PROTECTION & PROGRESS

2009–2010 | LONG ISLAND SOUND STUDY | BIENNIAL REPORT

RECONNECTING A CITY TO ITS RIVER

Restoring and protecting a river brings many benefits to communities, including experiencing the joy of seeing river herring return to areas where dams had previously prevented fish passage for more than 300 years. On April 20, 2010, the Connecticut Department of Energy and Environmental Protection released 400 alewives into the Mill River in Stamford, close to where two large, dilapidated dams were removed in 2009. A variety of partners, including the city's Mill River Collaborative, are improving water quality, planting native plants along the banks, and building pathways and parks to reunite Stamford's downtown community to the river and Long Island Sound. Learn more about LISS's involvement on page 9.

2009–2010 LISS BIENNIAL REPORT

For more Information on LISS, please visit: *www.longislandsoundstudy.net*

STUDENTS FROM the Cloonan Middle School watch CT DEEP staff release alewives into the Mill River to spawn before returning to the Sound.

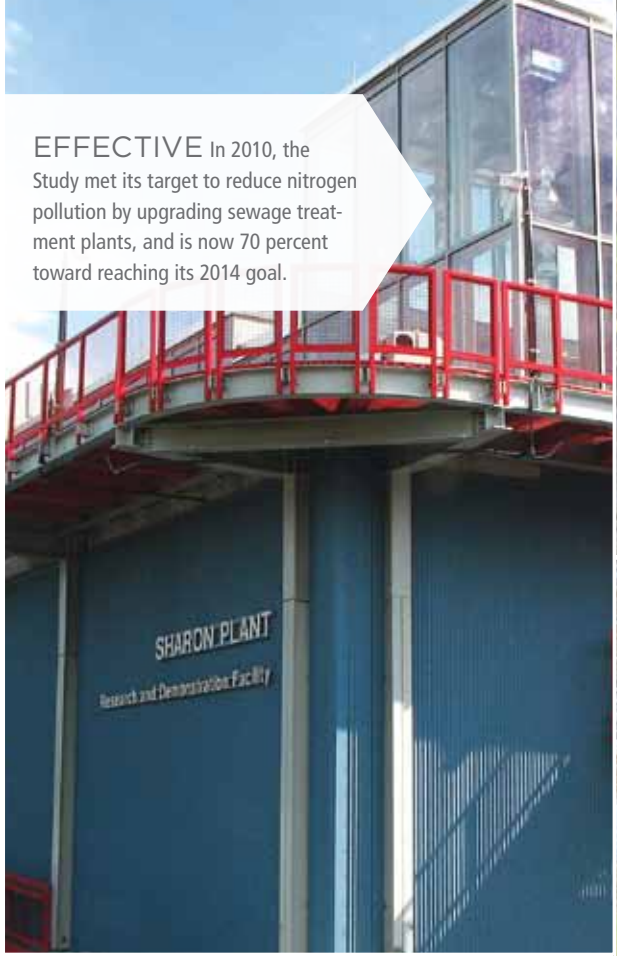
ACRONYMS AND SHORTENED NAMES:

CCMP: Comprehensive Conservation and Management Plan
CT DEEP: Connecticut Department of Energy and Environmental Protection
EPA: U.S. Environmental Protection Agency
FWS: U.S. Fish and Wildlife Service
LISFF: Long Island Sound Futures Fund
LISS: Long Island Sound Study
NFWF: National Fish and Wildlife Foundation
NOAA: U.S. National Oceanic and Atmospheric Administration
NYSDEC: New York State Department of Environmental Conservation
SBU: Stony Brook University
STP: Sewage Treatment Plant
SOUND FUTURES FUND: Long Island Sound Futures Fund
THE STUDY: Long Island Sound Study
UCONN: University of Connecticut

Unsure about a term used in this report? See *www.LIShealth.net* for a definition.

LISS PRINCIPLES

The Long Island Sound Study (LISS), sponsored by the U.S. Environmental Protection Agency (EPA) and the states of Connecticut and New York, is a partnership of federal, state, and local agencies, universities, businesses, and environmental and community groups. Its mission is to restore and protect Long Island Sound, an ecologically vital coastal body of water where fresh water draining from the Sound's large watershed mixes with salt water from the ocean. Its principles are to be **adaptable**, **collaborative**, **effective**, and **efficient** in the implementation of a Comprehensive Conservation and Management Plan that will lead to improved water quality, restored habitats to protect marine life and shore birds, and increased opportunities for human use.



EFFECTIVE In 2010, the Study met its target to reduce nitrogen pollution by upgrading sewage treatment plants, and is now 70 percent toward reaching its 2014 goal.

ADAPTABLE Pilot projects to plant eelgrass and culture shellfish and seaweeds are helping resource managers evaluate how the Sound's natural resources can improve water quality.

EFFICIENT From 2006-2010, for every dollar spent by the Study to implement the Sound's Comprehensive Conservation and Management Plan, an additional $67.11 was spent by federal, state, local or private partners.

COLLABORATIVE Federal and state agencies partner with local communities, environmental groups, and universities to restore habitats, improve water quality, monitor environmental conditions, and develop a greater understanding of emerging threats to the Sound.

CLOCKWISE FROM TOP: The SHARON demonstration project at Wards Island Sewage Treatment Plant, NYC; ribbed mussels are being adapted for use in a water quality project in the Bronx River; 2009 Sound Futures Fund Award recipients at Harkness Memorial State Park, Waterford, CT; and volunteers restoring a dune at Rocky Neck State Park, East Lyme, CT.

LISS is a member of both the EPA's National Estuary Program and the Council of Large Aquatic Ecosystems. Visit *water.epa.gov/type/oceb/* for information.

DIRECTOR'S REMARKS

In a 1971 article, Newsday posed the question, "Who's killing Hempstead Harbor?" Victim to industrial chemical and municipal sewage discharges, Hempstead Harbor, an embayment in western Long Island Sound, fell into decline. Contrast that story with a recent Newsday editorial lauding the June 1, 2011 reopening of 2,500 acres of shellfish beds in outer Hempstead Harbor. For the first time in 40 years licensed fishermen were busy harvesting clams from the harbor. This overnight sensation can be traced back decades to the work of multiple partners: EPA for cleaning up Superfund sites, New York State for upgrading wastewater treatment, local towns for organizing a protection committee to oversee storm water improvements, and local citizens for monitoring the harbor's water quality.

Think 40 years is a long time? In 2010, alewives, a type of herring, were reintroduced to the Mill River in Stamford, Connecticut for the first time in hundreds of years. Dams and degraded water quality had long prevented alewives from swimming up the Mill River. But through work by the City of Stamford, the nonprofit Mill River Collaborative, the U.S. Army Corps of Engineers, and the Connecticut Department of Environmental Protection, alewives are again swimming upstream to spawn, with the hope of establishing a new and permanent run of herring in the river.

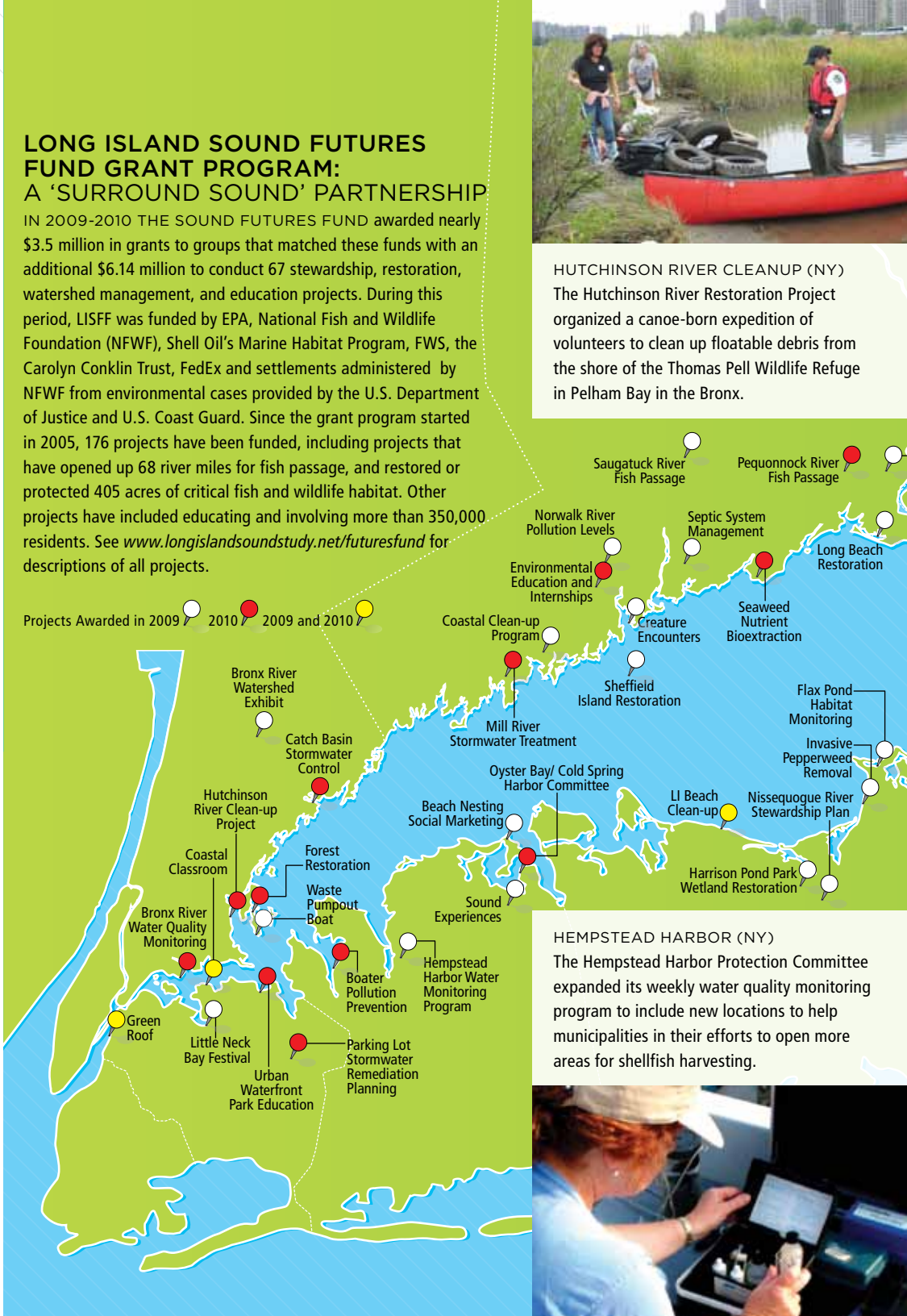
In another sign that persistence pays off, the total load of nitrogen to the Sound from wastewater treatment plants steeply declined in 2010. Connecticut, continuing its highly successful and innovative upgrade program, is *ahead* of schedule, even meeting the 2014 target during portions of the year. And New York took a big step forward with the complex engineering projects to upgrade the large New York City wastewater treatment plants. One of the projects, using a new technology to remove nitrogen from sewage, received an Engineering Excellence Award from the American Council of Engineering Companies.

Yes, we are in an era of deep skepticism over the potential to collectively solve problems. But these examples and others highlighted in this report demonstrate that the demise of working together to accomplish big things has been greatly exaggerated.

MARK TEDESCO
Director,
U.S. EPA Long Island Sound Office

LONG ISLAND SOUND FUTURES FUND GRANT PROGRAM: A 'SURROUND SOUND' PARTNERSHIP

IN 2009-2010 THE SOUND FUTURES FUND awarded nearly $3.5 million in grants to groups that matched these funds with an additional $6.14 million to conduct 67 stewardship, restoration, watershed management, and education projects. During this period, LISFF was funded by EPA, National Fish and Wildlife Foundation (NFWF), Shell Oil's Marine Habitat Program, FWS, the Carolyn Conklin Trust, FedEx and settlements administered by NFWF from environmental cases provided by the U.S. Department of Justice and U.S. Coast Guard. Since the grant program started in 2005, 176 projects have been funded, including projects that have opened up 68 river miles for fish passage, and restored or protected 405 acres of critical fish and wildlife habitat. Other projects have included educating and involving more than 350,000 residents. See *www.longislandsoundstudy.net/futuresfund* for descriptions of all projects.



HUTCHINSON RIVER CLEANUP (NY)
The Hutchinson River Restoration Project organized a canoe-born expedition of volunteers to clean up floatable debris from the shore of the Thomas Pell Wildlife Refuge in Pelham Bay in the Bronx.

HEMPSTEAD HARBOR (NY)
The Hempstead Harbor Protection Committee expanded its weekly water quality monitoring program to include new locations to help municipalities in their efforts to open more areas for shellfish harvesting.

OUTER ISLAND EDUCATION CENTER (CT)

The Friends of Outer Island is building a revitalized educational centre on Outer Island, including a marine lab, learning stations, and a classroom pavilion, to provide hands-on learning and research opportunities about Long Island Sound.

NEIGHBORHOOD STEWARD TEAMS (CT)

Solar Youth delivered an after-school program that engaged New Haven youth to investigate the local ecology of their community and Long Island Sound, and identify environmental issues that affect the health of people and the natural environment.

SOUND EXPERIENCES (NY)

Cornell Cooperative Extension provided educational experiences to more than 500 underserved students through land and shipboard-based activities about Long Island Sound's marine ecosystem.

BEACH NESTING (NY)

Audubon New York worked with property owners and local groups to increase protection and reduce threats to piping plovers on eastern Long Island beaches.

ORGANIC LANDSCAPING (CT)

CT Northeast Organic Farmers Association ran workshops and created a Web site to help homeowners move from chemical to organic landscaping in order to reduce pesticide and fertilizer use.

WATER QUALITY

LISS's partners in 2009-2010 made significant strides toward fulfilling a long-term goal of improving water quality by reducing nitrogen, a pollutant that contributes to hypoxia (low oxygen dead zones), harmful algal blooms, loss of underwater vegetation, fish kills, and changes in the Sound's food web.

Nitrogen is a vital nutrient to stimulate plant growth, but in excess, nitrogen in coastal waters can lead to problems, including hypoxia. In the summer months as much as 200 square miles of the Sound's 1,300 square miles of bottom waters might experience hypoxia.

In the 1990s, the Study determined that the largest single source of nitrogen—42 percent or 211,724 pounds per day—came from the treated human waste discharged from sewage treatment plants (STPs) operated by municipalities in Connecticut and New York. In 2000, the states and EPA developed a Total Maximum Daily Load (TMDL) plan to reduce nitrogen loads by 58.5 percent at STPs through plant upgrades. The communities with STPs must reach their targets by 2014 with the exception of plants in New York City and Westchester, which received extensions to 2017.

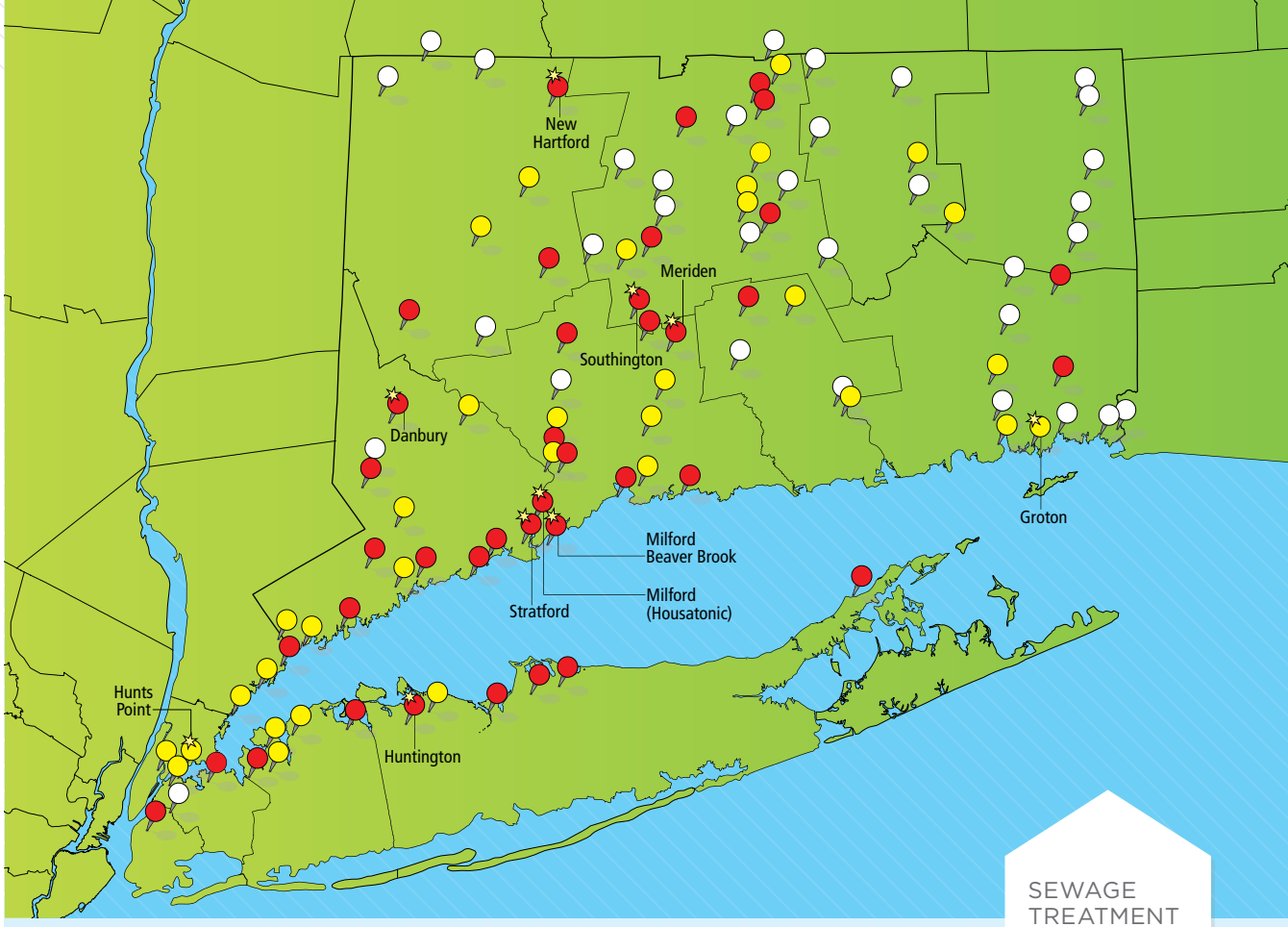
In 2010, LISS's partners reduced nitrogen discharges by 8,385 pounds per day (or 5,308 equalized pounds) from the previous year, the largest year to year decrease since the TMDL program began (see Highlights, Data).

In addition to upgrading STPs, the Study is looking at reducing nutrient runoff (see p. 8) and biologically extracting nutrients from the Sound (see p. 7). LISS is also working with New Hampshire, Vermont, and Massachusetts to address nitrogen discharges from the upper reaches of the Connecticut River, the Sound's largest source of fresh water.

GOAL
Improve water quality by reducing nitrogen pollution

PROGRESS
Cut nitrogen by 43% since early 1990s

CHALLENGE
Maintain adequate funding for plant upgrades



HIGHLIGHTS 2009—2010

- TEN PLANTS, 8 in CT and 2 in NY completed final or phased upgrades in 2009 and 2010 at a cost of $339.83 million. These upgrades resulted in a reduction of 4,936 equalized pounds per day from early 1990s baseline levels. The upgrades used a process called biological nutrient removal (BNR), in which bacteria is used to break down the reactive nitrogen found in human waste in a series of steps before the clean effluent is discharged into the water. About 60% of the reduction was the result of an interim project completed at the Hunts Point plant in the Bronx.

- IN 2010, THE WARDS ISLAND plant in New York City reduced 3,006 equalized pounds per day from baseline years as part of a demonstration project that involved the use of methanol. The innovative method, available for large plants, is called the SHARON (Single Reactor System for High Ammonia Removal Over Nitrate) process.

- IN 2009, THE STAMFORD Water Pollution Control Authority received $900,000 for selling credits to a Nitrogen Credit Exchange as part of CT's innovative Nitrogen Trading Program. Communities that complete their projects, and exceed their targets, can sell credits to the exchange, which are purchased by communities that have not yet completed projects. By 2010, Stamford exceeded its 2014 target by 400 equalized pounds per day.

SEWAGE TREATMENT PLANT CONTROL STATUS

STPs without Biological Nutrient Removal (BNR) upgrades

STPs with interim BNR

STPs with BNR completed

FOOTNOTES:
Pins with a * indicate that an upgrade (interim or final) was completed in 2009 or 2010

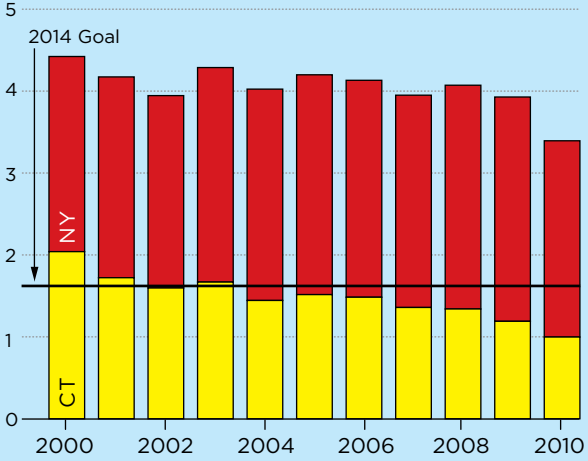
THE DATA

REDUCING NITROGEN

IN 2010, NITROGEN DISCHARGES decreased by 5,308 trade equalized pounds per day from the previous year, the largest year to year decrease since nitrogen reduction efforts began in the early 1990s. This is largely due to the partial completion of upgrades to reduce nitrogen at large NYC STPs. Since 2000, the first year of the Total Maximum Daily Load for nitrogen, 10,219 trade equalized pounds of nitrogen have been reduced. Since the early 1990s, when baseline discharges were calculated at 59,147 pounds per day, a total of 25,444 equalized pounds per day have been reduced. The ultimate goal is to reduce point source nitrogen inputs to Long Island Sound by another 11,000 pounds. In 2010, the states reached 70% of the final reduction target compared to 52% in 2009. A decrease in point source nitrogen loads reflects progress by the states of CT and NY in upgrading wastewater treatment facilities.

Trade equalization is a geographical calculation of the effect a pound of nitrogen leaving a treatment plant source will eventually have when it reaches western Long Island Sound where the problem of hypoxia is the greatest.

LIS POINT SOURCE NITROGEN TRADE-EQUALIZED LOADS
(Thousands TE pounds per day)



PROJECT SPOTLIGHT

INNOVATIVE WAYS TO IMPROVE WATER QUALITY

TRADITIONAL METHODS to reduce nutrients in the Sound include upgrading sewage treatment plants to eliminate reactive nitrogen in sewage and reducing stormwater runoff that carries nutrients from fertilizer and animal waste into storm drains and tributaries. These methods reduce the amount of nutrients entering the Sound from the land. An additional method that is being explored by managers is called "nutrient bioextraction," in which nutrients are removed from within the Sound by the cultivation and harvest of organisms such as shellfish and seaweed. As these organisms grow, they take up nutrients from the surrounding waters, and, when harvested, the nutrients they contain are directly removed.

A workshop in Stamford, organized by LISS, was held in 2009 to learn about nutrient bioextraction technologies being used around the world and to discuss the opportunities and challenges of implementing these practices in the Sound. One of the major recommendations from the workshop was the need for a Sound-based pilot study, to get local information and assess the potential effects of nutrient bioextraction on the environment.

A multi-institutional partnership has formed over the last year to conduct this pilot study in a highly-urban environment. The location for the pilot study is in the farthest western reaches of the Sound, at the confluence of the Bronx and East rivers in New York City. The Bronx River pilot study site is currently impacted by a variety of human-derived stressors common to urban waters. The nearby Hunts Point STP releases 200-400 million gallons of treated effluent per day, combined sewer overflows are a recurring problem, and the large amount of impervious surfaces in the area exacerbates ongoing problems with polluted stormwater. The original habitat along the Bronx River was predominantly salt marshes inhabited by dense populations of ribbed mussels (*Geukensia demissa*). These salt marshes became degraded (and in many cases eliminated) as the city expanded along the rivers. With the loss of habitat, the capacity of the local shellfish to filter microorganisms fertilized by high nutrient levels from the ecosystem was also lost.

The Bronx River Watershed Initiative is funding the installation of a raft of ribbed mussels to evaluate the potential for shellfish aquaculture to increase biological filtration activity in this environment. The raft will be installed and maintained by Pemaquid Mussel Farms, a commercial mussel-aquaculture firm from the state of Maine, and Rocking the Boat, a local youth development organization. NOAA's Milford Laboratory will be monitoring the raft to measure impacts of the mussels on local water quality. The Sound Futures Fund has funded researchers at UConn to install and monitor seaweed grown on longlines alongside the mussel raft. Finally, EPA's Office of Research and Development has provided funding to model the potential impacts of shellfish aquaculture on Long Island Sound using data from the pilot study, and to provide an economic assessment of shellfish nutrient bioextraction. The modeling and economic assessment team is being led by NOAA's Center for Coastal Monitoring and Assessment. The pilot study is scheduled to begin in 2011 and continue for two years.

AN EXAMPLE OF A MUSSEL SOCK hanging from a raft (top). Ribbed mussels found along the shore of the NOAA Milford laboratory (below).

WATERSHED MANAGEMENT

In 2003, LISS's Policy Committee, consisting of the commissioners of New York and Connecticut, and EPA's regional administrators, agreed that there was a need to increase efforts to reduce pollution on land that could get washed into storm drains and streams, and ultimately Long Island Sound. The 2003 Long Island Sound Agreement set a goal to develop or implement watershed protection strategies in 50 percent of the Sound's watershed in New York and Connecticut by 2010. These strategies could include reducing impervious surfaces—where pollutants such as motor oil, trash, and pet waste collect before getting washed into storm drains—and restoring and protecting vegetation along streams and lakes, which helps to filter pollutants before they can enter the water.

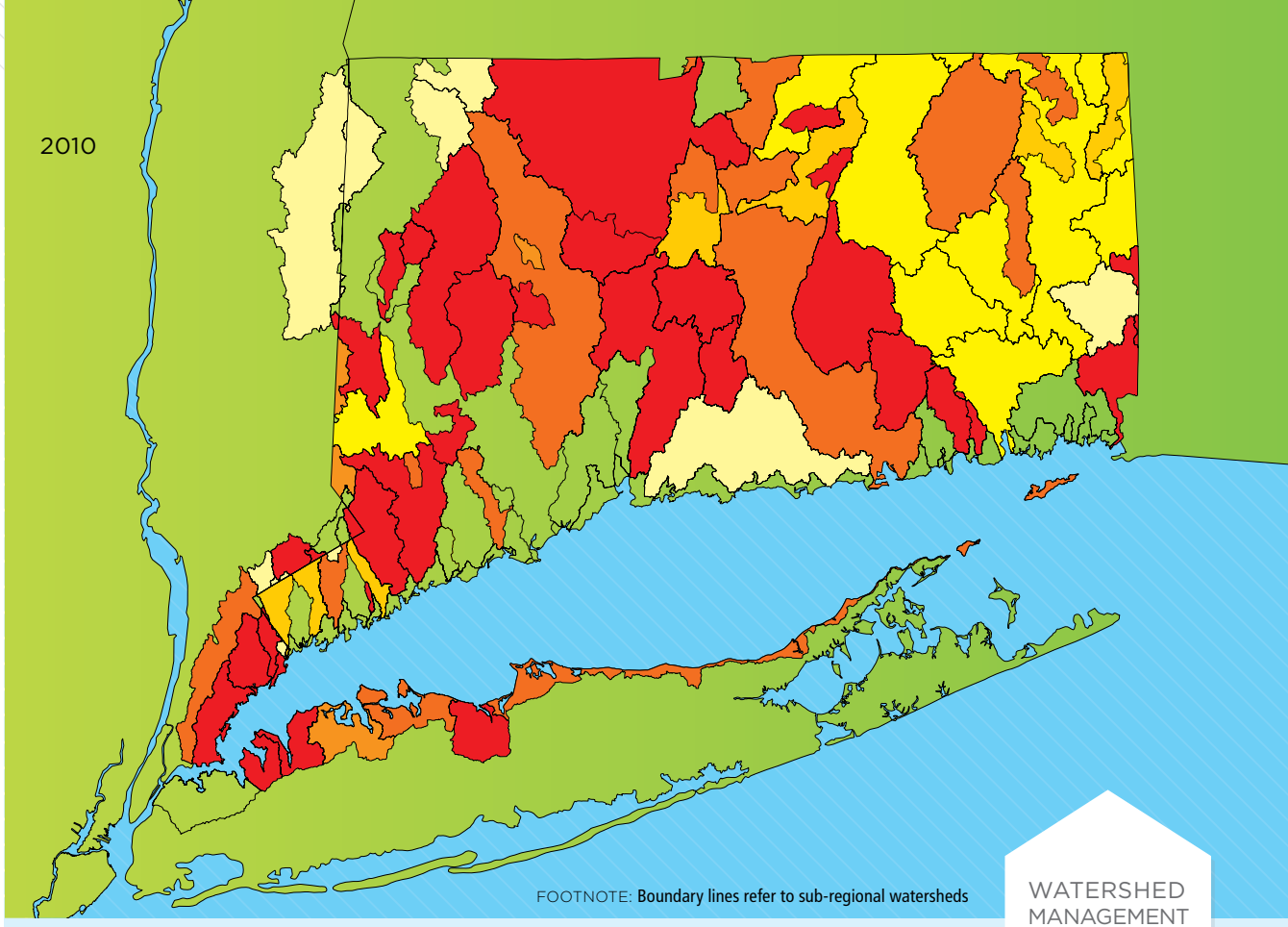
A watershed is the area of land that contributes runoff to a common body of water. The Sound is the common body of water for an area that covers more than 17,000 square miles in six states. Within the large watershed are hundreds of small local watersheds that drain into streams, lakes, and rivers, which ultimately connect to the Sound. Environmental groups and local governments, often working across municipal boundaries, organize local watershed associations and councils to develop and implement management plans.

LISS, through the Sound Futures Fund, provides grants to help municipalities and environmental groups develop and implement watershed plans. NYSDEC and CT DEEP, the New York and Connecticut Sea Grant programs, and the state affiliates of the Nonpoint Education for Municipal Officials program, or NEMO, also provides guidance.

GOAL
Reduce polluted runoff and non-point source pollution

PROGRESS
Supported more than 20 watershed projects in 2009-2010

CHALLENGE
Fostering development in a sustainable manner



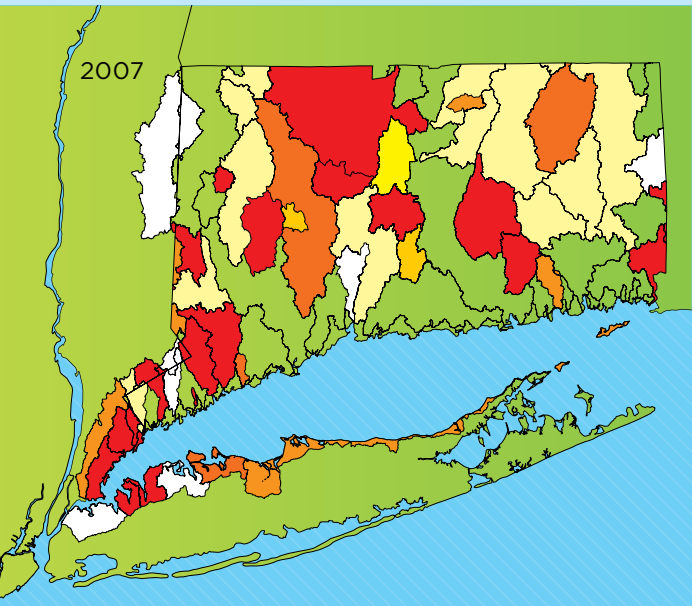
HIGHLIGHTS 2009—2010

- A $48,243 LISFF grant was awarded to the town of Smithtown in 2010 for a project to remove a dam and restore wetlands. The grant helped achieve one of the recommendations of the Nissequoque River Stewardship Action Watershed Management Plan, an effort that also has received LISFF grants.
- A $39,602 LISFF grant was used by CT Sea Grant in 2009 to promote the use of riparian buffers (natural vegetation along stream banks) in the Niantic River watershed.
- A $63,000 LISFF grant was awarded to the Town of Mamaroneck (NY) in 2010 for a project that will retrofit 50 catch basins to remove or reduce 75% of sediments, suspended solids, oil and grease, trash, bacteria, nitrogen, and other pollutants from storm drains before these pollutants can enter the Sound.
- A $26,000 LISFF grant was awarded to the Friends of the Hockanum River Linear Park of Vernon (CT) in 2010 to draft low impact development regulations and create a stormwater design manual for the Tankerhoosen Watershed.
- A $60,000 LISFF grant to the Town of Oyster Bay (NY) in 2010 helped to create an Oyster Bay/Cold Spring Harbor Protection Committee to help protect and enhance the harbors and a 40 sq. mi. watershed consisting of 18 municipalities.

WATERSHED PLANS

MANAGEMENT PLANS ARE BEING DEVELOPED and implemented by watershed groups and municipalities across the Sound. By 2010, these groups were developing or implementing plans in more than half of the area of the Sound's watershed in NY and CT (about 2,800 square miles). An increase in developing and implementing watershed plans reflects progress in managing water pollution that originates on land.

Since a 2010 survey of watershed management activity, several sub-watersheds advertised kick-off meetings to launch a watershed management proposal, to improve their plan or strategies, or develop interest in creating a management organization. These watersheds include the Pequonnock River, Saugatuck River, Five Mile River, and the Mianus River in CT and the Nisseqogue River in NY. More information about watershed projects and plans in the Long Island Sound is available in the "watershed management" section of *www.longislandsoundstudy.net.*



MILL RIVER

MILL RIVER is the popular name for the lower reaches of the Rippowam River in Stamford where numerous mills historically generated power. In the 19th and early to mid-20th centuries, the mills would release their waste into the river. More recently, residents used the river as a dumping ground, until the Mill River Collaborative began engaging the community in restoring and protecting the river.

A major part of the restoration was the removal in 2009 of two dams and a concrete mill pond by the U.S. Army Corps of Engineers. That work has made it possible for the community to envision dramatically new possibilities for the development of a scenic, natural area in downtown Stamford, Connecticut's fourth largest city. One of these visions, the migration of fish, unimpeded by dams, swimming from the Sound to the upper reaches of the Rippowam River, was realized in 2010 with the release of 400 alewives by the CT DEEP in Scalzi Park, just north of the downtown area (a second release occurred in 2011). The city has also restored natural vegetation along the banks, worked with community groups to build an exciting children's playground, and is developing new areas for public access.

A key challenge in restoration will be improving water quality by controlling polluted runoff into the lower reaches of the river, the heart of downtown Stamford, where 89 percent of the land area is developed. The Collaborative is looking to solve this problem by constructing landscapes that will filter and cleanse stormwater that falls on the park and the adjoining road network.

The stormwater management system in the downtown area will include three major infiltration swales—grassy depressions that collect runoff—and large rain gardens—carefully designed landscapes that absorb water. It also will include a piped system that will capture excess stormwater and process it in a treatment unit before it enters the river. The overall system is designed to retain or treat the first inch of rain during a storm, when the most pollutants are washed off of roads and into storm drains, all of which lead to the river. It is for this design that the Sound Futures Fund in 2010 awarded a $500,000 grant to the Collaborative. The project is expected to begin in 2011, and will have the added benefit of reducing flooding onto the city's streets.

UNTIL 2009, the Mill River was the site of an aging dam and sea wall; now green infrastructure projects such as vegetative swales are being constructed along restored riverbanks to reduce polluted runoff from entering the river (top). Youth from BuildOn and the Student Conservation Association conduct macroinvertebrate surveys in the restored Mill River (right).

HABITAT RESTORATION

LISS established a Habitat Restoration Initiative in 1996 to restore and protect 12 priority Long Island Sound habitat types that have been degraded, or are under threat, from development and pollution. These habitat types include some of the most valuable natural resources on the Sound: tidal wetlands, submerged aquatic vegetation, intertidal flats, coastal barriers, beaches, and dunes, riverine migratory corridors (opening rivers for fish passage), coastal grasslands, rocky intertidal zones, coastal and island forests, molluscan (shellfish) reefs, estuarine embayments, submerged aquatic vegetation, cliffs and bluffs, and freshwater wetlands.

To achieve the goal of restoration—reestablishing ecological conditions before human disturbance to the fullest extent possible—the Initiative identified hundreds of sites to be restored, and established acreage and river mile restoration targets (see the Data, p 11). Descriptions of projects that have been restored can be viewed on a database in LISS's Web site.

To help municipalities and environmental groups restore the remaining sites, LISS-funded habitat restoration coordinators have been providing communities with technical assistance and advice on where and how to apply for grants. In part because of their efforts, the Sound Futures Fund is beginning to see an increase in habitat restoration proposals.

Recognizing that habitat restoration projects can be expensive, the Sound Futures Fund also increased the potential grant awards for these projects to $150,000 from $75,000 in 2007. In 2010, the ceiling was raised to $500,000. While four projects received more than $75,000 in 2010, the highest grant award was $150,000 to fund a project to restore 65 acres of woodlands in Pelham Bay Park in the Bronx.

GOAL
Restore shoreline habitats and river corridors

PROGRESS
Restored 1,045 acres and 160.4 miles of new river passage

CHALLENGE
Accomplishing more costly and compli-cated restorations

HIGHLIGHTS 2009—2010

- IN 2009-2010, the Sound Futures Fund awarded $1.1 million for 12 habitat restoration projects.
- IN 2009, the New York City Parks & Recreation Department completed a 23.5 acre project to remove invasive species and restore coastal woodlands at the headwaters of a creek in Alley Pond Park in Queens. LISFF provided a $150,000 grant in 2007 for the project, which is in a LISS Stewardship Area.
- A $100,000 LISFF grant was awarded to the Trust for Public Land in 2009 to help fund a project to remove 41 dilapidated cottages on Long Beach West in Stratford, CT to facilitate the restoration of dune and barrier beach habitat. The American Recovery and Reinvestment Act (ARRA) provided nearly $1 million for the restoration of the 18-acres site. Long Beach West is part of a LISS Stewardship Area.
- THE NUMBER OF ALEWIVES passing through a fish counter at Brides Brook in Rocky Neck State Park in CT increased from 74,839 in 2009 to 164,149 in 2010 following the completion of a project to replace an aging and collapsing culvert. The project, which included ARRA as a sponsor, also restored 82.4 acres of tidal wetlands. Continued monitoring will assess long-term trends.
- IN 2009-2010, Westchester County installed a tidal gate and restored and created meadows as part of a $1.3 million project to restore tidal flow and stabilize an eroding shoreline at Manursing Lake in Rye. The Dissolved Oxygen Environmental Benefit Fund for the Western Long Island Sound and Jamaica Bay, a program managed by NFWF, awarded a $190,000 grant for the project, which is in a Stewardship Area.

HABITAT RESTORATION PROJECT PROGRESS 2009–2010

Projects completed in 2009

Projects still in progress at end of 2010

Projects completed in 2010

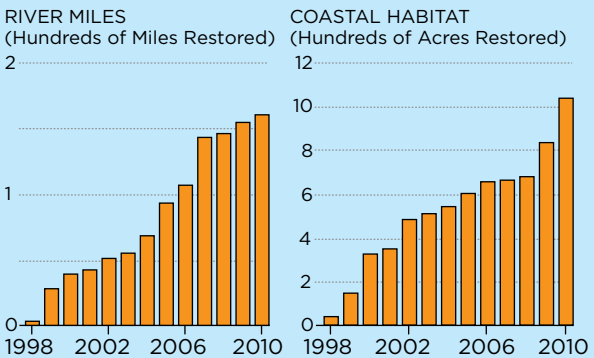
FOOTNOTES:
All of these projects are listed in the LISS Habitat Restoration Initiative database. Five of the project received LISFF awards

THE DATA

RESTORING HABITATS

BY 2006, LISS met a goal to reopen 100 miles of river for fish that migrate between rivers, the Sound and the ocean—two years ahead of schedule. The success can be attributed to implementing fish passage projects with the cooperation of CT DEEP and federal, municipal, and non-profit partners. Owing to this progress, LISS set a new goal of restoring an additional 43 miles by 2011. That goal was met by 2008. Fish passage projects include removing dams that prevented many migratory fish from finding suitable freshwater spawning habitat. In addition to removing dams, opening river miles can involve creating fishways to allow fish to pass over or around a dam.

LISS and its partners have restored 1,045 coastal acres, falling short of a goal launched in 1998 to restore 2,000 acres of coastal habitat in 10 years. As a result, the goal was extended to 2020. For several years, after initial success restoring larger, relatively less expensive sites, LISS partners tackled smaller sites on sensitive lands that were expensive and difficult to restore. But the number of restored acres increased in 2009-2010, primarily because funding became available to fund three projects that involved increasing tidal flow (Brides Brook, Manursing Lake, and Tweed/New Haven Airport), the types of projects that have the potential to quickly restore wetland vegetation in large areas. In total, 20 habitats, totaling 361 acres, were restored in 2009-2010, including 204 acres in 2010, the highest amount of acreage restored in one year since reporting started.



FOOTNOTE: Both charts show cumulative totals

PROJECT SPOTLIGHT

HARRISONS POND DAM REMOVAL

IN THE 18TH AND 19TH CENTURIES, property owners around Long Island Sound built thousands of dams to create ponds or to help power mills. While dams had benefits, they also had their downsides, including preventing migratory fish from swimming upstream to spawning habitat, causing the build up of sediments behind the dam, and possibly the accumulation of debris and pollutants.

Today, many of these dams are faltering due to age and cost of maintenance, leading to another concern—flooding. This was the case in 2004 in New York when a large storm caused a dam to collapse in the Town of Smithtown's Harrison Pond Park.

The Town first considered rebuilding the dam. But the community also wanted to see the surrounding wetland restored, and that was unlikely to occur if the dam and the pond remained. Because of the dam, native wetland plants that would have thrived next to a flowing steam had been replaced by overgrown invasive species. While the Town was deciding whether to replace the dam, citizens heard the benefits of removing the dam at meetings of the Nissequogue River Stewardship Action Plan steering committee. They voiced their support, and the Town removed the dam in 2010 as part of the restoration project at the park. A 40-foot long section of intact concrete dam was removed, along with rubble and debris. The banks of the stream were regraded and stabilized with gabions, and the bottom of the channel was lined with river rocks. Areas cleared for restoration work were planted with native trees, plants, and shrubs. The project involved the restoration of approximately 0.35 acres of the wetland area. A pedestrian footbridge, gravel walkways, and viewing areas were provided for park goers to view the restoration. Additionally, two interpretative signs were installed in the viewing areas. One sign informs the public about the various plants, animals, and trees found in the surrounding wetland. The second sign concerns the history of the area and wetland, and the important function of wetland streams. Other important outcomes of the project are that it enhanced the stream flow and coldwater input to the adjacent Nissequogue River tributary, thus improving the habitat for fish spawning, and it removed the obstruction to fish passage upstream.

The final project cost was $218,145, and included a $94,993 grant from the Sound Futures Fund. The project was completed in October 2010. Rebuilding the dam would have cost approximately $600,000.

The Nissequogue River Stewardship Action Plan also was developed with financial assistance from the Sound Futures Fund. It includes recommendations that have led to projects such as the dam removal to ensure the protection of the habitat and water quality of the Nissequogue River in a densely populated 40-square mile watershed.

THE STREAM at Harrison Pond Park, before and after a dam was removed.

STEWARDSHIP

The Study's Management Committee established the Long Island Sound Stewardship Initiative to protect the diverse plants and animals that make their home in or near the estuary. The Stewardship Initiative also seeks to ensure that the Sound's citizens will continue to have access to the natural seascapes that make the area an enjoyable place to live.

As a culmination of over three years of effort, the Stewardship Initiative work group in 2006 identified 33 inaugural areas around the Sound with significant recreational and ecological values (see *www.longislandsoundstudy.net/stewardship* for details). To help protect these areas, the Sound Futures Fund in 2009-2010 provided grants to states, municipalities, and environmental organizations to help develop conservation plans for these areas and to implement projects such as restoring habitats and engaging the public to become better stewards of their local, natural resources.

In 2009-2010, the Initiative also responded to a need first identified in the Study's 1994 Comprehensive Conservation and Management Plan to help its partners in the acquisition and protection of environmentally significant, privately owned, undeveloped lands. Through the Sound Futures Fund and awards to the states, the Study provided $720,000 to help acquire two coastal properties totaling 45.3 acres.

GOAL
Protect open spaces and natural areas

PROGRESS
Protected 1,466 coastal acres in 2009-2010

CHALLENGE
Protecting sensitive lands threatened by development

HIGHLIGHTS 2009—2010

- A $21,000 LISFF grant in 2010 was awarded to CT Sea Grant to help develop plans to manage critical habitats for a diversity of plant and animal life in three Stewardship Areas—Goshen Cove in Waterford, the Lower Connecticut River in Essex, and Hammonasset Beach.
- A $450,000 grant in 2009 from LISS to NYSDEC helped the state purchase a 28.3 acre woodland property in Setauket, Long Island. The property, which was owned by the Roman Catholic Diocese of Rockville Centre, was the largest privately-owned undeveloped area draining into Consience Bay. Preservation of the woodlands will help prevent runoff from roads and related contaminants from entering the estuary.
- IN 2009-2010, LISFF provided acquisition, restoration, and management grants for 18 projects within stewardship areas.
- A $260,000 LISFF grant in 2010 to Trust for Public Land helped the town of Madison acquire and protect the Griswold Airport property next to one of the state's largest coastal parks (see p. 13).
- IN 2010, the city of Rye completed the purchase of the 1-acre Bird property adjacent to the Blind Brook and part of a LISS Stewardship Initiative Area. In 2008, LISS contributed $200,000 toward the purchase of the land, which provides protection to tidal wetlands at Milton Harbor and the Marshlands Conservancy, the largest salt marsh preserve in Westchester County.

COASTAL LANDS PROTECTED

Parcels Protected in 2009

Parcels Protected in 2010

FOOTNOTES:
The map shows acquisitions as well as conservation easements purchased by federal, state, or local governments, and land trusts. Information was collected by LISS's Habitat Restoration Initiative.

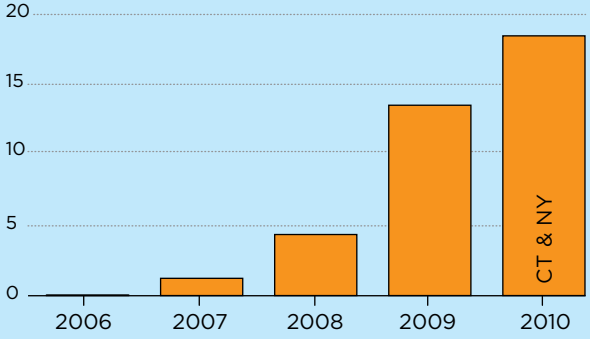
The parcels at pin 14 (A and B) are too close to separate on this map.

THE DATA

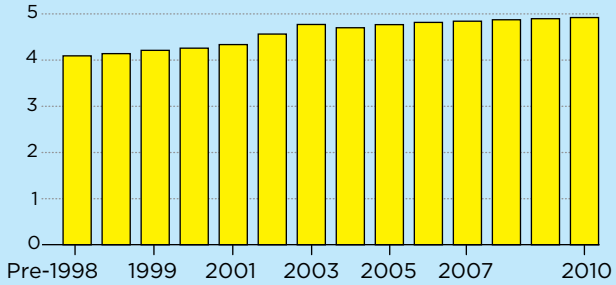
OPEN SPACE PROTECTION

IN 2009 AND 2010, local, state and federal agencies, and non-profit groups acquired or purchased easements for at least 46 properties totaling 1,466 acres to protect undeveloped lands as natural open space in the coastal Long Island Sound watershed. The research was compiled by LISS's habitat restoration coordinators from press releases, newspaper articles, and Web sites. The list does not account for all transactions, but shows that the region far exceeded a goal established by the LISS Policy Committee in 2006 to restore and protect 300 acres of land by 2011. The acquisitions and easements also help to fulfill Open Space Protection Plans established by CT and NY.

COASTAL AREA PROTECTED NY AND CT
(Hundreds of Acres—cumulative since Oct. 2006)



CT STATEWIDE LANDS PROTECTED
(Hundred Thousand Acres—cumulative)



FOOTNOTE: CT is more than 70% toward the state goal of protecting 673,210 acres of land for the entire state.

PROJECT SPOTLIGHT

GRISWOLD AIRPORT PROPERTY

STRONG COMMUNITY SUPPORT and an effective partnership between nonprofit groups and local, state, and federal agencies, including LISS, resulted in the purchase in 2010 of a large, environmentally valuable shoreline property in Madison, CT. The former Griswold Airport, next to one of Connecticut's largest coastal state parks, was purchased, with the help of Trust for Public Land (TPL), from a developer who had been proposing a 127-unit residential development for the site.

The town of Madison purchased the 42-acre Griswold property in May 2010 from LeylandAlliance for $9.5 million following a January referendum in which voters overwhelmingly approved the sale. Of the 42 acres, about 20 acres along the Hammonasset River closest to the 919-acre Hammonasset Beach State Park and Natural Area Preserve, part of a LISS Stewardship Initiative Area, will be designated as conservation lands. The remaining acreage will be developed by the town for recreational use, including ball fields.

One of the funding partners was the Sound Futures Fund, which awarded a $260,000 grant to TPL, which raised, along with Audubon Connecticut and a local committee, $1.7 million of the total purchase price. CT DEEP also was an important funding supporter, providing $1 million, including $500,000 to TPL through the Long Island Sound License Plate Fund and Ecosystem Management Habitat Restoration Grant Program.

Hammonasset Park is an important habitat to a wide variety of nesting, migrating, and wintering birds with nearly 300 species having been recorded there, including one of the highest concentrations of Saltmarsh sparrows, birds that are on CT DEEP's list of threatened birds and birds of special concern. Protection of the Griswold property will provide a significant buffer to Hammonasset, and enhance the saltmarsh and upland habitat that support bird species.

"When I learned of the vote, it was the first time in a long time that I felt this deep satisfaction that people today can still step up and do the right thing," said Diana Johnson of Old Lyme, who posted her comment on the Facebook page of Stop Griswold Over Development. Johnson, a birder who frequently visits Hammonasset, added in an e-mail to the Study: "There are so few opportunities to acquire Long Island Sound waterfront and even rarer that a large parcel becomes available that is contiguous to State owned lands. Thank goodness for the folks in Madison who 'get it,' and the hard work of you and TPL and Audubon to ensure its perpetual protection."

THE FORMER GRISWOLD AIRPORT property was purchased by the town of Madison in 2010 (top). Almost half of the 42-acre property will be protected as a conservation area. The site is a haven for many coastal birds, including the marsh wren (left).

MONITORING & ASSESSMENT

Monitoring environmental conditions, both on land and in water, over a long period of time provides crucial information for state and federal agencies to determine whether progress has been made in achieving the goals of the Study's Comprehensive Conservation and Management Plan (CCMP), and to identify emerging trends.

The Study has played an important role in supporting as well as funding monitoring programs. Since 1987, for example, LISS has funded CT DEEP to conduct a comprehensive water quality monitoring program. CT DEEP collects data on conditions such as dissolved oxygen levels, chlorophyll a levels, and water clarity, which helps resource managers evaluate the effectiveness of the efforts to reduce hypoxia (low dissolved oxygen). Scientists also use the data to support basic research on the causes of hypoxia and other water quality issues.

In 2010, the Study also provided support to the Interstate Environmental Commission, which specializes in near shore and harbor areas in the western Sound and the Narrows. Through the Sound Futures Fund, LISS also has provided grants to citizen monitoring groups to sample water quality in harbors and near shore areas.

Monitoring also helps track other CCMP goals, including protecting habitats and managing the impact of development on water pollution. In 2009, for example, LISS funded FWS to survey the extent of eelgrass meadows, and in 2010 funded UConn's Center for Land Use and Education (CLEAR) to track changes in land use and impervious surfaces that can impact the Sound and its tributaries (see feature, next page).

Several other programs monitor the Sound, including CT DEEP's Long Island Sound Trawl Survey, NYSDEC's estuarine survey, and state surveys of coastal bird populations.

GOAL	PROGRESS	CHALLENGE
Track the ecological health of Long Island Sound	Improved understanding of the Sound's resources	Synthesizing data to monitor progress and identify trends

HIGHLIGHTS 2009—2010

- FROM OCTOBER TO MAY, CT DEEP collects monthly water quality samples at 17 stations aboard the agency's research vessel John Dempsey. From June to September the surveys expand to biweekly at 48 stations.
- UCONN'S Long Island Sound Integrated Coastal Observing System (LISICOS) provides real time water quality monitoring in the open Sound and in embayments through equipment deployed on six buoys, a lighthouse, and a dock. The program had received start-up funding through the EPA in 1998 with LISS's support.
- FWS USED A $150,000 LISS enhancement grant to identify the extent of eelgrass meadows in 2009 in eastern Connecticut and Long Island. The survey was the third since 2002.
- IN 2009-2010, LISFF awarded more than $150,000 in grants to five community groups to monitor water quality and coastal animal populations.
- LISFF FUNDS helped start the Project Limulus program to monitor horseshoe crabs in Long Island Sound. Cornell University's Cooperative Extension of Suffolk County also has a horseshoe crab monitoring program.
- DATA COLLECTED by state and federal agencies was used by LISS to produce the Sound Health 2010 environmental indicators report, which was distributed to more than 300,000 residents. LISS also used the data for its redesigned Status and Trends Web pages.

WATER QUALITY MONITORING STATIONS

Year-Round CT DEEP Station

Summer CT DEP Station

LISICOS Buoy

FOOTNOTES:
Summer boat stations collect samples from mid-June to September. The buoy sensors are operated by UConn's Long Island Sound Integrated Coastal Observing System.

DATA SPOTLIGHT

LONG ISLAND SOUND TRAWL SURVEY

CT DEEP'S LONG ISLAND SOUND TRAWL SURVEY is a vital tool to measure the abundance and distribution of finfish, squid, and other macro-invertebrates (lobster, crabs, horseshoe crabs, whelks) in Long Island Sound, independent of commercial or recreational fishing. By comparing Trawl Survey data with current fishery data (landings, catch/effort, seasonal patterns) each species' harvest can be weighed against its abundance, providing a gauge to determine whether harvest limit targets are being met. The Trawl Survey also provides a measure of recruitment strength (abundance of young fish entering the population each year) as well as detailed characterization of the size and age composition of several species entering the Sound. Each spring (April, May, June) and fall (September, October) the 50-foot research vessel *John Dempsey* carries its crew of 4-6 scientists and vessel staff on the monthly cruises, sampling 40 stations selected at random from 12 depth and substrate categories (called "strata") between Groton and Greenwich in both CT and NY waters.

CT DEEP RESEARCH VESSEL *John Dempsey* (below) has been used for monitoring the Sound's water quality and marine life since 1991. The Dempsey was out of service for part of 2010 when its engine was replaced and other equipment added. It returned to the Sound in early 2011.

PROJECT SPOTLIGHT

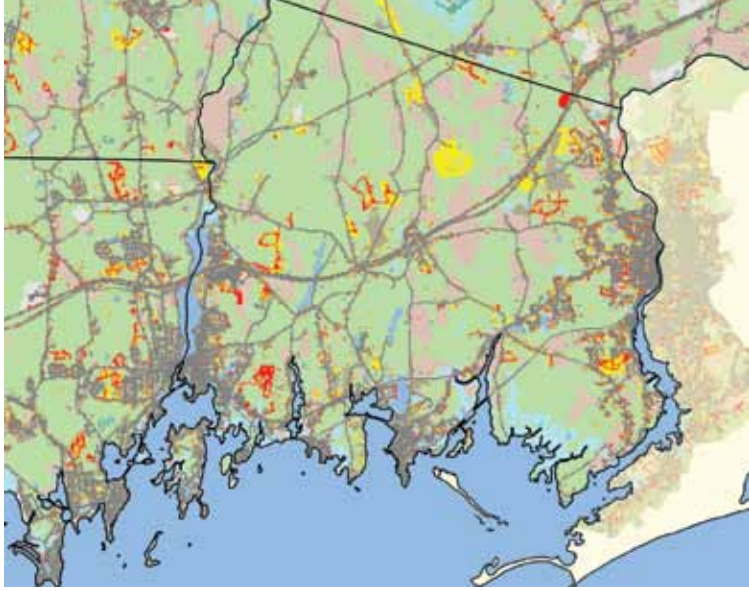
LAND COVER MAPPING

MANY OF THE PROBLEMS facing the Sound are connected, either directly or indirectly, to land use in the watershed. In order to get a better handle on land use changes over time and their relationship to trends in various environmental health indicators and CCMP goals, the Study has funded UConn's Center for Land Use Education and Research (CLEAR) to expand its current land cover change research. CLEAR conducts an ongoing, research project that uses remote sensing-based land cover to track changes over time to Connecticut's landscape. Land cover, or what is physically covering the ground, is linked by a robust and growing body of literature to a number of environmental health concerns, particularly those involving water resources. CLEAR's project now characterizes land cover change in the state during the 21-year period 1985-2006. The projects include information on changes to land cover categories like developed land, forest and turf/grass, and also subsidiary analyses focusing on forest fragmentation, impervious cover, and riparian corridors.

In the past, the Study has funded specific land cover studies by CLEAR, and also used the land cover change data to help track the status and trends of key CCMP-related measures, like developed land and riparian cover; however, these datasets generally applied only to Connecticut. In 2010, LISS funded CLEAR to expand the coverage of its project to include the New York portion of the lower watershed, in order to generate uniform land cover measures for the LISS area from 1985-2006. Included will be overall land cover change, riparian corridor change, and forest fragmentation. In the second year of the project, both the Connecticut and New York portions of the study area will be updated to 2010, creating a unique dataset covering a 25-year period. The land cover data will be used by LISS managers to help track and assess progress against Study goals. It is also hoped that the data will be used by other researchers as they continue to study the impacts of land use on the water quality and biological health of the Sound.

The land cover data are already used by municipalities to provide information on where projects to reduce pollutants entering bodies of water are needed to lessen the impact of development. For example, Stamford's Mill River Collaborative cited CLEAR's analysis of the amount of impervious surfaces in downtown Stamford as part of its justification to propose a project to implement a watershed wide system of green and engineered stormwater treatment infrastructure to protect the river and Long Island Sound. CLEAR data also were used by CTDEP to conduct statewide research comparing CLEAR impervious cover estimates to populations of in-stream macroinvertebrates; the results became the research foundation of the Eagleville Brook impervious cover-based Total Maximum Daily Load plan—the first in the country.

STONINGTON LAND COVER



A MAP SHOWING development changes in Stonington and surrounding area (top). Participants in one of CT NEMO's Rain Garden Workshop trainings, sponsored by CT DEEP and EPA Region 1, install a rain garden at the Beardsley Zoo in Bridgeport, CT in 2010. The training was focused on helping landscapers, contractors, public works staff and others learn how to design and install a rain garden, a low impact development practice (below).

MONITORING FOR CLIMATE CHANGE

Since the Study's CCMP was approved in 1994, global climate change impacts have come to the forefront in science, and in managing environmental resources. The complexities of a changing climate and the subsequent impacts on different ecosystems have caused many estuary programs to revisit their management plans to take into consideration regional climate change. The LISS Management Committee also saw the need to address the localized effects of climate change and created a work group to develop a Sentinel Monitoring for Climate Change strategy.

The Sentinel Monitoring for Climate Change program involves a multidisciplinary approach to provide early warnings of climate change impacts to the Sound's estuarine and coastal ecosystems, plant and animal species, and processes to facilitate appropriate and timely management decisions and adaptation responses. These warnings will be based on assessments of climate-related changes to the indicators/sentinels. The ultimate goal is to begin a long-term monitoring program, through which resource managers will be able to identify which Long Island Sound resources are most vulnerable to climate change and which are the most critical to protect.

The Sentinel Monitoring for Climate Change Work Group formed in summer 2009 and began more effectively coordinating efforts already underway in both states to develop the monitoring strategy. The work group includes staff from the EPA Long Island Sound Office, NOAA, NYSDEC, CT DEEP, and the New York and Connecticut Sea Grant programs. Two state technical advisory groups include more than 60 federal, state, non-governmental, and university partners who have contributed to all stages of the strategic plan development.

GOAL
Identify climate change impacts and determine appropriate adaptation and mitigation strategies

PROGRESS
Completed strategy and determined six priority sentinels

CHALLENGE
Maintain and expand funding for long-term monitoring

MATTITUCK CREEK SEA LEVEL RISE SCENARIO

Flood Areas (2020)

Highest mapping confidence*

Medium

Lowest

*Mapping confidence ranges are provided to account for the error in LiDAR data. "Highest" represents a 99% likelihood that the shaded areas will be inundated under the selected sea level rise and/or storm surge scenario.

Potential for Marsh Migration (2080)

Yes

No, impeded by existing development

HIGHLIGHTS 2009—2010

- CT DEEP, UCONN, AND NYSDEC convened work groups of regional experts in both states that resulted in recommendations for indicators and the program as a whole. The program will measure indicators (such as the abundance of key species and habitats) that are likely to be affected by climate change and that can be monitored.
- THE SENTINEL MONITORING for Climate Change work group narrowed down the list of possible pilot study indicators to 6 through the use of an on-line survey and the availability of existing data to supplement new monitoring.
- THE WORK GROUP received LISS funding to issue a request for proposals (RFP) to implement a short-term, pilot-scale study.
- LISS, THROUGH THE SOUND Futures Fund, also awarded a $50,000 grant to The Nature Conservancy (TNC) to create a portion of TNC's Coastal Resilience web-based decision support tool. The grant helped fund TNC's efforts to show projected climate change impacts for North Shore communities in Suffolk County (see top). Visit TNC's *coastalresilience.org* to see the entire Sound project and other sites.

MAP FOOTNOTES
The LiDAR derived digital elevation model (above) provided by Suffolk County Information Services is overlain by a range of down-scaled sea level rise scenarios generated using Intergovernmental Panel on Climate Change (IPCC) emission scenarios, historic tide gauge data, land subsidence, local differences in mean ocean density, circulation changes, thermal expansion of sea water, and changes in ice mass due to global temperature increases. The map above depicts projected inundation for coastal resources such as salt marsh and built structures under an IPCC A2 scenario by 2020. "Advancement Zones" that may accommodate migrating marshes reflect above the projected inundation scenarios by 2080.

OTHER PROGRAMS

STATE CLIMATE INITIATIVES

The States of Connecticut and New York are also working independently to combat climate change and green house gas emissions. Here are examples:

NEW YORK

- IN 2007, THE NEW YORK STATE Legislature created the Sea Level Rise Task Force, led by NYSDEC, and charged it with preparing a report that addresses sea level rise issues, including recommendations for an action plan to protect coastal communities and natural resources from rising sea levels. The final report, which calls for immediate action, was delivered to the State Legislature in late December 2010.

- IN 2009, 31 COMMUNITIES, including six in the Sound's watershed, signed the new Climate-Smart Communities Pledge. Climate Smart Communities is a New York State program, lead by NYSDEC, to reduce the statewide carbon footprint by encouraging local governments to help fight global warming.

CONNECTICUT

- CONNECTICUT STATE AGENCIES are collaborating to reduce greenhouse gas emissions in Connecticut. The Governor's Steering Committee, made up of leaders from key state agencies including CT DEEP, Public Utility Commission, Transportation, Administrative Services, The Office of Policy and Management, and The Connecticut Clean Energy Fund led a collaborative effort that developed a Climate Change Action Plan for Connecticut.

- CONNECTICUT STATE PARKS performed a vulnerability assessment of their coastal properties, including Stewardship areas, with assistance from CT DEEP's Office of Long Island Sound Programs (OLISP).

PROJECT SPOTLIGHT

CLIMATE ADAPTATION WORKSHOPS

IN 2010 LISS, ICLEI-Local Governments for Sustainability, the Town of Groton, and CT DEEP supported three workshops for government officials at all levels to collaborate on ways to adapt to for climate change. The financial support for the workshops, and for an overall effort to help develop a climate change adaptation plan that can be used as a model for coastal communities, came from a $30,000 grant LISS received in 2009 from EPA's Climate Ready Estuaries Program.

Groton was chosen by CT DEEP's Office of Long Island Sound Programs as the pilot community because the town offered a mix of local, state, and federal coastal climate change issues including inundation from sea level rise at the Navy Base, Groton-New London Airport, Groton Reservoir, state parks such as Bluff Point, vulnerable commercial areas such as downtown Mystic and developed coastal barrier beaches.

The workshops were designed to complement the Town's ongoing sustainability and development planning and to engage representatives from federal, state, and municipal governments in adaptation planning. They also were intended to identify and gain local support for the specific steps that Groton (or a similar city) would need to take to adapt to climate change and clarify roles of citizens as well as local, state, and federal levels of government to implement the plan. The workshops were well attended, but, the first workshop was postponed because of a "nor'easter", a severe storm. The second meeting in March 2010 was held despite a "500-year storm event" that caused extensive flooding and illustrated how coastal communities are vulnerable to severe storms, high tides, and sea level rise.

The conclusion from the workshops was that existing model projections of climate change scenarios were sufficient to develop plans to adapt to potential impacts. Groton also has initiated several actions recommended from the workshops, including developing zoning to create incentives to direct development away from coastal hazards, and raising public awareness of flood prone areas. It completed its final draft report in December 2010.

ICLEI and CT DEEP, through the Long Island Sound Study, also were awarded another EPA Climate Ready Estuaries grant to develop an Adaptation Resource Toolkit which will focus on integrating climate adaptation tools, resources, and information for local communities in Connecticut. As part of the grant, a Connecticut Municipal Climate Protection Network was launched in November 2010 in Waterbury. More information about the network and other Information on climate change resources is available at *www.ctclimatechange.com.*

TOP TO BOTTOM. An aerial view of Groton. A severe "500 year" storm event on March 30, 2010 caused flooding and erosion, and also helped to highlight the need to plan for severe weather at the second Groton Climate Change Adaptation held on the same day.

RESEARCH

Since 2000, LISS has awarded research grants biennially through the Long Island Sound Study Research Grant Program. The objectives are to investigate the complex ecological issues facing the Sound and to apply this research to help improve conditions.

Since 2008, the Research Grant Program has been administered by the New York and Connecticut Sea Grant programs. In 2010, of the 40 proposals submitted, six received funding with grants totaling $1.13 million (see list, p. 19). This is the fifth grant cycle for the program, which has awarded a total of 32 grants to scientists totaling $4.5 million since its inception. Descriptions of all projects are available at: *www.longislandsoundstudy.net/research.*

LISS also has a Science and Technical Advisory Committee (STAC), consisting of engineers, scientists, and representatives from government agencies, academia, industry, and private organizations. The committee meets three times a year to provide the LISS Management Committee with overall direction and advice on science and technical issues. It also supports efforts to manage the Sound by providing the policy and management process with the best available scientific and technical information. Among the topics it has focused on in recent meetings are the impact of climate change in the Long Island Sound region and the linkages between nutrients and hypoxia (low dissolved oxygen levels).

GOAL
Apply research to improve management of the Sound

PROGRESS
Initiated six new research projects

CHALLENGE
Integrating research from different scientific fields

JENNIFER GEORGE, a graduate student in Christopher Gobler's Stony Brook University laboratory, collects mesozooplankton samples in April 2010, aboard an SBU research vessel in Central Long Island Sound.

HIGHLIGHTS 2009—2010

- FIVE RESEARCH PROJECTS, funded with $820,000 in grants from the 2008 LISS Research Grant Program, were initiated in 2009-2010. The projects were all related to water quality and included investigating the impact of climate change on water quality, the causes of harmful algal blooms, and the affects of weather patterns on the severity of hypoxia. Final reports of these projects will be posted on the LISS Web site.
- IN 2009 SCIENTISTS from NYSDEC and CT DEEP completed a LISS-funded project to study the quantity of toxics such as mercury and PCBs found in popular sport fish such as striped bass and bluefish. The data was used by state health departments to evaluate changes to their fish consumption advisories.
- IN 2009, LISS ORGANIZED AND HOSTED a workshop on nutrient bioextraction, the practice of farming and harvesting shellfish, finfish, and seaweed for the purpose of removing nutrients from coastal waters. The workshop brought in the top researchers from around the world, and helped initiate a bioextraction pilot program in the Sound (see p. 7).
- IN 2009-2010, MEMBERS OF THE STAC worked on writing chapters of a book that will compile and synthesize the wide range of scientific research related to the environmental health of the Sound. The synthesis report is expected to be published in 2012.

RESEARCH SPOTLIGHT

CLIMATE CHANGE IMPACTS ON MICROBIAL LIFE

HIGHER THAN AVERAGE water temperatures in winter can lead to shifts in microscopic animal and plant populations, which in turn can affect water quality and alter the food supply for fish and other aquatic species in the Sound, according to Stony Brook University (SBU) researchers.

The research project was funded in 2008 through the LISS Research Grant Program as part of efforts to help resource managers understand the potential impacts climate change might have in the Sound. Seawater temperatures in the Sound have increased by 1.5 degrees C between 1976 and 2001, which represents typical patterns seen along the northeast coast.

The research team was led by Darcy Lonsdale and Christopher Gobler of SBU's School of Marine and Atmospheric Sciences. Based on knowledge that microscopic animals (zooplankton) reproduce quicker when water temperatures are higher than normal, the scientists investigated whether warmer temperatures will result in increased populations of zooplankton and therefore increased grazing on microscopic algae (phytoplankton), leading to a decline in the phytoplankton population.

To test this hypothesis, the SBU team took water samples in the Sound from January to April in 2010, and again in 2011. From these field samples they found that the warmer year (2010) had a smaller phytoplankton population than the colder year (2011), which is consistent with the hypothesis. They also put seawater into tanks in a Stony Brook lab to simulate seawater conditions at cold, ambient, and warm temperatures. From these lab experiments they found the warmer seawater condition had increased grazing and a smaller phytoplankton population, which also supports the hypothesis.

The results, both in the Sound and in the lab samples, showed that warmer waters lead to a smaller phytoplankton population. More research will be needed to determine if the suppressed phytoplankton bloom in the winter and early spring affects water quality and the food supply for larger marine species, which depend on phytoplankton and zooplankton for food.

BLOOMING PLANKTON: *Skeletonema*

PROJECT SPOTLIGHT

2010 LISS RESEARCH GRANTS

(PROJECTS WILL TAKE PLACE FROM 2011-2013)

Systematic Evaluation of Nitrogen Removal by BMPs in the Long Island Sound Watershed
Shimon Anisfeld and Gaboury Benoit, Yale University School of Forestry and Environmental Studies, will examine the effectiveness of projects involving constructing wetlands or retention basins (known as "wet ponds") to reduce nitrogen and improve water quality in the Sound's watershed.

Sources and Fate of Nitrogen in the North Shore Embayments
Gilbert N. Hanson and Teng-Fong Wong, Geosciences Department, SBU, will study the effects of nitrogen pollution from groundwater and wastewater treatment plants at two diverse harbors on Long Island's north shore, Stony Brook Harbor, which has minimum anthropogenic impact and Port Jefferson Harbor, which has high anthropogenic impact.

The Influence of Gelatinous Zooplankton on Nutrient Cycles, Hypoxia, and Food Webs Across Long Island Sound
Darcy J. Lonsdale and Christopher J. Gobler, School of Marine and Atmospheric Sciences, SBU, will look at the impacts of gelatinous zooplankton, primarily ctenophores (comb jellies) and to a lesser extent cnidarians (jellyfish), on nutrient cycles, hypoxia, and food webs across the Sound. The data will help resource managers assess the impact of gelatinous zooplankton grazing on larval lobsters and hard clams.

A SCUP (PORGY) swims by a restored eelgrass meadow on the north shore of Long Island (top). A view of Port Jefferson Harbor (bottom).

Phase Shifts Among Primary Producers within Long Island Sound: Will Anthropogenic Stressors Continue to Expand the Niche of PSP- and DSP-producing Dinoflagellate Blooms?
Christopher Gobler, School of Marine and Atmospheric Sciences, SBU, will examine whether the increase in harmful algal blooms that could lead to the production of shellfish poisons in the Sound is due to human alterations in the ecosystem—including nitrogen discharges and increasing carbon dioxide and temperatures as a result of climate change. The project will generate near real-time reports of bloom events to serve as an early warning system.

Nitrogen Removal Capacity of Connecticut Estuaries: Assessing Distribution and Controls
Craig Tobias, Department of Marine Sciences, UConn, and Bongkuen Song, University of North Carolina at Wilmington, will quantify seasonal removal rates of two nitrogen-removal processes in tidal reaches of a Connecticut estuary. The nitrogen removal will then be mapped and provide clues to whether hot spots for these processes persist over time and space or are transient.

Comparative Analysis of Eutrophic Condition and Habitat Status in CT and NY Embayments of Long Island Sound
Jamie Vaudrey and Charles Yarish, Department of Marine Sciences, UConn, will survey habitat characteristics of eight representative embayments in Connecticut and New York, looking at estuarine status and the susceptibility of these embayments to hypoxia. The ability of the habitats to support economically and ecologically important eelgrass will also be assessed using a GIS model.

PUBLIC INVOLVEMENT AND EDUCATION

A successful plan to restore and protect the Sound depends on the millions of people who live along the coast and in the upland watershed areas. With that in mind, the LISS Public Involvement and Education program strives to raise the public's awareness about the issues impacting their local waters and the Sound, and to foster environmental stewardship so they can take steps to prevent water pollution and protect animals and their habitats.

Publications such as **Sound Health 2010,** which was distributed to schools, inserted in newspapers and posted on the Web, provide the public with information on the health of Long Island Sound and what efforts are still needed. In 2010, the Study also redesigned its Web site to make it easier to find information, photos, and videos about the Sound, and started a Facebook page to bring the conversation about the Sound to the internet.

In the community, LISS's public outreach staff arrange field trips, visit schools, and offer presentations to environmental groups and at conferences to spread the word about the special qualities of the Sound that make it a "living treasure". LISS's New York outreach coordinator established the Sound Stewards program in 2008, which bring students to Stewardship Initiative areas to conduct field studies. Connecticut's coordinator, a horticultural specialist, provides talks to the public on how proper landcare can help reduce or eliminate fertilizers and pesticides that can drain into the Sound and cause harm.

LISS also has a Citizens Advisory Committee that meets quarterly to provide guidance and advice to the LISS Management Committee and to promote public awareness and understanding of the Study's issues and goals.

GOAL
Promote watershed and environmental stewardship

PROGRESS
Educated more than 350,000 residents through LISFF projects since 2005

CHALLENGE
Empowering change in people and communities

HIGHLIGHTS 2009—2010

- IN 2009-2010, LISFF awarded 46 grants to organizations who educated people about the Sound and/or engaged them in activities to clean up beaches, monitor and protect habitats, and take steps to reduce or prevent pollution.
- IN 2009-2010, LISFF funded unique programs in New Haven and the Bronx (Solar Youth, Rocking the Boat, and Yale University's Peabody Museum) that taught urban teenagers environmental skills, who in turn used their skills to foster stewardship in their communities.
- LISS'S CAC held "Sound Visioning" workshops in 2010, a first step in preparing a Long Island Sound Citizens Action Plan, and to provide guidance to the Management Committee in updating the Comprehensive Conservation and Management Plan.
- LISS PROVIDED $65,000 to CT Sea Grant to run the Long Island Sound Mentor Teacher program in 2009-2010. From 2002-2010, the program has held 22 workshops, utilizing 26 high quality, respected teachers to mentor 284 educators on incorporating Long Island Sound content into their science curricula. In 2010-2011 the program was extended to educators in NY through NY Sea Grant.
- IN 2009, LISS teamed up with NY Sea Grant, SBU, and a local legislator to sponsor a "take back unwanted medicine" event in Setauket, Long Island. The event helped educate the public that medicines flushed down the toilet will end up in the Sound and degrade water quality. Almost 500 pounds of unwanted medicines were collected from 140 participants.

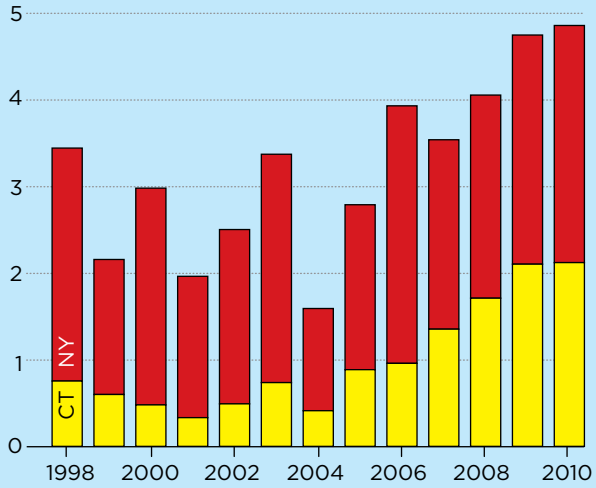
ROCKING THE BOAT, an environmental group in the Hunts Point section of the Bronx, uses boat building and student-involvement in monitoring and restoration projects to help disadvantaged youth develop into empowered and responsible adults.

THE DATA

VOLUNTEER BEACH CLEANUPS

THE MARPOL TREATY OF 1988 made ocean dumping illegal. But garbage continues to collect on the coast, including the Sound's 600 miles of shoreline. While some of this debris is still dumped from vessels, most of the garbage comes from the streets in our communities. This trash gets washed into the Sound as stormwater runoff. The success of Long Island Sound Coastal Cleanups, held on weekends in September and early October in the Sound as part of International Coastal Cleanup Day, is evidence that community residents are willing to volunteer in large numbers to help clean up a persistent problem. In 2010, 4,891 volunteers removed 130,064 pounds of debris along 135 miles of shoreline, an average of 963 pounds of debris per mile. More than 30,000 cigarette butts, 14,000 food wrappers and containers, and 12,000 beverage cans and bottles were among the types of debris found in CT (data for the NY portion of the Sound's watershed was not available). More information about beach cleanup programs in NY and CT is available in the water quality section of *longislandsoundstudy.net/status-and-trends*.

NUMBER OF VOLUNTEERS AT COASTAL CLEANUPS
(Thousands of Volunteers)



PROJECT SPOTLIGHT

ENCOURAGING SUSTAINABLE PRACTICES

THE PUBLIC SERVICE AD and the informational brochure are useful ways to raise awareness that activities such as overfertilizing, applying pesticides onto a lawn, or dumping trash into a storm drain can be harmful to local streams and Long Island Sound. But is the message enough to change people's behaviors? Supporters of another public education method, Community Based Social Marketing (CBSM), believe that behavior change campaigns must first identify the barriers that prevent good environmental practices within a target audience. Next, marketing tools are used to promote measurable and sustainable changes in behaviors.

Since 2008, LISS has been holding workshops for community groups to help them learn CBSM techniques. In 2009-2010, LISS, through the Sound Futures Fund, also funded five projects, which used CBSM principles such as:

Identifying Your Audience
Audubon New York wanted to find out what was disrupting nesting sites of piping plovers, birds listed on New York's endangered species list, before developing an education campaign at two beaches in Oyster Bay. Audubon conducted an observational study to find out what behaviors were disrupting the nesting sites, and observed beach personnel, in an effort to beautify the beaches, rake the wrack-line—the dried up seaweed that lies on beaches and is home to worms, insects, and small crustaceans. The wrackline is an important food source for the birds. As a result of the survey, Audubon is developing an education program to work with beach staff on protecting the nesting sites.

AN EDUCATOR at the Maritime Aquarium in Norwalk uses a watershed display to show how polluted stormwater runoff drains into coastal waters.

Making a Commitment
The Maritime Aquarium of Norwalk in 2010 presented a live 15-minute animal exhibit, "Creature Encounters," to more than 100,000 participants who were then asked to sign a Clean Water Pledge to change one of four behaviors that were negatively impacting coastal waters and the habitats of animals featured in the exhibits such as the diamondback terrapin. About two-thirds of people who responded to a follow-up survey said that they did change one of their behaviors as a result of the program.

Modeling Sustainable Behavior
The CT chapter of NOFA (Northeast Organic Farmers Association) used organic land care experts to demonstrate the benefits of converting from traditional lawn care practices such as applying synthetic fertilizers and pesticides to lawns to organic land care practices, which are beneficial to the Sound. With a Sound Futures Fund grant, NOFA sponsored five community workshops and developed a Web site that included step by step instructions and an "ask the expert" section. In a follow up survey on NOFA's Web site, 80 property owners caring for about 1,600 acres said that they adopted one or more organic land care practices as a result of NOFA programs or materials, or hired an organic landscaper to care for their lawns.

BUDGET

Section 119 of the federal Clean Water Act authorizes Congress to provide up to $40 million per 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 2008-2010 for projects that took place in fiscal years 2009-2011. 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 and Connecticut for projects to implement the CCMP.

Electronic versions of annual CCMP Implementation Tracking and Monitoring 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.

LISS BUDGET	FY 2009 (Oct 08—Sept 09)	FY 2010 (Oct 09—Sept 10)	FY 2011 (Oct 10—Sept 11)
Coordination/Reporting	$366,950	$358,162	$420,507
Public Information/Education	$547,907	$560,917	$656,033
Monitoring, Modeling & Research	$1,719,440	$1,193,891	$2,073,831
Implementation Support and Technical Assistance*	$2,352,855	$1,019,847	$2,597,216
Habitat and Water Quality Improvements**	$450,000	$450,000	$2,013,500
TOTAL	$5,437,152	$3,582,817	$7,761,087

* includes habitat restoration and watershed management planning, and Stewardship Initiative.
** includes EPA grants to the Sound Futures Fund grant program.

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LONG ISLAND SOUND STUDY OFFICES

CONNECTICUT

U.S. Environmental Protection Agency Long Island Sound Office | Stamford Government Center
888 Washington Blvd; Stamford, CT 06904-2152, T: 203-977-1541

NEW YORK

NY Public Outreach Coordinator | New York Sea Grant
146 Suffolk Hall, Stony Brook University, Stony Brook, NY 11794-5002 T: 631-632-9216

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GARY WIKFORS, PHD, National Marine Fisheries Service, Milford Laboratory

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A Partnership to Restore and Protect the Sound