Blood pressure, body temperature, heart rate or pulse—nearly every visit to a doctor begins with these simple measurements, perhaps the most basic indicators of human health. Like the human body, Narragansett Bay is a complex biological system and, increasingly, scientists and managers are using the concept of “ecosystem health” to describe the condition of estuaries such as the Bay. Waters clean enough for swimming and shellfishing; habitats that support abundant wildlife; robust fisheries; pristine views—clearly these are characteristics of a healthy estuarine ecosystem and, not coincidentally, the things we value most about the Bay.

One need not look far, however, to see less desirable conditions: closed beaches and shellfish beds; fenced-off waterfronts; declines of fish and shellfish. As global warming, sprawling land development and a myriad of other human impacts create ever-greater pressure on natural systems, citizens and policy-makers are appreciating the need for basic measures of environmental health. Worldwide, scientists and managers are developing “environmental indicators” in an effort to better track, understand and restore ecosystems such as Narragansett Bay.

This special issue of the Narragansett Bay Journal compiles a broad set of indicators in order to report on the state of Narragansett Bay: its waters, fisheries, and other natural aspects, as well as social measures such as economics and management. The portrait that emerges is one of a remarkably diverse estuary, the life of which is closely intertwined with the lives of all who live, work and play on its waters, along its shores and throughout its watershed. The Bay retains outstanding natural values, though nearly every aspect of the estuary, its rivers and watershed lands has been shaped by human habitation and use, largely through unintended consequences.

Like its past and present, the future of Narragansett Bay will be decided largely by the people of its watershed: all two million of us, from Worcester and Brockton, Mass., to Newport and Narragansett, R.I. (map, page 10). To preserve the natural features we value most, and restore some of what has been lost, requires a new and greater awareness of the effects of human use upon the Bay and its watershed.

Environmental indicators such as these, though imperfect, are essential to improving the Bay environment—illuminating environmental trends, exposing gaps in scientific knowledge, and providing a basis for assessing the effectiveness of government action. ■
The purpose of the Narragansett Bay Journal is to report on all aspects of the Bay—ecological, economic, scientific, historical and cultural—in order to encourage a new and broader dialogue about the future of Narragansett Bay. NBJ is published quarterly by the Narragansett Bay Estuary Program (NBEP).

The Narragansett Bay Journal is distributed free throughout the Bay watershed and beyond; bundles are available for distribution on request. Publication is made possible by grants from the U.S. Environmental Protection Agency (EPA) through the National Estuary Program and URI Coastal Institute, with additional funding from the Narragansett Bay Estuarine Research Reserve (NBERR), the R.I. Saltwater Anglers’ Foundation (RISAF), and private donors. The views expressed herein do not necessarily reflect those of NBEP, EPA, URI, NBERR, or RISAF.

The Narragansett Bay Journal welcomes letters, articles, photographs, story ideas, drawings, poems, cartoons, etc. Most of the material published in the Narragansett Bay Journal may be reprinted free of charge with permission—contact the editor.

Narragansett Bay Journal Editorial Board
Monica Allard Cox, R.I. Sea Grant
Andy Burkhart
Rachel Calabro, Taunton River Stewardship Council, Southeastern Regional Planning and Economic Development District
Meg Kerr, R.I. Rivers Council
John Martin, Save The Bay, Inc.
Margherita Pryor, U.S. Environmental Protection Agency
Richard Ribb, Narragansett Bay Estuary Program
Laura Ricketson, R.I. Coastal Resources Management Council
Norm Rubinstein, U.S. Environmental Protection Agency
Jame Samons, Narragansett Bay Commission
Juliana Wyman
Chip Young, URI Coastal Resources Center

Narragansett Bay Journal Staff
Editor: Thomas Ardito, Narragansett Bay Estuary Program
Assistant Editor: Vanessa Venturini, Narragansett Bay Estuary Program
Designer: Darrell McIntire, URI Office of Marine Programs
Mapping: Paul Jordan, R.I. Department of Environmental Management

The Narragansett Bay Estuary Program
The Narragansett Bay Estuary Program is one of 28 National Estuary Programs, a nationwide network of coastal watershed programs created under the Clean Water Act. Its purpose is to protect and restore Narragansett Bay through collaborative action and sound science. Visit us online at www.nbep.org or contact Richard Ribb, Director, (401) 874-6233; rrribb@go.uri.edu

Address correspondence to:
Thomas Ardito, Editor
Narragansett Bay Journal
Narragansett Bay Estuary Program
URI Bay Campus, Box 27
Narragansett, RI 02882
toms@go.uri.edu
Telephone: (401) 874-6492
Fax: (401) 874-6899

Printed on recycled paper.

To Our Sponsors—Thanks!
The Narragansett Bay Journal is published by the Narragansett Bay Estuary Program, with additional funding from:

- Narragansett Bay National Estuarine Research Reserve;
- U.S. Environmental Protection Agency;
- National Oceanic and Atmospheric Administration;
- R.I. Saltwater Anglers Foundation; and
- Private donations.

To find out how you can help make publication of the Narragansett Bay Journal possible, contact Thomas Ardito, editor, at (401) 874-6492.

If you haven’t already subscribed to the Narragansett Bay Journal, it’s FREE! Subscribe on the Web (www.nbep.org) or use this form.

Free Subscription Form

Fax or mail to: Narragansett Bay Journal
Narragansett Bay Estuary Program
URI Bay Campus, Box 27
Narragansett, RI 02882
Fax: (401) 874-6899

Name

Address

City    State    Zip    E-mail

Where did you find this copy of NBJ?
NARRAGANSETT BAY CALENDAR

**Ongoing**

Various dates and times in June
Gaspee Days Celebration
Parade, Arts and Crafts Fair, and other events celebrating the burning of the HMS Gaspee
Pawtuxet Village, Warwick and Cranston, R.I.
www.gaspee.com

Selected Fridays and Saturdays
Waterfire Providence
Waterplace Park
(401) 272-3111
www.waterfire.org

Various locations on the Bay
Save the Bay Eelgrass Transplants
9:00 a.m.–4:00 p.m.
(401) 272-3540 ext. 117 to sign up
www.savebay.org

Tuesdays and Thursdays
Living on the Edge: An Interactive Coastal Exhibit
Coastal Institute Visitors Center
URI Bay Campus, Narragansett, R.I.
11:00 a.m.–1:00 p.m.
Free admission
(401) 874-6211
http://omp.gso.uri.edu

**June**

1–4 Congress for the New Urbanism
R.I. Convention Center, Providence
www.cnx14.org

3 5th Annual Rhode Island Sustainable Living Festival and Renewable Energy Expo
Apexon Institute/Nicherson Community Center
Coventry, R.I.
(401) 397-3430
www.livingfest.org

3, 10, 17, 24 Source to Sea Paddle
Wood-Pawcatuck Watershed Association
Hope Valley, R.I.
9:00 a.m.–3:00 p.m.
(401) 539-9017 for reservations
www.wpwa.org

3–Aug. 20 Wilderness Tour aboard the Blackstone Valley Explorer
Central Falls, R.I.
Sundays 1:00, 2:00, 3:00, 4:00 p.m.
(401) 724-2200
www.rivertourblackstone.com

11 Burning of the H.M.S Gaspee
Symbolic burning of the 1772 ship Pawtuxet Cove Park, Warwick, R.I.
4:00 p.m.
www.gaspee.com

14 History of SE New England’s Native American Coastal Communities
Lecture by John McNiff
North Kingstown Free Library
North Kingstown, R.I.
7:00 p.m.
(401) 874-6842
http://seagrant.gso.uri.edu

17 River’s Day
Blackstone Valley Explorer Landing
Central Falls, R.I.
1:00 p.m.–4:00 p.m.
(401) 724-1342
www.rivertourblackstone.com

19–July 7 July
R.I. Jewels of the Bay Cruises
Quonset Point, North Kingstown, R.I.
Mon.–Thurs., departs 2:00 p.m.
(401) 296-4040 for reservations
www.southcountryri.com

24, July 22
Beachcombing for Kids
Fort Gayte State Park, Jamestown, R.I.
12:30 p.m.–2:30 p.m. (June)
11:30 p.m.–1:30 p.m. (July)
(401) 874-6211 to register
http://omp.gso.uri.edu/omp/calendar

**July**

1 River Glow
Bonfires on the Pawcatuck River, Westerly, R.I.
7:00 p.m.–10:00 p.m.
(800) SEA-7636

1–Labor Day
Visit the Rose Island Lighthouse
10:00 a.m.–4:00 p.m. daily
www.roseislandlighthouse.org

7, 14 Family Fun Fishing Day
Carolina Trout Hatchery, Carolina, R.I.
10:00 a.m.–1:00 p.m.
(401) 364-9720

10–14, 17–21 Oceanography Explorer Day Camp
Weeklong exploration of the coastal environment for grades 6–8
URI Bay Campus, Narragansett, R.I.
9:00 a.m.–3:00 p.m.
(401) 874-6211
http://omp.gso.uri.edu

11 Big Screen Movie on the Beach
Tuesdays in July at dusk
Misquamicut Beach, Westerly, R.I.
(401) 596-7761
www.westerlychamber.org

15 5th Annual “Lights and Legends” Stories of shipwrecks and slideshow
with Dr. Harlan Hamilton
Pleasant View Inn
Misquamicut Beach, Westerly, R.I.
7:30 p.m.
(401) 322-1026
www.southcountryri.com

18 20th Annual Citizen’s Bank/Save the Bay Swim
(Bay Day)
Governor’s Bay Day
Free admission and parking at all R.I. State Beaches
Send Bay-related calendar items to Narragansett Bay Journal
URI Bay Campus, Box 27, Narragansett, RI 02882 or rb@gs.gso.uri.edu

19, 22, 25, 27, 29, 30

Some events require advance registration or fees—contact sponsor for details.

**November**

15th Annual “Chowder Challenge”
Wood River at Barberville Dam
Hope Valley, R.I.
4:00 p.m.–6:00 p.m.
(401) 539-9017 for reservations

27 Historic South Ferry Walking Tour
Meet at Coastal Institute Visitor Center
URI Bay Campus, Narragansett, R.I.
10:30 a.m.
(401) 874-6211

27–28 Shakespeare at the Beach
A Mixed Magic Theater Production
North Kingstown Town Beach
North Kingstown, R.I.
(401) 294-3331

28–29 Blessing of the Fleet
Narragansett, R.I.
(401) 783-7121
www.narragansettri.com/chamber

29 30th Annual Citizen’s Bank/Save the Bay Swim
Naval Station, Newport to Potter’s Cove, Jamestown
7:00 a.m. registration, 9:00 a.m. start time
(401) 273-7153
www.savebay.org

30 Governor’s Bay Day
Free admission and parking at all R.I. State Beaches
Send Bay-related calendar items to Narragansett Bay Journal
URI Bay Campus, Box 27, Narragansett, RI 02882 or rb@gs.gso.uri.edu
THE STATE OF
CLEAN WATERS

Evolution of Pollution

Steady Progress Toward Cleaner Waters, But Problems Remain

Thomas Ardito
Clean water is fundamental to Narragansett Bay’s ecology. The Bay’s native waters and habitats support about 200 species of marine fish, along with hundreds more of shellfish, birds and other wildlife. Most of these creatures are sensitive to the wide variety of pollutants that are discharged to the Bay; as a result, the most polluted areas, like the Providence River, support far fewer species of marine life than does the lower Bay. Clean water is also essential for many human uses of the Bay—pollution causes beach and shellfish bed closures, and, at its worst, makes boating and even proximity to the shoreline unpleasant, causing algae blooms and noxious odors.

Water pollution takes many forms. During the late 19th and early 20th centuries—the heyday of manufacturing in New England—there were few environmental laws, and factories discharged a range of toxic substances into the Bay. In 1972, the federal Clean Water Act began to reign in these kinds of contaminants, though the Bay’s bottom sediments remember them well (story, page 7). Today, the types of pollution of greatest concern are nutrients such as nitrogen and phosphorus, largely from waste-water treatment plants (and seven surveys were used to calculate average DO. The map reveals extensive areas of hypoxia and suboxia throughout upper Narragansett Bay during the

under the EPA guidelines, DO levels above 4.8 milligrams per liter (mg/l) are considered healthy for nearly all aquatic organisms. Chronic oxygen levels below 4.8 mg/l (also known as suboxic conditions) are known to cause reduced growth rates and death of young and sensitive organisms. Oxygen levels below 2.9 mg/l (hypoxic conditions) cause acute effects, including widespread death of larvae and juvenile fish and shellfish. The guidelines stipulate that more than one day of hypoxic conditions during the summer causes unacceptable harm to the aquatic environment. Any occurrence of oxygen levels below 1.2 mg/l (severely hypoxic) is sufficient to assume that the water body is impaired by low DO.

For five consecutive years beginning in 1999, Dr. Christopher Decasts of the Narragansett Bay Estuary Program organized a team of volunteer scientists to study DO in the Bay. As many as 11 boats crewed by researchers from federal and state agencies, universities and environmental groups measured oxygen at more than 60 locations throughout the upper Bay. The team worked through the night on summer evenings, when the risk of hypoxia is greatest, dubbing themselves “The Insomniacs.” It was the first in-depth study of hypoxia on the Bay, and it produced some surprising—and disturbing—findings, shown in the map on page 5.

The map shows average dissolved oxygen for bottom waters during the summer months (July-August). At each of 68 stations in the upper Bay, between five and seven surveys were used to calculate average DO. The map reveals extensive areas of hypoxia and suboxia throughout upper Narragansett Bay during the

Gasing for Breath

Dissolved Oxygen in Narragansett Bay

Study by NBEP and Brown University Finds Widespread Problem in Upper Bay

Emily Saarman
Oxygen—the second-most abundant element in Earth’s atmosphere—may not seem to have much to do with the state of Narragansett Bay’s ecosystem. Yet dissolved oxygen in Bay waters is one of the most important scientific measures of the estuary’s health. A recent study by the Narragansett Bay Estuary Program and Brown University finds oxygen conditions in the upper Bay lacking—with potentially serious consequences for Narragansett Bay’s fish and shellfish.

Why is dissolved oxygen an important indicator of the health of Narragansett Bay? Fish and shellfish need dissolved oxygen (DO) in the water to breathe, just as we need it in the air. When DO levels drop, fish and shellfish suffer adverse effects, ranging from reduced growth rates to death by suffocation. The U.S. Environmental Protection Agency considers low DO a major threat to estuarine ecosystems, and recently published guidelines to protect aquatic life from the impacts of low DO.

In estuaries like Narragansett Bay, the condition of low DO (known as hypoxia) often occurs in response to nitrogen pollution from wastewater treatment plants, lawn fertilizer and other human activities. Nitrogen stimulates the growth of algae, such as plankton and seaweed, during the spring and summer months. The subsequent decay of organic matter consumes available oxygen from the surrounding water. In the absence of strong winds or tides, which mix and ventilate deeper waters, oxygen is depleted faster than it can be supplied from the surface, and hypoxia results. EPA designed its saltwater DO guidelines to protect the sensitive larval stage of fish and shellfish, with the goal of ensuring that hypoxia does not significantly affect the abundance of adult fish and shellfish populations.

Under the EPA guidelines, DO levels above 4.8 milligrams per liter (mg/l) are considered healthy for nearly all aquatic organisms. Chronic oxygen levels below 4.8 mg/l (also known as suboxic conditions) are known to cause reduced growth rates and death of young and sensitive organisms. Oxygen levels below 2.9 mg/l (hypoxic conditions) cause acute effects, including widespread death of larvae and juvenile fish and shellfish. The guidelines stipulate that more than one day of hypoxic conditions during the summer causes unacceptable harm to the aquatic environment. Any occurrence of oxygen levels below 1.2 mg/l (severely hypoxic) is sufficient to assume that the water body is impaired by low DO.

For five consecutive years beginning in 1999, Dr. Christopher Decasts of the Narragansett Bay Estuary Program organized a team of volunteer scientists to study DO in the Bay. As many as 11 boats crewed by researchers from federal and state agencies, universities and environmental groups measured oxygen at more than 60 locations throughout the upper Bay. The team worked through the night on summer evenings, when the risk of hypoxia is greatest, dubbing themselves “The Insomniacs.” It was the first in-depth study of hypoxia on the Bay, and it produced some surprising—and disturbing—findings, shown in the map on page 5.

The map shows average dissolved oxygen for bottom waters during the summer months (July-August). At each of 68 stations in the upper Bay, between five and seven surveys were used to calculate average DO. The map reveals extensive areas of hypoxia and suboxia throughout upper Narragansett Bay during the

continued on page 5
Nitrogen is the major cause of the Bay’s oxygen problems; wastewater treatment plants are the largest source of this pollutant. Map: Emily Saarman, Brown University.

The “Insomniac” surveys found poor oxygen conditions throughout the upper Bay during the summer months. Map: Emily Saarman, Brown University.

In August, 2003, more than a million small menhaden were killed by low oxygen conditions in Narragansett Bay. Most scientists believe nutrient pollution to be the culprit. Photo: NBJ.

summer months. The Providence River and Greenwich Bay experience the most severe and persistent hypoxic events; however, much of the upper Bay has average summer DO levels that fall below EPA guidelines.

Nearly all of upper Narragansett Bay, including Mount Hope Bay, suffers from poor oxygen conditions at some point during the summer months. Even if infrequent, hypoxia can have grave consequences on the Bay ecosystem. A severe hypoxic event killed more than a million small menhaden on Greenwich Bay in August, 2003. Less obvious but perhaps more pernicious, hypoxia can kill sensitive organisms at the base of the estuarine food chain, leading to an environment where only the hardiest—but not necessarily the most desirable—animals can survive.

Hypoxia in the Bay shows a distinct North-South trend, occurring more frequently in upper Narragansett Bay. This is no surprise—the upper Bay is the location of several large wastewater treatment plants, and is less subject to wind and tidal mixing than the lower Bay.

The Insomniac surveys are leading to better management of Narragansett Bay. The finding of widespread hypoxia led the R.I. Department of Environmental Management to push for stricter nitrogen limits from wastewater treatment plants, and the Narragansett Bay Commission—operator of the state’s largest treatment plants—is working to reduce nitrogen discharges (story, page 6). Despite these encouraging developments, the battle against hypoxia on Narragansett Bay is sure to be a difficult one. Nitrogen pollution from wastewater treatment plants has steadily increased over the past decade, and the technology required to reverse this trend is expected to cost at least $80 million. Meanwhile, current rates of land development in the Bay watershed are likely to increase non-point nitrogen pollution from runoff and other diffuse origins. Better management of land use and improvements in stormwater treatment can help reduce these sources, as well.

—Emily Saarman researched hypoxia in Narragansett Bay from 2001 to 2005. She is currently trying her hand at science writing at the University of California, Santa Cruz.
A Different View
Oceanographer Questions Nitrogen Goal

Thomas Ardito

“Talk about a different Bay—I’ll show you a different Bay,” Scott Nixon said to a visitor recently, unrolling a full-size copy of a nautical chart. Spread flat, the document covered a clutter of books and papers on a large worktable in the middle of his office at the University of Rhode Island’s Graduate School of Oceanography. A circular window in the wall beyond the table looked out over Dutch Island and the West Passage of Narragansett Bay—blue water swept by whitecaps, the Newport Bridge visible in the distance on a clear January day.

The chart, of Providence Harbor, was dated 1865: the last year of the Civil War. The original was printed from a copper plate, etched by hand. To the south it shows Starve Goat Island in the Providence River, later buried by the Providence City Dump and now hidden somewhere beneath Field’s Point. To the north it shows the wharves of Providence, then a bustling manufacturing center flush with wartime commerce. Along the edges of the river and throughout the harbor south of India Point, in neat, handwritten script, “eelgrass,” “grass beds,” “oyster shoals,” and “oyster beds” were carefully noted by a meticulous, forgotten surveyor of the U.S. Coast and Geodetic Survey.

Today, the bottom of Providence Harbor is a thick, black ooze, inhabited almost exclusively by opportunistic worms and hardy little shellfish. There are undoubtedly some quahogs there, and if you looked hard enough, you’d probably find a few small oysters eking out a living in the shallow waters along the shore. But to find eelgrass—a rooted aquatic plant that provides valuable habitat for fish and shellfish—you’d have to travel ten miles south, to the waters off Prudence Island. Upper Narragansett Bay has clearly undergone a profound change in the past 150 years, and marine scientists have no doubt that nitrogen pollution, largely from wastewater, has been a major factor.

“Eelgrass is a very sensitive indicator of nitrogen enrichment,” said Dr. Nixon.

Nitrogen is a powerful fertilizer at sea as well as on land, and Dr. Nixon has been studying its role in Narragansett Bay and other estuaries for 30 years. He has reconstructed historic trends in nitrogen pollution to the Bay, concluding in a published article that nitrogen “increased dramatically over just a 30 year period between about 1880 and 1910,” following the introduction of running water and sanitary sewers, but that the “increase since that time has been modest.”

But unlike most scientists who have looked at the issue, Dr. Nixon is not convinced that nitrogen reduction at wastewater treatment plants is likely to produce a substantial improvement in the Bay environment. “The question really is,” he said, “to what extent is nitrogen having a negative impact on Narragansett Bay?”

Dr. Nixon does not dispute that nitrogen pollution is a driver—under certain weather and tidal conditions—of low oxygen, or hypoxia, in the Bay (story, page 4). But he believes that hypoxia has been occurring in the Bay for a long time. A 1959 survey showed extensive areas of low oxygen in upper Narragansett Bay, and an 1898 newspaper account describes a massive fish kill in the upper Bay, apparently caused by hypoxia. Yet these were periods when Bay fisheries were much more productive than today. “I guess the question I would ask,” he said, “is what’s ‘broke’ about the Bay that we need to fix? There’s no evidence I know of that intermittent hypoxia in the upper Bay is interfering with the services that we want from the Bay.”

His conclusion runs counter to the prevailing scientific opinion about nitrogen in estuaries. Several national scientific panels, including the National Academy of Sciences, have declared nitrogen pollution a serious threat to estuarine ecosystems nationwide. A 2004 report by academic and government scientists, commissioned by R.I. Governor Donald L. Carcieri, recommended that nitrogen discharges be significantly reduced in order to reduce or eliminate “episodes of dissolved oxygen,” in part to “reduce the risk of fish kills.” And the R.I. Department of Environmental Management (RIDEM) considers at least a quarter of the state’s estuarine waters to be “impaired” by nitrogen pollution.

Nitrogen Removal at Field’s Point
Cost of Technology at Issue

Jamie Samons

The Field’s Point wastewater treatment plant in Providence is Rhode Island’s largest and oldest wastewater facility, processing 45 million gallons on an average day and contributing more than ten percent of the nitrogen that currently enters Narragansett Bay. Last July, in order to reduce nitrogen pollution to the Bay, the R.I. Department of Environmental Management (RIDEM) issued new, stricter discharge permits for Field’s Point and the state’s second-largest plant, Bucklin Point in East Providence, R.I. Both Field’s Point and Bucklin are operated by the Narragansett Bay Commission (NBC). NBC appealed the permits, contending that RIDEM’s schedule for implementing nitrogen reduction at wastewater treatment plants is unreasonable and raising legal objections to RIDEM’s process for enforcing the requirements of the U.S. Clean Water Act, which calls upon state and federal governments to “restore the chemical, physical, and biological integrity” of U.S. waters.

Over the past five years, NBC has evaluated 24 alternatives to remove nitrogen from the effluent or outflow at Field’s Point by upgrading plant technology. The commission estimated capital (construction) costs for the alternatives ranging from $20 million to $130 million. In general, capital and operating costs increase along with the amount of nitrogen that’s removed from the waste stream. Of the 24 alternatives, NBC identified two technologies that were cost-effective and which did not require a great deal of land—an important consideration, since space is limited at the Field’s Point plant. Each of these technologies would use a bacterial process to remove nitrogen from the wastewater, converting it to harmless nitrogen gas. Nitrogen is the most abundant element in Earth’s atmosphere.

At present, the Field’s Point plant discharges a monthly average of about 13 milligrams per liter (mg/l) of nitrogen to Narragansett Bay. The new permits call for reducing that number to 5 mg/l from May to October, when the risk of hypoxia is greatest. Though there is no question that technology improvements at Field’s Point can greatly reduce nitrogen pollution, engineers at NBC are concerned that the new systems may not prevent the plants from occasionally exceeding the stricter permit limits. Once NBC chooses a technology, it will likely be several years before plant improvements are designed, constructed and operational.

At the Bucklin Point wastewater treatment plant, NBC brought a nitrogen-reducing plant upgrade online in November. However, those facilities, designed and constructed before RIDEM issued the new permits, are designed to remove nitrogen only to a level of 8 mg/l.

NBC and RIDEM are continuing to negotiate the terms of the new permits.

—Jamie Samons is public affairs manager with the Narragansett Bay Commission.
Pollution Persists on Bay Bottom

EPA Program Provides Nationwide Comparison

Norm Rubinstein and Hal Walker

Pollution to Narragansett Bay has been greatly reduced over the past several decades, primarily due to the passage of modern environmental laws such as the federal Clean Water Act. Yet pollution continues to enter the Bay through a variety of pathways, including airborne transport via wind and rain, and runoff from roads, parking lots, lawns and other developed land-uses. Toxic metals such as mercury and lead, and organic contaminants such as pesticides, enter the Bay where they eventually accumulate in the sand and mud, or sediments, of the bottom. A legacy of historic pollution from 19th and 20th century industry is also trapped in Bay sediments, particularly in upper Bay and harbor areas.

In 2000, the U.S. Environmental Protection Agency established the National Coastal Assessment (NCA) program to better understand the affect of pollution on the health of estuaries throughout the country, examining water quality, sediment pollution, and the health of living resources such as fish and shellfish. The nationwide assessment provides a standard of comparison for current environmental conditions in Narragansett Bay.

Benthic communities—the collection of shellfish, worms, and other creatures that live on the bottom—are critically important to the Bay’s food chain, and much of the NCA work is focused on these areas, tracking the effects of oxygen (related story, page 5) and toxic pollution. The study found “poor” benthic conditions throughout most of upper Narragansett Bay, Greenwich Bay, and urbanized areas of the lower Bay such as Newport Harbor. In these places, biodiversity is reduced and pollution-tolerant organisms are dominant, the result of periods of low dissolved oxygen or of sediment contamination.

Sediment contamination can also affect human health. In seafood, the toxic metal mercury is of major concern, accumulating in sediments and passing up the food chain to fish and then humans. The NCA found that New York Harbor has the highest concentrations of mercury in the Northeast, but elevated levels are also present in parts of Narragansett Bay, particularly the upper Providence River, Greenwich Bay and parts of the Taunton River.

Another contaminant of particular concern is polychlorinated biphenyls, or PCB’s, a suspected carcinogen that persists in the environment for long periods of time, accumulating in marine food chains. The NCA found significant levels of PCB’s in many upper Bay locations, a legacy of industrial pollution. The highest concentrations were found in the upper Providence River and Greenwich Bay.

Metals in the Mud: The Seekonk River

Metals in upper Bay sediments reflect Rhode Island’s industrial history. Source: John King, University of Rhode Island.

CSO Project Update

Jamie Samons

The Narragansett Bay Commission’s Combined Sewer Overflow (CSO) project reached a major milestone in December, 2005, as the 690-ton tunnel boring machine completed its three-mile mining operation, drilling a 30-foot diameter tunnel 250 feet beneath the city of Providence.

The tunnel will store and transport sewage and storm-water runoff during heavy rain storms, reducing pollution of the Bay by fecal coliform and other harmful bacteria. Bacteria pollution creates a human health hazard, causing the closure of Bay beaches and shellfish beds. The tunnel is the centerpiece of the first phase of the commission’s three-phase CSO Abatement Plan, developed under consent agreement with the R.I. Department of Environmental Management. Phase I of the plan will cost $342 million.

Tunnel boring began in March, 2004, and progressed at an average of 42 feet per day. More than a million tons of rock were removed from the hole, which will have a capacity of 62 million gallons. Most of the rock was sandstone, shale and graphitic shale.

Phase I of the CSO project, which includes seven vertical shafts from the surface and a large pumping station to lift the flow from the tunnel to the Field’s Point Wastewater Treatment Facility, is slated for completion in Fall, 2008. During Phase II of the project, scheduled to begin in 2010, the commission will construct piping systems along the Woonasquatucket and Seekonk Rivers to carry polluted waters to the tunnel. Phase III, beginning in 2016, is another deep rock tunnel which will transport CSO flow from the cities of Pawtucket and Central Falls, R.I. to the Bucklin Point wastewater treatment plant in East Providence, R.I.

The National Coastal Assessment shows that, while industrial pollution of Narragansett Bay has declined, everyday activities, from driving cars to fertilizing lawns, can still have a serious impact on the health of the Bay.

—Norm Rubinstein and Hal Walker are environmental scientists at the U.S. Environmental Protection Agency in Narragansett, R.I.

Go Deeper!

For more information on the NCA’s recent findings on Narragansett Bay, visit: www.epa.gov/emap/nca
For earlier reports, see: www.epa.gov/owow/oceans/nccr

Metals Pollution at Field’s Point, 1981–2004

In recent decades, Bay wastewater treatment plants such as Field’s Point have greatly reduced their discharge of toxic metals such as lead to the Bay. Source: Narragansett Bay Commission.
THE STATE OF
THE BAY ECONOMY

Valuing the Bay
Economists Cast a Wide Net

Thomas Ardito

How do you place a price tag on something that’s irreplaceable? In the case of Narragansett Bay, it would seem impossible—the Bay is so intrinsic to the regional economy that its value seems inseparable from the whole. Yet a recent study by economists at the University of Rhode Island found that Narragansett Bay provides more than $2 billion annually in "ecosystem services:" about $1,000 for every person living in the Bay’s watershed, in Rhode Island and Southeastern Massachusetts.

What are these services? Coastal wetlands such as salt marshes, for example, protect coastal property from the effects of storms, flooding and sea-level rise, acting as a natural buffer. They trap and filter pollution, often more cheaply and efficiently than pollution-control technology. And they provide essential habitat for fish, birds and other wildlife of commercial and ecological value.

The URI study arrived at its estimate through a new approach known as ecological economics. A pioneer of the method, Dr. Robert Costanza of the University of Maryland, estimated the value of all ecosystem services on Earth at $33 trillion, nearly twice that of the global economic product (or worldwide monetary economy) of $18 trillion. The authors of the Narragansett Bay study, Andraida I. Pacheco and Timothy J. Tyrell, based their valuation on the Bay's fisheries, habitat, recreational uses, and natural ecological processes, among other things.

Many traditional economists look askance at these kinds of estimates. Yet the value placed on the Bay by regional residents and visitors is reflected in conventional economic measures, as well. Perhaps the most striking example is waterfront housing—while the average home price in Rhode Island was $283,000 in 2005, it has become commonplace for a modest house on the water to sell for $1 million or more.

 Fisheries are another obvious source of economic activity generated by the Bay. The dockside value of commercial fish landings in Rhode Island is about $75 million, although most of this is caught offshore, and figures are not available specifically for the estuary. Economically, recreational fishing is much more important than commercial fishing on the Bay. According to the R.I. Department of Environmental Management, about 300,000 recreational anglers try their luck in Rhode Island waters every year, spending about $150 million on bait, tackle, boats and gear.

Recreational fisheries are just one part of a much larger tourism economy in Rhode Island and Southeastern Massachusetts, dependent largely upon access to Narragansett Bay, its rivers and other watershed resources. A separate study by URI’s Dr. Tyrell determined that nearly 24,000 jobs and $400 million in wages are generated by tourists attracted to Rhode Island’s marine resources, including the Bay. The research found that more than 2 percent of the gross state product (all economic activity in Rhode Island) is produced by “marine dependent travel and tourism,” from fishing and sailing to beach-going and birdwatching—one in every 50 dollars spent statewide.

Coastal tourism is not without negative impacts as well, as is clear to anyone attempting to drive the length of Thames Street in Newport on a summer weekend. Over the past several decades, Newport’s waterfront has been swamped by condominiums, hotels and gift stores, displacing year-round businesses like boatyards and fishing piers, replacing year-round employment with seasonal positions, and severing the city’s historic and cultural connections to the sea.

Communities in the Bay watershed are beginning to learn from Newport’s example as they seek to capitalize on waterfront values and coastal tourism.

The Blackstone Valley Tourism Council promotes “sustainable tourism” designed to foster economic development while furthering historic preservation and environmental protection in the northern reaches of the Bay watershed. The Council runs several boats providing environmental tours on the Blackstone River—one fouled by mill-waste, today the centerpiece of the region’s revival.

On the east side of the Bay, the town of Warren, R.I., partnered with state agencies and non-profit organizations to preserve its historic working waterfront. The innovative project has improved public access to the shoreline while preserving commercial maritime uses. Warren’s effort is one of several major redevelopment projects converting former industrial sites to high-value coastal uses—see “A Tale of Four Cities,” page 18.

Go Deeper!
For more on the Blackstone River Tourism Council and attractions throughout the Blackstone Valley, see www.tourblackstone.com or call 1-800-454-BVTC.

Photo courtesy of Blackstone Valley Tourism Council.

Source: R.I. Turnpike and Bridge Authority


For more on the Blackstone River Tourism Council and attractions throughout the Blackstone Valley, see www.tourblackstone.com or call 1-800-454-BVTC.
Rivers of Narragansett Bay
Numbers key to map, next page

**Blackstone River**
The Blackstone River is, along with the Taunton, one of Narragansett Bay's two largest tributaries. The river rises in Worces-
ter, Mass., and flows 64 miles through Rhode Island, ending as the Moshassuck River at Waterplace Park. The lower reaches of the river's habitats provide excellent opportunities for fishing, birding, hiking, canoeing and duck hunting. The state maintains fish ladders on the dams, but herring runs on the Annaquatucket system still remain standing, and the old mill ponds have become valuable riverfront properties. Local advocates, including the Narrow River Preservation Association, which has monitored water quality in the river since 1992, and the Narrow River Restoration Committee, have worked to improve water quality and restore riverine habitats. Throughout its watershed, the river is experiencing a resurgence of interest and reemergence of fishing, boating, and other recreational uses available in the rural, suburban, and urban communities of the watershed.

**Contact:** Woonasquatucket River Watershed Council 27 Sims St., Providence, RI 02909 (401) 861-9046 www.woonasquatucket.org

**Pawtuxet River**
The Pawtuxet is a true Rhode Island river, as it emanates from the ground in the center of the state and winds easterly to empty into Narragansett Bay. Given its dimensions and consistently strong flow, it may have been the first river in the state to be tamed industrially. Ironically, while its headwaters now provide Rhode Island with 60% of its public drinking water supply (by means of the Scituate Reservoir as well as public wells), for most of the 20th century, the Pawtuxet was one of the most polluted rivers in the nation.

Rhode Island's textile industry both shaped and punished the Pawtuxet, which hosted no fewer than 35 major textile complexes packed into 26 river miles. The river receives discharge from three municipal sewage treatment plants, the state's largest chemical manufacturer, and its largest landfill.

Faced with these daunting problems, the R.I. General Assembly created the Pawtuxet River Authority in 1972. For 30 years, the PRA has worked to reverse the damage done by 150 years of industrial development. The PRA has cleaned hundreds of tons of debris from the Pawtuxet, built river access and trails, obtained funds to upgrade sewage treatment plants, and worked to preserve open space. Currently, the PRA is working to restore migratory shad and herring to the River system. Volunteers are always needed!

**Contact:** Pawtuxet River Authority and Watershed Council Robert Nero, Chair 618 Main St., Coventry, RI 02816 (401) 739-7635 www.pawtuxet.org

**Buckeye Brook**
Buckeye Brook is located in Warwick, R.I., adjacent to T.F. Green Airport, and flows easterly into Narragansett Bay. The brook is an exceptionally important tributary to the Bay. It is one of the few remaining undammed fish runs on the Bay—alewives and blackback herring migrate from the sea into Warwick Pond to spawn, followed by fish ladders. The brook's fresh and saltwater wetlands play a vital role as natural pollution filters for Narragansett Bay, and serve as spawning grounds for many Bay inhabitants. Buckeye Brook Coalition advocates for protection of the brook and its wetlands, working to clean up debris, prevent pollution, and restore the native herring run.

The R.I. Department of Environmental Management has identified stormwater from the airport as the major source of pollution to Buckeye Brook. In 2003 and 2004, the coalition, supported by Conservation Law Foundation and Save the Bay, prompted the state to issue the airport one of the strongest stormwater discharge permits in the nation. The airport appealed the permit, delaying protection of Buckeye Brook until the dispute is resolved.

**Contact:** Steve Inzana P.O. Box 9025 Warwick, RI 02889 (401) 737-1342 www.buckeyebrook.org

**Greenwich Bay Watershed**
Greenwich Bay is one of the most intensively developed sections of Narragansett Bay's shoreline—more than 4,000 pleasure boats are on the water, and boating facilities occupy more than half the surface area of two of the smaller coves within the bay. Several popular state and municipal beaches are along the shoreline. The bay once supported a large and valuable bay scallop fishery; today, scallops are practically extinct, but quahog and oyster beds remain healthy. Greenwich Bay is homeport to a large shellfishing fleet. Water pollution from land-based sources is a continuing problem for Greenwich Bay, causing periodic fish kills, beach closures and excessive seaweed growth in summer. A major environmental issue facing the bay and watershed, in the view of local advocates, is a proposed runway extension at T.F. Green Airport in Warwick, R.I.

**Contact:** Greenwich Bay Watershed Group Richard Langseth, Executive Director 170 Builiding Farm Rd., Warwick, RI 02886 (401) 738-4347 staff@greeeneshed.org

**Hunt River**
The watershed of the Hunt River is similar to that of its neighbor, the Annaquatucket—a small drainage basin on the west side of Narragansett Bay, dominated by suburban land uses. The river is connected to an important groundwater resource or aquifer, tapped by wells that provide drinking water for North Kingstown, Quonset Point and Kent County. Recent studies by the U.S. Geological Survey and others have shown that water withdrawals from the Hunt aquifer can harm the ecology of the river and wetlands. "There are many streams into that aquifer, and the river is showing effects," said Meg Kerr, chair of the R.I. Rivers Council. Continuing residential development in the area and projected growth of the state's business park at Quonset Point will likely exacerbate the problem by increasing demand for fresh water.

**Contact:** Do you know of an organization involved in stewardship of the Hunt River, or are you interested in getting one started? If so, contact Meg Kerr at the R.I. Rivers Council or call us at the Narragansett Bay Journal.

**Annaquatucket River**
The Annaquatucket River runs through North Kingstown, R.I. During the 19th century, it powered several large textile mills; today, the mills are gone or converted to new uses, but the dams remain standing, and the old mill pond properties have become valuable waterfront properties. The Annaquatucket system has declined, possibly due to water pollution. Like most other watersheds around Narragansett Bay, the Annaquatucket suffers pollution from commercial, residential, and transportation-related land uses. Invasive, non-native plants, such as common reed and purple loosestrife, are also a growing problem for the river's habitats.

**Contact:** Do you know of an organization involved in stewardship of the Annaquatucket River, or are you interested in getting one started? If so, contact Meg Kerr at the R.I. Rivers Council or call us at the Narragansett Bay Journal.

**Narrow River**
The Narrow or Pettaquamscutt River is, as its name implies, a long tidal estuary connected to a small freshwater system. Despite its size, the Narrow supports one of the largest and best-known annual herring runs in Rhode Island, on Gilbert Stuart Pond, part of the town's Ryan Park property. The presence of importance to river advocates is maintaining clean water and protecting biodiversity. Water pollution from sprawling residential development, faulty septic systems, storm drains and even pet and wastewater waste has caused the closure of the river's once-productive shellfish beds. The Narrow River Preservation Association, which has monitored water quality along the river for many years, is working with state and local government to install stormwater treatment facilities that will help clean the river. Meanwhile, federal and
Narragansett Bay was born as a river. 10,000 years ago, when sea level was much lower than today, the present East Passage was a narrow tidal channel into which flowed freshwater streams from the Blackstone and Taunton basins. As the glaciers melted, the sea rose, flooding the river valley and establishing the Bay's modern shorelines.

The dynamic interplay of fresh and salt water continues to define Narragansett Bay. Each day the rivers of the Bay watershed pour, on average, more than 2 billion gallons into the estuary. As a result, the salinity of the Bay can range from nearly fresh in Providence to nearly oceanic at Newport, providing a diversity of habitats for hundreds of kinds of fish and wildlife.

Narragansett Bay's rivers contribute immeasurably to the needs of communities, as well. People settled in the Taunton River basin at least 12,000 years ago, drawn in part by abundant annual herring runs that continue to bring people to the Nemasket River each spring. Soon after European colonization, rivers such as the Blackstone, Quequechan and Pawtuxet were dammed and developed for industry. During the 19th and 20th centuries, the Bay's rivers powered the Industrial Revolution, providing the basis for the region's prosperity and growth—but suffering the insult of pollution, dams, floodwalls, and pavement. At the headwaters of the larger streams, forests and wetlands were flooded for reservoirs, even as the rivers' lower reaches became too polluted for swimming or fishing.

Today, there is a resurgence of interest in the rivers of Narragansett Bay—at least a dozen watershed councils and organizations have been established here in recent years. These local heroes are organizing clean-ups, building greenways and canoe launches, fighting pollution, and restoring migratory fish runs. Some of their projects are funded by government, but the councils are truly grass-roots organizations, powered largely by volunteers, achieving results that government could never accomplish alone. Perhaps most important, the watershed councils are helping us rediscover the rivers and streams running through our own back yards—and, with them, our true connection to Narragansett Bay.

—Thomas Ardito

I've known rivers ancient as the world and older than the flow of human blood in human veins.

—Langston Hughes

Go Deeper!

For more information about the rivers of Narragansett Bay or to become involved, contact:

R.I. Rivers Council: Meg Kerr, Chair; P.O. Box 1565, North Kingstown, RI 02852

Commonwealth of Massachusetts, Riverways Program; 251 Causeway St., Suite 400, Boston, MA 02114; (617) 626-1540

www.mass.gov/dfwele/river

www.planning.state.ri.us/rivers
Rivers of Narragansett Bay

state agencies are developing a plan aimed at improving water quality and habitat by increasing tidal flushing at the Narrow River Inlet, just north of Narragansett Town Beach.

**Contact:** Narrow River Preservation Association
Richard Grant, President
PO Box 8, Saunderstown, RI 02874
(401) 783-6277
www.narrowriver.org

**Saugatuck River**

The Saugatuck River flows from Indian Lake in South Kings-town, R.I., through Peace Dale and Wakefield, and into salt water at Point Judith Pond. It is a small river system with a rich cultural heritage—flowing through two historic districts listed in the National Register of Historic Places, and blessed with historic landscapes designed by some of America’s foremost landscape architects, including Charles Eliot and Frederick Law Olmsted. According to river advocates, the Saugatuck also has some big environmental issues: lack of public awareness and access; watershed development; and pollution from residential and commercial land uses as well as the former Rose Hill landfill, now a Superfund site. The Saugatuck River Heritage Corridor Coalition is working with the town to develop a new walkway and canoe launch along the river in downtown Wakefield; the first phase of the project was recently completed. Meanwhile, state and federal agencies are restoring the river’s ecology by building and upgrading fish ladders for migratory river herring.

**Contact:** Saugatuck River Heritage Corridor Coalition
Glenn Ricci
PO. Box 209, Wakefield, RI 02879
(401) 782-0149
www.saugatucket.org

**Wood and Pawcatuck Rivers**

The watershed of the Pawcatuck River and its major tributary, the Wood, is one of the largest of the Narragansett Bay region. The Wood and Pawcatuck meet in Richmond, R.I., then flow together as the Pawcatuck along the border between Rhode Island and Connecticut, entering salt water at Little Narragansett Bay, near Watch Hill, R.I. The Wood-Pawcatuck watershed is about 300 square miles in area and includes large areas of undeveloped land, including major state preserves such as Rhode Island’s Arcadia, Carolina and Great Swamp management areas. As a result, the Wood-Pawcatuck system provides high-quality wildlife habitat and excellent recreational opportunities—it is a favorite of birders, fly-fishers, hunters, canoeists and kayakers. Open-space preservation is a major concern for those seeking to retain the unique character and beauty of the watershed. The Wood-Pawcatuck Watershed Association is working with state, local and non-governmental organizations against a “tickling clock”—the pressure to develop large parcels of land for commercial and residential uses.

**Contact:** Wood-Pawcatuck Watershed Association
Lori Uno, Executive Director
203B Arcadia Rd., Hope Valley, RI 02832
(401) 539-9017
www.wpwa.org

**Salt Ponds Watershed**

Nine salt ponds lie along Rhode Island’s Atlantic coastline, from Watch Hill to Point Judith, sharing a narrow watershed. The ponds are a unique resource, comprising a sensitive ecosystem threatened by recent, rapid development in the region. The Salt Ponds SPC Coalition serves as steward for the ponds, which contribute substantial revenues to tourism and fishing—the economic livelihood of communities in Southern Rhode Island. The ponds are rich spawning, nursery and feeding grounds for fish and wildlife, but signs that their ecosystems may be in serious trouble include local shellfishing closures, increasing seaweed, and higher levels of bacteria.

The coalition is working with state and federal agencies on projects to improve the salt ponds’ water quality, habitats and fisheries. The state is undertaking a watershed management plan for two of the nine lagoons, Green Hill and Ninigret Ponds, in an effort to reduce pollution. Solutions under consideration include stormwater treatment and advanced, nitrogen-reducing home wastewater systems. State and federal agencies are dredging the Ninigret Pond tidal inlet, or breachway, in an attempt to restore seagrass habitat there, and are working to restore bay scallops in several of the ponds by developing “spawner sanctuaries” where the shellfish can reproduce. The shellfish restoration is funded by a settlement for damages caused by the 1996 North Cape oil spill off Rhode Island’s south shore.

**Contact:** Salt Ponds Coalition
Bambi Popnick, Executive Director
Box 875, Charlestown, RI 02813
(401) 322-3068
www.saltpondscoalition.org

**Ten Mile River**

The Ten Mile River rises in Plainville, Mass., and flows to East Providence, R.I., where it empties into the Seekonk River at the head of Narragansett Bay. One tributary, the Bungay River, provides excellent red maple swamp habitat and is home to rare plants and wildlife, including the endangered diamondback terrapin. Historically, the watershed supported important fisheries for oysters, quahogs and blue crabs; at present, almost 18 miles from Mount Hope Bay, and hosts the regions largest herring run—up to a million fish per year. The river’s watershed covers an area of 562 square miles, encompassing more than 200 lakes and ponds as well as Hockomock Swamp, the largest freshwater wetland in Massachusetts. It is rich in historical and archeological resources, and home to rare and endangered plants and wildlife. Over 50% of the watershed remains as forest or open land; it contains some of the state’s most intact coastal ecosystems. The Assonet River contains Narragansett Bay’s largest contiguous area of salt marsh, while large reserves of shellfish remain in the lower reaches of the Taunton.

**Contact:** Taunton River Stewardship Council
Southeastern Regional Planning and Economic Development District
88 Broadway, Taunton, MA 02780
(508) 824-1367
www.tauntonriver.org

**Taunton River**

The Taunton River watershed is the second largest in Massachusetts and the largest contributor of fresh water to Narragansett Bay. The Taunton is unique among Bay rivers because it has no dams along its entire 40-mile mainstem. As a result, it is tidal for almost 18 miles from Mount Hope Bay, and hosts the regions largest herring run—up to a million fish per year. The river’s watershed covers an area of 562 square miles, encompassing more than 200 lakes and ponds as well as Hockomock Swamp, the largest freshwater wetland in Massachusetts. It is rich in historical and archeological resources, and home to rare and endangered plants and wildlife. Over 50% of the watershed remains as forest or open land; it contains some of the state’s most intact coastal ecosystems. The Assonet River contains Narragansett Bay’s largest contiguous area of salt marsh, while large reserves of shellfish remain in the lower reaches of the Taunton.

**Contact:** Taunton River Watershed Alliance
PO. Box 146, Bridgewater, MA 02324
(508) 697-5700
www.trwaonline.org

**Quequechan River**

The Quequechan is the river that powered the mills of Fall River, leading the city to become the largest producer of textiles in the U.S. about a century ago. Today, much of the river is buried, flowing through a massive culvert beneath Interstate 195. Green Futures, a local non-profit organization, is seeking to reopen portions of the river and develop a Quequechan Falls Greenway, restoring the city’s relationship to the river that gave it its name.

**Contact:** Green Futures
Quequechan River Initiative
PO. Box 144
Fall River, MA 02724
(508) 673-9304
www.greenfutures.org

**Many Thanks!**

Sincere thanks to the many river advocates in Massachusetts and Rhode Island who assembled and reviewed this information:

Rachel Calabro, Christopher D’Ovidio, Christopher Frechet, Greg Gemit, Richard Grant, Judy Hadley, Steve Insana, Meg Kerr, Richard Langeth, Frank Matta, Ann Morrill, Bob Nero, Jenny Pereira, Bambi Popnick, Jane Sherman, Lori Uno, Rich Youngken and others!
Cause and Effect

Mixed Outlook for Fish and Wildlife

Harvest and Habitat Drive Changes

Thomas Ardito

There’s a scruffy bit of land along the shoreline of Greenwich Cove, a sheltered inlet on the western edge of Narragansett Bay. Fishing shacks perch on cinderblocks; mooring stakes stand at odd angles; a couple of sturdy little outboard skiffs bob on the water, tied to floating docks. Wedged between the railroad tracks, a wastewater treatment plant and a row of marinas, the area is a throwback to an earlier era—a last vestige of Scalloptown. The once-notorious waterfront district of East Greenwich, R.I., was as famous in its day for the high quality of its shellfish as the low morals of its inhabitants.

During the late 19th century, bay scallops were abundant in Narragansett Bay—In 1880, Bay fishermen landed more than 300,000 bushels. Yet by the early 20th century, the scallop fishery had collapsed, replaced by a burgeoning oyster industry—actually a Bay-wide aquaculture operation, in which seed oysters were brought by schooner from Chesapeake Bay and Long Island Sound, then grown on leased beds on the bottom of the Bay. The oyster business peaked in 1910 with a harvest of more than 7,000 tons, but it, too, eventually declined, falling victim to the 1938 hurricane and reduced demand during World War II.

Today, quahogs are the most common shellfish in Narragansett Bay and its most important inshore fishery, producing roughly 2000 tons per year—although the harvest has dropped steadily since the 1980’s, which saw bumper crops five times as large. As quahogs decline, soft-shelled or steamer clams seem to be becoming more plentiful. The story of the Bay’s fisheries is one of steady change, the result of fishing pressure and, equally important, the destruction and alteration of natural habitats—by water pollution, wetland destruction, dam-building, and now, global warming and accelerated sea level rise. Recent years have seen positive as well as negative trends. Human activity continues to alter the Bay’s ecology, for better and for worse—overall, the impact of these changes cannot be entirely foreseen.

Native Fish under Pressure

Like shellfish, Narragansett Bay’s finfish stocks have changed considerably over time. The total commercial harvest of fish from the Bay has dropped dramatically since the mid-20th century. According to a recent study, fishing is the primary cause of the decline, but pollution and habitat destruction are important as well. As high-value species like winter flounder have become scarcer, they’ve been replaced by non-fishery species like spider crabs. The overall biomass of the Bay—the combined weight of all its living creatures—is relatively stable. But resident species—those that spawn in the Bay—have fared poorly.

Winter flounder exemplify this trend. A century ago they were so common in the Bay that many were caught, not with hook or net, but with spears in shallow water. During the 20th century the fish became a principal target of southern New England’s trawler fleet which grew, in number and in size, as fast as more powerful diesel engines became available. The flounder’s sweet white flesh brought a good price at market, while its habit of wintering in the Bay made it accessible to the fishery year-round. Flounder was the bread-and-butter of many a small Rhode Island dragger during the post-war era.

The same period saw many changes to the Bay’s shorelines and shallow-water habitats; winter flounder, which spawn close inshore, were particularly vulnerable to these impacts. Dredge-and-fill projects for shipping channels, roadways and shorelines destroyed flounder spawning grounds. Nitrogen pollution from waste-water treatment plants killed off native sea grass beds that once provided foraging areas and predator protection. Toxic chemicals in the mud of urban harbors gave the fish cancerous tumors. In the mid-1980’s, operational changes at the Brayton Point Power Station in Somerset, Mass., greatly increased the plant’s impact on flounder. The combination of impacts caused a catastrophic collapse of winter flounder stocks on Narragansett Bay. Some scientists have suggested that global warming, which causes the flounder’s...
chief predators to become more active during its spawning period, contributed to the problem. If, as is generally projected, the warming trend continues, Narragansett Bay’s winter flounder stocks may never fully recover.

By contrast, “summer migrants”—fish like fluke and striped bass, which move into Narragansett Bay to feed during the warmer months—are on the rise. The bass, which migrate annually along the East Coast, are beneficiaries of one of the few real success stories in fisheries management. In response to stock declines during the 1970’s, the Atlantic states banded together to close down fisheries, leading to a coast-wide recovery of the species. Ironically, stripers may indirectly benefit from some types of water pollution. Some biologists have suggested that nitrogen pollution from wastewater treatment plants may change the ecology of estuaries such as Narragansett Bay in ways that favor pelagic—mid-water—species like stripers and their prey at the expense of bentthic—bottom-dwelling—fish like winter flounder.

Native Shorebirds Rebound
Recent changes to Narragansett Bay’s shoreline habitats have not been entirely negative. Until the end of the World War II, many of the Bay’s smaller islands were occupied by the U.S. Navy. Rose Island, off Newport, was Fort Hamilton; Dutch Island in the West Passage was Fort Greble. The now-rotted “T-Wharf” at the south end of Prudence Island, in the middle of the Bay, was used for loading warship munitions deemed too dangerous by the Navy for storage at Quonset Point.

With the rise of the nuclear submarine and the intercontinental ballistic missile, the Bay islands lost their strategic importance; most were abandoned by the Navy soon after the war. The buildings crumbled, while the land reverted from manicured lawns to scrubby thickets. With few predatory mammals and little disturbance by people, the islands offered ideal breeding habitat for ground-nesting seabirds such as gulls, herons and oystercatchers. Today, they provide irreplaceable nesting sites for many of the Bay’s distinctive seabirds.

Over the years, several of the islands caught the eyes of housing developers, while grassroots organizations like the Rose Island Lighthouse Foundation advocated preservation. Piece by piece, the state of Rhode Island purchased about 2500 acres on the Bay islands, funded largely by open-space bonds approved by state voters. Most of this area is managed as the Narragansett Bay National Estuarine Research Reserve, including much of Prudence Island along with Patience, Hope and Dyer Islands in the middle of the Bay.

Among the birds using island habitats, the distribution of species has changed over time. As Rhode Island towns closed municipal landfills—opting to send trash to the state’s Central Landfill in Johnston, R.I., instead—they removed a ready source of food for seagulls which, while still abundant, have declined somewhat. Beginning in the 1980’s, cormorant populations increased throughout the Northeast, though reasons for this trend are not well understood. As cormorant nesting sites increased on the islands, they have degraded habitat for herons, apparently causing a modest decline in black-crowned night herons, an important native species.
The first dam on the lower Blackstone River was built in 1718 at Pawtucket Falls, where Main Street now crosses the river in Pawtucket, R.I. The dam prevented Atlantic salmon, American shad and river herring from migrating upstream to spawn, severing a living connection between Narragansett Bay and its watershed. During the next three centuries, at least 500 dams were built throughout the Bay watershed. By 1800, most of the watershed was cleared for agriculture (although much has since reforested); by 1900, Providence was one of the most urbanized and densely populated areas of the country. The population of the Bay watershed swelled to two million people and, also around 1900, sanitary sewers came into use, discharging thousands of tons of nitrogen and causing the destruction of sea grass habitat throughout the Bay. According to the U.S. Fish and Wildlife Service, the Bay watershed has lost about a third of its original wetlands since 1780, although the figure is certainly closer to 100 percent in some important areas like the Providence and Seekonk Rivers.

As go the Bay’s habitats, so, too, its fish and wildlife. Dam building wiped out salmon in the watershed by the mid-19th century and caused drastic declines in herring and shad, which in turn meant less food for fish and birds that preyed on these species. The decline of sea grass beds eliminated spawning habitat for bay scallops—these once-common shellfish are now rare on the Bay. Wetland fill and channel dredging in the Providence River destroyed natural oyster beds, eliminating habitat for dozens of species of fish and shellfish that depend on the underwater structure provided by these mollusks. Urban development causes pulses of storm-water flow, scouring away natural river habitats, flooding city streets and washing toxic pollution into the Bay. People in the Bay watershed—all two million of us—leave a heavy footprint. The cumulative impact of many incremental changes is unknown, but certainly we have profoundly altered the Bay’s biology and will continue to do so. A new issue is invasive species—non-native creatures introduced to the Bay and watershed by shipping and other human activity which can displace native plants and animals, reducing the Bay’s natural biodiversity.

The emerging science and practice of habitat restoration offers one ray of hope. Over the past ten years, government agencies and community groups have restored wetlands, salt ponds, migratory fish runs, sea grass beds and other natural habitats at locations throughout the Bay watershed, and several important large-scale projects are now under way. In 2002, the R.I. General Assembly recognized the promise of habitat restoration by creating a new trust fund that provides $250,000 per year toward these kinds of projects; typically, federal grants leverage this funding by at least two to one.

In both Rhode Island and Massachusetts, ongoing work to reduce nitrogen pollution and storm water flows are also a cause for cautious optimism (related stories, pages 4–7). While no one expects Bay waters to return to pristine conditions, these efforts should lead to significant improvements in upper Narragansett Bay’s habitats over the next decade or so.

Habitats are Key

As go the Bay’s habitats, so, too, its fish and wildlife. Dam building wiped out salmon in the watershed by the mid-19th century and caused drastic declines in herring and shad, which in turn meant less food for fish and birds that preyed on these species. The decline of sea grass beds eliminated spawning habitat for bay scallops—these once-common shellfish are now rare on the Bay. Wetland fill and channel dredging in the Providence River destroyed natural oyster beds, eliminating habitat for dozens of species of fish and shellfish that depend on the underwater structure provided by these mollusks. Urban development causes pulses of storm-water flow, scouring away natural river habitats, flooding city streets and washing toxic pollution into the Bay. People in the Bay watershed—all two million of us—leave a heavy footprint. The cumulative impact of many incremental changes is unknown, but certainly we have profoundly altered the Bay’s biology and will continue to do so. A new issue is invasive species—non-native creatures introduced to the Bay and watershed by shipping and other human activity which can displace native plants and animals, reducing the Bay’s natural biodiversity.

The emerging science and practice of habitat restoration offers one ray of hope. Over the past ten years, government agencies and community groups have restored wetlands, salt ponds, migratory fish runs, sea grass beds and other natural habitats at locations throughout the Bay watershed, and several important large-scale projects are now under way. In 2002, the R.I. General Assembly recognized the promise of habitat restoration by creating a new trust fund that provides $250,000 per year toward these kinds of projects; typically, federal grants leverage this funding by at least two to one.

In both Rhode Island and Massachusetts, ongoing work to reduce nitrogen pollution and storm water flows are also a cause for cautious optimism (related stories, pages 4–7). While no one expects Bay waters to return to pristine conditions, these efforts should lead to significant improvements in upper Narragansett Bay’s habitats over the next decade or so.
We’re All Downstream

Watershed Changes Affect Bay Waters

Thomas Ardito

Narragansett Bay is an estuary—a semi-enclosed body of water where fresh and salt water mix. The North Atlantic roars up the passages twice daily, its cold salt waters bearing fish and other creatures from Georges Bank, Chesapeake Bay, the Gulf Stream and Sargasso Sea. Rainstorms and snowmelt swell the lakes, ponds and wetlands of the Bay's watershed, filling the Scituate Reservoir and Assawompsett Pond, coursing fresh water through streams and rivers and into the Bay. The dynamic interaction of land and sea creates an ever-changing mosaic of habitats, from red-maple swamps to salt marshes, sea grass beds, tidal ponds and open water, supporting hundreds of species of fish, shellfish, birds and other wildlife.

Narragansett Bay's watershed or drainage basin is 1800 square miles in extent, nearly 15 times the size of the Bay itself. Each day, on average, more than two billion gallons of fresh water flow over, through and under the watershed to enter the estuary. Particularly along the northern shores of the Bay, the watershed is highly urbanized, but areas of its interior remain quite rural. The watershed is shared by two states—roughly 60 percent lies in Massachusetts, the rest in Rhode Island—and home to about two million people in 100 cities and towns.

The Bay's watershed has an enormous and underappreciated affect on the estuary. As land is developed and paved, rainfall and snowmelt run off the surface or through storm drains, rather than into the groundwater. Higher storm-water flows erode stream banks and destroy fresh water habitats, while water pollution of all types is increased. In general, once about 10 percent of a watershed is developed, the environmental quality of downstream water bodies begins to decline; 30 percent development causes severe ecosystem impacts such as loss of native fish.

Yet development continues apace throughout the Narragansett Bay watershed. Over the past several decades, land development in Rhode Island has increased at nine times the rate of population growth. If current trends continue, nearly half of all Rhode Island land will be developed by 2025, while by 2060, “the state could exhaust its entire developable land base,” according to a draft report, Land Use 2025, by Rhode Island’s Statewide Planning Program. The report recommends “smart growth” that concentrates new development in existing urban areas while maximizing the preservation of natural lands. Nationwide, such approaches have had some success in curbing suburban sprawl, but have often been beaten back, legally or politically, by developers and property rights advocates.

While Rhode Island’s plan would protect the state’s landscape and inland waters, it would not necessarily do much to preserve Narragansett Bay, since it would concentrate development along the Bay’s shorelines and lower tributaries. Though Rhode Island and Massachusetts each compile land-use trends statewide and regionally, neither state tracks land use on a watershed basis, and there has been no serious attempt at land-use planning aimed specifically at the Bay environment. An integrated approach to land use information and planning across the watershed would seem a sensible first step toward reigning in the impact of land development on Narragansett Bay.

Go Deeper!

Land Use 2025, Rhode Island’s draft land use plan:
See www.planning.state.ri.us or call (401) 222-7901.

Housing development in the Bay watershed causes loss of forests and wetlands as well as water pollution from roads and runoff. Photo: NBJ.
Southeastern Massachusetts Sees Rapid Growth

Communities Embrace Regional Planning; Results are Mixed

Rachel Calabro

Though most of Narragansett Bay’s salt waters and shorelines are within Rhode Island’s borders, more than half its watershed lies in Massachusetts, including the drainage basin of the Taunton River—one of the Bay’s largest and most significant tributaries. Much of the Ten Mile River basin, along with smaller watersheds that drain to Mount Hope Bay (maps, this page and pages 10–11), are also situated in Southeastern Massachusetts. This area is the fastest-growing region of the state, and a hotspot of development within the Bay watershed.

Between 1960 and 1990, the population of Southeastern Massachusetts grew by 46 percent, triple that of the state as a whole. Land is being consumed at an even greater rate: two and a half times that of population increase. More land has been developed in the region during the last 40 years than in the preceding 330—back to the settlement of Plymouth. And by 2020, there will likely be more than 200,000 additional residents, an increase of about 20 percent.

Patterns of land use are also changing. Between 1951 and 1985, one-third of agricultural and open land was converted to urbanized uses. If current trends continue, the percentage of developed land in Southeastern Massachusetts will increase an additional 20 percent by 2020. In the ten communities bordering the Taunton River, more than 1,200 acres of agricultural land have been lost since 1971. In the city of Taunton, for example, there has been more than 400 acres of commercial and industrial growth and nearly 1,500 acres of residential growth since 1971, while nearly 600 acres of farmland and 1,700 acres of forest were lost over the same period.

The rich alluvial soils of the Taunton River corridor are prime farmland, producing vegetables, fruit, berries and dairy products. The area gave rise to Cumberland Farms, Inc., and Ocean Spray Cranberries, and though the watershed has largely retained its rural and agricultural feel, new pressures are bearing upon the region’s land use. Cumberland Farms is selling much of its agricultural land while many cranberry bogs are being converted to other uses. Some communities within the region do not have municipal water or sewer systems and have little protected open space. In Berkley, one of the smallest towns in the Taunton River watershed, only one percent of land is permanently protected, while population has more than doubled since 1980. Growth in the watershed continues to put a strain on freshwater resources and adds demand to wastewater treatment systems that are already beyond capacity.

Citizens, elected officials and state agencies are facing these challenges in an effort to shape a better future for the region. In 1999, the three state-chartered regional planning agencies in Southeastern Massachusetts published Vision 2020: An Agenda for the Future. The report outlines visions and actions for land use, economic development, natural resources, and infrastructure, along with a new planning framework for achieving them. In 2000, 42 communities voted to endorse a “New Mayflower Compact,” agreeing to voluntarily cooperate in a growth management program for the region.

In 2004, the Vision 2020 partners measured regional progress in achieving “smart growth,” compact, resource-efficient land use. Of 52 communities assessed, the audit concluded that only three were “growing smart,” while another 19 were “starting to grow smart.” There were bright spots in the findings, however: the number of communities with a recent land-use plan in place increased to 70 percent, while 73 percent have a current open space plan and 87 percent have groundwater protection laws in place. Yet much remains to be done to adequately protect the watershed of the Taunton River and other natural resources in Southeastern Massachusetts.

—Rachel Calabro coordinates the “Adopt-a-Stream” program of the Massachusetts Riverways Program and serves on the Taunton River Stewardship Council.

Go Deeper!

For more on Vision 2020 and efforts in Southeastern Massachusetts to manage growth and land use, as well as the Taunton River Wild and Scenic Study, contact the Southeastern Regional Planning and Economic Development District at www.srpedd.org or (508) 824-1367.
THE STATE OF SHORELINES

A Tale of Four Cities
Upper Bay Communities Redevelop Urban Shorelines

Monica Allard Cox

Boom and Bust
For most of its settled history, northern Narragansett Bay has been a commercial and industrial hub, and today represents one of the largest stretches of urban shoreline in the country. In the early 1700’s, ships were built in Providence; later, trading thrived, as tea, porcelain and textiles from China made their way to Providence in return for such goods as anchors, cannonballs, whale-oil candles and rum. With the birth of the Industrial Revolution, manufacturing overtook shipping. In the 19th century, shoreline recreational facilities, from shore dinner halls and amusement parks to inns and hotels, sprouted at the head of the Bay and spread south as travel by railway, steamboat, and trolley expanded. As the southern Bay began to draw more tourists from the cities, recreational facilities at the head of the Bay declined. At Fields Point in Providence, where families once went for coastal picnics, there is now a sewage treatment plant and municipal pier. Much of the land belonging to Crescent Park, once a sizeable amusement park in Riverside, R.I., has been converted to residential development, though the well-known carousel there remains.

With the rise of the automobile in the mid-20th century, people began moving from the cities to the suburbs, a trend that has increased in recent years. This, combined with a decline in heavy industry and manufacturing in Rhode Island, contributed to an economic downturn in urban areas. Urban renewal efforts, beginning in the 1960’s, sometimes met with disastrous results, as historic buildings were torn down to make way for modern monoliths that soon were seen as eyesores—and which failed to bring residents and visitors back to the cities.

Recent Successes
More recently, redevelopment efforts by Cranston, East Providence, Pawtucket, and Providence—the Rhode Island cities that border northern Narragansett Bay—have met with success in bringing people back to urban shores. Famously, Providence uncovered its rivers in a project that spanned a dozen years, creating River Walk and Waterplace Park, where Barnaby Evans’ WaterFire installation has been an enormously popular attraction since 1994. Providence is not the only Bayside community to reintroduce recreation to an urban coastline—riverboats packed with tourists ply the Blackstone, kayakers paddle the Seekonk River, and cyclists appreciate East Providence’s superb view of Narragansett Bay from a formerly abandoned railroad bed, now reclaimed for public use as the East Bay Bike Path.

In addition to recreation, the cities are working to rehabilitate unused industrial properties for housing and new businesses. Vacant textile mills have been transformed into townhouses as well as lofts for artists and small companies. Pawtucket and Providence have promoted these new uses by creating sales-tax-free arts districts, and by providing federal, state and local funding assistance to developers for renovation of the old mills.

Pawtucket, which recently signed a deal to develop a hotel, restaurant and office complex on the site of a former car dealership at the head of Narragansett Bay, unveiled, in early 2005, plans for redeveloping the site of a former coal gasification plant. The Tidewater Redevelopment Plan presents four alternatives for the 28-acre property along the Seekonk River, owned by the New England Gas Company and National Grid. “We have had some conversations with the electric company,” said Michael Cassidy, Pawtucket director of planning and redevelopment. “We’ve changed the zoning to allow for less industrial uses, such as office, apartments, commercial uses. The reuse plan (that the gas and electric companies develop) will drive the remediation plan” to clean up contamination at the site.

East Providence recently created a Waterfront Special Development District that encompasses over 300 acres of shoreline along the Providence and Seekonk Rivers, where it seeks to encourage a mix of development and redevelopment including a variety of commercial, residential, and recreational uses, particularly those oriented towards the water. One such project is the redevelopment of the former Ocean State Steel plant (also known as Washburn Wire) which, until recently, stood abandoned on a contaminated site along the Seekonk river shore. Through a public/private partnership with the city, GeoNova Development Corporation is cleaning up 27 acres at the site, which it plans to redevelop as a mix of commercial space and residential uses. The project recently received an award from the Environmental Business Council of New England.

Challenges and Incentives
GeoNova used a licensed process to clean up soils contaminated by toxic metals, highlighting one of the challenges facing cities trying to attract developers—many former industrial sites are brownfields, requiring expensive remediation before they can be redeveloped. Another is Rhode Island’s fragmented and lengthy permitting process, compared with that of other states, which can dissuade companies from taking on redevelopment projects.

Yet once redeveloped, the Bay’s urban waterfronts can serve as an important incentive for businesses considering relocating to the Narragansett Bay region, providing a high quality of life to help them attract and keep the best employees. Providence recognizes this fact—the city hired Sasaki Associates to create “A Vision for Providence: 2020,” a plan that identifies water as one of the city’s biggest assets. The plan seeks to better connect neighborhoods to downtown and to the waterfront, establishing a continuous waterfront esplanade by extending the present River Walk. In response to the plan’s initial draft, city residents called for improved public access to the shore, with an additional pedestrian crossing over the Providence River and waterfront access at Fox Point.

Regional Solutions
While urban planning goes way back—the first comprehensive plan in the country was published in 1909 and the first zoning resolution seven years later—the difference with what’s happening now in Cranston, East Providence, Pawtucket...
and Providence is that the four cities are looking at the Bay shoreline and their municipal plans regionally. They are doing so, in part, under the auspices of the Metro Bay Special Area Management Plan (SAMP), an effort spearheaded by the R.I. Coastal Resources Management Council (CRMC) and staffed by Rhode Island Sea Grant and the University of Rhode Island Coastal Resources Center. Through the SAMP, the cities hope to make the entire area more attractive to business, and to pool their resources to better confront contemporary challenges.

For example, the municipalities are using the SAMP process to develop consistency among their master plans. The Providence Plan, a nonprofit organization, is developing maps of the four municipal plans to show where overlap, connections or conflicts occur—for instance, where one city’s plan for road construction may wreak havoc on the traffic patterns on its neighboring city’s streets.

Cranston’s waterfront is not as extensive as that of the other cities along the upper Bay, but the city is looking toward the SAMP for help in managing changing uses of the shoreline. The city would like to see “a coordinated approach to use and management of the upper Bay between the prime partners, balancing public access opportunities between communities and reducing inherent conflicts that can develop when you situate heavy industry and recreation close together,” said Jared Rhodes, Cranston’s planning director. According to Mr. Rhodes, major shifts are occurring in urban waterfront uses, as out-of-date industrial facilities are converted to academic, recreational and residential uses. He adds that Cranston hopes to offer more public access to the shore.

CRMC is also using the SAMP to encourage shoreline redevelopment in urban areas. Current regulations governing shoreline setbacks (the distance between a building and the shore) and coastal buffers (natural, vegetated areas along the water’s edge) are better suited to the less-developed shorelines of lower Narragansett Bay than to the urban waterfronts of the northern Bay. New policies will consider the constraints inherent in developing city shorelines—such as small lots, contaminated soils, and public access needs—to facilitate urban redevelopment while protecting the Bay environment.

In developing the SAMP, CRMC intends to give citizens, businesses and other stakeholders a forum for envisioning the future of Narragansett Bay’s urban waterfronts. “The Metro Bay SAMP will look closely at the issues important to the residents of this area and, at the same time, facilitate redevelopment of a number of old industrial sites, many of which are brownfields,” said Grover Fugate, executive director of CRMC. “In doing so, we will have to get more sophisticated in the way we manage these important coastal resources.”

—Monica Alland Cox is a communicator with Rhode Island Sea Grant in Narragansett, R.I.

—continued from page 20

Massachusetts as well as Rhode Island. Most importantly, they must include clear goals against which governments and citizens can assess progress.

Building a Framework for Better Bay Management

Around the country, watershed-based partnerships are proving the best approach for solving environmental problems. Stakeholders define goals and priorities; government oversees the measurement of progress; and all work together to achieve results. Government, citizens, non-profit and private-sector organizations all contribute human and financial resources toward shared goals, identifying problems and building solutions. As Narragansett Bay’s watershed is shared almost equally between Massachusetts and Rhode Island, cooperation between the two states is critical to preserving and restoring the Bay.

In 1993, Massachusetts established a statewide “watershed initiative,” while in 2004, Rhode Island created a cabinet-level committee to oversee management of Narragansett Bay. Both programs were modeled on well-known watershed management programs such as the Chesapeake Bay Program and the National Estuary Program. Yet Massachusetts disbanded its program in 2003 while, to date, Rhode Island’s committee has little funding and no formal staff. Interstate cooperation on Bay management remains largely ad-hoc, with no formal structure and many inconsistencies.

Citizens in Rhode Island and Massachusetts have demonstrated time and again their commitment to preserving and restoring Narragansett Bay and its watershed, approving state funding measures and devoting time and money to work on the ground and in the water. They are providing a constant reminder that that pollution, like friendship, ignores political boundaries; and that stewardship extends beyond government to citizens, schools, non-profit organizations and private companies. State and local governments need to adopt a more effective watershed framework that fully recognizes these realities and makes collaboration, community involvement and communication essential parts of how they conduct their work.

—Richard Ribb is director of the Narragansett Bay Estuary Program, which publishes the Narragansett Bay Journal. NBEP is one of 28 National Estuary Programs around the U.S., established by Congress in 1987 under the Clean Water Act.

Go Deeper!

For more information about the cities and the SAMP, see: http://seagrant.gso.uri.edu/metrosamp

Or contact Jennifer McCann, Metro Bay SAMP project manager, at (401) 874-6127 or mccann@gso.uri.edu

---

**Go Deeper!**

For more information on the Narragansett Bay Estuary Program and watershed management, check out [www.nbep.org](http://www.nbep.org) or call the Narragansett Bay Journal. For information on the National Estuary Program, see [www.epa.gov/owow/estuaries](http://www.epa.gov/owow/estuaries).
Bay Challenges Demand New Approaches
Addressing Problems at the Watershed Level

Richard Ribb

Narragansett Bay is a complex ecosystem—changes to any part affect the whole. The health, prosperity and quality of life of communities throughout Rhode Island and southeastern Massachusetts are dependent upon the condition of the environment which, in turn, is profoundly influenced by human activity and land use throughout the Bay watershed.

State, federal and local governments have made great strides in reducing water pollution since passage of the U.S. Clean Water Act in 1972, and restoration of wetlands and river habitats is gaining steam throughout the Bay watershed. Yet much remains to be done. In Rhode Island, 30 percent of state-assessed river miles are unsafe for swimming, while shellfishing is prohibited in one-third of the Bay’s waters (related stories, pages 4–7). “Sprawl” development continues throughout the Bay watershed, converting farms and fields to subdivisions and parking lots, and creating new pollution problems from runoff and transportation impacts that threaten to reverse previous gains.

A healthy environment is a long-term goal and an ongoing challenge. To continue improvements or even maintain the status quo demands new principles for protecting and restoring the Bay and its watershed—stronger partnerships and collaboration between governments and stakeholders; better environmental monitoring; and management approaches that are inclusive, adaptive and address problems at the ecosystem level. Taken together, these principles can establish a better framework for Bay management and, ultimately, help us toward a cleaner, healthier Bay and watershed.

Supporting Grassroots Action
Citizen-based organizations, concerned about environmental degradation and passionate about saving local watersheds, are taking responsibility for cleaning up and protecting natural resources on the Bay’s tributaries (map and story, pages 9–12). The Blackstone River Coalition spurred state and federal agencies to action with its Fishable/Swimmable Campaign; the R.I. Rivers Council empowers local watershed councils; a stakeholder-based Taunton River stewardship plan has just been completed; a coalition of Rhode Island nonprofits is advocating better water supply management; non-profit organizations are restoring coastal habitats; land trusts are saving open space—all are signs of maturing citizen-based efforts.

While state and federal funding supports much of this work, government can do more to build local capacity and recognize key local efforts. Better technical assistance, stable grant programs tailored toward local needs, and stronger partnerships with conservation commissions, watershed councils and other community-based organizations will ensure a meaningful role for citizens and local groups in decision-making.

Measuring Progress Toward Shared Goals
The public invests substantially in environmental improvement. Examples include the $342 million combined sewer overflow (CSO) tunnel now under construction in Providence (page 7); $70 million in new Rhode Island bonds for open space, Bay and watershed restoration; $80 million in planned sewage treatment plant upgrades (page 6); state and federal funding for habitat restoration; and the passage, in many communities, of local sewer bonds. To assess whether these investments are successful—or not—requires the ability to measure environmental conditions in the context of clearly defined goals and objectives, using carefully selected indicators that tell us something about the state of the Bay.

Yet existing monitoring programs are limited, unable to sufficiently track key indicators of Bay ecology and often stopping at state lines. Volunteers play a crucial role in monitoring water quality, habitats and fish runs while state and federal agencies are partnering with universities to monitor fisheries, dissolved oxygen and other factors (related story, page 5). But the various programs are not well-integrated or tied to common goals, and information is often ineffectively managed, with the result that basic questions of cause and effect remain unanswered. A $1.3 million proposal to improve Bay monitoring in Rhode Island, developed by an interdisciplinary team of scientists, managers and environmentalists, remains unfunded. To ensure that taxpayer resources are used wisely, a re-design and strengthening of state monitoring programs is essential, in

—continued on page 19

Rising from the Ashes (Maybe)

A public fishing pier is proposed at the site of the old Jamestown Bridge in North Kingstown, R.I. More information at www.dem.ri.gov (click on “News”). Image courtesy of R.I. Dept. of Environmental Management.