

# Nonpoint Source News-Notes

The Condition of the Water-Related Environment  
The Control of Nonpoint Sources of Water Pollution  
The Ecological Management & Restoration of Watersheds

## Introduction to the Coastal Issue

### Welcome to the Coastal Issue

As the International Year of the Ocean draws to a close, *News-Notes* is looking at that portion of the ocean impacted by nonpoint source pollution. Ever since the Coastal Zone Act Reauthorization Amendments of 1990 instructed state and federal governments to address coastal nonpoint pollution, we have recognized the wider swath cut by NPS — both inland and offshore. We now know that human activities hundreds of miles inland along the Mississippi River have serious implications for the ecology of the Gulf of Mexico. And coral reefs many miles from shore appear to be suffering from an array of ills, with nonpoint source pollution implicated as one cause.

Many questions remain about the relationship of land activities to coastal water quality. In some cases, answers hover tantalizingly close; for example, what is the role of nutrient enrichment in the devastating fish kills attributed to *Pfiesteria*? More uncertainty surrounds atmospheric deposition of pollutants and their effects on coastal water quality and habitat.

On the other side of the coin, the results of hard work are visible all along the U.S. coastline: shellfish beds are reopening, sensitive coastal habitats are being restored, sustainable development is catching on, and research and monitoring are giving us a clearer picture of the problems and our alternatives in solving them.



The CWA logo seen throughout this issue denotes articles related to action items called for in the President's Clean Water Action Plan. See *News-Notes* #51 and #52 for more information on the plan.

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# Notes on the National Scene

## EPA Beach Program Makes Waves



On May 23, 1997, EPA Administrator Carol Browner formally announced the Beaches Environmental Assessment, Closure, and Health (BEACH) program to strengthen U.S. beach programs and water quality standards, better inform the public, and promote scientific research to further protect the health of beachgoers. The BEACH program's significant accomplishments in its first year indicate that EPA and its state partners are making steady progress to "significantly reduce the risk of infection to users of the nation's recreational waters through improvements in recreational water programs, enhanced communication, and scientific advances."

Surveys and ongoing scientific studies continue to document actual or potential occurrence of disease-carrying bacteria, viruses, and other pathogens in local beach water, primarily from sewage and stormwater runoff. High levels of such pathogens in recreational waters increase human exposure to disease-causing organisms through ingestion, inhalation, and bodily contact, thus increasing the risk of illness. The BEACH program concentrates on three specific goals to lower the risk of human illness: getting up-to-date beach water quality standards adopted in all states, informing the public about recreational water quality, and developing new indicators for non-gastrointestinal diseases and new monitoring protocols to ensure detection of water quality problems.

### *Nation's First Beach Survey*

EPA conducted the first National Health Protection Survey of Beaches in spring 1998. This comprehensive survey of government agencies collected information on coastal beach programs (as opposed to inland beaches) carried out at local beaches, asking: Which beaches are monitored and how frequently? Who conducts the monitoring? Where and how often have advisories been posted? What are likely pollution sources? What are the water quality standards?

EPA targeted U.S. coastal beaches and the Great Lakes, distributing 350 questionnaires to state and local beach health protection agencies. The agency received 159 responses from 26 states and Guam which included information on about 1,000 coastal beaches. The respondents were almost exclusively local governmental agencies from coastal counties, cities, or towns, although a few of the respondents represented state or regional (multi-county) districts.

### *Current Programs and Areas for Improvement*

The 159 survey respondents indicated that 117 programs are in place to monitor beach water quality for bacteria or other pathogens, 124 agencies have programs to close the beach or restrict swimming when unsafe water quality conditions are present, and 126 agencies have recreational water quality standards for bacteria or other pathogens.

During 1997, at least 4,153 U.S. oceans, bays, and Great Lakes beaches posted individual closings and advisories, 17 extended (6-12 weeks) closings and advisories, and 55 permanent (over 12 weeks) closings and advisories. Sixty-nine percent of beach closings and advisories were due to bacteria levels that exceeded water quality standards, while 13 percent were due to a specific known pollutant. Eighteen percent were attributed to polluted runoff and stormwater.

In early 1999, EPA will conduct a second survey to fill in any gaps left in the first survey. In subsequent years, EPA plans to expand the annual beach survey to include inland beaches.

### *Beach Information Available to the Public*

A key goal of this effort is to integrate national and local beach health information and make it available to the public quickly and accurately. In late 1997, EPA stepped up plans to build local partnerships with county and state agencies responsible for monitoring waters at beaches. EPA's Office of Water teamed with the agency's Environmental Monitoring for Public Access and

Community Tracking (EMPACT) program to fund five pilot projects in Boston, several Florida cities, the Mississippi Gulf coast, Lake Ponchartrain (Louisiana), and several southern California cities. The projects will establish and improve:

- State/local partnerships
- Bacterial indicators and monitoring methods
- Site-specific predictive tools
- Ways to communicate time-relevant information (such as postings and closures) through a variety of media (including use of the Internet, telephone hotlines, newspapers, local radio and TV reports, and multilingual presentations)

### National Conference

The Association of State and Territorial Health Officials (ASTHO) and EPA cosponsored the first national beach health conference in October 1997, in Annapolis, Maryland. Representatives from the federal government, states, counties/cities, academic institutions, associations, environmental groups, and others attended the conference. They discussed current issues and activities related to beach health and exchanged information about beach health initiatives across the country. They also identified beach health needs and assigned priorities to short-term and long-term actions. The conference encouraged greater consistency among jurisdictions in beach monitoring and notification.

Recommendations made during the conference are summarized in an EPA publication titled *National Beach Conference, Report on Action Items* (EPA-823-R-98-004). To order a copy, contact the National Center for Environmental Publications and Information (NCEPI), 11029 Kenwood Road, Building 5, Cincinnati, OH 45242. Phone: (800) 490-9198.

All the regional projects plan to make this information available to the public by using the Internet and other time-relevant notification approaches. At the national level, EPA will design a long-term data system that can quickly accommodate monitoring and advisory information on beach health. The agency is also working to improve predictive tools (rainfall and hydrodynamic models) to inform the public before exposure occurs.

### *Clean Water Action Plan and the BEACH Plan*

As part of the "Clean Waters: Healthy People" portion of President Clinton's Clean Water Action Plan, EPA is developing a BEACH Plan that describes future directions and priority actions for implementing beach monitoring and notification programs. This strategic multi-year plan will be flexible enough to incorporate emerging concerns and advancing technologies. The plan will include monitoring strategies, improved indicators, enhanced modeling tools to predict beach contamination, and epidemiology studies. It will describe EPA's program development and guidance plans, identify unresolved scientific research issues and proposed research, describe water quality standards issues, and address other aspects of the BEACH program. The plan will help launch the BEACH program into the new year.

*[For more information about the BEACH program and related topics, visit EPA's BEACH Watch website at [www.epa.gov/OST/beaches](http://www.epa.gov/OST/beaches), or contact Rick Hoffmann, U.S. EPA, Office of Science and Technology (4305), 401 M Street, SW, Washington, DC 20460. Phone: (202) 260-0642.]*

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## *Clean Boating Partners Award Program Unfurled*

Come next July, marinas, boatyards, and marine dealers will be able to proclaim their dedication to clean water by flying a colorful flag. Leading recreational marine organizations met in Fort Lauderdale, Florida, on November 3 to develop an awards program for publicly recognizing marinas, boatyards, and marine dealers who voluntarily take the pledge to practice and promote clean boating. Named the National Environmental Excellence Awards Program, it builds on the National Clean Boating Campaign launched by the Marine Environmental Education Foundation (MEEF) in 1998. The Clean Boating Campaign now has 618 partners, and interest is swelling, according to MEEF's president, Neil Ross.

The excellence awards will recognize those partners who have gone beyond implementing clean practices to promoting them to their customers. According to Ron Stone, chair of the awards task force, participants who agree to follow recommended clean boating practices will qualify for a certificate of recognition and the right to fly a distinctive flag identifying them as award winners. Compliance, though completely voluntary, will be subject to verification and periodic review by MEEF's regional representatives.

Award criteria, a pledge, and the flag will ready for the 1999 boating season, which MEEF will officially kick off with the 1999 Clean Boating Week, July 10-18. "The marina and boat-building industries have long recognized that clean water is good for business, and the flag program is a good way to recognize their efforts and to publicize the need for clean boating practices," says Stone.

[For more information, contact MEEF/NCBC, P.O. Box 37, Kingston, RI 02881. Phone: (401) 792-9025; fax: (401) 782-2116; e-mail: neil.ross@worldnet.att.net.]

### Some Recommended Practices for Clean Boating Partners

- Arrange for recycling service on used oil, solvents and oil filters.
- Demonstrate economic and environmental benefits of using dustless sanders and grinders.
- Offer free pump-outs to all boaters during National Clean Boating Week, July 10-18, 1999, and register to be on MEEF's national pump-out publicity list.
- Install a national pump-out sign showing the new logo and slogan.
- Designate a pet walk area for dogs.
- Post signs describing how to dispose of litter and fish cleaning waste and clearly mark disposal areas.
- Post signs showing boaters clean fueling techniques.
- Organize on-site training for marina managers and staff on best management practices; give certificates of training.

These tips and many more are available on the Clean Boating Campaign's fact sheet series, which can be downloaded from [www.cleanboating.org/info/boat5b.htm](http://www.cleanboating.org/info/boat5b.htm).

### Declining Coral Reefs Draw Administration's Attention

Coral reefs, often thought of as pristine areas of almost magical beauty, appear to be vulnerable to the impacts of human activities, including the ubiquitous nonpoint sources implicated in the degradation of other aquatic resources.

"Too much civilization, accompanied by too little education, is creating havoc with these beautiful underwater habitats. It is high time that federal and public efforts converge to protect these fragile environments," Secretary of the Interior Bruce Babbitt told the first meeting of the Coral Reef Initiative Task Force in October.

The task force, established by Executive Order, is co-chaired by Babbitt and Secretary of Commerce William Daley. It includes representatives from 11 federal agencies, and governors from U.S. jurisdictions with coral reefs (Florida, Puerto Rico, the U.S. Virgin Islands, Texas, Louisiana, Guam, American Samoa, and the northern Mariana Islands).

Natural phenomena like hurricanes and disease have always taken their toll on reefs, but their effects are apparently exacerbated by human activities in the ocean and on land. Besides destructive fishing practices and coral collecting, impacts come from sewage and other effluents and from sediments eroded from agricultural and construction operations. (Global temperature rise is also thought to be a factor in the decline of reefs.) Excess nutrients from domestic sewage and agricultural runoff have the potential to adversely affect reefs as well.

According to scientists at the meeting, up to two-thirds of the world's coral reefs are currently in decline or threatened. Aside from their intrinsic value as ecological communities, the economic value of reefs is substantial. They are a multi-billion dollar economic engine for tourism, a spawning ground for commercial fishery species, and a source of new medicines.

To address nonpoint source pollution and other problems facing the nation's coral reef systems, task force members identified issues of concern, which included the factors affecting reef health, but they also cited a lack of coordination in scientific research and a need for improved reef restoration methods. Working groups will develop specific strategies to deal with these issues on a large scale.

At the meeting, both Deputy Secretary of Commerce Robert Mallett and Secretary Babbitt announced major new programs to protect the nation's coral reefs and ensure their long-term ecological and economic vitality. The new programs include increased monitoring of water quality and biological diversity in critical coral reef systems, grant awards for monitoring and education projects in U.S. territories and Hawaii, additional new funds for local-level coral conservation projects, and expanded mapping of U.S. coral reef ecosystems.

Secretary Babbitt also directed the National Park Service and the Fish and Wildlife Service to review and revise, no later than FY 2002, plans for the protection and management of the nine national parks and 17 national wildlife refuges containing coral reefs. The National Park Service and EPA, in cooperation with NOAA, will expand EPA's Water Quality Monitoring Program to cover both the Biscayne and the Dry Tortugas National Parks. The National Park Service has committed \$25,000 for the expansion.

The Department of the Interior, in cooperation with NOAA, will develop plans and implement actions to protect coral reef ecosystems in the Dry Tortugas National Park and the surrounding area of the Florida Keys National Marine Sanctuary. The park will undertake a parallel and coordinated process with the sanctuary for assessment, planning, and management.

[For more information, visit the U.S. Geological Survey's website at [www.usgs.gov/coralreef](http://www.usgs.gov/coralreef). Also visit NOAA's coral reef website at [coral.aoml.noaa.gov](http://coral.aoml.noaa.gov). "The Extent and Condition of US Coral Reefs." is another resource on NOAA's State of the Coast website at [http://state-of-coast.noaa.gov/bulletins/html/crf\\_08/crf.html](http://state-of-coast.noaa.gov/bulletins/html/crf_08/crf.html).]

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## Notes on Coastal Watershed Management

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### *Pfiesteria: The Year After the Scare*



Fish kills in Chesapeake Bay tributaries brought the dinoflagellate *Pfiesteria* to national attention in the summer of 1997. North Carolina's Albemarle-Pamlico region also suffered from *Pfiesteria* outbreaks, a phenomenon that has killed over a billion fish in the last decade. The flurry of research following the Chesapeake Bay region outbreak has answered a few questions, but raised many more, especially since the surprising "no-show" of the organism in Bay tributaries in 1998, despite similar environmental conditions.

*Pfiesteria* normally exists in nontoxic forms, feeding on algae and bacteria in the water and sediments of tidal rivers and estuaries. Certain conditions, possibly the secretions or excrement of schooling fish, trigger *Pfiesteria* cells to shift forms and begin emitting a powerful toxin that stuns fish. Other toxins are believed to break down fish skin tissue, opening bleeding sores or lesions. The toxins or subsequent lesions and secondary infections are frequently fatal to the fish. Exactly what conditions trigger the outbreaks is not clear and the toxic outbreaks are remarkably short, lasting only a few hours. Although other organisms that are often grouped with *Pfiesteria* as HABs (Harmful Algal Blooms) are known to thrive under high nutrients loads, direct evidence of a nutrient-induced population increase in *Pfiesteria* is not currently available. (See page 17 for another article on HABs.)

Thousand of fish were killed in the Chesapeake Bay area outbreak in 1997. Maryland and Virginia reacted immediately by closing affected water bodies and issuing health advisories, while initiating a more thorough analysis of the problem.

### *Economics and Health Impacted*

The organism took a toll on several Chesapeake Bay area industries. According to Douglas W. Lipton, coordinator of the Maryland Sea Grant Extension Program, *Pfiesteria* cost the Chesapeake Bay seafood industry an estimated \$43 million in 1997, even though currently there is no evidence of seafood poisoning caused by the organism. North Carolina Sea Grant Extension Specialist David Patrick Green, who is investigating the potential public health hazards associated with fish and

shellfish, says that laboratory studies exposing oysters to heavy doses of Pfiesteria toxins failed to find the toxin in the shellfish. Green points out that there has never been a reported case of seafood-borne illness linked to the organism. Still, to be on the safe side, NOAA advises people not to harvest or consume fish or shellfish from areas that have been closed and to avoid handling or consuming fish that are dead or dying or that exhibit sores. Green believes that seafood from restaurants, supermarkets, and other retailers should be considered safe.

The seafood industry was not the only one impacted. Recreational anglers stayed away from the Bay area, and Maryland economist Lipton reported that the recreational fishing business suffered to the tune of at least \$4.3 million.

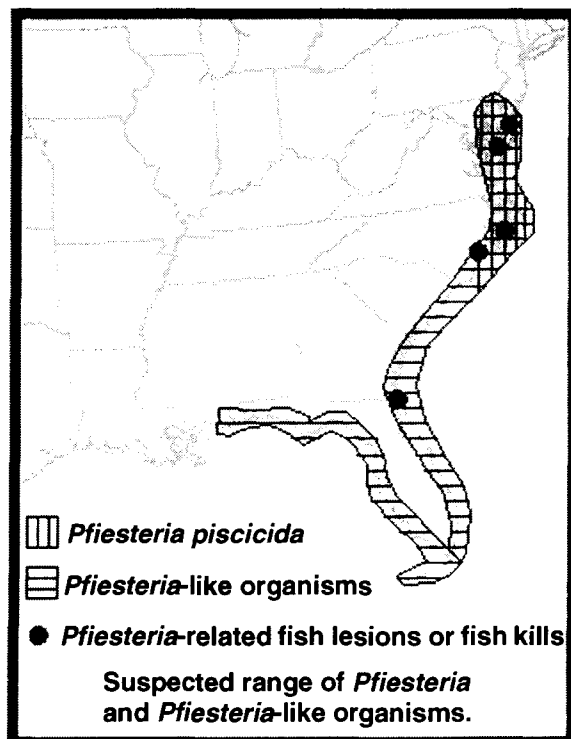
Human health impacts from contact with water and aerosols containing Pfiesteria toxins, heatedly debated in 1997, have now been confirmed among 146 watermen and laboratory workers. According to leading authority JoAnn Burkholder of North Carolina State University, a Maryland medical team "documented profound learning disabilities and short-term memory loss sustained by some people who were exposed to the Pfiesteria-affected areas where fish were diseased or dying." Headache, skin lesions and burning, and diminished learning ability and memory were among the symptoms, which resolved 3-6 months after exposure. The Center for Disease Control and Prevention is currently working with the states to develop standard diagnoses, therapies, and health advisory information for potential future outbreaks.

### Research

Other government agencies are also taking action to fill in data gaps and to better address such events in the future. "Pfiesteria-like organisms are the most current example of the growing problem of harmful algal blooms," says Danielle J. Luttenberg of NOAA. NOAA's Coastal Ocean Program is leading the federal multi-agency National Algal Bloom Program. In 1993, NOAA developed a national plan for addressing HABs. Last year, in response to the Pfiesteria crisis, NOAA released a strategy to govern research and monitoring efforts. "Due to the potential linkages between coastal nutrient loading, HABs, and eutrophication, NOAA is addressing the HAB issue as part of a larger program to combat nutrient pollution and habitat degradation in our nation's coastal waters," Luttenberg says.

Meanwhile, both long-term and short-term studies that may someday provide definitive answers proceed. Parke A. Rublee, a biologist at University of North Carolina at Greensboro, is working on a gene probe for *Pfiesteria piscicida* that can be used to confirm Pfiesteria as the cause of fish kills and may provide insights into management practices that can reduce the incidence of fish kills. The probes can also be used to test aquaculture ponds for the presence of Pfiesteria, which could potentially cost a fish farmer thousands of dollars in lost revenues.

At the Aquatic Animal Disease Diagnostic Laboratory at Virginia's Institute of Marine Science, Wolfgang Vogelbein's research is casting doubt upon the widely accepted notion that Pfiesteria was the single culprit in last year's outbreak of fish disease in the Chesapeake Bay region. Vogelbein found that affected menhaden (the fish species hardest hit) in Chesapeake Bay were consistently infected with a deeply penetrating *Aphanomycte* fungus known to cause skin lesions. Based on his



findings, the researcher questions the practice of using skin lesions in menhaden as an indicator of Pfiesteria activity in Chesapeake Bay waters.

“Whether this fungal agent is an obligate pathogen capable of producing disease on its own or whether it is a secondary invader that colonizes skin damaged by some other environmental factor (e.g., Pfiesteria toxin, salinity) is presently not clear. However, the causal link between Pfiesteria toxin and lesions occurring in natural populations of menhaden is not dogma as has been presented to the public, but should instead be treated only as a hypothesis requiring further testing. Clearly, additional studies are required to clarify this association,” writes Vogelbein.

Scientists at the National Ocean Service Charleston Laboratory in South Carolina have been working with the National Institute for Environmental Health Sciences and North Carolina State to develop assays to detect Pfiesteria toxins in human blood and field samples. At the National Marine Fisheries Service Beaufort Laboratory in North Carolina, researchers have identified a new genus of a Pfiesteria-like organism from Pamlico Sound, and are working to understand its ecology and potential toxicity.

NOAA recently awarded \$2.4 million in ECOHAB (Ecology and Oceanography of Harmful Algal Blooms) research grants to study the causes and consequences of harmful algal blooms, including outbreaks of toxic Pfiesteria and similar organisms in mid-Atlantic coastal waters.

“These NOAA ECOHAB grants pave the way for research that is important to the environmental and economic health of our coastal regions,” says Nancy Foster, head of NOAA's National Ocean Service. “Our partners in the states and academic community are an important link in our national program to unlock the mysteries of HABs and Pfiesteria-like species.”

The Pfiesteria-related research funded by the grants ranges from determining the conditions that contribute to Pfiesteria blooms to identifying the species-specific toxins produced by the several different types of Pfiesteria-like organisms.

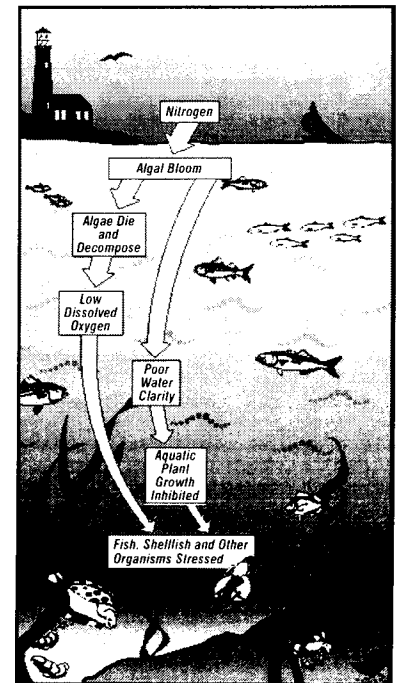
[For more information, visit the University of Maryland's website at [www.mdsg.umd.edu/seagrant/mediacenter/roadmap/pfiesteria](http://www.mdsg.umd.edu/seagrant/mediacenter/roadmap/pfiesteria).]

## Preliminary Assessment Reports at Gulf of Mexico Hypoxia Task Force Meeting



The need to control nonpoint source runoff is nowhere more clearly demonstrated than in the Gulf of Mexico. Deepening concern about the hypoxic (low oxygen) conditions that plague the Gulf and threaten the livelihood of regional fishermen sparked the formation of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force in December 1997. The Task Force is charged with developing solutions to the nutrient overenrichment that depletes oxygen in portions of the northern Gulf of Mexico. (See *News-Notes* Issue #51 for more background information on hypoxia.)

At the Task Force's most recent meeting in September, preliminary assessments were unveiled by members working on scientific assessment of the problem. The goals are to 1) document the state of knowledge of the extent, characteristics, causes and effects (both ecological and economic) of hypoxia in the Gulf, and 2) compile existing information on the nutrient sources, identify alternatives to reducing nutrient loads, and examine the costs and benefits of reducing nutrient loads.



The impact of nutrients on the Gulf's ecology.

The Task Force is developing six interrelated reports on various aspects of these issues:

- Characterization of the distribution, dynamics and causes of hypoxia in the Gulf, including the relationship of hypoxia to nutrient loadings, and the relative contributions of human and natural factors.
- Ecological and economic consequences of nutrient loading, including the impacts on the Gulf fisheries and the regional and national economy.
- Sources and loads of nutrients transported to the Gulf from within the Mississippi/Atchafalaya River system, including identification of the most significant nutrient loads to the basin's surface water and estimation of the relative impact of human versus natural sources of nutrients.
- Effects of reducing nutrient loads on water quality, primary production, and hypoxia within the basin and Gulf. Modeling will estimate the magnitude of load reductions necessary to significantly affect hypoxic conditions.
- Evaluation of methods to reduce nutrient loads to surface water, ground water, and the Gulf. Analysis will include reduction of source contributions as well as the effects of alterations to the system, such as hydraulic transport modifications.
- Evaluation of social and economic costs and benefits of nutrient reduction methods.

At the September meeting, Don Goolsby of the United States Geological Survey provided an overview of the sources and loadings of nitrogen and phosphorus to the Mississippi River basin and outlined human activities that contribute to the loadings. An upward trend of nitrogen, primarily in the form of nitrate, in the 1970s was followed by a steady level from 1983 to 1996. From 1980 to 1996, the average load of total nitrogen to the basin was 1,567,900 metric tons per year. According to Goolsby, highly variable yields of nitrogen from year to year suggest the presence of soils with a large storage capacity. Sources of loadings include fertilizer applications, air deposition, manure, and legumes. Goolsby estimated that 17 percent of the total loadings are from municipal and industrial point sources, and Iowa and Illinois lead the basin states in total estimated nitrogen load contributions.

Bill Mitsch, Ohio State University, discussed potential approaches for reducing nutrient loads to the basin. Suggested approaches include modifying agricultural practices, improving point source control technologies, restoring landscapes (including wetlands and riparian corridors) in rural areas, implementing urban nonpoint source controls, restoring the Mississippi River Delta and other streams and rivers in the basin, and implementing and improving atmospheric pollution controls. Modeling scenarios predict that approximately 10 million acres of wetlands and riparian areas would have to be restored or created in the basin in order to decrease nitrogen loads significantly. The science team will most likely recommend a combination of control efforts.

Otto Doering of Purdue University reported on progress in evaluating the social and economic costs and benefits of methods for reducing nutrient loads. About 80 percent of total U.S. acres in major crop production of wheat, corn, soybeans, and hay are in the Mississippi River basin, making agricultural nitrogen an important target for reduction strategies. Several economic scenarios focus on reducing nitrogen from nonpoint sources, particularly cropland. One scenario included point source-nonpoint source trading where point sources would support efforts by agricultural producers to reduce nitrogen loads.

**New Federal Law  
on Hypoxia in the  
Gulf of Mexico**

P.L. 105-383, the Coast Guard Authorization Act of 1998 and 1999, was enacted on November 13, 1998. Title VI of the law is the "Harmful Algal Bloom and Hypoxia Research and Control Act of 1998." In short, the new law

- establishes a Federal Task Force on Harmful Algal Blooms and Hypoxia
- provides for assessments of ecological and economic consequences of harmful algal blooms and hypoxia, and
- requires a plan for controlling hypoxia in the northern Gulf of Mexico by March 30, 2000.

(See article on page 17 for more information on harmful algal blooms.)



Another modeling scenario included the economic and environmental effects of reducing nitrogen use. Still another predicted the effect of moving high-nitrogen-use crops to land areas that do not drain to the Mississippi Basin. The models indicate that a sixty percent reduction of nitrogen input to the Gulf would create significant economic disruptions to the agricultural sector in the Mississippi basin. A twenty-percent reduction, considered more realistic, would avoid causing a significant economic impact. The science teams will submit their final reports next year.

The Task Force also drafted a "win-win" strategy for identifying near-term actions needed to reduce nutrient loads. The strategy, which would modify existing programs to reduce impacts to the hypoxic zone, is based on the premise that improving water quality "up-river" will benefit the Gulf of Mexico as well as landowners and the environment throughout the basin. Most strategy actions focus on nutrient management and habitat restoration and build on existing programs and the Clean Water Action Plan.

The next meeting of the Nutrient Task Force is planned for February 11, 1999, in Memphis, Tennessee.

[For more information, contact Mary Belefski, U.S. Environmental Protection Agency, 4503F, 401 M St. SW, Washington, DC 20460. Phone: (202) 260-7061; e-mail: belefski.mary@epa.gov; website: [www.epa.gov/surf/surf98/Mississippi/msrhp.html](http://www.epa.gov/surf/surf98/Mississippi/msrhp.html).]

## Federal-Private Partnership Helps Communities Restore Coastal Habitat



Eight coastal communities are getting help restoring marine fish habitat, thanks to a partnership between NOAA and the American Sportfishing Association (ASA), a nonprofit industry trade association. A three-year agreement between the two groups provides the funding and expertise to aid communities that may not have the necessary resources to accomplish the task alone.

"Working directly with the local community provides the best benefit to marine resources for America's tax dollars," says Terry Garcia, deputy NOAA administrator. "NOAA's \$50,000, coupled with an equal amount from ASA, will result in almost a half million dollars of restoration through in-kind contributions, local donations, and volunteer work."

Technical experts from the NOAA Restoration Center and regional offices, along with the large volunteer base of the ASA's FishAmerica Foundation, will undertake habitat restorations that contribute directly to the joint goal of restoring estuaries and marine habitats, especially salt

### The Projects

- In an anadromous fish restoration project in the Parker River in Massachusetts, volunteers will revitalize fishways around six small dams to allow migrating fish to reach primary spawning habitat.
- At Alaska's Russian River, the Youth Restoration Corps will stabilize and repair eroding riverbanks.
- Local conservation groups in Echo Lake, Rhode Island, will construct a fishway to allow fish access to Echo Lake.
- In New Jersey, on the Cooper River, a new fish ladder will provide access to the spawning and rearing habitat of migrating fish.
- Oysters and sportfish will both benefit from the restoration of oyster reefs in the Lafayette River in Norfolk, Virginia, where volunteers will create habitat for both fish and shellfish.
- On Dutch Bill Creek in California, a reconstructed fish passage will provide increased access to native populations of coho salmon and steelhead trout.
- The Fiock Dam in Shasta Valley, California, will be removed through cooperation with the dam's owners and local and regional water users, improving habitat for steelhead and salmon.
- High school students and divers will help restore southern California's kelp beds, reestablishing sites that provide critical habitat for more than 800 marine species.

marshes, seagrass beds, coral reefs, mangrove forests, and freshwater habitat important to marine species. The community-based projects have the added benefit of promoting stewardship and a conservation ethic among coastal communities, according to a NOAA spokesperson.

FishAmerica's \$50,000 contribution was generated through ASA membership and three sportfishing businesses. Berkley, one of the world's leading producers of sportfishing gear, teamed up with Turner's Outdoorsman hunting and fishing specialty stores and the Santa Ana River Lakes recreational fishing facility to cooperatively fund several of the California projects.

[For more information, visit NOAA's National Marine Fisheries Service website: <http://www.noaa.gov/public-affairs/pr98/oct98/noaa98-r72.html>.]

## The Casco Bay, Maine, Air Toxics Deposition Monitoring Program



Along with surface runoff, atmospheric deposition is a significant source of pollutants in Maine's Casco Bay. The Maine Department of Environmental Protection, EPA Region I, and research scientists at the University of Massachusetts-Lowell have embarked on a study assessing the influence of the atmospheric deposition of toxic pollutants and nutrients on water quality in the bay. Casco Bay was designated an estuary of national significance by the National Estuary Program in 1987. (See *News-Notes* #51 for an article on atmospheric deposition in Tampa Bay.)

The Casco Bay Air Toxics Deposition Study is characterizing seasonal and annual deposition patterns of airborne toxics to the bay and developing a tool to assess the importance of atmospheric pollution to coastal ecosystems. Researchers are looking at four priority contaminant groups: mercury, toxic trace elements (cadmium, in particular), PAHs and nitrogen.

Although extensive studies have been conducted in some aquatic ecosystems — the Great Lakes, Lake Champlain, and Chesapeake Bay — no generic methodologies to assess coastal atmospheric pollutant loadings have been established.

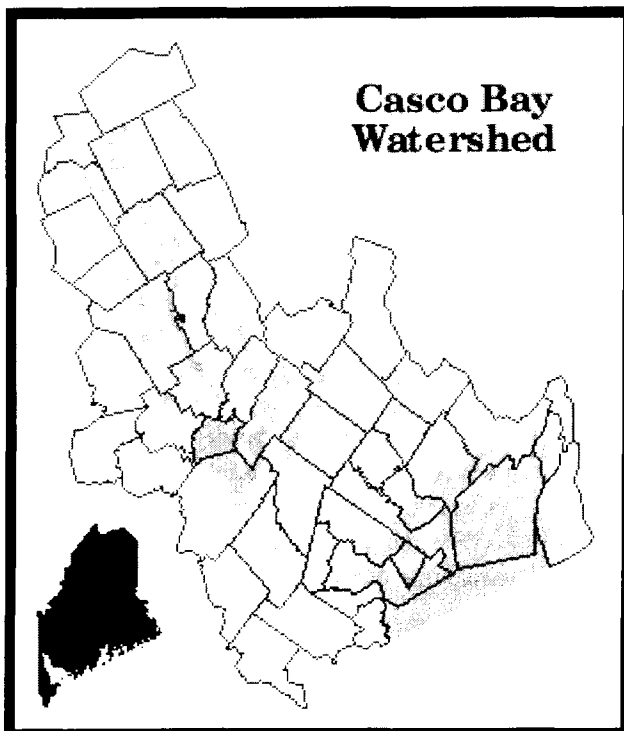
In addition to the air deposition information that is gathered at existing monitoring stations throughout the New England region, four types of air samplers have been located adjacent to Casco Bay at Wolfe's Neck in Freeport about 13 miles northeast (downwind) from Portland and 10 miles south of Brunswick. The monitoring instruments include a PAH collector. Sample collectors that are part of other established air monitoring networks belong to the National Atmospheric Deposition Program (NADP), the Mercury Deposition Network (MDN), and the Interagency Monitoring of Protected Visual Environments (IMPROVE). The combination of air deposition parameters being measured at this site is unique and will give a more complete picture of the complex of pollutants deposited in the bay.

The IMPROVE collectors provide atmospheric particulate samples of small particles (2.5 microns diameter), referred to as PM 2.5, that are deposited as dry material. The specific parameters analyzed from the samples collected are sodium, magnesium, iron, lead, hydrogen, sulfate, nitrate, chloride, and carbon. Although the specific sources of these air pollutants in the Casco Bay area have not been identified, the general sources of dust, smoke, and soot particles include burning of wood, diesel and other fuels, industrial plants, agricultural activities such as plowing and burning of fields, and unpaved roads. Respiratory system irritation and damage are the primary health effects from these airborne pollutants, which also cause atmospheric haze and property damage such as discoloration and dirt to structures, clothing, and furniture.

The NADP and MDN instruments collect samples during precipitation events (i.e., wet deposition). The compounds analyzed from NADP collectors include calcium, magnesium, sodium, potassium, ammonium, chloride, nitrate, and sulfate. The concern with these elements is the role they play in forming acidic precipitation.

The MDN collectors measure the total mercury that is deposited at the site. The human and ecological health effects of this neurotoxin have been well documented. Fossil fuel combustion is the main contributor of mercury to the atmosphere.

A modified version of the PAH collectors is being used at Casco Bay. Refinements made by the University of Massachusetts enable the collectors to gather both wet and dry forms of atmospheric deposition. Researchers are hopeful that the current PAH collector will help them more accurately define the airshed and its



characteristics. PAHs are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances. Several PAHs are known carcinogens and can be harmful to marine life.

Data results from this fast-track project (initial funding was received in fall of 1997 and equipment was in place and running by January 1998) are preliminary. So far, mercury leaks at the Casco Bay site appear to be higher than other monitoring sites in Maine, but no statistical evidence confirms the results as yet.

[For more information, contact Cathy Richardson, Maine Department of Environmental Protection, Bureau of Air Quality, 312 Canco Road, Portland, ME, 04105. Phone: (207) 822-6312, fax: (207) 822-6303.]

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## Coastal Agriculture News

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### Dairy Farm Receives Multiple Awards



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Kevin and Cathy Barrett are the owners of Heavenly View Farm in Bradford County, Pennsylvania. Set among the rolling hills of the Endless Mountains, a short growing season, clay soils, and steep slopes all make it difficult to farm in this area. However, Barrett, a third-generation farmer, has not only successfully farmed his 600 acres for more than 20 years, he has also managed to improve water quality and preserve soil and water resources at the same time. This year, the Barretts were awarded a Chesapeake Bay Clean Water Farm Award by the Pennsylvania departments of environmental protection and agriculture as well as a conservation district award as Outstanding Co-operator by The Goodyear Tire & Rubber Company. The farm is often used as a demonstration site for other Chesapeake Bay Program activities.

The Goodyear Tire & Rubber Company seeks to be a socially aware and responsive global citizen wherever it operates or does business. To help meet that objective, Goodyear provides financial assistance to the National Association of Conservation Districts as a way of complementing the Goodyear farm tire program. Each year, three levels of awards are presented to soil conservation districts. Grand Awards are given to individual districts within states (or groups of states). Co-operator Awards, like the one the Barretts received, are presented to individuals, companies, or groups participating in a winning district project who have implemented outstanding conservation practices on their land.

The Pennsylvania departments of environmental protection and agriculture also honor farms in the Chesapeake Bay watershed each year who have excelled in water quality protection with Pennsylvania Chesapeake Bay Clean Water Farm Awards. The awards highlight positive practices that farmers are using in their watershed to help protect water quality while at the same time spreading the word to other farmers. Farmers must meet criteria regarding soil testing, manure testing, nutrient and pesticide management, and conservation. The Barretts are one of four farm owners who won the award this year. The other winners represented Blair, Clearfield, and Lancaster counties.

The Barrett farm's primary cash crop is milk produced from 80 dairy cows. Conservation of soil and water resources has a long, successful history on the Barrett farm. The Barrett family has adopted a multitude of BMPs to preserve soil and water resources and has worked tirelessly to promote these practices through various organizations.

In 1991, as a participant in the Chesapeake Bay Program, Barrett constructed an earthen waste storage pond with program assistance to improve water quality and enhance the farm's profitability. The manure from the waste storage pond is a natural fertilizer, saving Barrett money while producing exceptional crops. Manure is stored in the pond for 240 days to span risky times of the

milk house wastewater and silo leachate, are also prevented from entering surface water by being stored in the pond.

During the spring, Barrett empties his manure storage onto cornfields, plowing it under within 24 hours. Cornfields that do not receive manure may be side-dressed with nitrogen if soil tests deem it necessary. Manure is also applied to grass hayfields to increase growth during the summer after the first cutting is completed.

Barrett also follows a nutrient management plan developed by the Bradford County Conservation District and revised on a yearly basis by his Agway consultant. The nutrient management plan carefully balances annual soil test results, manure analysis, fertilizer rates, and crop requirements.

In addition to the waste storage pond, Barrett enlisted the aid of the NRCS to design a crop rotation sequence and install BMPs to minimize soil erosion. For example, cover crops using a rye seeding are planted in the fall on corn silage ground, reducing the amount of soil exposed to the harsh, northern tier winter.

Over the years, to protect cropland and pastureland, more than 2,000 feet of diversions have been installed. Where the cows had access to a diversion, it has been fenced, eliminating direct deposit of manure into the flowing diversion water. Diversion outlets have been stabilized where needed. Many fields have been strip-cropped, and some corn is usually left for wildlife.

After recent flooding severely eroded a stream bank adjacent to a field, Barrett worked with a local gas company that has a gas line running through the field to stabilize and repair the stream bank.

Barrett applies pesticides to his crops himself through a restricted-use pesticide license from the Commonwealth of Pennsylvania. He works with an Agway consultant to carefully select precise chemical rates for his crops, applying a variety of chemicals at different rates to accommodate different weed and insect invasions. This practice not only saves money, but reduces the risk of surface water contamination.

Barrett contributes time and expertise to a variety of organizations. He has recently been elected to the board of Agway, where he will assist in governing the northeast's largest cooperative. In addition, he has been involved for the last six years in Milk Marketing, the farm's milk cooperative.

Barrett's semi-retired parents act as backup management to the farm enterprise. His father's farm was one of the first in Bradford County to win the conservation district's Co-operator of the Year Award in 1959. Kevin Barrett is proud to carry on the tradition 37 years later.

*[For more information on Barrett's conservation practices, contact the National Association of Conservation Districts, Inc., (717) 236-1006. For more information on nutrient-management practices or water quality protection, visit the Pennsylvania DEP website at [www.dep.state.pa.us](http://www.dep.state.pa.us).]*

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## **Notes on Estuaries**

### *Citizen Involvement Hailed as Cornerstone of Tampa Bay Restoration*

The National Estuary Program was established in 1987 to identify, restore, and protect nationally significant estuaries of the United States. Unlike traditional regulatory approaches to environmental protection, the NEP targets a broad range of issues and encourages local communities to take responsibility for managing their own estuaries. The main objective of each NEP estuary is to create and implement a Comprehensive Conservation and Management Plan (CCMP) that addresses the whole range of environmental problems facing the estuary, as well as the economic and social values of the estuary community.

Tampa Bay, Florida's CCMP presents a vision for the future of Tampa Bay and invites all citizens to participate in its restoration. A cornerstone of the plan is its community outreach program that enlists and involves diverse interests as partners in the restoration and protection of the bay.

More than two million people live in the 2,200-square-mile Tampa Bay watershed, which includes all or part of three counties and three major seaports — St. Petersburg, Manatee, and Tampa. Tampa Bay is Florida's largest open-water estuary, covering nearly 400 square miles. Human activity in the watershed profoundly influences the health of the bay. It has been estimated that more than four billion gallons of oil, fertilizer, and other hazardous material enter the bay each year. The CCMP outlines the need to reduce such pollution from Tampa Bay's growing population, despite limited funding and competing social needs.

Studies by the Tampa Bay NEP estimate that stormwater runoff contributes about half of the bay's total nitrogen input and significant amounts of heavy metals and pesticides. Yet fewer than half of the citizens responding to the public opinion poll were able to identify stormwater runoff as a major source of bay pollution. Even fewer recognized their own contribution to stormwater pollution. Since population in the area is expected to increase by about 17 percent by the year 2010, the Tampa Bay NEP realized that public involvement in stormwater management issues was a key to successfully implementing of the CCMP for Tampa Bay.

A public opinion poll conducted in 1991 (the year the Tampa Bay National Estuary Program was established) confirmed the need for public input in developing the CCMP, along with a campaign to educate the community and foster stewardship. The findings became the springboard for the Community Advisory Committee (CAC) composed of citizens with diverse perspectives and backgrounds. Members of the CAC were appointed by the Tampa Bay NEP's Policy Committee and include representatives of various industries and organizations — agriculture, business, education, fishing, and the environment — who also share their perspectives as taxpayers and community residents. The committee was charged with the task of educating area residents about the bay's priority problems, including stormwater runoff and seagrass protection.

To increase awareness and participation, the committee helped institute the following programs:

- **Florida Yards and Neighborhoods Program**

The Tampa Bay NEP, Sarasota Bay NEP, and the Florida Cooperative Extension Service worked together to establish a program to teach residents ways to reduce runoff pollution and enhance their environment by improving home and landscape management. The program promotes home landscaping that emphasizes native and other beneficial plants and relies on the least-toxic techniques for controlling pests. The successful pilot project has now been expanded by the Cooperative Extension Service to 18 counties throughout Florida.

- **Boater's Guide to Tampa Bay**

To promote protection of seagrasses and other vital bay habitats, the Tampa Bay NEP and the Florida Department of Environmental Protection published the "Boater's Guide to Tampa Bay" in 1992. It includes a color map of the bay that identifies ship channels, seagrasses, aquatic preserves, reefs, and public boat ramps. More than 100,000 copies of the guide have been distributed.

- **Finding Volunteers for Bay Improvement**

Through funding provided to Tampa BayWatch, a nonprofit stewardship group, the Tampa Bay NEP established the Bay Conservation Corps, which recruits volunteers for bay protection and restoration activities. More than 3,000 citizens have participated in the corps, helping to improve the bay through salt marsh plantings, bird island cleanups, and a high school wetland nursery program where students cultivate plants used in restoration projects.

- **Bay Grants Program**

The Bay Grants program has been instrumental in developing community partnerships for bay restoration. The NEP has awarded more than \$50,000 in small grants to more than a dozen organizations, schools, and community groups for projects to educate and involve citizens in bay improvement projects. Projects have included educational programs at the Florida Aquarium, development of pollution prevention plans to reduce stormwater

runoff, eco-landscaping for businesses, mangrove restoration and seagrass protection projects, and production of a how-to restoration video by high school students.

- **Outreach to Schools**

Through partnerships with local school districts and the Florida Aquarium, the Tampa Bay NEP has sponsored field trips and workshops for several thousand area students. In cooperation with the *Tampa Tribune's* Newspaper-In-Education Program, the Tampa Bay NEP also produced a 6-unit teaching curriculum called "Exploring Tampa Bay."

The Tampa Bay NEP has linked diverse sectors of the community as partners to protect and restore the bay and its resources. In May 1998, EPA awarded the Tampa Bay NEP a Bronze Medal for its management plan, *Charting the Course*. According to EPA, successful community-based environmental programs played an integral role in the selection of Tampa Bay NEP for the award. Tampa Bay's CCMP has set a national example of how to generate broad community support to protect and restore natural resources.

[For more information, contact Nanette Holland, Public Outreach Coordinator, Tampa Bay National Estuary Program, 111 Seventh Avenue South, St. Petersburg, FL 33701. Phone: (813) 893-2765; fax: (813) 893-2767.]

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## Puget Sound's Shellfish Beds Make a Comeback



On June 23, two Puget Sound area shellfish beds were reopened to harvesters. The beds were closed to harvesting for years, after monitoring showed contamination from failing on-site sewage systems and farm animal waste. The openings are the result of a community-based, watershed-wide effort to clean up the Sound.

The widespread distribution of toxic contaminants, bacteria, and nutrients throughout Puget Sound is well documented. The *1998 Puget Sound Update*, prepared by the Puget Sound Water Quality Action Team, reports that contamination is heaviest and its effects are most severe in waters near urban areas in Puget Sound. The good news is that due to the efforts of concerned residents, water quality in the Sound continues to improve.

For example, Eld Inlet had been closed to shellfish harvesting for four years, but, this summer, 450 acres were upgraded from conditionally approved to fully approved. "Conditionally approved" waters can be harvested only from June through September, when rainfall, and thus pollution, are lowest. "Fully approved" allows harvesting at any time of the year.

To reach this milestone, residents of the Eld Inlet watershed have repaired their septic systems and implemented BMPs on their farms, with help from county government agencies. In addition, the county surveyed almost every mile of shoreline in Eld Inlet to identify failing on-site sewage systems and then worked with property owners to repair their systems. The survey revealed a 16.5 percent failure rate. Thurston Conservation District pitched in by helping farmers develop small-farm plans and methods to keep livestock out of streams.

Washington's Department of Health monitors water quality in Eld Inlet from 28 sampling locations six times a year. State officials hope that a new early-warning system will help local governments in their efforts to manage pollution sources.

Also in June, 585 acres of shellfish beds in the Samish Bay and 2,800 acres of shellfish beds in Sequim Bay were upgraded to fully approved. Beds in the Samish Bay were upgraded from prohibited/restricted to approved/conditional, while those in the Sequim Bay were upgraded from conditionally approved to fully approved. In the Samish Bay, the upgrade means that shellfish can be harvested and marketed directly from the bay, rather than being relayed to approved waters for purification which is required for shellfish harvested from a restricted area. In the Sequim Bay, the upgrade means that there are no restrictions on harvesting.

Residents in Blanchard and Edison along Samish Bay repaired dozens of failing on-site sewage systems and installed a community sewage disposal system, significantly reducing bacterial

pollution in the bay. Improvements on agricultural lands and septic repairs contributed to the upgrade. County agencies and the local conservation district, along with the health and ecology departments, helped with funding and technical assistance. However, says Duane Fagergren, deputy director of the Puget Sound Water Quality Action Team, "the credit for this upgrade really goes to the residents of Blanchard and Edison and other members of the community, who committed themselves to solving this problem." In the Sequim Bay watershed, shellfish bed reopenings are attributable to major improvements in the secondary sewage treatment plant in the city of Sequim.

In the last 17 years, more than 46 thousand acres of shellfish beds in the Puget Sound area have been restricted to shellfish harvesters. Of that total, 12,820 acres (28 percent) have been upgraded as a direct result of water quality protection measures implemented throughout the watershed. Nearly 6,000 acres have been upgraded in the last two years. Despite these upgrades, nearly 2,000 acres of shellfish-growing waters remain off-limits to harvest.

Despite the many acres of shellfish beds in the Puget Sound that have been upgraded since the first bed was downgraded in 1981, residents in the Sound's watershed won't rest until all the shellfish beds in the Puget Sound are reopened. Local conservation districts and other state and local agencies are continuing to work with area citizens to foster watershed stewardship.

[For more information, contact Don Melvin, Washington State Department of Health, Shellfish Programs, 7171 Cleanwater Lane, Building 4, P.O. Box 47824, Olympia, WA 98504-7824. Phone: (360) 236-3320; fax: (360) 236-2257.]

### One Farm's Success Story

Robert and Judy Garrigues own five acres in the Eld Inlet watershed. When they bought Sojourn Farm in 1989, they planned to board horses. However, the fields soon became overgrazed and overrun with weeds, leading to high rates of erosion and runoff of horse manure. When they traded in their horses for llamas in 1992, they decided to do things differently, and their land and water quality have been improving ever since.

Understanding that llamas require clean feeding areas to prevent the spread of parasites, the Garrigues implemented better pasture and manure maintenance practices. Llamas also require very high-nutrient feed, which led the Garrigues to try a rotational fencing program to keep the pasture grazed evenly and restrict the amount of pesticides and fertilizer they used. Likewise, their growing awareness of poisonous plants sent them to the fields to begin a hands-on war on invasive weeds instead of using chemical herbicides. The result has been beautiful, clean, water-friendly pastures. Garrigues also received help from the Thurston County Conservation District to improve the quality of their fields and increase wildlife habitat.

Even though it has been only a few short years, the Garrigues are already getting compliments on their land and water stewardship. They often talk to their friends and neighbors about why they mow the fields instead of using chemicals. They also share what they have done with other llama owners.

Marilyn Mead, of the Thurston County Conservation District, says, "Sojourn Farm itself is the best educational tool that the Garrigues have to promote responsible resource management. A visit to their farm with their warm hospitality, lush pastures, and gentle llamas leaves one with the desire to emulate their land stewardship practices. They make it look easy to do the right thing."

[For more information, contact Marilyn Mead, Thurston County Conservation District, 6128 Capital Boulevard, Olympia, WA 98501-5217. Phone (360) 943-6738, e-mail: meadm@aol.com.]

## Tech Notes

### Pinning Down Sources of Coliform Bacteria



Adapted from *Coastlines*, Spring 1998.

Waterways plagued by elevated levels of fecal coliform bacteria from nonpoint sources continue to be one of the major issues faced by water quality managers. Tracking down and verifying nonpoint sources sometimes seems an impossible task, but recently, researchers on opposite sides of the continent teamed up to focus modern-day molecular biology on a site-specific fecal coliform problem. The technique they used, DNA fingerprinting, is based on the fact that some E.coli

strains are specific to certain animal species. Their results offer considerable promise for those seeking to find the source of fecal coliform in coastal waters.

During the fall of 1997, a partnership including the San Diego County Department of Environmental Health, the city of San Diego, and George M. Simmons, Jr. of the Biology at Virginia Tech in Blacksburg, Virginia, initiated studies to investigate potential sources of fecal coliform contamination at a beach at Children's Pool in San Diego, California. Work on the project was funded by the city of San Diego and the San Diego County Department of Environmental Health.

The Department of Environmental Health believed the source of contamination to be harbor seals that frequent the beach after feeding offshore. The seals like to sun themselves on the horseshoe-shaped cove that is protected from the waves by a breakwater. Staff from the department collected water samples from offshore monitoring sites, as well as seal scat. Ten colonies of the fecal coliform bacterium, *Escherichia coli* (*E. coli*), were isolated from 10 water samples and 18 seal scat samples. These samples were sent to Virginia Tech to determine how many of the *E. coli* from the water samples could be matched with the *E. coli* in the seal scat using modern molecular biology techniques.

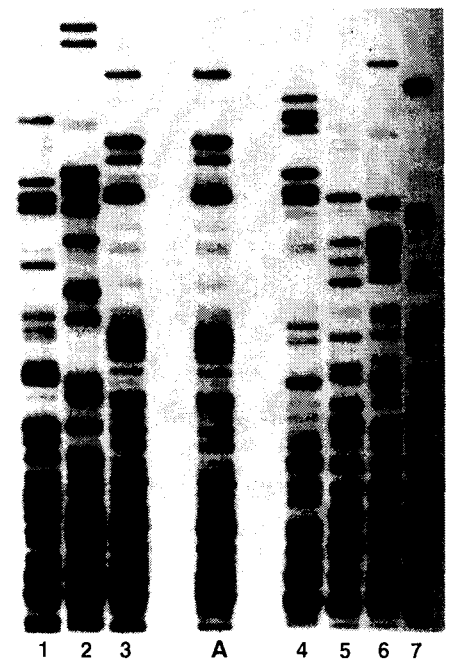
DNA fingerprints for each sample were compared. First, scientists compared the *E. coli* strains from the water with those from the seal scat. Then they compared the *E. coli* strains from the water with those in the Virginia Tech's DNA fingerprint library, which has fingerprints from many different animals, including humans, from the southern Chesapeake Bay area.

### The Matching Process

In most comparisons in this type of research, a 100 percent match is rare. Of those 83 water samples that were usable, 72 matched seal fingerprints with 80 percent similarity or better. Three samples were identified as only "possibly" of seal origin. Seven other fingerprints could not be matched with anything in Virginia Tech's DNA fingerprint library, but the one remaining sample showed an 80 percent similarity with a raccoon fingerprint. While raccoons are transcontinental in their distribution, researchers point out that little is known about the similarity of *E. coli* strains in animals of the same species on different sides of the continent.

Researchers found some very close matches with *E. coli* fingerprints from several other animals' fingerprints in the library. For example, in addition to matching with a seal fingerprint from the library with 84 percent similarity, one water sample matched a beaver's *E. coli* fingerprint with 90 percent similarity and a merganser's *E. coli* fingerprint with 82 percent similarity. Knowing the waters that were sampled, researchers suspected a seal source first and a waterfowl source second, unless beaver were known to exist in the area.

One water sample matched an *E. coli* fingerprint from a mallard duck with 93 percent similarity and a seal fingerprint with 88 percent similarity. One would have to conclude that if the source was not from seals, then there would be a high probability that the source was from waterfowl, such as ducks. There was even one sample that shared similarities with human (87 percent), beaver (84 percent), merganser (82 percent), and seal (77 percent) *E. coli*. This *E. coli* sample is probably a "garden-variety-type" that may have similarities to *E. coli* found in many animals and would not provide very much information about a potential source.



DNA Fingerprint Matching. In this example, sample #3 matches exactly with the original sample A.



Simmons notes that Virginia Tech's DNA library is based on approximately 300 distinct DNA fingerprints from known animal sources. Compared to the total number of possible *E. coli* strains in nature, the library is quite small. Virginia Tech researchers have yet to add strains from domestic animals and still need an extensive number of samples from seabirds, making it difficult to list other potential sources for the fecal coliform in Children's Pool.

Overall, 87 percent of all the water samples that could be fingerprinted showed an 80 percent similarity or greater with that of a seal. The DNA research enabled the San Diego Park and Recreation Department to evaluate a range of solutions to the pollution problem caused by seals. The city has proposed the removal of 3,000 cubic feet of sand, returning the beach to its 1940 size in the hopes that fewer seals will use the beach to sun themselves, thereby reducing the fecal coliform count to safe levels for human contact with the water. The cost of the project is expected to be approximately \$40,000. The city hopes to complete the beach narrowing project by Memorial Day 1999. (See *News-Notes* #48 for an earlier article on DNA fingerprinting.)

While further research on *E. coli* strain fidelity over large geographic scales is still needed, the data continue to suggest that this kind of molecular approach can be helpful in identifying nonpoint fecal coliform sources in specific cases.

[For additional information, contact George Simmons, Biology Department, Virginia Tech, 2088 Derring Hall, Blacksburg, VA 24061-0406. Phone: (540) 231-6407; fax: (540) 231-9307; e-mail [gesimmon@vt.edu](mailto:gesimmon@vt.edu). Or contact Chris Gonaver, County of San Diego, Department of Environmental Health, P.O. Box 129261, San Diego, CA 92112-9261. Phone: (619) 338-2201; fax: (619) 338-2174; e-mail: [cgonaveh@co.sandiego.ca.us](mailto:cgonaveh@co.sandiego.ca.us). For more information on the beach narrowing project, contact Mike Morrow, City of San Diego, 2581 Quivira Court, San Diego, CA 92109. Phone: (619) 221-8903; fax: (619) 221-8906; e-mail: [mem@sdcity.sannet.gov](mailto:mem@sdcity.sannet.gov).]

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## Uncommon Blooms: The Nitrogen Factor



By Merrill Leffler

Reprinted from *Maryland Marine Notes*, May-June 1998, Vol. 16, No. 3

For almost three weeks this past May, the surface of the Choptank River ran visibly red for about 10 miles from Cambridge, Maryland, downstream to its mouth. "It was the largest bloom in anyone's memory," says Pat Glibert, a professor at the University of Maryland Center for Environmental Science Horn Point Laboratory. And even more surprising, it consisted of a single species of dinoflagellate, *Prorocentrum minimum*.

"*Prorocentrum* typically blooms at this time of year," says Glibert, "but it's usually isolated in coves here and there. We just haven't seen anything of this magnitude in the river." In the mainstem of the Bay, on the other hand, blooms covering as much as 30 miles have been observed over the years.

The Choptank was not the only host river. A second *Prorocentrum* bloom was noted in early July in several eastern shore tributaries. The same dinoflagellate showed up in the Tred Avon and Miles rivers in the region, and, possibly, says Glibert, in the Pocomoke. The bloom seems to have gotten underway when the sun finally emerged after several days of rain that probably introduced heavy loads of nutrients from the land, according to Glibert. But nitrogen and phosphorus loading, warming temperatures and sunlight — prime conditions for algae in general — don't account for *Prorocentrum* in particular, nor can it explain why there wasn't another species or a mixed group.

Large outbreaks of *Prorocentrum* are of some concern. While there are no reports of it being toxic to shellfish or humans in the Chesapeake Bay system, there have been such reports in other coastal waters. To ensure that it is not toxic, Glibert evaluated several water samples from the Choptank. She found that this particular strain of *Prorocentrum* is not directly toxic, but it does have negative effects on some aquatic organisms. "First, it is not a favorable food for shellfish larvae," says

Glibert, “and second, by reducing available light penetration, seagrass survival is threatened.” However, it is too early to estimate the impact of these effects on the larger ecosystem.

Whether or not this bloom serves as a warning signal for potential outbreaks of harmful algal blooms in the Bay is open to question, but “one of the situations we face in the United States,” says Donald Anderson, “is that we have more toxic algae, more toxic outbreaks, more areas affected, more economic costs, and more impacts on resources.” A scientist at the Woods Hole Oceanographic Institution, Anderson has been studying harmful algal blooms for years. Everything is growing better because of nutrient pollution running into our coastal waters, he says. “It is like fertilizing your lawn, but just as you get more grass, you also get more dandelions and more crab grass.”

But why more harmful algal blooms? Glibert, together with scientists Sybil Seitzinger at Rutgers and Deborah Bronk at the University of Georgia, has strong suspicions that explanations are to be found in the kind of nitrogen present in the water. By way of analogy, Glibert says, “when you use fertilizers in your garden, you use different formulations of phosphorus, nitrogen, and other compounds, depending on whether you’re growing grass, tomatoes, or roses. While we have a good understanding of how these combinations affect gardens,” she adds, “we have very limited knowledge about what we’re selecting for in coastal waters like the Chesapeake. That’s because there are different forms of nitrogen entering the Bay, and we don’t understand their dynamic relationships with algal species.”

### *Nitrogen in the Bay*

The issue is not an academic one — in the long run, understanding how different forms of nitrogen are related to the growth of particular algal species could be critical to successful restoration of the Bay’s degraded water quality and sustaining the production of fish and shellfish.

Nutrient control, after all, has been the keystone goal of the Chesapeake Bay Program since 1987. According to Bay researchers and their increasingly sophisticated computer modeling, a 40-percent reduction from 1985 levels is the minimum necessary to keep oxygen levels in large stretches of the Bay from bottoming out at or near zero, to bring back underwater grasses, and to revive benthic habitats in the deeper waters.

While there has been measurable success in reducing the loading of total nitrogen and phosphorus compounds from point sources to the Bay over this last decade, there has been less success in stemming flow from diffuse sources such as agricultural and urban runoff. Glibert and her colleagues Seitzinger and Bronk have been speculating that the form of nitrogen in that runoff could have important consequences. Different compounds of nitrogen — along with other available nutrients, temperature, salinity, light, oxygen concentrations and compounds such as metals — can determine which species of algae will grow.

A dominant nitrogen compound in fertilizer and stormwater runoff and in treated sewage discharges is nitrate, an inorganic form. “We know that algae readily take up nitrate,” says Glibert. “We can measure it easily, and we have a good deal of understanding about the dynamics.”

Seitzinger estimates that stormwater runoff may be composed of 30 to 60 percent organic nitrogen. For sewage treatment plants, the numbers range from 15 to 60 percent. In confined animal areas, organic nitrogen could comprise 60 to 90 percent of total nitrogen, and rain falling from the sky may have 30 to 70 percent of nitrogen in an organic form.

### *Algae and Nitrogen*

Unlike their uptake of inorganic nitrate, many algae do not take up organic nitrogen directly — it first has to be recycled into inorganic forms by bacteria and other microbes. But according to Glibert, there are algae that do take up organic nitrogen compounds directly. If inorganic nitrogen, such as nitrate, is all used up in a particular part of the Bay, then those algal species that are better at taking up organic nitrogen (such as urea) could directly outcompete algal species that have to wait for microbial cycling to supply nitrogen in inorganic forms.

In a study of golden-brown algae (the chrysophyte *Aureococcus anophagefferens* which has caused massive brown discolorations in coastal waters in the northeastern United States), Glibert found that it had a higher affinity for organic nitrogen than inorganic nitrogen. This algal species was able to absorb organic nitrogen through biochemical processes on the surface of its cell, which implies that it could outcompete algal species which lack that capability, as well as bacteria.

While organic nitrogen in the form of urea can run off the land directly, it — like inorganic nitrogen — is also the product of microbial recycling. How much urea, for instance, is coming off the land and how much is being recycled? That is an important question, says Robert Magnien of the Maryland Department of Natural Resources. Before answering it, he says, we have to find out how much organic nitrogen is in the ecosystem, what percentage algae use, and how this form of nitrogen influences the development of different kinds of algal species.

“Once you measure the dissolved organic nitrogen, can you ask where it comes from? That’s a complex question,” Magnien says, “a tough one.” If organic forms such as urea are found to be important in controlling the dynamics of algal or bacterial communities, then identifying specific sources becomes very important. “If there’s some direct runoff stimulating harmful algae, that might point us to a more refined management approach than just trying to reduce total nitrogen. We might be more concerned,” Magnien says, “with a particular fraction of the nutrients.”

In the Bay, Glibert and others suggest, that resource managers will need to understand more completely the different effects of organic and inorganic nitrogen — and to trace and control their sources accordingly. Only then will they be able to control inputs of nutrients to hold down unwanted algal blooms.

*[For more information, contact Pat Glibert, University of Maryland Center for Environmental Science Horn Point Laboratory, 2020 Horns Point Road, P.O. Box 775, Cambridge, MD 21613. Phone: (410) 221-8422 or 8458; fax: (410) 221-8490.]*

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## Notes on Education

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### Educational Resources Column

#### Software

##### Hi-Tech Software Spotlights Watershed Efforts

The Aurora Project is on the frontier of rapidly developing advanced digital multimedia technologies. Produced by Mountain Visions for the Bureau of Land Management, this CD-ROM and website both offer a virtual exploration of community watershed partnerships in the western United States.

The Aurora Project shows users a variety of riparian environments where work to restore damaged watersheds has been rewarded by significant improvement in watershed health and productivity. At Community Watershed Partnership website, you’ll be able to navigate virtual panoramas of the watershed. The “In-depth Info” area has papers and further information related to the restoration and management of riparian areas and watershed. Users can travel through desert canyons, coastal mountains, or redwood forests. They can select their route, the flora and fauna they want to see, the birds they want to hear, and the depth of the experience and information they desire.

The interactive CD-ROM also includes movies, slide shows, and sound files that are not available on the Internet version.

To order a copy, e-mail Mountain Visions at [mv@mtnvisions.com](mailto:mv@mtnvisions.com). The Aurora Project is also viewable in an interactive computer kiosk at the Idaho Department of Fish and Game MK Nature Center, 600 S. Walnut St., Boise, ID. Phone: (208) 334-2225.

*Publications*

**Water Pollution**

This 20-page layperson's guide to water pollution discusses NPS water pollution and its effects on California's surface water and groundwater supplies. Included in the guide is an explanation of the different forms of pollution, the most prevalent causes of nonpoint pollution, the costs and consequences of such pollution, and ongoing efforts to solve these problems through approaches such as watershed management. Also included are eight regional case studies from San Francisco Bay to Santa Monica Bay and a glossary of terms. The guide was produced by the Water Education Foundation, a nonprofit organization that develops and implements education programs leading to a broader understanding of water issues and to resolution of water problems.

The guide costs \$5 and can be ordered from the Water Education Foundation, 717 K Street, Suite 517, Sacramento, California 95814. Phone: (916) 444-6240, fax: (916) 448-7699.

*Websites*

**Indian River Lagoon**

Indian River Lagoon's new website takes visitors on a virtual tour of the lagoon, explaining how the lagoon works, its history, and the plants and animals that make the lagoon their home. Based on a CD-ROM produced by the Indian River Lagoon NEP called Living Lagoon, this new website presents many photos and graphics that makes visitors feel as though they are actually at the lagoon. It also includes discussion of human impacts on the lagoon, and how the NEP is working to address those impacts. The site can be found at [www.epa.gov/OWOW/oceans/lagoon](http://www.epa.gov/OWOW/oceans/lagoon).

*Curricula and Educational Materials*

**Environmental Concerns**

A board game geared towards players ages 8 and up, "Environmental Concerns" makes polluters pay stiff fines for dumping hazardous waste into rivers. Miniature recyclable soda bottles move around a busy gameboard where players earn incentives by buying squashed aluminum cans and garbage dumpsters. The best environmental strategy wins. Canals, parks, rain forests, and recycling centers dot the landscape instead of banks, jails, and housing projects. There are many directions to travel on the gameboard and many ways to win each game by helping to clean up the environment, but by learning to preserve the environment, everyone wins.

To order, send \$14.95 plus \$4.95 shipping and handling to Environmental Game, RR 3, Box 3016, Harveys Lake, PA 18618. For more information, call (717) 639-3253; fax: (717) 639-2126, e-mail: [harveylake@aol.com](mailto:harveylake@aol.com).

**WaterWays**

A water education curriculum developed by the St. Johns River Water Management District in Florida, "WaterWays" is a multi-disciplinary program that involves students in hands-on experiments that demonstrate the fundamental concepts of water use, management, and conservation. The program strengthens critical thinking and cooperative learning skills and offers solution-oriented activities that promote a balanced approach toward water education.

By attending a free workshop, teachers will explore the mysteries and wonders of Florida's vital water resources, learn practical tips and techniques for using the curriculum in the classroom, and receive hands-on practice with water resource experiments featured in the WaterWays student textbook. Teachers will also receive more than \$200 worth of materials, including a teacher's guide and 35 colorful student texts, and posters and classroom sets of many other supplementary resources, such as coloring books, brochures, and stickers.

For more information, contact Eileen Tramontana, SJRWMD Education Supervisor, at (904) 329-4572 or e-mail at [eileen\\_tramontana@district.sjrwmd.state.fl.us](mailto:eileen_tramontana@district.sjrwmd.state.fl.us).

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## National Estuaries Day

Coastal residents from the country's Atlantic and Pacific coasts celebrated the 10th annual National Estuaries Day on Saturday, October 3, 1998 at National Estuary Program (NEP) and National Estuarine Research Reserve (NERR) sites across the country. The theme of the event was "Estuaries — Gateways to the Ocean," highlighting the vital transitional areas between land and sea and tying in with the International Year of the Ocean. The campaign underlined the importance of America's estuaries and provided an opportunity to appreciate these coastal bays, sounds, and lagoons.

Narragansett Bay, Rhode Island, was the official hub of the national celebration, cosponsored by the Narragansett Bay NEP and NERR. Hundreds of people turned out at a local mall to visit educational exhibits hosted by environmental groups, state agencies, the NEP, and the NERR. The Navy Band, the University of Rhode Island Jazz Band, and the University of Rhode Island Wind Ensemble provided musical ambiance, and posters created by local school children enlivened the scene. Two local radio station broadcast live from the mall where listeners, including Senator John Chafee, called in to discuss issues facing the bay. The lively discussion included questions such as "Is it safe to eat the fish in the bay?" and "What will be the impacts of a proposed container port terminal at Quonset Point?" Attendees went home with National Estuaries Day posters, stickers, brochures, t-shirts, and, hopefully, an education on estuaries.

National Estuaries Day is held each year during Coast Weeks, an annual autumn celebration of the coasts sponsored by the Center for Marine Conservation. Coast Weeks includes the International Coastal Cleanup, held this year on September 19.

### *And Elsewhere...*

Other National Estuaries Day events included Alabama's Mobile Bay Estuary Gateway to the Gulf celebration that spanned several weeks and featured coastal cleanup, a native plant sale, an outdoor music festival, and an open house at Dauphin Island Sea Lab.

In California, residents discovered why estuaries are such vital habitats on a two-mile walk beginning in Tijuana Estuary's uplands and ending where the river meets the sea.

Delaware's annual "Coast Day" featured estuary-related organizations with displays and activities emphasizing the importance of the Delaware Estuary. Participants could choose from sea seminars, a crab cake cook-off, ship and lab tours, and a nautical flea market.

Florida's CMP, NERRs, and NEPs teamed up to host a series of educational field trips for state and Congressional leaders into each of the state's estuary systems. A one-day festival featured live birds of prey, native plant landscaping, guided nature walks, the CoastalArk mobile classroom, and Sapelo basket making.

In Louisiana, La Fête d'Ecologie focused on the Barataria-Terrebonne Estuary NEP and celebrated Cajun culture and natural resources.

Massachusetts drew attention to the Waquoit Bay NERR with a concert by the aptly chosen Blue Crab Blues Band. The event was billed as "a unique concert with zany lyrics and giant estuary creature costumes, guaranteed to make the family laugh, sing, and dance!"

Ducker's Day in New Hampshire centered on the Great Bay NERR and celebrated the history of waterfowling with retrieving dog demos, a scavenger hunt, field dressing, duck box building, and a duck calling contest.

Oregon celebrated National Estuaries Day with a paddling tour of South Slough Estuary's shoreline to clean up trash and debris.

Puerto Rico's Jabos Bay NERR was spotlighted with an open house featuring a conference and exhibitions on estuarine ecosystems.

A three-day coastal camp for South Carolina high school students and field trip to a barrier island gave youths an up-close and personal view of Ace Basins.

In Washington, kids and their families gathered for the 6th annual Puget Sounds Kids Day, with an emphasis on the Padilla Bay NERR. Participants enjoyed songs, food, and a visit from Octonoto the Octopus.

[For more information, contact EPA's Coastal Management Branch, 401 M St., SW, Washington, DC 20460. Phone: (202) 260-6502; website: [www.epa.gov/owow/estuaries/nep.html](http://www.epa.gov/owow/estuaries/nep.html).]

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## Reviews and Announcements

### *Sample Ordinances for Protecting Significant Coastal Habitats*

Produced by the Association of New Jersey Environmental Commissions (ANJEC) through the New Jersey Department of Environmental Protection's Coastal Grant program, this booklet focuses on protecting migratory bird habitat, but many of the same techniques can be used for other types of coastal resource protection. Significant coastal habitat can include woodlands, marshland, and even backyards.

Model ordinances dealing with the following topics are included:

- Impact of new development on the community
- Flexible zoning techniques
- Open space planning and promotion
- Preservation of sensitive areas
- Landscaping and vegetation
- Stream corridor protection and stormwater management
- Dune protection

[For a copy of the booklet, send \$5.50 (includes shipping and handling) to ANJEC, P.O. Box 157, Mendham, NJ 07945. Phone: (973) 539-7547; e-mail: [anjec@aol.com](mailto:anjec@aol.com).]

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### *Manual Promotes On-Farm BMPS*

*On-Farm Strategies to Protect Water Quality: An Assessment and Planning Tool for Best Management Practices in New Jersey* provides farmers with valuable information on how they can voluntarily prevent and control NPS pollution on their farms. The manual was produced by the New Jersey Department of Agriculture through the New Jersey Department of Environmental Protection's Coastal Grant Program. New Jersey Department of Agriculture Secretary Arthur R. Brown, Jr. says, "This guide has been developed to help those farmers who need additional conservation assistance." The manual presents NRCS-recommended BMPs.

[For a copy of the manual, contact the New Jersey Department of Agriculture at (609) 292-5540.]

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### *Coastal Ocean Program Grants Available for 1999*

NOAA's Coastal Ocean Program has announced that it will begin providing and administering financial aid in the form of grants and cooperative agreements for managing coastal ecosystems starting in 1999. The funding was previously provided to nonprofit organizations and educational institutions through joint participation in the National Sea Grant Program.

The program supports research on critical issues in the nation's estuaries, coastal waters, and Great Lakes and translates its findings into accessible information for coastal managers, planners, lawmakers, and the public. Historically, the program's projects are multi-disciplinary, large in scale,

and long in duration (usually three to five years). Solicitations for proposals will be issued on an as-needed basis beginning in fiscal year 1999.

[For more information, contact Leslie McDonald, COP Grants Office. Phone: (301) 713-3338 ext. 137; website: [www.cop.noaa.gov/grants/intro.htm](http://www.cop.noaa.gov/grants/intro.htm).]

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## Watershed Assistance Grants Available

EPA's Office of Wetlands, Oceans, and Watersheds recently awarded River Network \$300,000 to distribute grants to local watershed partnerships to support organizational development. River Network, a national organization based in Portland, Oregon, supports river and watershed advocates at the local, state, and regional levels to build effective partnerships and organizations.

The Watershed Assistance Grants program will distribute grants ranging from \$2,000 to \$30,000 in 1999 to support watershed partnerships working to protect and restore their watersheds. Grant applications will be available after December 1, 1998.

[To request an application, please write to River Network, Watershed Assistance Grants Program, PO Box 8787, Portland, OR 97207, or e-mail River Network at [info@rivernetwork.org](mailto:info@rivernetwork.org). For additional information on funding opportunities, visit River Network's website at [www.rivernetwork.org/nonprofi.htm](http://www.rivernetwork.org/nonprofi.htm).]

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## Interagency Stream Restoration Handbook Now Available

This long-awaited handbook is now available in its final form from the National Technical Information Service. The handbook, *Stream Corridor Restoration: Principles, Processes, and Practices*, was developed as part of an unprecedented cooperative effort by 17 federal agencies to document stream corridor restoration design, planning, and implementation. The handbook serves as a technical reference with expert advice and field-tested methods to help protect and improve the nation's stream corridors.

[Copies are available in paper form (\$71) or on CD-ROM (\$60). To obtain a copy, call the NTIS Sales Desk at (800) 553-NTIS (ext. 6847), or visit the NTIS website at [www.ntis.gov](http://www.ntis.gov).]

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## Phase II Stormwater Workshops

Working through a grant from the U.S. Environmental Protection Agency, the American Public Works Association (APWA) has developed a training program for communities that will need to come into compliance with the Phase II National Pollutant Discharge Elimination System regulations governing stormwater runoff. The official rule is scheduled to be issued by the EPA in March of 1999.

APWA has conducted several workshops in 1998 and will continue the series of one-day workshops around the country throughout 1999. These workshops offer a comprehensive explanation of the regulations, the requirements, the safeguards for each community, and the liabilities to which an agency could be exposed.

The workshops are designed to be a highly interactive resource for local government officials, administrators, and public works departments by providing the opportunity for practitioners to share their regional expertise and concerns.

[For more information, contact Cheryl McOsker, American Public Works Association, 2345 Grand Boulevard, Suite 500, Kansas City, MO 64108-2641. Phone: (816) 472-6100; fax: (816) 472-1610; e-mail: [cmcosker@apwa.net](mailto:cmcosker@apwa.net).]

### **Schedule\* of Workshops**

January 20, 1999 Worcester, Massachusetts

February 16, 1999 New York City, New York

March 2, 1999 Monterey, California

April 21, 1999 Novi, Michigan

April 22, 1999 Kansas City, Missouri

May 20, 1999 Corvallis, Oregon

\*Schedule is subject to change

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## Reflections

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### ...Water On My Face

Submerged in a deep  
But dazzling darkness,  
Water freezing my image,  
Freezing my soul.  
The force of a hurricane  
Summoning an endearing smile.  
The colors of the rainbow  
Painting rosy cheeks.  
Crystal raindrops  
Bringing sparkle to my eyes.  
As the invading rushing waters,  
Find their way into the tributaries,  
Into the rivers,  
Into the oceans,  
That are emptied into me.  
And I emerge,  
With water still on my face.

By Carrie Elizabeth Johnson, Grade 7  
Winner in the 1997 River of Words Contest  
North Iredell Middle School  
Harmony, North Carolina  
Teacher: Mrs. Elizabeth Campbell

*[For more information about the River of Words Poetry and Art Contest, sponsored by the International Rivers Network, contact International Rivers Network, 1847 Berkeley Way, Berkeley, CA 94103. Phone: (510) 848-1155; e-mail: row@irn.org .]*



# DATEBOOK

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## January 1999

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- 11-15 *Working at a Watershed Level*, Chico, CA. Contact Dr. Donald Holtgrieve at (530) 898-5780; fax: (530) 898-6781; e-mail: holtgrieve@facultypos.csuchico.edu.
- 24-27 *Tailings and Mine Waste 99*, Ft. Collins, CO. Contact Linda L. Hinshaw at (970) 491-6081; fax: (970) 491-3584; e-mail: lhinshaw@engr.colostate.edu.
- 27-30 *WEF/AWWA Residuals and Biosolids Management Conference*, Charlotte, NC. For more information, call (800) 666-0206 or (703) 684-2492, fax: (800) 444-2492; or e-mail: confinfo@wef.org. Visit [www.wef.org/docs/conferences.1999.html](http://www.wef.org/docs/conferences.1999.html) to see the conference program outline.

## February 1999

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- 4-5 *Source Water Protection: Effective Tools and Techniques You Can Use*, Jacksonville, FL. For more information contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's website at [www.awwa.org/tand/eduframe.htm](http://www.awwa.org/tand/eduframe.htm).
- 11-12 *Source Water Protection: Effective Tools and Techniques You Can Use*, Charlotte, NC. For more information contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's website at [www.awwa.org/tand/eduframe.htm](http://www.awwa.org/tand/eduframe.htm).
- 10-12 *The 1999 North Carolina Environmental Education Conference*, Research Triangle Park, NC. Conference sessions will focus on partnerships or cooperative efforts that demonstrate how North Carolina is actively involved in environmental stewardship. Contact Judy Pope, Office of Environmental Education, P.O. Box 27687, Raleigh, NC 27611-7687. Phone: (919) 733-0711.
- 15-17 Introductory and advanced hands-on workshops on SWMM, PCSWMM, WASP, and EPANET modeling for stormwater and urban water system impacts and analysis. Toronto, Ontario. Contact Lyn James at Computational Hydraulics, Int., 36 Stuart Street, Guelph, ON, Canada N1E 4S5. Phone: (519) 767-0197; fax: (519) 767-2770; e-mail: [info@chi.on.ca](mailto:info@chi.on.ca); web: [www.chi.on.ca](http://www.chi.on.ca).
- 18-19 *Source Water Protection: Effective Tools and Techniques You Can Use*, San Diego, CA. For more information contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's website at [www.awwa.org/tand/eduframe.htm](http://www.awwa.org/tand/eduframe.htm).
- 18-19 *Conference on Stormwater and Urban Water Systems Modeling*, Toronto, Ontario. Contact Lyn James at Computational Hydraulics, Int., 36 Stuart Street, Guelph, ON, Canada N1E 4S5. Phone: (519) 767-0197; fax: (519) 767-2770; e-mail: [info@chi.on.ca](mailto:info@chi.on.ca); web: [www.chi.on.ca](http://www.chi.on.ca).
- 18-20 *Third Annual American Wetlands Month Conference: Communities Working for Wetlands*, New Orleans, LA. The conferences will feature hands-on, interactive workshops where participants will learn how to solve their own wetland problems. Contact Terrene Institute, 4 Herbert St., Alexandria, VA 22305. Phone: (703) 548-5473; fax: (703) 548-6299, e-mail: [terconf@erols.com](mailto:terconf@erols.com).
- 22-26 *International Erosion Control Association's 30th Annual Conference and Trade Exposition*, Nashville, TN. For more information, visit IECA's website at [www.ieca.org](http://www.ieca.org); e-mail [ecinfo@ieca.org](mailto:ecinfo@ieca.org); or call (800) 455-4322.
- 25-26 *Source Water Protection: Effective Tools and Techniques You Can Use*, Austin, TX. For more information contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's website at [www.awwa.org/tand/eduframe.htm](http://www.awwa.org/tand/eduframe.htm).
- 28-March 3 *WEF/AWWA Joint Management Conference*, San Antonio, TX. For more information, call (800) 666-0206 or (703) 684-2492, or e-mail: [confinfo@wef.org](mailto:confinfo@wef.org). Visit [www.wef.org/docs/conferences.1999.html](http://www.wef.org/docs/conferences.1999.html) to see the conference program outline.

## March 1999

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- 4-5 *Source Water Protection: Effective Tools and Techniques You Can Use*, Kansas City, MO. For more information contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's website at [www.awwa.org/tand/eduframe.htm](http://www.awwa.org/tand/eduframe.htm).

- 11-12 *Source Water Protection: Effective Tools and Techniques You Can Use*, Indianapolis, IN. For more information contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's website at [www.awwa.org/tande/eduframe.htm](http://www.awwa.org/tande/eduframe.htm).
- 18-19 *Source Water Protection: Effective Tools and Techniques You Can Use*, Farmington, CT. For more information contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's website at [www.awwa.org/tande/eduframe.htm](http://www.awwa.org/tande/eduframe.htm).
- 25-26 *Source Water Protection: Effective Tools and Techniques You Can Use*, Denver, CO. For more information contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's website at [www.awwa.org/tande/eduframe.htm](http://www.awwa.org/tande/eduframe.htm).

## **April 1999**

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- 8-9 *Source Water Protection: Effective Tools and Techniques You Can Use*, Milwaukee, WI. For more information contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's website at [www.awwa.org/tande/eduframe.htm](http://www.awwa.org/tande/eduframe.htm).
- 15-16 *Source Water Protection: Effective Tools and Techniques You Can Use*, Seattle, WA. For more information contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's website at [www.awwa.org/tande/eduframe.htm](http://www.awwa.org/tande/eduframe.htm).
- 14-17 *Third Annual American Wetlands Month Conference: Communities Working for Wetlands*, San Francisco, CA. The conferences will feature hands-on, interactive workshops where participants will learn how to solve their own wetland problems. Contact Terrene Institute, 4 Herbert St., Alexandria, VA 22305. Phone: (703) 548-5473; fax: (703) 548-6299, e-mail: [terrconf@erols.com](mailto:terrconf@erols.com).
- 19-21 *Program Review Meeting: Water and Watersheds*, Silver Spring, MD. Scientists funded by the joint EPA/NSF/USDA program in Water and Watersheds will present results from their recent research. For more information, go to [www.epa.gov/ncercqa/ncqcalen.html](http://www.epa.gov/ncercqa/ncqcalen.html).

## **May 1999**

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- 3-4 *EPA/WEF Analysis of Pollutants Conference*, Norfolk, VA. For more information, contact Cindy Simbanin at (202) 260-7117; fax: (202) 260-7185; e-mail: [simbanin.cynthia@epa.gov](mailto:simbanin.cynthia@epa.gov).
- 6-8 *Third Annual American Wetlands Month Conference: Communities Working for Wetlands*, Boston, MA. The conferences will feature hands-on, interactive workshops where participants will learn how to solve their own wetland problems. Contact Terrene Institute, 4 Herbert St., Alexandria, VA 22305. Phone: (703) 548-5473; fax: (703) 548-6299, e-mail: [terrconf@erols.com](mailto:terrconf@erols.com).
- 23-28 *10th International Soil Conservation Organization Conference (ISCO)*, West Lafayette, IN. *Sustaining the Global Farm: Local Action for Land Stewardship*. Contact ISCO99, Purdue University, 1196 Soil Building, West Lafayette, Indiana 47907-1196. Phone: (765) 494-8683; fax: (765) 494-5948; e-mail: [isco99@ecn.purdue.edu](mailto:isco99@ecn.purdue.edu); web: <http://spc3.ecn.purdue.edu/isco99/index.htm>.
- 16-19 *Sixth National Watershed Conference*, Austin, TX. Contact John Peterson, Executive Director, National Watershed Coalition, 9304 Lundy Court, Burke, VA 22015-3431; phone: (703) 455-6886; fax: (703) 455-6888; e-mail: [jwpeterson@erols.com](mailto:jwpeterson@erols.com).

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*Nonpoint Source News-Notes* is an occasional bulletin dealing with the condition of the water-related environment, the control of nonpoint sources of water pollution, and the ecosystem-driven management and restoration of watersheds. NPS pollution comes from many sources and is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural pollutants and pollutants resulting from human activity, finally depositing them into lakes, rivers, wetlands, coastal waters, and ground water. NPS pollution is associated with land management practices involving agriculture, silviculture, mining, and urban runoff. Hydrologic modification is a form of NPS pollution that often adversely affects the biological integrity of surface waters.

Editorial contributions from our readers sharing knowledge, experiences, and/or opinions are invited and welcomed. (Use the coupon on page 31.) However, *News-Notes* cannot assume any responsibility for publication or nonpublication of unsolicited material or for statements and opinions expressed by contributors. All material in *News-Notes* has been prepared by the staff unless otherwise attributed. For inquiries on editorial matters, call (202) 260-3665 or (703) 548-5473 or fax (202) 260-1517.

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