

Times

Gulf of Maine

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

More than arrowheads and old bones

Coastal archaeological remains can reveal much about our ecological past and future; but vandals and sea level changes loom large

By Andi Rierden, Editor

Bruce Bourque is driving through the lush backroads of Boothbay Harbor in Maine searching for ancient trash. He is stalking shell middens—heaps of kitchen scraps—left behind by inhabitants thousands of years ago. As the chief archaeologist at the Maine State Museum, Bourque has surveyed these sites before, but the burst of new homes and constructions sites leaves him disoriented and reaching for a map. “The middens always face south to east,” Bourque says, surmising, “Most likely because of the sun.”



Bruce Bourque standing in front of a Boothbay Harbor cove in Maine where ancient shell middens line a severely eroded coastline.

Photo: Andi Rierden

At the edge of a pine grove overlooking a quiet cove, Bourque finds a severely eroded bank layered with splintered shells—the signature of a midden. The debris is packed about three meters deep [ten feet] with its exposed edges slowly crumbling into the sea. Nearby lies a dug pit. “The

mark of vandals,” Bourque says.

A midden, he goes on to explain, may contain the discards from several groups of inhabitants. Sometimes a succeeding culture added to the pile, or used it for a camp or home site. Way back then, a small cove like this one in Boothbay was boiling with shellfish and other marine life, making it an ideal habitation.

“Any archaeologist that works on this coast understands that there was an incredible abundance of resources,” he says. “It was very, very different then.”

Long before Europeans, populations waxed and waned along the Gulf of Maine’s coastline reaping the ocean’s bounty and migrating game. Along the coast of Maine alone, some 2,000 middens remain to tell their story. These shards of broken bones, tools and shells

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Gulf of Maine Expedition: The final stretch

By Lee Bumsted

On the day I go sea kayaking with the members of the Gulf of Maine Expedition, their sun and wind-burned faces attest to the fact that they’ve spent a great deal of time on the ocean recently. They tell me they’ve been underway for five weeks already, and have four



Natalie Springuel and Rich MacDonald are taking water samples along their 1,000-mile journey from Cape Cod to Cape Sable, Nova Scotia.

months still to go. From their departure point on the northeastern tip of Cape Cod, Massachusetts, they are kayaking

along the entire rim of the Gulf of Maine, all the way to Cape Sable Island, Nova Scotia. Their goal is to raise awareness of the Gulf as a distinct bioregion while learning more about its ecology and human history.

The four expedition members, two from the United States and two from

Canada, are meeting many peo-

ple along the way. Natalie Springuel, the team’s leader, notes, “The traditional expedition goes to an extremely remote

Aquaculture’s new frontier:

Scientists at the University of New Hampshire are developing a novel approach to fish farming — offshore

By Maureen Kelly

Five miles off the coast of New Hampshire is an unlikely site for a fish farm, but it is here that faculty at the University of New Hampshire (UNH), in collaboration with other institutions including the Massachusetts Institute of Technology (MIT) and Woods Hole Oceanographic Institution, are working on an experimental project that aims to demonstrate how finfish and shellfish can be raised offshore in the open ocean.

Unlike the salmon farms already hugging New England’s coasts, farms located offshore would free space in coastal

areas for other purposes like recreation and shipping. Offshore farms in deep water may also avoid pollution problems associated with farms in bays whose waters are not well flushed by the tides.

To bring healthy fish to harvest in the Gulf of Maine’s often turbulent seas UNH’s Open Ocean Aquaculture project (OOA) is working to develop the technology to keep large cage systems moored in the sea.

I joined Project Manager Michael Chambers and several of his colleagues on a sunny July day as they made the trip from Rye, New Hampshire to their 30-acre (12-hectare) open ocean aqua-

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Editor's Notes

In the International Year of Ecotourism, one island's story

It is clear and calm in the pale blue morning as we circumnavigate Isle Haute, Nova Scotia, an island off Cape Chignecto in the Upper Bay of Fundy. Leaning up against the sides of the retired fishing boat, several field naturalists, binoculars fixed on the towering basalt cliffs, call out the names of seabirds clustered upon the ledges and craggy coves. There are gannets, black guillimonts, shearwaters, and perhaps a peregrine falcon soaring high above the island. The bird scoops its wings full of cool air, then disappears beyond a line of



Isle Haute appears destined for federal protection.

trees. A pod of grey seals, necks stretched like steel cranes, watch curiously as our boat nears the shore.

In 1604, Samuel de Champlain came upon the island while looking for a place to settle his crew. He too noted the "high cliffs surrounded by great rocks," and "a pond of salt water, which lies at the base of a gravel point having the form of a spur."

We disembark on that same gravel beach near the pond. With us is Dan Conlin, the curator of marine history at the Maritime Museum of the Atlantic in Halifax and Isle Haute historian, who has volunteered to lead a hike and tells us the island's story. Our group includes a retired university history professor, a wildflower expert and a marine biologist. We will spend the next five hours in wonder of this place, rarely inhabited, but more and more threatened.

Unlike Champlain, we find the beach littered with soda cans, snack wrappers

and a mix of debris including a plastic pig. Recent visitors have left a fire smoldering. To get an idea of the increase of visitors, Conlin opens a covered container he left the year before with a journal inside. He notes the surprising number of entries from visitors as far away as Japan.

In 1997, Conlin was part of an expedition sponsored by the Nova Scotia Museum that spent a week here recording the island's natural history. The Isle Haute survey caught the eye of Kevin Davidson, the head of endangered species and habitat conservation in the Atlantic region for Environment Canada's Canadian Wildlife Service (CWS). Davidson recognized that Isle Haute's wildlife, archaeology and rare plants made it eligible as a national wildlife area. He has spent the past five years discussing the management of the island with the Department of Fisheries and Oceans, Isle Haute's present owner.

When Conlin tells the field naturalists about the probability of the island receiving federal protection, there is a collective sigh of relief.

"Thank goodness, it won't become a basalt mine," says one birder. "Or some rich person's fantasy island," remarks another.

Davidson works out of an office in Sackville, New Brunswick, nearby some of the largest protected areas in the Bay of Fundy. Back on the mainland, I phone him to ask how he plans to manage the island. "In all honesty I still don't know

how I'm going to do it," he tells me. "But if I didn't try I'd be remiss in my responsibilities to the Canadian public."

Davidson's responsibilities encompass a region that spans southern New Brunswick to the Arctic Circle. To say he is understaffed is an understatement.

"I've got 14 migratory bird sanctuaries, 11 wildlife areas and one guy to take care of them," he says.

That's 14,400 hectares or 35,500 acres. Environment Canada owns 3,300 hectares [8,151 acres] in the Bay of Fundy alone. Isle Haute would add 83 more hectares [205 acres].

Despite it all, Davidson is sanguine. "That may seem abysmal, but we've had minimal damage to the environmental integrity of our wildlife areas." The way the Canada Wildlife Act is written, he explains, protection is not 100 percent guaranteed, but it is more easily achieved than through other federal or provincial legislation. "Unlike national parks where a range of activities are permitted at the outset," he continues, "as our starting point in wildlife areas absolutely nothing is allowed. And then you permit things. If our sign doesn't say you can do it, you can't do it."

Still, the boom of tourist operations over the past decade that transport people to Fundy's migratory bird areas has Davidson worried. He views the trend, "as the biggest single threat to our protected areas."



Mary DesRoches and her sons operate a low-impact tourist business in the Bay of Fundy.
Photos: Andi Rierden

He adds, "When this started ten years ago the average person running an ecotourism venture tended to be granola bar types, close to the earth, interested environmentalists, people just making a living. Now we've got constant pressure from tourism departments and ecotourism businesses, which view our protected areas as, in their own words, 'underdeveloped products.' It makes my hair stand."

Nevertheless, Davidson says, with the proper regulations and community support all parties should be able to strike a balance. "It's a fine line between allowing people to see these wonderful gems and allowing them to destroy what they came to see," he says.

Davidson envisions a plan for Isle Haute similar to the one in place on Machias Seal Island, which is also managed by the Canadian government.

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(Canada and the United States both claim sovereignty over the island but so far each have agreed to disagree about its ownership).

At Machias Seal Island, only three tour operators are licensed to take passengers out to the island, and tourists are limited to 30 a day. Visitors must stay on walkways and view birds from prescribed blinds. Because the tour operators must undergo a strict licensing process, and carry costly liability insurance, Davidson says, the system becomes self-policing. "If one of the tourists, or one of the other captains does something wrong, we hear about it pretty quickly. They're very protective and monitor each other and other people that land there."

If CWS establishes a National Wildlife Area on Isle Haute, the first thing he will do, Davidson says, is "talk to the community, find out who has a real interest in preserving the island and who has an interest in taking people out.

Camping would be highly restricted, if allowed at all."

Perhaps more than anyone, Dan Conlin, who speaks with Davidson on a regular basis, wants to see the island retain its integrity. He's been coming here since he was a Boy Scout and returns whenever the opportunity arises.

At the top of the island near the rubble of the old lighthouse, Conlin recites tales of treasure hunters to the island; of the Maliseet and Micmac natives who met here 350 years ago, over a meal of dog flesh, to plan their attack on the British in Annapolis Royal; and of those who succumbed to Isle Haute, like the fellow who met his death reaching too far over a cliff for bird eggs.

As Conlin speaks about the island's unpredictable weather, a roll of fog enshrouds him, then lifts. We wend our way back to the boat, past a field of fireweed and down a primitive trail along a steep-sided ravine that leads to a section

called the Gully, the only forested area on the island. It is composed mostly of hardwoods that have never been cleared or disturbed. Along the way, the field naturalists spot wild columbine, striped maples and several varieties of ferns. Back on the beach they take away some of the debris—including the plastic pig—and douse out the smoldering driftwood with water from the salt pond.

Mary Desroches pitches in. She and her two sons own the tidy boat that will carry us the 12 miles back to Harbourville. It is a no-frills venture and the family has had to jump through plenty of regulatory loops just to make this one trip. Like many families in this area of the Bay, the DesRoches have been rocked by the collapse and privatization of the fisheries. Shuttling tourists back and forth to the island a few times during the summer is just one of the ways they can earn money to keep afloat. They are generous with their knowledge of the

region, and display a genuine love for the island. When I ask if she considers herself an ecotourism operator, DesRoches flashes a grin. "Not really," she answers. "We're just people trying to make a living." More than anything, she adds, they just want to see the island receive the protection it deserves.

Those are words that would make Kevin Davidson very happy.

Keep in mind a new *Fundy Issues Fact Sheet*, "Putting the Fun in Fundy: Possibilities and Pitfalls of Ecotourism." You can find it online at www.aura.com/~bofep/publications.htm. It considers 'balancing the costs and benefits' of ecotourism and the increasing potential for conflict between an expanding ecotourism industry and some of the natural features that sustain it, including shorebirds, whales and cruise ships.

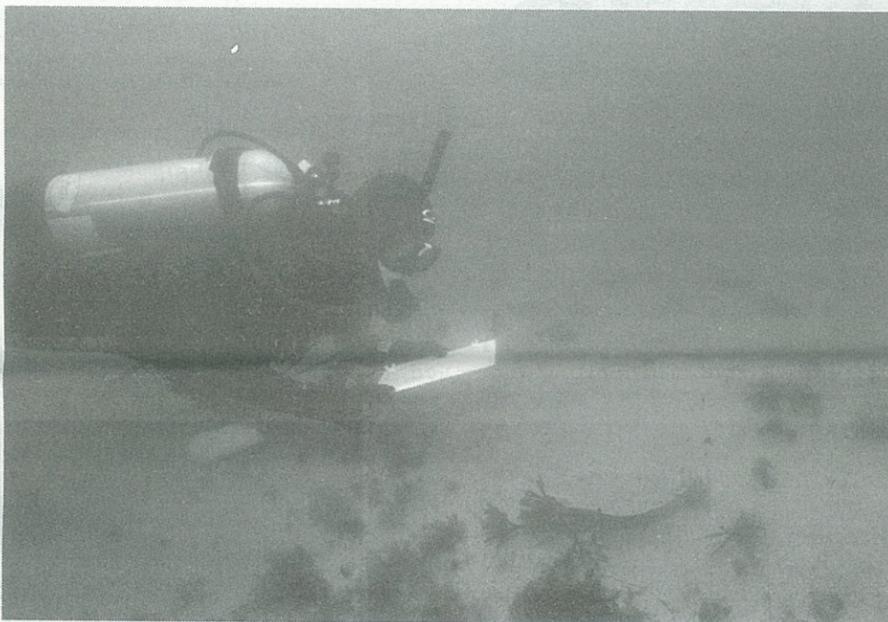
Gulf Voices

Diving into the glorious Gulf of Maine

By Bob Michelson

The Gulf of Maine is an extraordinary place to go scuba diving. Many types of underwater habitat you can be found here, ranging from a sand and mud habitat in Cape Cod Bay to a bouldery ledge habitat off the Nova Scotia, Maine and New Hampshire coastlines. The marine life is as diverse as the habitats in which they live. Incredible shapes, sizes and colors of creatures are everywhere. With such extreme tidal ranges, the Gulf of Maine can be as challenging a place to dive as it is fascinating.

I had the opportunity to dive Eastport, Maine several years ago and was astounded at the marine life found in only 28 feet [8.5 meters] of water at low tide (add 28 feet for high tide; diving can only be done at slack tide in the Bay of Fundy, it is too dangerous to attempt a dive at any other time). Stalked tunicates, red branching soft coral, several species of sea stars, as well as northern red anemones were everywhere. I found all these creatures at all depths of my dives. The normal stratification of marine life



A Gulf of Maine fish surveyor with flounder

clines—significant drops in temperature—from forming, allowing deep, cold-water species to survive in comparatively shallow water.

The coasts of Nova Scotia and Maine have primarily a rock, ledge habitat near shore. The harder rock substrate tends to yield much better horizontal underwater

ing striped bass, sea ravens, sculpin, lumpfish and schooling pollock. Invertebrates such as sea stars, urchins and sea cucumbers are all around. New Hampshire's diving is limited to offshore locations such as The Isles of Shoals, which has islands located in both Maine and New Hampshire waters. It is a great place for both newly certified and more experienced divers. The Shoals are home to sheer wall-like diving and offer deep ravines that rival winter diving vacation destinations.

Massachusetts is the dividing line where marine life habitats change within the Gulf. The Cape Ann communities of Gloucester and Rockport have a mix of rocky shore line and sand beaches—the convergence zone where rock and sand bottom dwellers meet. Here you can see winter and windowpane flounder, winter and little skate in the center of a sandy bottom cove, then move off to one side of the cove and explore the rock habitat of sites such as Folly Cove and Old Garden Beach. Boulders covered with frilled sea anemone are everywhere on the rocky sides of the coves, while rock gunnells dart in and among smaller rocks and cobble near the rock/sand convergence zone. Bottom dwelling sand dollars, moon snails and northern starfish

(different species from the sea stars) cover the bottom of the sand habitat. Underwater visibility is better over the rock and ledge and will average ten to 20 feet over sand habitat.

The area from Plymouth, Massachusetts and points south have primarily sand habitat. The main structures above the sea floor are usually shipwrecks. Shipwrecks are unintentional artificial reefs that are host to massive schools of cunner and tautog, several species of hake, Atlantic cod and wolf fish. There are hundreds of wrecks in and around Cape Cod Bay at all diving depths for every skill level.

There is a new program in place that teaches divers how to identify 56 different species of fish found throughout the Gulf of Maine. The Northeast REEF Fish Identification Program, with support from the Stellwagen Bank National Marine Sanctuary (SBNMS) was launched July 2001. Divers receive free training through sanctuary sponsored training seminars, then conduct fish surveys at any dive site they wish within the Gulf of Maine and southern New England. The data are then uploaded onto the Internet at www.reef.org. To date, 250 divers, snorkelers, students and educators have received training and have conducted over 300 fish surveys in the first year of the program. For more information on the program, or to schedule a training seminar for your dive club, school or organization, you can contact me, Bob Michelson, SBNMS Fish ID Coordinator at (781) 848-8870, or by e-mail pbm.inc@verizon.net.

Bob Michelson is an underwater photographer and videographer who has been diving for 23 years. He recently formed the Stellwagen Bank National Marine Sanctuary Dive Team and is currently working with the National Oceanic and Atmospheric Administration (NOAA) on various projects including The Great Annual Fish Count. In 2001, Bob was named an Environmental Hero by NOAA. He was one of 27 recipients nationwide to receive this honor.



Cunner fish

Photos: Bob Michelson

found in the southern half of the Gulf was nowhere to be seen. The incredible tides and currents prevent thermo-

visibility. Forty to 60 foot [12 to 18 meter] visibility is not uncommon. This ledge habitat provides a home to forag-

A seasoned environmental group considers the issue asks and what's fair

Q & A with Mark Butler, Ecology Action Centre

By Andi Rierden, Editor

The Ecology Action Centre (EAC) in Halifax, Nova Scotia evolved from a college course in 1971 designed to convince local residents to recycle their trash and to provide the public with environmental information. Thirty-one years later, the nonprofit environmental organization has taken on a range of issues from hazardous waste disposal to wilderness preservation.

In recent years, the Centre has organized Gulf-wide workshops on salt marsh restoration and the impact of invasive species contained in ballast water. In 2000, it hosted the first international symposium on deep-sea corals, attended by 120 scientists, environmentalists, government representatives, fishers and citizens from 20 countries.

As part of a current campaign, the Centre is urging the federal Department of Fisheries and Oceans (DFO) to create a policy that recognizes some gear types cause more damage than others. The Centre filed papers last year seeking a judicial review of DFO's decision to open Georges Bank to groundfish draggers.

In June, DFO closed most of a 424-square-kilometer [170 square mile] portion of Georges Bank to all bottom-dragging fishing gear, including gillnets to save ancient, deep-sea corals. Because their gear is less harmful to corals, long-line fishermen are allowed to fish in ten percent of the restricted area. The closure will allow scientists to study the impact of fishing on 35 coral species. They will probe waters 400

meters [1,320 feet] deep in the outer edges of the closed area, which could be expanded or tightened depending on research results.

In a recent interview, Mark Butler, a former deck hand on commercial fishing boats and head of the EAC's Marine Issues Committee, talked about the need to assess gear types, the recent closure and some of the financial and social challenges faced by environmental groups in Atlantic Canada. The following are some excerpts from that conversation.



Mark Butler

Photo: Andi Rierden

What's the premise behind your campaign on gear types?

This is not an issue that arose yesterday. Fishermen have long been concerned and warned of the consequences of dragging heavy gear over the bottom. If you went to any wharf in Atlantic

Canada in the last 30 years, people will tell you, even people in the dragger industry, that that type of gear does a lot of damage to the ocean floor.

The [federal] Fisheries Act says thou shall not destroy fish habitat, and it's quite clear that fish habitat is anything a fish uses in its life cycle. The act has been applied to freshwater habitat. If you're going to damage salmon or trout habitat you have to go through a regulatory process or you have to make efforts to minimize that damage or restore fish habitat elsewhere. But when it comes to the ocean floor, we have tended to ignore damage done. In most people's mind the ocean is dark, deep and obscure. But with advances in underwater video, side-scan sonars and multi-beam bathymetry, we have a better understanding of the ocean floor and realize there is a lot of life there and it needs protecting.

What are you hoping to accomplish?

We're seeking some change in the way fishing is done everywhere. The way it is now, all gears types are treated the same—a hand liner with six hooks over the side is excluded from an area in the same way that a 90-foot dragger is. Yet the reason there's this growing concern is because of the damage done, in particular, by industrialized forms of fishing. To make people who have done the least amount of damage pay for the sins of all is unfair. DFO should assess the impact of gear types and identify which does the least amount of damage. Then let's favor

that type of gear. We don't want to shut down fishing; we just want to see it done right.

What about designating more marine protected areas?

We haven't put marine protected areas at the forefront of our campaign. Yes, they have their place, but they are far from what's needed if we want a healthy ecosystem and a healthy fishery. If we protect 10 or 20 percent of the oceans, that leaves 80 percent unprotected. To protect corals, for example, we have to know where they are—and we don't know where they are. So closing areas to protect corals has its limits. If we said instead, for instance, that if you're fishing for cod, haddock, pollock [groundfish] you have to use a hook and not a drag, we would protect corals even if we don't know where they are.

Do you think EAC had an impact in the recent closure on Georges Bank?

Yes, I think we've had an impact along with a lot of other groups like the Canadian Ocean Society and the bottom long-line fishermen in that region. We're glad to see the corals protected. It's a good step and recognition that the ocean floor is important. However, it was traditionally a long-lining area. As I understand it, the bottom draggers couldn't fish there because of the bathymetry [terrain]. So in a way, the people who do the least damage to the ocean floor, the long-liners, are going to be the ones most affected by this closure.

Q&A continued on Page Nine

Sending positive ripples through the lives of teens

By Theresa Torrent-Ellis

Last year, a nonprofit youth development organization called Rippleffect raised the funding necessary to purchase the 26-acre Cow Island in Casco Bay, with assistance from the Maine Coast Heritage Trust. Tom Regan, who founded the Rippleffect in 1998, said

his goal was to give coastal education opportunities to a broad range of youngsters, particularly those at risk. He envisioned an outdoor classroom, or ocean academy, to help teens build self-confidence and make sound decisions through wilderness adventures.

Earlier this summer, Rippleffect offered 16 teens a week on Cow Island to learn sea-kayaking skills and island geology,

swim and hike. Rippleffect and the Parkside Community Policing Project in Portland sponsored the program. Using kayaks as educational tools and Casco Bay as a classroom, the week-long adventure marked one of the highlights of the opening season of Rippleffect's Cow Island Ocean Academy.

Officers from the community-policing project also volunteered to work with the participants. In addition to learning kayaking and other recreational skills, the teens studied tidepools and worked with local lobstermen.

For Regan, the start-up of the youth programs is the fulfillment of a long-time dream. In 1999, he led a 2,700-mile kayaking expedition to pay homage to the lives of several young people he knew who had died of AIDS and to educate teens about the disease. The team set out from Lubec, Maine and completed the journey in Key West, Florida. Along the way, the kayakers spoke to 2,300 youths about the importance of taking acceptable versus unacceptable risks in their daily lives. Having lost friends to AIDS, Regan used the metaphor of the risks inherent in kayaking to the risks teens face from AIDS.

"All youth are at risk—some more at risk—and these kids face serious conse-

quences resulting from inappropriate, poorly advised choices," Regan told me.

After completing their journey, Regan and expedition team member Aaron Frederick, inspired by their youth contacts, brought Rippleffect back to Maine. "It was bittersweet, the experience of making contact with these kids, introducing them to kayaking and then having to leave. We needed something that would continue and to create an affordable and accessible opportunity."

Regan added that developing the program in Maine was his way of giving back to the community where he was raised and honoring his friends who died of AIDS, in particular, a childhood friend who had helped him through troubled times and inspired his love for Casco Bay.

"Having grown up in Cape Elizabeth without means, I was fortunate to have friends who introduced me to the Bay," Regan said.

Future plans for the Cow Island Ocean Academy include an arts center, theater, classrooms (both indoor and outdoor) and summer office space. For more information go to www.rippleffect.net.

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



Youngsters from Portland cruised out to Cow Island, Maine this summer for a week of kayaking and wilderness education.

Photo: Theresa Torrent-Ellis

SCIENCE INSIGHTS

The space between

Lying at the edge of land and water, riparian habitats play a crucial role in the ecosystem

By Peter H. Taylor

Plip...plop. A raindrop hits a farmer's field on a hillside in New Brunswick, seeps into the ground, and begins a downhill journey toward a brook. Pesticides and fertilizers in the soil dissolve and hitch a ride along the way. As it nears the stream, however, the water percolates through a natural habitat called a riparian zone, which acts as a filter and removes the chemicals. The water is clean when it enters the brook, en route to the Gulf of Maine.

Thousands of streams flow into more than 60 rivers that meander to the Gulf. This drainage network spans 69,115 square miles [176,699 square kilometers] and carries some 250 billion gallons to the sea each year. Riparian areas are vegetated habitats; often forests that form a transition zone where land meets water. They fringe the shores of rivers, streams, lakes, ponds and parts of the coastline. Riparian zones play a vital role in the ecosystem as they filter the water, provide homes for animals and plants and control flooding.

A report from the National Academy of Sciences in the United States identifies protection and restoration of riparian areas as a national priority. In Canada, the issue is equally pressing. Riparian areas often suffer tremendous impacts from forestry, agriculture and urbanization. According to the NAS report, loss of these vital habitats in some places exceeds 90 percent. Around the Gulf of Maine, where the presence of Europeans extends back 400 years, a long history of human population growth and resource use has resulted in widespread destruction and degradation of riparian zones. These changes can have severe consequences for aquatic and coastal ecosystems. Today environmental managers, conservation planners and scientists are implementing numerous initiatives to sustain riparian habitats, but they say many advances are needed to close gaps in scientific understanding and effective management.

"Current regulatory mechanisms are probably not totally sufficient, and other solutions are required," said Jed Wright, a watershed protection specialist at the U.S. Fish and Wildlife Service's Gulf of Maine Coastal Program.

Traditionally, laws and scientific studies have focused solely on the role of riparian zones in protecting water quality. Indeed, these habitats can be quite effective as natural purifiers that remove pesticides, nutrients, petroleum products

and other contaminants before they enter a stream or other water body. The vegetation also helps prevent erosion of sediments into the water and stabilizes water temperature for salmon, brook trout and other creatures that depend on cool conditions.

"You can have a stream where the watershed is highly urbanized, for example, and if it still has an intact riparian area it's likely to be in much better shape than streams that don't," said Jeff Dennis, a biologist for the Maine Department of

100 meters [330 feet] wide," said Bob Bancroft, a riparian management consultant based in Nova Scotia. Many songbirds are vulnerable to parasitism by cowbirds, which thrive along the edges of woodlands. If a riparian buffer zone is wide enough, it can provide adequate protection from the cowbirds.

To retain a wider suite of species such as herons, scarlet tanagers and American redstarts, studies suggest a buffer width of 660 feet [201 meters].

Recently, a Nature Conservancy pro-

adequately for some potential problems, such as changes in flow caused by climate change.

Such a broad view of riparian management is not yet common. While many general scientific principles are well understood, tailoring them to particular sites can be a formidable challenge. Often this can require extensive – and expensive – fieldwork. In the future, this dilemma might be resolved in part by the development of advanced mathematical techniques that use existing data about terrain and geology to understand water flow and ecological conditions.

While scientific progress is important, an equally pressing challenge lies in translating existing scientific knowledge into successful management. At present, legislation and enforcement fall well short of protecting riparian zones. In many cases, regulations call for narrow buffers that may scarcely support water quality or habitat. Moreover, exemptions included in the laws sometimes allow for development and other harmful land use practices, depending on the circumstances. Even in cases where the laws might protect riparian zones adequately, agencies often do not have the resources to enforce them.

As a result, there is an immediate need to upgrade the legislative framework for riparian management. This might include developing incentives for riparian protection or mechanisms that transfer some of the societal costs to developers and others that degrade riparian habitats. As an alternate strategy, some non-government organizations purchase land or acquire the development rights along waterways in a bid to protect riparian zones and aquatic habitats.

Riparian habitats are not only the transition zone between terrestrial and aquatic ecosystems, but these rich environments also stand squarely at the intersection of ecology, economics and policy. At a fundamental level, improving awareness and education about riparian zones could fuel better management.

"Effective management," Jed Wright said, "requires a good combination of science and judgment."

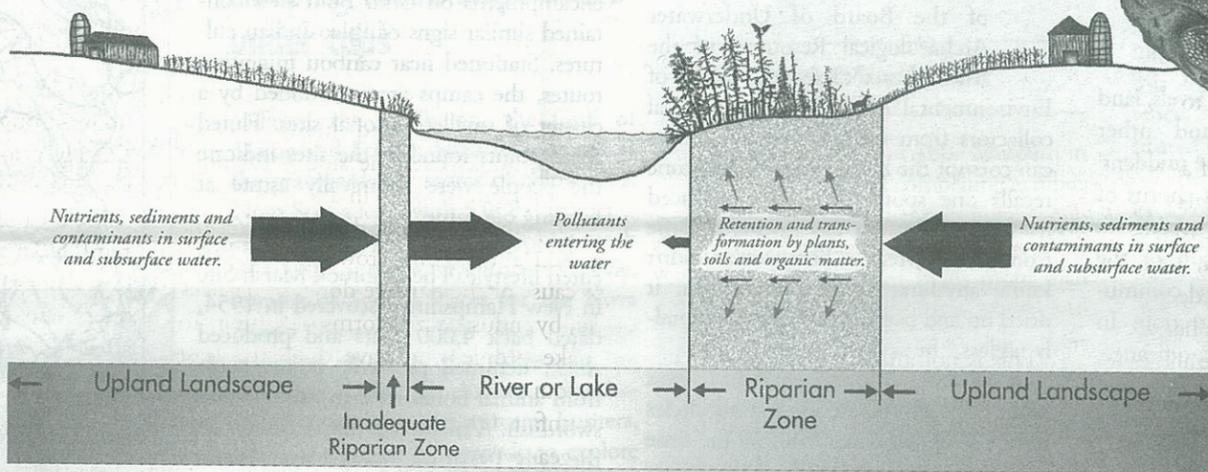
Peter H. Taylor, the article's author, and Ethan Nedeau, its illustrator, are the science translators for the Gulf of Maine Council. The mission of the Council's new science translation project is to aid the transfer of scientific information to environmental managers and policy makers. Taylor can be contacted at (207) 774-3450 or ptgome@maine.rr.com. Nedeau can be reached at (413) 253-6561 or ejnedeau@attbi.com.

BAD BUFFERS...

- ...Have minimal wildlife habitat value
- ...Do not protect water quality
- ...Cause warm and fluctuating water temperatures
- ...Offer no food or cover to aquatic animals
- ...Lead to erosion, sloughing and sedimentation

GOOD BUFFERS...

- ...Provide good wildlife habitat
- ...Protect water quality
- ...Moderate water temperatures
- ...Provide food and cover for aquatic animals
- ...Help streambanks resist erosion



Environmental Protection.

Regulations typically prescribe that a riparian strip be left in place as a buffer zone along shorelines where development, timber harvest or agriculture occurs. Numerous studies have investigated the minimum riparian width needed to maintain water quality. That distance ranges from less than 50 feet to more than 300 feet, depending on such local conditions as steepness of the slope and type of soil. Consequently, the laws, which vary between jurisdictions, usually specify minimum buffer width, amount of trees remaining and other requirements.

Increasingly, scientists and managers are moving beyond the traditional emphasis on water quality. "It goes well beyond the issue of water quality," Wright said, "because riparian buffer zones are also significant habitat for wildlife." Riparian areas host a greater variety and number of birds than other habitats, for example, and the luxuriant vegetation provides animals with shelter and food. Riparian buffer zones also can offer travel corridors for moose, bear and other animals in an otherwise fragmented landscape.

Studies show, however, that buffer zones may need to be wider to sustain wildlife. "If you want to accommodate songbirds, which are especially sensitive animals, you might need a buffer that's

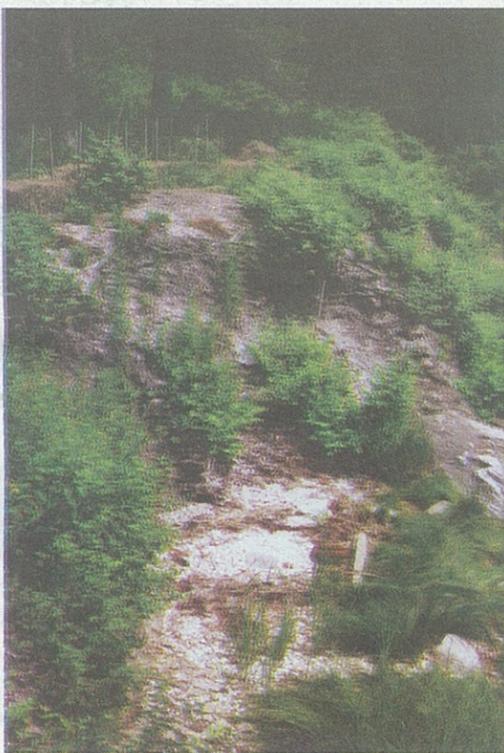
ject on a 185,000-acre [740,000-hectare] tract along the St. John River in northern Maine adopted an innovative, comprehensive approach that aims to incorporate these additional considerations in riparian management. The St. John is the largest river in the Gulf of Maine watershed and hosts rare plants such as Furbish's lousewort, a member of the snapdragon family.

"We're taking the simple standard buffer and seeing how we can apply it more smartly to the land to really protect the whole system, not just one species or water quality," said Josh Royte, a conservation planner for the non-profit organization.

The core of the plan is a necklace of riparian buffer zones along streams and the main river. Buffers up to 250 feet wide [76 meters], where no tree cutting will occur, form the 'chain' of the necklace. Located at intervals along the waterway are larger 'beads' of buffer zone—circular, no-cut areas of 300 to 600 acres [120 to 240 hectares]. The Conservancy designed these expanded areas to help support wildlife such as mating groups of pine martens. The project also intends to safeguard sites where groundwater flows into the river, because these areas are essential habitat for rare plants. Although the Nature Conservancy's design is remarkably comprehensive, Royte noted that even this plan might not account

Archaeology *continued from Page One*

can tell us what people ate, how they fished and hunted, how they buried their dead and how their lifestyles evolved with the changing climate and sea levels. The little information archaeologists know about these ancient cultures, in fact, came mainly from rummaging through their garbage.



Coastal erosion and land development are causing shell middens dating back thousands of years, to crumble into the sea. Photo: Andi Rierden

But erosion from rising sea levels, land development, vandalism and other assaults are contributing to the middens' demise. Bourque is among a chorus of archaeologists in the Gulf hoping to change the public's perception of the ancient remains and encourage communities to rally for their protection. In addition to their cultural significance, the archaeologists say, shell middens and other historic sites can reveal how ecosystems developed across the long march of time and help clarify the underlying causes of ecological change. In turn, the knowledge can be translated into grounded policies for restoration and management.

In a study published last year in *Science* magazine, Bourque, along with a team of ecologists, archaeologists and marine biologists, drew from historic records to uncover past evidence of seas teeming with large animals as well as scores of shellfish and oysters so vast they posed hazards to navigation. Their data showed that historical overfishing of the world's seas triggered current ecological collapses—many of which have been mistakenly attributed to pollution. The researchers found a direct link between removal of key predators such as sea otters on the West Coast, for example, and Atlantic cod in the Northeast and how that has undermined the food web, unleashing a chain of ecological instability from toxic algae to diseases.

Bourque refers to the study as "the manifesto."

"Using the historical record showed how humans have disrupted the bottom up productivity of the oceans," he says, emphasizing that ecological problems have deep historical roots, therefore protecting artifacts and ancient refuse is critical.

Stealing from the past

While vandals have always looted archaeological sites—from middens to rock-filled cellars and shipwrecks—the rise in global commerce, including services like the online auction house, *eBay*, has made it more tempting. Even though various federal, state and provincial laws aim to protect the remains, many sites are hidden far from public view. "It's a major problem," says David Christianson, Nova Scotia's provincial archaeologist. "On the enforcement side, there are not enough people to patrol the sites and even if there were, with all the other crimes, it's not a priority. By the time we hear about it, the vandals are long gone."

He says a range of researchers depend upon archaeological sites, citing the work of marine biologists like Dr. Alfonso Rojo, who is developing a reference collection of fish skeletal structures from the Maritime provinces based on examining shell middens. "These sites are a repository for a whole range of data," Christianson says. "If we're trying to understand climate change and animal populations, it is pretty hard to come up with long-term plans if we don't have the information from the past."

Vandals are not the only problem. Victor Mastone, the director of the Board of Underwater Archaeological Resources of the Massachusetts Executive Office of Environmental Affairs, says even casual collectors from tourists to scuba divers can corrupt the historic record. Mastone recalls one sports diver who surfaced from Massachusetts Bay towing a frame from a shipwreck. "Because he didn't know anything about preservation, it dried up and became powdery and totally useless," he says.

In another instance, Mastone was called in to investigate some stone circles on the Taunton River. "But by the time we got down there, most of the stones had been turned over. So now we don't have the shape we wanted and the context of the site has been disturbed. People don't realize that any disturbance of a site can destroy information."

The human record

When archaeologists talk about the human record in the Gulf of Maine they're referring to a span going back 12,000 years. But it took many more thousands of years of glacial movement to create the setting for these ancient pioneers to migrate into this new land. In short, the Gulf of Maine as we know it today owes its existence to the Laurentian Ice Sheet—the last major ice sheet—that advanced from northern Canada and reached southern New England about 21,000 years ago. A few thousand years later, the ice sheet began retreating, exposing the land. Elevated banks in the Gulf remained above sea level for thousands of years. Animals and plants spread there from ice-free areas in the United States.

To get an idea of what the Gulf looked like 12,000 years ago imagine Stellwagen Bank. The bank stood well above sea level and may have been connected to Cape Cod. According to computer-generated models, lakes, swamps and marshes probably dotted the landscape, with

tundra shrubs and grasses covering the bank top. Beaches, sea cliffs, spits and lagoons lined the shoreline. In recent years, fishermen have dredged up the teeth of woolly mammoths and mastodons from Stellwagen and Georges banks, giving some evidence of the animal life of the time. Humans possibly followed the herds out onto the banks and onto the continental shelf. By 11,000, the melting glaciers continued to return water to the ocean basins causing a rise in sea level. About 10,000 years ago, the rising waters inundated Stellwagen Bank.

Because sea levels have risen about 300 feet since pre-historic times, most of the early sites older than 5,000 years have been washed away. Even so, Mastone says, bathymetric and geophysical models can predict where sites might be. Models developed by Mastone and his team were used recently by a natural gas company to chart possible historic sites the companies by law must avoid before pipelines are laid along the sea floor in Massachusetts Bay. While the remote sensing technologies did not detect sites in the area mapped for dredging, that doesn't mean they don't exist elsewhere, Mastone says, adding, "We have all these intuitive suspicions as archaeologists that there are sites out there."

The Debert site in Nova Scotia, dating back 10,600 years and Bull Brook, in Ipswich, Massachusetts, dating back 9,000 years are among the Gulf of Maine's largest and earliest human encampments on land. Both sites contained similar signs of Paleo-Indian cultures. Stationed near caribou migration routes, the camps are surrounded by a cluster of smaller seasonal sites. Fluted spear points found at the sites indicate the people were technically astute at hunting big game.

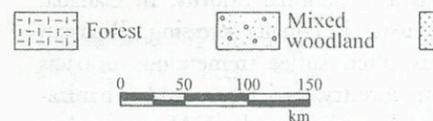
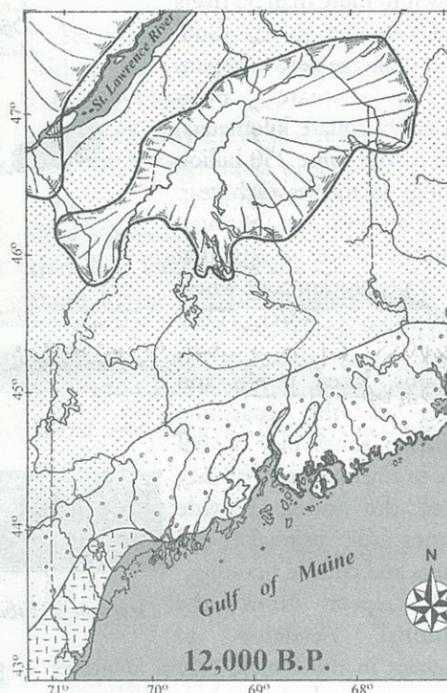
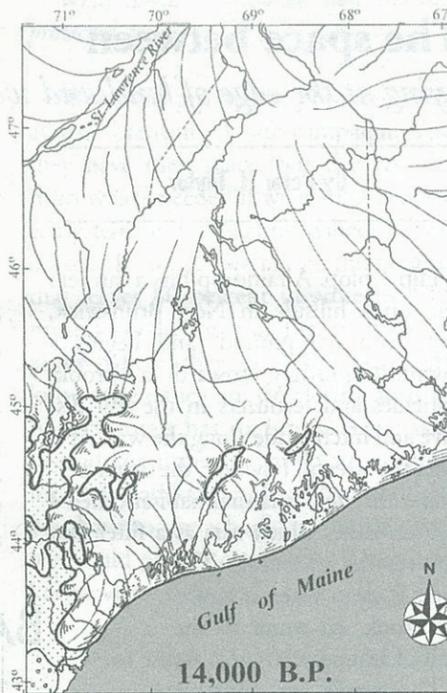
Later cultures adopted a maritime-oriented lifestyle. The Seabrook Marsh Site in New Hampshire discovered in 1954, dated back 4,000 years and produced small, stemmed projectile points made from animal bones used to fish cod and swordfish. A major site first excavated in the early 1970s on North Haven Island in Penobscot Bay, Maine, called Turner Farm, details the record of what some archaeologist call the Red Paint People, named so because of the red ochre they placed in their grave sites.

Also referred to as the Moorhead phase, after archaeologist Warren K. Moorhead, who excavated many of those sites in Maine, the Red Paint People took full advantage of the Gulf's biological productivity. The people were highly skilled swordfish hunters and also ate an abundance of cod, shellfish, deer and quahogs. They left barbed hooks made of deer or moose bone along with elegantly carved slate bayonets, chisels, plummets, gouges and daggers. The vast collection of artifacts from this period can be viewed at the Maine State Museum as part of a permanent exhibit.

About 3,800 years ago the Red Paint People vanished mysteriously. One possible explanation was the disappearance of swordfish, brought about by the cooling of the water.

The Red Paint People were replaced by a distinct culture called the Susquehanna, whose remains were also found at Turner Farm and in other parts of New England, Nova Scotia and New Brunswick. Chemical analysis of bones found in Susquehanna shell middens indicates they survived more on inland resources than marine life. They probably ate a mix of mollusks and game.

David Black, an archaeologist at the University of New Brunswick, has dedicated the past 20 years to piecing together a narrative of the Bliss Islands in the Quoddy region of southern New Brunswick. His story spans from the tail end of the Susquehanna era, 3,500 years ago to the early 1800s. Situated at the confluence of the U.S. Gulf of Maine and the Bay of Fundy, the Bliss Islands are surrounded by a highly productive



The retreat of glacial ice in Maine, from Twelve Bourque (University of Nebraska Press, 2001)

mosaic of marine and inland life; in short, a great place for early inhabitants to set up camp. The native people, Black says, "Must have thought this was heaven on earth."

Four thousand years ago, the islands were one land mass with the average high water line located where the average low water line is today. Today these three islands continue to be shaped by the rising seas. Occupied by ancestors of the Passamaquoddy people of southern New Brunswick and northern Maine, Black found some of the sites to be remarkably intact. Excavations have produced a bonanza of artifacts, including 18 species of shellfish.

At one location called the Weir Site, "By the time that native people abandoned it about 1,000 years ago there was this build up of forest soil that was

around 30 centimeters [one foot] deep sealing the whole site," Black says. He adds that because of its location the site was never occupied by Europeans. The natives used the site season after season discarding heaps of shellfish debris from clams, sea urchins and mussels along with animal bones. Calcium carbonate from the shells helped to preserve the contents. A closer analysis found other glimpses into the culture, such as pottery

he says. The researchers found bones from pigs, chickens, cattle, sheep, trapped beaver and mink. They uncovered metal cod fishing hooks and a two-tined fork, haddock and dogfish bones. Bliss owned a schooner named the *Hazard* that may have transported potatoes from markets in Nova Scotia. He died in 1803, in his early 50s. From his home, "Bliss could see all the way to the American border," Black says. "On a beautiful day, it was a stunning place, on a nasty day it just howled."

Today the Bliss Islands sit within one of the densest aquaculture arenas in the Gulf of Maine. Black says the boat traffic connected to the operations has degraded the water quality in areas surrounding the island, and that tourism and development are on the rise.

"I guess you have to take the long view and say people are creating new archaeological sites to replace the old ones," Black says. "But it is troubling because with more access to offshore islands and more foot traffic, there is much more potential for destruction of the sites, either intentional or unintentional."

Keeping those shipwrecks under caps

From the 1500s on, the Gulf of Maine and Scotian Shelf have served as the graveyards for scores of shipwrecks. Nova Scotia leads with 5,000 documented wrecks, but estimated numbers reach to 10,000 or more, says Robert Ogilvie, curator of Special Places for the Nova Scotia Museum. Just like heritage resources on land, the shipwrecks are protected by law. To eliminate plundering by scavengers and souvenir hunters, divers must obtain a permit to explore these locations. Individual violators that remove or disturb artifacts can be fined up to \$10,000 and companies up to \$100,000. That applies to offshore oil and gas companies as well as land developers. "If you damage something during construction, we can issue a stop order and you could be prosecuted," Ogilvie says. "So it pays to spend some money to do an archaeological assessment," of potential development sites.

Ogilvie says enlisting the help of sports diving groups and community members to caretake archaeological sites on land or sea makes it less likely for vandals or collectors to disturb them. "Many people realize that these are truly nonrenewable resources," he says. "If we allow them to be lost, they are lost for good and we can never get them back."

To 'wean' people away from disturbing historic shipwrecks in Massachusetts Bay, the Board of Underwater Archaeological Resources lists 40 exempt shipwrecks on its Web site that the public is free to explore without a permit, provided they do not do any damage. The sites include the Albert Gallatin, a steamer that went down in 1892 off Boo Hoo Ledge in Manchester, and the Henry Endicott, a four-mast schooner that sunk in 1939 off Plymouth.

"These are sites that have been tampered with in the past and have lost their historical integrity," says Mastone. As for



Students at the Samuel Bliss homestead site in New Brunswick.

Photo: David Black

the designated historic shipwrecks, he adds, "We keep those at a low profile."

While archaeologists know they can't save every site, more resources to excavate and preserve the most valuable remains are desperately needed.

For the earliest coastal sites, in particular, the clock is ticking. As inhabitants of the Gulf of Maine have learned over

the millennia, rising waters show no mercy.

To be sure, Christianson of the Nova Scotia Museum recalls visiting several pre-historic sites in the southwestern part of the province in the early 1970s. They have since slipped beneath the sea.

Abbe Museum pays tribute to Maine's earliest people

By Andi Rierden, Editor

Visitors to the new Abbe Museum in Bar Harbor will find compelling exhibits conveying some of the most notable collections of native artifacts in the Gulf of Maine. The museum holds more than 1,000 baskets, mostly from Maine and the Canadian Maritimes, as well as pottery and stone and bone tools from the museum's archaeological excavations.

"Wabanaki: People of the Dawn," a timeline designed and developed by Rebecca Cole-Will, Abbe's curator, begins with the lives of contemporary native people and traces back 12,000 years. Cole-Will composed the exhibit with assistance from Native Americans in Maine who shared their research, stories and photographs.

The Wabanaki nation includes the Penobscot, Passamaquoddy, Maliseet and Micmac. While all four tribes maintain communities in Maine, their range overlaps into Canada. The Micmac extend across New Brunswick, Nova Scotia and Prince Edward Island. The Passamaquoddy and Maliseet also live in New Brunswick and Quebec. And the Penobscot also live in southern Quebec.

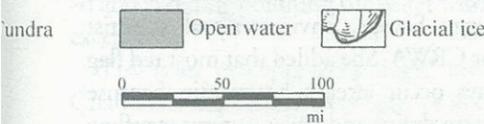
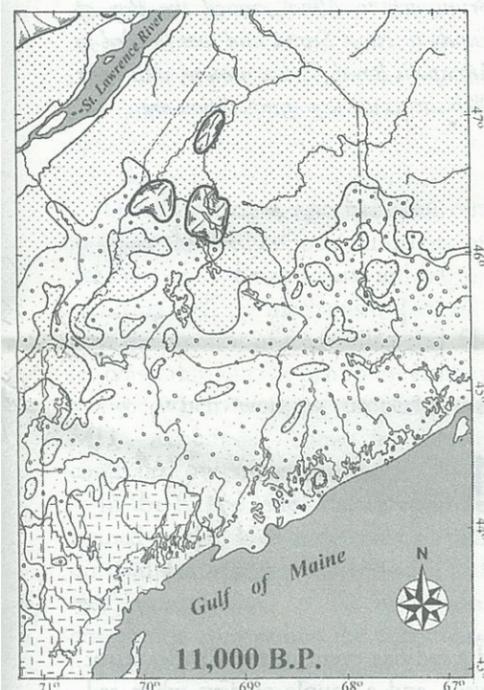
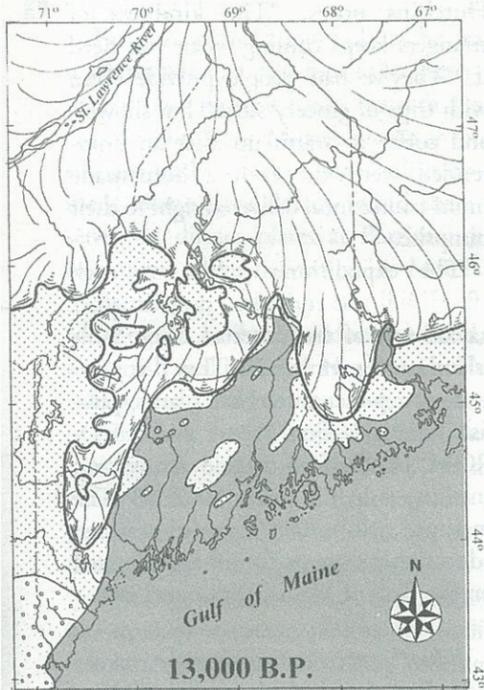
Cole-Will says the exhibits and displays are designed to break stereotypes and show the enduring history of the Wabanaki people. She adds that even the earliest people left timeless contributions such as canoes, snowshoes,

moccasins and pottery. "Theirs wasn't this tooth and nail struggle for existence," she says. "They had very sophisticated technologies."

The museum was originally founded in 1927 by Robert Abbe, a New York surgeon, and opened a year later in a trailside building at Sieur de Monts Spring in Acadia National Park. While it remains open seasonally, the small space lacked the proper climate control and lighting essential to preserve many artifacts.

After years of fundraising for a new space, the museum opened last fall in an 1890s landmark in downtown Bar Harbor. Extensively renovated, the museum is softly lit and spacious. The expanse of 17,000 square feet contains exhibition halls, education centers for adults and children, a conservation laboratory and gift shop.

Located on Mount Desert Street, the Abbe is open year-round. For information contact the museum at (207) 288-3519 or visit the Web site at www.abbe-museum.org.



and Years: American Indians in Maine by Bruce J.

© Maps by Richard D. Kelly

shards that were used to cook seal meat or render seal fat.

Black says the artifacts, which belong to the province of New Brunswick, contain a trove of untapped information. From an ecological standpoint he says, "We have all these sea urchins that go back 2,500 years. If we investigate further, that could tell us something about micro-scale climate change and what has happened to sea urchins since that time."

A Loyalist officer from Massachusetts, Samuel Bliss, later inhabited another part of the island. Bliss received the islands as part of a land grant following the American Revolution and in 1784 built his house. Excavations led by Black surrounding the Bliss homestead revealed middens of a different sort. "They had quite a farming operation,"

Expedition *continued from Page One*

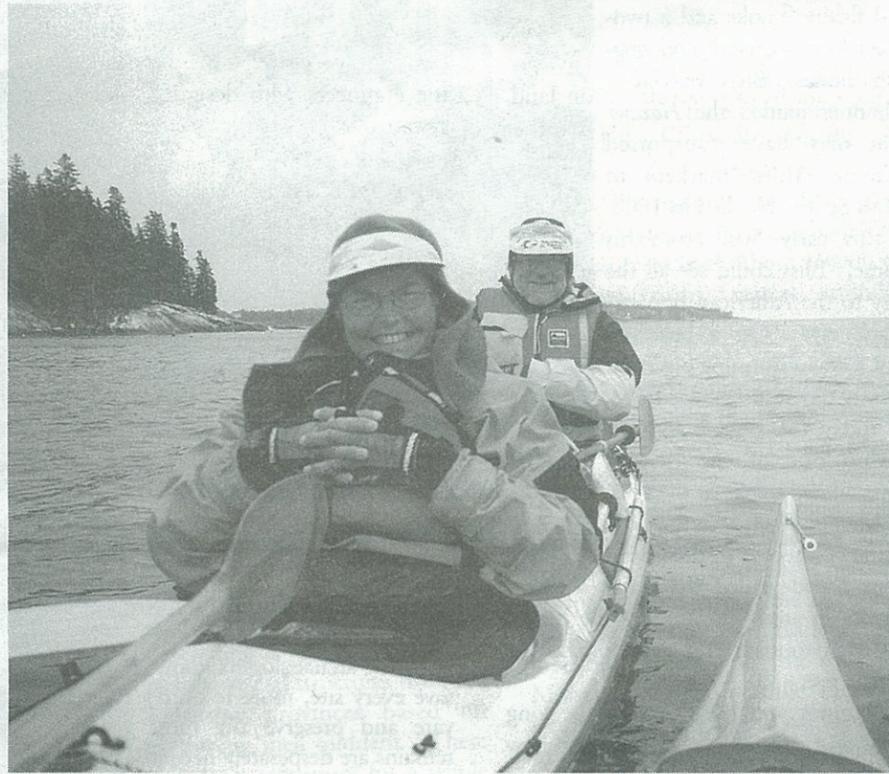
area and travels along a portion of the planet that not many people have traveled through, and has little interaction with people. We are very deliberately taking the opposite approach. We're interested in the stories of folks who live and work in the Gulf of Maine." The team is offering 19 community outreach programs along their route to share what they're learning and observing.

When the expedition members come ashore, people are drawn to their kayaks with their "Gulf of Maine Expedition" logos. Beach walkers in Massachusetts asked them, "Did you really come all the way from Maine in those little things?" Such questions open the door to conversations about the Gulf of Maine being the watershed for three states and three provinces, how it's not just along the coast of Maine. These conversations provide the expedition members with opportunities to hear locals' stories: how the dunes have shifted over the years, or how the area was previously less heavily built up.

"We were surprised that the whole Gulf of Maine coast of Massachusetts and New Hampshire was so highly developed," expedition member Dan Earle says. Another member of the team, Rich MacDonald, adds, "It was disheartening that there was very little natural landscape in Massachusetts and New Hampshire."

The kayakers had to make special arrangements to camp along that part of their journey, and they only stayed at one public camping area. Ironically, that was in the midst of busy Boston Harbor, in the Boston Harbor Islands National Recreation Area. "This lack of opportu-

nity for coastal camping on the Massachusetts and New Hampshire coast potentially puts a lot more pressure on Maine as a recreational destination,



Sue Hutchins and Dan Earle

Photos: Lee Bumsted

since people can't do these trips on their own coast," Earle notes.

When I paddle with the team members off Southport Island in Maine, most of the cottages and homes we pass are small, particularly compared to what they had seen in Massachusetts. Sue Hutchins, who paddles a tandem kayak with Earle, comments that the scale of development seems much better balanced along the coast of Maine than in Cape Cod.

The expedition members are documenting what they are observing in a number of ways. Tucked into their kayaks are a laptop computer, digital

cameras, a solar panel and a set of watercolors. They are sharing their journals and photos on their Web site. Twice each week they troll for phytoplankton and then analyze the samples under a field microscope back at their campsite; they are on the lookout for the phytoplankton species that contribute to red tide. Water samples, which allow them to check levels of dissolved oxygen, temperature, salinity and pH, are also collected twice weekly. The kayakers are recording

the range of various types of vegetation, and they already identified 131 different bird species by the time I meet up with them. They hope their "snapshot in time" will contribute to people's understanding of the Gulf.

While traveling along 1000 nautical miles of often-populated shoreline presents some challenges, such as finding appropriate camping sites, that same population density can be helpful. As Hutchins notes, "The kindness of strangers keeps coming when you need it." They've had people provide them with trips to grocery stores, hot showers and coffee to warm up after an unintended wet exit, even a homemade multi-course meal delivered right to their campsite.

The expedition's public outreach efforts will not end when they lift their kayaks out of the water at Cape Sable Island on September 28. They'll continue to give presentations and plan to publish articles, a final report and a CD-ROM. A Gulf of Maine Expedition Institute is in the works for 2003. The institute will offer "expedition-based education programs for all ages focused on the Gulf of Maine," Springuel says.

Editor's note: At press time the expedition had kayaked the coast of New Brunswick to Alma, crossed the Bay of Fundy to Nova Scotia and was headed to Annapolis Royal. To learn more, visit their Web site at www.gomexpedition.org.

Flagged by the Charles River Watershed Association

Oldest watershed group in U.S. hoists conditions for boaters

By Michelle Vaillancourt

On a recent summer day, the Charles River Basin is teeming with boating activity. Rowers slice through the water while a fleet of small sailboats tack lazily back and forth between the Boston and Cambridge shores. Amphibious duck boat tours introduce tourists to the river with a splash. On days like this, the river becomes an urban oasis that draws thousands of boaters.

Over the years, the Charles River has been plagued with poor water quality, trash and pollution. Today, the river is significantly cleaner, but on occasion, water quality conditions still reach levels that could pose a threat to public health.

To alert boaters to water quality conditions, the Charles River Watershed Association (CRWA) runs a flagging program now in its fifth season. "The program was initiated when the boating community asked CRWA to help ascertain the water quality of the river on a daily basis during the boating season," says Kathy Baskin, CRWA project manager.

Flags are posted daily in the summer months at four sampling sites. If a red flag is hoisted, bacteria levels in the water exceed state standards for safe boating. If

the samples do not exceed the state standard, a blue flag is flown. "On red flag days CRWA cautions boaters to wash immediately after they have been on the water," Baskin says.

Samples are taken two to three times a week in the lower section of the river, called the Charles River Basin, where most of the boating occurs. They are tested for fecal coliform bacteria, an indicator of human sewage and animal waste. Sample results are augmented by a predictive modeling computer program that takes recent rainfall into account to estimate when bacteria levels are likely to exceed safe boating standards. To date,

the modeling program has been 85 percent accurate in its water quality predictions.



Courtesy of Charles River Watershed Association

As of mid-August, the association had recorded only one day where three out of the four sites monitored prompt-

ed a red flag event in the Charles River Basin, and a couple of days when red flags flew over just one of the sites, said Peggy Savage, environmental scientist for CRWA. She added that most red flag days occur after a heavy rain because storm drains and sewer systems overflow and flush pollutants into the river. CRWA research shows that the basin does not meet safe boating standards after a heavy rainfall about 13 percent of the time.

Established by a group of citizens in 1965, CRWA was founded to protect and enhance the Charles River and its tributaries years before federal water protection regulations were enacted. The river had suffered many years of abuse and was in a severely degraded condition. Landfills were caving into the river, drums and cars were dumped in tributaries, and water quality was very poor with several daily discharges of raw sewage.

Today the CRWA has more than 5,000 members and 13 staff, making it the largest watershed organization in the country.

Michelle Vaillancourt is a coastal steward and former member of the Gulf of Maine Council's Public Education and Participation Committee.

Aquaculture continued from Page One

culture site, south of White Island. We rode out in the *Bluefin*, the smaller of two vessels UNH uses to maintain the site.

Mussels and finfish raised at sea

Far from shore, buoys bob in the sea marking where a 380-foot (116-meter) line of blue mussels hangs beneath the water on longlines. Mussels grown at the site are ready for commercial development. Some have already found themselves on dinner plates at Portsmouth restaurants after a harvesting last March.

For finfish development, UNH is focusing on halibut, haddock and cod, hardy fish well suited to New England's cold waters. UNH stocked its first group of halibut at the OOA site last fall. The fish, the first halibut to be raised in open ocean pens, will swim in their cage, suspended in water 180 feet (55 meters) deep, for two years before harvesting.

The cage system makes an unobtrusive mark on the seascape. The pen itself is submerged, its nylon netting bulging just below the surface. In shape, it resembles a diamond, albeit 50 feet (15 meters) in diameter and 30 feet (9 meters) in height, swollen in the middle and tapering at the top and bottom. A metal feed hopper, built by MIT, sits over the pen, above the waterline.

The *Bluefin* crew, who has come out to repair this feed hopper, climbs out of the boat onto the structure and begins tinkering with the mechanism that controls the amount of feed pellets that filter down through the pen to the halibut below. When working properly, the MIT "Robofeeder" allows for remote controlled, automated feeding.

In the future, video cameras will be trained on the cages underwater so staff on land can monitor fish behavior and feed consumption. If the fish under observation stop eating, the pellet flow can be shut off by remote control, thereby minimizing the amount of food wasted and avoiding polluting the water with excess feed.

This is an "evolving technology," says Chambers, explaining that each prototype deployed enables UNH to identify and correct problems in design. The "next generation" of cages will be com-

pletely submersible, feed buoys and all, he says. The aim is for simple designs that are "user-friendly" and are automated as much as possible.

Another buoy afloat on the farm allows researchers to monitor environmental data from their offices on land. The buoy transmits real-time weather and environmental data—including waves, currents, temperature, salinity, fluorescence and turbidity—to UNH and the Seacoast Science Center in Rye.

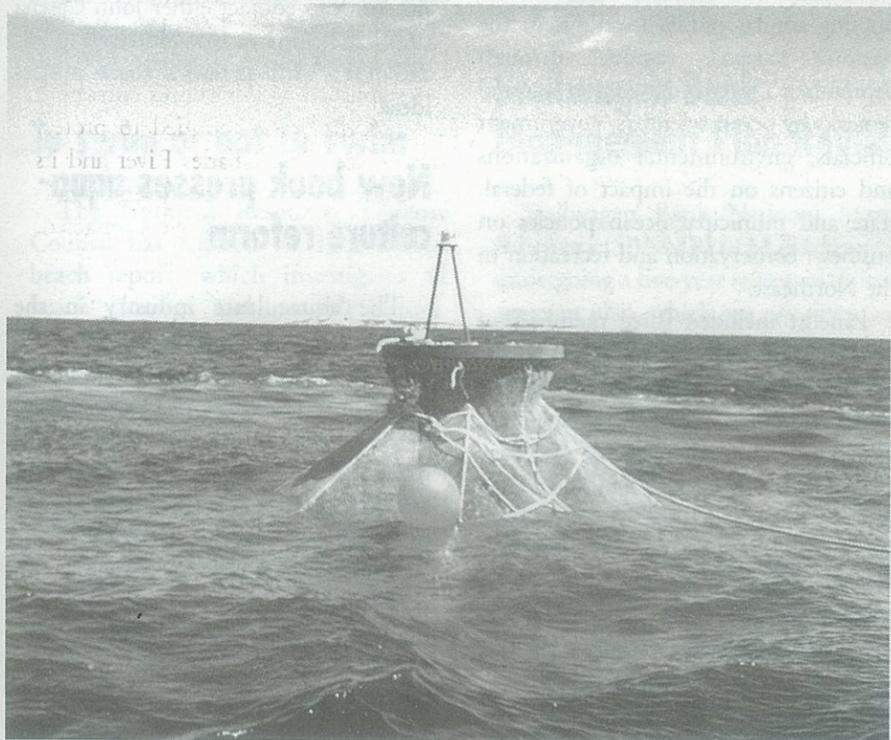
Despite the farm's automated sys-



University of New Hampshire team conducting environmental monitoring at open ocean aquaculture site.

tems, maintenance of the site is done by old-fashioned manual labor. Divers must regularly attend to the nets year-round to prevent biofouling. The nets need to be clean so that waves will flow through the cage, otherwise the currents will drag the nets.

Today, the sea is calm with one to two foot seas, posing no danger to the workers as they work dangling off the Robofeeder. But inclement weather can bring hazards to the crew attending the open ocean farm site, unlike those experienced by aquaculturalists working in sheltered bays. Dive safety is a concern and poor visibility underwater can be a problem.



Fish cage

Photos: Maureen Kelly

Troubleshooting back at the lab

New England's harsh marine conditions also presented a major challenge to the engineers who designed these cage systems.

At UNH's Ocean Engineering Laboratory in Durham, a miniature version of a Russian-made pen, about the size of a birdcage, dangles in the warehouse-size building. It is one of the

designs that have been tested in the lab's tow/wave tank to determine the motions of a full-size cage under stress of waves and currents in the ocean. Computer modeling based on the tank experiments enable researchers to simulate the tension of mooring lines and predict cage performance in the ocean. The simpler design of the cages at the OOA site went through the tow/wave tank before the full-size structures went into the ocean.

David Fredriksson, a UNH research assistant professor, stands on a platform overlooking the tank, which could pass for a one-lane lap swimming pool were it not for the contraption at one end that pushes the water to form waves and a buffer, or "beach," at the opposite end, which absorbs the energy from the waves. He asks his colleague at the computer controls to send a wave coursing down the length of the tank. A wave, barely knee-high, ripples through. In the sea, that wave would be 30 feet, Fredriksson explains. Cages deployed in the ocean need to be able to withstand the surge of waves that size in the Gulf of Maine.

The cages at the OOA site offshore are secured by a one ton (1000 kg) anchor, and held in place with four mooring lines; each line is anchored to the seafloor with a 90-foot (27-meter) chain, each link weights about 34 lb (15 kg). The design is proving successful. These nets have been in the sea for over three years and have "survived multiple Northeast storm events," says Fredriksson.

Since there is no blueprint to go by when constructing systems for open ocean aquaculture, all the pieces that go into a successful farm system need to be developed simultaneously.

"We're tackling all the issues at once," he says, and "we're troubleshooting all the time."

Q&A continued from Page Four

Are grassroots organizations in the region's small communities hindered by embracing controversial issues?

Sure, if you're in Yarmouth for instance, and you come out with a strong anti-dragger campaign, you're not going to get local businesses to support you. You'll just remain a marginal group. In a larger city like Halifax, you can mount a campaign against something and you don't have to worry about running into your neighbor Buddy at the corner store. But even though EAC is in an urban area and we've come out against dragging, it's not this big glossy campaign that demoralizes people. Living in Nova Scotia we try to look at the social side of this too, and ask what's fair.

What are some of the major differences between conservation groups in Atlantic Canada and those in New England?

Here everything is much smaller and there are many more resources available to New England groups. We don't have the tradition that exists in the United States of private or foundation funding for environmental groups. Overall, the foundations here are small and the money available is much less. Most of our wealth in Atlantic Canada is in relatively young businesses; we don't have large foundations that made their fortunes in the 1920s, or before. This is not a whine, mind you, because at the same time, the problems are much more severe in the States.

Do you think a conservation group is compromised once it receives funding from corporations or government?

It's the perennial question and it's what busts up a lot of groups. In our own organization we have different points of view. We've taken funding from DFO in the past, but we don't take corporate funding. Our rule is never, ever let funding determine what you want to say. You always have to be ready to move on if the funder doesn't like what you're doing, or if they want to pull the funding. You may even have to end the program being funded. I think our bigger responsibility is to our members and to doing what's right for the environment—we have to make choices and compromises too, but those two things should be first and foremost in our consideration.

What's the key to EAC's longevity?

We have long and strong roots in the community with more than 150 active volunteers to raise money each year. We also have around 500 members. A good strong volunteer and membership base is very important. Say if tomorrow all of our foundations deserted us, we'd still have our members to provide staffing.

Another aspect is core funding. For instance, to develop our Marine Issues Committee we got a small grant, which allowed us to hire somebody, then we used that to get further funding and bring in other people. To get that first bit of funding that allows you to grow is hard. There's no guarantee that you'll succeed, but at least it's some initial funding that enables you to go out and initiate projects.

Gulf Log

A big maybe for endangered species law

The Species at Risk Act (SARA), was passed by Canada's House of Commons in June by a vote of 148 to 85. It was the third attempt in nine years to pass a law to protect the country's growing list of species at risk of extinction. That list,



Minas Basin beach, Nova Scotia

prepared by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), has grown from just short of 250 species in 1993, when the federal government first promised to protect species, to more than 400 today. Though conservation groups felt the bill remained far from perfect, they supported recent amendments that strengthened habitat protection in some areas of federal jurisdiction and provisions to allow scientists to have more say on which species are listed as endangered. The Senate is expected to pass SARA this fall. Seven Canadian provinces, including Nova Scotia and New Brunswick, have laws in place to protect endangered species.

Low frequency sonar approved, lawsuit follows

In July, the National Oceanic and Atmospheric Association's (NOAA) National Marine Fisheries Service (NMFS) announced its decision to grant the U.S. Navy a small take exemption under the Marine Mammal Protection Act to allow the Navy to operate its controversial low frequency active (LFA) sonar on two vessels over the next five years. The sonar, touted for its ability to detect submarines at long range, is opposed by many environmentalists who believe that its intense sound blasts will harm marine mammals.

NMFS's authorization came with stipulations that prohibit the Navy from operating LFA sonar within 12 miles [19 kilometers] of any coast and in marine mammal protection sanctuaries. The Navy must also shut off the LFA if the

sound source is within 1.1 miles [1.76 kilometers] of mammals or turtles to protect them from exposure to sound levels above 180 decibels (db).

The Navy will use visual monitoring, passive sonar and high frequency active sonar to spot animals. The mitigation measures will have nearly "100 percent effectiveness to detect mammals," said Ken Hollingshead, program manager for NOAA Fisheries Small Takes Program.

Russell Wray of Citizens Opposing Active Sonar Technology, an advocacy group in Maine, called the mitigation measures a "smoke-screen" since LFA sounds travel extraordinary distances through water, well beyond the 1.1 mile safety zone.

The fact used to justify the decision was that, "marine mammals would not be harmed under 180 dB," Wray said. The Navy tested LFA on blue, fin, gray and humpback whales at levels below 155 dB. There is a hole in the data, Wray said.

Under the authorization, NMFS is requiring that the Navy conduct more research into effects of LFA on marine mammals, specifically between 155 dB and 180 dB.

Within days of the decision, a coalition of environmental groups led by the National

Resources Defense Council filed a lawsuit against the Navy and NMFS to block deployment of the sonar system, arguing that it could pose a threat to entire populations of whales, dolphins, seals and other marine mammals.

—Maureen Kelly

"Small but mighty" Gulf of Maine Program honored

The Maine Coast Heritage Trust (MCHT), a statewide land conservation organization, has presented its 2002 Land Heritage Award to the U.S. Fish and Wildlife Service's Gulf of Maine Program, for its contribution to land conservation in Maine.

Jay Espy, president of MCHT, described the federal program as "small but mighty." He added that the program's staff, "truly embody the spirit of partnership that is so essential to conservation success throughout the State of Maine."

With its goal to protect the fish and wildlife resources of the Gulf of Maine watershed, the Gulf of Maine Program uses existing scientific data along with biological expertise and state-of-the-art computer mapping and database management, to analyze, identify and map important habitat. Staff members then recommend and implement measures for habitat protection and restoration. They share biological information, offer technical assistance and identify funding opportunities. Developing partnerships with a range of interested parties is a key component of the program. These include federal and state agencies, towns,

statewide conservation groups, local land trusts, watershed associations, angling clubs, industry representatives and willing landowners

Stewart Fefer, the program's director, said the award "offers us the opportunity to celebrate the partnerships that helped protect and restore thousands of acres for Maine's fish, wildlife and people."

In the past decade, the Gulf of Maine Program has helped secure more than \$68 million [CND \$105 million] in federal funding assistance for Maine conservation projects.

By working in partnership with numerous groups, the agency has played a key role in permanently protecting more than 37,000 acres [14,800 hectares] of high value fish and wildlife habitat through fee and easement acquisition; restoring more than 5,400 acres [2,160 hectares] of habitat for migratory birds; and completing 26 river restoration projects of benefit to anadromous fish including the removal of ten man-made barriers on rivers and the installation or repair of 12 fish passage facilities at existing dams.

Founded in 1970, the MCHT works to conserve coastal and other lands in Maine. The trust has protected more than 112,000 acres [44,800 hectares] including 275 coastal islands. For more information, go to www.mcht.org.

To find out more about the Gulf of Maine Program contact: <http://gulfofmaine.fsw.gov>.

Ocean commission visits New England

The U.S. Commission on Ocean Policy, which is compiling recommendations from experts nationwide for the development of a comprehensive federal ocean policy, held a Northeast region meeting in July at Faneuil Hall in Boston. The meeting included testimonies from Robert B. Gagosian of the Woods Hole Oceanographic Institution, Rebecca Goldberg, a senior scientist with Environmental Defense and William K. Reilly, director of the World Wildlife Fund and former director of the U.S. Environmental Protection Agency.

It was the seventh of nine stops for the 16-member commission, which is conducting similar public meetings in the nation's coastal regions through September. The two-day session featured remarks by ocean scientists, government officials, environmental organizations and citizens on the impact of federal, state and municipal ocean policies on business, conservation and recreation in the Northeast.

Panelist included three members of the Gulf of Maine Council: Thomas Skinner, director of the Massachusetts Office of Coastal Zone Management, David Hartman, manager of the New Hampshire Coastal Program and David Keeley, acting director of the Maine State Planning Office.

Andrew Rosenberg, a member of the Commission and dean of the University of New Hampshire's College of Life Sciences and Agriculture, said all residents of the Gulf of Maine, including Canadian citizens, should feel free to contribute to the Commission's information gathering process.

"It's one of the charges to the Commission," Rosenberg said. "We have to think about international relations. United States leadership [on ocean policy] won't come without considering these factors."

A draft document, *Toward a National Ocean Policy: Ocean Policy Topics and Related Issues* can be viewed on the Commission's Web site, www.ocean-commission.gov, along with a complete record of testimonies before the Commission.

The Commission's findings and recommendations will be presented to Congress and President Bush in a final report in 2003.

—Kent Curtis

\$250,000 awarded for restoration projects; new proposals sought

The Gulf of Maine Council and the National Marine Fisheries Service has awarded \$250,000 [CND \$387,500] for 13 habitat restoration projects in Massachusetts, New Hampshire and Maine. The projects are geared to restore habitats that benefit marine resources, including anadromous fish species. The 2001-2002 projects include: Sebasticook River Channel Restoration, submitted by the Town of Newport, Maine; Quivett Creek Salt Marsh and Fish Run restoration, submitted by the Town of Dennis, Massachusetts; and Wiswall Dam Removal, submitted by the New Hampshire Department of Environmental Services.

Elizabeth Hertz of the Maine State Planning Office said the partnership between the Council and NMFS offers an opportunity to undertake habitat restoration within a regional context. "By focusing on shared resources, we will be able to multiply the benefits of the individual projects beyond their respective geographical location and strengthen the ecological systems within the Gulf," she said.

The Council and NMFS are soliciting proposals for its next round of funding. For deadline and eligibility requirements access http://gulfofmaine.org/habitat_restoration_grants.html. You can contact either John Catena (978) 281-9251 or Eric Hutchins (978) 281-9313 with questions about project ideas.

New book presses aquaculture reform

The aquaculture industry in the United States and around the world will never grow to its full potential unless it radically reforms its practices and produces positive impacts on the environment and society. That is the premise of a new book called *Ecological Aquaculture* by Barry Costa-Pierce, director of the Rhode Island Sea Grant Program and professor of fisheries and aquaculture at the University of Rhode Island.

The book details specific new technologies, practices and policies that must be enacted for the industry to resurrect its reputation and gain the support of its many detractors.



New Brunswick salt marsh

Photos: Andi Rierden

“Environmental groups have done a service to society and the global aquaculture industry by pointing out the ecological and social impacts caused by aquaculture,” Costa-Pierce said. “Aquaculture does have an impact on the environment, just as agriculture does.”

Those impacts include habitat degradation, nutrient discharges from feed and wastes, introduction of diseases and parasites and the genetic dilution of native wild species from breeding with escapees from aquaculture facilities. Costa-Pierce defines ecological aquaculture as “an alternative model of aquaculture research and development that brings the technical aspects of ecological principles and ecosystems thinking to aquaculture.”

“To make this happen,” he said, “we

need to get beyond the constant user conflicts between marine fisheries, aquaculturists, coastal zone management and coastal communities.”

Costa-Pierce's recommendations include: use of advanced waste collection and recycling systems; escapement control and recovery procedures; reduction in the feeding of fish meal so aquaculture facilities do not consume more protein than they produce; submersible cages to eliminate the visual blight of surface facilities; and elimination of the use of chemicals that are harmful to human and ecosystem health. *Ecological Aquaculture* is published by Blackwell Science in Oxford, England and distributed by the Rhode Island Sea Grant Program.

Calendar

New Hampshire Coastal Clean-up, September 21, 11 to 2 p.m. Clean our coast and rivers in this international event. September 20th is reserved for schools. Sponsored by the NH Coastal Program in conjunction with Waste Management of NH. Other sponsors include: Seacoast Coca-Cola, Portsmouth Regional Hospital and Frisbee Memorial Hospital. Call 603-431-9366 to participate.

Year of Clean Water National Water Quality Monitoring Day. The New Hampshire Department of Environmental Services (DES) will sponsor a Governor's press event on October 18. This will include a trip to the Franklin Wastewater Treatment Plant and Training Center in Franklin, NH to observe the kick-off of the Healthy Water, Healthy People education program. Facilitated by Nicole Clegg, DES Project Wet Coordinator, teacher sessions will focus on the Clean Water Act and its history, nonpoint source pollution and water quality monitoring for schools and youth groups. A water quality restoration site that was funded by a Clean Water Act 319 grant will be chosen for the Governor to visit as well. For more information, contact Barbara McMillan, DES Watershed Outreach Coordinator, (603) 271-7889 or bmcmillan@des.state.nh.us.

The Fresh Water for Atlantic Canada Conference is scheduled for October 24 and 25 in Bathurst, New Brunswick. The Conference will explore critical issues pertaining to the stability of future surface and ground water resources in Atlantic Canada. The conference hopes to increase understanding and knowledge of the impacts that climate change is placing on fresh water resources. Sessions will focus on emerging issues in purification, conservation, restoration and available supplies of fresh water, and will make the link between water quality and human health. Managers of drinking water supplies, consulting engineers, government and business representatives, environmentalists, conservation groups, citizens, researchers, students and others concerned with drinking water and fresh water resources are welcome. For more information visit <http://atl.ec.gc.ca/community/cap.html>, or call Melanie Corkum at 1-800-663-5755.

Canada's Oceans: Research, Management and the Human Dimension, is a national conference scheduled for October 25 to 27 in Ottawa, Ontario. It is designed for ocean and coastal researchers, managers and policy-makers to share the current state of knowledge and to develop discussions on national social science research priorities for the future. The Ocean Management Research Network is organizing the conference. For information, access www.dal.ca/aczisc/call.pdf, or e-mail the network's national secretariat at omrn@stmarys.ca.

Fishing and Benthic Habitats 2002, a Symposium on the Effects of Fishing Activities on Benthic Habitats: Linking Geology, Biology, Socioeconomics and Management is scheduled for November 12 to 14 in Tampa, Florida. The major themes are earth sciences, biology and economics in managing natural resources. Other themes include characterization and understanding natural change; and understanding the ecological and economic effects of fishing. The sponsors of the symposium are the American Fisheries Society, the Ecological Society of America, the National Oceanic and Atmospheric Administration, and the US Geological Survey. Information is at <http://walrus.wr.usgs.gov/bh2002/>.

Resources Useful information for and about the Gulf of Maine

Proceedings of MPA symposium

Proceedings from the symposium, “Marine Protected Areas: Design and Implementation for Conservation and Fisheries Restoration,” hosted by the Ocean Life Institute of the Woods Hole Oceanographic Institution on August 27 to 29, 2001 in Woods Hole, Massachusetts, are available to the general public at a cost of \$7.00 U.S. per copy (includes shipping). To obtain a copy, e-mail Ellen Bailey at ebailey@whoi.edu.

To swim or not to swim

The National Resources Defense Council has released its 12th annual beach report, which investigates all beach closings and possible causes. Nationally, almost 20 percent more beaches were closed last year than the year before. In Massachusetts, beach closings/advisories increased from 390 in 2000 to 653 in 2001, a rise of 67 percent. Representatives from the environmental advocacy organizations pointed to more local testing as a reason for the increase in beach closings, but said that many of the sources of bacterial contamination remain unknown. The report sites Massachusetts is as having one of the most comprehensive water monitoring programs in the country. To view the report go to: <http://www.nrdc.org/default.asp>.

Go GoMOOS

For up-to-date information on weather and oceanographic conditions log on to GoMOOS (Gulf of Maine Ocean Observing System), a pilot program designed to bring hourly oceanographic data from the Gulf of Maine to commercial mariners, coastal resource managers, scientists, educators, search and rescue teams, emergency response, public health officials and the curious. Go to: www.gomooos.org.

Stellwagen Bank Management Plan Review

Stellwagen Bank National Marine Sanctuary (SBNMR) in Massachusetts is undergoing a five-year review of its management plan, which sets priorities, contains regulations, presents existing programs and projects, and guides development of future sanctuary activities. SBNMS has opened a public comment period through October 18. Written comments should be mailed to: MPR, Stellwagen Bank National Marine Sanctuary, 175 Edward Foster Road, Scituate, MA 02066. Please send comments through sbnmsplan@noaa.gov. To find the dates, times and locations of the September meetings and to view a copy of the State of the Sanctuary report, which provides general background information on the Sanctuary and its

programs, log on to <http://stellwagen.nos.noaa.gov>. If you wish to be placed on the SBNMS mailing list or require further information, e-mail sbnmsplan@noaa.gov.

State of the oceans report

The Ocean Conservancy, a nonprofit organization that works to protect ocean ecosystems through science-based advocacy, research and public education, has issued a new report *Health of the Oceans*. The report calls for revolutionary changes in ocean management saying

poor management has reduced many species of fish and marine wildlife to a fraction of their historical abundance — in some cases to near extinction. And overfishing has become the greatest threat to the oceans, with a more profoundly negative impact on the oceans than all other human impacts, including pollution. The report contains a comprehensive resource list for concerned citizens. To view the report go to: www.oceanconservancy.org. The site also contains contact information and a web link to the conservancy's New England office in Portland, Maine.

TWELVE THOUSAND YEARS

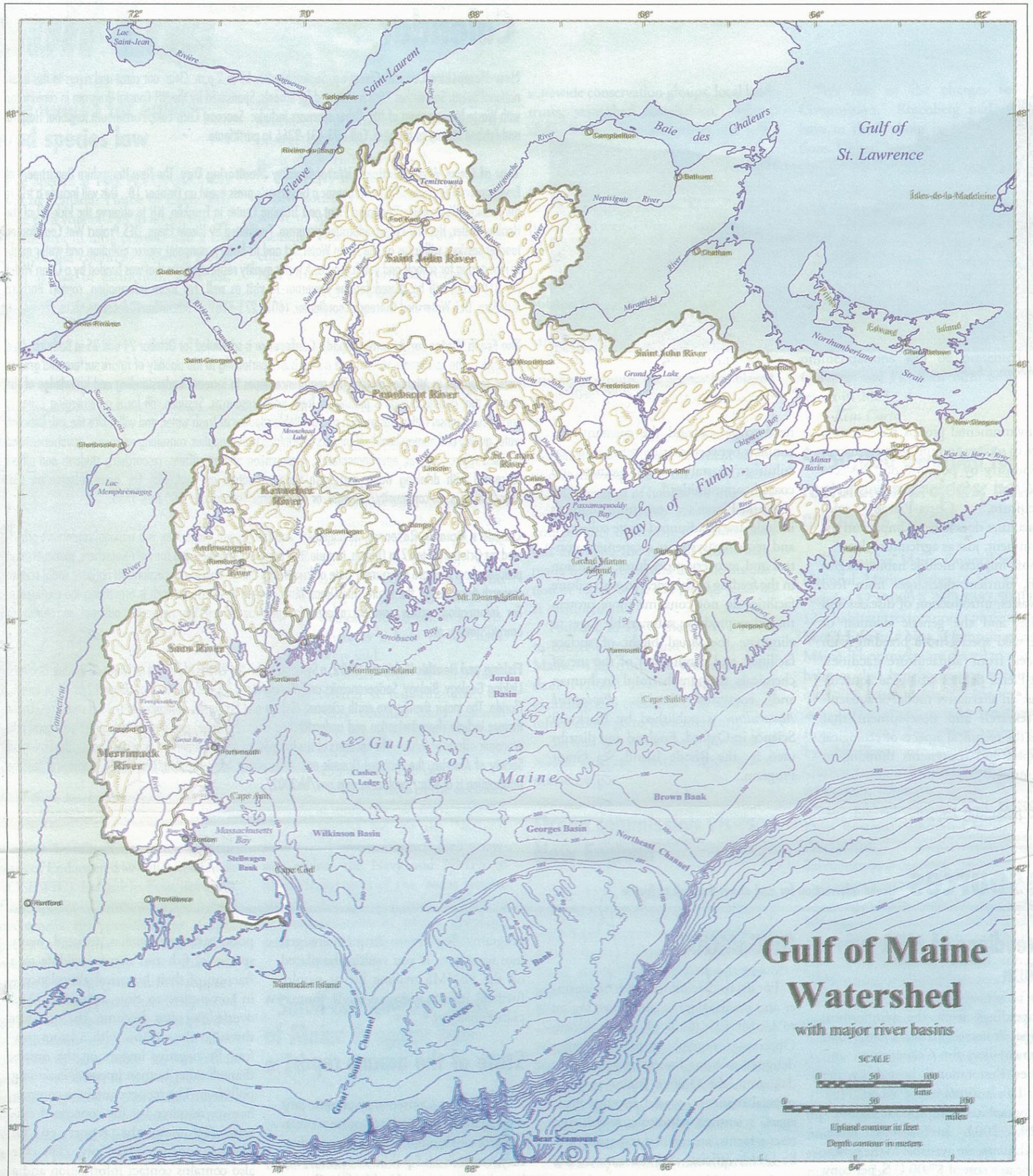
American Indians in Maine



BRUCE J. BOURQUE

With contributions by Steven L. Cox and Ruth H. Whitehead

The Gulf of Maine has a rich history of archaeological research that goes back to the 1839 discovery of coastal shell middens. Bruce Bourque, chief archaeologist and curator of ethnography at the Maine State Museum, surveys the findings of this archaeological research, providing a thorough history of the Paleo-Indian period to the present. An enjoyable read for both a professional and lay audience. Published by the University of Nebraska Press, 2001, Lincoln, Nebraska.



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

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