

The Long Island Sound Study (LISS) biennial report highlights work performed in 2005-2006 by government agencies, universities, nonprofit groups, citizens, and businesses to restore and protect the Sound. These projects help fulfill goals established in LISS's Comprehensive Conservation and Management Plan of 1994. Authorized by Congress, LISS brings together people and institutions from across the Sound to protect a waterway that benefits millions of people, while providing natural habitats to more than 1,200 species of invertebrates, 170 species of fish, and dozens of species of migratory birds.



▲ U.S. FISH AND WILDLIFE SERVICE biologist Andrew MacLachlan checks his Global Positioning System (GPS) unit while helping to survey coastal areas of Long Island Sound in September 2006 (see p. 17).

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2005-2006  
LISS Biennial Report

*(On the cover)* Jennifer Mattei, Chair of the Biology Department of Sacred Heart University, picking a horseshoe crab to be tagged and monitored as part of Project Limulus (see p.16). A horseshoe crab with an injury to its shell, such as the crab shown on the cover, can heal its wound and survive.  
*Photo by Richard Howard*

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## Policy Committee Meets in 2006

On Sept. 28, 2006, the LISS Policy Committee met at the Jay Heritage Center in Rye, NY to review progress in restoring Long Island Sound. It also set new interim targets for habitat restoration, approved 33 stewardship areas, established a new \$6 million grant program for research and restoration, and charged LISS's partners to review and update the nitrogen reduction plan to improve water quality. These actions will help LISS move closer to its goal of restoring the Sound to health by 2014.



## 2007 Policy Committee Members:

**Alexander B. "Pete" Grannis**  
Commissioner, New York State Department of Environmental Conservation

**Gina McCarthy**  
Commissioner, Connecticut Department of Environmental Protection

**Alan J. Steinberg**  
Regional Administrator, U.S. Environmental Protection Agency, Region 2

**Robert W. Varney**  
Regional Administrator, U.S. Environmental Protection Agency, New England

◀ THE LISS POLICY COMMITTEE signing agreements at the carriage house of the Jay Heritage Center in September 2006. The Center includes the Peter Augustus Jay House (middle right), a historic landmark undergoing restoration. The mansion faces the 173-acre Marshlands Conservancy, part of a designated Stewardship Initiative Area, and the largest tidal marsh system in Westchester County (top, middle left, and bottom left).





## → Director's Remarks

What will it take to clean up Long Island Sound and restore the health of its natural resources? Simply put—creative partnerships and money. No major breakthroughs, just strategic investments of financial and human capital. What do I mean?

Our first challenge is to maintain, repair, and upgrade our wastewater and stormwater treatment infrastructure for existing development. Clean water does not come cheap. The federal government alone has spent more than \$71 billion nationwide on wastewater treatment programs since 1973. These investments can be largely credited with reversing the centuries-long trend in the degradation of the Nation's waters. But many of those wastewater systems now face enormous infrastructure funding needs in the next 20 years to replace pipes and other constructed facilities that have exceeded their design life. According to the U.S. Environmental Protection Agency (EPA), the national need for wastewater and collection system investments is \$162 billion.

Locally, projects are proceeding to upgrade wastewater treatment plants to remove nitrogen (see pages 6-7 for examples), correct combined sewer overflows, and rehabilitate sewer conveyance systems. The local need alone is in the billions of dollars. However, the benefits would also be enormous: more waters safe for swimming and recreation, more shellfish safe for human consumption, and healthier waters for aquatic life. The technical know-how exists. Funding is needed.

Our second challenge is to ensure that new development is sustainable. New development simply cannot impose the same burden on the environment as past development if we expect a different environmental outcome for our streams and rivers, and for the Sound. We must develop and grow in ways that generate less polluted runoff, while protecting and restoring open space and natural habitats. The region has the human capital to accomplish this. The space to grow outward is quickly diminishing. We will need to grow up (literally and figuratively) and in. It is here where past and future investments in wastewater and transportation infrastructure can accommodate growth. There are many creative partnerships demonstrating how this can be accomplished. Some are illustrated on the map to the right depicting the Long Island Sound Futures Fund projects initiated over the past two years.

Meeting these challenges will position the region as a leader in the transition from an unsustainable growth model to one that can sustain our natural resources, while growing our economy.

**Mark Tedesco**  
Director,  
U.S. EPA Long Island Sound Office

# LIS Futures Fund Grant Program A 'Surround Sound' Partnership

IN 2005 AND 2006, the Long Island Sound Futures Fund provided \$1.8 million in grants to groups across the Sound for stewardship, restoration, planning, and public outreach projects. The Futures Fund is funded by the EPA, the U.S. Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration, and is managed by the National Fish and Wildlife Foundation, which seeks out additional funding support from the private sector and foundations. The New York State Department of Environmental Conservation and the Connecticut Department of Environmental Protection also provide technical support.

See [www.longislandsoundstudy.net/futuresfund](http://www.longislandsoundstudy.net/futuresfund) for descriptions of all projects.



### Saugatuck Watershed Partnership p.8

The Nature Conservancy leads efforts to involve 11 municipalities to create a watershed partnership and Watershed Action Plan.



### Moulson Pond Fishway

The Lyme Land Conservation Trust leads a project to replace a water control gate 100 yards upstream from a "steepass" to improve fish passage on the Eight Mile River in Lyme. Fishway system allows alewives and blueback herring to bypass a dam built during the colonial era, and swim upstream to spawning and nursery habitat.



### Sea Turtle Stranding

Mystic Aquarium informs the public about distressed marine mammals and sea turtles through workshops that teach appropriate responses to strandings.

### Solar Youth Citywide Steward Program

Youth from New Haven learn about their local watershed, the Long Island Sound, and their place in protecting the environment through lessons and community service action projects focused on conservation. Also funded as a 2006 small grant.

### Eelgrass Restoration

Cornell University Cooperative Extension of Suffolk County establishes and monitors eelgrass meadows in the waters off St. Thomas Point.



### Branford Fishway p.10

The Branford Land Trust and its partners build a fishway on Queach Brook to allow fish such as alewives to swim upstream for the first time in 100 years.



### Beach Nesting Birds

Environmental groups collaborate to support monitoring and protecting piping plover nesting sites, and promote the Beach Habitat Awareness Campaign to provide information about how birds and humans can coexist.



### Nissequogue R. Stewardship p.8

The Regional Plan Association coordinates the Nissequogue River Stewardship Action Plan in Smithtown.



5 2.5 0 5 Miles

MAP SOURCE: U.S. Fish and Wildlife Service Coastal Ecosystems Program, Charlestown, Rhode Island



# Water Quality

The National Research Council and the United Nations Environmental Programme have recognized nutrient pollution as one of the greatest threats to the health of coastal waters. In the Sound, the nutrient nitrogen has increased by 400 percent since the early 19th century, primarily due to the increase in sewage caused by population growth. This excess nitrogen contributes to low oxygen zones, the loss of seagrasses, and reduced biodiversity.

In response, the EPA, New York, and Connecticut developed a plan in 1998 to reduce nitrogen by 58.5 percent by 2014 from early 1990s levels. To help achieve this target, communities across the Sound are upgrading sewage treatment plants to incorporate new technologies that eliminate nitrogen during the treatment process. For example, Stamford completed a \$105 million dollar upgrade and expansion of its treatment plant in 2006, of which \$50 million was for nitrogen removal. The plant now removes nearly all of the 4,000 pounds of nitrogen entering the plant daily (also see highlights, this page, and results, p. 7).

In 2005, the EPA, through the Long Island Sound Restoration Act, awarded Connecticut \$1,984,000, which the state used to help distressed communities pay for the planning and designing of their nitrogen removal projects. New York was also awarded \$1,984,000 in 2005, which the state is using to fund water quality improvement projects.

As part of the nitrogen removal plan, New York City in 2006 also agreed to sharply reduce nitrogen discharged from its East River plants. Environmental groups such as Audubon New York and the Natural Resources Defense Council, along with federal, state, and city agencies, hailed the announcement as one of the most significant developments in the efforts to improve water quality for the Sound.

In 2006, the LISS Policy Committee also authorized the Management Committee to conduct a technical review of the progress being made toward achieving water quality standards for dissolved oxygen and adjusting reduction goals as appropriate. The report should be completed by December 2007.

Sewage treatment plants are not the only source of nitrogen entering the Sound. Other sources include polluted runoff from impervious surfaces and discharges from boats (see no discharge areas, opposite page).

WATER QUALITY

➔ **Goal** Improve water quality by reducing nitrogen pollution  
**Progress** Nitrogen reduced by 20% from sewage plants since 1994  
**Challenge** Maintaining adequate funding for plant upgrades



## ▲ PROJECT// Oyster Bay Sewer Plant Upgrade

THE SBR PROCESS TANK where nitrogen is removed (top). Sewer district employee Alan Minicozzi (left) showing that the clarity of a sample of treated effluent (in his left hand) is virtually the same as a glass of tap water.

process occurs in one tank (in a single batch) with a computer regulating when diffusers bubble oxygen into the tank in the aerobic phase, and when the diffusers are turned off for the anaerobic phase. SBR takes up less space and treats sewage quicker than other nitrogen removal processes. It's also faster to build than other systems.

The upgrade came on line in December 2005 and immediately reduced nitrogen discharges to less than 60 pounds a day compared to as much as 230 pounds before the upgrade. The

resource that includes a National Wildlife Refuge and the state's largest commercial oyster hatchery.

Nitrogen is removed from sewage in two phases—an aerobic phase (with oxygen) that changes ammonia in sewage to nitrites and nitrates, and an anoxic phase (without oxygen) in which nitrates are broken down by bacteria to a harmless gas. In a SBR, the treatment

## ➔ HIGHLIGHTS 2005—2006

### Oyster Bay Sewer District

By upgrading its wastewater treatment plant using the Sequencing Batch Reactor (SBR) process, the Oyster Bay Sewer District applied advanced technology to meet its nitrogen reduction target eight years ahead of schedule.

In addition to improving water quality in the Sound, the upgrade will improve water quality in Oyster Bay, a valuable

## ▶ PROJECT// No Discharge Areas

PUMPOUT boat operators removing waste from recreational boat holding tanks (top and bottom)



decrease exceeds the reduction the District was required to achieve in stages by 2014.

The project cost \$10.6 million. The Oyster Bay Sewer District contributed \$3.9 million, with New York providing the remaining funds through the New York State Clean Water/Clean Air Bond Act. The hamlet is the first north shore community to complete a plant with SBR technology. Huntington and the Suffolk County Department of Public Works in Port Jefferson are also constructing facilities that use the SBR process.

## No Discharge Areas

In 2006, Connecticut took major strides toward banning sewage discharged from boats.

The State received approval from the EPA for its third No Discharge Area (NDA) for the Sound, and also applied for a fourth NDA that would complete the ban from Rhode Island to the New York State line.

The latest approved NDA restricts boaters with toilets from discharging treated sewage in the waters from

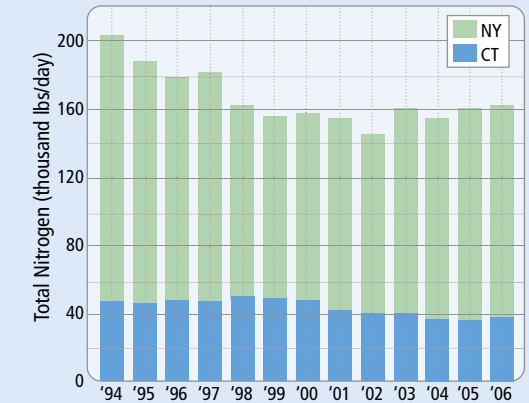
Groton to Guilford. Now, boaters must use pumpout boats or pumpout facilities on shore. The state received the designation after demonstrating to EPA that vessel waste could affect local water quality, and that sufficient pumpout facilities were available to boaters.

There are an estimated 20,000 boats with toilets in Connecticut waters at any time during the boating season. Pollution from these boats is a relatively small contributor to water quality problems, but a discharge could be a serious local problem. Raw or poorly treated sewage can spread disease, contaminate shellfish beds, and lower oxygen levels in water, causing stress to fish and other aquatic animals.

"Discharge of sewage in poorly flushed harbors or coves where vessels may congregate can certainly pose a significant water quality issue," said Rick Huntley, Supervising Environmental Analyst with the Connecticut Department of Environmental Protection Office of Long Island Sound Programs. "Even a small discharge of sewage over a shellfish bed could make people sick from eating shellfish raw."



## NITROGEN FROM SEWAGE TREATMENT PLANTS



◀ NITROGEN has been reduced by 40,645 pounds a day since 1994, but there was a slight increase in the past two years.

## RESPONSE:

# { Reducing Nitrogen }

The discharge of nitrogen from sewage treatment plants reached its peak in 1994. Since then, 39 of the region's 104 sewage treatment plants have been upgraded to provide Biological Nutrient Removal (BNR) of nitrogen, resulting in about 40,645 fewer pounds of nitrogen per day. That's enough nitrogen to fertilize 327,462 acres of turf for one year, an area nearly the size of the Bronx, Westchester County, and Stamford combined.

In 2005 and 2006, six nitrogen removal projects were completed at a cost of about \$77 million. In addition, two interim plant upgrades were completed, and 13 other plants were undergoing construction. In spite of these actions, nitrogen loads increased by 6,000 pounds a day in 2005. New York City plants, which had been accomplishing moderate reductions of nitrogen, were "offline" during this period as a result of undergoing modernization. In addition, heavy rainstorms contributed to overcapacity problems in older plants that accept stormwater, diminishing the ability of these plants to treat nitrogen.

Both New York and Connecticut are implementing innovative programs to reduce nitrogen levels in phases by 2014. In Connecticut, communities that upgrade their plants receive nitrogen credits that are exchanged for cash through a state Nitrogen Credit Trading program. Communities that have delayed upgrades buy the credits at the exchange. The program takes into account that some plants can more cost-effectively remove nitrogen because of their size and design, or have a greater impact because of their proximity to the western Sound where hypoxia is more severe. New York's plants are divided into five management zones. As long as each zone meets an aggregate nitrogen reduction target, all plants are in compliance. Every five years, the permitted aggregate nitrogen target is reduced for the zone, requiring more plant upgrades to go on-line.



# Watershed Management

Water pollution can originate from point sources such as the discharge pipe of a sewage treatment plant or the smokestack of a factory. Or it can originate from thousands of diffuse sources. Each year, for example, rainfall carries thousands of pounds of nitrogen pollution from paved surfaces and lawns into the Sound through storm drains and tributaries, contributing to the Sound's low dissolved oxygen problem. Stormwater runoff also carries pesticides, pathogens, motor oil, debris, and sediment from road sanding and construction sites. Other diffuse sources of water pollution include septic waste infiltration and automobile exhaust.

To help control the pollution from diffuse sources, LISS works with communities in "local watersheds"—subregions of the Sound's 16,000 square-mile watershed—whose lands drain into the same system of rivers, streams, or lakes that eventually flows into the Sound. Communities that work together in their local watershed can pool staff and financial resources to become more efficient in identifying regional problems, initiating projects, and providing outreach to their residents to educate them about what they can do to protect their water.

LISS also helps provide watershed information to communities. Through a LISS enhancement grant, Columbia University in 2006 developed a Riparian Buffer Toolbox Web site ([www.longislandsoundstudy.net/riparian](http://www.longislandsoundstudy.net/riparian)) for local officials to learn about drafting and implementing regulations to encourage healthy riparian areas—the vegetated riverbanks, streambanks, and lake shorelines that filter pollutants before they can enter the surface waters. LISS also provided an enhancement grant to the University of Connecticut's Center for Land Use Education and Research (CLEAR) to track impervious surface coverage in coastal communities from 1985 to 2002. Impervious surfaces such as asphalt, concrete, and rooftops prevent percolation of water into the soil, and lead to stormwater runoff. The project, completed in 2006, identified a 17.2 percent increase in impervious surfaces in the New York and Connecticut portion of the watershed. Impervious surface data by community is available at <http://clear.uconn.edu>.



**WATERSHED** → **Goal** Reduce polluted runoff and nonpoint source pollution  
**Progress** Supported 11 local watershed-management projects  
**Challenge** Fostering development in a sustainable manner

▼ PROJECT// The Saugatuck River Watershed Partnership



→ HIGHLIGHTS 2005—2006

THE SAUGATUCK RIVER WATERSHED includes some of the most beautiful land in the Sound's watershed. But even here, where more than 15,000 acres of land are protected forest—the largest protected forest block in southwest Connecticut—streams and tributaries are showing signs of degraded water quality. Instead of accepting declining water quality, the 11 communities of the Saugatuck River Watershed decided

in 2006 to work together to manage environmental threats such as loss of riparian buffers, poorly maintained septic systems, and lawn chemicals and fertilizer being carried into streams as polluted runoff. In April 2006 they signed the Saugatuck River Watershed Conservation Compact, declaring their intention to confront issues damaging the water resources of the watershed and working to "ensure the long-term environmental

health and vitality of the watershed." The compact was drafted by the Saugatuck River Watershed Partnership (SRWP), which was organized in 2005 by The Nature Conservancy to develop a regional approach to protect and preserve the watershed. As part of its collaborative strategy, the Partnership is also reaching out to state and federal agencies, and other environmental groups. For example, the Partnership is collaborating



with the Connecticut Department of Environmental Protection, Save the Sound, American Rivers, the National Oceanic and Atmospheric Administration, and Restore America's Estuaries to improve fish passage on the Saugatuck River and study alternatives to dam removal on an

upper watershed tributary. LISS has supported SRWP through the Sound Futures Fund, which awarded a \$25,000 grant to The Nature Conservancy in 2005 to support planning workshops and development of SRWP, and awarded a \$46,000 grant in 2006

to provide support for projects such as a multi-town workshop on erosion and sediment control. SRWP also receives funds from Nature Conservancy donors and from municipalities within the watershed.



◀ VOLUNTEER JOAN FRANKLIN and Project Director Sally Harold sample the aquatic life in the Aspertuck River; Headwater wetlands, like the one below in West Redding, support plant and animal species and filter and store stormwater; Natural Resources Conservation Service staff lead a stream survey workshop (*bottom left*); Devil's Glen Falls, the historic limit of anadromous fish passage in the Saugatuck (*opposite page*).



▲ CONSERVATION CREW along the Bronx River installing black fabric to control Japanese knotweed, an invasive plant.

RESPONSE:

## { Funding Watershed Programs }

In 2003, the LISS Policy Committee established a goal of having communities develop and implement local restoration plans by 2010 on 50 percent of the land area in New York and Connecticut that drains to the Sound. To achieve this goal, LISS, through the Sound Futures Fund, provided grants to watershed groups to help develop management plans and implement projects. Besides the Saugatuck River Watershed Partnership, other watershed projects that received grants through the Sound Futures Fund in 2005-2006 included:

- **Long Island Sound Stewardship Initiative Nissequogue River Watershed Project**  
The Regional Plan Association is developing a Stewardship Action Plan that identifies and prioritizes management activities, and identifies restoration opportunities and potential open space acquisitions. The Nissequogue is a 40-square mile watershed on the north shore of Long Island.
- **Bronx River Restoration and Stormwater Retrofit**  
The Bronx River Alliance is removing invasive plants and debris while restoring three acres of riverine Bronx River forest habitat. Project partners include New York City Parks, Gaia Institute, Neighborhood Initiatives Development Corporation, Youth Ministries for Peace and Justice, and the Mosholu Preservation Corporation.
- **Mattabeset River Regional Basin Analysis**  
The Connecticut River Coastal Conservation District is conducting a comparative subwatershed analysis of the Mattabeset River regional basin in 12 municipalities as the first step in a program to develop small watershed restoration plans to address known water quality impairments. The Mattabeset is a 108-square mile watershed contributing to the Connecticut River and the Long Island Sound.



# Habitat Restoration

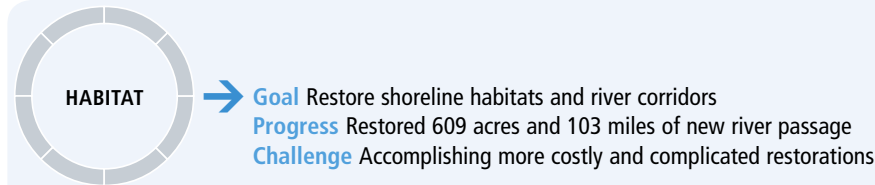
The destruction of natural habitats rivals hypoxia and over-fishing in harming the Sound's living resources. For example, destruction of tidal marsh grasses deprives shellfish, worms, and juvenile fish of their habitat. And dams that had been constructed from as early as the colonial era block the migration of fish between the Sound and its rivers.

To assist with the reversal of the environmental degradation of coastal habitats, LISS created the Habitat Restoration Initiative. In 1998, the Initiative established a goal to restore 2,000 acres of coastal habitats and 100 miles of fish passage. The Initiative met its goal for fish passage in 2006, but by the end of 2005 had met only 28 percent of its goal to restore coastal habitats (see p. 11, results). The LISS Policy Committee in 2006 responded to these divergent trends by increasing the goal for fish passage by an additional 50 miles from 2006-2011, and setting an interim target to protect or restore at least 300 acres from 2006-2011. The committee established 2020 as the new target date to restore 2,000 acres.

In agreeing to continue the Initiative beyond 2008, the Policy Committee recognized the environmental and economic benefits of restoration, including flood moderation, pollutant filtration, fish and wildlife habitat, recreation, and tourism.

To help finance habitat restoration projects, the Sound Futures Fund provided grants in 2005-2006 for 14 habitat restoration projects (see p. 10, highlights).

The National Fish and Wildlife Foundation in 2006 also offered grants to restore habitat and improve water quality in the western Sound as well as Jamaica Bay through the Dissolved Oxygen Environmental Benefit Fund (EBF) program. The EBF was created as part of a settlement and consent order associated with nitrogen discharges from water pollution control plants managed by New York City.



▼ PROJECT// Branford River Fishway



▲ **FIRST GRADERS WITNESS** the first alewives to swim over the dam in 100 years at the inaugural ceremony on April 11, 2006; Project Manager Tom Cleveland (left); and the Supply Ponds fishway with the dam in the background (far left).

→ HIGHLIGHTS 2005—2006

EVERY SPRING, fish such as alewife migrate from the salt waters of the Sound to freshwater rivers, streams, ponds, and lakes to spawn. But in Queach Brook, a tributary of the Branford River, a 17-foot high dam has blocked fish trying to swim upstream for the past 100 years.

That changed in spring 2006, thanks to the efforts of the Town of Branford, state and federal government agencies, and non-profit groups. These partners built a fishway that has helped restore

the natural cycle of fish that migrate between saltwater and freshwater. As a result of these efforts, the Branford Land Trust, which manages the project, won a Coastal America Partnership Award for an outstanding team effort to restore and protect a coastal environment.

"It was really exciting to see that connection being remade between the ocean and the inland areas around the watershed," said Tom Cleveland, the project manager, and a member of the Branford Land Trust's Board of Directors.

"Within 20 years, we hope to see tractor trailer loads of migratory fish spawning in this high quality watershed."

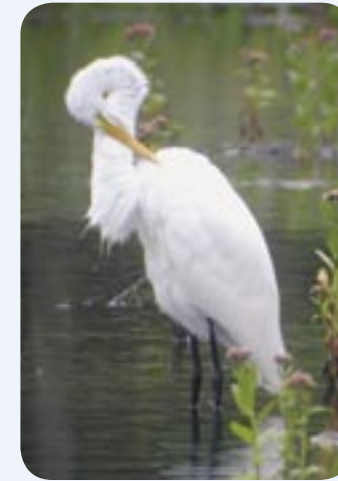
Fishways are structures made of various materials that allow fish to swim around and over barriers. Branford's fishway, known as the Supply Pond fishway, is a steppass, a pre-fabricated aluminum chute. Vanes along the sides and bottom of the chute create turbulence that lowers the velocity of the water spilling from the dam to the brook from 20 cubic feet per second to 3 cubic

feet per second. At the slower speed, fish can swim up the steppass and reach the other side of the dam.

As soon as the fishway opened in April 2006 fish took advantage. A counter installed at the top of the dam counted 3,000 alewives passing through to Supply Pond in the first season. Monitoring upstream has revealed that some of the fish ended up in Lindsley Lake, a 24-acre waterbody four miles upstream, which had been a traditional spawning ground before the dam was erected.

Fishways can be expensive because each project needs to be specially

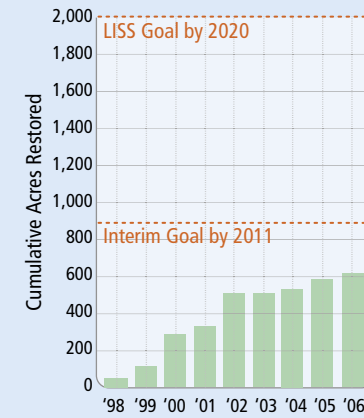
designed for the site. Branford's fishway cost \$203,500 plus \$50,000 in in-kind services. To help pay for the project, the Land Trust reached out to many funding and service partners, including the Town of Branford, the Connecticut Corporate Wetlands Restoration Partnership, the Connecticut Long Island Sound License Plate Program, Save the Sound, the National Oceanic and Atmospheric Administration, the U.S. Fish and Wildlife Service, and the U.S. Natural Resources Conservation Service. LISS, through the Sound Futures Fund, also was a partner, contributing \$60,000.



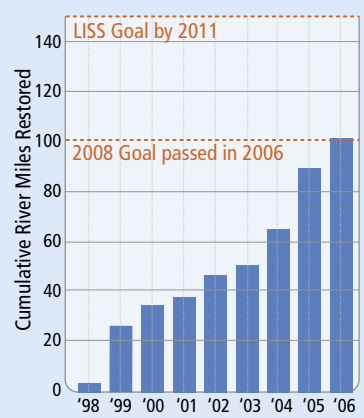
▲ PROJECT// Pryer Manor

In 2005, the town of Mamaroneck in Westchester County planted wildflowers, grasses, and shrubs at the Pryer Manor Marsh, completing a three-year project to restore tidal flow and recreate a salt marsh at the 5.25 acre site. Beginning phases of the project included installing pipes underneath Pryer Manor Road to the Premium River, permitting salt water to once again flow into a marsh that had become a stagnant, freshwater pond surrounded by invasive species. The land is in New Rochelle, but neighboring Mamaroneck sponsored the project because the marsh helps retain stormwater destined for the town. A bird survey of the marsh in 2005 identified 88 species, including 14 species of shorebirds and waders. The restoration was funded through a grant from the New York State Clean Water/Clean Air Bond Act. The marsh is part of the 65-acre Premium River-Pine Brook Wetlands complex, a designated-New York State Significant Habitat, bordering suburban homes and commercial development.

COASTAL HABITAT



RIVERINE MILES RESTORED



▲ A TOTAL OF 609 coastal acres has been restored by 2006; an additional 281 acres are needed to reach the 2011 interim goal. The 2008 goal to restore 100 riverine miles was surpassed in 2006 with 103 miles.

RESPONSE:

{ Restoring Habitats }

In 2005 and 2006, local, state, and federal agencies and non-profit partners worked to restore 37.5 miles of river passage and 83 acres of coastal habitat. The pace of habitat restoration was slow compared to peak years of 2000 and 2002, in part because there were fewer large sites available to restore. The majority of recent habitat restoration projects under construction or being planned also involve more obstacles that add to the cost and length of time to complete the project. For example, many of the newer projects required using special excavation equipment to remove debris on sensitive lands. Habitat restoration coordinators in New York and Connecticut, who are funded by LISS, are working with local communities and non-profit organizations to find suitable sites for restoration, and to identify potential funding sources to help offset the cost of restoration.

▶ THE PROJECT manager for the Peconic Land Trust removing *Phragmites*, an invasive species, at the Great Pond restoration project in Southold, NY.





# Stewardship

Stewardship of the Sound took a major leap forward in 2005-2006 with the adoption of 33 inaugural coastal stewardship areas, and the passage of the federal Long Island Sound Stewardship Act.

These actions resulted from efforts of the Long Island Sound Stewardship Initiative, a partnership program formed by LISS to identify places with significant ecological or recreational value, and to develop a strategy to protect and enhance these special places. The goals of the Stewardship Initiative are to conserve natural areas, increase access to the Sound, protect important habitats, and plan for multiple uses.

A Stewardship Initiative work group first prepared an inventory of hundreds of significant ecological and recreational sites. After a series of public hearings in 2005, the LISS Policy Committee, at its September 2006 meeting, approved 33 inaugural areas that meet the highest criteria for stewardship (see [www.longislandsoundstudy.net/stewardship](http://www.longislandsoundstudy.net/stewardship)). In recognizing the need for a stewardship ethic for the Sound, the Policy Committee noted that the Sound's ecosystem is under stress because of sustained human uses and emerging global and regional conditions.

The initiative is now focused on developing partnerships with local communities and landowners to protect and enhance the Stewardship areas (see highlights, this page, and watersheds, p. 8). In 2005 and 2006, 11 stewardship-related projects were funded through the Sound Futures Fund. With passage of Public Law 109-359, the Long Island Sound Stewardship Act of 2006, additional federal assistance may be on the way. Congress has authorized up to \$25 million per year for Stewardship projects, including acquisitions of environmentally-sensitive lands from willing owners, through 2011.

Few large parcels of natural areas remain undeveloped along the shores of the Sound. To help assess and prioritize preservation opportunities, LISS in 2006 funded Columbia University to document unprotected, undeveloped open space greater than five acres in New York, and to identify their significant natural features. The project aims to help the state's Department of Environmental Conservation target land protection efforts, and complements the Connecticut Land Assessment Methodology project, a similar initiative developed by the Connecticut Department of Environmental Protection.



**Goal** Protect open spaces and natural areas  
**Progress** Protected nearly 8,700 acres in 2005 and 2006  
**Challenge** Protecting sensitive lands threatened by development

## PROJECT// Models for Stewardship Initiative Implementation



▲ HIGH SCHOOL volunteers with a Westchester County parks curator planting American beachgrass at Edith Read Wildlife Sanctuary.



◀ LIGHTHOUSE POINT PARK, New Haven; the Orient Point to Plum Island conservation committee during their visit to Plum Island (below).



▲ CHILDREN observing fish with a net

## HIGHLIGHTS 2005—2006

**AUDUBON** New York and Audubon Connecticut are demonstrating how the Audubon's Important Bird Areas (IBAs) program can serve as an outreach model for improving the stewardship of natural areas.

As part of the project, specific conservation strategies were developed for four IBAs to help protect habitats that are havens for coastal birds, including many rare species.

The project started in 2005 and is

being funded partially by a \$40,000 grant through the Sound Futures Fund. The four sites were selected for their diversity of land ownership, and ecological and recreational value:

- **A 2,000-acre area in Rye, NY** (also a Sound Stewardship Area) anchored by two Westchester County parks, the 170-acre Edith Read Wildlife Sanctuary and the 173-acre Marshlands Conservancy;

- **Orient Point** and the federally-owned Plum Island in Southold, NY (also a Sound Stewardship area);

- **Mamacoke Island**, a 40-acre undeveloped island owned by Connecticut College, and adjacent coves in Waterford; and

- **Lighthouse Point Park**, an 84-acre city-owned park in New Haven.

While specific approaches vary by site, each IBA has identified key stakeholders to work with, ways to reach consensus in creating science-based plans for conservation, and strategies to increase public involvement and access without compromising the protection of wildlife. The groups involved include municipal, state, and federal agencies, and local conservation groups. Audubon helped to facilitate local meetings of these key groups.

According to Alison Beall, the

Westchester County curator of the Marshlands Conservancy, people who enjoy their local stewardship areas and learn about the wildlife that live there are likely to also become passionate advocates for protecting these areas.

"The challenge is to encourage the public's interest in these sites without harming the environment through overuse or misuse," said Beall.

The Audubon Connecticut and Audubon New York Web sites will be posting information on the results of the model stewardship program.

## MARSHLANDS CONSERVANCY

Nature can restore itself if the land and water are protected. The Marshlands in the 1970s, in part due to severe winter storms that caused chunks of ice to rip apart sod. But with the area remaining free of development, sediments have drifted back. And with water quality remaining good, the marsh is thriving again.

The stewardship at Marshlands began with the foresight of two property owners who wanted to preserve their landscapes between historic Boston Post Road and the Sound. They donated a total of 150 acres to Westchester County in 1967 and 1979 to create the preserve. Additional purchases by the state and county have increased the protected area to 173 acres.

## RESPONSE:

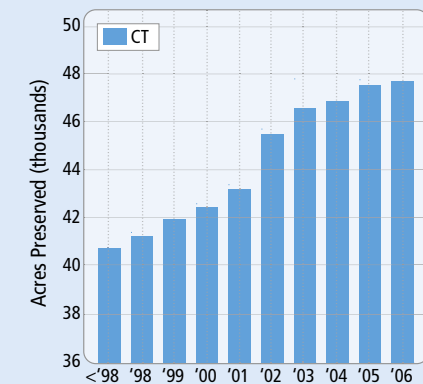
### { Preserving Open Space }

Acquisitions and conservation agreements are key tools in protecting environmentally sensitive areas from development. Both Connecticut and New York work in partnership with the federal government, local governments, and non-profit conservation groups to protect these lands.

Since 1998, when Connecticut passed legislation to preserve 21 percent of its land as open space by 2023, the state has preserved an additional 64,640 acres. In 2005 and 2006, significant coastal acquisitions include the 95-acre Clark Pond property in East Lyme, part of a plan to protect the forested Oswegatchie Hills, an area of more than 700 acres overlooking the Niantic River, 303 acres in North Stonington abutting the Pachaug State Forest, and the 150-acre Queach property in Branford, a parcel that will increase a protected area to 830 acres.

Since 2000, New York has protected more than 900 acres of Sound watershed land in Nassau and Suffolk counties as part of a statewide Open Space Conservation Plan to protect 1 million acres. In November 2005, the state purchased the former Petersen's Marina on the west side of Mattituck Creek inlet for \$2.25 million, providing waterfront and docking access to an 11-acre assemblage of properties the state has purchased in recent years. In 2006, New York also issued its fourth update to the Open Space plan, and included a list of several potential acquisitions for the Long Island Sound corridor. These sites include additions to the Nissequogue River system, Mitchell Creek wetlands, northeastern Queens shoreline, the Eastchester Bay waterfront, and Davids Island, a 78-acre island off New Rochelle.

## OPEN SPACE PRESERVED IN THE LIS WATERSHED



◀ IN 1998, Connecticut passed legislation to preserve 21% of the state's land, or 673,210 acres, as open space by 2023. As of 2006, 477,926 acres have been preserved, which is more than 70% of its ultimate goal.



# Water Quality Monitoring

In order to assess the environmental health of the Sound, LISS's partners monitor its biological, physical, and chemical condition. Some of these data are used by resource managers to help assess whether restoration goals are being met. The data can also reveal new trends not foreseen when LISS began monitoring nearly 20 years ago.

Since 1991, the Connecticut Department of Environmental Protection has conducted a comprehensive water quality monitoring program funded by LISS. Water quality samples are collected at stations throughout the Sound aboard the research vessel *John Dempsey*. The data collected provide information on phytoplankton algal blooms, how hypoxia (low levels of oxygen) varies from year to year, and whether management actions, over time, improve conditions.

While nitrogen, phosphorus, and silica fuel the growth of microscopic plants that lead to hypoxia, other parameters, including temperature and the salinity structure of the water column also contribute, and are monitored as part of the program. These factors, and weather and climate patterns, lead to year-to-year variations in water quality conditions, even while there has been an overall trend toward less severe hypoxia since 1987.

Monitoring also is done in the rivers and streams that flow into the Sound. In 2006, the U.S. Geological Survey (USGS), working with the New England Interstate Water Pollution Control Commission (NEIWPCC), released a report of their upper Connecticut River basin water quality sampling program. Results from this study (from 2002-2005) found that an estimated 21.6 million pounds a year of nitrogen are draining from the upper CT River basin—the New Hampshire, Vermont, and Massachusetts portion of the CT River watershed—into the river. USGS is also studying the amount of nitrogen in the river that is attenuated—lost through natural processes—such as by being absorbed by aquatic plants. Moving forward, NEIWPCC will continue to work with LISS and the upstream states to develop nitrogen reduction targets.

Visit [longislandsoundstudy.net/monitoring](http://longislandsoundstudy.net/monitoring) for information about other water quality monitoring programs for the Sound.



**Goal** Track the ecological health of Long Island Sound  
**Progress** Improved understanding of the Sound's water quality  
**Challenge** Synthesizing and interpreting data to identify trends

## PROJECT// Tracking Phytoplankton



▲ A LAB TECHNICIAN loading sample vials into the automated High Performance Liquid Chromatograph.

## HIGHLIGHTS 2005—2006

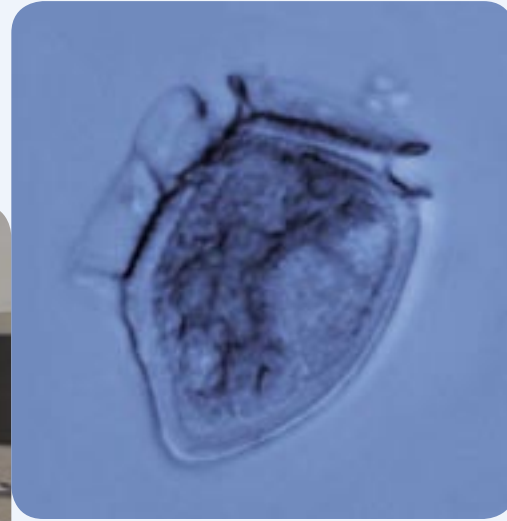
TRACKING THE TYPES and amounts of phytoplankton provides critical information in understanding hypoxia and the health of Long Island Sound. But how do you measure tiny free-floating plants that can populate a drop of water by the thousands?

Using a microscope, the traditional technique for counting phytoplankton, is time consuming work and lacks the ability to distinguish some of the smallest

species. In 2002, with technical and financial support from the National Coastal Assessment Project of the EPA, the Connecticut Department of Environmental Protection (CTDEP) decided to try a newer approach using a process called High-Performance Liquid Chromatography or HPLC.

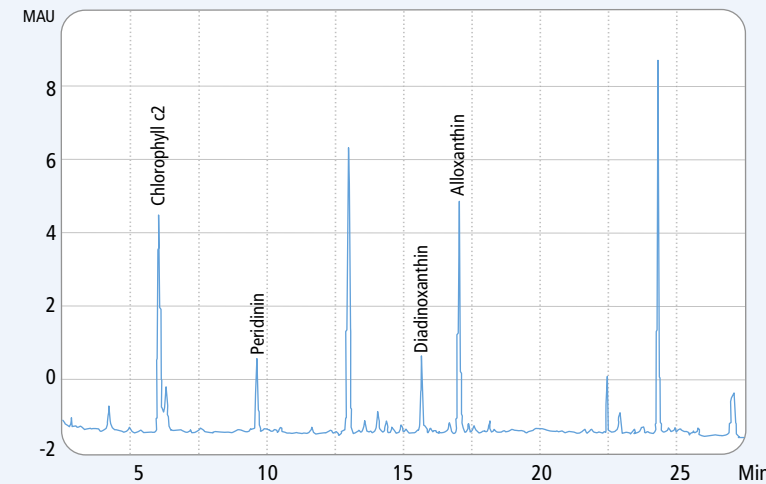
Each plant species has a unique composition of pigments that produces a characteristic color in its tissue. Scientists

using HPLC can take a water sample, identify each of these pigments, and chart the pigment composition of the sample on a graph. The process is done for CTDEP by the Horn Point Laboratory of University of Maryland's Center for Environmental Science. A software program called CHEMTAX can then read the graph to identify the composition of phytoplankton species in the water sample. But before CHEMTAX can do



▲ DINOFLAGELLATES AND DIATOMS are two types of phytoplankton (microscopic plant groups) found in the Sound. The dinoflagellate *Dinophysis* (left) is more likely to be found in July and August, with a smaller, declining population seen in the fall. The diatom *Chaetoceros curvisetus* (top) may be found during mid-winter and mid-summer.

HPLC SAMPLE SHOWING PIGMENT PEAKS



◀ A CHROMATOGRAPH from a water quality sample taken from the eastern Narrows in the fall. The peaks in the graph are pigments that indicate the presence of dinoflagellates.

its job, CTDEP staff must supply the information on pigment composition for different species in the Sound—akin to developing a pigment “fingerprint.”

The monitoring program has revealed a distinct seasonal pattern in phytoplankton community composition. Diversity of plant life

is low during winter when heavier phytoplankton dominate. Diversity is higher in the summer, with smaller phytoplankton taking up a greater percentage of the community composition. The information may eventually prove valuable to scientists in learning the specific mechanism

of how potentially troublesome phytoplankton blooms are triggered. It will also help scientists learn more about the most basic level of the Sound food web, and how it interacts with the tiniest animals in the food web—zooplankton—and larger fish species.

## FISH TISSUE CONTAMINANTS

Fish caught in the Sound can be a delicious and healthy source of proteins, vitamins, and nutrients. However, some sport fish may contain chemicals that could pose health risks if the fish are eaten in large amounts.

To protect consumers, New York and Connecticut health departments provide advisories on how much fish can be eaten at minimal health risk. As part of their assessments, the health departments review studies on the chemical residues in fish from the Sound. In 2006, LISS contributed \$151,000 to update contaminant assessments of polychlorinated biphenyls (PCBs) and mercury in two of the most popular recreational fish in the Sound—striped bass and bluefish. The last time striped bass was studied in the Sound was in 1994. Bluefish was last studied in the mid-1980s.

Using samples taken in 2006 from trawl surveys and from recreational anglers and commercial fishermen, the New York State Department of Environmental Conservation (NYSDEC) and the Connecticut Department of Environmental Protection will determine typical concentrations of PCB and mercury contamination in the fish throughout the Sound and in specific locations. The study results, expected to be completed by the end of 2007, will be shared with staff from the health departments to determine if advisories need to be adjusted. The information will also help to analyze the success of current controls to reduce PCB contamination in fish, and will provide the first comprehensive assessment of mercury in striped bass and bluefish from the Sound.

The study is being managed by the NYSDEC's Division of Fish, Wildlife, and Marine Resources.

▶ A STRIPED BASS being returned to the Sound as part of a fish population survey conducted by the CTDEP. For the contaminant study, samples of striped bass were taken to study the concentration of PCBs and mercury in fish.





# Living Resources Monitoring

Long Island Sound provides habitat for 1,200 species of invertebrates, 170 species of fish, and dozens of species of migratory birds, including many rare species. In order to help assess the abundance and health of these species, resource managers and scientists develop monitoring programs to track the populations of animals and the quality of the habitats that they need to thrive.

One of the largest monitoring programs is the Long Island Sound Fish Trawl Survey. For more than 20 years, the Connecticut Department of Environmental Protection (CTDEP) has surveyed the abundance of fish populations. On each trawl, the crew of the research vessel *John Dempsey* counts, weighs, and measures finfish and invertebrates before returning them to sea and moving on to the next site. The monitoring enables resource managers to compare year to year the relative abundance of dozens of species living in Long Island Sound's varied habitats. The information is shared with fisheries programs from New York State, other Atlantic coastal states, and regional fisheries commissions to help support decisions on managing fish stocks to prevent overfishing. The New York State Department of Environmental Conservation also monitors finfish as well as lobsters, crabs, and horseshoe crabs in the New York portion of the Sound.

Among the critical habitats that are monitored are tidal wetlands, which provide nesting and feeding grounds for many migratory birds as well as small fish. Both states compare historic aerial infrared photographs of wetlands sites with recent images to help analyze the extent of wetland gains or losses. LISS has funded some of these projects (see [www.dec.ny.gov/lands/4940.html](http://www.dec.ny.gov/lands/4940.html)) as well as a research project to develop a cost-effective approach for more extensive tidal marsh monitoring (see p. 19). Aerial photography and field work are also used to monitor underwater seagrasses (see opposite page).



**Goal** Track abundance and distribution of key species  
**Progress** Improved data on wetlands, eelgrass, fish, and shellfish  
**Challenge** Understanding the causes of adverse changes

▼ PROJECT// Project Limulus (Horseshoe Crab Monitoring)



→ HIGHLIGHTS 2005—2006

**HORSESHOE CRABS** (*Limulus polyphemus*), described as “living fossils,” are actually more closely related to spiders than crabs. Although they have been around since before the dinosaurs, little is known about their population dynamics and mating patterns in the Sound.

That’s changing thanks to Project Limulus, a monitoring project being conducted by Jennifer Mattei, an Associate Professor and Chair of the

Biology Department at Sacred Heart University in Fairfield, Connecticut.

Her research uses “citizen scientists,” including local volunteers, elementary school teachers, and students to help tag horseshoe crabs as they appear in the spring on Connecticut beaches for spawning. Since 2000, dozens of volunteers have applied more than 10,000 tags to the shells of *Limulus* and reported more than 650 recaptures.

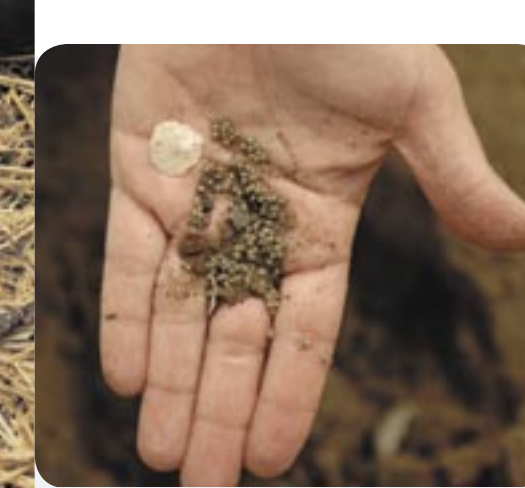
So far what Mattei’s monitoring

▲ **MATTEI**, four high school students, and Captain Jack Cardello from the Sound School in New Haven following sonar tagged horseshoe.

teams have found is not good news for the horseshoe crabs. They have consistently found that only 40 percent of the spawning population is female. And of the total population, not all are mating. For example, in 2005, only 57 percent of the 2,200 horseshoe crabs tagged at Milford Point in 2005 were found as mated pairs. The monitoring reveals the potential for a declining population. It also shows that in 2005 only three pairs had one additional male



◀ SONAR TAG being attached to an adult female after spawning; developing green eggs in the sand (above).



as a potential mate nearby, pointing to another problem that could lead to a decline in the loss of genetic diversity. In Delaware Bay most females mate with clusters of males.

“In Delaware Bay, DNA analysis has revealed that at least three different males may fertilize the eggs in one nest so the genetic diversity of those eggs is quite high,” said Mattei. “Conservationists and ecologists know from experience in managing other economically important species that the higher the genetic diversity, the healthier the population.”

Protecting the species is important to the Sound’s ecosystem. Numerous shorebird species find sustenance by eating the horseshoe crab eggs left in shallow nests on the beach between high-and low-tide lines. In water, a horseshoe crab acts as an “environmental engineer,” using claw-like appendages to dig up nutrients in the sea floor and circulate them in the water. Because of the food supply it generates, about 20 marine animals, including flatworms, blue mussels,

barnacles, and sponges live in or around its shell.

Project Limulus has received funding from the Connecticut Long Island Sound License Plate Fund, Wildlife Trust, Sacred Heart University, and LISS, through the Sound Futures Fund. Participating volunteer groups include the Sound School in New

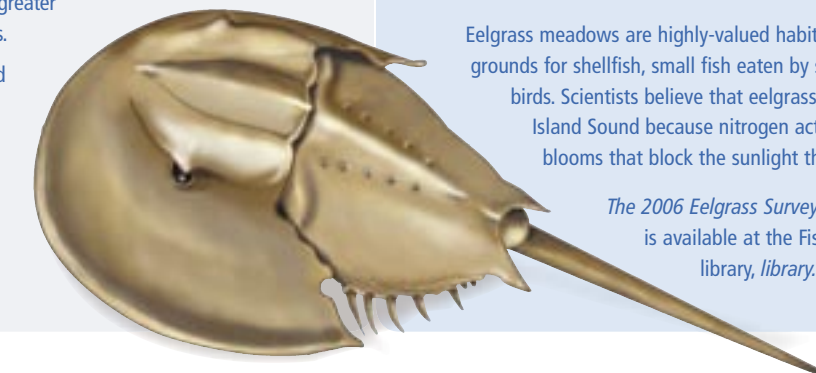
Haven, which provides high school volunteers and boat time to help Mattei track the movements of the crab underwater utilizing sonar tags and sonar monitoring equipment.

Anyone interested in volunteering for Project Limulus can contact Mattei at: [matteij@sacredheart.edu](mailto:matteij@sacredheart.edu)

▼ FACTS ABOUT HORSESHOE CRABS

- Their tail, the telson, looks threatening, but it is only used as a lever for righting itself when it is flipped upside down on the beach or Sound bottom. Their shell also has eyespots running down its length to aide in detecting light.
- They have been described as “walking hotels”—barnacles, blue mussels, sponges, and flatworms are some of the animals that attach themselves to their shells.
- Research on their vision has led to a greater understanding of human eye diseases.
- Their blue, copper-based blood is used to test the purity of medicines.

For more information about horseshoe crabs, including viewing a slide show of Project Limulus, see: [www.longislandsoundstudy.net/horseshoecrab](http://www.longislandsoundstudy.net/horseshoecrab)



RESPONSE:

{ Eelgrass Monitoring To Yield Management Plan }

Meadows of eelgrass were common across the central and western Sound until they were wiped out, first by a fungal disease in the 1930s, and then, gradually, by poor water quality attributed to the effects of nitrogen pollution from sewage discharges. In 2002 and 2006, U.S. Fish and Wildlife Service scientists tracked the remaining acreage of eelgrass beds submerged along the shore of eastern Long Island Sound and Fishers Island with site visits. Their search was aided by use of aerial photographs that documented general vegetation growth, and a global positioning system to find the precise places to look. The monitoring indicated a gain of 306 acres of eelgrass to 1,905 acres from 2002 to 2006, a 12 percent gain.

Information about the current status of eelgrass will help the Connecticut Department of Environmental Protection and the University of Connecticut in a related LISS funded project to establish eelgrass restoration objectives. The project will try to answer questions relating to the effect nutrient loading has on eelgrass vitality, such as:

- How much nitrogen discharge is too much?
- How will different characteristics of the receiving water such as tidal flushing or depth affect the conditions for healthy eelgrass growth?
- What is nitrogen’s impact on eelgrass greater during certain times of the year?
- Can we manage nitrogen to improve conditions for eelgrass?

Eelgrass meadows are highly-valued habitats, providing food and nesting grounds for shellfish, small fish eaten by sport fish, and many migratory birds. Scientists believe that eelgrass cannot grow in most of Long Island Sound because nitrogen acts as a fertilizer to fuel algal blooms that block the sunlight the plants need to grow.

The 2006 Eelgrass Survey for Eastern Long Island Sound is available at the Fish and Wildlife Service’s on-line library, [library.fws.gov](http://library.fws.gov)



▲ U.S. FISH AND WILDLIFE SERVICE Biologist Tom Halavik searching for underwater eelgrass plants during a 2006 survey.





→ **Goal** Apply research to improve management of the Sound  
**Progress** Increased understanding of the Sound's ecosystem  
**Challenge** Integrating research from different scientific fields

# Research

Recognizing the important role that research plays in decision-making, the EPA, 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 September 2005. Priority research topics, identified with the help of LISS's Science & Technical Advisory Committee, were habitat classification and mapping, benthic and water quality indexes, and invasive species. Of the 14 proposals submitted, three projects were selected, totaling \$400,000 in grant awards. For a listing of current projects, see the following page and for past research grants, see [www.longislandsoundstudy.net/research](http://www.longislandsoundstudy.net/research).

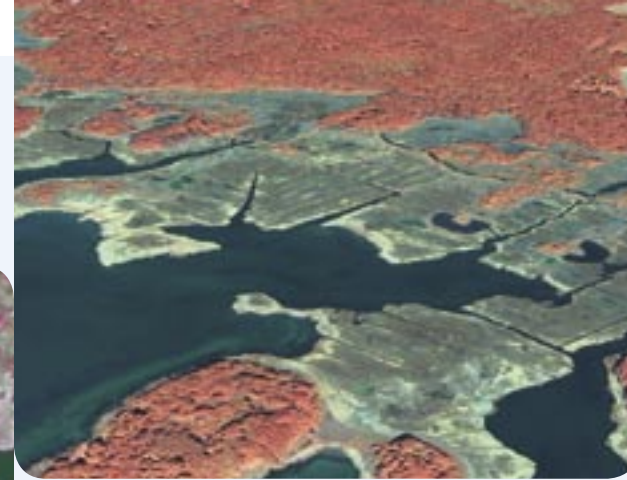
In 2006, the LISS Policy Committee also established the Cable Fund Steering Committee to oversee \$6 million in funds contributed by three utilities—Cross-Sound Cable, the Connecticut Light And Power Company, and the Long Island Power Authority—as part of an agreement to reactivate the cross-Sound cable in 2004. The committee will include representatives from the EPA, the New York State Department of Environmental Conservation, the Connecticut Department of Environmental Protection (CTDEP), and the Sea Grant programs of New York and Connecticut. Priority will be given to projects that promote scientific understanding of the biological, chemical, and physical effects of existing or potential cable and pipeline crossings and the mitigation of their impacts.

The Sea Grant programs and CTDEP also maintain their own separate research grant programs to enhance our understanding of key issues facing the Sound.

## ▼ PROJECT// Identifying Salt Marshes Using Satellite Imagery



◀ **GEOLOGIST** Martha Gilmore, with spectroradiometer and laptop, at Ragged Rock Creek marsh in Old Saybrook. She is collecting the spectra (reflectance values) of *Typha*, a wetland plant whose common name is cattail.



◀ A SATELLITE IMAGE of Ragged Rock Creek in the visible blue and green bands and near infrared band—the greenish patches are *Typha*-dominant, the reddish patches are *Phragmites*-dominant, and the whitish patches contain *Spartina patens*, another wetland plant; and a satellite image of the Barn Island tidal marsh overlaid onto elevation data (top).

## → HIGHLIGHTS 2005—2006

THE SOUND'S resource managers face a challenge in monitoring the health and abundance of salt marshes. First, there is a lot of ground to cover—more than 15,000 acres in Connecticut alone. Second, site visits involve trekking (often with bulky equipment) through brush and wet ground near the water's edge.

But scientists from University of Connecticut and Wesleyan University may be on the verge of developing a

quicker, cost effective method using the unique characteristics of light reflected off salt marsh plants.

Plants have specific "reflectance" values in the visible and infrared region of the electromagnetic spectrum. These values differ from other materials on the earth's surface. In the salt marsh, the team has determined that some plant species have unique values at times of the year that are like "signatures" that

can be used to identify the type and health of plants.

Their initial project, completed in 2006, was funded through a LISS Research grant. In field surveys of selected sites from 2004-2006, the team used special radiometry equipment to measure the reflectance values of these species, and then compared them to reflectance values measured from satellite images from the same area.

Further research will be needed to determine if the values from the selected sites could be used as a reference to assess satellite images taken of any marsh habitat in the Sound.

"What we would like to do is help people use satellite data that is available to everybody," said Martha Gilmore, a geologist at Wesleyan University. "So if a wetlands manager would like to know how much *Phragmites*, an invasive species, is in a particular marsh in 2005, the manager could purchase satellite data in August, when *Phragmites* has higher values of near-infrared reflectance than the other major marsh species."

Besides identifying specific species,

the monitoring also could be used to identify the extent of coastal wetlands, wetland loss, and urban encroachment. Aerial photographs taken from an airplane can do this work, but satellite data is collected more frequently, and is already digitized to be analyzed with other sets of data using geographic information systems.

Salt marshes are some of the most valuable habitats in Long Island Sound. But while laws protect salt marsh from development, development adjacent to salt marsh could degrade the soil and water conditions of the marsh. Salt marshes have also been infiltrated by invasive species, and have lost acres due to severe weather conditions.

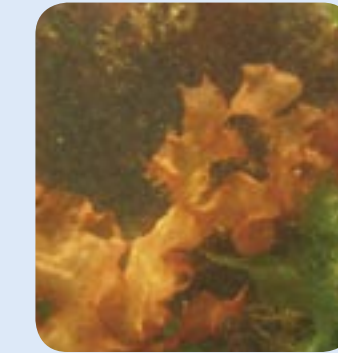
# { 2006 Research Projects }

## Linking Seafloor Habitat Mapping Protocols to Management and Policy Needs

Investigator: Dr. Peter J. Auster, National Undersea Research Center and Department of Marine Sciences, University of Connecticut

The objective is to develop a habitat classification protocol that describes and delineates the representative habitats of marine life. The classification protocol would provide a "common currency" for diverse user groups to effectively map and manage habitats below the surface of the Sound. The final protocol and example applications will be produced as a technical document for Web delivery.

## ▼ POLYCHAETE WORM



## ▲ GRATELOUPIA SEAWEED

## Multi-component Evaluation to Minimize the Spread of Aquatic Invasive Seaweeds and Harmful Algal Bloom Vectors in Long Island Sound

Investigator: Dr. Robert Whitlatch, Dr. Charles Yarish, and Dr. Senjie Lin, University of Connecticut  
 Dr. George Kraemer, State University of New York, Purchase

The project will be examining worm bait products and associated packing materials as potential carriers of non-indigenous seaweed species and harmful algal blooms to Long Island Sound. Non-native, invasive seaweeds and HAB-forming organisms represent threats to the ecological and economic health of the Sound. The goal is to generate information that will be useful in efforts to limit the spread of invasive species through bait products.

## Development of a Long Island Sound-Specific Water Quality Index Using Cluster Analysis and Discriminant Analysis

Investigator: Dr. Pengfei Zhang, Department of Earth and Atmospheric Sciences, City College of New York

The objective is to develop a Long Island Sound-specific water quality index to assess poor, intermediate, and good water quality. This will be accomplished by analyzing the relationship of four commonly measured water quality indicators—chlorophyll a abundance, total dissolved nitrogen, total dissolved phosphorous, and dissolved oxygen—using two statistical methods, multivariate analysis and cluster analysis.

## ▼ WATER QUALITY SAMPLE





# Public Outreach

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

As a result, LISS works to increase public awareness and involvement. In April 2006, for example, *Sound Health*, LISS's biennial environmental indicators report, was distributed as a newspaper insert to more than 400,000 Sunday newspaper subscribers. Schools, universities, libraries, nature centers, and bait and tackle shops were some of the organizations and businesses that later requested bulk copies to distribute to their audience. LISS also publishes newsletters and brochures that help people keep informed (see runoff, opposite page). Many of these publications also appear on LISS's Web site, whose audience has increased from 5,000 visitors a month in 2003 to nearly 20,000 visitors a month in 2006.

LISS also funds public outreach coordinators in New York and Connecticut to promote citizen involvement by responding to requests for information, giving presentations to community groups and schools, and staffing displays at events.

While LISS's outreach is growing, much more needs to be done to teach a watershed population of 8 million about their role in the Sound's cleanup. In 2006, a LISS-funded telephone survey of watershed residents conducted by the Center for Survey Research at Stony Brook University indicated that a sizeable minority of residents living in the Sound were engaging in behaviors that could degrade water quality. But the survey also revealed that residents who were more knowledgeable about the environment were more likely to practice positive lawn care behaviors. The survey, which was funded by a LISS enhancement grant, is available at [www.longislandsoundstudy.net/lisspublicsurvey](http://www.longislandsoundstudy.net/lisspublicsurvey).



→ **Goal** Promote watershed and environmental stewardship  
**Progress** Supported funded projects that have increased awareness  
**Challenge** Empowering change in people and communities

▼ PROJECT// Silvermine River



▼ PROJECT// Beach Cleanups



▼ PROJECT// Alley Pond



◀ PROJECT// Solar Youth

→ HIGHLIGHTS 2005—2006

**THE SOUND FUTURES FUND** Large Grant program is just one of several grant programs that reach out to communities across the Sound. Another important program is the LISS Small Grant program. Since 1995, small grants of up to \$5,000 have been awarded to organizations to educate residents about how to protect the estuary. In 11 years, 131 grants have been awarded totaling about \$580,000. In 2006, management of the program was transferred to the National Fish and Wildlife Foundation from New York Sea Grant.

Projects Funded in 2005 and 2006 included:  
**Little Neck Bay/Long Island Sound Estuary Festival**  
 In 2005 and 2006, LISS provided the Alley Pond Environmental Center with grants to hold a community festival to celebrate National Estuaries Day, held annually on the last Saturday of September. Alley Pond's festivities at its Little Neck Bay location in Queens involved boat tours, a beach cleanup, local environmental organization exhibits, hands-on

demonstrations, crafts, and lessons about wetland ecosystems to raise awareness about the value of estuaries.  
**Solar Youth Neighborhood Steward Teams**  
 In 2005, LISS provided Solar Youth in New Haven with a small grant to help fund Neighborhood Steward Teams, a community-based after school environmental education and action program that provides urban youth with the knowledge, skills, and motivation to address environmental problems in their

▼ PROJECT// Alley Pond

community related to the Long Island Sound watershed. In 2006, the Sound Futures Fund awarded a grant to Solar Youth for its summer citywide steward program.

**Beach Cleanups**

In 2005-2006, LISS provided grants to the American Littoral Society in New York and Save the Sound in Connecticut to coordinate dozens of beach cleanups as part of International Coastal Cleanup Day. The organizations recruited volunteers for beach cleanups, helped distribute brochures educating the public about floatable pollution and prevention, and collected statistics about the types and amounts of trash collected. International Coastal Cleanup, sponsored by the Ocean Conservancy, involves volunteers to clean up trash at beaches around the world on the third Saturday of September.

**Monitoring the Silvermine River**

In 2005, LISS provided a small grant to Earthplace of Westport, Connecticut to help fund a program involving local high school students conducting water quality monitoring of the Silvermine

River. The students did field work on a boat and laboratory analysis under the guidance of the Harbor Watch River Watch program. The data, which included sampling for levels of dissolved oxygen and for fecal counts of bacteria, was provided to local communities and the Connecticut Department of Environmental Protection (CTDEP) to help manage the river, which flows into Long Island Sound at Norwalk.

**Connecticut Department of Environmental Protection**

CTDEP 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 2005 and 2006 included:

• **Summer and Winter Camp Programs for Urban Youth**

CTDEP provided \$18,000 to the Sea Research Foundation, Inc. and Mystic Aquarium to hold two week long summer and winter camp programs at Mystic Aquarium for urban youth from Bridgeport and Hartford, providing opportunities for students to explore marine science and interact with scientists.

• **A Web-Based Tour of the Diversity of Habitat and Marine Life in Long Island Sound**

CTDEP provided University of Connecticut—Groton with a \$24,576 Education grant to provide a web-based narrated underwater tour of Long Island Sound, illustrating the diversity of organisms and habitats that can be observed beneath the surface.

▼ **MENTOR TEACHERS**

In 2005 and 2006, LISS provided funds to Connecticut Sea Grant's Long Island Sound Mentor Teachers Program, in which science teachers skilled in teaching about the Sound's ecology share their knowledge with other teachers.



▲ "FERTILIZING THE SOUND" is one of the images in LISS's *Step by Step* guide to preventing polluted runoff.

RESPONSE:

{ **Stormwater Management Campaign** }

The "pollution guy" doesn't seem to care for Long Island Sound, or at least he doesn't have a clue that practices such as overfertilizing the lawn, not picking up dog waste, and washing the car in the driveway are all behaviors that could lead to pollution going into storm drains, streams, and eventually the Sound.

The image above and similar images of the pollution guy washing his car and walking the dog were borrowed from a series of posters developed by the Washington Department of Ecology for Puget Sound. They have become a popular source of information here in Long Island Sound to teach citizens common-sense steps to prevent polluted runoff.

Using these images, LISS developed a guide in 2005, *Step by Step: a citizen's guide to curbing polluted runoff*, and distributed more than 10,000 copies to municipalities to help in their public outreach as they develop federally-mandated stormwater management plans. LISS also offered municipalities and non-profit groups a template to print their own copies with their logos for bulk distribution. As a result, more than 50,000 additional brochures were distributed to residents around the Sound. Brochures as well as posters and magnets with similar themes have been delivered to libraries, schools, town halls, beaches, community centers, condominiums, street fairs, and car washes.

Visit [www.longislandsoundstudy.net/runoff](http://www.longislandsoundstudy.net/runoff) to view the guide, and see all of the pollution guy's missteps.





# 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 2004-2006

for projects funded in fiscal years 2005-2007. 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 Reports, which provide a comprehensive list of projects undertaken by the Long Island Sound Study and its partners, are available at [www.longislandsoundstudy.net](http://www.longislandsoundstudy.net) under implementation.

## LONG ISLAND SOUND STUDY BUDGET

|   | FY 2005<br>(Oct '04– Sept '05) | FY 2006<br>(Oct '05–Sept '06) | FY 2007<br>(Oct '06–Sept '07) |
|---|--------------------------------|-------------------------------|-------------------------------|
| Coordination/Reporting                    | \$165,277                      | \$329,207                     | \$617,397                     |
| Public Information/Education              | \$411,586                      | \$505,511                     | \$576,702                     |
| Monitoring, Modeling & Research           | \$1,219,575                    | \$1,423,387                   | \$195,225                     |
| Technical Assistance*                     | \$538,988                      | \$514,058                     | \$916,025                     |
| Habitats and Water Quality Improvements** | \$5,470,500                    | \$3,968,000                   | \$450,000                     |
| <b>TOTAL</b>                              | <b>\$7,805,926</b>             | <b>\$6,740,163</b>            | <b>\$2,755,349</b>            |

\* INCLUDES habitat restoration and watershed management planning, and Stewardship Initiative.

\*\* INCLUDES EPA grants to NY and CT for infrastructure projects (2005 and 2006) and EPA's contribution to the Sound Futures Fund grant program (2005 and 2007).

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