

Times

Gulf of Maine

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

Fishermen, scientists bridge Gulf with research

By Suzy Fried, Editor

Gulf of Maine — From studying squid mating habits to modifying fishing gear to prevent whale entanglements, fishermen and scientists are expanding their understanding of the Gulf of Maine, and of one another, through diverse collaborative research projects.

Several factors are contributing to what sources describe as an increase in joint research projects. One is that fishermen want more of a role in managing their fisheries. Another is that government agencies need help collecting data, especially in Canada, where budget cuts are limiting federal researchers' time in the field. But most important is what fishermen and researchers describe as a growing understanding and appreciation of one another's contributions.

"Scientists and fishermen have learned to communicate better and work together to ensure the sustainability of the resource. A new conservation ethic is developing," said Patty King, Project Manager for the Fishermen and Scientists Research Society (FSRS) in Canada's Scotia-Fundy region.

"In a lot of cases, they need each other to be successful," observed Rollie Barnaby, a former fisherman and an Extension Educator at the University of New Hampshire (UNH) Sea Grant Extension Program. At UNH, he said, "There's a fairly long history of connecting scientists and fishermen together." The same is true for other universities in the Gulf.

Fishermen are involved in Gulf of Maine research to varying degrees:

providing vessels, equipment, and crew; helping to collect data; and serving as advisors. In some cases, they are initiating and designing research efforts, though Barnaby and others say this should occur more often.

Researchers recruit fishermen to participate in their projects through industry organizations, fishermen's cooperatives, community-based fishery association meetings, or by walking the wharves and talking with fishermen they know, or who know fishermen they know.

Fishermen also get involved through bidding processes and contracting agencies. CR Environmental Inc., an oceanographic and ecological consulting firm in East Falmouth, Massachusetts, matches government, private, and academic organizations with fishing vessels that are chartered for oceanographic sampling, research, and survey operations, according to company President Charlotte Cogswell.

A boat brokerage service is also being developed by the Northwest Atlantic Marine Alliance (NAMA), a Saco, Maine-based organization of fishermen and others with an interest in the Gulf's marine environment. Executive Director Craig Pendleton said NAMA is developing profiles of vessels — including his own — that are available for scientific work.

Who wants to know

As fishermen and researchers pursue opportunities for collaboration, they are bolstering mutual trust and credibility,

Fishermen/researchers *continued on page 6*



Photo: A. Carr/MA Division of Marine Fisheries

Captain Henry Souza extracts fish from one codend of a trouser trawl net. The trouser trawl has two codends, enabling fishermen and Massachusetts Division of Marine Fisheries (DMF) researchers to conduct comparative testing. DMF works with fishermen on experimental fishing gear and numerous other research projects.

Proponents: Hague Line reserve would help ecosystem, fisheries

By Suzy Fried, Editor

Gulf of Maine — Supporters of a proposal to establish a marine reserve along the boundary dividing the Gulf's US and Canadian waters say prohibiting fishing and other activities there would help to regenerate commercial fisheries and provide valuable research areas.

Describing the logistics of establishing a multinational marine reserve as formidable, but not insurmountable, proponents cite their biggest difficulty as winning public support for the proposal, especially among marine users. Many commercial fishermen, for example, dread more restrictions on where they can fish in the Gulf.

According to Ron Huber, Director of the Coastal Waters Project (CWP) in Rockland, Maine, that organization, along with Canadian and US researchers, is pushing for designation of a marine reserve on the Hague Line, the international boundary

established by the International Court of Justice in the Hague, the Netherlands. The reserve would define a strip of ocean about 200 miles (320 kilometers) long and a little more than six miles (10 kilometers) wide, stretching from the top of Jordan Basin through Georges Bank.

Huber said the reserve would protect diverse types of habitat that are home to an extensive array of species, possibly including some undiscovered ones. Left alone to recover from human activity, he said, the site would become a treasure trove for researchers studying "what a natural ecosystem in the Gulf of Maine is supposed to be like." He called this "essential for wise management of offshore fishing, mining, and oil drilling."

During a workshop at the New England Aquarium in April organized by the Marine Conservation Biology

Hague Line *continued on page 8*

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Visit the Gulf of Maine Council's web site at:

www.gulfmaine.org

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Think regionally, take action in your own backyard

By Robert W. Varney, Commissioner
New Hampshire Department of Environmental Services

On a cold weekend last November, more than 900 clambers (including yours truly) braved the elements to take advantage of the reopening of the Middle Ground clam flats in Hampton/Seabrook Harbor along New Hampshire's coast. We lined up before dawn to wait for a ride out to the flats in a small outboard launch. There, we were rewarded with a plentiful supply of softshell clams, easily harvesting the 10 quart (9.5 liter) limit. This was the first time in nearly ten years that this popular and productive shellfish area had been open for harvesting, and my fellow clam diggers responded enthusiastically.

This fall, a small group of researchers and environmental managers will also be harvesting shellfish along New Hampshire's seacoast, but they won't be bringing their harvests home for dinner. The mussel samples collected by staff from my department and the University of New Hampshire (UNH) Jackson Estuarine Laboratory will be

shipped off to laboratories in Maine and Canada. There they will be analyzed for organic contaminants and heavy metals, as part of the regional Gulfwatch toxic contaminant monitoring program.

These are just two examples of how New Hampshire, as a member of the Gulf of Maine Council, is increasing its



Photo: NHDES

investment in issues of important regional concern.

The Gulf of Maine Council's *Action Plan: 1996 - 2001* lists reducing toxic contaminants in the region as one of its top five goals. For the last six years the Council's Gulfwatch mussel monitoring program has helped us to better understand and define the problem of toxic contaminants by sampling sites throughout the region every three years. Our department is working

closely with the Jackson Laboratory to double the number of sampling sites in New Hampshire from six to 12, and to increase sampling frequency here to every two years. We'll be augmenting regional monitoring while also gaining valuable information on our own coastal waters.

Another Council Action Plan goal is shellfish habitat restoration. The plan sets region-wide measurable objectives for reopening shellfish beds. In New Hampshire, we are working to reopen 700 additional acres (283 hectares) of closed shellfish beds by 2001, and another 1,000 acres (405 hectares) by 2005. We will also work to triple our numbers of harvestable clams and oysters by 2005.

I believe strongly in the importance of regional cooperation on environmental issues. But the success of regional efforts depends on local actions. As New Hampshire increases its investment in shellfish habitat restoration and toxic contaminant monitoring, I hope that you will join us by investing in similar efforts in your jurisdiction.

Letter to the Editor

Dear *Gulf of Maine Times*,

Someone just gave me a copy of your Winter 1998 issue (Vol. 2 No. 4), which is excellent.

I have to carp, however, at your arbitrary boundary of the Gulf of Maine watershed map. You show the line coming through the Cape Cod Canal, down Buzzards Bay, through Woods Hole, and into Nantucket Sound, leaving Martha's Vineyard and the Elizabeth Islands beyond the pale.

Well, folks, if you look at the tidal charts, you'll see the currents flowing from the Atlantic through Vineyard Sound and on through Nantucket Sound and out through the shoals between Cape Cod and Nantucket.

I hope that you'll change your very arbitrary boundaries and include all these islands. Our island certainly should be included if Nantucket is!

Thanks,

Virginia C. Jones
Martha's Vineyard, Massachusetts

Editor in Chief Anne Donovan:

The truth is, the boundary line shown on the Gulf of Maine Watershed map that has appeared on page 12 of previous issues of the Gulf of Maine Times was established in a relatively arbitrary fashion. When discussing what the boundary should be, members of the Gulf of Maine Council on the Marine Environment agreed that Georges Bank is part of the Gulf of Maine. They then looked at the currents feeding the Bank and determined that some of the waters south of Cape Cod were part of the overall system. They drew a line that would include these currents in the Gulf of Maine, but never really determined the true southern or western extent of where the boundary would lie.

The recently revised official Gulf of Maine Watershed map (see page 12) was developed using a less arbitrary method to determine the extent of the Gulf of Maine watershed. This map considers Cape Cod Bay to be the most southern point of the circulating gyre that is the Gulf of Maine. Consequently, the Cape Cod Bay watershed boundary is the delineation. This

boundary cuts along the spine of Cape Cod, placing northern areas in the Gulf of Maine watershed and excluding the rest.

Clearly, with the new map, even less of Massachusetts' coastal waters is considered part of the Gulf of Maine. In truth, however, you are right that the coastal currents at least to the Elizabeth Islands (and probably beyond) are directly connected to the rest of the Gulf. With this in mind, Massachusetts will treat all of its coastal waters and watersheds as part of the Gulf of Maine for planning and implementation of environmental protection initiatives.

Thank you for your astute comments and your interest in the Gulf of Maine.

Correction On page 6 of the March 1999 *Gulf of Maine Times* (Vol. 3 No. 1) two aerial photographs of Maine's Bangor/Brewer area are shown. The orientation of the top photo gives the impression that Brewer is on the north side of the Penobscot River and Bangor is on the south side of the river when, in fact, the opposite is the case. Also, captions describe the photos as showing the Bangor Mall area, but they actually show much wider areas of the cities of Bangor and Brewer. The editors apologize for the errors.

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New theory: Tidal mixing creates red tide incubator

By Nick Howe
University of Maine, Department of Public Affairs

Orono, Maine — Last fall, when scientists proposed a new theory about the cause of red tide outbreaks in the Gulf of Maine, they took a cautious course. Their ideas were based on shipboard observations and preliminary data.

Since then, laboratory analyses of water samples have provided support for the theory that *Alexandrium tamarensis*, a species of marine algae that causes paralytic shellfish poisoning (PSP) in New England and the Canadian Maritimes, thrives in the eastern Gulf under conditions associated with cold, well-mixed, nutrient-rich waters and seasonal circulation.

The new theory could pave the way for predicting red tide outbreaks and reducing their impacts on human health and the region's shellfish industry. It has emerged from work by David Townsend, Neal Pettigrew, Andrew Thomas, and their students, all of the University of Maine, who are collaborating with scientists from other research institutions including Jennifer Martin of the Canadian Department of Fisheries and Oceans at St. Andrews, New Brunswick; Donald Anderson at the Woods Hole Oceanographic Institution (WHOI); Ted Loder at the University of New Hampshire; and Maureen Keller at the Bigelow Laboratory for Ocean Sciences.

The researchers are nearing the end of the second year of a five-year project and have earned more than \$5 million in grant support from the National Science Foundation and the National Oceanic and Atmospheric Administration.

"We think we're on the verge of understanding what causes red tide outbreaks in the Gulf," says Townsend. "This is the first time anybody has gone out and really looked from ships out in the Gulf. Up to this point, most of our information came from near-shore measurements and extrapolation."

The term "red tide algae" is a misnomer because harmful algae rarely reach densities high enough to turn water red, and they are not caused by the tides. Nevertheless, some species do have red pigments and when they appear in near shore waters in large concentrations, or "bloom," they can contaminate shellfish with toxins. They include diatoms and dinoflagellates such as *Alexandrium*. The diatom pseudo-nitzschia produces the toxin domoic acid, which causes amnesic shellfish poisoning and was responsible for deaths among shellfish consumers in Prince Edward Island in 1988.

Alexandrium causes PSP, which, according to Donald Anderson of WHOI, is a life-threatening syndrome. Symptoms include tingling, numbness, burning sensations, loss of muscle coordination, giddiness, drowsiness, fever, and rash. The most severe cases result in respiratory arrest within 24 hours of consumption of the toxic shellfish.

The theory

According to the theory, *Alexandrium* grows in the nutrient-rich water that

stays just below the surface in the eastern Gulf of Maine. Strong tides in the Bay of Fundy mix deep waters and nutrients and bring them into closer contact with surface waters. Currents carry this plume southwest along the coast of New Brunswick and Maine. At a point near Jonesport, part of this current turns south toward deep water.

Alexandrium is found in abundance in and on the edges of this current. In the microscopic world of marine algae, *Alexandrium* is a relatively large organism with the ability to swim. It turns out that this ability to swim — especially vertically — may give the species an advantage, says Townsend, particularly during the mid and late summer months.

That's because, as the summer wears on, a layer of warm water tends to develop at the surface of all northern hemisphere water bodies. If left undisturbed by strong tides or currents, the warm water is like a wet blanket on a smoldering fire. Lacking in nutrients, it tends to dampen the growth of algae. Moreover, it pushes colder, nutrient-rich water down to

shore. Their transects ranged from Cape Cod to just east of Grand Manan Island (see maps on the Web at crusty.er.usgs.gov/ecohab/).

"By the time we did the August survey, we could look at the print out of how water temperatures changed with depth and say whether we were or were not going to find *Alexandrium* there. It worked quite well," says Townsend.

Rivers and the sandwich

The theory also explains other observations that scientists have made about red tide in past years. For example, local pollution sources have been thought to promote red tides. Since fresh water tends to stay on the surface of the Gulf, high levels of nutrients coming out of rivers discharging to the Gulf can indeed give *Alexandrium* a boost.

Monhegan Island has also been known as a red tide "hot spot," says Townsend, who wrote a scientific paper in 1983 proposing an explanation. "Turns out I was dead wrong. There's always been a lot of toxicity in

of Marine Resources (DMR). John Hurst at DMR refers to this as the sandwich. Nothing in the middle and bread on both sides. Nobody really understood it," says Townsend.

Based on the observation that the nutrient-rich current moves away from the coast at Jonesport, it makes sense that *Alexandrium* would be much less abundant there.

"The theory provides for the first time a foundation that's purely oceanographic in nature, rather than that there's a source of pollution here, and something else there. It clearly shows us that it's the oceanography of the region that controls this. Unless we have oceanographers applying themselves to these problems, these things will remain elusive, and that's been the case until now," Townsend says.

The five-year project is part of an international effort to understand the causes of toxic algae outbreaks that have plagued the world's coastal waters in recent years. For more information visit crusty.er.usgs.gov/ecohab/ on the Internet.

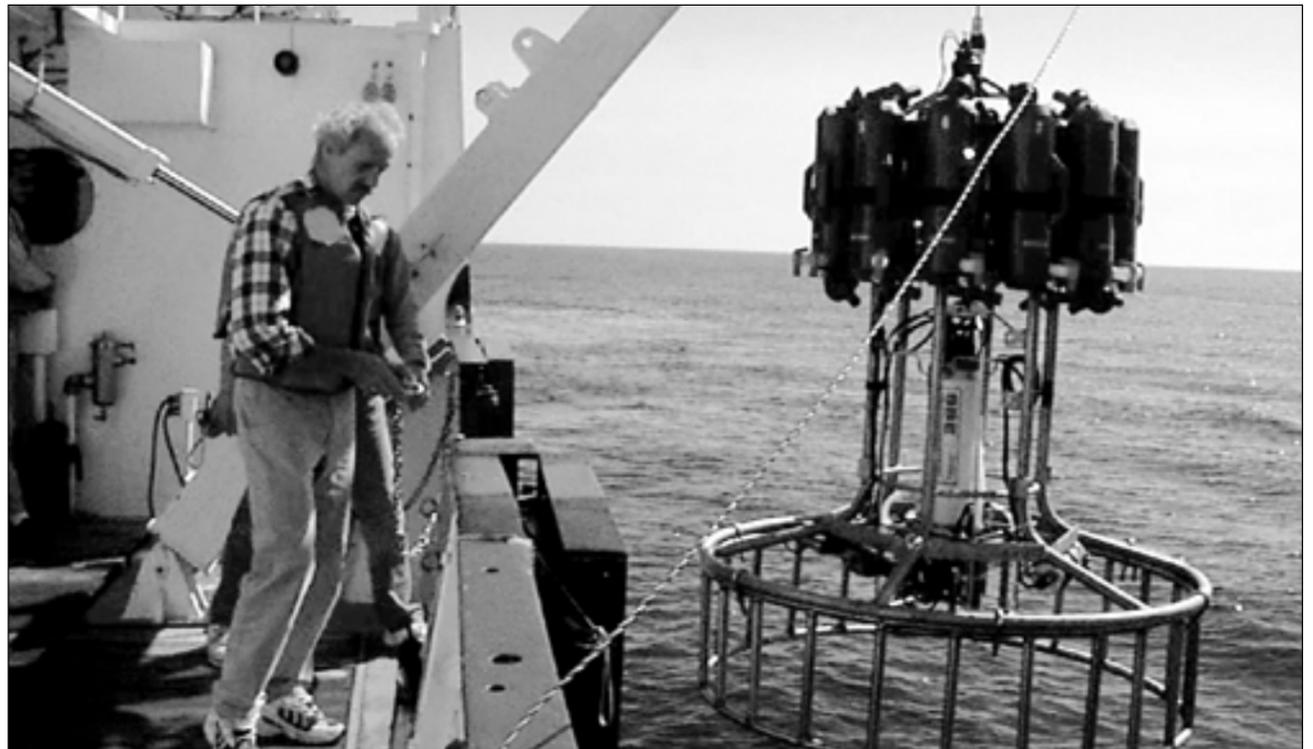


Photo courtesy of the University of Maine

depths where there is not enough light for algae to grow.

"It turns out from other studies done in the lab that *Alexandrium* needs high levels of light and nutrients. These two things are usually mutually exclusive in the ocean. In the summertime, other phytoplankton have already used up the nutrients in the surface waters. It's pretty well depleted. The light is highest in the surface waters, and it's dark down deep where there are lots of nutrients. You have to bring the two together, and this tidal mixing in the eastern Gulf of Maine brings them together," Townsend explains.

With nutrient-rich water only a few meters below the surface, the theory goes, *Alexandrium* is able to swim down to absorb the necessary nutrients at night and return to the surface during the day to bask and grow in sunlight. In the western Gulf of Maine, nutrient-rich water is too deep, beyond the reach of the algae.

During cruises last June, July, and August, the researchers collected more than 2,000 water samples at 215 different points along the coast up to 70 miles (113 kilometers) off the Maine

the mussels out there. It's always the first one to become toxic in the summer. It's the only one we sample on a regular basis that's off shore. Everything else we sample is along the coast. This is the only outer island that's sampled. If you're going to look for it to occur first, you'd naturally look for it out where it lives."

Another mystery involves a stage in the *Alexandrium* life cycle known as a cyst. The algae form cysts when they are under stress. When conditions improve, the cysts respond by developing into active cells.

"Well, the cysts are in the water all the time," says Townsend. "It's like saying where do the diatoms come from in the spring in the middle of the Atlantic Ocean? The answer is, there are always some around."

Scientists have also known for many years that red tide algae are rarely seen along a section of the Maine coast from eastern Penobscot Bay to Jonesport. "Either side of that, we see PSP in the mussels that are monitored by the Maine Department



Photo: Nick Houtman/University of Maine

Top: During a July, 1998 research cruise in the Gulf of Maine, Dave Townsend of the University of Maine and Ted Loder (hidden from view) of the University of New Hampshire prepare to lower an electronic data acquisition package off the RV Cape Hatteras, owned by the National Science Foundation.

Bottom: University of Maine researchers Abby Deitz (left) and Maura Thomas (right) prepare sea water samples for biological analysis as part of the search for the origin of red tide.

Whales migrating as protection measures unfold

By Suzy Fried, Editor

Woods Hole, Massachusetts — This year's north Atlantic right whale migration through the Gulf of Maine was jarred early in the season by the discovery of a dead whale in Cape Cod Bay. Meanwhile, activities continue on land to address threats to endangered whales.

Scientists believe approximately 300 right whales now live in the north Atlantic. Once hunted to near extinction, they are now threatened by collisions with vessels, entanglement in fishing gear, and loss of habitat — factors that threaten other whale species as well. Massachusetts and US federal regulations prohibit vessel operators from approaching right whales within 500 yards.

On April 20, a whale survey team from the Massachusetts Division of Marine Fisheries discovered a dead female right whale in Cape Cod Bay. First identified in 1974 and nicknamed "Staccato" by researchers, she was known to have given birth to at least six calves during her lifetime and was

last seen alive on April 15. A necropsy (animal autopsy) revealed evidence of disease, as well as broken bones indicating a ship struck the whale before she died, said David St. Aubin of the Mystic Aquarium in Mystic, Connecticut. Laboratory analysis of information gathered during the necropsy is expected to help determine the whale's exact cause of death.

A week earlier, Massachusetts officials had issued an urgent warning to all mariners operating in the eastern half of Cape Cod Bay and around Provincetown to slow their vessels and post watch for north Atlantic right whales through the end of April, when the animals move to offshore feeding grounds. At least 20 of the whales were known to be surface feeding in the area. Because they lack dorsal fins, right whales are very hard to see and therefore especially susceptible to collisions with vessels.

This spring, the Canadian Right Whale Recovery Team issued a series of recommendations for increasing the north Atlantic right whale population, while the National Marine Fisheries

Service (NMFS) issued a plan in February to protect endangered whales off the US Atlantic Coast from entan-

glements in fishing gear. The NMFS plan, which took effect April 1, continues seasonal closures of some fishing grounds and makes some changes to gear restrictions already in place for lobster pot and gillnet gear, among other measures.



Photo: New England Aquarium

glements in fishing gear. The NMFS plan, which took effect April 1, continues seasonal closures of some fishing grounds and makes some changes to gear restrictions already in place for lobster pot and gillnet gear, among other measures.

Meanwhile, whale watch operators throughout the Gulf are working under

New recommendations and measures in Canada and the US are intended to prevent injury to endangered whales, such as the north Atlantic right whale, above. Whales in the Gulf face numerous threats including collisions with vessels and entanglement in fishing gear.

Petitcodiac Causeway experimental opening begins

By Suzy Fried, Editor

Fredericton, New Brunswick — Provincial and federal agencies planned in May to open one or more of the controversial Petitcodiac River Causeway's five water regulation gates on an experimental basis. Government officials will study the effects of the experimental opening to determine the feasibility of restoring free flow to the tidal river. Options for doing so range from opening its gates to removing the causeway altogether.

Flowing through southeastern New Brunswick to the Bay of Fundy, the Petitcodiac is one of many rivers in the Gulf blocked by dams and causeways. The 3,400-foot (1,036 meter) causeway that spans the river, linking the communities of Moncton and Riverview, has been a point of debate since its construction 30 years ago. Its water regulation gates have been kept mostly closed since then, and this has created a head pond upstream of the causeway that some call Lake Petitcodiac.

Proponents of free-flow claim that the structure is killing the river's natural ecosystem by blocking anadromous fish access and preventing the tidal exchange of fresh water and salt water. But the Lake Petitcodiac Preservation Association (LAPPA), which includes Riverview residents and others opposed to opening the causeway, argues that restoring free-flow would also have negative environmental ramifications.

Opening the causeway gates to allow free-flow, they contend, would cause the head pond to drain and receive large deposits of silt, destroying an ecosystem and valuable recreational resource. They assert that a free-flowing Petitcodiac would also pose public health risks by eroding a landfill and exposing water supply and sewage lines, and may also affect lobster

breeding grounds at the river's mouth.

New Brunswick Department of Environment spokesman Peter McLaughlin acknowledged that free-flow might result in heavy silt deposits, depending on the option chosen to achieve free-flow, but he emphasized that precautions are being taken to prevent such problems during the experimental opening. These include keeping the head pond at a low elevation, and limiting the duration of the experiment.

Experiment a year late

This spring's experimental opening was originally to have taken place a year ago under the supervision of the provincial transportation and environment departments and two federal departments, Environment Canada and the Department of Fisheries and Oceans. In 1997, the agencies announced that one of the causeway's gates would be opened daily for seven months beginning in Spring 1998 to allow fish to pass through. The agencies planned to study the resulting effects to determine further action.

The project stalled, however, when LAPPA sought a federal court injunction to postpone the experimental opening pending completion of an environmental impact assessment of its potential effects. According to LAPPA spokesman Victor McLaughlin, the group had repeatedly, but without success, asked the federal agencies to undertake such an assessment, which he said is required by law, and sought the court injunction "as a last resort." In April 1998, he noted, the court determined that the issue should be settled by negotiation.

According to Peter McLaughlin, the legal proceeding delayed the project until after last spring's flooding. This prevented the province from taking advantage of spring flood waters to scour out the upstream sediment deposits that had to be removed before the

experimental opening could take place.

The federal and provincial governments issued a draft screening report in February of this year on the anticipated effects of the experimental opening, and decided to undertake the project following a public comment period on the draft. The final version of the report was released in April 1999.

Peter McLaughlin said government agencies will report on the results of the experimental opening. Any proposed steps to restore free-flow would be subject to the Provincial Environmental Impact Assessment process, he added.

In April, as preliminary flushing of the causeway was under way, Peter McLaughlin anticipated that the experimental opening would follow within a month. He said the province was draining the head pond to cut a channel through a mud plug upstream of the causeway, so that water can move back and forth during tidal exchange.

The province was also lowering the head pond from its usual 18- to 20-foot (5.5- to 6-meter) level to the level of the original river channel — eight feet (2.5 meters) — to prevent sediment from depositing on the head pond's mud flats during the experiment, Peter McLaughlin explained. The rate of sediment accumulation downstream of the causeway will determine the duration of the experiment. He said he doubts the project will last the seven months originally planned, anticipating that within several weeks, enough sediment could accumulate downstream of the head pond to cause it to rise above the desired eight-foot (2.5 meter) level.

Both sides waiting, watching

LAPPA is waiting to see what happens as a result of the experimental opening before taking any further steps, said Victor McLaughlin.

"They're talking and they're watching," he said of the group. "There's no intention of any interference or legal action or anything." LAPPA is concerned about the experiment, however. "There are some things we're not too enthused about. What we will have, when they open up the gates there, is effluent from the sewage treatment plant. So we're not very happy about that, but we'll see what they learn," said the Riverview resident.

"We know [the experiment] won't go seven months," said Michel LeBlanc, spokesman for Ecoverite, a University of Moncton Environmental organization that has led the campaign for a free-flowing Petitcodiac, "But the government has assured us they will get the data they need to be able to go to the next level — a full environmental assessment [of opening all five gates]. We'll be watching them very closely to make sure the political climate either way doesn't become a factor and that they follow the science."

According to Le Blanc, "Ecoverite would prefer that the government study taking a good chunk of that causeway out." If the experiment results in a recommendation to open all five of the causeway's gates to allow free-flow, "they might as well pull a good chunk out," he asserted. "That's an agenda we're going to have to push over the next year."

THE FINAL SCREENING REPORT on the Petitcodiac River Causeway experimental opening, along with other documents and an animated visual depiction of various stages of the project can be viewed at <http://www.atl.ec.gc.ca/Petitcodiac/index.html>. Copies of the report can also be obtained by calling (506) 851-7768 or (506) 851-7729.

Charlie Swain: Cape crusader champions clean boating

By Suzy Fried, Editor

Falmouth, Massachusetts — In his youth, Charlie Swain would walk down to Quisset Harbor on Buzzards Bay nearly every day. He'd shellfish or row a dinghy out to the buoys to fish for scup and rock bass. Or sometimes he'd head over to the family boatyard on the Child's River, a tributary of Waquoit Bay, to help paint buildings or just hang around.

After high school, Swain spent more than 20 years working for the Mead Paper Co. in Ohio until his father and uncle asked him to come back in 1979 to take over the boat yard so they could retire. He returned to find his hometown harbor a mess. "The first thing I noticed was you couldn't catch any more fish in Quisset Harbor for some reason," he recalls. "All the eelgrass had disappeared and shellfish were getting thin." And Waquoit Bay was suffering the effects of pollution as well.

While living in Ohio, Swain had followed the cleanup efforts on Lake Erie. "Before I left," he recalls, "The commercial fishery was back, the beaches were opened." Work was also under way to clean up Ohio's notorious Cuyahoga River — at one time so polluted that it caught fire. "So when I got back here and saw the mess, I said, 'We should be able to clean this up, this is terrible,'" he says.

A new course

Upon his return to the Cape, Swain immediately became involved in efforts to designate Waquoit Bay, which opens into Nantucket Sound, as an Area of Critical Environmental Concern under the Massachusetts Coastal Zone Management Program (MCZM). His own concern eventually led him to pursue a gradual environmental make-over of his business.

Appointed by then-Governor Michael Dukakis to MCZM's Coastal Resources Advisory Board (CRAB), Swain also became involved in reviewing the agency's programs, informing the public about coastal environmental issues, and especially educating the marine business community about ways to clean up their own operations. Swain favors education and support over regulations and fines. He believes people are inclined to go along with greener methods once they understand more about their benefits and that "clean business is good business."

For example, he is looking for funds to help boatyards that are not hooked into municipal sewer lines to install systems to collect runoff from their boat-washing and servicing operations. These sorts of systems help prevent the contaminated runoff from draining into coastal waters, but are not affordable for some businesses. His own boatyard's service areas have concrete floors with drains and sediment traps.

"He's amazingly dedicated and forward-thinking in terms of environmental awareness, particularly as it relates to marina and boatyard operations," says Truman Henson, MCZM's Regional Coordinator for Cape Cod, Nantucket, and Martha's Vineyard.

Swain, who also campaigns for environmental concerns as a member of the Falmouth Planning Board and the local planning committee for the Cape Cod Commission, suggests that most environmental damage on the Cape has resulted from a combination of explosive growth and inadequate planning. "When I was a kid there were only 8,000 people in the town of Falmouth. Now there are 32,000," he notes.

No leaks allowed

Swain requires each of his customers, some of whom have been coming to the Edwards Boatyard for generations, to sign a contract binding them to adhere to the marina's environmental practices in order to keep their slip or mooring. Requirements include using nontoxic antifreeze and biodegradable cleaners; properly disposing of hazardous and septic wastes; and keeping bilges scrubbed clean of oil and sediment. Marina staff show customers how to fill their fuel tanks without spilling any fuel into the water. And, says Swain, "We don't allow any leaky engines." He also claims to have provided the town's first pump-out station for

locations of septic pumpout facilities, and local habitat protection and conservation efforts.

Swain's marina also brings its philosophy into the surrounding community, co-sponsoring, along with MCZM, an annual cleanup of the Child's River. "We started out with two huge dump truck loads of debris the first year. Now there are just a few odds and ends each year," he says. He attributes the decline in rubbish to the efforts of a more educated and involved community.

All hands on deck

"I try to do what I can for the environment because I like to fish and shellfish like everybody else," says Swain, though he finds little time to relax on the water. He has been recognized with awards from the National Oceanographic and Atmospheric Administration and the Environmental Protection Agency for his environmentally-minded business practices. But Swain also believes that protecting the environment is the right thing to do, and makes good business sense. "It's expensive at first, but after awhile it isn't. You find clean business is good business. You can

commissions. We need to get the message to the people because that's the only way we're going to get things turned around."

Marine businesses are an effective conduit for information, according to Swain, who has convinced federal and state agencies, harbor masters, and other organizations to provide marine businesses and boatyards with informational brochures they can distribute to their customers on pump-out services for marine septic tanks and other marine-related environmental topics. Swain has also helped launch TV public service announcements about clean boating, and has worked with the Waquoit Bay National Estuarine Research Reserve to develop educational campaigns. A grandfather himself, Swain delightedly points out that children are also learning about environmental stewardship in school, which should bode well for environmentally-sound business practices in the years to come.

Community members are becoming more aware of the need to protect the marine environment, and this is showing up in positive changes along Falmouth's coastline, says Swain. Shellfish beds in Quisset Harbor that



Photo courtesy of Charlie Swain

Charlie Swain (right) took over the family boat yard 20 years ago so his father Albert "Pete" Swain (left) could retire. The younger Swain has since become known for his "green" boatyard and his passion for educating others about environmentally responsible boating and business practices.

marine septic waste tanks — a service he provides for free.

Customers, employees, and fellow marine business owners didn't immediately warm up to Swain's rigorous methods. "To begin with, a lot of people objected and kind of harassed me a little bit, but once we got going and started educating people, after a while people started helping, and now there's not a person in the boatyard that doesn't support it," says Swain, who employs about 16 people in the off season and 20 in the summer to staff the boatyard and to sell and rent canoes, kayaks, sunfish, and sailboats.

Swain sees his business as an opportunity to inform his customers about clean boating not only through his green policies, but also by distributing brochures on environmentally safe boating products, fuel conservation,

actually make money by having a clean marina," he asserts.

"He's been very vocal in his advocacy for clean boating and its immediate impact on the maintenance of pristine marine environments," says Henson. "He's been very successful in bringing others into that way of thinking — recognizing that a pristine marine environment is the backbone of the marine industry."

Swain recruits MCZM staff to come to boat shows to speak with attendees about ways to safeguard the marine environment. "He's always encouraged me and our agency to take advantage of opportunities for public outreach," says Henson. An informed public is top priority, according to Swain, who says, "We have to stop educating the planning boards and the conservation

had been closed due to contamination are now open for harvesting in the winter. He expects that the planned construction of a new sewage treatment plant in West Falmouth will help improve water quality even more, potentially allowing shellfishing there in the summer as well.

Improving the coastal marine environment is, acknowledges Swain, "a big project, but it's not insurmountable." The way to do it, he explains, is harbor by harbor, and marina by marina, with each developing and carrying out its own community-supported plan for improving its waters. He advises, "You can turn the environment around and head it in the right direction, but it can't be done by a single person. Everybody has to help."

Herring hunt

The Gulf of Maine Aquarium Development Corporation (GOMADC) is coordinating a herring hunt that capitalizes on fishermen's "incredibly vast store of experiential knowledge and understanding of a very complex ecosystem," according to GOMADC President Don Perkins. The project aims to address the herring industry's concern that Gulf of Maine herring stock abundance is being inadequately monitored, he said.

Two Maine-based fishing vessels that already use acoustical fish-finding instruments have been outfitted with additional acoustical instruments of a type used by Canada's Department of Fisheries and Oceans. The instruments will log information for researchers, and because they are ones that fishermen typically use, "there's not a debate about where did you get this data and what does it mean," Perkins said.

Walt Raber, owner of the participating trawler *Providian*, and a relatively recent arrival on the Maine coast from Alaska, is not worried that the research may reveal the herring stock to be smaller than originally thought. "What really matters to me is getting the most accurate information," he said.

One component of the project involves collecting data on herring stocks while the vessels are fishing. Fishermen simply turn the instruments on as they leave port. Another part consists of estimating the abundance of spawning herring stocks. Because fishermen don't fish on spawning herring, these surveys have to be done separately from fishing trips, according to Phil Yund, an Associate Professor at the University of Maine School of Marine Sciences, and Research Manager for the project.

Organizers said few of the spawning surveys took place last season because it was a poor season for herring, and fishermen were unwilling to give up a night fishing to conduct research, regardless of the compensation they would receive for the survey trips.

But despite this setback and some technical complications in installing equipment, the partners are eager to keep pursuing the project. "We all believe that the partnership is in everybody's best interests," said Jeff Kaelin, Executive Director of the Maine Sardine Council, who secured funding for the project.

Fisherman Paul Tough (left) and Sean Smith, Data Analyst/Coordinator for the Halifax-based Fishermen and Scientists Research Society, review a record book that Tough keeps for the organization.

Many collaborative projects involve collection of data by fishermen while they are at sea.



Photo: Fishermen and Scientists Research Society

Fishermen/Researchers *continued from page 1*

and reducing the friction that has historically existed between them. Wariness, mostly on the part of fishermen, is long-ingrained, and has a number of root causes. But several sources said tension is somewhat generalized, and dissipates quickly once individuals begin working together.

One source of apprehension on the part of some fishermen is the fear that research — especially that undertaken by government regulatory agencies — might uncover information that could work against them by providing a basis for tighter regulations.

But several fishermen said they're prepared to accept whatever conclusions result from the research they are helping to conduct. Southwest New Brunswick fisherman Roger Hunter and his colleagues are tagging and collecting data on some of the cod they catch on the southern Scotian Shelf in the Bay of Fundy to determine if those fish are a separate stock from cod found elsewhere in the area. They hope to prove this is the case so a separate quota can be established for the fish they catch. "The outcome of research may hurt me instead of help me, and that's the scary part, but in order to better things, that's the route you have to go," Hunter said.

Notwithstanding the risk of discovering "bad news," Hunt Howell, of UNH's Zoology Department, found that he was able to recruit fishermen who "knew that the future of the fishing industry depends on good scientific data." Howell worked with fishermen in the early 1980s to quantify groundfish bycatch and discards in the Gulf of Maine.

Fishermen's caution also grows from competition. "Lots of information of interest to scientists are things that they may very well consider, like any business man, to be a proprietary form of information," said Cliff Goudey, Marine Advisory Leader for the Center for Fisheries Engineering at the Massachusetts

Institute of Technology's Sea Grant Program. Goudey works mostly on improving fishing gear.

A keystone in the relationship between fishermen and researchers is that fishermen "like being asked rather than told," said Glenn Salvador, an Outreach Coordinator for the National Marine Fisheries Service (NMFS). Salvador works with Maine fishermen to develop gillnets and lobster fishing gear that will be less likely to entangle whales. According to Salvador, presenting fishermen with a problem and asking them to help develop the solution is likely to get cooperation. Giving orders might get you an earful — or nothing.

The inherent differences between fish harvesting and data collection are another source of conflict between fishermen and researchers. Fishermen pride themselves on their ingenuity in continually finding better ways to catch fish. Scientific researchers say they emphasize uniformity and repetitive methods so that different batches of data can be compared to one another, and have sometimes characterized fishermen's experiences as anecdotal and not indicative of real trends. Fishermen, meanwhile, frequently describe scientific research as too far removed from real life to provide information that makes sense on the water.

But as they spend more time working together on research projects, fishermen are growing to appreciate scientific methods while researchers are recognizing the value of fishermen's experience.

"Fishermen know a lot," said University of Maine researcher Bob Steneck, who has worked closely with lobstermen for years, and has received \$200,000 in grants to facilitate relationships between science and the fishing industry. "Ultimately they have a story to tell and they want managers to see the resource the way they do," he said.

Maine lobstermen participate in the University's annual Penobscot Bay lobster sampling program that last year drew a record 160 participants, said Steneck. Government researchers participated in last year's sampling as well, offering fishermen a treasured opportunity to show them first-hand what they see on the water. "Lobstermen were saying, 'Come on my boat, come on my boat,'" said David Cousens, President of the Maine Lobstermen's Association.

A sense of ownership

Fishermen seem most interested in projects that will increase their understanding of their fishery and give them a voice in its management. Patty King of FSRS explained that when fishermen participate in research projects, it "allows them to take more of an active role in determining their future. They feel they've developed credibility."

Fishermen and researchers alike said involving fishermen in research helps them understand scientific methods better, and lessens their suspicions about the conclusions. "You learn very quickly that when you do

science it's not just a little pinch of this and a little pinch of that. You've got to follow the recipe," said Ginette Robert, an offshore scallop scientist for Canada's Department of Fisheries and Oceans (DFO). Robert said the scallop industry collaborates with DFO on several research projects including an annual scallop survey on Georges Bank that is funded and conducted by scallop draggers under federal oversight.

Conducting fishery research using commercial fishing gear is one way researchers can "increase confidence in the industry that we know what's going on," said Steve Murawski, Project Chief of the Population Dynamics Branch at the NMFS Northeast Fisheries Science Center in Woods Hole. Last summer, the US Gulf of Maine scallop fishing industry urged federal fishery researchers to determine whether scallop grounds on the US side of Georges Bank could be reopened within the constraints of groundfish closures there. NMFS worked with six commercial vessels to survey and map the distribution of scallops, said Murawski, noting that parts of Georges Bank might be reopened to scalloping in mid-June.

Two projects, driven largely by the northern New England herring industry's need for information, and incorporating participation by fishermen, are being coordinated by Maine organizations. In one project, introduced by the Island Institute in Rockland, Maine, Downeast lobstermen are helping researchers track herring spawning activity by reporting herring eggs stuck to their traps.

The Gulf of Maine Aquarium Development Corporation (GOMADC) is developing a project in which acoustic instruments are being used on two fishing boats to track herring stocks at sea, according to Don Perkins, President of the organization.

Craig Pendleton considers the research projects in which he participates an opportunity to exchange information with researchers. He charts his vessel to Global Ocean Ecosystem Dynamics (GLOBEC), a research program organized by oceanographers and fisheries scientists who are studying life cycles of fish in the Gulf of Maine and on Georges Bank. He is also providing his boat to a New Hampshire Sea Grant project in which he and other fishermen are helping to develop systems for fishing vessels, using specially designed instrumentation, to gather and relay data to land-based academic and scientific institutions. The system will also include E-mail links to fishing co-ops and fish markets.

Chatham, Massachusetts fisherman Mark Simonitsch said declines in his squid and mackerel catches led to his interest in helping Roger Hanlon of the Marine Biological Laboratory in Woods Hole with his research. Simonitsch, along with two other fishermen, have allowed Hanlon to dive in and around their weir traps to observe squid reproductive behavior. Simonitsch also helped Hanlon install a floating



Photo: Peter Lawton/Canada Dept. of Fisheries and Oceans

Above: David Robichaud, a Lobster Biologist for Canada's Department of Fisheries and Oceans, measures lobsters and records other data on a lobsterman's catch in the Bay of Fundy. Lobster fishermen have begun sampling a portion of their own catches, helping to offset the reduced amount of time agency staff can spend in the field while also gaining a voice in stock assessment.

Right: A University of New Hampshire graduate student prepares to plant oyster seed for an oyster aquaculture project involving fishermen and researchers.



Photo courtesy UNH Jackson Estuarine Laboratory

squid trap near the Woods Hole Lab so that he could have access to live squid for study. "By cooperating we feel that we're contributing to what can be learned — in a small way — about the very fish that we would like to see more of," said Simonitsch, who Hanlon described as "a very progressive guy. He wants to preserve the resource."

Research projects that explore new fisheries also attract interest. "Fishermen are seeing that their future is in jeopardy and they are looking for new opportunities," said Rich Langan, a former commercial aquaculturist and now Director of the UNH Jackson Estuarine Laboratory. He works with fishermen on federally-funded aquaculture development projects.

Keeping fishermen informed about the results of their efforts is also key to engaging them in research, according to Mike James, an Acadia University graduate student known as "Turtle Man" to those who help him collect data on leatherback sea turtles for his research. Noting that fishermen often take part in projects "and never hear what results from it," he asserted, "Thanking them for their contribution and explaining how the information is used keeps them interested in participating." Though James is not conducting fishery research, he said fishermen help him out simply because they like the turtles and are curious about them.

Fishermen as initiators

If fishermen need to solve a problem or get information, they don't always wait to be asked to participate in research projects. According to Barnaby, a group of New Hampshire fishermen developed a solution to keep harbor porpoises from getting caught in their gillnets using noise-making devices developed by Newfoundland researcher John Lien to warn whales away from cod traps.

Lobstermen in the upper Bay of Fundy have taken over sampling work that DFO biologists carried out before budget cuts limited their field time, according to Peter Lawton, Head of DFO's Gulf of Maine Crustacean Fisheries Section. This helps DFO broaden its sampling coverage and gives lobstermen a voice in the stock assessment process, he said.

And when DFO announced in 1994 that it would no longer attempt to survey groundfish in an important area of the Bay of Fundy because its large vessels were losing too many nets on the especially rough bottom, fishermen in the Scotia-Fundy Mobile Gear Fishermen's Association offered to do it using their smaller, more maneuverable vessels.

"Last year [DFO] started using some information from our survey in their calculation of population dynamics and biomass. It validated our work," said Brian Giroux, Executive Director of the association.

The group was nervous about gathering information that could affect their livelihood, but, Giroux said, "Inevitably what you're doing here is setting out on the road to truth. You have to live with what you find."

A desire to manage their fishery at the community level has driven a group of Nova Scotia fishermen to launch community-level research projects, including recording data on their groundfish catches. Arthur Bull, Coordinator of the Fundy Fixed Gear Council on the Nova Scotia side of the Bay of Fundy, said the group asks DFO to collaborate "as needed."

Compensation gap

Practical considerations are an important influence on a fisherman's decision about whether to participate in research. Compensation varies from project to project. Many fishermen who work on research projects volunteer at least some of their time for free. Proponents of increased collaboration say more money to pay fishermen has to be included in

Swells, salt air, and satellites

"Our goal is to empower the commercial fishing community with knowledge, data, new tools, and direct connection to the academic research community," said University of New Hampshire (UNH) Sea Grant Director Ann Bucklin, describing the National Oceanographic Partnership Program (NOPP), coordinated by UNH Sea Grant.

The program, which includes academic, private sector, and fishing industry partners, began when Joe Novello, Vice President of a manufacturing company and a member of a Gloucester, Massachusetts fishing family, offered to develop a device to assist fishermen by reading water temperature near the ocean floor. Sea Grant expanded that idea to include collection of additional information that could be bounced to shore via satellite for other entities to use.

According to Bucklin, "With autonomous NOPP sensor systems, fishermen would be collecting weather and ocean data as they fish, and relaying these data directly to shore-based centers, including the National Weather Service prediction centers."

The meteorological, hydrographic, and satellite instrumentation now being developed will be installed on board two fishing vessels and tested at sea this fall and winter. Research grants and government programs will pay for the equipment and its installation, as well as compensate fishermen for the use of their vessels.

One vessel is in Gloucester. The other is owned by Craig Pendleton, Executive Director of the Northwest Atlantic Marine Alliance, based in Saco, Maine. Pendleton is helping to design the NOPP software that fishermen will use at sea. He noted that confidential E-mail links will enable communication with fish markets and could also be used to report sightings of endangered whales.

A sticky situation

"There's been [herring] eggs around as long as anybody can remember, but it seems that maybe in the last 10 or 15 years there's been sort of a decline in the amount of spawn that's seen up around this way," said Stillman Fitzhenry, a retired fisherman in Cutler, Maine.

During the last three lobster fishing seasons, Fitzhenry has helped researchers find out how much spawning is or isn't going on in Downeast Maine as part of a project launched by the Rockland, Maine-based Island Institute with help from researchers David Libby and David Stevenson at the Maine Department of Marine Resources.

The project, which has received funding from the Cox Foundation, the Maine Outdoor Heritage Fund, the National Marine Fisheries Service, and the Maine Sardine Council, combines time-tested, first-hand observation with sophisticated computer mapping technology to create a picture of herring spawning activity in the region.

Herring eggs, Fitzhenry explained, "are very sticky." When Downeast lobstermen find them stuck to their traps, they call him. Fitzhenry then takes samples from the bottom where the traps were hauled, and, using a Global Positioning System data collector, records the sites' coordinates, which are later downloaded to a computer and mapped at the Island Institute.

Support from the fishermen "has been tremendous," according to Bill MacDonald, Marine Resources Director at the Island Institute. Lobster fishermen, he noted, are interested in protecting herring as a bait source, while herring fishermen are concerned about the future of their fishery.

Hague Line

continued from page 1

Institute based in Redmond, Washington, an international group of marine scientists identified 29 percent of the seabed in the Gulf of Maine and Georges Bank as top priority areas for protection due to their "exceptional biological resources." According to Martin Willison, Professor of Biology and Environmental Studies at Dalhousie University in Halifax, Nova Scotia, and a proponent of establishing a Hague Line reserve, the group determined that "the greatest concentration of areas suitable for the protection of species and communities at risk lies on the Hague Line."

Marine protected areas

The Hague Line reserve would fall under the classification of a marine protected area (MPA), a generic term describing any terrain below the high tide line that is protected by any legislation, regulation, or ordinance to conserve biodiversity or to promote study or sustainable use of its ecosystem. Tidal flats, marine mammal or rare species habitat, spawning and nursery areas, estuary zones, kelp forests, salt marshes, and other features are potential candidates for designation as marine protected areas.

The degree of protection provided by MPA designation can vary "from temporary fishery closures up to permanent closed areas from which nothing will be extracted," including fish, oil, gas, or gravel, explained Willison, who is working with Canada's Department of Fisheries and Oceans (DFO) to identify and address the research necessary to establish a system of MPAs in Canada under its federal Oceans Act.

According to the International Marine Mammal Association, based in Guelph, Ontario, more than 1,300 sites in the world's oceans receive some degree of protection as marine reserves, parks, sanctuaries, and conservation areas. But conservation organizations are calling for more. The Washington, DC-based Center for Marine Conservation is urging expansion of US efforts to conserve marine protected areas, and is calling for more funding for programs that support them.

Why the Hague Line

A Hague Line reserve, Willison said, would be protected against oil drilling and fishing gear that drags on the ocean floor, but would not be closed to vessel traffic. He has also described the reserve as a "peace park," that would provide a buffer zone to help US and Canadian fishermen stay out of one another's fishing grounds. Huber noted that the Hague Line is routinely patrolled by the US and Canadian coast guards to prevent fish poaching and drug trafficking, so mechanisms are already in place to enforce protective designation.

Willison advocates that some areas of the ocean floor be left completely undisturbed to protect biodiversity. He explained that while fishing quotas may reduce pressure on certain species by limiting the number of individual organisms harvested, the restrictions don't protect residents of

the ocean floor from damage caused by fishing gear, drilling, and other intrusions.

Proponents of the Hague Line reserve assert that banning fishing, drilling, and other activities within the proposed reserve area would allow bottom-dwelling species there to regenerate and spawn. Currents would then distribute that spawn elsewhere in the Gulf, reinvigorating fish stocks in areas open to fishing. "In a way these things can act like cornucopias," said Huber in describing marine protected areas.

Willison and American researcher Richard McGarvey determined several years ago through bioeconomic modeling that if parts of Georges Bank were closed to scalloping, allowing the shellfish to reach their reproductive peak at about 12 years of age, their populations would regenerate. Older scallops produce many more eggs than do younger ones, but scallops are routinely harvested well before they reach their reproductive peak, Willison said.

Huber said the resurgence of scallops on Georges Bank following closures to protect groundfish stocks there shows that closures do facilitate recovery — at least as far as scallops are concerned. Federal fisheries officials are scheduled to reopen areas of Georges Bank to scalloping in June, although groundfish closures there remain in effect.

Routes for designation

No precise recipe exists for establishing an international marine protected area such as the proposed Hague Line reserve, though the US and Canada have shared a transborder land park designated in the 1930s. It combines Glacier National Park in the US and Canada's Waterton Lakes National Park. Though there are some provincial and state pathways for establishing protected areas in their respective waters, most marine protected areas are designated through US or Canadian federal programs.

In the US, these include the Marine Protection, Research, and Sanctuaries Act; the Coastal Zone Management Act; and the Magnuson-Stevens Fishery Conservation and Management Act. Huber said he has presented the Hague Line proposal to the New England Fisheries Management Council, which is determining areas that should be covered by the US Essential Fish Habitat plan under the Magnuson-Stevens Act, with the hope that the plan may serve as a route for designating a Hague Line reserve. One area the management council has named a Habitat Area of Particular Concern (HAPC) is on Georges Bank's Northern Edge. Huber describes this area as the "anchor" of the proposed reserve.

In Canada federal designation of marine protected areas can occur through its National Parks Act, its Canada Wildlife Act, and, most recently, its 1997 Oceans Act, which created a marine protected area policy and mandates development of a national MPA network.

Bob Rutherford, Acting Manager of Oceans Division of DFO's Maritimes Region, said DFO is trying out the new policy with a pilot

site east of Sable Island. He noted that the department is also considering two other sites, one in Prince Edward Island, and one in Musquash Harbor just south of Saint John, New Brunswick. DFO said the three sites will help it test and refine the process for establishing MPAs before it takes on anything as complicated as the international Hague Line proposal.

Public support

Willison predicted that the public's level of interest in a Hague Line reserve will determine whether the Canadian and US governments will support and pursue it. "The public challenge is the biggest challenge, particularly with regard to the users of the environment," such as fishermen and oil and gas enterprises, he said.

Some groups in the Gulf of Maine are exploring how MPAs can be used as a tool for managing Gulf resources. The Gulf of Maine Council has facilitated a discussion, a workshop, and a survey about marine protected areas among those with a stake in the marine environment; has developed a database of existing protected coastal and marine areas, conservation zones, and restricted fishing areas in the Gulf; and has evaluated legal mechanisms for establishing MPAs.

Jennifer Atkinson, Staff Attorney in the Conservation Law Foundation's Rockland, Maine office, said a new group of MPA proponents is continuing and expanding on these MPA discussions. Its members include representatives of state and federal governments, nongovernmental groups, researchers, and a former fisherman. Although it currently consists only of US members, Atkinson said the group could decide to include Canadian representatives as well as other interested parties.

Canada offers more effective routes than the US for establishing marine protected areas, Atkinson asserted. In the US, she said, designations don't always effectively shield so-called "protected" areas. She noted that within Stellwagen Bank National Marine Sanctuary, for example, while there are certain restrictions in place against extraction of sand and gravel, it is not closed to fishing. Stellwagen Bank spokesperson Anne Smrcina said the sanctuary is undergoing a five-year review of its management plan, which presents an opportunity for the public to express their concerns and suggest changes to the plan.

Concerns about restrictions

Needless to say, the idea of increasing restrictions in certain areas is alarming to some. Craig Pendleton, a fishing vessel owner and Executive Director of the Northwest Atlantic Marine Alliance (NAMA) based in Saco, Maine, anticipated that fishermen would not welcome the idea. "When you look at the closures right now and the ones coming up, half the Gulf of Maine is going to be closed so it's a struggle to find it in yourself to say, 'Yeah, sure, why don't you just close another place forever,'" he said.

Pendleton acknowledged that dragging fishing gear on the ocean floor disturbs it, but said he needs more proof that the practice is necessarily detrimental to the ecosystem as a whole. He noted that he continues to catch fish in the same place year after year, despite the effects his gear may be having on the sea floor.

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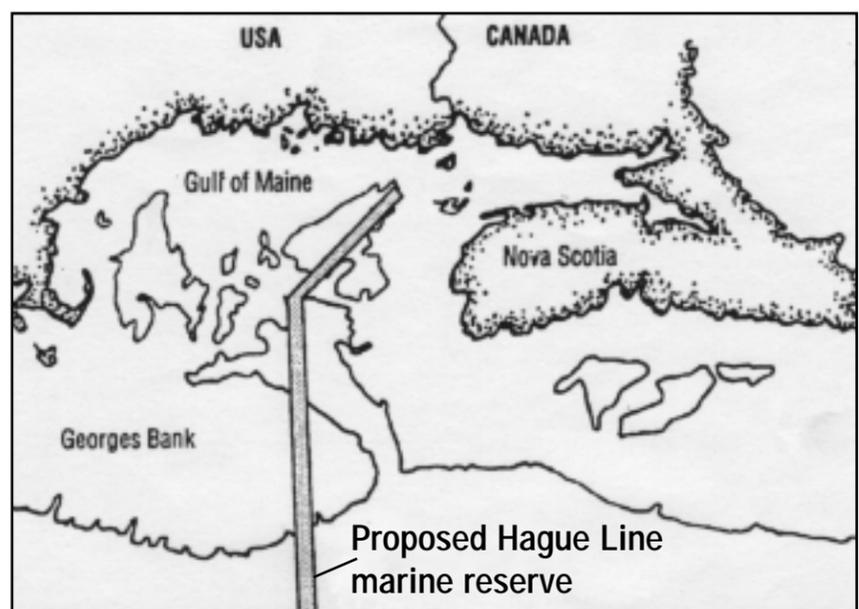
Fishermen OK Musquash MPA

The Musquash Harbor and estuary on New Brunswick's Saint John River could be the first MPA created in the Gulf of Maine under Canada's new Oceans Act. A committee that includes the Fundy North Fishermen's Association (FNFA), the Conservation Council of New Brunswick (CCNB), federal and provincial departments, and other local groups has nominated the area — which the World Wildlife Fund (WWF)-Canada describes as largely undeveloped and relatively unpolluted — for such designation.

In developing the proposal, the Conservation Council and the fishermen's association have agreed that scallop dragging would be allowed to continue within a "special scallop zone" at the mouth of Musquash Harbor, but that there would be no expansion of the scallop fishery within the MPA.

Greg Thompson, Secretary Treasurer of FNFA, said the Conservation Council proposed the idea at the association's annual meeting. CCNB explained the value of the saltmarsh to local fisheries as a nursery and food source, and expressed concern about the effects of potential development of heavy industry in the Port of Saint John.

"I think with the fishermen it is more an issue of, 'how is this going to affect me?'" said Thompson. "We didn't see [the proposal] was any harm to us. It could only help us if marshes are, in fact, the contributors to the marine ecology that is believed at the moment."



Map courtesy of Coastal Waters Project

NB rockweed harvest prompts calls for more study

By Suzy Fried, Editor

St. Andrews, New Brunswick — The harvesting of rockweed — sea plants that grow along the Gulf of Maine's rocky coastline — isn't new to the region. But the industry's expansion into New Brunswick is prompting concern that too little is known about the effect of the harvest on the marine ecosystem.

The Gulf's largest rockweed processing company, Acadian Seaplants Ltd., based in Dartmouth, Nova Scotia, began harvesting in New Brunswick in 1995 under a government pilot program. The company maintains that sustainable harvesting methods, an internal monitoring program, and adherence to government requirements show its "commitment to safeguarding the seaweed resource."

Important resource

The rockweed species most harvested in Nova Scotia, New Brunswick, and Maine is the brown algae, *Ascophyllum nodosum*, which is especially abundant along Nova Scotia's southwest shore and around the mouth of the Bay of Fundy. The algae, which has fronds that attach to rocks with hold-fasts, provides food and shelter for invertebrates and for fish — including commercially valuable species. When *Ascophyllum* decomposes, it sheds nutrients into the water, nourishing other organisms.

As much as it is an important component of the Gulf's ecosystem, *Ascophyllum* is also a valuable commercial commodity. Companies in the region process it and market it locally and internationally for use in agricultural products, livestock feeds, and as a stabilizer and conditioner in paints, cosmetics, and foods.

During the summer, harvesters collect the algae from small boats using long-handled rakes fitted with cutting blades. During low tide, some harvest the algae from the beach using machete-like knives. Mechanized harvesting used in Nova Scotia in the 1980s has been eliminated.

Between 2,000 and 3,000 metric/US tons of *Ascophyllum* are harvested annually in Maine, according to Glyn Sharp, Marine Plant Biologist for Canada's Department

of Fisheries and Oceans (DFO) Maritime Region. He said the bulk of the harvest takes place in eastern Canada, mostly in Nova Scotia. Up to 33,000 tons (30,000 wet metric tons) can be harvested in eastern Canada annually, according to Sharp. The New Brunswick pilot program has allowed up to 11,000 tons (10,000 wet metric tons) of *Ascophyllum* to be harvested annually by Acadian Seaplants.

A federal/provincial government management committee planned to decide in May whether or how to continue rockweed harvesting in New Brunswick, said Sharp. This follows a three-year federal review of the project in St. Andrews, New Brunswick on April 28 and 29.

Groups have questions

The Conservation Council of New Brunswick (CCNB) is calling for a full Environmental Impact Assessment of the New Brunswick harvest, according to Inka Milewski, CCNB Past President and a marine biologist. The group says research to date has not determined sustainable levels of harvesting. "It's not clear how much you can remove without having an impact on fish," or other organisms, agreed Bob Rangeley, a DFO researcher.

But rockweed processor Robert Morse, President of Atlantic Labs in Waldoboro, Maine, and President of the Maine Seaweed Council, argues that models for sustainable harvesting do exist. "This is not an unknown industry, it is an industry in eight other countries. The information is there, the scientific exchange is there," he said.

CCNB and the Island Rockweed Committee, formed on Grand Manan where some of the harvesting is taking place, also say the pilot program was implemented despite public concern that over-harvesting problems experienced by Nova Scotia could occur in New Brunswick. The groups question the adequacy of federal and provincial oversight of the New Brunswick harvest, and assert that the government has provided financial support to Acadian Seaplants.

"The Nova Scotia experience was

deplorable. The resource was not managed well," said Sybil Joan Simms, spokesperson for the Island Rockweed Committee. Andy Cameron, Coastal Advisor for the Nova Scotia Department of Fisheries and Aquaculture, acknowledged that over-harvesting did occur in some areas, but said that after temporary closures in those areas, the *Ascophyllum* has since grown back and is now being harvested using sustainable practices. According to Sharp, New Brunswick's 11,000-ton (10,000-wet-metric-ton) quota protects the standing crop of *Ascophyllum*, and preserves its value as habitat for other species.

Feds, province co-manage

Under a memorandum of understanding, the New Brunswick Department of Fisheries and Aquaculture (DFA) and the federal Department of Fisheries and Oceans jointly oversee rockweed harvesting. DFA Development Officer Kim Lipsett said the province took Nova Scotia's experience into account when developing the New Brunswick management plan. New Brunswick also held "numerous public consultations" on its management strategy and submitted the document for peer review by scientific authorities, who determined that the pilot program would be sustainable with proper monitoring, she said.

Provincial and third-party monitoring, overseen by the federal government, track Acadian's harvests, according to Sharp and Lipsett. Under an exclusive licensing system, Acadian Seaplants is the only rockweed processing company harvesting in the province, said Lipsett, asserting that a single licensee approach makes controlling the harvest manageable.

As to government subsidies, both Lipsett and Sharp said Acadian is

eligible for the same loans and economic development programs open to other industries and businesses in the region, but neither they nor Acadian Seaplants would say whether the company has received government funding under those programs.

Maine management

In Maine, where the rockweed harvesting industry is much smaller than in eastern Canada, *Ascophyllum* harvesters must be licensed, but otherwise, "There's no [government] management to speak of right now," said Pete Thayer, Marine Resources Scientist at the state Department of Marine Resources (DMR). He noted, however, that DMR and the Maine Seaweed Council are developing regulations that DMR plans to implement.

Morse said the council is also supporting state legislation that would reinforce DMR's authority to "start implementing the management procedures that all of us as a group have developed over the last 20 to 30 years." Thayer said that legislation would also increase harvesting license fees to help fund rockweed harvesting research.



Photo: Glyn Sharp/Canada Dept. of Fisheries and Oceans

A harvester gathers Ascophyllum nodosum in southwest Nova Scotia using a long handled rake with a special cutting blade.

Hague Line

continued from previous page

Atkinson, who is active in NAMA, said there is no absolute proof, but she explained that marine protected areas represent a precautionary approach — one that can benefit the fishing industry. "It's important to set aside areas to understand what we are doing over time and how we are affecting the whole of the ecosystem," she said.

"We're asking for a tremendous leap of faith by industry," said Huber, "that the fishery gains achieved by marine reserves elsewhere are more or less what will happen here; that if we create large baseline protected areas in our offshore public lands, there will be benefits for them." Pendleton said he

could support protecting certain areas as "generators," that produce more fish elsewhere. But, he said, "If it just builds plants and barnacles and looks pretty in pictures, that doesn't cut it for me."

"Right now marine protected areas are not something New England's fishing community wants to hear about," Atkinson acknowledged. "First we need to build on real successes, like the HAPC, to get support for what MPAs mean and what they are for — to help sustain a healthy ecosystem that supports a diversity of uses including fishing." She and Pendleton both voiced the need to involve the fishing community in discussions of MPAs.

There is a way to protect both fishermen and fish habitat, according to former fisherman Herb Hoche Jr.

of Hope, Maine. A supporter of the Hague Line proposal, Hoche remembers catching scallops the size of dinner plates on Georges Bank in the late 1950s and early 1960s, and said the reason they were so large and plentiful was that "we were not dragging all over the place."

Hoche said advanced navigational instruments enable scallopers to see what's on the ocean floor, making it possible to drag more of the bottom than in years past, when fishermen avoided unfamiliar areas for fear of losing their gear. He proposed that scallopers reduce the amount of area they drag, and define specified "avenues" for dragging — just as drivers on land are supposed to confine themselves to driving on designated roadways leaving other areas undisturbed. "It makes a lot of sense to

protect the habitat for the fish," Hoche said. "Unless the [juvenile fish] have a place to hide they'll never grow up. Where are they going to live if you're constantly stirring up the mud?"

Web sites for more information

Gulf of Maine Council
www.gulfofmaine.org/library/mpas/mpa.htm

Marine Conservation Biology Institute
www.mcibi.org/

Center for Marine Conservation
www.cmc-ocean.org/main.html

World Wildlife Fund-Canada
www.wwfcanada.org

New England Fishery Management Council
www.nefmc.org

Canada Department of Fisheries and Oceans
www.dfo-mpo.gc.ca or www.oceansconservation.com

US National Marine Fisheries Service
www.nmfs.gov

Gulf Log

Premiers, governors adopt emissions plans

By Joy Manson
New Brunswick Department of the Environment

Fredericton, New Brunswick — The New England states and eastern Canadian provinces have joined forces to address the issues of mercury emissions and acid deposition in a region that includes the Gulf of Maine.

At its June 1998 conference in New Brunswick, the Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP) adopted two action plans to reduce mercury and acid rain emissions. A workshop on the plans' progress was scheduled for June 4 in Portland, Maine.



Mercury enters the atmosphere during combustion and incineration processes that take place at power plants and other industrial facilities. Once in the atmosphere, it can travel across international borders.

Although some of the mercury present in the Gulf of Maine region exists naturally, most of it is released by incinerators, boilers, and manufacturing plants both within and outside the region. Mercury is also found in some household products.

When mercury is released into the atmosphere during combustion and manufacturing processes, it is converted to other forms and mixes with rain, snow, sleet, or dust and falls back to earth, a process known as atmospheric deposition. The mercury can then mix with certain bacteria in marine sediments that convert it to its most toxic form — methyl mercury — which can cause nerve and developmental damage in humans and animals.

Sulfur dioxide released into the atmosphere converts to sulfuric acid, which can increase the acidity of rain, snow, sleet, fog, dew, gases, or dust. Acidified rainwater more easily dissolves heavy metals — including mercury — in upland soils, subsequently depositing them in estuaries in the form of runoff. Acid deposition demands a regional approach to research and strategic action, according to scientific representatives on the NEG/ECP.

The Acid Rain Action Plan will incorporate coordinated data management and exchange, a forest mapping project, and monitoring programs for

surface water quality and the presence of fine particulates in the air. The Mercury Action Plan aims to reduce mercury emissions by 50 percent by 2003 through source reduction and waste management, and research and strategic monitoring. A public outreach working group is developing a strategy and resource materials in support of the plans.

For more information, please contact Rheel Poirier at (902) 424-5905, or John Shea at (613) 423-6900.

Scientists studying risks to salmon

Orono, Maine — University of Maine Scientists are studying the effects of acidity and aluminum on Atlantic salmon smolts — juvenile salmon that

are ready to migrate — with support from a \$55,764 grant from the US Geological Survey's Biological Services Division.

Scientists Terry Haines and Malcolm Shick of the Department of Biological Sciences are working with the Maine Atlantic Salmon Authority and the National Marine Fisheries Service. They are investigating the risks posed to salmon smolts in Maine by acidic stream water and dissolved aluminum during the smolts' migration into seawater.

Research in Norway suggests that salmon smolt deaths could increase under such conditions. Smolt survival during the young salmon's transition to seawater has not previously been evaluated in Maine other than through limited tagging and tracking studies in 1996, according to the university.

Those concerned about conservation of Atlantic salmon in the Gulf of Maine cite numerous threats to the species, including disease, obstruction of their migration routes by dams and causeways, and loss of habitat.

NMFS adopts new code of angling ethics

Washington, DC — The federal agency charged with managing saltwater species in the US has adopted a new code intended to promote ethical, conservation-minded fishing behavior by recreational fishermen, the Commerce Department's National Marine Fisheries Service (NMFS) announced in March.

NMFS developed the "Code of Angling Ethics" with the help of angling groups, including the American Sportfishing Association, the Coastal Conservation Association, the Recreational Fishing Alliance, and Trout Unlimited, according to the agency.

Recreational fishermen who adopt the code agree to adhere to conservation practices that include avoiding spilling or dumping pollutants, such as gasoline and oil, into the aquatic environment; disposing of all trash, including worn fishing gear, in appropriate containers; taking precautionary measures to prevent the spread of exotic plants and animals, including live baitfish, into non-native habitats; and using tackle and techniques that minimize harm to fish when engaging in "catch and release" angling.

NMFS is providing the code to recreational fishermen, fishing clubs, bait and tackle shops, and fishing boat operators through a variety of cards, stickers, and posters that promote its use. The code is also posted at www.nmfs.gov/irf/irf.html on the agency's recreational fisheries web site.

Beach health strategy pushes monitoring

Washington, DC — A new long-term strategy recently released by the US Environmental Protection Agency (EPA) will help states and localities protect public health at beaches and recreational waters, according to the agency.

Though studies have linked some illnesses to contaminated recreational waters, many localities still do not regularly monitor recreational water quality and many states have not adopted EPA's water quality criteria for bacteria. Despite significant progress in protecting beaches, coastal areas, and other water bodies from pollution, many recreational waters remain threatened by bacterial contamination from sewage and polluted runoff from farms and city streets. Each year, thousands of beaches are closed to swimming because of pollution.

Under the new plan, EPA says it will: conduct annual National Beach Health Surveys to collect data on state and local monitoring and protection activities; assist state and local managers in strengthening water quality standards based on EPA's recommended criteria; strive for consistent management of recreational water quality programs; improve the science that supports monitoring at these sites; and continue the dialog with state, local, and other public health officials through conferences and meetings.

State and local information on recreational water quality, as well as EPA's Beach Action Plan, are available at www.epa.gov/ost/beaches or by calling the National Service Center for Environmental Publications at 1-800-490-9198.

UN promotes shark, seabird conservation

Washington, DC — The world's fishing nations have negotiated final agreements that will improve international conservation and management of sharks and seabirds, according to the Commerce Department's National Oceanic and Atmospheric Administration (NOAA).

The United Nations Food and Agriculture Organization's (FAO) Committee on Fisheries decided in February at its annual meeting in Rome, Italy to approve final Plans of Action to improve the conservation of sharks and seabirds at the national, regional, and global levels. According to NOAA, the plans provide concrete and specific steps, and call for FAO members to develop and implement national plans by 2001.

Calendar

GOMC mini-fair and forum

The Gulf of Maine Council's summer meeting is scheduled to take place June 10-11 at the Rodd Grand Hotel in Yarmouth, Nova Scotia. The meeting will feature a "Mini-Fair" showcasing non-governmental organizations, and a forum on communication among the diverse groups and organizations in the Gulf. For more information, contact Megan Trites-Tolson at the GOMC Secretariat's office via E-mail at tritesml@gov.ns.ca or call (902) 424-1764.

CZ '99

Coastal Zone '99 — *The People, The Coast, The Ocean: Vision 2020* will take place July 24-30, in San Diego, California. Visit omega.cc.umb.edu/~cz99 or E-mail Chantal Lefebvre at cz99@umb.edu or fax (617) 287-5575 for more information.

CZ Canada 2000

This bilingual event (French/English) is scheduled to take place at the Trade and Convention Center in Saint John, New Brunswick September 17-22, 2000. Addressing the theme, *Coastal Stewardship: Lessons Learned and the Paths Ahead*, the conference will focus on aboriginal practices, community-based actions, coastal health, and oceans governance. Discussion will be based on a review document, *Baseline 2000*, to be distributed to participants before the conference. For a registration kit call (506) 453-2253 or e-mail czc2000@gov.nb.ca or visit www.gov.nb.ca/dfa/czc-zcc200.htm for more information.

Council Currents

News from the Gulf of Maine Council on the Marine Environment

The Gulf of Maine Council is an international body formed in 1989 to foster cross-border cooperation among government, academic, and private groups on implementing sustainable management strategies for the Gulf, which extends from Cape Cod to the Bay of Fundy. The Council's primary goals are to: restore shellfish habitat; promote restoration of fishery resources; address ecosystem and public health effects of toxics in the marine food chain; protect and restore regionally significant coastal habitats; and reduce marine debris. For more information, visit www.gulfofmaine.org or contact Chris Simmers at the Council Secretariat via E-mail at c_simmers@des.state.nh.us or call (603) 225-7940.

Gulfwide contact list on GOMC web site

Gulf of Maine — A listing of Gulf of Maine contacts is now available on the Gulf of Maine Council's web site at www.gulfofmaine.org/cdb/index.html. This list contains the names and addresses of individuals and organizations that have an interest in estuarine, coastal, and marine habitats in the Gulf. Its purpose is to promote interaction and communication on these topics.

The Council's Data and Information Management Committee (DIMC) derived the listing from information originally placed on the Environmental Data and Information Management System (EDIMS) hosted at the University of New Hampshire.

DIMC is seeking help in correcting, updating, and expanding on the contact listing to make it an active and useful tool for coastal habitat stewardship. The new searchable listing can be edited through a password-

protected function so that everyone has full control over his or her own information. Visitors to the web site can add their names, or those of their organizations.

For more information, contact DIMC Co-Chair Paul Boudreau at (902) 426-7464.

Information sharing topic of GOMC forum

Yarmouth, Nova Scotia — In an effort to facilitate communication among non-governmental organizations, First Nations, and the private sector, the Gulf of Maine Council planned to host a June 10 forum, *Sharing Information Among Neighbors*, at the Rodd Grand Hotel.

The Council hoped to provoke discussion of ways to develop mutual understanding and exchange among the diverse organizations working in the Gulf, and to encourage collaboration to preserve the region's marine and coastal resources.

The forum was to take place during

the Council's summer meeting in Yarmouth June 10-11, which was also to feature a "mini-fair" for nongovernmental organizations to exhibit information on their work in the Gulf.

The Council also planned to announce the recipient of the first annual Art Longard Award, given to an outstanding volunteer in the Gulf of Maine. The award honors a founding and long-time member of the Gulf of Maine program and its working group. Longard, who placed high value on the role of volunteers in Gulf stewardship, died in December 1997 after a long battle with cancer.

Council to celebrate tenth anniversary

The Gulf of Maine Council is planning activities to commemorate the tenth anniversary of the signing of an agreement by the premiers of Nova Scotia and New Brunswick, and the governors of Maine, New Hampshire, and Massachusetts, committing them to wise management of the Gulf of Maine and its watershed. A tenth year anniversary celebration is tentatively planned for December in New Hampshire. Check the pages of upcoming issues of the *Gulf of Maine Times* for more information.

Fall '99 Coastal cleanup dates

New Brunswick
Saturday, September 18
(506) 652-2227

New Hampshire
Saturday, September 18
(603) 431-9366

Maine
Saturday, October 2
(207) 287-3261

Massachusetts
Throughout September and October
(617) 727-9530, ext. 455

Clean Nova Scotia also organizes Beachsweeps in Nova Scotia and New Brunswick each spring. Watch the pages of the *Gulf of Maine Times* for more information.

Resources

Wetlands Web Walk

The League of Women Voters of the United States has launched a wetlands web site that gives an overview of wetlands education projects developed and implemented by local Leagues of Women Voters across the US. The *Wetlands Web Walk* at www.lwv.org/webwalk/index.html offers insights, ideas, and organizing techniques that can be applied to any local citizen participation project.

Digital photos of MA on the Internet

Map-quality aerial photographs of Massachusetts' coastline are available at <http://coast.mit.edu> on the Internet. Users have employed the maps to measure shoreline changes, in contingency planning for oil spills and hurricanes, and for other planning purposes. The digital aerial photos are precise enough that they can be used for accurate measurements, and users can pan and zoom in on them, as well as download any portion of the orthophoto library in a format compatible with desktop publishing and geographic information systems (GIS).

Habitat restoration database and report

A *Coastal Wetland Restoration Database* includes information on approximately 100 tidal marsh restoration projects, more than 100 freshwater impoundments in Canada, and several innovative projects aimed at restoring seagrass and tidal flats. The database also includes information on more than 400 potentially restorable tidal marshes, representing more than 2,000 acres (809 hectares). Visit gulfofmaine.org and click on Our Library/Regionally Significant Coastal

Habitats/Coastal Habitat Restoration to view or download the database and related report. The report is also available by calling (617) 727-9530, ext. 420. If you have new information on a restoration project to add to the database, or if you have questions, contact Susan Snow-Cotter at Massachusetts Coastal Zone Management, (617) 727-9800, ext. 210.

Atlantic Coastal Zone Database Directory

Version 3 of the *Atlantic Coastal Zone Database Directory*, compiled by the Atlantic Coastal Zone Information Steering Committee (ACZISC), lists and describes 608 databases relevant to the integrated management and sustainable development of the coastal zone of Atlantic Canada. The databases are maintained by governments, academic/research institutions, the private sector, non-governmental organizations, and non-profit organizations. The directory is available at www.ndi.nf.ca/ndi/aczisc/ on the web.

Undersea poster

Undersea Landscapes of the Gulf of Maine is a map and poster that focuses on the landscapes, geology, and biology of the Gulf of Maine. The poster's concept and text were developed by Robert Steneck of the University of Maine School of Marine Sciences and Joseph Kelley of the Maine Geological Survey. The project was coordinated by Paul Dest of the Maine Coastal Program/State Planning Office. For a copy contact (in the US) Massachusetts Coastal Zone Management, (617) 727-9530, ext., 420; Cynthia Lay, New Hampshire Coastal Program, (603) 431-9366; or Paul Dest, (207) 287-

5305; (in Canada) Tim Hall at (902) 426-4116.

Clean boating guide

The Portland Harbor Marine Debris Council, a project of Friends of Casco Bay, has published *Clean Boating in Casco Bay: Action Guide for Boaters*. The guide features sections on practical steps boaters can take to prevent problems caused by toxic substances, human waste, and marine debris in the Bay. Another section explains how to explore ecologically sensitive islands with minimal impact. The guide also includes safe boating tips and a map of Casco Bay area boating facilities. For a copy, call Friends of Casco Bay at (207) 799-8574.

Marine organisms guide

A *Guide to Common Marine Organisms Along the Coast of Maine* has been published by the University of Maine Sea Grant Program and Cooperative Extension. The 56-page book presents a compendium of information about the flora and fauna of the intertidal zone in an easy-to-use format illustrated with pen-and-ink drawings. The guide is divided into three parts: marine organisms, seaweeds, and phytoplankton, and includes a full index for easy reference. It is available for \$10.00 US plus shipping costs from the University of Maine Cooperative Extension at 1-800-244-2104 or from the Maine/New Hampshire Sea Grant Program at (207) 581-1440.

Non-profit management

Visit the River Network on line at www.rivernet.org/nonprofi.htm for information on nonprofit

management, including strategic planning, boards of directors, financial management, fundraising, media/marketing, volunteer management, and personnel.

Mr. and Mrs. Fish bring tales to 'Net

A web site at www.mrandmrsfish.com features Mr. and Mrs. Fish, who have, for 20 years, traveled throughout the world teaching about life in the sea. In 1993-94, the pair received the Gulf of Maine Council's Visionary Award for their work with young children in the Gulf region. A resource for all ages, Mr. and Mrs. Fish perform humorous yet highly educational shows about how life works in the waters of the Gulf of Maine.

NS natural history

Natural History of Nova Scotia, Volumes 1 and 2, organizes biophysical and land use information into topics, habitats, and ecozones using text, graphics, maps, and pull-out charts. The information is applicable throughout the Gulf of Maine. Order through the Nova Scotia Museum via E-mail at educ.nsm.doucetat@gov.ns.ca or by calling 1-800-632-1114 or (902) 424-7344. There is a charge for this publication.

Watershed map

To get an 18" x 24" three-color map of the Gulf of Maine watershed (the updated version featured on page 12 of the *Gulf of Maine Times*) while supplies last, contact Massachusetts Coastal Zone Management, (617) 727-9530, ext., 420; Cynthia Lay, New Hampshire Coastal Program, (603) 431-9366; or Paul Dest, Maine Coastal Program/State Planning Office, (207) 287-5305.

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