

Gulf of Maine Times

Promoting Cooperation to Maintain and Enhance Environmental Quality in the Gulf of Maine

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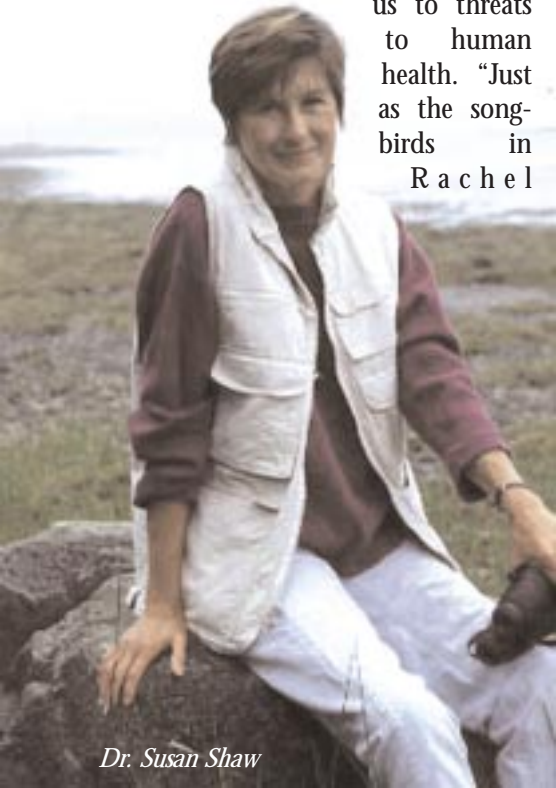
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Seals as the Gulf of Maine's sentinels

By Lee Bumsted

Susan Shaw, the energetic executive director of the Marine Environmental Research Institute (MERI) in Blue Hill, Maine, believes that seals in the Gulf of

Maine can alert us to threats to human health. "Just as the songbirds in Rachel



Dr. Susan Shaw

A good thing gone awry:

The environmental disruption caused by an overload of nitrogen is emerging as a new concern for the Gulf of Maine

By Andi Rierden, Editor

As a fertilizer for lawns, gardens or farm fields, nitrogen has long been thought of as mostly benign and beneficial. The element occurs naturally and is essential to plant growth, and thus to animal growth. A common chemical in living tissues, nitrogen is a component of amino acids, the building blocks of protein. As a manufactured fertilizer, the compound has made modern-day agriculture possible. It is so useful, in fact, that human beings have more than doubled the amount of nitrogen naturally available to the Earth's ecosystems over the past century.

And therein lies the rub. Behind nitrogen's amazing ability to stimulate growth dwells the reason for the havoc it can cause. Among the disturbing find-



Nitric oxides from smokestacks and other sources are a main contributor of excess nitrogen in the Gulf of Maine region. Source: National Renewable Energy Laboratory

ings, science has established that an excess of chemically "fixed" nitrogen is harming and altering ecosystems by making plants poorly equipped to cope with nitrogen-rich environments disappear.

World-wide, the major sources of excess nitrogen are many and varied, including industrial processes that produce nitrogen fertilizers, the burning of fossil fuels in automobiles and power plants, and the clearing of forests and draining of wetlands, which free nitrogen from long-term storage in soil and tree trunks. Run-off from farm fields, wastewater treatment plants, faulty septic systems and fish wastes from aquaculture operations also add to the nitrogen glut.

In marine and coastal systems, nitrogen is the main ingredient that kick-starts a sequence of ecological impacts called eutrophication. The condition occurs when a surfeit of nitrogen promotes an extensive growth of phytoplankton and seaweed, or macroalgae. While they live, these organisms can cloud the water, blocking sunlight to

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Cape Cod toxics program slated to be cut

By Maureen Kelly

A U.S. Geological Survey (USGS) research site on Cape Cod will close in September if Congress approves the proposed cut of the agency's \$13.9 million Toxics Substances Hydrology Program from the federal budget in fiscal year 2003.

Since 1983, the USGS has studied an underground sewage plume emanating from the 22,000-acre Massachusetts Military Reservation (MMR) in an

effort to understand the processes that affect the behavior of contaminants in groundwater. Sewage is the most common threat to ground water purity in the United States. What scientists learn from the Cape Cod site can be applied to remediation at other contaminated aquifers nationwide.

In the late 1970s, the USGS discovered what is now called the Ashumet Valley Plume; the first of 15 contaminant plumes found originating beneath the base. Over nearly a century,

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The Gulf of Maine Council on the Marine Environment was established in 1989 by the governments of Nova Scotia, New Brunswick, Maine, New Hampshire, and Massachusetts to foster cooperative actions within the Gulf watershed. Its mission is to maintain and enhance environmental quality in the Gulf of Maine to allow for sustainable resource use by existing and future generations.

Visit the Gulf of Maine Councils Web site at:
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Editor's Notes

Bay of Fundy forums designed to motivate

In a recent essay in National Geographic Magazine, E.O. Wilson, the Harvard University biologist and two-time Pulitzer Prize winner paints a sobering world review: "Our species, at more than six billion



Chester and Marilyn McBurnie say they are tired of being "regulated to death."
Photos: Andi Rierden

strong and heading toward nine billion by mid-century, has become a geophysi-

If we consider our own corner of the world here in the Gulf of Maine, the Minas Basin would surely be among its hotspots.

cal force more destructive than storms and droughts. Half the world's forests are gone...Polluting, damming, and the introduction of alien organisms are causing the wholesale extinction of native aquatic species...Many experts believe that at the present rate of environmental change, half the world's surviving species could be gone by the end of the century." A promising glow in this warren of destruction, Wilson continues, are the

25 "hotspots" that conservation biologists define as "highly threatened but fertile grounds." Together, these hotspots, ranging from the Caribbean to the Western Ghats in India, contain more than 60 percent of the world's plant and animal species—within just 1.4 percent of the planet's land surface. British ecologist Norman Myers developed the hotspot concept in 1988, and his analysis has been adopted by conservation organizations internationally.

Key to rescuing these fragile areas is a push by conservation groups and scientists to work closely with governments, businesses and the local citizens that depend upon these lands or seas for their economic viability. As an accompanying article makes clear, building bridges is not easy, yet good protection and good science can and do combine forces to manage healthy ecosystems.

Closer to home, the obstacles and promises of a shared approach to natural resource management and sustainability are being played out in communities throughout the Gulf of Maine/Bay of Fundy. One recent example was a series of public forums held this spring by the Bay of Fundy Ecosystem Partnership (BoFEP), a Fundy-wide conservation and research group,

and local hosts. Their aim, according to forum organizer, Robin Musselman, was to encourage community awareness of the natural and human resources of the Minas Basin watershed and to begin action toward their sustainable management. "We want to motivate communities to identify key issues, come up with a plan and then help them carry out doable projects," she said. If we consider our own corner of the world here in the Gulf of Maine, the Minas Basin would surely be among its hotspots. Located in the upper reaches of the Bay of Fundy, the Basin is world-renowned for its geology and geometry. Its arrow shape together with the surging waters of the whole Bay produce the highest average tides in the world. More than 30 rivers flow into its cavity, feeding in sediment and creating an intricate and complex dynamic. The Basin's mudflats, which fan out at low tide like an intertidal prairie, are a magnet for waterfowl and shorebirds that congregate in massive flocks. The long-legged sandpipers and plovers, in particular, draw birders and conservationists from every part of the globe. Despite its relative remoteness, the Minas Basin is under great stress. Development mostly in the eastern side in Kings County threatens wetlands,



Art Fillmore and daughter Terry Nuttall, say they have been bombarded with information and came to seek some truth.

water quality and wildlife habitat. A declining and increasingly corporate-owned fishery drains the economic viability of small communities. Decades of poor forestry practices, outdated septic systems and agricultural run-off have degraded rivers and streams. By April, forums held in Wolfville, Truro and Parrsboro had drawn nearly 400 people. The Parrsboro forum drew the largest crowd of 200 people plus, with many eager to vent their sometimes conflicting and impassioned concerns. In the opening segment, some attendees said they wanted more conservation measures, while other residents, some representing ATV or snowmobile associations, were adamant, saying that the new provincial park at Cape Chignecto—where motorized recreational vehicles are prohibited—and a proposed

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Letters to the editor

The *Gulf of Maine Times* welcomes readers' letters, however, we reserve the right to edit them for length and clarity. Please include your name, address and phone number. All submissions may be mailed, faxed or e-mailed to the *Gulf of Maine Times*, c/o Editor. We will consider all letters for publication, but cannot guarantee that we will print and/or respond to every one.

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conservation reserve for the Upper Bay of Fundy were conspiring to destroy a way of life they had known for generations.

Hoping to clear up the confusion about a range of land-based issues in the region, Terry Nuttall, her father Art Fillmore and other residents had formed the Conservation Study Group. "We've got so many groups bombarding us with information," Fillmore said. "We're here to try to get some answers."

Chester McBurnie, 74 years old, sat next to his wife Marilyn and his two sisters. His agenda was agriculture. "I've been getting up all my life seven days a week and taking care of my farm that's been in my family five generations. Now they want us to fence off the brooks so

the cows can't get in them. Well, those cows have been going into those brooks all along and they haven't killed anybody yet, so what's the point?"

In a separate focus group, people voiced their worries about overfishing and the destruction caused by fishing gear. "The draggers come through and then there's not a fish left," one weir fisherman said. "Some of these boats with satellite [equipment] will go in and take whole schools of fish and there's not enough officers to enforce things."

Another group discussed potential effects of pharmaceuticals spilling into waterways and the "chemical rain" coming from parts of the U.S. Midwest and southern Ontario. "We always think about saving the planet for the next gen-

eration," said a schoolteacher. "But with all the destruction humans are causing, we better start thinking about saving the species, period."

The forums did generate a range of potential solutions and actions, from lobbying for more effective policies and legislation to education campaigns.

Yet with so many problems and different viewpoints, not to mention the many competing pressures on natural resources, and with government itself often divided as to how those resources should be allocated, what, I wondered, can a few citizens really accomplish? BoFEP's answer is to ferret out community leaders at these meetings, continue discussions in smaller venues, attract funding, build alliances,

then help them walk the talk.

It is a good, positive plan.

The grand conundrum of trying to balance conservation with economic needs and cultural traditions won't happen overnight, but as these forums made clear, there are many citizens straddled with a loss of certainty and feelings of powerlessness who are willing to give it a try.

As one retired fisherman told another on the way out to the parking lot, "Part of me thinks it's a waste of time, but if we don't start talking out our differences and figuring out what to do, it'll all go to hell."

Gulf Voices

Global warming in a Maine estuary

By Ed Myers

Way back in the month of March, 1917 (only coincidentally the month and year of this columnist's birth), father and son Evander and Ervine Hatch slid a building for the Bristol Ice Company off the wharf and onto the ice in Clark's Cove, Maine. They triggered a capstan out ahead of it and moved the structure across the Damariscotta River with capstan bars and six-part blocks. The job took most of a month, but there was no hurry because the salt water ice was over three feet thick. The building is still there in Edgcomb and is used to store farm equipment.

In March of 1944, Harry Marr's shipyard in Damariscotta (now the municipal parking lot) had two 93-foot wooden minesweepers ready to go to the Pacific. The Coast

Guard sent an icebreaker from Boothbay Harbor to carve out a channel for the vessels. As they set out on their long voyage, 50 or 60 cars and pickup trucks drove onto the two-plus-foot thick ice and drove alongside the minesweepers to keep them company as far as Cottage Point, horns blaring all along.

In the winter of 1971, we noticed that we had forgotten to remove the nice piece of nylon from a mooring stump about 150 yards from the dock. We strolled out confidently over the two feet of ice, removed the pickup buoy and the mooring line and put them in covered storage where they belonged, until spring.

In 1974, Clark's Cove had the begin-



Ed Myers
Photo: Lee Bumsted

nings of the first mussel farm in North America. In the ensuing 18 winters we used a scow-mounted plough blade to break ice from Clark's Cove, so that the floatation bottles for the mussel lines and the head-ropes would not be carried away. In the worst winter, we used up 17 full day's work on this chore.

There has been no ice whatsoever since 1993, when there were a couple of one-inch skims that went out on their own. The decade of the 90s is in the records as the warmest on the planet since data were collected, so it isn't all that surprising. When icebergs the size of Connecticut have broken off the Larsen B Ice Sheet in Antarctica and the Arctic

has lost 42 percent of its cover, some effect can be expected from the Labrador Current on the Gulf of Maine.

In 1997, we had a casual visitor from Detroit who was employed by one of the automobile companies with membership in the Global Climate Coalition. Despite the sonorous title, this is the outfit financed by the coal and petroleum interests. Three of its "scientists" were taken to court in 1997 and under oath revealed fees of a \$100,000 a year each for three years to debunk climate change and keep the issue "up in the air" (if you'll pardon the expression). We heard the man out as politely as possible, resisted saying anything pertinent and waved goodbye. Then we looked up March for the first four years in the 1980s—the range was from 32 to 35.5 degrees Fahrenheit [0 to 2 C]. For 2002, the average was 40 F [10 C] in Clark's Cove. These are sea water temperatures, most generally a couple of degrees lower than the automated readings from the Large Navigation Buoy off Portland with temperature readings closest to us.

The World Almanac tells us that the United State's annual contribution to greenhouse gases is 4.1 billion tons. Lester Brown's latest book, *Eco-Economy: Building an Economy for the Earth* tells us that the United States alone sends

"When icebergs the size of Connecticut have broken off the Larsen B Ice Sheet in Antarctica and the Arctic has lost 42 percent of its cover, some effect can be expected from the Labrador Current on the Gulf of Maine."

enough into the atmosphere to warm the planet. The Worldwatch Institute's *State of the World 2002* reaffirms that the eight major polluters following you know whom are all in the Northern Hemisphere. Philip Conkling of the Island Institute here in Maine traced Robert Peary's 1909 dog-sled tracks to the North Pole in a ship last summer. Bob Reiss in *The Coming Storm* tells us that there are ten trillion tons of methyl hydrates and methane waiting to melt as soon as the carbon dioxide load in the atmosphere takes the temperature up enough to get that going—it is already started in parts of Siberia and Alaska—and if the permafrost ain't perma our abacus tells us that's four pounds of methane for every square foot of the planet's surface. The green crab and the sea squirt, scourge of bivalve seed and weighty competitor on bivalve lines respectively, have made their way up the Nova Scotia coast and turned the corner to the Gulf of St. Lawrence.

Research can be terrifying fun, but all we had to do this past winter for ground truth (or liquid truth) was go to the dock shed and look out the window.

Ed Myers is a columnist for The Working Waterfront, published monthly by the Island Institute. He lives in Damariscotta not far from Clark's Cove.

Gulf of Maine wetlands advocate wins national award

Christy Foote-Smith's passion for wetlands began with her childhood explorations of the interdunal ponds along the southern shores of Lake Michigan. She went on and has worked for more than 30 years to protect Massachusetts' wetlands. Last month Foote-Smith was awarded the 2002 National Wetlands Award for Outstanding Wetlands Program Development. The program honors individuals who have "demonstrated extraordinary effort, innovation, and excellence in wetland conservation, research, or education through programs or projects at the regional, state, or local level."

As the director of the Massachusetts Wetlands Restoration Program, Foote-Smith has helped develop hundreds of regional wetland restoration projects by creating a variety of programs, writing grants and newsletters and conducting fieldwork. In 1999, she collaborated with government and business representatives to establish the first Corporate Wetlands Restoration Partnership, which funneled \$1 million in donations to Massachusetts' restoration projects.

"Bringing together local, state and federal agencies, non-profits, businesses, academics and landowners for the common goal of proactively restoring wet-

lands has been the greatest pleasure of my career," Foote-Smith says.

The National Wetlands Awards program is co-sponsored by the Environmental Law Institute, U.S. Environmental Protection Agency, Natural Resources Conservation Service, U.S. Fish and Wildlife Service, U.S. Department of Agriculture Forest Service and National Marine Fisheries Service.



Christy Foote-Smith



Harbor seals

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nants can interfere with hormones and their receptors, influencing the messages being sent to growing cells in animals and humans. As a result, growth and development can be compromised and immune systems weakened. Over the past three decades, endocrine disruptors have been linked with devastating impacts on the reproductive and immune systems of seals in the Baltic Sea, the North Sea and other polluted waters. In a study of Pacific coast seals, Shaw's findings indicated that young harbor seals exposed to PCB's in the womb may be at high risk for immune deficiencies and altered hormone levels.

Higher levels of endocrine disruptors in seals may reflect localized pollution. Sources include pesticide and herbicide runoff from agriculture, blueberry fields and golf courses; municipalities or medical facilities burning PVC plastics; brominated compounds added as flame retardants to clothing, electronic circuitry and household products; and point sources such as pulp mills and finfish aquaculture.

MERI is now in the second year of its five-year Atlantic Coast Seal Study, a multidisciplinary effort to examine endocrine disruptors in Gulf of Maine seals, establish baseline levels and compare them to key health indicators. It is funded in part by the Maine Department of Environmental Protection and is recognized by the Gulf of Maine Council on the Marine Environment as a priority project.

"Contaminants have not been measured in these seals for 25 years despite the fact that they are exposed to contaminated habitats and prey in their range," Shaw says. "Just the fact that a population is increasing doesn't tell us whether it is healthy. For example, harbor seal birth rates are increasing overall, but the regional patterns are troubling. Pupping has declined in southern Maine and is at a standstill in the midcoast region. Possible explanations include habitat disturbance, food shortages or other factors, but from our perspective, the big ques-

tion is: 'Are these animals healthy, are they affected by ocean pollution?'"

In the initial phase of the Atlantic Coast Seal Study, MERI conducted the first baseline study of toxic pollutant loads in wild Gulf of Maine harbor seals. Working with the NOAA Northeast Fisheries Science Center, MERI researchers obtained blood and hair sam-

what connections may exist. In the study's second phase, researchers are analyzing samples from 50 dead stranded harbor and gray seals and 20 live seals that stranded and were then rehabilitated and released back into the wild. "Ultimately this study will enable us to better assess long-term health risks posed by toxic pollutants to marine mammal



Shaw with Elisabeth Mann-Borgese, founder of the International Ocean Institute and MERI board member who died in February. "Elisabeth had a tremendous influence on my life," Shaw says. "She was a close friend and dedicated to protecting the world's great commons—the oceans." Photo: Courtesy of the Marine Environment Research Institute

ples from 29 harbor seals in Chatham Bay, Massachusetts and Penobscot Bay, Maine. They found that these seals carry significant body burdens of dioxins, mercury and lead. They also measured immune and hormone profiles in seal blood. Once they complete the analysis of that data, they will compare their findings to the contaminant levels to see

populations," Shaw says.

MERI's ability to study seals has recently been enhanced by the completion of a Marine Mammal Care Unit at their Center for Marine Studies. Seals stranded in the Blue Hill Bay region can be rescued and given emergency medical treatment by MERI staff members before being transported to the Marine

Animal Lifeline in Westbrook or the University of New England in southern Maine for rehabilitation.

The addition of the Marine Mammal Care Unit illustrates MERI's goal of combining research and education. Volunteers are trained to help with stranded seals, presenting another opportunity at MERI for community members to learn firsthand about the ocean and its inhabitants.

"Unless you are educating people about what you are finding, a lot of the science gets lost," says Shaw of her efforts to both conduct research and share information with the public. She believes that MERI has an important role in spreading a message of ocean conservation and stewardship, particularly to young people. The Center for Marine Studies gives children a chance to view Gulf of Maine inhabitants up close in the Ocean Aquarium Room, for instance. Summer internships for high school and college students are offered to foster interest in science careers. Outside the center, MERI takes children and adults on cruises in Blue Hill Bay and on island field trips so they can explore and appreciate the importance of the ecosystem.

This spring, MERI received a major gift to endow the Elisabeth Mann-Borgese Lecture Series in honor of the late oceans advocate and longtime member of the MERI board of directors. The series will bring internationally recognized ocean experts to Blue Hill to share their knowledge with the general public.

Through the work of Susan Shaw and MERI, we will have a better understanding of the health of the Gulf of Maine, and the seals who may prove to be its sentinels.

To learn more about the Marine Environment Research Institute's educational programs, seal stranding rescue program or research, visit www.meriresearch.org, phone (207) 374-2135, or stop by 55 Main Street, Blue Hill, ME.



Humpback whale and calf

THE DIN WITHIN THE SEA

By Maureen Kelly

Man-made sound in the oceans is gaining more recognition as a potential threat to sea life. Commercial shipping, seismic surveys, activities associated with oil and gas exploration and sonar all contribute to noise pollution in the sea. Some believe that the din from machinery could disrupt biologically important behaviors like communication, mating, migrating, feeding and rearing of young.

A new noisemaking technology may get approval to operate in the seas in the next few weeks when the National Marine Fisheries Service (NMFS) makes a final decision on whether the U.S. Navy can proceed with the deployment of its new Surveillance Towed Array Sensor System Low Frequency Active sonar (SURTASS LFA). *[Editor's note: At press time, the NMFS had not issued a decision].*

The experimental sonar, currently on one ship, the R/V Cory Chouest, cost \$350 million to develop and is designed to detect the newest generation of quiet submarines. The SURTASS LFA has an active component that emits a sound pulse that echoes off objects in the water. Its low-frequency pings travel greater distances through water than higher frequencies, so the SURTASS LFA has a greater range than other sonars.

The sonar operates at a frequency of between 100 to 500 hertz, within the hearing range of many marine mammals and fish. While better able to detect distant submarines, some environmentalists fear that the sonar will also have a farther reach in terms of impacting sea life and that sounds broadcasting from a ship's hydrophones will prove detrimental to wildlife.

Other nations have developed low frequency sonars as well and, like the United States, are in the testing phases. However, Navy spokesman Lt. Patrick McNally said, "The U.S. is the only one going this low — down to 500 hertz."

Evidence has shown that certain sonars can be harmful to mammals. The military took responsibility for the stranding of 16 whales in the Bahamas in March 2000 that resulted from the

Navy's testing of mid-frequency sonar. The carcasses of the whales that died showed signs of auditory trauma.

"Scientific evidence is compelling that mid-range tactical sonar used by U.S. warships can seriously affect certain marine mammals under certain circumstances," said

Roger Gentry of NMFS's Acoustic Research team in a written statement. But, he added, "Many kinds of sonars exist, all with different operating characteristics...Because of these differences science does not support the conclusion that these same effects will be caused by sonars other than mid-range tactical sonar. This is a highly technical field that offers few simple, straightforward answers."

In October 2001, Hawaii's Congresswoman Patsy T. Mink testified before the House Subcommittee on Fisheries Conservation, Wildlife and Oceans expressing concern that the SURTASS LFA could harm marine mammals, with low frequency broadcasts having the potential to change behaviors and affect breeding and rearing of young. Furthermore, she said the Navy would be in violation of the Marine Mammal Protection Act (MMPA) if the sonar were deployed. The Navy has requested a "small take" exemption under the MMPA from the NMFS, which would allow incidental disturbances to a small number of mammals from the operation of the sonar.

The Natural Resources Defense Council (NRDC) also expressed concerns to NMFS about the sonar's potential harmful effect on marine mammals including the east coast's endangered Northern right whales. The Navy reported that it does not intend to deploy the sonar in the Gulf of Maine unless the United States is under threat conditions because it is an important

While there is disagreement about the impacts that low-frequency sonars will have on animals, uncertainty also remains over the long-term effects that other man-made sounds are having on the ecosystem.

habitat area, but the NRDC was unappealed.

Northern right whales migrate "well offshore of the continental United States and Canada and well outside the Navy's Offshore Biological Exclusion Area, where presumably the risk of impact would increase," the

group stated in a letter urging NMFS to deny the Navy's application for a take exemption.

While there is disagreement about the impacts that low-frequency sonars will have on animals, uncertainty also remains over the long-term effects that other man-made sounds are having on the ecosystem.

Gentry stated, "There is no scientific evidence that shipping, construction or oil and gas development are having severe, lasting effects on marine mammals." But, he added, "This does not mean that these sound sources are having no effect, only that the effects, if any, are not being detected."

Researchers trying to determine how noise interferes with behaviors among mammals, fish and ocean-going reptiles recognize that the hearing ranges of species differs and noise in the environment does not affect all creatures in the same way.

Mammal acoustics are completely different from fish acoustics, said Phillip Lobel, an ichthyologist and associate professor of biology at the Boston University Marine Program. Among fish, hearing can range from 50 to 800 hertz depending on the species, he said.

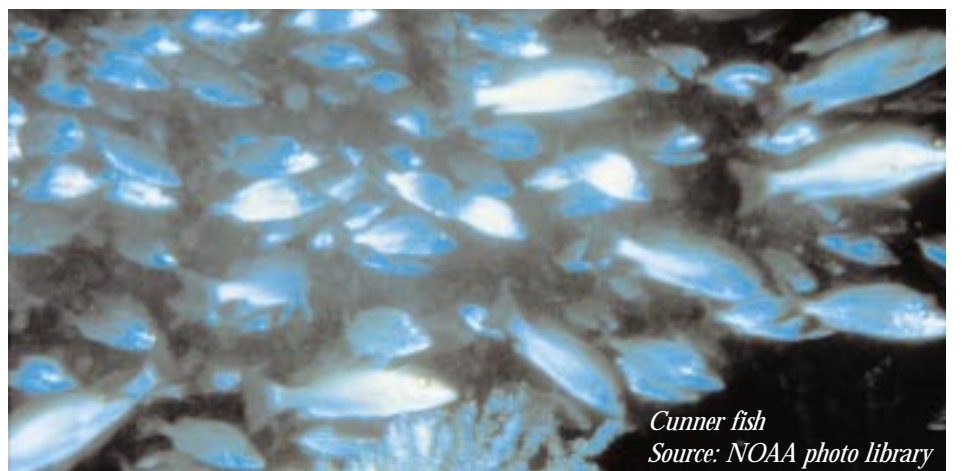
A fish's sensitivity to sound depends on various physical factors, such as whether or not it has a swimbladder—an organ involved in buoyancy and sound production—and whether it is a salt-water or fresh-water species. Lobel believes that fresh-water fish may have more acute hearing that allows them to detect predators in murky waters.

Other factors that contribute to noise impact on wildlife include the intensity of the sound, duration, frequency, pressure and distance the animal is from the sound source and whether the sound is traveling through deep or shallow water.

In his studies Lobel found that if a noise is "loud enough and persistent enough" it will disturb fish. But, he added, "Just because a disturbance is occurring doesn't mean it's having an adverse impact."

There can be "disturbance because of novelty," he said, though some fish adjust to the racket. In one study, he discovered that fish became acclimated to noise from heavy boat traffic and were able to spawn normally.

Scientists have more to learn about whether noise pollution is disrupting normal biological activities. In February, the Navy announced its decision to fund the North Pacific Acoustic Laboratory project, which will study long distance sound transmissions in the ocean and their long-term effects on sea life.



Cunner fish
Source: NOAA photo library

Nitrogen continued from Page One

plants and other marine life. When they die, they are consumed by bacteria, which proliferate and deplete the water of oxygen. By depriving and smothering life within an aquatic system, eutrophication ultimately lowers biodiversity.

On the home front

In the Gulf of Maine region, symptoms are perhaps most acute in areas of coastal Massachusetts, particularly in southern parts of Cape Cod, where studies have linked the decline of eelgrass, an important habitat for fish and shellfish, to nitrogen enrichment of the region's bays. Says Andrew Gottlieb, assistant commissioner for Policy and Planning for the Massachusetts Department of Environmental Protection: "We're experiencing significant degradation in some embayments. They're over eutrophied, dominated by blue green and brown algae and we've had fish kills."

There are uncertainties and gaps in data, and much is unclear about the wide-ranging effects of excess nitrogen in the Gulf or whether it has increased or decreased. Data collected by the National Oceanic and Atmospheric Administration (NOAA), satellite imagery, scientific cruises and some monitoring have contributed preliminary information to show areas in the Gulf considered most susceptible to eutrophication. But experts across the region say much more research, monitoring and management are critical in determining what embayments may be impaired or at risk, particularly as development along the coast spreads and activities like finfish aquaculture expand.

A recent workshop report by the University of New Hampshire's Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET), NOAA and the Gulf of Maine Council on the Marine Environment, calls for a Gulf-wide plan to help local and regional communities determine the degree and severity of nitrogen in their coastal embayments. Researchers who contributed to the report say resource managers and regulators need a model to calibrate and compare nitrogen impacts throughout the Gulf, taking into account measures like an embayment's population density, tidal conditions and sources of nitrogen input.

"Not everybody in the Gulf of Maine needs to be concerned, but they should be aware [of nitrogen problems]," says Richard Langan the UNH director of CICEET, and workshop organizer. "As development of the coast continues to expand we need to give people a heads up, so they can get a handle on any of the impacts."

A natural source

One thing scientists know for certain, the vast majority of nitrogen circulating in the Gulf of Maine is natural and comes from the open ocean. Whether the nitrogen-rich ocean water will cause problems once winds, currents or other conditions carry it inshore is a question of scale, says Dr. David Townsend, an

oceanographer at the University of Maine. Nitrogen entering a well-flushed estuary may quickly disperse to the open sea and contribute little to eutrophication. On the other hand, a poorly-flushed embayment may retain its nitrogen load long enough to stimulate eutrophication and knock the system out of whack. If the water hangs around, Townsend says, more nutrients accumulate creating a higher potential for algae blooms and oxygen depletion. The size of the estuary or embayment also influences the concentration of nitrogen once it enters the watershed.

"The level of contaminants or human impacts becomes significant the smaller the body of water and the closer the source of those nutrients, which is the shoreline," he says.

Townsend and other scientists have established that Alexandrium fundyense,

ful nitrogen compounds. In nature, there are two ways this happens: a few specialized algae and soil bacteria contain enzymes that enable them to convert the nitrogen into useable form, and lightning transforms the gas into nitrates, which then rain into soil and water.

Before humans began altering the nitrogen cycle with synthetic compounds, these natural processes fixed from 90 million to 150 million metric tons of nitrogen a year according to the Ecological Society of America. Today, human activity adds 132 million to 153 million metric tons annually. Chemically altered nitrogen molecules, commonly known as "reactive nitrogen," then cycle from one polluting form to another. For example, nitric acid is a chief element in acid rain, nitrates and other compounds in waterways are blamed for depleting coastal waters of oxygen, while nitrogen oxides form soot and smog and threaten respiratory health.

Atmospheric nitrogen

Next to natural nitrogen, atmospheric nitrogen from smokestacks, cars and trucks, is the largest source in the Gulf of Maine, according to the CICEET report. The effects are as far-reaching as Acadia National Park in Maine where summer ozone levels have occasionally exceeded federal health standards. Around the Bay of Fundy, southern New Brunswick and parts of Nova Scotia southwest of Halifax, 50 to 80 percent of the smog is caused by cross-border pollution from the northeastern United States or emissions from central Canada.

Controlling the problem is, in part, out of the hands of local and regional communities and depends on federal and international regulatory strategies.

On a positive note, scientists say the

amount of atmospheric nitrogen in the Gulf appears to have stabilized. They further estimate that tougher automobile emissions controls in the United States and Canada will help decrease atmospheric deposits of nitrogen oxides. The new controls for both countries will go into effect next year.

In April, New Hampshire passed legislation aimed at reducing emissions of nitrogen oxide and three other pollutants from the state's fossil fuel burning power plants. The Clean Power Act makes New Hampshire the first state to legislate a reduction in common pollutants from power plants. By 2007, nitrogen oxide emissions must be cut by 70 percent, which will reduce this pollution to 90 percent lower than 1990 levels.

"With this legislation, New Hampshire is sending a powerful message to other states and the federal government," Governor Jeanne Shaheen said in a press release. "Pollution does not respect state boundaries. Other states and the federal government must follow our lead so that downwind states like New Hampshire have clean air."

Wasted away

Then there's the unpleasant issue of waste. One of the Gulf of Maine's biggest headaches is the excess of nitrogen spewing into waterways from wastewater treatment plants and septic systems. According to a NOAA inventory of land-based pollution sources to the Gulf of Maine published in 1994, about 91 percent of all point source nitrogen discharges—those originating from a concentrated source with a specific point of release—come from wastewater.

Some 300 billion gallons of effluent from at least 378 wastewater treatment plants are discharged each year into the Gulf's watershed, according to a 1998 survey by the Global Programme of Action Coalition for the Gulf of Maine. Yet few facilities treat sewage for nutrients, like nitrogen. Typically, sewage treatment in the Gulf watershed uses a preliminary process to break down the solids, followed by a secondary level of treatment to break down organic matter.

The problem is, secondary treatment of sewage effluent removes only about 25 percent of the nitrogen. Advanced treatment to remove the compound is expensive and rarely applied in the Gulf region. In general, states,

"We're experiencing significant degradation in some embayments. They're over eutrophied, dominated by blue green and brown algae and we've had fish kills," says Gottlieb of Massachusetts' Department of Environmental Protection.

the algae that causes red tides, grows in healthy, nitrogen-rich waters offshore in the Gulf of Maine. But when red tides are blown inshore, the toxin omitted by the algae can contaminate clams and mussels with paralytic shellfish poisoning—putting them off limits to human consumption. Coastal waters polluted by excess nitrogen can exacerbate these blooms, or mimic conditions that work well for Alexandrium offshore. Because of certain factors including population size, some harbors and bays are more susceptible to promoting red tides.

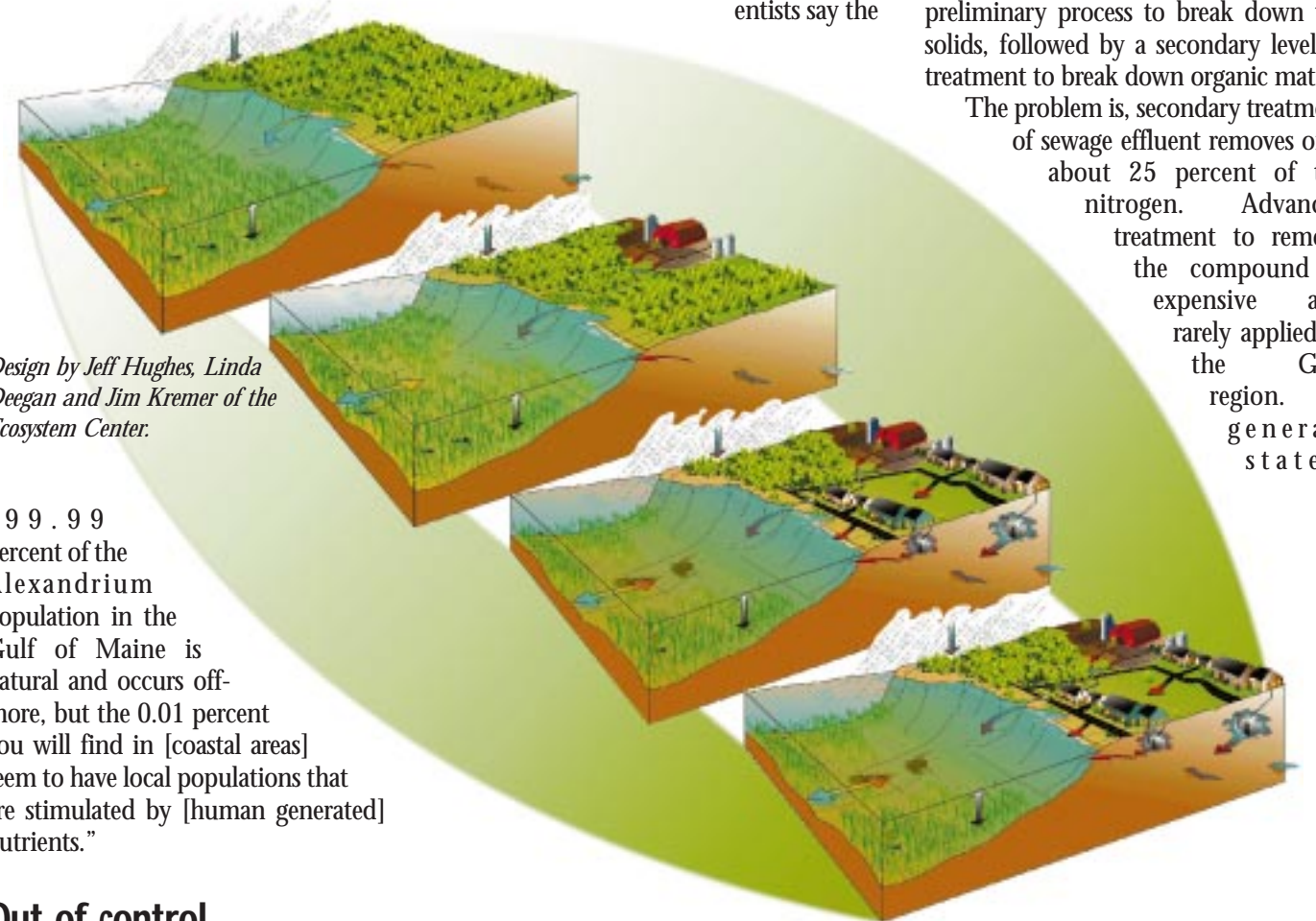
Says Townsend:

Design by Jeff Hughes, Linda Deegan and Jim Kremer of the Ecosystem Center.

"99.99 percent of the Alexandrium population in the Gulf of Maine is natural and occurs offshore, but the 0.01 percent you will find in [coastal areas] seem to have local populations that are stimulated by [human generated] nutrients."

Out of control

In its natural state, nitrogen is abundant. More plentiful than oxygen, nearly 80 percent of the atmosphere is nitrogen gas. But plants cannot absorb it until it becomes fixed—bonded with hydrogen or oxygen—to form into biologically use-



This model, created by a team of scientists and educators at the Ecosystem Center, Marine Biological Laboratory, Woods Hole, MA, illustrates the ever-increasing load of nitrogen into an estuary caused by the surge of suburban development. The arrows represent nitrogen sources from the atmosphere, fertilizer run-off from lawns, golf courses, agriculture, wastewater treatment plants, on-site septic systems and impervious surfaces. For more detailed graphics and explanations go to www.ecosystems.mbl.edu/Research/Clue/.

provinces or municipalities regulate whether an industrial or wastewater treatment plant requires advanced treatment.

Other wastewater challenges include underdesigned sewer systems found mainly in older urban areas and built to collect rainwater runoff, domestic sewage and industrial wastewater in the same pipe. During periods of heavy rainfall or snow melt, the wastewater volume in a combined sewer system can exceed the capacity of the main treatment plant. The U.S. Environmental Protection Agency estimates that after a heavy precipitation event, hundreds of millions of gallons of untreated sewage and stormwater are discharged into New England waterways from overflow pipes. A few urban centers are slowly upgrading treatment systems and removing the old pipes, though at a high cost.

In Massachusetts, the Massachusetts Water Resource Authority's \$2 billion wastewater system has diverted much of the wastewater that used to flow to the combined sewage and stormwater pipes and into the Boston Harbor to the Deer Island sewage treatment plant. As a result, the number of beach closures in the harbor has decreased.

Finfish aquaculture

Among other concerns is the impact of nitrogen loads coming from aquaculture farms. In 2000, more than 100 million pounds of finfish were grown in the Gulf of Maine. New Brunswick produced 66 million pounds, followed by Maine at 36 million pounds, with 1 million generated between Massachusetts, Nova Scotia and New Hampshire. John Sowles of Maine's Department of Marine Resources (DMR) has found that finfish aquaculture increases the amount of nitrogen in Cobscook Bay by ten percent. However, his research has not shown that aquaculture in the Bay creates adverse impacts to water quality or habitats.

"You don't see the effects because the nutrients are flushed out," he says. "Where we're concerned is when you move west along the southern coast of Maine into these long bays and inlets that don't flush and have longer resident times. That's why we're concerned with Blue Hill Bay."

Yet even in well-flushed regions of the Gulf, nitrogen wastes from aquaculture operations are an ongoing concern. "Any bay can carry only so much activity," says

Dr. Thierry Chopin of the University of New Brunswick's Centre for Coastal Studies and Aquaculture. "The problem is, nobody knows exactly what this carrying capacity is, which, moreover, can vary from bay to bay."

Despite the vigorous tidal action of the Bay of Fundy, Chopin adds, the effects of excess nitrogen can take its toll. "The myth is that the Bay can handle the excess, but there is not as much flushing as people think. The water goes in and it goes out, but like a big bathtub, it's the same water. And studies have shown that it takes 76 days to exchange all that."

Dr. Peter Strain, a marine chemist with Canada's Department of Fisheries and Oceans, has been studying the impact of nutrients and organic wastes discharged into coastal inlets, and the susceptibility of an inlet to eutrophication. In one study of the Letang Inlet in southern New Brunswick, where there is a large concentration of fish farms, Strain found aquaculture to be the single largest contributor of nitrogen. Some of the possible impacts of the excess nutrients, Strain says, include more extensive mats of nuisance intertidal algae. "There certainly have been anecdotal reports [of more algae mats] and we're trying to quantify that to see if that is true," he says.

Trying to nail down the effects of aquaculture in the open waters of the Bay is more of a challenge because of tidal action, Strain adds. "Certainly we see changes very close to fish farms or areas like the Letang but once you move a little offshore, the effects are much more subtle and more difficult to identify."

The bottom line, say researchers, is that nitrogen in the Gulf of Maine is coming predominantly from the ocean and from reactive compounds in the atmosphere, but that additional human inputs of nitrogen can easily tip the balance and wreak havoc within local embayments.

"If you go into a bay the main source may be septic tanks of individual property owners. In another bay it might be a sewage treatment plant, and in another bay it might be aquaculture," Sowles of Maine's DMR says. "Theoretically we could be improving these bays as long as people take the issue seriously. Otherwise problems are going to increase."

A copy of the CICEET report Managing Nitrogen Impacts in the Gulf of Maine is available at: <http://gulfof-maine.org/council/monitoring.shtml>.

Alternative septic systems to the rescue

By Andi Rierden

On Cape Cod where 90 percent of homes have on-site septic systems, degradation of coastal embayments from nitrogen has become a serious problem. Conventional septic systems primarily remove bacteria from the decay of organic wastes, yet do little to remove nitrogen. In recent years more alternative systems with a greater capacity to remove nitrogen have become commercially available thanks to the Massachusetts Septic System Test Center. Started in 1999 as a collaborative project between the Buzzards Bay Project National Estuary Program and state and local agencies, the center is a testing ground for alternative septic systems suited for individual homes or cluster developments.

The innovations range from units with modifications in leach trench design to improve soil absorption, those involving recirculating sand filters, and small plants containing aerobic biofilters that spray effluent over a foam media. Rigorous testing has shown that some systems can remove twice as much nitrogen as a state-approved system, which removes only 22 to 25 percent of nitrogen.

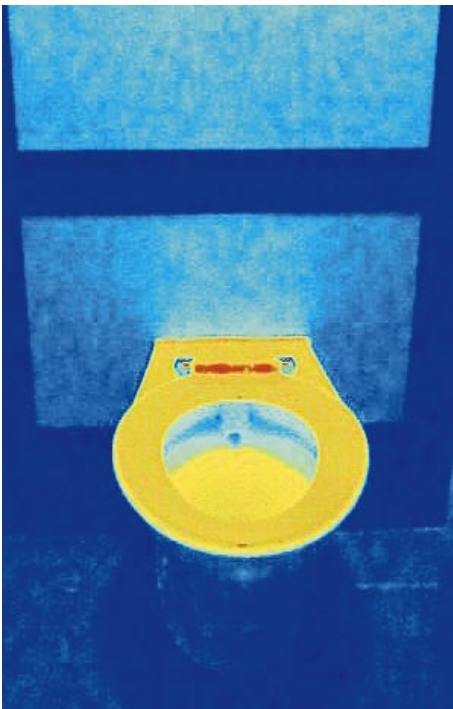
Depending on location, lot size and soil conditions a conventional system in Massachusetts ranges from \$8,000 to \$16,000 or more. The alternative systems can cost from \$5,000 and up to \$10,000, says George Heufelder, operations manager for the test center. Because denitrification models require more maintenance and oversight than standard systems, he adds, they are more ideal for small developments of five to 15 homes.

"I think the better option for a community is to use these systems to supply more than one house. By code they have to be inspected four to five times a year, which will run an individual homeowner about \$400 to \$500 plus electricity to run them. But if you cluster them you cut your costs to about \$120 a year."

About 300 homes on Cape Cod have installed the alternative systems, he says, but the problem is, "many are not being

monitored or watched properly."

Heufelder, who is also the environmental program manager with the Barnstable County Department of



Health and the Environment, says county officials are trying to convince towns to develop comprehensive management programs to inspect, maintain and monitor the alternative systems.

With vigilant maintenance the units will perform properly, more models will be produced and the costs of these systems may decline, he predicts. But the clock is ticking. Massachusetts has committed \$12 million to identify nitrogen sensitive embayments. Once that is completed and total daily maximum nitrogen loads are determined, Heufelder says, "We're going to have to say, 'Okay in this watershed we've got 600 homes and we have to get rid of X amount of nitrogen.' Right now we only have two solutions: build another treatment plant or have everybody do it on-site."

To safeguard ground and coastal waters for the long-term, he says, more cost-wise innovations and flexible thinking are critical. "We need more things in our toolbox, we need different sized hammers and screwdrivers, and if we don't have them by the time we identify these nitrogen sensitive embayments, we're not going to have the tools to fix them."

Sustainable aquaculture?

Dr. Thierry Chopin of the University of New Brunswick's Centre for Coastal Studies and Aquaculture wants to turn nitrogen and phosphorus-rich fish effluent into gold. In the waters near St. Andrews, New Brunswick, Chopin and his colleagues are employing an age-old farming method that integrates Atlantic salmon with blue mussels and kelp. The idea is to convert the nutrients coming from the fish waste and food into mussel meat and seaweed tissues of commercial value. Chopin explains that the seaweed and mussels act as a scrubbing system, absorbing the nitrogen, which helps to maintain a balanced ecosystem. Mussels grow faster when grown around finfish, he adds, and the introduced seaweed also serves as a competitor. "If I cultivate desirable seaweeds like kelp,

there should be proportionally less nutrients for the undesirable ones, like those in the fuzzy brown and green mats," he says.

The practice of growing different species of seaweeds, shellfish and fish in close proximity is referred to as integrated aquaculture or polyculture, and is nothing new. "The Asian countries have been doing it for centuries," Chopin says.

He adds that with the low price of salmon, aquaculturists cannot afford to bypass polyculture's environmental and economic benefits. "By turning the wastes of one resource user into fertilizer or food for the other," Chopin says, "we contribute both to bioremediation and diversification of the aquaculture industry."



*Dr. Thierry Chopin wants to spin nitrogen (and phosphorous) into gold.
Photo: Oak Tree Photography*



*Estuaries function as nutrient and particle traps, recycling nitrogen through repeated processes of growth and decay.
Photo: Daryl-Ann Hurst*

Gulfwatch: monitoring for the long-term

Q & A with Dr. Stephen Jones

By Theresa Torrent-Ellis

For more than a decade, scientists and volunteers around the Gulf of Maine have been plucking mussels from the shoreline and examining them to determine environmental conditions. Under the auspices of a Gulf of Maine Council program called Gulfwatch, the mussel tissues are analyzed for a list of potentially toxic contaminants, including chlorinated pesticides, polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs). In elevated concentrations, these types of contaminants can cause cancer, mutations, neurological disorders and disrupt endocrine systems.

Knowing the level and distribution of certain contaminants in mussels, said Dr. Stephen Jones, a researcher at the University of New Hampshire in Durham and co-chair of the Council's environmental monitoring committee, can help scientists, government agencies,



Stephen Jones with blue mussels
Photo: Suzy Fried

businesses and environmentalists in developing regional plans and programs. Along with providing baseline data, the information also helps determine if and how water quality in a particular area has been affected by a specific occurrence such as an oil spill.

In a recent interview, Jones said that the diversity of the Gulf's coastline—spanning from urban to rural—makes it impossible to draw a general picture of the levels of contaminants in the region. However, he added, since the program began, scientists have seen an overall decrease in some contaminants from the 60 sites sampled. In the following excerpt, Jones talked about the evolution of Gulfwatch, some of its findings and concerns.

Tell us about Gulfwatch.

Gulfwatch is a Gulf of Maine Council supported monitoring program. The program addresses both public health and ecosystem quality issues related to toxic contaminants. It entails monitoring for trace metals and toxic organic

compounds using blue mussels as an indicator of the level and extent of contamination in the Gulf of Maine. The monitoring is conducted in all five jurisdictions of the Gulf and all participants are volunteers. The results have been published in eight consecutive annual reports, two scientific, peer-reviewed articles and translated into fact sheets and summaries for environmental managers and the public. The data and most reports are on the Council's Web site [www.gulfofmaine.org / library / gulfwatch/index.html].

Gulfwatch was launched more than ten years ago. What were your concerns at that time?

When beginning to develop the early projects for the Gulf of Maine Council it was recognized that toxic contamination is transboundary and unlike other issues very little was known about toxic chemicals on a Gulf-wide basis. Monitoring for toxic chemicals is an important component of many monitoring efforts and Gulfwatch was modeled after the ongoing NOAA [National Oceanic and Atmospheric Administration] Mussel Watch program.

What is Gulfwatch focused on today?

Gulfwatch is looking at a suite of priority contaminants which are either persistent in the environment or can cause unwanted effects if present at high enough concentrations. These contaminants can be harmful to humans through the consumption of seafood or toxic to other organisms through exposure in the marine environment. Gulfwatch provides information that shows whether these contaminants are present at levels above what are natural conditions, as a result of human activities.

Could you give an example of specific contaminants of concern at this time?

Mercury still has numerous active sources in the Gulf of Maine, the most significant of which is atmospheric deposition. As a result of this source, mercury is found at elevated levels at many sites around the Gulf of Maine. Having mercury concentration information for blue mussels allows scientists to incorporate this data from the marine environment with that from freshwater environments—lake water, loons and fish—into their models to provide a more comprehensive assessment of mercury impacts and dynamics in the whole Gulf of Maine ecosystem.

Other contaminants of immediate concern are those that are listed in the warnings for human consumption of seafood, including PCBs and dioxin.

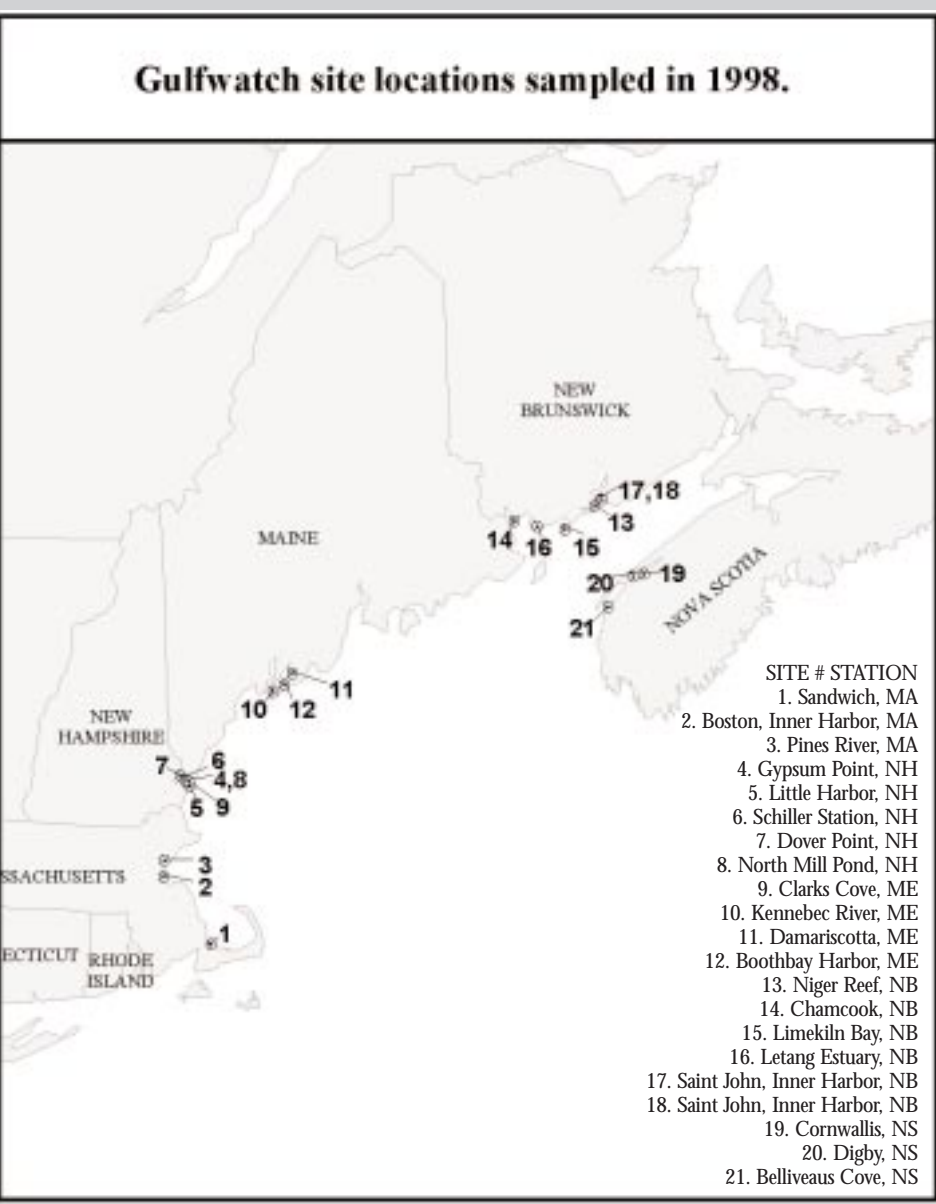
Have any of the contaminants monitored for decreased in concentration?

Since 1991, we have been analyzing mussel tissue for ten different heavy metals and four types of toxic organic contaminants at over 60 sites. The sites vary from Boston Harbor to sites in Maine far from any human activities. Thus, it is difficult to make general statements about decreasing contaminant concentrations across the whole Gulf of Maine. We have seen both increases and decreases of all the contaminants at different sites within the ecosystem. When looking at all the contaminants and all the sites over time the results show that there have been more decreases than increases.

What have been the five major successes for the first ten years of Gulfwatch?

The first is simply the fact that we overcame the logistical challenges in establishing a multi-jurisdictional, national and international effort. Second, we have successfully maintained participation and financial support for 11 years. Third is the ability to provide useful information to public health officials and environmental managers throughout the Gulf of Maine. Fourth is that we have been able to establish a Gulf-wide baseline of contaminant concentrations as well as to draw attention to sites where contaminants are present at higher concentrations. And finally, that we have drawn local, jurisdictional, national and international recognition as an important regional monitoring effort.

Theresa Torrent-Ellis is the outreach and education coordinator for the Maine Coastal Program/Maine State Planning Office.



A snapshot of Gulfwatch findings in its latest review of contaminants in the Gulf, *Evaluation of Gulfwatch 1998: Eighth year of the Gulf of Maine Environmental Monitoring Plan* (published in December, 2001, by the Gulf of Maine Council):

- In New Brunswick the Letang Estuary and two sites in the inner harbor of Saint John had elevated levels of silver, chromium, nickel, copper, polynuclear aromatic hydrocarbons and organochlorine pesticides, the majority of which were higher than the Gulfwide median.
- Widespread elevated levels for chromi-

um, copper, lead and especially mercury suggest possible regional sources of these contaminants.

- Mercury was highlighted in the five-year review as unusually high and a possible concern.
- The concentration of organic contaminants, especially polychlorinated biphenyls and organochlorine pesticides, tended to be higher in the southwestern Gulf.
- The majority of metal concentrations appeared to decrease, while most organic contaminant concentrations were higher than in 1995.

The Gulfwatch contaminant checklist

Inorganic contaminants

Heavy Metals

Silver

Lead

Chromium

Zinc

Nickel

Mercury

Cadmium

Copper

Iron and Aluminum

Heavy metals are persistent environmental contaminants—meaning they cannot be degraded or destroyed. They tend to accumulate in soils, seawater, freshwater and sediments. Excessive levels of metals in the marine environment can affect marine life and pose risk to human consumers of seafood. Sources include various industrial activities such as present and former mining activities, foundries and smelters and diffuse sources such as piping, combustion by-products and automobile emissions. Several heavy metals, like cadmium, lead and mercury are highly toxic at relatively low concentrations and can accumulate in body tissues over long periods of time.

Organic Contaminants

Polycyclic Aromatic Hydrocarbons (PAHs) are present in low concentrations virtually everywhere. Elevated concentrations of PAHs can occur from prolonged industrial burning or by release of materials such as creosote-based wood preservatives, which contain PAHs in high concentrations. Sources include power plants, domestic heating systems that burn oil, coal or wood, gasoline and diesel engines, waste incineration, various industrial activities and tobacco smoke.

Chlorinated Pesticides (TPESTs) are man-made organic chemicals that have been used to control everything from fungus to grasshoppers. DDT was the first that was used on a large scale in North America; it was heavily applied in agricultural regions. Most organochlorine pesticides have been banned in Canada and the United States, but are still routinely found in air and precipitation.

Polychlorinated Biphenyls (PCBs) are a group of over 200 man-made chemicals. They are extremely persistent compounds. Because of their insulating and fire-resistant properties, mixtures of PCBs were commonly used as coolants and lubricants in heat exchangers, pumps, electrical transformers and capacitors. Older electrical equipment and fluorescent lighting fixtures still in service may contain PCBs. The manufacture of PCBs in the United States and Canada has been banned.



A warning sign near Marsh Creek in Saint John, New Brunswick. The creek has been contaminated with polycyclic aromatic hydrocarbons, chemicals found predominantly in petroleum-based products like creosote.

Cape Cod continued from Page One

hazardous waste from landfills, military material, fuel, solvents and treated sewage leached into the ground beneath the reservation, which sits above an aquifer that is the sole source of drinking water for 200,000 year-round and 520,000 Cape Cod summer residents. The Air Force and National Guard are now overseeing a massive clean-up, under the U.S. Environmental Protection Agency's toxic waste clean-up program, Superfund, and the Safe Drinking Water Act that is expected to cost over \$1 billion by the time it is finished.

As the sewage plume, which is over two miles long, filters through the Cape's sandy soil towards Buzzards Bay, it provides a field laboratory to USGS scientists and their academic colleagues who conduct long-term research to find how toxins spread and degrade underground. The USGS sunk over 10,000 sampling devices into the ground to monitor variations in contaminant concentrations along the plume's path and used tracer experiments to track the movement of toxins.

"The geochemical environment in aquifers that have been contaminated by organic chemicals and nutrients is very complex," said Denis LeBlanc, a USGS hydrologist. "More field research is needed to help understand how physical, chemical and biological processes work together in affecting the fates of various types of contaminants."

The soil at the study site is "alive with bacteria," he said, and there is much more to be learned about the role microbes play in breaking down and diluting toxins.

Contaminants continue to seep beyond the MMR's boundaries. This spring, the town of Bourne shut down several public wells after trace levels of perchlorate, a chemical used as a propellant in munitions, was detected in the water supply.

Web site for the Toxics Substances Hydrology Program:
<http://toxics.usgs.gov/investigations/>

Contaminant Shorts

FRIENDS OF CASCO BAY LOVES THOSE "GREEN" LAWNS



Meaghan Murphy, a volunteer for Friends of Casco Bay in Maine, testing water quality.
Courtesy of Friends of Casco Bay

By Verna DeLauer

"It's just a beautiful place," says Peter Milholland, citizen stewards coordinator of Friends of Casco Bay (FOCB), a not-for-profit organization started in 1989 in response to concerns of water pollution. Casco Bay is an estuary in southern Maine that starts from the tip of Cape Elizabeth and extends northwesterly to the tip of Cape Small in mid-coast Maine. The Friends of Casco Bay have several programs in place to train volunteers to monitor water quality and educate people about the Bay and the importance of taking responsibility for their actions. Milholland compares water quality monitoring to a visit to the doctor. "We establish a baseline of the Bay's health so we know where to focus our efforts."

Since rain transports pesticides into the Bay, FOCB scientists collect water samples from streams or storm pipes that feed into the Bay after heavy rains. The

samples are analyzed to document the presence or absence of pesticides and nutrients commonly found in weed and feed products. The data is then used to educate the public about the harmful effects of these products on the Bay and to reduce their use by providing alternative ways to care for your lawn.

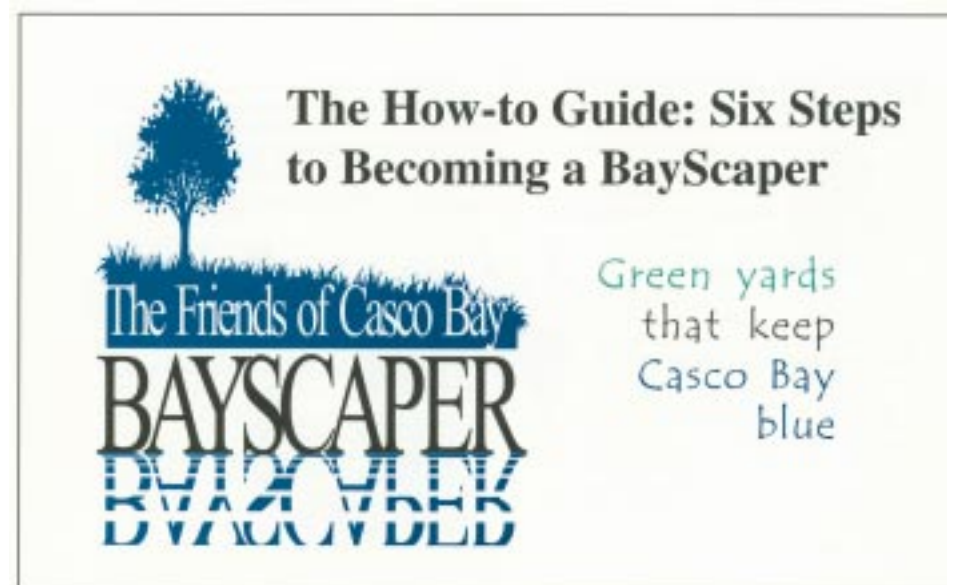
The monitoring effort is a component of BayScaper, a program that informs homeowners about lawn chemicals and water quality health. The sale of lawn care products with pesticides has dou-

bled in Maine in the last five years. And many people don't realize they are buying products with pesticides in them. Fortunately, Milholland says, the state of Maine has banned several lawn care products. The BayScaper program also educates landscapers and others how to use environmentally sound horticultural practices and products while maintaining healthy looking yards.

Keeping the estuarine waters clean is no easy task with an increasing number of people living around the Bay. Even so, adds Milholland, "More people are realizing that in order to enjoy the Bay, we all have to take care of it."

For more information contact The Friends of Casco Bay, (207) 799-8574, www.cascobay.org or the Maine Board of Pesticides Control (207) 287-2731.

Verna DeLauer, the outreach coordinator for the New Hampshire Coastal Program chairs the Gulf of Maine Council's Public Education and Participation Committee.



For this guide and other information about Friends of Casco Bay activities, access www.cascobay.org.

Gulf Log

A right-of-way for right whales

Transport Canada has given the go ahead on a proposal to alter shipping lanes in the Bay of Fundy between New Brunswick and Nova Scotia to give migrating Northern right whales a safe passage zone. Paul Doucet, a Transport Canada spokesman, said it is hoped the new lanes will be in effect by the summer of 2003. The lane change was recommended by an advisory group co-chaired by Transport Canada, with the goal of minimizing the risk of whale and ship collisions, the most common killer of right whales. The agency has asked the International Maritime Organization to move shipping lanes in the bay to skirt the area where right whales congregate.

If approved, the changes would be made near Grand Manan Island, New Brunswick, where there is an outbound shipping lane. Under the proposal, lanes will be moved about three nautical miles to the east, toward the Nova Scotia coast and away from Grand Manan.

Scientists at the Whale and Seabird Research Station at Grand Manan have observed that the mammals tend to congregate on the water's surface in the middle of the lane. The scientists are also concerned about whether the whales can hear approaching ships. Laurie Murison, the managing director of the station and a member of the advisory group that recommended the lane change, has estimated that the alteration could reduce the potential for collisions by 80 percent.

Right whales travel toward Canadian waters after ending their birthing season off Florida and Georgia. Most spend their summers feeding in the plankton-rich waters of the Bay of Fundy.

But arriving at their feeding grounds, unharmed by fishing gear or vessel collisions, is a major feat. As of early May, researchers had sighted two right whales entangled in fishing gear. The first, seen in February off Florida was a male around 21 years old, according to reports by the National Oceanic and Atmospheric Administration (NOAA). The whale was severely entangled in heavy, marine line that was wrapped twice around its rostrum with a looser loop over the back. A second whale seen near Cape Cod was a yearling, seriously entangled with multiple body wraps including lines in the mouth. For updates on the whales' conditions and more information contact Dana Hartley of NOAA at (508) 495-2090 or visit www.coastalstudies.org/.

The scoop on sewage

Controlling sewage pollution was the topic of a two-day workshop held in April at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. Sponsored by the Gulf of Maine Council and hosted by the Nova Scotia Department of Environment and Labour, the workshop included waste-

water experts from Massachusetts, New Hampshire, Maine, New Brunswick and Nova Scotia who shared and evaluated sewage management information and explained the current status of sewage management in their jurisdictions.

Andrew Gottlieb, the assistant commissioner for Policy and Planning, Massachusetts Department of Environmental Protection and a keynote speaker, called the combined sewer and storm water pipes found mostly in older urban centers one of region's major pollution concerns. The systems can overflow during storms or snow melts, spewing untreated human waste, industrial waste, toxic materials and floating debris into waterways. Though the systems are "difficult and expensive" to remediate, Gottlieb said, progress is slowly being made. Many of the overflow pipes have

communities already in the process of improving plants. Environment Canada is also developing a four-part strategy to address wastewater contaminants, Bangay said. He added that among the "most exciting" contributions to fixing the sewage problem are the education campaigns by groups like the Atlantic Coastal Action Programs. In one instance, underwater video footage of the sewage in coastal Lunenburg, Nova Scotia, taken by the local ACAP, raised public awareness and gave the town the impetus to take action. "They are now building a new sewage treatment plant as a result of that footage," he said.

The workshop provided sessions in sewage treatment innovations, ecosystem health, the costs of sewage management, regulation and enforcement, funding and public education. Four case studies were presented: two chronicling

The draft policy outlines a coastal management approach based on sensitivity to development impact and susceptibility to storm surge. Coastal areas are divided into three sensitivity zones: the areas closest to the water including beaches, dunes, rock platforms, dyked lands and salt marshes; buffer areas; and areas that form a transition from coastal to inland areas. Development would be limited in the most sensitive zones, closest to the water. The policy calls for a 30 meter (99 foot) coastal buffer for salt marshes and is designed to reduce threats to personal safety by storm surges, minimize the contamination of water and wetlands from hazardous materials or other contaminants, maintain flora and fauna and reduce the costs required to repair storm damage to public property.

According to figures from the department, 60 percent of New Brunswick's population lives within 50 kilometers (31 miles) of its 5,501-kilometer (3,410-mile) coastline. From 1990 to 1999, 6,268 new coastal lots or parcels were created with an average of 627 new coastal properties a year.

Jaime Orser, an environmental planner for the department, said they are in the process of designing an interim strategy for the most sensitive zones based on the public consultations. Regulatory and non-regulatory components, legislation and a stewardship program, will be included in the longer-term strategy for the policy, she said.

Gulf of Maine Council receives award

Last month, the U.S. Environmental Protection Agency awarded the Gulf of Maine Council and in particular, seven individuals that inspired its formation with 2002 Environmental Merit Awards. The following people were cited "for their innovative and sustained commitment" to improving the management of the Gulf Of Maine: Bill Ayer of New Brunswick (formerly with the Department of Environment and Local Government), Richard Delaney of Massachusetts (former director of Massachusetts Office of Coastal Zone Management), David Hartman of New Hampshire (director of the New Hampshire Coastal Program), Barry Jones of New Brunswick (formerly with the Department of Fisheries and Aquaculture), David Keeley of Maine (with the Maine State Planning Office), Art Longard of Nova Scotia (deceased, was with the Department of Fisheries) and Peter Underwood of Nova Scotia (formerly with the Department of Environment, now deputy minister of the Department of Agriculture and Fisheries). The awards, given out since 1970, honor individuals and groups who have shown particular ingenuity and commitment in their efforts to preserve the region's environment. This year's competition drew more than 90 nominations.



*The Gulf of Maine Expedition team
Photo: courtesy of Ramsey McDonald*

On May 4, a team of two American guides, two retired Canadian educators and volunteers, launched their kayaks from Provincetown, Massachusetts to document the ecology and culture of the 1,000 mile-long edge of the Gulf of Maine from Cape Cod to Cape Sable Island, Nova Scotia. At community presentations along the way, the team is sharing air quality test results done using ozone sensitive patches, phytoplankton analysis using a field microscope, and water quality tests using electronic probes. Their digital cameras and ultra-light laptop computer are recording the human scene. The Web site for the expedition, www.gomexpedition.org, is being updated several times a week to provide an evolving virtual documentary with a route map, images from the Gulf, observations and journal entries. Dates and activities for each stop are also available on the site.

been eliminated from the 43 communities surrounding Boston, for example, due to the state-of-the-art Deer Island treatment plant.

In addition, Massachusetts is also establishing total maximum daily loads (TMDLs) for pollutants, such as nitrogen, which spill into the waterways from industries, wastewater treatment plants and septic systems. The federal Clean Water Act mandates that states develop and adopt TMDLs for waters affected by pollutants. And to bring on-site septic systems up to code, Gottlieb added, the state now mandates that homeowners have their septic systems approved by state-licensed inspectors before they can transfer the title on their home to a new owner.

In Canada, communities are benefiting from a "green" infrastructure program started in 2000, to help provinces and municipalities fund safe drinking water and wastewater treatment projects, said Garth Bangay, the regional director general of Environment Canada, and a keynote speaker. New Brunswick and Nova Scotia will receive more than \$100 million in funding to upgrade or build new treatment systems, with several

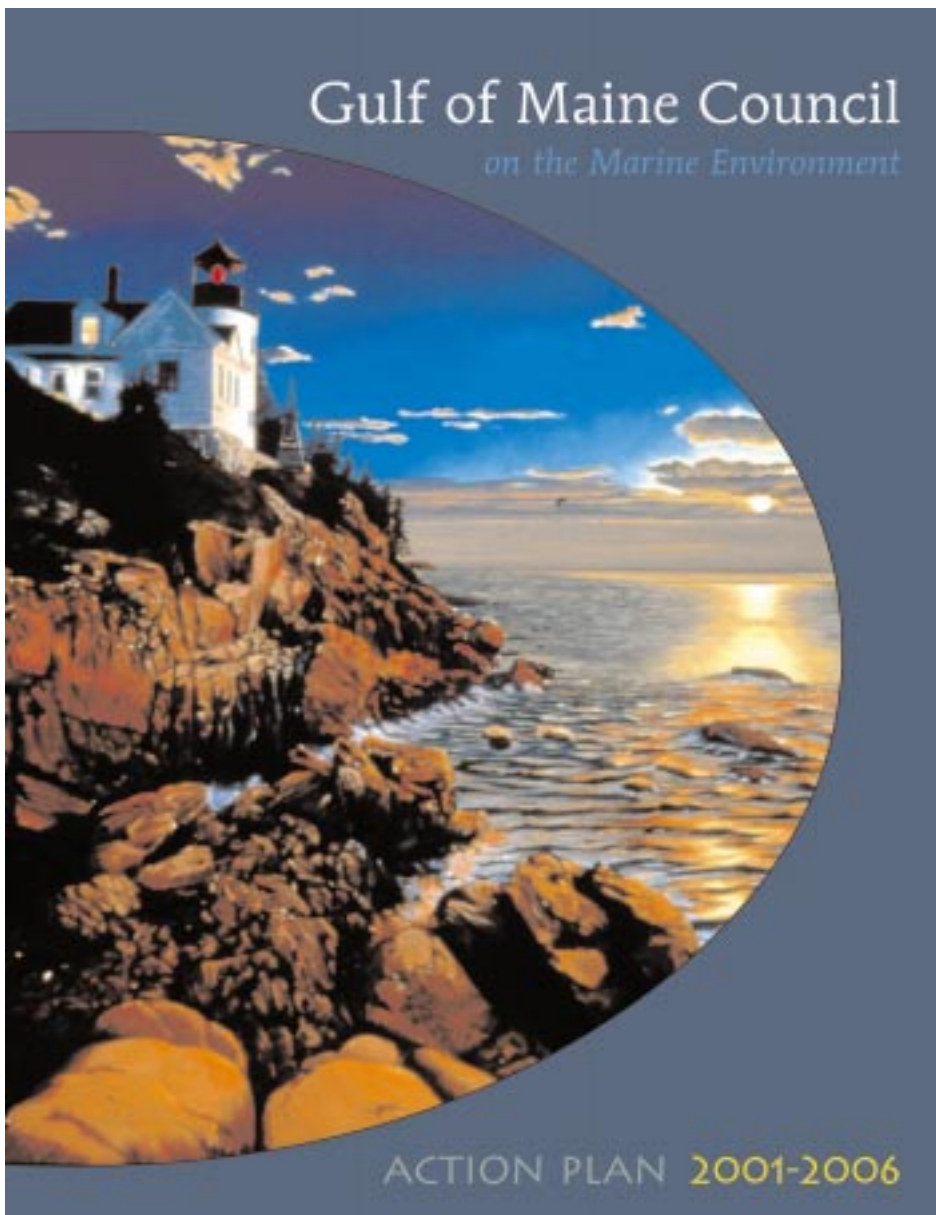
the history of sewage treatment in Saint John, New Brunswick and Bangor, Maine; one on constructed wetlands as tertiary treatment; and a presentation on non-conventional sewage treatment collection in a rural areas.

Patricia Hinch of the Department of Environment and Labour and workshop coordinator, said the two-day sessions "provided a tremendous opportunity to exchange experiences, activities, successes and failures. It gives us all a chance to learn from each others' experiences."

A workshop report will be available on the Gulf of Maine Council's Web site in the fall (www.gulfofmaine.org).

Protecting New Brunswick's coast

New Brunswick has proposed a new policy to address increasing coastal development pressures. The goal of policy according to the proposal, Coastal Areas Protection Policy for New Brunswick, is to protect the character of coastal areas while managing future coastal development in a sustainable manner.



The Gulf of Maine Council's new action plan has been finalized and will be released this summer. Look for details at www.gulfofmaine.org.

Resources Useful information about the Gulf of Maine

Where's the drought?

The National Drought Mitigation Center (<http://enso.unl.edu/ndmc>) is one of the United State's chief sources of current materials on drought and its consequences. The site offers definitions, indices and many links to other drought-related Web sites. The "Drought Watch" section links to the multi-institutional "Drought Monitor." Experts synthesize a number of drought indices to produce the monitor's map of current U.S. drought impacts, issued weekly on Thursday.

Canadian wetlands restoration partnership

A Corporate Wetlands Restoration Partnership (CWRP) similar to the one in the United States is under active consideration in the Maritimes with the Bay of Fundy as the possible initial focus. The CWRP is a public-private partnership between the federal government, state governments and private corporations in the United States with the goal of restoring wetlands and other aquatic habitats. For further information on the Canadian proposal, e-mail Reg Melanson, Canadian Wildlife Service, at reginald.melanson@ec.gc.ca. For information on the CWRP, access <http://www.coastalamerica.gov/text/cwrp.html>.

Stellwagen Bank and more

The new U.S. Geological Survey Stellwagen Bank Web site is now online and titled: *USGS National Geologic*

Studies of Benthic Habitats, Northeastern United States: Stellwagen Bank National Marine Sanctuary Region off Boston, Massachusetts. The site offers seafloor maps, posters, a list of publications, photographs of seabed habitats and various fauna and imagery of geologic features. Go to <http://woodshole.er.usgs.gov/project-pages/stellwagen/>.

Coastal conditions report

A U.S. federal report confirms the declining quality of U.S. coastal waters and the threat that this trend poses to both humans and marine life. The report calls for a national strategy to combat nitrogen and phosphorus pollution in coastal waters. The overabundance of these nutrientsoften from agricultural runoff, sewage treatment plants and fossil fuel emissionsis causing serious environmental damage on all of the nation's coasts, according to the report. The report is available at <http://www.epa.gov/owow/oceans/nccr/>.

Coastal sprawl threatens ecosystems

The Pew Oceans Commission's latest scientific report on the state of the nation's oceans, entitled "The Effects of Urban Design on Aquatic Ecosystems in the United States," links over-development along the coasts to the declining health of aquatic habitats. Although U.S. coastal counties account for only 17 percent of the nation's area, they are home to more than half the U.S. population. An additional 27 million people are estimated to be funneling into this narrow corridor over the next 15 years. The

Calendar

The 2002 Mercury Conference sponsored by the Northeast States for Coordinated Air Use Management and the U.S. Environmental Protection Agency Region 1 (New England) will take place June 12 through 13 at the Nonantum Resort in Kennebunkport, Maine. The conference will provide the northeast states and Atlantic provinces environmental and public health agencies an update on the state-of-the-science and regulatory programs that address mercury impacts in the northeast U.S. and the Atlantic provinces. Topics will include new mercury health information, a status report on power plant controls, impacts on wildlife, new mercury sources to consider: indoor air, landfills, cultural uses and regional research in the northeast. For registration information contact Jeri Weiss at EPA (617) 918-1568 or Margaret Round at NESCAUM (617) 367-8540, ext. 212.

The Science and Local Knowledge: Making the Linkages Work in Canada's MPAs Workshop is scheduled for June 19 through 21 at the Université de Moncton in Moncton, New Brunswick, Canada. The objective of the workshop is to examine the challenges and issues regarding public access to information to improve the linkages between science and local knowledge in Canada's marine protected areas. For information, e-mail Marise Robichaud.<http://www.umoncton.ca/chairedd/mee/english.html>.

Coastal Zone Canada 2002 is scheduled for June 24 to 28 in Hamilton, Ontario. The theme of the conference is *Managing Shared Waters: Towards Sustainable Transboundary Coastal Ecosystems*. The main goal is to address the capacity needs of the international community to implement sustainable water resource management practices in real situations. To register go to www.pollutionprobe.org/managing.shared.waters/index.htm.

The Wetlands Health Assessment Toolbox (WHAT) team, a partnership between the Massachusetts Office of Coastal Zone Management, Massachusetts Bays Program and Salem Sound 2000, is holding a series of workshops throughout the summer. The workshops will train volunteers on salt marsh monitoring techniques focusing on vegetation, fish, aquatic macroinvertebrates, land use, water chemistry, tidal influence, and birds. For more information on the WHAT training workshops, e-mail info@salemsound.org or call Britta Magnuson at (978) 741-7900.

The impacts of fishing gear will be the topic for a major national symposium sponsored by the American Fisheries Society on November 12 to 14 in Tampa, Florida. The symposium is co-sponsored by the Ecological Society of America, U.S. Geological Survey and the National Oceanic and Atmospheric Administration. For more information see <http://walrus.wr.usgs.gov/bh2002/index.html>.

Wetlands and fish publication

Wetlands and Fish: Catch the Link, is the title of a new publication jointly developed by the Izaak Walton League, National Marine Fisheries Service (NMFS) and the U.S. Geological Survey (USGS) Biological Resources Division. The document provides information on how wetlands are important to fish and what fish might be in wetlands in a particular local area. The text is geared to the general public, but the tables and references will be of interest to fishermen and scientists as well. For a free copy contact the NMFS Office of Habitat Conservation at (301) 713-2325 or susan.stedman@noaa.gov.

Pesticides and frogs

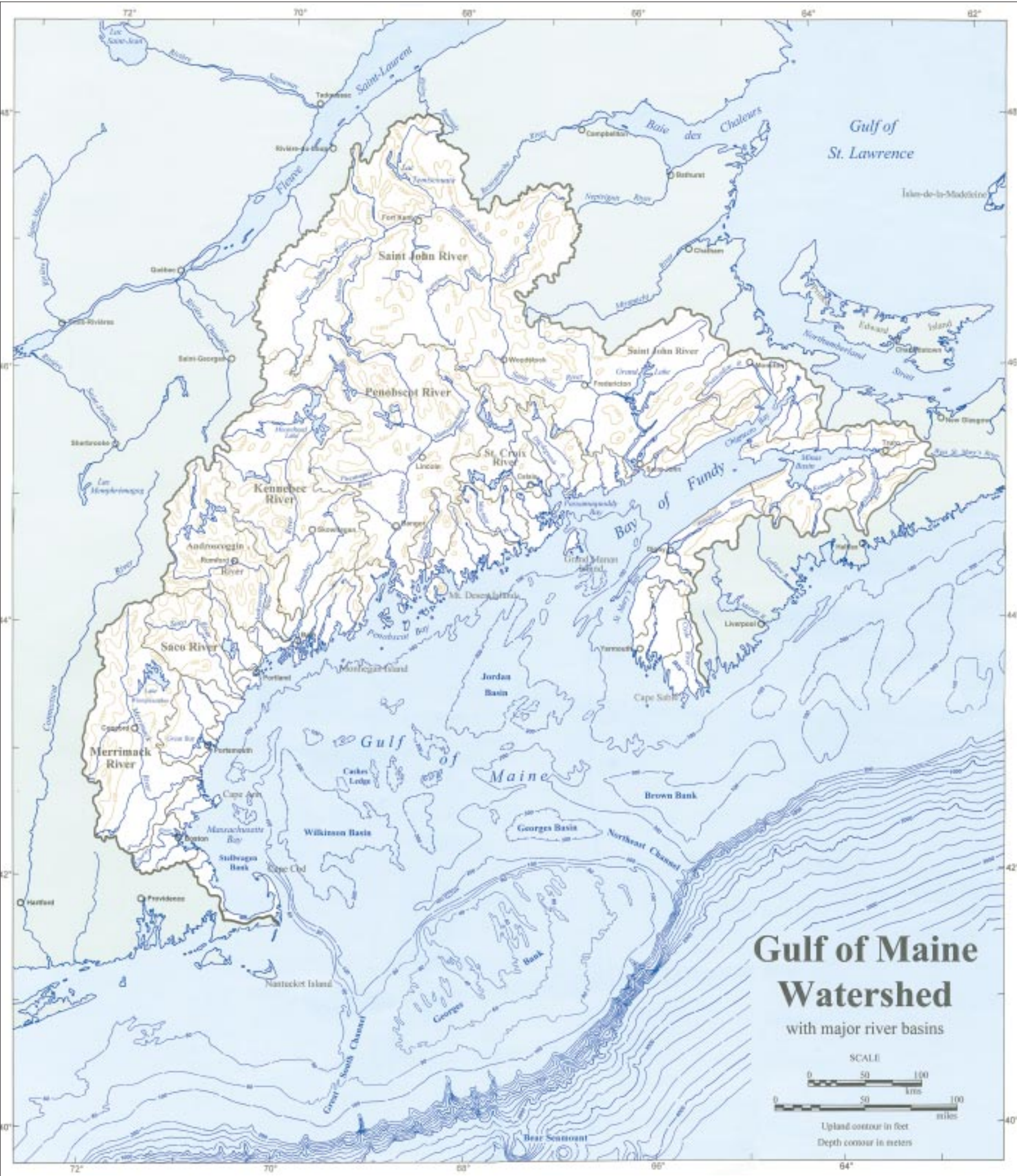
Researchers have found that even very low doses of atrazine, a common weed killer, can cause male frogs to develop multiple sex organs—and sometimes both male and female organs.

The research was reported in the April 16 issue of the *Proceedings of the National Academy of Science*, (www.pnas.org). Atrazine is the most commonly used weed killer in North America, and appears in rainwater, snowmelt and groundwater. The researchers found that atrazine affected frogs at doses as small as 0.1 part per billion. The U.S. Environmental Protection Agency allows as much as 3 parts per billion of atrazine in drinking water.

report details the effects of poor urban design and land-use practices on aquatic ecosystems in the United States and new strategies and tools that communities may use to preserve the same ecosystems that attract residents, tourists and businesses to the coasts. For more information or a copy of the report, go to www.pewoceans.org.

Pharmaceuticals and hormones

Another new report by the U.S. Geological Survey (USGS) looks for the first time at the presence of many human and animal pharmaceuticals, hormones and common organic chemicals in the nation's waterways. Published in the journal *Environmental Science & Technology*, "Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams, 1999-2000: A National Reconnaissance" shows that multiple medical drugs (including antibiotics), both natural and synthetic hormones and many other organic wastewater-related chemicals have been detected, though usually at very low levels, in 80 percent of streams sampled nearly everywhere across the United States. Most of the chemicals examined (81 of 95) do not have state or federal drinking water standards. Chemicals commonly found in households, or used in agriculture or industry, find their way into sewage treatment systems but are rarely monitored, and secondary water treatment often cannot eliminate them. The full report is available at http://pubs.acs.org/hotartcl/est/es011055j_rev.html.



Map by Richard D. Kelly Jr., Maine State Planning Office, 1991; revised 1999.

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