Protection + Progress

2003–2004 LONG ISLAND SOUND STUDY BIENNIAL REPORT

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BIENNIAL REPORT

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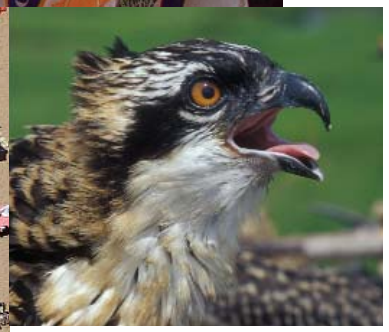
AUTHORIZED BY CONGRESS, the Long Island Sound Study (LISS) brings together federal, state, interstate, and local agencies, industry, universities, and the community to restore and protect Long Island Sound. The Sound is a vital waterway, an estuary where salt water from the ocean mixes with fresh water from rivers. It provides economic and recreational benefits to millions of people, while also providing natural habitats to more than 1,200 invertebrates, 170 species of fish, and dozens of species of migratory birds.



FROM THE POLICY COMMITTEE

Ten years ago, the U.S. Environmental Protection Agency, New York, and Connecticut adopted the Long Island Sound Study's Comprehensive Conservation and Management Plan to restore the Sound. This biennial report highlights projects undertaken in 2003 and 2004 to implement that plan. These projects show that through the cooperation of many partners, water quality is being improved, habitats are being restored, and we are moving closer to fulfilling the vision of Long Island Sound restored to health by 2014.

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DIRECTOR'S REMARKS

In 1985, Congress charged the U.S. Environmental Protection Agency, Connecticut, and New York to characterize environmental conditions in Long Island Sound and develop an ecosystem-focused management plan. Developing a comprehensive conservation plan for the Sound required some audacity to undertake. Of course the Sound was degraded and even a cursory conversation would round up the usual suspects: the legacy of contaminants from historical discharges; an overdeveloped and densely populated landscape; an aging and under-maintained infrastructure to convey and treat sewage; degraded natural habitats; and a too-large fraction of the populace resigned to the status quo. But hadn't plans—comprehensive and thoughtful directives—already been written? Why was another plan needed? How would it be any different?

Today, 10 years after the Connecticut and New York governors and the EPA Administrator approved it in 1994, the Comprehensive Conservation and Management Plan (CCMP) for Long Island Sound continues to distinguish itself—not because it is an elegant definition of the problems of the Sound—but because it is being actively implemented. The cooperative partnership that developed the plan, called the Long Island Sound Study, continues, with the support of Congress, but with a focus on coordinating implementation, evaluating effectiveness, and refining efforts. And Connecticut and New York have responded to the challenge by investing hundreds of millions of dollars to upgrade wastewater infrastructure, restore habitats, and reduce polluted runoff.

This biennial report is our first, prepared in recognition of 10 years of implementation, but highlighting the progress made in 2003–2004. Two things stand out. First, a strong and sustained constituency for the Sound that translates into political will is vitally important. Without it, general prescriptions for action can't sustain the challenge of identifying specifically who will need to do what, where, and at what cost. Second, there is a need to manage uncertainty, not be paralyzed by it. We learn best from doing. Together, the actions and research highlighted on these pages are critical to our efforts to restore and protect the Sound.

Mark Tedesco
DIRECTOR, U.S. EPA LONG ISLAND SOUND OFFICE

Historical Overview

Hundreds of years of increasing population and intense development diminished the Sound's natural resources; restoration efforts are now reversing that trend.

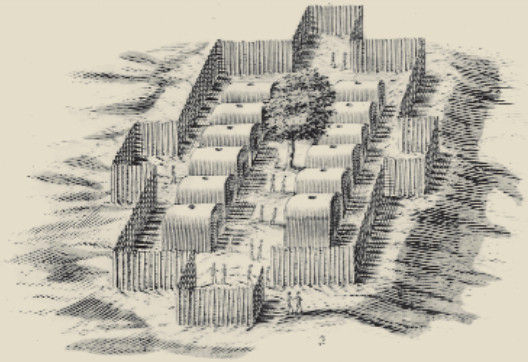
Pre-colonial

Perhaps as many as 10,000-15,000 Indians live near Long Island Sound, harvesting bountiful fish and game along the shore and in interior forests.*

Colonial

In 1614, Dutch explorer Adriaen Block completes his final expedition to the Sound. Block, the first European to sail the entire Sound, opens the Sound to trade. Colonial settlers clear forests for farms and settle in seaside communities for trade, fishing, and whaling. Indian tribal influence dwindles by late 1600s.*

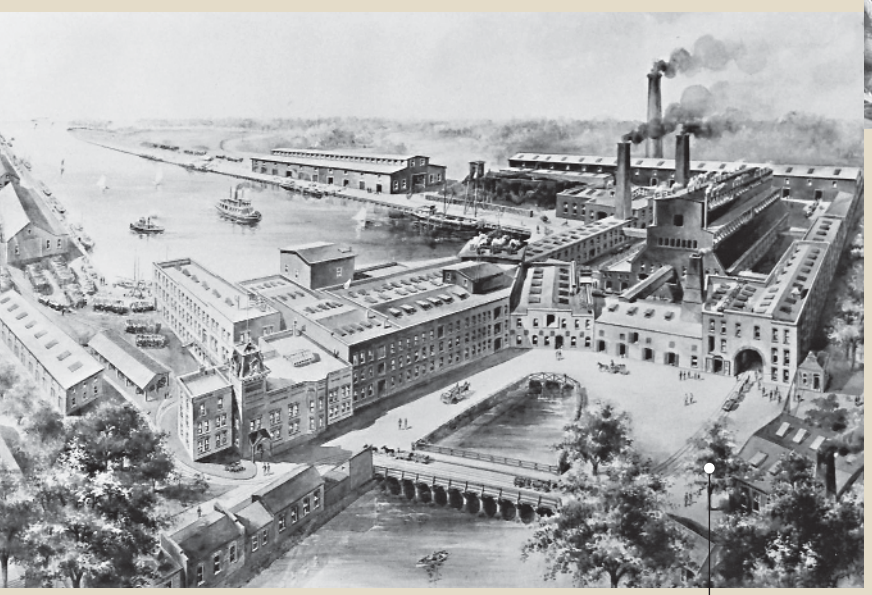
1800
POP. 55,830



An Indian village depicted in an early Dutch map of "New Netherland."

* Source: Tom Andersen, *This Fine Piece of Water: An Environmental History of Long Island Sound* (Yale University Press, 2002)

Menhaden kill, along the Mianus River, 1988.



Stamford Manufacturing Company, Cove Island, Stamford.

2003

LISS adopts the 2003 Long Island Sound Agreement, establishing measurable targets to implement the CCMP and to restore the health of the Sound by 2014, the 400th anniversary of Block's final exploration.

1970s

Low levels of dissolved oxygen contribute to fish kills in the western Sound. Nationally, concerns about the health of America's waterways lead to the 1972 federal Clean Water Act.

1985

Congress creates the Long Island Sound Study (LISS). Field surveys identify low levels of oxygen, later related to nitrogen pollution, as the greatest environmental threat to the Sound.

2001

EPA approves CT and NY's "Total Maximum Daily Load" of nitrogen to the Sound, allocating responsibility to meet the 58.5 percent reduction goal.

1900
POP. 2,423,260

1970
POP. 7,729,030

1850
POP. 989,890

1950
POP. 5,982,690

2000
POP. 8,539,230

Industrial

Commerce grows, and the Sound and its tributaries become known for brass and metal finishing, textiles, hatmaking, and oystering. The Sound is prized for its beauty and becomes a source of inspiration for American Impressionist painters. But the Industrial Revolution also brings intense growth and pollution.

1950s

Manufacturing declines, while postwar housing production leads to a population boom and suburban sprawl. The first comprehensive study of water quality shows evidence of human impact affecting oxygen levels.

1994

LISS adopts the Comprehensive Conservation and Management Plan (CCMP) to restore and protect the Sound. The cleanup plan includes actions to address hypoxia, reduce toxic substances and pathogens, and restore natural habitats.

1998

CT, NY, and the EPA adopt a plan to reduce human sources of nitrogen pollution to the Sound by 58.5 percent by 2014. Through the Habitat Restoration Initiative, the Study also adopts goals to restore 2,000 acres of habitat and 100 miles of river for fish passage by 2008.

Dune creation project, Rye, NY.

Water Quality

→ point source pollution

Goal **Improve water quality by reducing nitrogen pollution.**
Progress **Twenty-five percent reduction in nitrogen from sewage treatment plant upgrades since the early 1990s.**

In 2004, the U.S. Commission on Ocean Policy described nutrient pollution as the most pervasive and troubling pollution problem facing U.S. coastal waters. Long Island Sound is a prime example. Each day, thousands of pounds of nitrogen enter the Sound from treated sewage, air pollution deposited by rain, and fertilizer carried by stormwater runoff. The nitrogen fertilizes microscopic plants called algae, overstimulating growth and causing blooms. When algae die and sink to the bottom, bacteria feed on them and consume oxygen in the process. That leads to hypoxia (low-dissolved oxygen) and some times anoxia—no oxygen at all. Marine animals with little mobility can die; others must leave the hypoxic zones for more oxygenated waters.

The Study's partners have identified reducing nitrogen pollution and hypoxia as the highest priority for implementing the 1994 Management Plan. As a result, in 1998, Connecticut, New York, and the EPA reached a landmark agreement to reduce human sources of nitrogen by 58.5 percent by 2014.

The greatest source of nitrogen in Connecticut and New York—about two-thirds—comes from the treated sewage discharged from sewage treatment plants. Treatment plants are often called "point sources" of pollution because they originate and discharge in a specific place. Fortunately, treatment plants can be upgraded to transform nitrogen into a harmless gas. In 2003 and 2004, as in previous years, hundreds of millions of dollars through federal, state, and local sources have been invested to reduce these point source discharges.

Since 1990, about 25 percent of the 105 treatment plants that discharge into the Sound and its tributaries in New York and Connecticut have completed full upgrades, known as biological nutrient removal. As a result of upgrades completed by the end of 2003, Soundwide discharges from plants have been reduced by 25 percent since the early 1990s.

PROJECT//STAMFORD WATER POLLUTION CONTROL AUTHORITY

>> HIGHLIGHTS | 2003—2004

IN THE EARLY 1990s, Stamford developed an inexpensive way to reduce nitrogen in sewage treatment plants that became a model for other communities.

But while Stamford has been praised for its early success in removing about 65-80 percent of its nitrogen, the city decided it could do more. The Stamford Water Pollution Control Authority is upgrading its facility to remove nearly all of the 4,000 pounds of nitrogen entering the plant daily. City, state, and federal officials wanted the full upgrade because of Stamford's location in the western Sound where the impact of nitrogen pollution is greatest. The authority also wanted to make sure that water quality would not be compromised by the increased sewage expected in the plant as the city's population grows.

Stamford's innovation, developed by Jeanette Brown, executive director of the authority, involved a method to optimize the existing plant to improve a commonly used process to break

Jeanette Brown, opposite page, in front of one of Stamford's new biological tanks. Construction workers, left, cut a hole in cement between two tanks at the Stamford treatment plant.

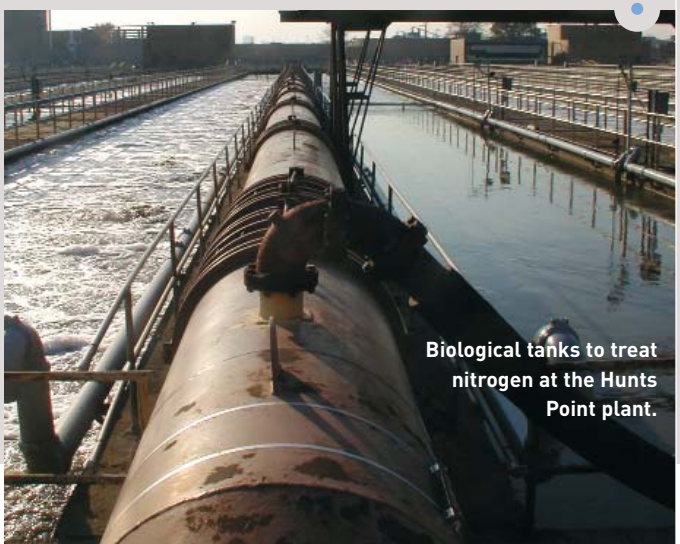
down nitrogen with bacteria. The process requires the biochemical conversion of ammonia to nitrate, and then to a harmless nitrogen gas, in the plant's biological tanks. In 2004, the U.S. Commission on Ocean Policy praised Stamford's "novel" process to remove nitrogen. The upgrade, meanwhile, will expand the capacity of the tanks to allow for up to 95 percent nitrogen removal.

"Not only is the Sound a large producer of high quality shellfish, but it is on the migratory path for many species of birds, fish, and aquatic mammals," said Brown. "We must continue to improve the Sound's water quality, or we can endanger various species of wildlife, impact the economics of the state, and lose a valuable recreational and environmental resource for many generations to come."

Hunts Point Sewage Treatment Plant

New York City is investing $208 million to remove nitrogen at its Hunts Point facility along the East River in the Bronx. It's one of the largest monetary commitments to reducing nitrogen in the Sound. It should remove an estimated 22,500 pounds of nitrogen a day when completed by 2007.

PROJECT//HUNTS POINT SEWAGE TREATMENT PLANT



Biological tanks to treat nitrogen at the Hunts Point plant.

CT Gov. Jodi Rell, at a greenway along the Naugatuck River in Beacon Falls, marking the first anniversary of the state's water quality trading program.

States Opt for Flexible Nitrogen Programs

To help meet the goal of reducing nitrogen pollution by 58.5 percent by 2014, Connecticut and New York have developed plans to gradually phase in sewage treatment plant upgrades. Both states have opted for flexible programs that achieve the desired results, while best utilizing limited financial resources.

New York's 23 plants that impact the Sound are divided into five management zones. As long as each zone meets an aggregate nitrogen reduction target, all the plants are in compliance. There can also be trades of nitrogen reduction requirements between zones. Every five years the permitted aggregate nitrogen target is reduced for the zone, requiring more plant upgrades to go on-line.

In Connecticut, the 74 coastal and inland communities with sewage treatment plants began trading "nitrogen pollution credits" in 2003 based on 2002 reduction efforts. In the program, communities that exceed their annual nitrogen reduction targets earn pollution credits and sell them in a Nitrogen Credit Exchange overseen by a state advisory board. Communities who have not yet upgraded their plants and do not meet their nitrogen reduction target goals must buy credits. The program takes into account that some plants can more cost-effectively remove nitrogen because of their size, design, or proximity to the western Sound where nitrogen's impact is greatest. In the first year, 39 plants reduced nitrogen output below their assigned permit limits, making them eligible to sell nitrogen credits valued at $2.76 million.

Goal Reduce nonpoint source pollution.
Progress More local watershed management efforts.

Water Quality

→ nonpoint source pollution

Each year, rainfall carries thousands of pounds of nitrogen pollution from atmospheric deposition, fertilizer, and animal waste into Long Island Sound through storm drains and tributaries. Originating at "nonpoint sources" such as paved surfaces, lawns, and automobile exhaust, these nitrogen pollutants contribute to the Sound's low dissolved oxygen problem. But nitrogen pollution is not the only concern: pesticides, pathogens, used motor oil, sediment from road sanding and construction sites, and debris are some of the other pollutants carried into the Sound with runoff. Accumulated sediments, for example, seem like an unlikely pollutant, but when washed into the Sound, they can bury fish eggs and harm habitats along the shoreline, and clog harbors used to dock boats.

As a result of these concerns, the Long Island Sound Study has supported the efforts of local communities to apply a variety of strategies to control nonpoint source pollution. These include:

- habitat restoration projects to provide wildlife habitat and to restore vegetation that filters pollutants;
- training programs to teach municipalities about controlling stormwater pollution, and education programs to help residents learn simple techniques to prevent pollutants from entering storm drains and waterways; and
- supporting watershed management groups that take a regional approach to reducing stormwater pollution.

Despite efforts by local municipalities and watershed associations to reduce nonpoint source pollution, the challenge remains formidable. Continued changes in individual behavior, such as reducing fertilizer use, and further community changes, such as stricter regulations affecting land use and development, will be needed.

PROJECT//BRONX RIVER

An outfall pipe, below fence, discharges sediment into the Bronx River.

>> HIGHLIGHTS | 2003—2004

COMMUNITIES IN Westchester that care about their local streams and the Sound are working together to try to reduce the impact of nonpoint source pollution.

In 2003, for example, 14 municipalities and three environmental groups joined the County's departments of Planning, and Parks, Recreation, and Conservation, to begin drafting a plan to control polluted stormwater that flows into the Bronx River, and eventually the Sound.

The communities formed a Watershed Advisory Committee, the fourth intermunicipal venture to work on watershed restoration in Westchester's Long Island Sound region.

Compared to most rivers in urbanized areas, the Bronx River has a long association with environmental stewardship. In the early 20th century, hundreds of homes, stables, and factories along the river's edge had turned the Bronx River into an open sewer. The Bronx River Parkway Commission acquired the properties, and replaced them with a greenbelt, with paths and trees, and a scenic parkway. But the

The Bronx River pathway, above, designed in the early 20th century, remains a popular scenic spot. A volunteer streamwalker, left, after assessing a segment of the Bronx River in spring 2004.

Commission did not consider the impact of sediments and pollutants carried into the river through stormwater pipes and from surrounding urban areas.

"Water is the universal solvent; it will carry everything into the river," said Jeff Main, Westchester County's Bronx River curator.

As part of the watershed plan, community volunteer "streamwalkers" in 2004 assessed the Bronx River to help identify impaired areas such as eroded riverbanks and pipes that could carry sediments and other pollutants into the river. A plan should be developed by early 2006 that will contain specific recommendations such as: reestablishing vegetation to filter pollutants before they enter the river; improving regulations to protect, preserve, and restore wetlands; and identifying pipes and storm drains that could be retrofitted with filters to eliminate pollutants.

By working together, watershed groups can streamline costs of programs that cross political boundaries—such as education outreach campaigns—and also ensure that water quality problems of one community do not impact another community, and Long Island Sound.

"The holistic approach to stormwater management in a watershed is a more economical and prudent approach than individual areas either neglecting their responsibility or trying to do it on their own," said Main.

Autumn on the Connecticut River, Vermont

Connecticut River Nitrogen Initiative

What does Lancaster, a small town in northern New Hampshire, have in common with Hartford? They both are situated along the Connecticut River, the longest river in New England, and the largest source of fresh water draining into Long Island Sound. While resource managers have a good idea of the impact Connecticut cities have on the Sound, less is known about the impact of "upper basin" communities in New Hampshire, Massachusetts, and Vermont. But that's changing. In 2003, the New England Interstate Water Pollution Control Commission (NEIWPCC) joined with the U.S. Geological Survey to begin monitoring nitrogen coming from factories and treatment plants, as well as nonpoint sources, throughout the Connecticut River valley. The information will be used by the Connecticut River nitrogen work group, which includes resource managers in Connecticut and the upper basin states, to help identify sources of nitrogen in the watershed that impact the Sound and to develop strategies to control them.

Habitat Restoration

Goal Restore shoreline habitats and river corridors.
Progress Restored 535 acres and 58 miles of river passage, since 1998.

The destruction of natural habitats rivals hypoxia and overfishing in harming the Sound's living resources. Destruction of tidal marsh grasses, for example, deprives shellfish, worms, and juvenile fish of their habitat; loss of these species would, in turn, deprive economically important fish such as bluefish, striped bass, and flounder of their primary food.

Tidal wetlands are one of 12 habitats being restored through the Long Island Sound Study Habitat Restoration Initiative. Other habitats include beaches and dunes, cliffs and bluffs, and coastal and island forests.

In 1998, the Long Island Sound Study, through the efforts of the Habitat Restoration Initiative, adopted a goal to restore, by 2008, 2,000 acres of coastal habitat and 100 miles for fish passage in rivers where dams and other structures have blocked fish from swimming upstream to reproduce. In preparation for the restoration work, the Habitat Restoration Initiative work group, which includes two state restoration coordinators funded by the Study, developed a priority list of sites based on ecological value, public benefit, and technical viability.

In 2003 and 2004, local, state, and federal agencies worked to restore 34 acres of habitat, and 13.5 miles of fish passage. Since its inception, the Habitat Restoration Initiative has restored 535 acres and 58 miles of fish passage.

In 2004, the Habitat Restoration Initiative also published a coastal habitat restoration technical manual in print and on the Long Island Sound Study Web site. Intended for resource managers in communities throughout Long Island Sound, the manual also has been requested by universities, government agencies, and non-profit groups in 17 other states wanting to learn how restoration work is done in the Sound.

PROJECT//LYNDE POINT

>> HIGHLIGHTS | 2003—2004

Lynde Point Peninsula is part of an internationally recognized wetlands complex in the lower Connecticut River Valley. A few decades ago, a large portion of the tidal marshes at Lynde Point were severely degraded. Thanks to a restoration project initiated in 2003, Lynde Point should soon fully regain its value as a premier wetland habitat for a wide variety of fish and birds.

The degradation of Lynde Point began in the 1940s, when 15 acres of tidal wetland were filled with sandy sediment dredged from the Connecticut River, completely burying the marsh. *Spartina alterniflora* and *S. patens*, the dominant marsh grasses, were replaced with a

CT DEP staff used "low ground pressure" equipment at Lynde Point to create proper elevations for future low and high marsh growth.

tall and aggressive invasive plant known as common reed, or *Phragmites australis.* In 2003, the Connecticut Department of Environmental Protection (CT DEP) removed the *Phragmites,* started excavating 45,000 cubic feet of dredged material, and created several small ponds to bring back the salty water required for marsh grasses. The area now looks like a mudflat, but over time the marsh grasses should return because marsh vegetation can spontaneously reestablish through seeds already present in the soil or transported by the tides from other marshes.

Key partners in the project also include the U.S. Fish & Wildlife Service (FWS), which provided a grant through its Partners for Fish and Wildlife Program and through a Coastal Wetland Conservation Grant, the U.S. National Oceanic and Atmospheric Administration (NOAA), and Ducks Unlimited.

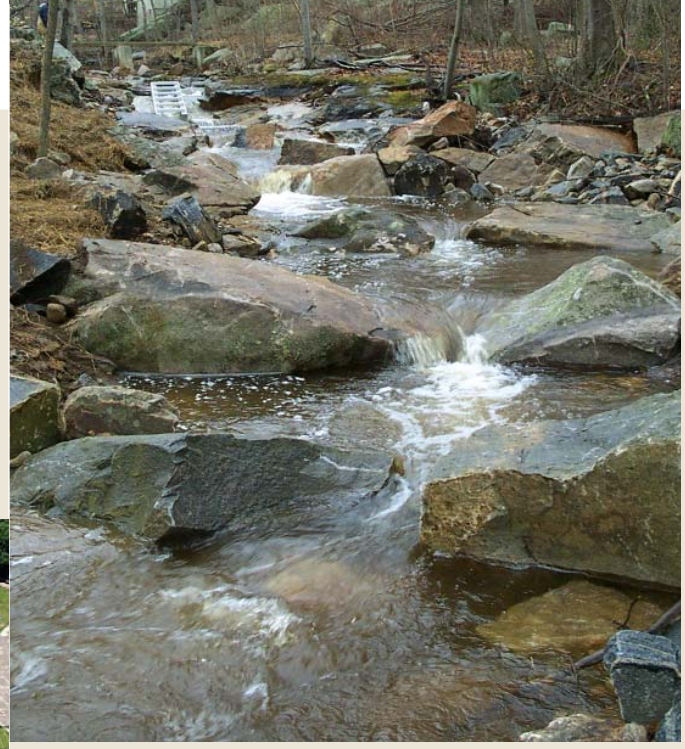
Bar Beach Lagoon in North Hempstead, Long Island, once a thriving marsh in Hempstead Harbor, had been severely degraded over several decades because of erosion, sediment sinking or sea level rise, and debris, mostly construction rubble. In 2003 and 2004, the first steps in restoring this marsh were undertaken. First, contractors and town staff removed rubble and *Phragmites* in a 0.8 acre area. After the correct elevation for the salt marsh was established to bring back salty water, volunteer harbor groups and high school students planted more than 4,000 marsh plants.

"A lot of harbor organizations who volunteered were already involved in the Long Island Sound Study and know about the importance of reclaiming our shorelines," said Kevin Braun, North Hempstead's environmental control specialist. "But the high school kids, I think they gained an important understanding of why we are doing this."

To increase public appreciation of the coast, the town also plans to make the site the first segment of a new shoreline nature trail. Key partners who helped select the site included NOAA, FWS, and the New York State Department of Environmental Conservation. These agencies also helped to acquire funds from industrial polluters as part of a settlement to clean up an industrial site across the harbor, and NOAA provided an additional grant.

PROJECT//
BAR BEACH LAGOON

Lagoon before restoration, above. Volunteers, left, planting marsh grasses in spring 2003. The site, below, in 2004 after the elevation was restored and grasses were planted.



Fishway to Bring Back Alewives, Herring

To restore passage for fish to travel from the brackish waters of the Sound to freshwater rivers to spawn, removing dams or other obstructions are preferable, but not always practical. For example, removing the dam at Lower Guilford Lake would have also drained the privately owned 14.2 acre lake, an important scenic resource for 240 homeowners who live there. In 2003, the owner of the dam—the Guilford Lake Improvement Association—with support from CT DEP, Yale University, and American Rivers created a fishway to provide alewives and blueback herring passage to freshwater nursery habitat in the lake and 0.75 miles up the East River.

The fishway was constructed to look natural and allow fish to swim against the fast-moving flow of water from the dam's spillway. The fish swim through narrow passageways created by embedding boulders in the steep channel. To get over the top of the dam, the fish swim through a steeppass, a 10-foot long aluminum trough, with vanes that create turbulence to neutralize the downward flow of water.

Volunteers are monitoring the fishway as well as the lake and East River for signs of the fish and their juveniles. Alewives and herring passage has been successfully restored using another fishway built one mile downstream in the early 1990s.

STEWARDSHIP

Stewardship

Goal Protect open spaces and natural areas.
Progress Protected, through acquisition and easements, more than 11,000 acres in 2003.

In 1992, Dr. J.R. Schubel, then Dean of Stony Brook University's Marine Sciences Research Center, recommended that healthy areas throughout the Sound be protected because "practicing preventive environmental medicine is far more effective and far less expensive than cleaning up environments that are degraded." That concept, "practicing preventive medicine," is a good way to think of the Long Island Sound Study's Stewardship Initiative, which is working to identify places along the Sound's coast with significant ecological, scientific, or recreational values and to develop a strategy to protect and enhance those special places.

Key partners in the Stewardship Initiative include the U.S. Fish and Wildlife Service Coastal Program, which in 2004 created an inventory of the important scientific and ecological areas along the Sound's shoreline, and the Regional Plan Association, which created in the same year an inventory of open space and recreational areas. Also, in February and March 2004, Save the Sound and Audubon New York helped coordinate a series of meetings in eight communities around the Sound to share information about the program with the public.

The Stewardship Initiative is now working to combine Geographic Information Systems data to create a comprehensive assessment of open space and ecological resources in the Sound. This information will be used to help identify priorities for land acquisition and protection, for increasing and improving public access, and for managing use conflicts around ecologically sensitive areas.

As a result of the public's interest in stewardship, the Long Island Sound congressional delegation has introduced federal legislation to support and fund the Stewardship Initiative.

>> HIGHLIGHTS | 2003—2004

NY Gov. George Pataki, above, touring the Jamesport site in 2003. Also, a view of the bluffs, right.

A STRETCH of shoreline property in Jamesport, Long Island, which had been the largest privately owned undeveloped property left along the Sound, is now 533 acres of protected natural parkland and farmland, thanks to an innovative deal between New York State, a utility company, non-profit groups, and farmers.

In November 2002, New York Governor George Pataki announced the state had reached an agreement to acquire the land from KeySpan Energy Corporation for $16 million. The purchase was made possible by the New York State Office of Parks, Recreation, and Historic Preservation through the Environmental Protection Fund.

In 2004, about 300 acres of the farm land portion of the property are being sold to seven farmers, with the state retaining development rights to ensure that the land would not be sold to developers. Farmland on the property had previously been leased under KeySpan's ownership, but farmers had indicated to the state that they preferred to own the land if

they were going to make a long-term investment in farming. The proceeds of the farm sales will go back to the State parks department to help turn more than 200 acres of the property into a publicly accessible natural park. In addition, about 20 acres are also being donated to two farm museums to help promote cultural tourism in the region.

recreational opportunities," said Pataki when he announced the acquisition.

KeySpan was supportive of the state's efforts to protect the land, and agreed to sell it at below the appraised price. Other key partners included the Trust for Public Land, Audubon New York, which had recognized in 2002 the KeySpan property as its number one land protection priority, the Peconic Land Trust, and the Long Island Farm Bureau.

PROJECT// JAMESPORT ACQUISITION

The park land includes a mile of beach front, dunes, bluffs, forest, and freshwater wetlands.

"With this agreement, we are preserving precious natural resources and providing greater access to Long Island Sound and its view for countless outdoor

In the 1960s, a prior owner, the Long Island Lighting Company, had hoped to build two nuclear power plants at the site.

Barn Island Wildlife Management Area

Good Stewardship Requires Teamwork

To achieve stewardship goals, Connecticut and New York often seek to protect through acquisition privately-owned shoreline properties that provide natural habitat and have the potential to increase public access to the Sound. But with funds for acquisition projects scarce in recent years, it has become important to develop partnerships to find innovative ways to pay for them.

A highly-effective partnership involved Connecticut's 2004 purchase of private property to add 144 acres to the Barn Island Wildlife Management area in Stonington. The acquisition was supported with "bridge financing" provided by The Nature Conservancy to hold the property until long-term acquisition funding, provided principally through a $1 million U.S. Fish and Wildlife Service Coastal Wetlands Conservation grant, was received. The Nature Conservancy also donated $150,000 to buy the land. In all, about a dozen groups, from state and federal agencies to municipalities and conservation groups, teamed up to acquire the addition from a developer who had planned to build a golf course on the property.

Barn Island had been described in the 1970s by William Niering, an internationally recognized wetlands expert and Connecticut College professor, as the "finest wild coastal area in Connecticut." With the 144-acre addition, the Barn Island Wildlife Management Area now has more than 1,000 acres of preserved, contiguous coastal habitat open space.

"Opportunities like this are rare and demonstrate that State partnerships with federal natural resource agencies, municipalities and private non-profit conservation organizations can help to conserve extraordinary examples of our coastal heritage," said Connecticut Department of Environmental Protection Commissioner Arthur J. Rocque, Jr.

Goal **Track the ecological health of Long Island Sound.**
Progress **Twenty years of collected data aid management decisions.**

Monitoring

How far along are we in our goal to restore and protect the Sound? To find out, the Long Island Sound Study's partners monitor water quality, the status of fish and bird populations, and the health of coastal habitats. Tracking these indicators helps resource managers assess whether goals are being met. They also help us learn of trends not foreseen when the Study began researching the problems of the Sound almost 20 years ago.

The comprehensive water quality monitoring program began 17 years ago, and has been conducted since 1991 by the Connecticut Department of Environmental Protection. The data collected allow the Study to track how hypoxia, or low levels of oxygen, varies from year to year, and whether management actions, over time, improve conditions.

From October to May, water quality samples are collected once a month from 17 sites by staff aboard the research vessel *John Dempsey*. Bi-weekly hypoxia surveys start in mid-June and end in September with up to 36 stations being sampled during each survey.

While nitrogen fuels the growth of microscopic plants that leads to low levels of oxygen, other parameters, including temperature, wind patterns, rainfall, and salinity, also contribute, and are collected in the sampling program. These factors lead to year-to-year variations in water quality conditions, even while there has been an overall trend toward less severe hypoxia since 1987.

Other agencies and universities supplement the baseline program with their own sampling. Key partners include the EPA, U.S. Geological Survey, New York State Department of Environmental Conservation, New York City Department of Environmental Protection, Interstate Environmental Commission, University of Connecticut, Stony Brook University, and the New York and Connecticut Sea Grants. Local volunteer monitoring programs also contribute data in near-shore waters.

>> HIGHLIGHTS | 2003—2004

FOR THE PUBLIC, as well as for researchers, getting water quality information can be as simple as going on the Internet and typing MYSound.

University of Connecticut started the Monitoring Your Sound program in 1998 with the support of the Long Island Sound Study, which was interested in applying new technology to collect and make available real-time data on water conditions. With the Study's support, the EPA's EMPACT program contributed $1 million to initiate the program. The Study also provided additional funding in 2003.

MYSound uses sensor equipment attached to buoys and docks to monitor water temperature, weather information (including air temperature, wind direction, and humidity), wave heights, salinity, and dissolved oxygen levels. The data from eight stations are then transmitted to a central computer network, which archives it and also presents it within minutes of sampling onto the Web site (www.mysound.uconn.edu).

MYSound supplements existing shipboard sampling programs by providing detailed, daily information about an area. This is useful to researchers who apply models to predict water circulation and dissolved oxygen concentrations, and to the public interested in better understanding the Sound. It also has become a popular site for recreational boaters, tug boats, and ferry boats to get up to the minute marine weather conditions.

In summer 2004, the Study also provided funds to the New York State Department of Environmental Conservation to install sensors onto 20 navigation buoys near lobster habitats as part of a project to monitor water temperature impacts on lobster mortalities.

Significantly elevated bottom water temperatures were present during the late summer and fall of 1999, when severe lobster mortalities occurred. The sensors will measure and record temperatures hourly, and will produce a time-series database for researchers.

PROJECT// MY SOUND

Deploying monitoring bouys (clockwise from top) in the central, eastern, and western Sound.

PROJECT// TIDAL WETLAND MAPPING

In Mt. Sinai Harbor, 46 acres of wetlands turned into mudflats and shoals. Wetlands pictured as red in 1974 and yellow in 1999.

Monitoring Critical Habitats

The Study monitors critical habitats such as tidal wetlands and eelgrass beds by mapping the size of the habitats over time.

Tidal Wetland mapping. A comparison of recent and historical aerial photo surveys are helping to document tidal wetlands being drowned by coastal waters, and being turned into mudflats. In 2003, the Study sponsored a workshop on tidal marshland loss that brought together researchers to discuss possible causes, including elevated sea level rise due to global warming of ocean waters, and excessive nitrogen in the affected sites. The workshop report summarized current understanding of tidal wetlands loss and stressed the need for more research to understand the issue. In response, the Study funded two tidal wetlands research projects in 2004.

Eelgrass Mapping. Eelgrass, a rooted plant found in shallow waters, serves as vital nursery for many desirable fish and shellfish. Algal blooms, fueled by an oversupply of nitrogen, shade sunlight and have caused the loss of eelgrass throughout the western and central Sound. In 2003 the release of the first comprehensive survey of eelgrass beds documented nearly 1,600 acres in the eastern Sound. The survey, which used aerial photography as well as divers, showed that the area of eelgrass beds in embayments declined, especially those receiving discharges from sewage treatment plants. A notable success story is Mumford Cove, where eelgrass is now growing again as a result of removing sewage discharges in 1987. The monitoring, conducted by the U.S. Fish and Wildlife Service for the Study, will be repeated in 2005.

PROJECT// EELGRASS MAPPING

RESEARCH

Goal Apply research to improve management of the Sound.
Progress Increased understanding of hypoxia and threats to marine resources.

Research

Recognizing the important role that research plays in decision-making, the U.S. Environmental Protection Agency, Connecticut Sea Grant, and New York Sea Grant developed a cooperative program to fund research in support of the Long Island Sound Study. Initiated in 1999, the Long Island Sound Research Grant Program awards funds to researchers whose work helps meet the needs of decision-makers to improve the management of the Sound.

The current funding cycle for the grant program was launched in August 2003. Priority research topics, identified with the help of the Study's Science & Technical Advisory Committee, included eutrophication, submerged aquatic vegetation, food web dynamics, and tidal wetland loss. Of the 40 proposals submitted, seven projects were selected, totaling $850,000 in grant awards. The projects include applying remote sensing technologies to monitor wetlands, developing models of food webs in Long Island Sound, and measuring toxic contaminants in the water (for a listing of current and past research grants, see p. 18).

The New York and Connecticut Sea Grants, and the Connecticut Department of Environmental Protection, also maintain their own separate research grant programs.

New York and Connecticut Sea Grants also manage the Lobster Research Initiative, established after a July 2000 Congressional allocation of $6.6 million in federal funds for scientific research into the causes of a lobster die-off in Long Island Sound. The funded research is investigating many different factors on an ecosystem-wide basis. These include disease-causing organisms, pesticides, pollution, and water quality conditions such as elevated temperatures and changes in salinity.

>> HIGHLIGHTS | 2003—2004

THROUGHOUT the northeast, tidal marshlands are turning into mudflats, destroying important habitats for wading birds, juvenile fish, and invertebrates. At the Quinnipiac River, for example, nearly half of the brackish marshes in a 130-acre site have disappeared since 1974.

Scientists don't know the reasons why. While news accounts have been warning that global warming may accelerate the rate of sea level rise—leading, among other consequences, to marsh drowning—tide gauge data in Long Island Sound don't show that yet, said Professor Shimon Anisfeld, a research scientist at Yale University.

Instead, said Anisfeld, excess nutrients such as nitrogen or phosphorous may be at the root of the Sound's problems. In 2004–2006, the Study is funding Anisfeld to examine the possible role of nutrients in contributing to marsh drowning.

Typically, sea level rises moderately in the Sound, and salt marshes are able to keep up with the rise by accumulating material,

Anisfeld, left and top, collects a sediment core at Sherwood Island in a patch of *Spartina alterniflora* surrounded by mudflat.

both from below-ground production of organic matter such as roots and rhizomes, and from trapping material at the surface. In the past 20 years, however, some marshes have not kept pace, and as a result the ground becomes too wet to support vegetation. Anisfeld's research will focus on whether high levels of nitrogen, while increasing above-ground plant production, might actually decrease the growth of below-ground material, such as roots. Anisfeld also will test a theory that as nutrients increase in the marsh peat, bacteria will also increase and will consume more organic matter.

Anisfeld is examining these questions at three Connecticut marshes: a degraded marsh at Sherwood Island State Park in Westport; a stable marsh at Hoadley Creek in Guilford; and a restored marsh at Jarvis Creek in Branford. He and his graduate students will assess factors related to the conditions of these sites, including levels of nutrients. At Hoadley Creek, Anisfeld will test whether experimentally adding nutrients will lead to the initial symptoms of marsh drowning.

PROJECT// THE ROLE OF NUTRIENT ENRICHMENT IN TIDAL MARSH LOSS

A water level recorder, right, collects hydrologic data.

"We want to be able to provide a clear, scientifically supportable statement to managers," said Anisfeld. "Either that nutrient loading is a likely contributing factor to marsh loss, or that it is unlikely to play a significant role."

The East River with the New York City skyline in the background.

East River Role Examined

Richard Fairbanks has traveled the world's oceans making important contributions to ocean science. Fairbanks, who in 2001 won the prestigious Maurice Ewing Medal, presented jointly by the United States Navy and the American Geophysical Union, also cares deeply about his native Long Island Sound.

In a 2004 report, the Columbia University professor summarized the results of his research funded by the Long Island Sound Study where he used isotope tracers to map the flow of nitrogen from the East River to western Long Island Sound. He confirmed that sewage treatment plants in the East River are the dominant source of the nitrogen fueling algal blooms that deprive the western Sound of oxygen. But he also identified four deep basins in the western Sound that act as "hypoxia incubators"—areas of low dissolved oxygen that spread vertically up the water column and mix laterally in the summer. Based on his research, Fairbanks recommends targeting hypoxia abatement strategies at these basins, including exploring the possibility of capping them.

Fairbanks' research on the understanding of the role of oceans in global climate change has taken him from the Arctic to the Antarctic. Locally, he would like residents to pay closer attention to the Sound's ecology. "The effects of pollution in the western Sound are insidious and require mitigation now," said Fairbanks, who lives in Connecticut near the shoreline.

>> GRANTS AWARDED IN 2004

• A Biological-Physical Numerical Simulation Model for the Investigation, Prediction and Management of Oxygen Production and Consumption in Long Island Sound: Data analysis and model formulation
INVESTIGATORS Dr. Nicole Goebel and Dr. James Kremer, University of Connecticut (UConn), Dr. Chris Edwards, University of California at Santa Cruz
OBJECTIVE Develop a simple and accurate ecosystem model of oxygen dynamics in Long Island Sound. This model will help improve our understanding of the processes that contribute to hypoxia in Long Island Sound and will be useful for evaluating management strategies.

• Natural Isotopic Tracers for Anthropogenic Nitrogen in Long Island Sound
INVESTIGATORS Dr. Mark Altabet, University of Massachusetts
Dr. Johan Varekamp, Wesleyan University
OBJECTIVE Quantify the impact of anthropogenic nitrogen loading to Long Island Sound with respect to natural sources. These results will help improve our understanding of the relationship between anthropogenic nitrogen loading and eutrophication.

• Food Webs in Long Island Sound: Review, Synthesis and Potential Applications
INVESTIGATORS Dr. Roman Zajac, University of New Haven
Mr. Dave Simpson, CT Dept. of Environmental Protection
OBJECTIVE Develop conceptual and quantitative food web models for different habitats in Long Island Sound. These models can be used to develop simulations and analyses to evaluate the impacts of management decisions on food webs and ecosystem dynamics in Long Island Sound.

• Application of Remote Sensing Technologies for the Delineation and Assessment of Coastal Marshes and their Constituent Species
INVESTIGATORS Dr. Daniel Civco, UConn
Dr. Martha Gilmore, Wesleyan University
OBJECTIVE Identify and delineate coastal marshes around Long Island Sound and distinguish various types of marsh vegetation using remote sensing satellite imagery coupled with in situ radiometry and other field data collection. This research will provide baseline information for managing coastal marshes and monitoring changes.

• Understanding the Role of Nutrient Enrichment in Tidal Marsh Loss in Long Island Sound
INVESTIGATOR Dr. Shimon Anisfeld, Yale University
OBJECTIVE Test the hypothesis that excessive loading of nutrients (nitrogen or phosphorus) plays a role in causing tidal marsh loss. The results of this research will help ascertain if nutrient loading is a factor in tidal marsh loss and, if so, identify which nutrient is likely responsible.

• Temporal and Spatial Changes in Copper Speciation and Toxic Metal Concentrations in Long Island Sound: Effect of changes in water temperature and dissolved oxygen levels
INVESTIGATOR Dr. Sergio Sañudo-Wilhelmy, Stony Brook University
OBJECTIVE Establish the chemical form and distribution of dissolved and particulate toxic metals in the water column in Long Island Sound. Dissolved metals undergo many changes in the estuarine environment, and this research will provide valuable information regarding the temporal and spatial variations in the chemical speciation of dissolved copper in the Sound.

• Assessment of the Effects of Bottom Water Temperature and Chemical Conditions, Sediment Temperature, and Sedimentary Organic Matter (Type and Amount) on Release of Sulfide and Ammonia from Sediments in Long Island Sound: A laboratory study
INVESTIGATORS Dr. Carmela Cuomo, University of New Haven
Dr. Paul Bartholomew, Superb Technical
OBJECTIVE Collect data on the release of sulfide and ammonia from sediments exposed to an array of environmental conditions. These data will aid in the understanding of the development and abatement of seasonal hypoxic conditions in the western Sound and the role that sediment organic matter and sediment oxygen demand play in such events.

>> GRANTS AWARDED IN 2002

• New Approaches for Assessing Mutagenic Risk of Contaminants in the Long Island Sound Environment
INVESTIGATORS Dr. Anne McElroy, Stony Brook University
Dr. Lynn Mendelman and Dr. Richard Setlow, Brookhaven National Laboratory
OBJECTIVE Evaluate the potential capacity of contaminants in the sediments of Long Island Sound to cause mutations in vertebrates and determine the types of mutations induced and the classes of contaminants responsible for these mutations. This information will be valuable for coastal managers involved in source reduction issues and concerned with the Sound's living marine resources.

• **Phytoplankton Dynamics in Long Island Sound: Influence of environmental factors on naturally occurring assemblages**
INVESTIGATORS: Dr. J. Evan Ward, UConn
Dr. Kevin Strychar, Dalhousie University
Dr. Gary Wikfors, National Marine Fisheries Service
OBJECTIVE Determine how phytoplankton dynamics differ in Long Island Sound along an eutrophication gradient (from east to west) and with the seasons. The researchers are also examining which environmental factors (i.e., nutrients, hypoxia or temperature) are the best predictors of phytoplankton assemblages.

• **Saltmarsh-breeding Sparrows in Long Island Sound: Status and productivity of globally important populations**
INVESTIGATORS Dr. Chris Elphick and Dr. Margaret Rubega, UConn
Mr. Patrick Comins, National Audubon Society
OBJECTIVE Compare a variety of methods for estimating saltmarsh sparrow abundance along the central Connecticut coast and identify the simplest, most cost-effective method for providing accurate population estimates. Saltmarsh sparrows are high priority species for bird conservation in New England.

• **Water Column Oxygen Production and Consumption in Long Island Sound: Measurements and coupled bio-physical modeling**
INVESTIGATORS Dr. James Kremer and Dr. Nicole Goebel, UConn
Dr. Chris Edwards, University of California at Santa Cruz
OBJECTIVE Measure water column oxygen production and consumption rates for Long Island Sound and develop a coupled bio-physical simulation model of the Sound. The researchers also developed a new model with which the relevant biological and physical processes that lead to eutrophication and hypoxia in the Sound can be analyzed. The results of this work will help inform planning and management decisions regarding hypoxia in the Sound.

• **Western Long Island Sound Hypoxia: Isotope tracers of the East River nitrate pump**
INVESTIGATOR Dr. Richard Fairbanks, Columbia University
OBJECTIVE Assess the contribution of discharge from the East River to hypoxia in western Long Island Sound using isotope tracers of East River water and organic particulate matter. Isotope data show that the eastward spread of low oxygen waters is due to tidal and current mixing with the extremely low oxygen waters pooling in four deep basins. Based on these findings, the researcher recommends managers target hypoxia abatement strategies at these four restricted basins in order to address the immediate source of the problem.

>> GRANTS AWARDED IN 2000

• **Trace Metals, Organic Carbon and Inorganic Nutrients in Surface Water of Long Island Sound: Sources, cycling and effects on phytoplankton growth**
INVESTIGATORS Dr. Sergio Sañudo-Wilhelmy, Stony Brook University
Dr. Christopher Gobler, Southampton College
OBJECTIVE Establish the concentration and distribution of dissolved metals and inorganic nutrients in the surface waters of Long Island Sound and to examine the relative importance of various sources (i.e., riverine inputs, sewage) of these nutrients and metals. Preliminary results indicated that the East River is the most dominant external source of trace metals during low flow conditions, but the Connecticut River is the most important external force during high flow conditions.

• **Environmental Change in Long Island Sound over the Last 400 Years**
INVESTIGATOR Dr. Johan Varekamp, Dr. Ellen Thomas, and Dr. Kristina Beuning, Wesleyan University
OBJECTIVE Document the environmental transition in Long Island Sound from pre-colonial times to the present day using sediment cores. This research provides information on the health of the Long Island Sound ecosystem, as well as the history of anthropogenically-induced changes in this ecosystem.

• **Assessment of the Causes and Extent of Morbidity and Mortality of American Lobsters (Homarus americanus) in Long Island Sound**
INVESTIGATORS: Dr. Richard French, Dr. Sylvain DeGuise, Dr. Salvatore Frasca, Jr., Dr. Christopher Perkins and Mr. Spencer Russell, UConn, Mr. Ernie Beckwith, CT DEP, Mr. Byron Young, NYS Dept. of Environmental Conservation
OBJECTIVE Analyze lobsters from Long Island Sound to identify pathology, possible disease-causing micro-organisms, and contaminant levels as a means of assessing the general health status of the Sound's lobster populations. The results of this research indicated that the health of the Sound's lobsters is impacted by at least two significant diseases (paramoebiasis and chitinolytic shell disease) and that these diseases could be exacerbated by environmental stressors, such as climatic and habitat conditions and contaminants.

OUTREACH

Outreach

Goal **Promote watershed and environmental stewardship**
Progress **Supported and managed projects that have increased public awareness.**

PROJECT// HARBOR DAY

Citizens who understand, appreciate, and enjoy the Sound help make important contributions to the Sound's cleanup. People who understand the issues will more likely be good environmental stewards in their homes, communities, and places of work. They also are more likely to support projects to restore the Sound.

Since its inception in 1985, the Study has always promoted citizen education and encouraged involvement. The Citizens Advisory Committee, for example, which consists of representatives from 40 non-profit, government, and industry groups, meets several times a year to provide guidance to the Long Island Sound Study.

The Study also tries to fulfill the public's interest in learning about the Sound with publications available both in print and on its Web site. In 2003 and 2004, newsletters and the Sound Health report (see p. 21) reached thousands of households. The Web site, which was relaunched in September 2003, receives an average of 5,000 visits a month. The "feedback" link has become a popular feature for Web visitors to ask questions about the Study, voice concerns about the Sound, and to request publication materials.

The Study also funds two public outreach coordinators in New York and Connecticut who promote citizen involvement in a number of ways. They respond to requests for information, give presentations to community groups and schools, and staff displays at events.

As part of education outreach, the Study also provided funds in 2003 and 2004 to Connecticut Sea Grant to help launch the Long Island Sound Mentor Teachers Program, in which science teachers skilled in teaching about the Long Island Sound ecology share their knowledge with other teachers.

In 2003 and 2004, the Long Island Sound Study Small Grant Program and other grant programs continued to serve as financial catalysts to help groups develop local community projects to educate citizens about the Sound and involve them in programs to restore it.

>> HIGHLIGHTS | 2003—2004

SINCE 1995, the Long Island Sound Study has reached out to community groups in New York and Connecticut through the Long Island Sound Study Small Grants Program. The Study provides grants of up to $5,000 for organizations to educate residents about how to protect the estuary. In 10 years, more than 100 grants have been awarded totaling more than $475,000.

Projects funded in 2003 and 2004 included:

• **Restoring the Environment Through Family Traditions** The Sansport/Shoshanna Hadassah in Port Washington, Long Island created a curriculum to educate families that live along the Sound to preserve and protect the ecosystem while learning about Jewish values toward ecology. The event coincided with Tu B'Shvat, the Jewish Holiday of Trees.

• **Seal Census Study** With the help of volunteers, the Maritime Aquarium of Norwalk monitored an increasing number of seals at Smith Reef in Stamford. Together with SoundWaters, a nonprofit educational organization, the Aquarium recruited, trained, and deployed a team of volunteer

PROJECT//SEAL CENSUS STUDY

research assistants to collect data.

• **Joint Village Harbor Day** Communities who want to inspire their residents to protect local harbors and bays can receive grants from the Study to sponsor waterfront festivals, including the 2003 Joint Village Harbor Day around Stony Brook Harbor. This annual event includes a non-motorized boat parade and a touch tank exhibit.

The Connecticut Department of Environmental Protection (CT DEP) also awards public outreach grants through its Long Island Sound Fund License Plate Program. Since 1993 the fund has raised more than $4 million through the sale of "Preserve the Sound" license plates. Projects funded in 2003 and 2004 included:

• **Scouting Out the Sound** New Canaan Nature Center received a grant to create a new Girl Scout and Brownie badge program focusing on the Sound.

• **Connecticut River Video** The Connecticut River Museum in Essex received a grant to create a video on the Connecticut River and its connection to the Sound.

Through the License Plate Program, CT DEP also provides free storm drain markers with an educational message to prevent polluting the Sound.

Students reading *Sound Health* in Donna Edgar's marine biology class.

Sound Health Details Trends

In fall 2003 the Study distributed more than 475,000 copies of *Sound Health 2003*, a report describing ecological trends in the Sound and on shore. The biennial report, which appeared as an insert in Sunday newspapers, provided the Sound's residents with an opportunity to learn about the status and trends in water quality, habitat conditions, and abundance of fish and bird populations. It also explored some of the research conducted in the Sound through articles and photographs.

At the request of teachers and principals, the Study also distributed thousands of copies of *Sound Health* to schools to be used as study guides in classrooms throughout the watershed.

"We have found *Sound Health* to be very helpful in depicting both the problems and the unique possibilities of Long Island Sound," said Donna Edgar, who distributed 30 copies to her Marine/AP Biology class at Bayport-Blue Point High School on Long Island. "It gives my students a nice perspective of our North Shore treasure."

Budget

Section 119 of the federal Clean Water Act authorizes Congress to provide up to $40 million a year to the Long Island Sound Study to implement the Comprehensive Conservation and Management Plan (CCMP).

Each year, the Long Island Sound Study develops a work plan to implement projects based on appropriations approved by Congress. This page lists these appropriations for the fiscal years 2002-2004. Long Island Sound Study partners who receive grants under these appropriations must meet matching fund requirements—50 percent for implementation projects and five percent for education and outreach projects. Not shown in the budget below are the additional funds provided by New York, Connecticut, and other partners for projects to implement the CCMP.

Electronic versions of annual CCMP Implementation Tracking Reports, which provide a comprehensive list of projects undertaken by the Long Island Sound Study and its partners, are available at www.longislandsoundstudy.net under implementation.

LONG ISLAND SOUND STUDY BUDGET	FY 03 (Oct 02—Sept. 03)	FY 04 (Oct 03—Sept 04)	FY 05 (Oct 04—Sept. 05)
Coordination/Reporting	$475,631	$486,194	$188,171
Public Information/Education	$652,864	$326,843	$411,586
Monitoring, Modeling & Research	$1,451,781	$1,545,646	$1,219,575
Technical Assistance *	$379,724	$510,634	$418,988
Habitats and Water Quality Improvements	$4,000,000	$3,576,600	$5,470,500
Other/Miscellaneous	$50,000	$121,118	$55,064
TOTAL	**$7,010,000**	**$6,567,035**	**$7,763,884**

* includes habitat restoration and watershed management planning, and Stewardship Initiative

LISS Biennial Report 2003–2004
Project Manager/Writer Robert Burg, NEIWPCC/LISS
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