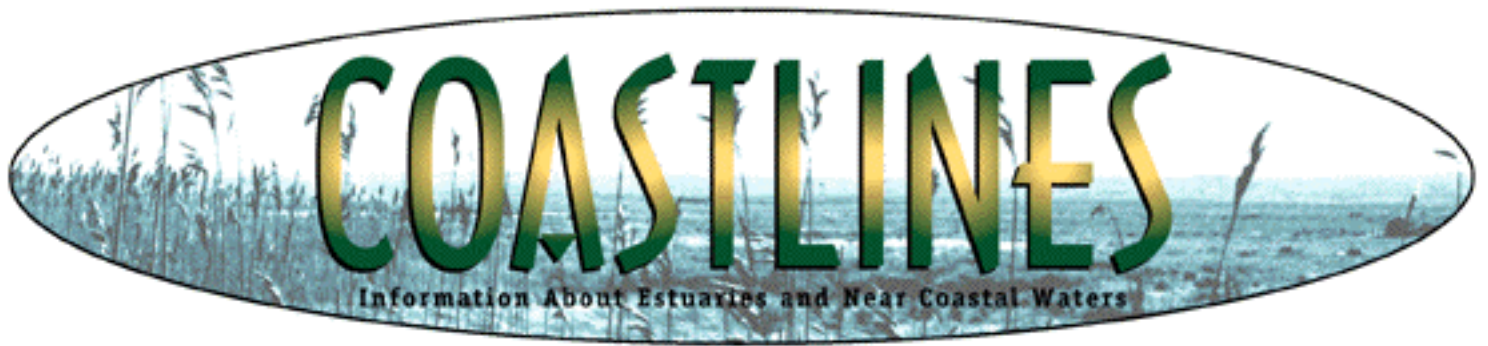
In recognition of the full geographical extent of the project area, which encompasses all of the bays and estuaries of the Coastal Bend, a new name has been adopted as the Program moves toward implementation. Henceforth, the Program will be called The Coastal Bend Bays & Estuaries Program.

The new name brings focus on the entire project area and program goal, which is to find sustainable, long-range solutions to all issues which may affect the quality of the Program's bays and estuaries.



A companion piece, entitled "The State of the Bay: A Report for the Future" will be released with the final Bays Plan. The report summarizes the results of more than 30 technical investigations undertaken during the past four years, which form the scientific basis for the actions contained in the plan.

For a copy of the final Coastal Bend Bays Plan or The State of the Bay report, call the Program Office at (512) 980-3420.



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EPA Wetlands Bioassessment Fact Sheets

The U.S. EPA Office of Wetlands, Oceans, and Watersheds (OWOW) announces the release of Wetland Bioassessment Fact Sheets, EPA843-F-98-001. The Wetlands Division of OWOW developed the 10 fact sheets in response to the increasing interest among wetland and water quality professionals to develop sound methods that measure the biological condition of wetlands. As interest in wetland restoration, mitigation, and creation has increased during the 1990s, the need for an assessment method which considers the biological components of wetland integrity has become apparent.

Thus far, measures of wetland health have been largely based on functional assessments (also known as the Hydrogeomorphic [HGM] Approach), aimed at predicting potential changes that may result from proposed human activities. Functions which are assessed in HGM generally fall within three major categories: (1) hydrologic (e.g., storage of surface water), (2) biogeochemical (e.g., removal of elements and compounds), and (3) physical habitat (e.g., topography, depth of water, number and size of trees). In addition to functional assessments, wetland acreage assessments have been a major focus of wetland professionals.

Wetland biological assessments measure the health of biological communities whose habitats are wetlands. Examples of communities, or taxonomic assemblages, which are measured include: macroinvertebrates, plants, amphibians, algae, and birds. Measuring the biological integrity of a wetland will allow scientists to determine if the wetland is degraded by any chemical, physical, or biological stressor. Based on the bioassessment, the scientist will then be able to diagnose the stressor causing the

damage. Wetland bioassessments, combined with functional assessments, provide wetland professionals with a tool to more accurately characterize the current condition of a wetland, and predict potential changes that may result from human activities.

The fact sheets, as well as other wetland information resources, are available by calling the EPA Wetlands Information Hotline (contractor operated) at 1-800-832-7828, or visit the Wetlands Division home page at <http://www.epa.gov/OWOW/wetlands> .

New Internet Sites for Beach and Fish Advisories

On June 12, Vice-President Gore announced a new public right-to-know initiative, an EPA Internet site for citizens interested in checking the health and environment of their favorite beaches. Through the Internet site, located at: <http://www.epa.gov/ost/beaches> , citizens can get information on whether their beach is monitored for microbial pollution and on advisories and closings for those beaches. The information is limited to those beaches that have responded to EPA's survey. The site currently has information on more than 1,000 beaches and continues to expand as responses are received. A similar website has been developed to provide access to state fish advisories, available at: <http://www.epa.gov/ost/fish/> .

New National Water Quality Inventory is Available

The US Environmental Protection Agency released its 1996 National Water Quality Inventory, a biennial survey of the nation's water quality. Consistent with data reported in the 1994 inventory, 40 percent of the nation's surveyed waters remain too polluted for swimming, fishing, and other recreational activities. For rivers and streams, runoff from agricultural lands remains the largest source of pollution, affecting 25 percent of all surveyed river miles. The 1996 report is the result of surveys conducted by states in 1994 and 1995 of 19 percent of the nation's river miles, 40 percent of lake acres, and 72 percent of estuarine square miles.

A 12-page summary entitled *Report Brochure: National Water Quality Inventory, 1996 Report to Congress*, a 197-page detailed summary entitled *The Quality of Our Nation's Water: 1996*, and selected chapters from the 588-page *Report to Congress* can be found on EPA's Office of Water website at <http://www.epa.gov/305b/>. Copies of *The Report Brochure: National Water Quality Inventory, 1996 Report to Congress* (EPA 841-F-97-003) are available from the National Center for Environmental Publications and Information (NCEPI) at 1-800-490-9198. *The Quality of Our Nation's Water: 1996* (EPA841-S-97-001) and the *Report to Congress* (EPA 841-R-97-008) will be available soon from NCEPI. For further information, contact George Doumani at (202) 260-3666.

Restoration Website

Interested in river corridors and wetlands restoration? Visit the EPA's new website designed to receive and contribute information concerning river corridors and wetland restoration projects, programs, or

organizations. Project information can be added to the database by using an on-line form under the heading "Put Your Project on the Map."

The website address is <http://www.epa.gov/owow/wetlands/restore>.

Mariners Can Dial-A-Buoy for Wind and Wave Reports

Mariners can now obtain the latest coastal and offshore weather observations through a new telephone service called Dial-A-Buoy. Dial-A-Buoy provides wind and wave measurements taken within the last hour at 65 buoy and 54 Coastal-Marine Automated Network stations located in coastal waters around the United States and in the Great Lakes. The stations are operated by the National Weather Service.

Large numbers of boaters use the observations, in combination with forecasts, to make decisions on whether it is safe to venture out to sea. Many have said the reports have saved them many wasted trips to the coast; some even claim that the reports have saved lives.

The reports include the latest wind direction, speed, gust, air, temperature, water temperature, and sea level pressure. Buoy reports also provide details on significant wave height, swells and wind wave heights. Some buoys also provide wave direction.

To access Dial-A-Buoy, dial (228) 688-1948 using any touch tone or cell phone.

For more information contact Barry Reichenbaugh, NWS (301) 713-0622 or Glenda Coss, NDBC (228) 688-1704

New Satellite Map of Chesapeake Bay to Aid Management Efforts

A Poster produced from satellite images of the Chesapeake Bay watershed, will aid a multi-state effort to restore and manage the bay's resources, according to the U.S. Geological Survey. USGS scientists will use the image of the entire 64,000-square-mile drainage basin of the Chesapeake Bay to provide a snapshot of recent surface conditions, including vegetation, that can be compared with historical and future images to help produce a report card of progress or setbacks in meeting resource management goals.

The image mosaic, composed of Landsat thematic mapper scenes collected from 1990 through 1994, will be the most complete and current basinwide image to date for the Chesapeake Bay.



Click on the image to view a closeup.

Copies of the map are available from the USGS Branch of Information Services, Denver Federal Center, Box 25286, Denver, CO, 80225. Credit card orders may be faxed to (303) 202-4693. For more

information about this map call 1-800-435-7627.

To find out more about USGS science in the Chesapeake Bay watershed, check <http://chesapeake.usgs.gov/chesbay> on the Internet.



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Airing Out the Problem: Methods of Reducing Water Quality Impacts and Fish Kills in Coastal Marinas

Fish kills occur all along the coasts and leave coastal waters littered with smelly, decaying carcasses that rise and fall with each passing wave. The good news is that a team of Sea Grant scientists has found a way to stop the carnage and prevent fish kills by pumping more oxygen into coastal waters.

Low oxygen levels combined with increased amounts of fertilizers lead to eutrophication, a condition in which rampant algae growth uses up the dissolved oxygen in the water, killing off other animals such as fish. Phytoplankton, or microscopic algae, use the fertilizers to produce oxygen during the day but then consume oxygen at night along with other plants, animals and bacteria. When this occurs, excessive algal blooms can result in nighttime oxygen levels that are too low for animals to survive, resulting in fish kills.

During the spring and summer of 1997, the Texas Sea Grant College Program demonstrated ways to improve water circulation and increase the amount of dissolved oxygen in the water to help reduce the potential for fish kills in the Clear Lake area. With nearly 6,500 wet slips in 22 marinas, the Clear Lake area has the highest concentration of recreational boats in coastal Texas - more than 50 percent of all coastal boat slips in the state.

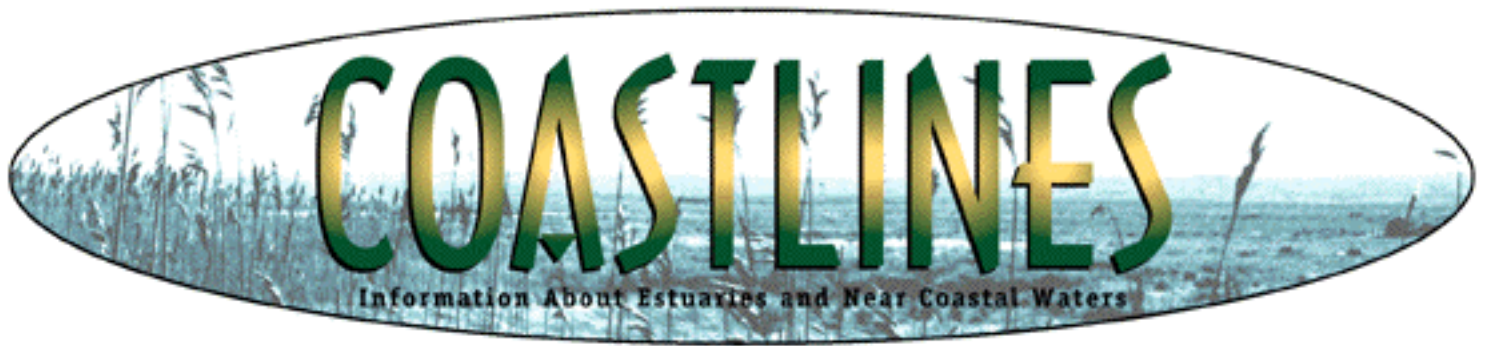
Four Clear Lake marinas that had experienced recent fish kills agreed to participate in a test of aeration

equipment and aeration methods. Before the test, marina personnel were briefed on why and how fish kills occur, and then taught how to use oxygen meters. Sea Grant provided the aeration equipment, oxygen meters, and covered installation costs while the marinas provided space for the equipment and personnel to monitor the equipment during the project.

Marina personnel used the aerators during the summer whenever dissolved oxygen levels dropped or when they saw dead fish floating on the water's surface. While several marinas reported potential fish kill conditions, the aerators seemed to alleviate the condition and no kills were reported during this time. Fishing also improved around the marina while the aerators were in use. The aerators provided marina operators with a simple solution to an often malodorous and expensive cleanup problem.

Aerators are not a permanent solution to the water quality problem, but are an excellent way to prevent fish kills and maintain water quality. The initial cost of aerators is minimal, particularly when compared to the cleanup costs after a fish kill. Aerators cost only between \$500 to \$1,200 fully installed. However, fish kill cleanups costs can vary greatly, depending on the size and type of cleanup required. Cleanup using vacuum trucks can be very expensive — cleanups in Clear Lake have ranged from \$3,000 to \$28,000. The use of aerators at marinas gives marina operators an "insurance policy" and an effective tool to deal with low dissolved oxygen levels in areas of their basins where circulation is restricted.

For more information, contact Dewayne Hollin, Julie Massey, John Jacob or Granvil Treece at the Texas Marine Advisory Service, Sea Grant, Texas A&M University, 1716 Briarcrest, Suite 702, Bryan, TX 77802, (409) 845-3854, Fax: (409) 845-7525, E-Mail: dhollin@univ.tamu.edu .



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Non-native species invading San Francisco Bay at increasing rate

Biological invasions occur when species are introduced by humans into environments in which they do not naturally occur, causing disruption to local ecosystems, and are increasingly recognized as, in the words of two researchers, "a major global environmental and economic problem." A new study of San Francisco Bay by those same two researchers has revealed a large number of exotic species that dominate many habitats in terms of number of species, number of individuals and biomass, and a high and accelerating rate of invasion. The factors suggest, say the researchers, that the San Francisco Bay and Delta "may be the most invaded estuary and possibly the most invaded aquatic ecosystem in the world."

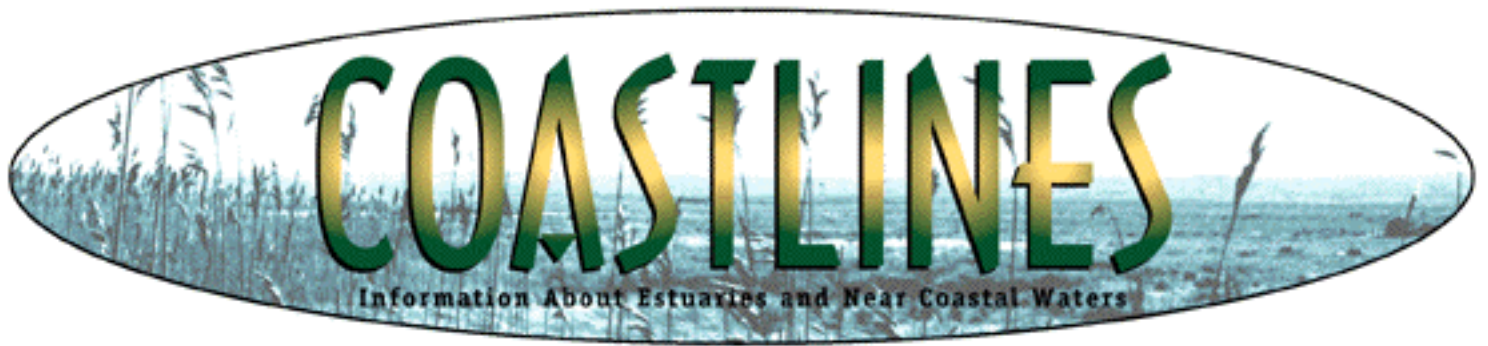
The researchers identified a total of 234 exotic species established in the ecosystem, including plants, protists, invertebrates, and vertebrates. "Exotic" was defined as a species that was not present in the North Pacific bioregion before the entry of Europeans in the 16th century, or present in distant parts of that region and later introduced to the Bay/Delta ecosystem by human-mediated mechanisms. Under this scenario, at least 125 additional species were categorized as cryptogenic that is, neither clearly native nor exotic.

Exotic species dominate many of the ecosystem's biotic communities, including organisms living within or on the bottom sediments, brackish water zooplankton, and freshwater fish. In these communities, exotic organisms "typically account for 40 to 100% of the common species, up to 97% of the total

number of organisms, and up to 99% of the biomass."

According to the study, about half of all invasions in the estuary region occurred after 1960. The rate of invasions has, say the researchers, increased from an average of one new species established every 55 weeks from 1851 to 1960, to an average of one new species every 14 weeks from 1961 to 1995.

(Excerpted with permission from SeaWeb, Ocean Update) Source: A.N. Cohen and J.T. Carlton. 1998. Accelerating invasion rate in a highly invaded estuary. *Science* 279: 555-57 Contact: A.N. Cohen, San Francisco Estuary Institute. E-mail: acohen@sfei.org .



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Driving Pesticide Use Below Par

With than 65 percent of Virginia's population now concentrated on the coast, an emphasis on controlling nonpoint source pollution from urban and developed areas is an important component in Virginia's efforts to improve its coastal water quality. Pesticides and fertilizers used by the urban turf and landscape industry are among the toxics

entering our coastal waters as nonpoint source

pollution. Golf courses, which are often sited on or adjacent to water bodies, rely heavily on the use of pesticides, fungicides and fertilizers to maintain consistently high quality turf.

Traditionally, golf courses have been thought of as a way to preserve green space that might otherwise have been developed more intensively. Today, golf course superintendents and owners are more keenly aware of the challenges to the idea of a golf course being a low-impact enterprise. Virginia's coastal population has also become increasingly knowledgeable about water quality issues and the impacts of the use of pesticides and fertilizers on our coastal waters. As in many other coastal plain regions of the southeastern United States, the number of new golf courses in Virginia has been on a steady increase, and these courses are being heavily marketed by the tourist industry. Increased public awareness, and an increased concern on the part of golf course owners and superintendents regarding the impacts of their

actions on the environment, have lead to an increased interest in applying new resources and approaches to golf course management that result in high quality turf with less negative impact on water quality.

One such approach is Integrated Pest Management (IPM). IPM is the use of a variety of management practices and tactics to reduce and maintain pest populations below damaging levels, including pest-resistant varieties and mechanical, physical, biological, cultural, genetic and chemical methods.

With funding from the Virginia Coastal Program, the Virginia Cooperative Extension initiated the Turf IPM Advisory Program in 1996, a research and demonstration program designed to reduce the use of pesticides on golf courses by helping superintendents make more accurate pesticide applications. The program is being implemented by a cooperative team of Extension Agents in James City County and the City of Newport News, in cooperation with Virginia Tech scientists and superintendents of the Ford's Colony Golf Course in James City County and Newport News Golf Course in Newport News.

The Turf IPM Advisory Program is grounded on the theory that application decisions based on accurate, calibrated predictive disease models reduce the average number of applications needed to control pests and weeds each year. Optimum timing will achieve effective pest control with a minimum of pesticide use.

Turf is susceptible to several serious diseases and insects which can quickly cause severe and irreversible damage. Some diseases spread so rapidly on a golf course that an entire green can be lost overnight (a \$25,000 investment if built to PGA standards). This threat has resulted in heavy applications of fungicides and insecticides to prevent such a loss even when risk of infection was low, which can result in significant runoff and leaching of toxics to surrounding coastal waters.

The Turf IPM Advisory Program draws on scientific research gathered in an earlier weather-based IPM program developed by Virginia Tech for Virginia's peanut industry, the Virginia Peanut Leafspot Advisory Program. By knowing when to make fungicide applications for optimum disease control, peanut growers have reduced fungicide use in the last five years by as much as 43 percent per year and increased annual net profit per acre by 25.5 percent. The adoption of IPM strategies in caring for highly managed turf offers golf course owners and superintendents one of the most potent and promising tools available in achieving production goals and lowering costs with minimal impact to the environment.

The risk of pest activity must be accurately predicted far enough in advance to inform golf course superintendents when pesticides should be sprayed. Two EnviroCaster Weather Data centers (valued at \$4,615 each), one located at the Ford's Colony Golf Course and another at the Newport News Golf Course, constantly monitor and feed weather data into computer models. These models correlate the weather data with the environmental thresholds required for initiation of pest activity. Based on air temperature, relative humidity, duration of leaf wetness and soil temperature at specified depths, these models calculate the current level of disease risk and, based upon this risk, recommend pesticide applications.

A computer bulletin board, updated every 24 hours, has been established in the Newport News Extension Office to share daily weather data and pest advisory information with area golf course staff and professional turf managers. A Turf IPM Educational Field Day was held last November for golf course superintendents from eastern Virginia. Superintendents were introduced to the project and the concept of using predictive modeling for pesticide application.

Response from field day and conference participants has been very encouraging. The Newport News Golf Course is surrounded by surface water features, some of which are part of the water supply for much of the peninsula. Any information that will allow a superintendent to improve the accuracy of pesticide management decisions benefits all involved.

Landscape managers, who have seen the potential for predictive advisories on treating ornamental insects and diseases, have also shown enthusiasm for the project. The Project Team has also been approached by a greenhouse manager about the possibility of adapting the project to the commercial greenhouse industry, which is heavily dependent on pesticide use.

Research, monitoring and model calibration, including correlation of occurrence of actual disease development with cumulative weather data and calibration of the predictive pest models, will continue in 1998 with water quality funding from the Department of Conservation and Recreation.

Reprinted from Virginia Coastal Program News - Spring 1998 Contact: Virginia Witmer, (804) 698-4320

For more information, contact Ed Overton, Extension Agent, ANR, James City County, VA, PO Box 69, Toano, VA 23168, phone: (757) 566-1367, or E-mail: eoverton@vt.edu.



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National Estuary Program Joins Forces With NEMO

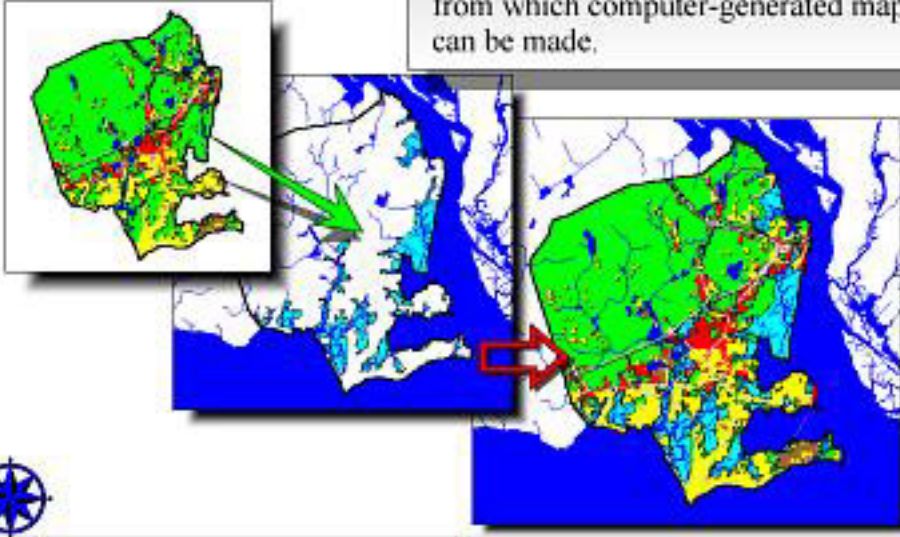
The importance of local land use decisions in determining the health of our nation's coastal water resources cannot be overstated. According to the U.S. Environmental Protection Agency, urban runoff is the number one source of pollution for our coastal waters, and polluted runoff is a direct reflection of land use. In recognition of this fact, the EPA's Coastal Management Branch has entered into a partnership with the University of Connecticut's Nonpoint Education for Municipal Officials (NEMO) Project.

Land use in the United States is primarily decided at the county and municipal levels of government, often by volunteer elected and appointed commissioners with little or no training (or interest) in natural resource management. This critical group of community leaders needs education, easily used tools, and truly accessible information to enable them to do a better job of protecting natural resources while planning and developing their communities. NEMO was created in 1991 to address these issues. NEMO, which is led by UConn Cooperative Extension and funded primarily by the USDA Water Quality Initiative, was developed as a "spin-off" application of the satellite-derived land use/land cover information for Connecticut that was created for the NEP's Long Island Sound Study.

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GIS Mapping

A Geographic Information System (GIS) is used to display, compare, and analyze geographically referenced data, from which computer-generated maps can be made.



NEMO is an educational project and targets local land-use decision makers. The complex relationships between land use and water quality are addressed, using geographic information system (GIS) and remote sensing (RS) technologies to create effective and relevant presentations. The project's recommendations focus on good natural resource-based planning as the first line of defense, followed by improved site design, and lastly, the use of best management practices (BMPs). NEMO's

emphasis on planning as the most effective and cost-effective method of water resource protection has been welcomed by the planning community, which has given the project national and state awards for its work.

In addition to the "basic" land use/water quality presentation, NEMO conducts a number of educational programs for Connecticut municipalities on topics ranging from open space planning to impervious surface reduction, and is engaged in several watershed projects with a host of partners, including the Connecticut Department of Environmental Protection, USEPA's New England office, the Nature Conservancy, and the U.S. Fish and Wildlife Service. Although affecting change at the local level takes time, NEMO has found that effective, professional educational programs can catalyze changes to local land use plans, programs and policies.

One of the project's major objectives is to enable local officials to visualize the future impacts of their current land use policies and plans. For instance, NEMO makes use of a zoning-based "build-out" analysis, which contrasts current levels of impervious surface (known to be a reliable indicator of the potential for water quality degradation, (see *Coastlines* Issue 7.1), with future levels estimated from zoning regulations. The project is currently developing much more sophisticated "visualization" techniques, including the use of three-dimensional GIS and the WWW-accessible GIS information and maps.

NEMO initiatives are not restricted to Connecticut. The project is currently working with multi-agency coalitions in over 15 states to adapt NEMO to their particular area and priority natural resource issues. Project staff members have conducted 20 out-of-state "scoping" workshops, assisting these coalitions to assess the issues, target audiences, opportunities, and barriers to creating their own tailored version of NEMO. The potential of this ad hoc national network of NEMO-inspired projects is such that in December, 1997, representatives from four federal agencies (USDA, EPA, NASA, and NOAA) formed the National NEMO Network Interagency Work Group, to explore mechanisms for collaborative support

of the project and the network.

The National Estuary Program collaboration is the first project to come out of the Interagency Work Group discussions. The need for better land use decision-making has not gone unnoticed by NEP Management Conferences; not surprisingly, nonpoint source pollution and watershed management are featured throughout the system's Comprehensive Conservation and Management Plans (CCMPs).

The EPA Coastal Management Branch is funding NEMO to provide assistance to the NEP in developing educational programs in support of these key CCMP components. NEMO will conduct on-site scoping workshops for four of the NEPs "Tier Five" programs. The Tier Fives are the latest NEP members: Morro Bay, CA; Barnegat Bay, NJ; Lower Columbia River, OR/WA; Maryland Coastal Bays, MD; New Hampshire Estuaries, NH; Charlotte Harbor, FL; and Mobile Bay, AL. NEMO staff will work closely with the staff/committee members of the selected NEPs to develop the workshops.

The goal of the project is to assist NEP members to initiate an educational program in support of better local land use planning. The NEMO project is not advocating NEMO clones, but tailored adaptations that meet the needs of a given area. The NEP structure, with its many committees representing a wide range of interests and organizations, is an ideal framework for generating discussion on these needs, and on educational approaches. NEMO is already working on project adaptations with groups in many of the Tier Five states, which should help to ensure positive outcomes for the workshops.

Although NEMO's planning and design approaches are non-regulatory, there are regulatory implications looming on the horizon for many of the country's communities. In the future, increasing numbers of communities will require strategies and assistance to meet the proposed Phase Two stormwater permits and increased use of Total Maximum Daily Loads (TMDLs). Thus, the needs of our local land use decision makers will only increase, and NEMO is one proven method to help meet these needs.


For more information about NEMO or the NEP project, contact Chester Arnold; phone: (860) 345-4511; phone: (757) 566-1367, or E-mail: carnold@canr1.cag.uconn.edu. or the NEMO Web site at <http://www.canr.uconn.edu/ces/nemo>.



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New York State Coastal Management Program Initiates Pilot Project



The increasing emphasis placed on restoring degraded ecosystems in the coastal zone presents a variety of challenges to natural resource managers in local and state governments. Restoration is, after all, the manipulation of natural systems—systems that scientists say we do not fully understand and should approach with caution. Unfortunately, many restoration activities go ahead without appropriate planning, unsupported by the available knowledge base, and are essentially independent initiatives without the organizational backing of a higher-level framework with regional or landscape-oriented goals. A current initiative in the New York State Coastal Management Program attempts to combat some common problems in the practice of coastal restoration by communities and interest groups in the state.

For instance, past experience with restoration is often not given adequate attention. Restoration of some habitat types, like salt marshes, have a well-documented success record. Others, like submerged aquatic vegetation beds, are more scantily supported and generally less successful. Method selection can greatly influence the cost, time frame, level of maintenance, and success of the project. For example, removal of a tide gate is inexpensive, requires low maintenance, and should result in restoration of some salt marsh habitat. However, several years may elapse before marsh vegetation returns, and disturbances to the

morphology of the site may decrease the area restored, or may result in the return of an altogether different habitat type. Failure to research previously employed methods and experience with specific habitats increases the likelihood that the mistakes of past practitioners will be needlessly repeated.

An additional shortcoming in many restoration projects is lack of monitoring. After a project is implemented, monitoring tracks progress toward the achievement of project goals. A monitoring program should therefore be designed to measure attributes associated with these goals. For example, if increasing wading bird feeding habitat is the project goal, then monitoring formation of pools, numbers and activity of wading birds, and the availability of prey species would be appropriate. Monitoring must be conducted on a regular basis, over a meaningful time period, and use standard, accepted methods. Failure to track progress in this manner may mean that problems are not identified in time for correction. Comparing projects is difficult and expenditures of time, manpower, and money are hard to justify to funding agencies.

Why do communities and groups conducting restoration neglect these issues? Several factors contribute to this chronic failure. First, there is a wide range in expertise among these communities and groups. Also, they often do not communicate or coordinate with one another. Use of information produced by scientific researchers is low. And, perhaps most unfortunate, while state governments provide funding for restoration projects, they often do not provide guidance on choosing, planning, implementing, and monitoring the projects.

Lack of guidance from state governments compounds the difficulties stemming from the other factors. Communities with lower levels of expertise and experience need guidance, however, lack of communication and coordination with others impedes the flow and appropriate timing of information. State governments can facilitate coordination and information flow, and at the very least can provide a central repository of information and a database of contacts to assist novice groups. Similarly, state governments have the resources and expertise that communities often don't have to gather scientific research, interpret it, and disseminate the information. Finally, based on all of these activities, state governments can and should develop frameworks and guidelines for restoration activities undertaken by communities and other groups under their governance.

The New York State Coastal Management Program is currently developing such restoration guidelines for use with state-funded municipal projects, by non-governmental interest groups, or by other state agencies undertaking restoration. State goals for coastal habitat restoration will be articulated to assist others in planning their own individual restoration program and projects. The guidelines will help standardize terminology, success criteria, restoration methodology, and monitoring protocols. Standardization should improve communication, clarify the state's expectations for restoration projects, make selection and justification of restoration methods more straightforward, ensure that adequate data are obtained to establish success, enhance the restoration knowledge base in New York State, and increase the comparability of data from restoration projects throughout the coastal zone.

The pilot project in this initiative is development of a guidance document for salt marsh restoration. Salt

marsh restoration has the greatest information base, and is the most frequently performed restoration using New York State funds. The document will include a comprehensive discussion of disturbances, impacts, and the details of all appropriate restoration methodologies. This discussion is synthesized from government documents, academic publications, conference proceedings, consultant reports, and peer-reviewed scientific literature.

An innovative, GIS-based salt marsh restoration site selection method will also be discussed. This method involves the use of digitized historical and current maps to determine where tidal restrictions and dredged material deposits may be removed in historically present salt marsh areas. This process is already in use for the South Shore Estuary on Long Island, and may also be employed for Long Island's Peconic Estuary. Increasing the use of GIS in coastal restoration will help centralize data resources, and will facilitate information sharing among disparate communities and groups with a stake in the coastal zone.

A conceptual model of the structure, functions, and controlling factors of the salt marsh habitat will be provided. These may act as a generic framework identifying relevant attributes and how they relate to and influence one another. Such a framework will help clarify trade-offs made during restoration goal setting, and choosing measurement parameters becomes more straightforward. Therefore, the models should provide a starting point for the development of site-specific restoration plans and monitoring protocols.

In addition, a generic monitoring protocol tailored for salt marsh restorations will be described. The protocol will contain a list of parameters to measure, a schedule for the frequency and timing of their measurement, and the details of measurement methodologies. A review of other salt marsh monitoring protocols will be included. The generic monitoring protocol, combined with the conceptual model, should provide a comprehensive basis ensuring the adequacy and comparability of more tailored, site-specific protocols developed for individual projects.

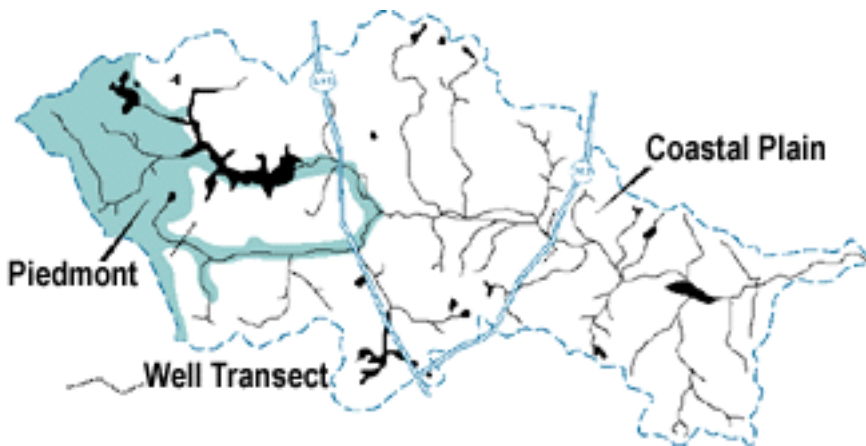
For further information, contact Nancy Niedowski, NOAA Coastal Management Fellow, NYS Department of State Division of Coastal Resources, 41 State Street Albany, NY 12231; phone: (518)-473-8359, fax: (518)-473-2464; or E-mail: nniedows@dos.state.ny.us.



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Polecat Creek Watershed Water Quality Monitoring



In April of 1993, the Virginia Chesapeake Bay Local Assistant Department (CBLAD), with the assistance of the Virginia Coastal Program, initiated a ten-year water quality monitoring study in the Polecat Creek watershed. The study goal was to determine whether the regulations and policies adopted pursuant to the Chesapeake Bay Preservation Act are effective in protecting water quality from the impacts of adjacent urban

development activities.

The Polecat Creek study, conducted by CBLAD, will provide information about how trends in water quality are affected by local land use regulations. The ten-year period of the study will allow data to reflect the average of a variety of weather/climatic conditions and increase its scientific validity. The study measures baseline levels of chemical, physical, and biological parameters of streams, groundwater, and rainfall, and will statistically evaluate changes in the baselines level as the watershed is developed. The project has received funding from the Virginia Coastal Program since 1991, when CBLAD began design of the project. The project has also received financial support from the EPA Chesapeake Bay Program, Non-Point Program (Section 319) funding through the Department of Conservation and

Recreation, and Water Quality Monitoring (Section 604B) funding through the Department of Environmental Quality.

Description of Study Area

The 30,000 acre Polecat Creek watershed is located in the south central section of Caroline County, Virginia. The headwaters of Polecat Creek rise in the Piedmont province of the Commonwealth and converges in the coastal plain with the Mattaponi River, one of the main tributaries to the York River. The watershed contains the Ruther Glen wetlands system, one of the least disturbed natural wetlands in the United States. The predominant land cover in the watershed is forest, followed by open fields and pasture land.



The Polecat Creek watershed was selected for this study for several reasons. In 1993, at the onset of the project, the watershed was predominately rural and undeveloped. However, it lies on the I-95 and Route 1 corridors between Richmond, Virginia, and Washington, DC, and is likely to see a substantial increase in urban development during the ten year project period.

About two-thirds of the watershed are designated as primary growth area in the county comprehensive plan. A regional wastewater treatment plant, servicing much of the area, was beginning to operate in 1993, and more feeder lines were being laid. These factors made it likely that development would occur as planned. Indeed, a number of development projects have been proposed in the last three years. Several of these have either been built, or are currently under construction. Much of the development in the watershed has been suburban in nature, with more urban development beginning to center at the juncture of I-95 and Route 301. (See map above)

Components of Study

The Polecat Creek Project has three components:

- 1. a system of water quality monitoring networks that provide quantitative information about chemical, physical, and biological parameters of surface water and rainfall;
- 2. a database of land use activities and land cover characteristics in the watershed with a method to monitor changes in each over the life span of the project;
- 3. and a geographic information system (GIS) which links water quality data and land use/land cover data to a digital geographic base map.

There are two types of water quality monitoring networks being used: trend monitoring stations and special studies. The network of trend stations comprise the "backbone" of the monitoring program. Data collected from these stations will be used to perform statistical trend analyses. These are fixed stations where samples are taken at specific time intervals using standard operating procedures describing collection, preservation, and analytical techniques. These methodologies will not change over the life of the project (with the possible exception of chemical analytical methodologies).

Special studies and intensive sampling efforts, will be used in the Polecat Creek project to determine the specific reasons for any changes in water quality that are detected, and whether these changes can be traced to non-conformance to Bay Act regulations. CBLAD is currently conducting a comparative biological monitoring study at a site outside the watershed. Other potential studies include: monitoring during high-flow events; monitoring logging and/or construction activities; monitoring base flow and high flow events near potential agricultural, commercial, or industrial nonpoint sources; and monitoring septic system discharges through groundwater to nearby streams.

The development and maintenance of a land use/land cover data base and a GIS, which allow links between land use/land cover data, water quality data and geographic data, are integral components of the Polecat Creek Project. The GIS is also being used to develop a nonpoint source pollution model for the watershed. Because many other watersheds in the Middle Atlantic region are similar physiographically to the Polecat Creek watershed, the results of the project and the predictive model should be transferable to other areas.

Current Status of Project

The Polecat Creek Project is currently in the fourth year of biological monitoring, the third year of physical/chemical monitoring, and the first year of groundwater monitoring. Early background monitoring (before development began) indicated that water quality was very high, and no significant variations have yet occurred in the data. However, land development has been under way in the watershed for the past two years. CBLAD is just now at the point where the agency can begin to evaluate trends in the data and begin work on developing the nonpoint source pollution model.

CBLAD has committed grant funds to Caroline County to employ a full-time inspector for its Bay Act program to ensure that farmers, developers, and others implement the Bay Act requirements correctly. This will allow an accurate determination of whether these requirements actually accomplish water quality protection as intended. The agency publishes an annual newsletter, usually each fall, and has developed a display to provide citizens in the Polecat Creek watershed and the general public with updates on the progress of the project.

For more information about this project, please call Scott Crafton at phone: (804) 371-7503 or (800-243-7229), or visit the agency's website at <http://www.cblad.state.va.us/>.

Reprinted from Virginia Coastal Program News - Spring 1998 Contact: Virginia Witmer, (804) 698-4320. Photo courtesy of Chesapeake Bay Local Assistance Department



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Collaborations that Work: Monitoring the San Francisco Estuary



The San Francisco Bay and Delta forms the West Coast's largest Estuary. The San Joaquin and Sacramento Rivers drain 40% of California and empty into the North Bay on the way to the Pacific Ocean. Saltwater enters the bay through the Golden Gate. The South Bay receives relatively little freshwater from rivers.

In addition to providing drinking water to 20 million people and water for irrigation to 4.5 million acres of farmland, the estuary is home to a large community of flora and fauna. The estuary is of great economic importance providing opportunities for shipping, fishing, recreation, and commerce.

The Estuary

The San Francisco Estuary is not only the largest, but probably the most highly modified estuary on the West Coast. Changes began during the gold rush when mining washed silt and mercury into the bay, and settlers

introduced species from east coast estuaries. Today, shipping, agricultural run-off, dredging, freshwater diversion, introduced species, and treated sewage continue to alter the bay ecosystem. In spite of all these activities, no coherent program existed to assess the bay in terms of pollutants until the signing of the Comprehensive Conservation and Management Plan (CCMP) for the estuary five years ago.

Monitoring Water Quality

The San Francisco Bay Regional Water Quality Control Board (Regional Board) is the state agency in charge of water quality issues in the Bay Area and a lead implementer of the CCMP. In response to the need for comprehensive water quality monitoring, the Regional Board and a wide array of discharge permit holders chose the newly formed San Francisco Estuary Institute (SFEI; see sidebar) to run the Regional Monitoring Program for Trace Substances (RMP). The foundation for funding, science-based monitoring, and the use of monitoring information in management and policy decisions were thus laid.

About two-thirds of the watershed are designated as primary growth area in the county comprehensive plan. A regional wastewater treatment plant, servicing much of the area, was beginning to operate in 1993, and more feeder lines were being laid. These factors made it likely that development would occur as planned. Indeed, a number of development projects have been proposed in the last three years. Several of these have either been built, or are currently under construction. Much of the development in the watershed has been suburban in nature, with more urban development beginning to center at the juncture of I-95 and Route 301. (See map above)

The Regional Monitoring Program seeks to characterize contaminant concentrations in San Francisco Estuary water, sediment, fish, and shellfish. Monitoring began in 1993 based on a Pilot Study conducted between 1991 and 1993. The ultimate goal of the RMP is to determine how contaminant concentrations in the estuary are changing in response to pollution prevention and reduction measures and to provide feedback to water quality management agencies, foremost among them, the Regional Board. The five key objectives are:

- To describe patterns and trends in contaminant concentration and distribution;
- To describe general sources and loadings of contamination to the estuary;
- To measure contaminant effect on selected parts of the estuary ecosystem;
- To compare monitoring information to relevant water quality objectives and other guidelines;
- To synthesize and distribute information from a range of sources to present a more complete picture of the sources, distribution, fates, and effects of contaminants in the estuary ecosystem.

Funding is provided by 77 public and private organizations that discharge treated wastewater, cooling water, or urban runoff, or are involved in dredging activities. Many of these funders also contribute expertise or logistical support, and a number of federal and state agencies also contribute funds or in-kind services to the RMP. Currently, the total Program budget is \$2.5 million, but varies from year to year depending on matching funds and in-kind contributions received.

The RMP has a Steering Committee and a Technical Review Committee which meet quarterly. The Steering Committee advises the Regional Board on issues such as distribution of Program costs to funders, reviews progress, and evaluates effectiveness. The Technical Review Committee works with SFEI staff on program design and methods for sampling and analysis. Committee members include representatives from wastewater treatment plants, storm water dischargers, industry, cooling water dischargers, dredgers, and SFEI and Regional Board staff. Outside scientific expertise is brought in regularly for product review and specific guidance.

The RMP routinely monitors:

- Conventional water quality (such as salinity, dissolved oxygen, and temperature) and chemistry (such as metals and pesticides);
- Water toxicity (effects on laboratory organisms);
- Sediment characteristics (such as particle size) and chemistry;
- Sediment toxicity (effects on laboratory organisms); and
- Contaminant bioaccumulation in transplanted shellfish.

The RMP also supports pilot and special studies. Pilot studies employ methods which are under evaluation for potential incorporation into the RMP, and special studies help improve interpretation or collection of RMP data. Since 1993, the RMP has conducted nine pilot and special studies. One of the most recent and noteworthy Pilot Studies, designed to address the sources and loadings objective of the RMP, is the Air Deposition Pilot Study. Efforts are currently underway to estimate loadings of key pollutants (among them mercury, copper, nickel, PCBs, dioxins, and modern pesticides) to the estuary via aerial deposition.



Trends in Contaminant Levels

In the future, RMP data will allow researchers to find long-term trends in the levels of contaminants in the estuary. Already, working with RMP data between 1993 and 1996, the RMP has uncovered some interesting patterns:

- Water samples consistently show spatial concentration gradients, with high levels of lead, nickel, zinc, diazinon, PCBs, and DDTs found in the South Bay. PCBs consistently exceed water quality objectives. Other trace organic contaminants show exceedances less frequently, as do copper, nickel, and mercury.
- Not surprisingly, contaminant concentrations have changed relatively little over time.
- Most transplanted shellfish accumulate trace organic contaminants (PAHs, PCBs, and pesticides) to levels above the implicit tissue residue guidelines embedded in EPA's California Toxics Rule. In tissue of certain fish species, mercury, PCBs, DDTs, and dioxins levels are above EPA screening values.
- Seasonal patterns are apparent. For example, cadmium concentrations are consistently higher in the late summer (the Bay Area's dry season) than in the winter and spring (the wet season). Oceanic influence and fluctuation in sources in the watershed may be responsible.
- Preliminary mass balance investigations based on a five-year record of PCB data in water, sediment, and tissue indicate that new inputs into the estuary may still exist.

Future of the RMP


A full external five-year review by some of the most highly respected experts in environmental monitoring was completed in July of 1997. This review evaluated all aspects of the RMP, including monitoring design, parameters measured, methods used, reporting and information transfer, usefulness of information generated, program structure, and cost effectiveness. The review panel recognized that the RMP has no parallel in the way it is organized. The collaboration between a regulatory agency, discharge permit holders, and an independent, non-profit organization results in *"...a unique and a trend-setting model for collective responsibility in assessing the overall condition of San Francisco Bay."*

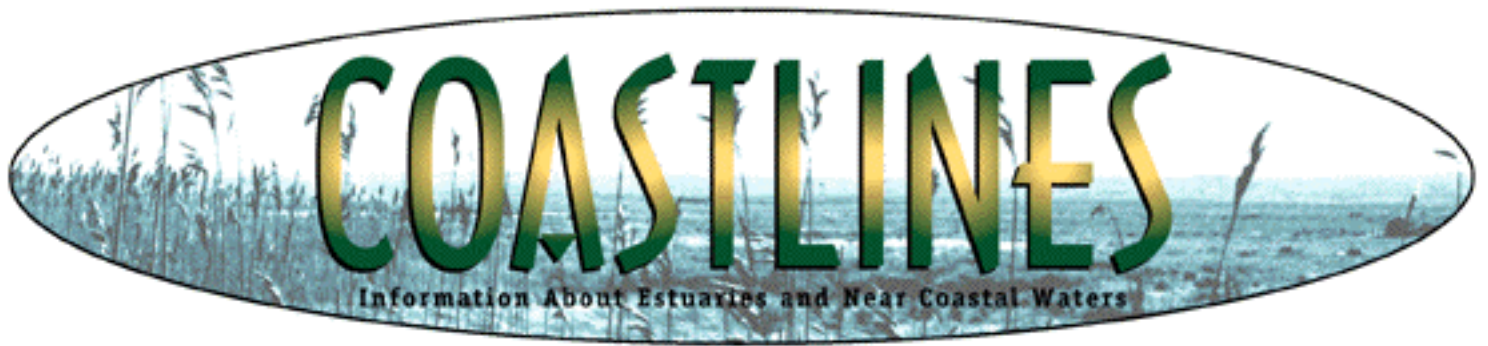
The review panel recommended that the RMP reconsider its objectives and focus its efforts more carefully on management needs. Management issues have been clarified and placed in writing, and RMP objectives have been revised. Specific workgroups with experts in different fields are currently convening to advise the RMP on how to re-design the monitoring and special study programs so that they may help answer the newly defined management questions. The re-design of all monitoring components is expected to take a few years, and modifications will be made incrementally, beginning in the year 2000.

The RMP is a unique model of cooperative environmental problem solving, involving industrial dischargers, regulators, scientists, and managers. Building on its past success, the RMP will continue to serve as a model for other comprehensive monitoring programs. Information generated by the RMP is likely to stimulate follow-up action in the watersheds surrounding the estuary and enable water quality managers to focus on priorities.

For more information, visit SFEI's website at <http://www.sfei.org>.

The San Francisco Estuary Institute is an independent, non-profit organization charged to foster the development of scientific understanding needed to protect and enhance the San Francisco Bay-Delta Estuary. SFEI was founded in September, 1994, to oversee the implementation of the Regional Monitoring Strategy for the estuary and to serve as the scientific and monitoring arm of the San Francisco Estuary Project. SFEI's precursor was the Aquatic Habitat Institute formed in 1983.

For more information about the Regional Monitoring Program or the San Francisco Estuary Institute, please visit our website at: <http://www.sfei.org>  or E-mail: Rainer Hoenicke, RMP Program Manager, at rainer@sfei.org.



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Tampa Bay Consortium To "Hold The Line" on Nitrogen Loadings

A dynamic alliance of local governments, regulatory agencies and key industry representatives spearheaded by the Tampa Bay Estuary Program (TBEP) has approved an historic blueprint for "holding the line" on nitrogen loadings to the bay, even with increased growth.

Although improvements in wastewater treatment have dramatically reduced nitrogen inputs associated with sewage discharges into Tampa Bay, contributions from other sources — including stormwater and atmospheric deposition — are still a significant cause of concern. By the year 2000, an additional 84 tons of nitrogen is expected to enter Tampa Bay as a result of population growth and associated development. Controlling the amount of nitrogen entering the bay so that water quality will be sufficient to foster the recovery of life-sustaining seagrasses is a cornerstone of the Comprehensive Conservation and Management Plan (CCMP) for Tampa Bay.

Specific goals established by the TBEP seek to maintain nitrogen loadings to the bay at 1992-1994 levels to allow the recovery of more than 12,000 acres of seagrasses. To achieve those goals, local governments and industries will need to reduce the amount of nitrogen they generate to compensate for expected growth, or at least avoid increasing their contribution. A Nitrogen Management Consortium was established in October, 1996, to develop a plan of action for nitrogen management.

Prior to the creation of the Consortium, the Estuary Program's local government partners agreed to reduce nitrogen loadings associated with stormwater runoff and wastewater discharges by nearly six tons per year from 1995-2000, for a total of 28 tons per year by 2000. The Consortium was charged with developing a strategy to address the remaining 11 tons of nitrogen per year, or 56 tons per year by 2000, linked to atmospheric deposition, industrial point sources, fertilizer shipping and handling practices, and intensive agriculture.

Members of the Consortium include representatives of agriculture, the Florida phosphate industry, and Florida Power and Light Company, as well as the six local governments and six regulatory/management agencies that serve on TBEP's Management Board. Earlier this year, the group approved an action plan that identified specific activities each member will need to undertake to meet their nitrogen management goal.

Among those ongoing or planned projects are land acquisition programs which prevent environmentally significant lands from being developed; construction of regional stormwater treatment facilities; conversion of septic systems to central sewer; and improvements in manufacturing processes that reduce pollution. In keeping with the NEP's emphasis on cooperation and flexibility to achieve environmental gains, each member can select the most cost-effective and beneficial option for their community or industry as long as the overall goals are met.

In fact, the Consortium has already made substantial progress in meeting the nitrogen loading goals. Estimates show that projects already completed or on the drawing board will allow Consortium members to meet or surpass the baywide nitrogen reduction goal by the year 2000.

In fact, the Consortium has already made substantial progress in meeting the nitrogen loading goals. Estimates show that projects already completed or on the drawing board will allow Consortium members to meet or surpass the baywide nitrogen reduction goal by the year 2000.

Although some companies have declined official membership on the Consortium, such as Tampa Electric Company and Florida Power Corporation, they have participated in the group's discussions and offered valuable recommendations. In fact, independent efforts by Tampa Electric to reduce nitrogen oxide, or NO_x emissions, from its power plants on Tampa Bay are among the key industry projects included in the overall action plan.

The TBEP will review and revise the nitrogen management goals for Tampa Bay every five years, or more often if warranted. Revisions will take into account any new sources of nitrogen that are identified, as well as unforeseen contributions from spills or other events.

Because of the strong scientific foundation of the Estuary Program's seagrass recovery and nitrogen management strategy, the Florida Department of Environmental Protection proposes using the nitrogen management goals developed through the TBEP as the basis for establishing a Total Maximum Daily Load (TMDL) for nitrogen for Tampa Bay, as required by the Clean Water Act. This interest in

incorporating goals developed by community consensus within the existing regulatory framework, highlights the proactive role the NEPs might play in addressing the TMDL issue.

For further information, contact Public Outreach Coordinator Nanette Holland or Senior Scientist Holly Greening; phone: (813) 893-2765; E-mail: tbnep@tampabayrpc.org.



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Evaluation of Shrimp Bycatch Reduction Devices in Texas Coastal Bend Waters

Demonstrating Practical Tools for Watershed Management Through the National Estuary Program

Characteristics:

- The Coastal Bend Bays & Estuaries Program (formerly the Corpus Christi Bay National Estuary Program) encompasses three of Texas' seven major estuaries and a wide variety of highly productive habitats, including oyster reefs, seagrass meadows, open bay bottoms, coastal marshes, wind tidal flats, barrier islands, and freshwater marshes.
- Shrimp (*Penaeus* sp.) are considered the most important commercial seafood product in Texas, accounting for over 90 percent by dollar value and approximately 80 percent by weight of all seafood landed

each year.

- Commercial shrimp represented 60 - 90 percent (by weight) of total seafood harvest in the Coastal Bend from 1988 to 1993.
- The Aransas Pass-Rockport Harbor is ranked among the nation's top ten most valuable fishing ports.
- Bycatch is defined as the catch of organisms in shrimp trawls other than the targeted shrimp species.

The Problem:

Worldwide fisheries stocks are being depleted and many fisheries operations presently use harvesting equipment that does not discriminate between species. Shrimp trawl bycatch (species caught incidental of the species meant for harvest) in Coastal Bend bay waters is between 1.5 to 7 times the weight of shrimp harvested. A recent study suggests that populations of important commercial and recreational species are in decline within the Coastal Bend bays, including Atlantic croaker, southern flounder, gulf menhaden and adult blue crab. Presently there are no regulations for any gulf state mandated use of bycatch reduction devices (BRDs) in state territorial waters. However, concerns regarding finfish mortality associated with shrimp trawling prompted a 1990 amendment to the Magnuson Fishery Conservation and Management Act that mandated the development of a Bycatch Reduction Research Program.

The Project:



Click on image for larger picture.

The purpose of the Bycatch Reduction Device Demonstration Project was to evaluate, for the first time in Texas coastal bays, the effectiveness of three BRDs. The project was designed to compare trawls with and without BRDs to determine bycatch reduction and shrimp retention rates.

Introduction to Coastal Bend Bays & Estuaries Program

The Coastal Bend Bays & Estuaries Program

(CBBEP) lies along the south central Texas Gulf coast in a semi-arid to subtropical climate. The Program's project area includes three of the seven major estuaries along the Texas coast. Among the major riverine systems that flow into the estuaries are the Mission, Aransas and Nueces Rivers. The composition and distribution of the habitats and biota of the Coastal Bend are greatly influenced by climate and their geographic setting.

Relatively healthy estuarine waters support a productive ecosystem and diverse economy. Bay related activities generate a total annual output in the region of \$4.1 billion, provide 53,068 jobs (about 1/3 of the employment in the area), and generate a personal income of \$1.3 billion. Bay and gulf commercial fisheries directly benefit from a productive bay system, and together generate \$45 million annually in total output in the region.

The number of licensed shrimp boats in the Coastal Bend has decreased steadily since 1985, however, statewide effort, or number of days fished, has increased 400 percent since 1961. The average shrimp caught per unit of effort has decreased in size by 40 percent between 1972 and 1993. During the same period, an increase in bay shrimp landings has occurred. In general, shrimpers are fishing for longer periods to catch smaller shrimp of less value.



Overview of the Project

A multi-partnership approach was taken in developing a project to evaluate the effectiveness of three BRDs. The partners included the Texas Seafood Producers Association, Texas Parks and Wildlife Department, and Texas Sea Grant College. Collectively, the group designed the project to allow for comparisons between trawls with and without BRDs to determine bycatch reduction and shrimp retention rates. All partners were involved in gear selection, placement and sampling methodology design.

Project Objectives

At the request of the shrimping industry, the CBBEP Management Committee approved funding for a demonstration project to evaluate the effectiveness of three BRDs, 1) large mesh extended funnel (LMEF), 2) a two-inch space bar turtle exclusion device (TED); and 3) a fish eye, which is a trawl with an escape hole for fish to exit. Paired-trawl sampling in Coastal Bend bay waters facilitated comparisons between BRDs and conventional trawls to determine bycatch reduction and shrimp retention rates. Sampling commenced in spring 1997 and concluded after the fall bay shrimp season the same year.



Implementing the Project

Twenty comparative trawl tows were conducted with each BRD during the 1997 spring and fall commercial bay-shrimp seasons. Two trawls, one with a BRD and one without were towed simultaneously. For each trawl, samples were separated into shrimp and bycatch then weighed separately aboard the vessel. A 25-pound subsample was collected from each tow, separated into species groups, weighed, and counted.

The LMEF had the highest total bycatch reduction rates by weight and second highest by number, with no significant overall shrimp loss in spring. In addition, the LMEF reduced the most abundant bycatch species, spot (*Leiostomus xanthurus*), during spring and fall and the blue crab (*Callinectes sapidus*) in the spring. Both Atlantic croaker and sand seatrout were also greatly reduced in the fall with the LMEF. The two-inch space bar TED was first in total bycatch reduction by number during spring, but had significant shrimp loss by weight resulting in greater shrimp loss than total bycatch reduction. The two-inch space bar TED also had the greatest reduction rates for sand seatrout (*Cynoscion arenarius*) in the spring.

Results of the fish eye BRD varied among groups but showed greatest reduction rates for Atlantic croaker and southern flounder (*Paralichthys lethostigma*) in the spring.

Success Stories

Results from the project varied between seasons and among BRDs, but there are indications that BRDs have the potential to reduce bycatch while limiting shrimp loss. Overall, the LMEF significantly reduced bycatch more effectively by weight and number than the other two BRDs during both spring and fall.

More importantly, this project thawed relations between historical adversaries in the shrimp resource management arena, namely shrimpers and shrimp regulators. Hailed by both sides as a step in the right direction, the project-fostered partnerships are the foundation for continued pursuit of common goals in an atmosphere of mutual trust.

The CBBEP will continue to promote this type of activity to increase the lines of communication and to further enhance our knowledge of bycatch-related issues.

Lessons Learned

There are many factors involved in determining which BRDs function more effectively than others. Some factors include trawl mesh size and type, length of trawl bag, BRD type, size, and placement along trawl, tow speed and duration, shrimp size, bycatch composition, wrack type, variations in bottom substrate, and water depth. Therefore, the need to continue refining the sampling gear and methodology to evaluate additional alternatives for bycatch reduction are necessary in order to maintain this highly productive commercial fishery.

For further information, contact:

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