LONG ISLAND SOUND STUDY

A Partnership to Restore and Protect the Sound

SOUND HEALTH 2001

Photo by EPA-LISO

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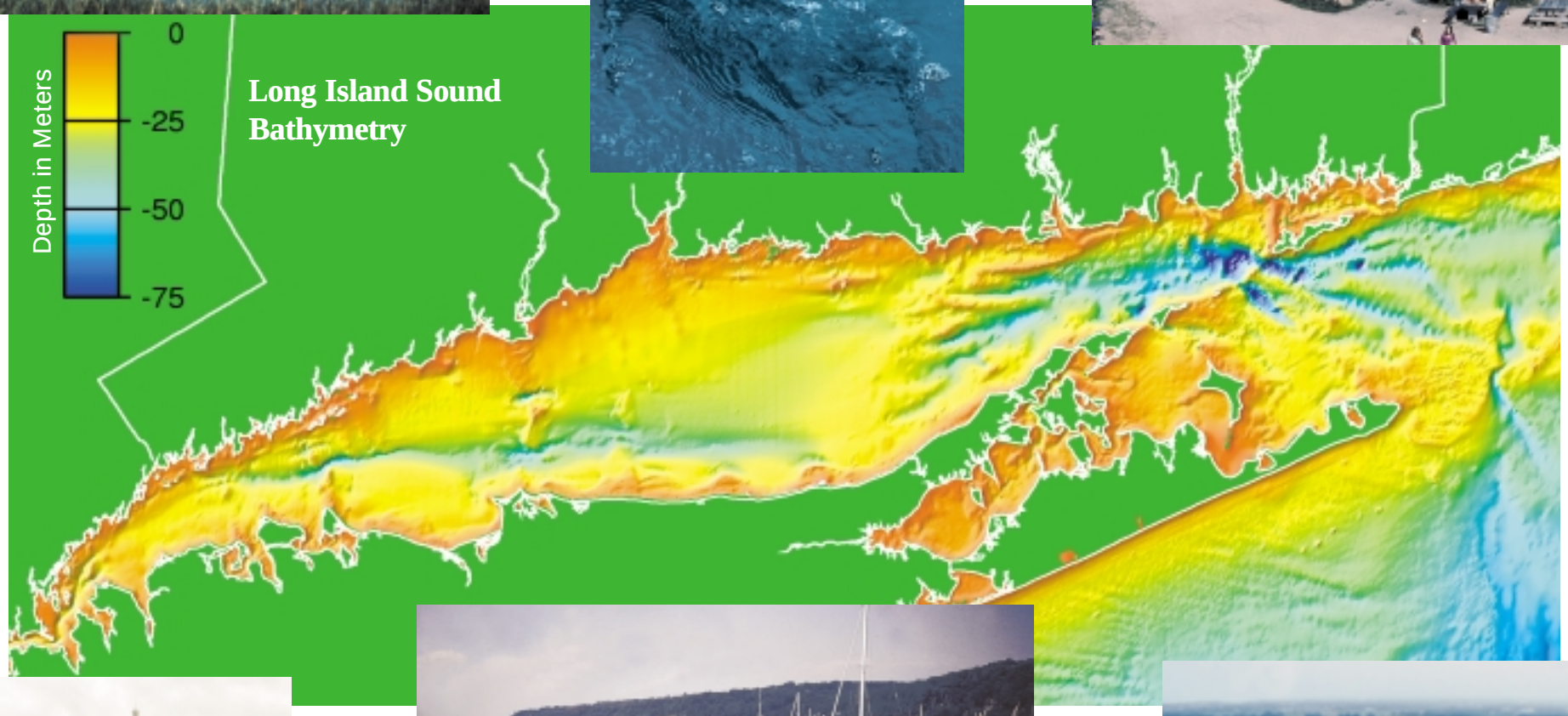

Richard Signell, USGS, Woods Hole

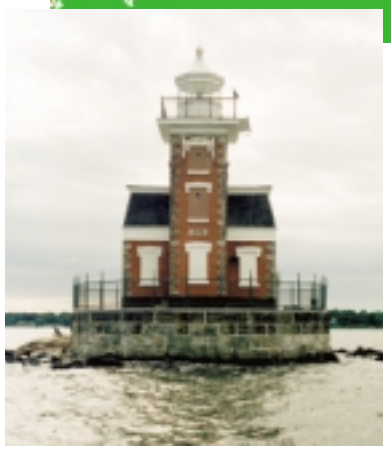

Photo by Peter Sattler

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STATUS AND TRENDS IN THE HEALTH OF LONG ISLAND SOUND

SOUND HEALTH 2001

Long Island Sound's Health

Long Island Sound is an estuary, a place where salt water from the ocean mixes with fresh water from rivers draining from the land. Like other estuaries, Long Island Sound abounds in fish, shellfish, and waterfowl. It provides feeding, breeding, nesting, and nursery areas for diverse animal and plant life.

Long Island Sound also supports many recreational and commercial uses. More than 8 million people live in the Long Island Sound watershed and millions more flock yearly to the Sound for recreation. More than $5 billion is generated annually in the regional economy from boating, commercial and sport fishing, swimming, and beachgoing. The ability of the Sound to support these uses is dependent on the quality of its waters, living resources, and habitats.

An Estuary of National Significance

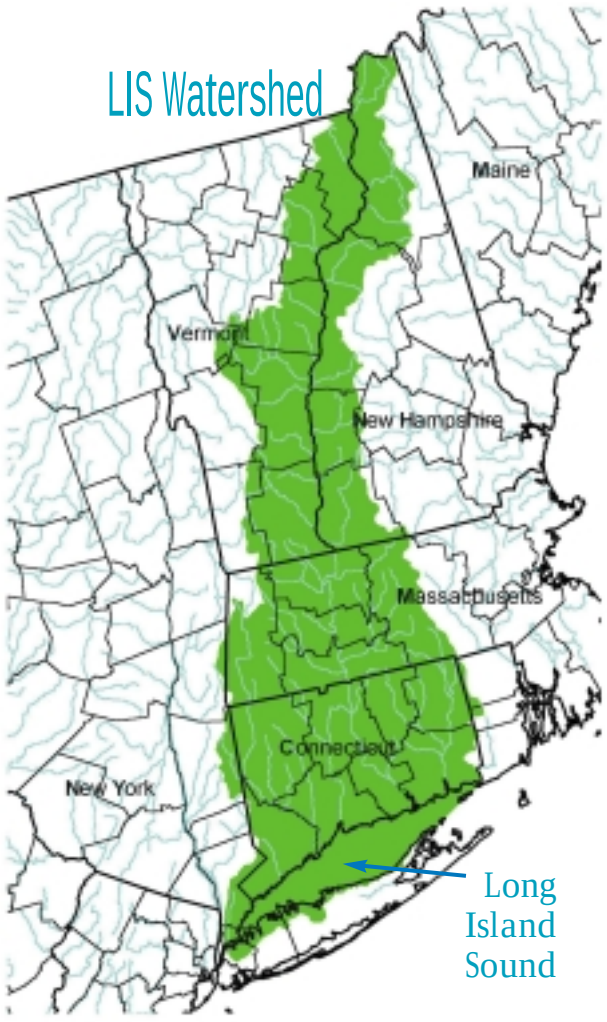
In 1985 the federal government and the states of Connecticut and New York initiated the Long Island Sound Study (LISS), a landmark cooperative endeavor designed to analyze and correct the Sound's most pressing environmental problems. In 1987, under the National Estuary Program (NEP) established by Congress, the Long Island Sound was designated an "Estuary of National Significance."

Collectively known as the LISS Management Conference, stakeholders representing citizen and environmental groups, businesses and industries, academic institutions, and local, state, and federal governments, are working together to implement the Comprehensive Conservation and Management Plan (CCMP) of 1994 to protect and preserve this vital estuary.

The Management Conference identified seven issues that merit special attention: (1) low dissolved oxygen (hypoxia), (2) toxic contamination, (3) pathogen contamination, (4) floatable debris, (5) living resources and habitat management, (6) land use and development, and (7) public involvement and education. The CCMP includes 232 action items that provide the framework for federal, state, local, academic, and citizen partners to combine their efforts to address these issues and achieve a common vision for the long-term health, restoration, and economic well-being of Long Island Sound, its watershed, and tributaries.

From colonial times until fairly recently, many uses of Long Island Sound and the surrounding watershed were made without considering the environmental impact on this great body of water. Since the federal Clean Water Act became law in 1972, investments in water pollution control programs have led to measurable improvements in water quality, in spite of increasing numbers of people and activities on the Sound and within its watershed. Obvious sources of pollution are now regulated and controlled through permit programs, tidal wetlands are protected, and major efforts to build and improve sewage treatment plants and control industrial discharges have helped to restore degraded waters.

It's important to assess, on an ongoing basis, just how effective these efforts have been. Is the water cleaner and safer to swim in? Are contaminant concentrations decreasing? Are habitats being protected and restored? Are the fish and shellfish more abundant (and safe to eat)? Just what is the state of the ecological resources of Long Island Sound? And what new threats may be emerging from contaminants or impacts that we currently know little about? Under a new initiative, the Long Island Sound Study (LISS) is working to develop indicators of the health of the Sound to answer these kinds of questions.



EPA, Office of Wetlands, Oceans, and Watersheds

Sound Health 2001 highlights water quality conditions, the status of living resources that call the Sound home, trends in land use and development, and other indicators of environmental health. By providing a snapshot of current conditions and trends, **Sound Health 2001** helps to assess the effectiveness of efforts to deal with issues such as nitrogen pollution, sediment contamination, habitat restoration, and the health and abundance of living resources.

Trying to briefly summarize the health of a body of water 110 miles in length is risky. Short sound bites (no pun intended) cannot capture the geographic variability of Long Island Sound. In addition, good news (reductions in nitrogen and toxic contaminant discharges) and bad news (a troubling die-off of lobsters) are part of the same, complex story. By putting the pieces side by side, we can better appreciate the complexity of the Sound and think about the links among issues.

We hope this report will pique your interest in further exploring Long Island Sound and its watershed and in making changes in your everyday life that will help the clean-up effort. Long Island Sound is a valuable resource - understanding how your activities can affect it will help us to restore and protect it.

If you are interested in obtaining more information, full citations for the data and findings contained in this summary are provided at **www.epa.gov/region01/eco/lis**.

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ECOSYSTEM INDICATORS

Environmental indicators are specific, measurable markers that help assess the condition of the environment and how it changes over time. Both sharp changes and general trends in the values of those markers can indicate improved or worsening environmental health. The LISS has developed a series of indicators to answer the following questions:

1 Are the Waters and Sediments Getting Cleaner?

Hypoxia

- Dissolved Oxygen Levels
- Biological Nutrient Removal (BNR)
- Point Source Nitrogen Loads
- Chlorophyll-a Levels

Toxic Contaminants

- End-of-Pipe Toxicity
- Industrial Chemical Discharges
- Contaminant Trends in Mussels
- Contaminants in Sediments

Pathogens

- Beach Closure Days

2 Are Fish and Wildlife Populations More Abundant?

Shellfish

- Oyster Harvest
- Lobster Landings

Finfish

- Bluefish, Winter Flounder, and Tautog Abundance

Coastal Birds

- Osprey Nesting Adults
- Plover and Least Tern Populations

3 Are Fish and Wildlife Habitats Being Protected and Restored?

- Miles of Stream Accessible to Anadromous Fish
- Acres of Tidal Wetlands Restored
- Acres of Inland Wetlands

4 How is the Landscape Changing Due to Human Activities?

- Forest Cover
- Watershed Population Levels

SOME FACTS ABOUT LONG ISLAND SOUND

- Long Island Sound is an estuary, a place where salt water and fresh water mix. Unlike other estuaries, it's open at both ends - through The Race to the Atlantic Ocean at the eastern end and through the East River and New York Harbor at the western end.

- Salt water flows into the Sound from the Atlantic Ocean. Approximately 90 percent of its freshwater comes from three major rivers in Connecticut: the Thames, the Housatonic, and the Connecticut.

- Long Island Sound's east-west orientation makes it unusual among estuaries. Most large estuaries in the North Atlantic are oriented north-south.

- It is bounded by the state of Connecticut and Westchester County, New York, on the north and by Long Island on the south. Long Island Sound is 110 miles long (east to west) and about 21 miles across at its widest point, with mid-Sound depths between 60 and 120 feet.

- The average depth of the Sound is a shallow 65 feet. If dropped into the Sound at this depth, the Statue of Liberty would still have 86 feet exposed above the water, and that's without its 150-foot granite base.

- Long Island Sound has a water surface of 1,268 square miles and a volume of 2.19 trillion cubic feet, which is about 67 billion tons or 18 trillion gallons of water.

- The Sound's watershed, which is all the land from which water drains into the Sound, extends into Canada, and covers an area of about 16,000 square miles. About 11,000 square miles (71 percent) of the watershed is in the drainage basin of the Connecticut River.

- The Long Island Sound watershed is inhabited by more than 8 million people. Any pollutants entering the water as a result of human activities in the watershed can ultimately harm Long Island Sound.

- The 82 sewage treatment plants in Connecticut and 23 in New York that discharge into the Sound or its tributaries contribute more than a billion gallons of treated effluent each day.

Photo by CT DEP

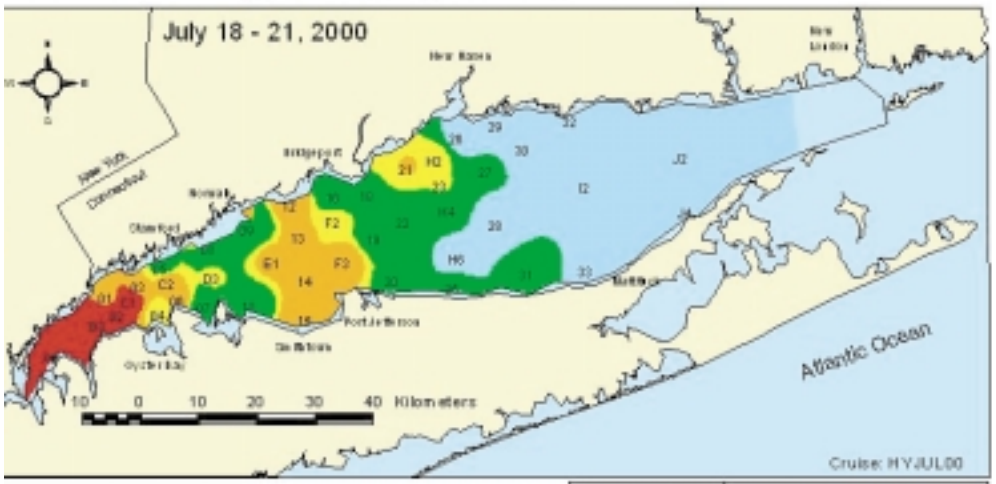
Are the Waters and Sediments Getting Cleaner?

HYPOXIA

Dissolved oxygen levels in water are often used to gauge the overall health of the aquatic environment. When dissolved oxygen levels in the bottom water layer of the Sound are low (a condition called hypoxia) to non-existent (anoxia), then the survival, reproduction, or use of an area by living marine resources is impaired. This can affect commercially-valuable marine species by depleting their food sources or impairing their development due to stress caused by inadequate oxygen concentrations.

From mid-July through September, Long Island Sound and many of its aquatic inhabitants suffer from hypoxia. During this period, oxygen levels in the bottom waters of Long Island Sound fall to levels inadequate to support healthy populations of aquatic life.

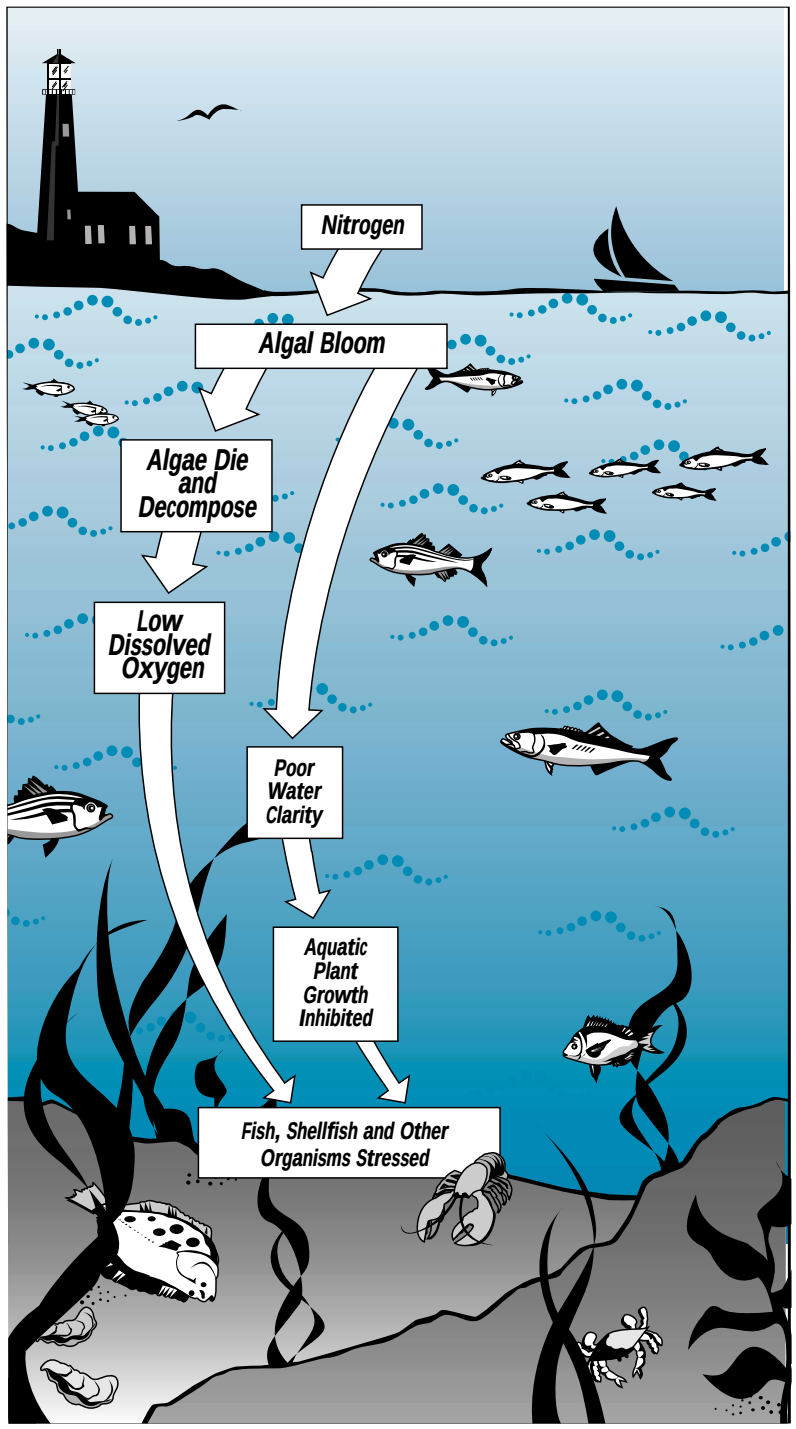
Dissolved Oxygen in Long Island Sound Bottom Waters



Dissolved oxygen levels in bottom waters in July 2000. The western portion of Long Island Sound exhibited hypoxic levels during this period. CT DEP, LIS Water Quality Monitoring Program

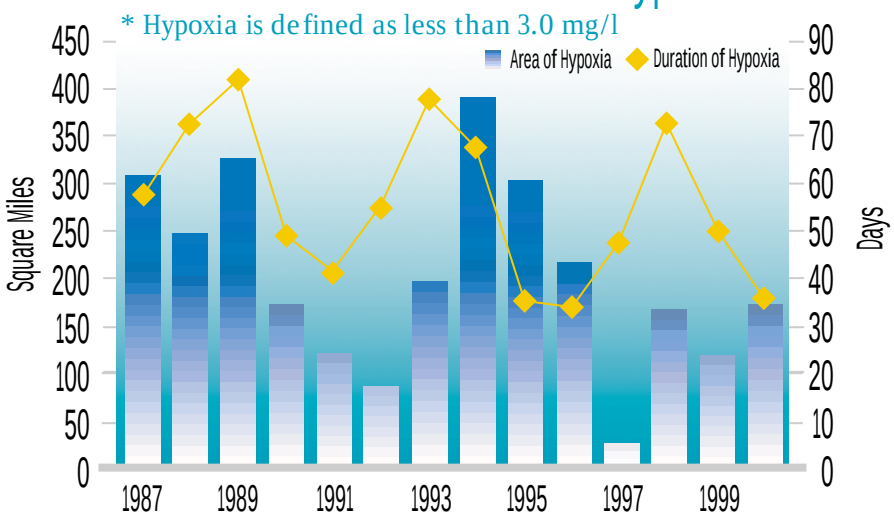
Hypoxia is a symptom of a larger problem, the over-fertilization of the Sound with nutrients, primarily nitrogen. While nitrogen is a necessary nutrient in a productive ecosystem - a building block for plant and animal tissue - too much nitrogen fuels the excessive growth of planktonic algae (floating plants). The dense algae blooms cloud the water and shade the bottom. When the algae die and settle to the bottom of the Sound, they are decayed by bacteria, a process that uses up available oxygen. Oxygen in short supply impairs the feeding, growth, and reproduction of the Sound's aquatic life. In extreme conditions, some organisms may suffocate and die, while others flee the hypoxic zones. The dense blooms also prevent enough light from reaching shallow water bottoms to support the growth of submerged aquatic vegetation, an important habitat for shellfish and juvenile fish. As a result, nitrogen - in excess - impairs the function and health of Long Island Sound.

Effects of Excess Nitrogen



Since 1990, the LISS has been implementing a phased plan to improve oxygen levels in the Sound by reducing nitrogen loads. In 1998, LISS adopted a 58.5 percent reduction target for nitrogen loads from human sources to the Sound over 15 years, with five and ten-year interim targets to assure steady progress. The states of Connecticut and New York are working to achieve the target through upgrades to sewage treatment plants, watershed restoration strategies to control nitrogen runoff, and reductions in nitrogen oxide emissions to the air. As a result, nitrogen discharges to Long Island Sound have decreased, reducing algae growth, and improving oxygen levels.

Maximum Area and Duration of Hypoxia*



CT DEP, LIS Water Quality Monitoring Program

Dissolved Oxygen Levels

The severity of hypoxia depends on the area affected, how long the condition persists, and how low the oxygen levels dip. Weather conditions influence the severity of hypoxia from year to year, but taken together, in terms of area, duration, and intensity, the severity of hypoxia has decreased since the late 1980s. Continued monitoring is necessary to observe how the Sound will respond to continued reductions in nitrogen.

The maximum area of hypoxia has averaged 206 square miles from 1987 through 2000, with a low of 30 square miles in 1997 and a high of 395 square miles in 1994. The duration of hypoxia has averaged 56 days during that same period, with a low of 34 days in 1996 and a high of 82 days in 1989.

Biological Nutrient Removal (BNR)

The dominant source of human-caused nitrogen loadings is from sewage treatment plants (STPs). Historically, conventional STPs removed oxygen-demanding solids from the wastewater. Now, STPs are being upgraded using an advanced technology called biological nutrient removal (BNR) to also remove nitrogen from the wastewater.

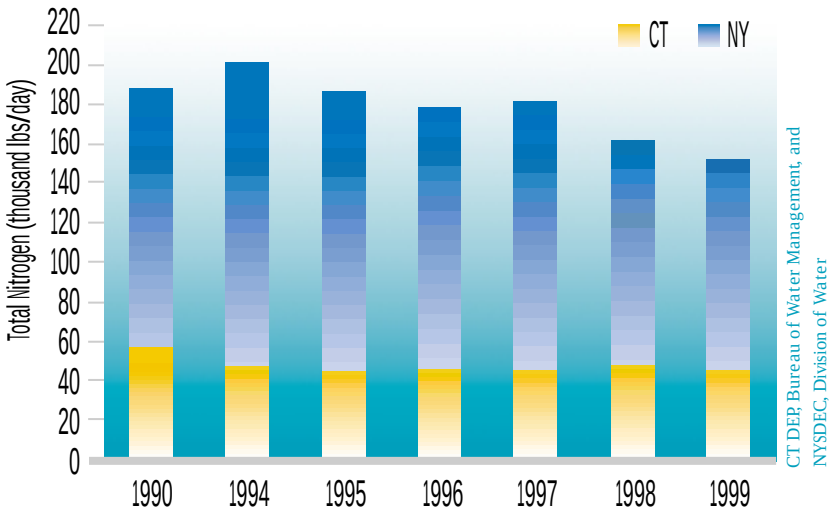
Since 1990, 25 percent of the STPs have been upgraded to include BNR. In some cases, BNR can be added to existing STPs with minor modifications and at a low cost. However, to achieve the ambitious levels of nitrogen reduction needed to alleviate hypoxia, many STPs will need to be reconstructed at a cost of several hundred million dollars.

BNR Treatment

EPA New England

* There are 105 STPs in Connecticut and New York that discharge into the Sound or its tributaries. BNR systems to remove nitrogen are being phased in at selected STPs.

Point Source Nitrogen Load



CT DEP, Bureau of Water Management, and NYSDEC, Division of Water

Point Source Nitrogen Loads

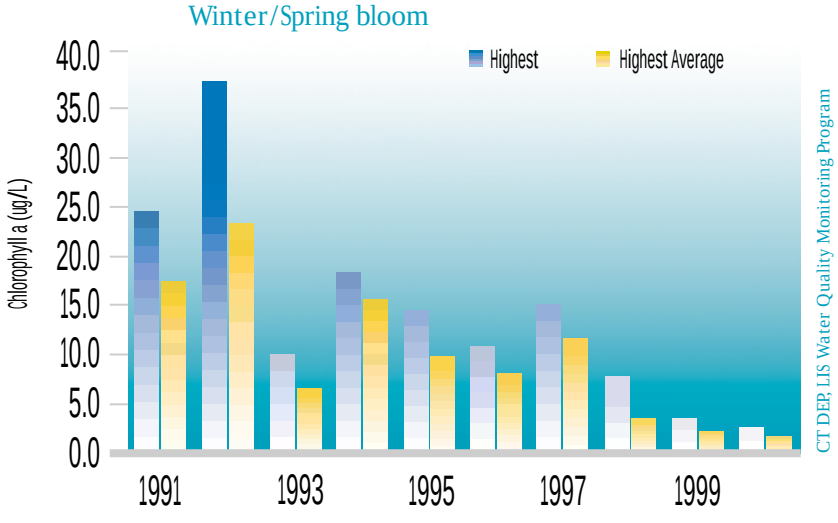
As a result of BNR upgrades to STPs, there has been a reduction of 19.2 percent in nitrogen loading to Long Island Sound from STPs over the past ten years.

Chlorophyll-a Levels

The concentration of chlorophyll-a, the green pigment in phytoplankton, is used to measure the levels of phytoplankton in surface water. Reducing the amount of nitrogen entering the Sound is expected to reduce chlorophyll-a levels, improve water clarity, and increase oxygen levels. For western Long Island Sound, the most sensitive region of the Sound, chlorophyll-a levels during the winter/spring bloom declined from 1991-2000.

Chlorophyll-a in Western LIS

Winter/Spring bloom



CT DEP, LIS Water Quality Monitoring Program

SOUND HEALTH 2001

TOXIC CONTAMINANTS

Humans have used Long Island Sound as a resource and a disposal site since industrialization began. Measurable quantities of contaminants exist in sediments dating back to the mid-1800s. Quantities of some have increased over time, new contaminants have been added, and amounts of some have decreased in response to regulatory action. Toxic chemicals enter Long Island Sound from sources such as manufacturing processes, household cleaning and pest control products, automobile exhausts, and emissions from fossil fuel power plants. Stormwater pipes carry contaminants washed from roads, parking lots, disturbed land, and construction sites. Rivers and streams transport contaminants from the watershed into Long Island Sound.

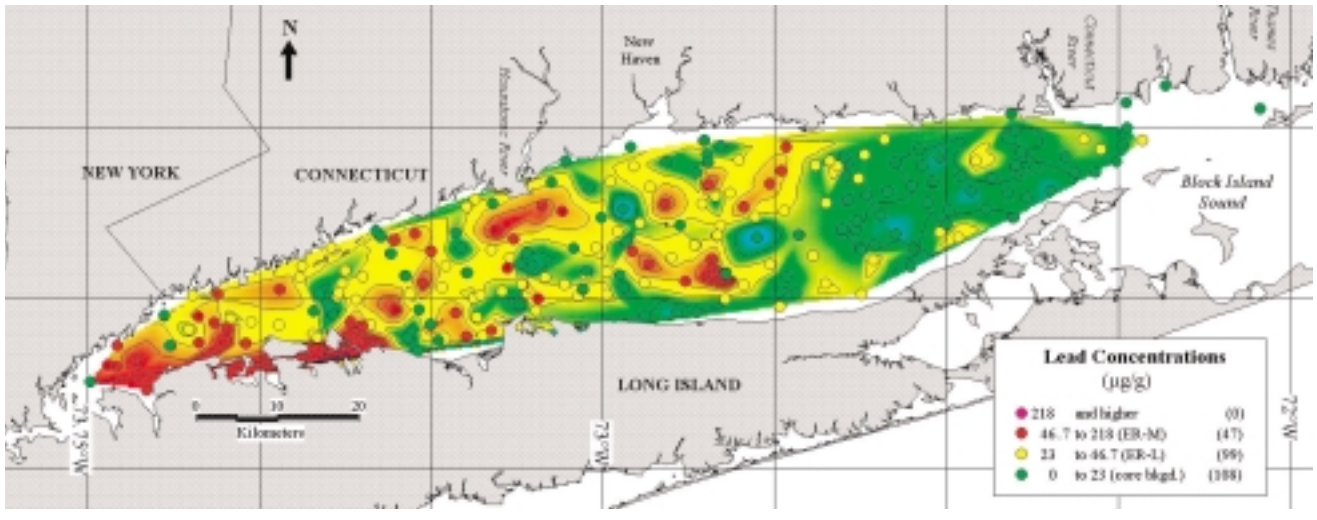
Potentially toxic substances, both naturally-occurring and human-generated, can cause adverse ecosystem or human health risks when exceeding certain concentrations. These substances include trace metals (chromium, copper, lead, mercury, silver, arsenic, zinc) and organic compounds such as PAHs (polycyclic aromatic hydrocarbons), PCBs, and pesticides (such as DDT, chlordane, and atrazine).

Many contaminants become associated with particles suspended in the water. These particles then settle to the bottom, accumulating the contaminants at higher concentrations in the sediments than in the overlying waters. However, contaminants are not uniformly distributed throughout the Sound. Contaminants accumulate in areas of weak currents, large sediment inputs, and little sediment reworking. Areas where strong bottom currents stir up the bottom tend to have less sediment accumulation and lower contaminant concentrations.

As particles settle to the bottom of the Sound, they create a reservoir of contaminants that can harm marine life living or feeding near sediments. Fish and shellfish can, in turn, accumulate toxic contaminants, posing a human health risk. Public health advisories are published to inform consumers about potential risks from eating large amounts of seafood that contain higher chemical levels.

Today, the major sources of toxic chemicals to Long Island Sound are STPs, industrial discharges, urban stormwater, and atmospheric deposition. Federal and state programs strive to reduce toxic chemical discharges to the Sound and to minimize the toxicity of effluents from sewage treatment plants and industries.

Lead in Surface Sediments



Mecray, E.L. and M.R. Buchholtz ten Brink, 2000, "Contaminant Distribution and Accumulation in the Surface Sediments of Long Island Sound", Journal of Coastal Research, v. 16, no. 3, p. 575-590.

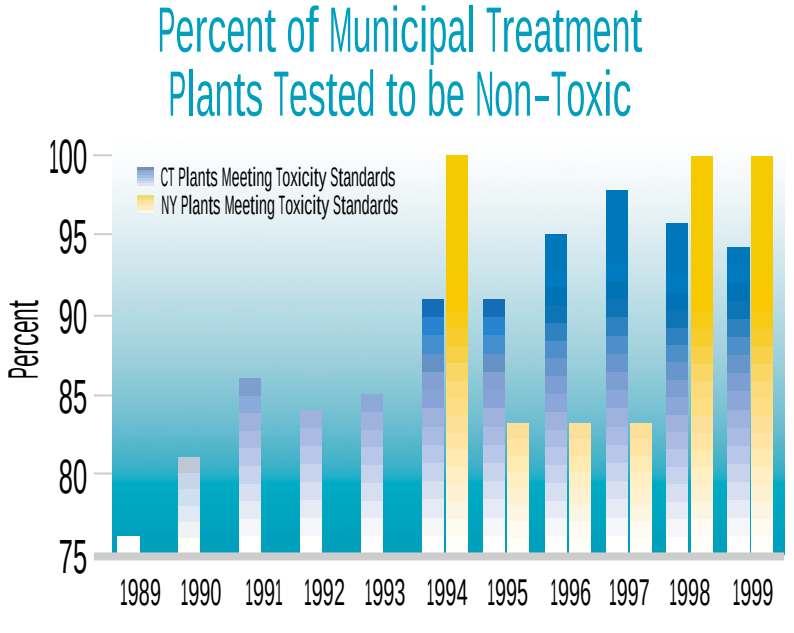
The concentrations of lead and other metals in bottom sediments are generally higher in the western Sound and lower in the bottom-scoured regions of the eastern Sound. This is primarily due to both the location of pollutant sources and the westward transport of contaminants associated with fine-grained particles.

End-of-Pipe Toxicity

Tests are conducted to measure the effects of chemicals and identify facilities that are discharging potentially toxic effluents to waterways. Connecticut requires toxicity testing at STPs throughout the state. New York State requires toxicity testing when appropriate to adequately protect aquatic life.

In 1989, the effluent from 76 percent of Connecticut STPs tested was non-toxic. In 1999, 94 percent were non-toxic, a 75 percent reduction in the number of facilities discharging a potentially toxic effluent. In 1998 and 1999, no New York municipal treatment facilities discharging to the Sound exhibited toxicity.

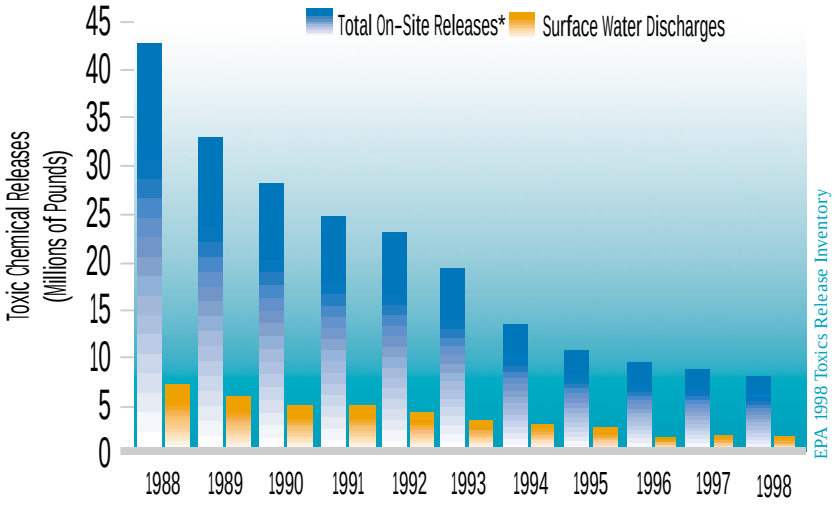
Percent of Municipal Treatment Plants Tested to be Non-Toxic



CT DEP, Bureau of Water Management, and NYSDEC, Division of Water

TRI Data

CT/NY Industries in LIS Watershed



* Total On-Site Releases include total air emissions, other on-site land releases, and surface water discharges.

Industrial Chemical Discharges

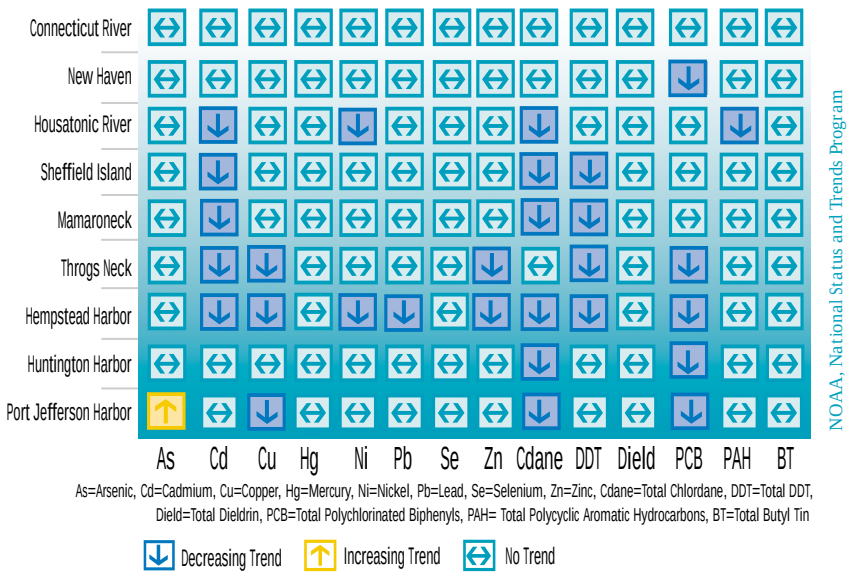
The Emergency Planning and Community Right to Know Act of 1986 requires facilities in the United States to report releases to the environment of more than 600 designated toxic chemicals. The U.S. Environmental Protection Agency (EPA) maintains the Toxics Release Inventory (TRI), a national database that identifies the chemicals manufactured and used at industrial facilities and the annual amounts of these chemicals released in waste. Seven new industrial sectors, in addition to the manufacturing industry, began reporting for the first time in 1998. The newly included sectors are electric utilities, coal mining, metal mining, chemical wholesalers, petroleum bulk plants and terminals, solvent recovery, and hazardous waste treatment, storage, and disposal. In addition, in 1999, EPA lowered the reporting thresholds for certain persistent toxic chemicals and certain other chemicals were added to the list of toxic chemicals. The major portion of the TRI consists of releases to air. Overall, toxic releases in the Sound's watershed have declined relative to the late 1980s. This is consistent with toxic releases throughout the country.

Contaminant Trends in Mussels

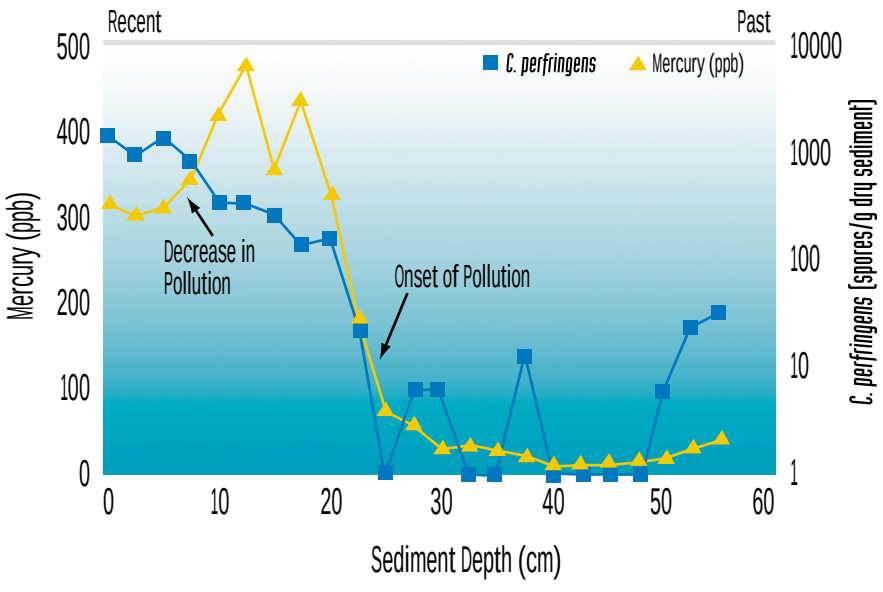
Since 1986, the National Status and Trends Mussel Watch Program has monitored chemical contaminants in bivalve mollusks. Concentrations of chemicals in mussels are related to the levels of chemicals in the water that they inhabit and in the food that they filter from the water. Decreased chemical concentrations in the water and in food sources will result in decreased concentrations in mussels.

On the whole, levels of metals (copper, nickel, lead, and zinc) and organic compounds in mussels have declined. Contamination is decreasing at many sites for chemicals whose use has been banned (chlordane, DDT, PCBs) or severely curtailed (cadmium). With the exception of arsenic in Port Jefferson Harbor, no chemical has increased in concentration in the monitored harbors in Long Island Sound.

Contaminant Trends in Mussels



Mercury Concentrations in Sediment



Varekamp, J.C., M.R. Buchholtz ten Brink, E.L. Mecray, and B. Kreulen, 2000, "Mercury in Long Island Sound Sediments", Journal of Coastal Research, v. 16, no. 3, p. 613-626.

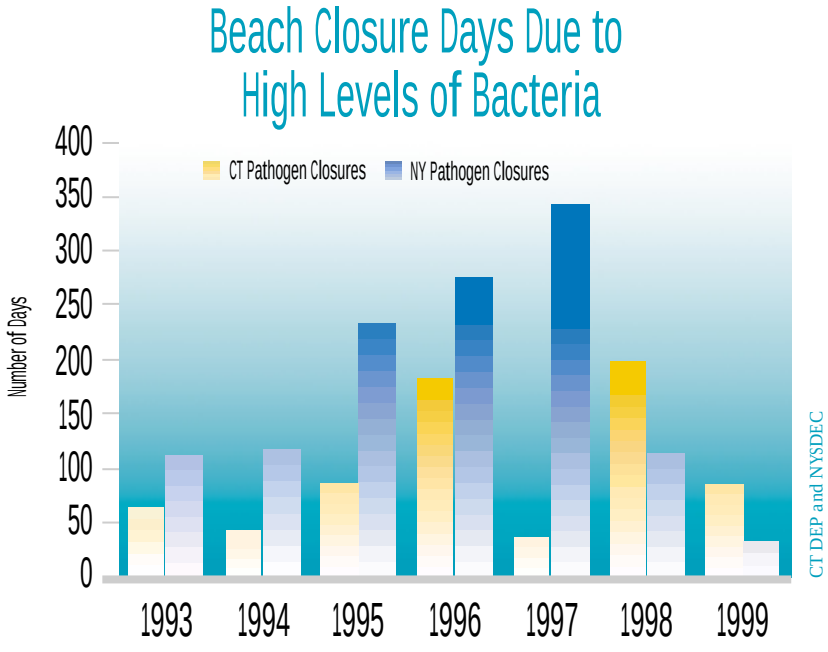
Contaminants in Sediments

Human activities over the last 400 years have affected the water and sediment quality of Long Island Sound. Sediment cores provide a history of contaminant inputs resulting from changes in the watershed. Surface sediments reflect recent condition; deeper sediments reflect past conditions. Many contaminants increased in the sediment of the Sound with increasing population and industrialization of the watershed. More recently, however, pollution controls and changes in manufacturing trends have decreased the amount of contaminants discharged in Long Island Sound and have resulted in decreased concentrations of contaminants in the surface sediments.

Mercury concentrations in the upper 10-15 cm of sediment have decreased, reflecting reductions in mercury sources in recent decades. C. perfringens, an indicator of sewage-derived pollution, mirrors the continued increases in population around the Sound.

PATHOGENS

Pathogens, which are disease-causing bacteria and viruses, can enter Long Island Sound from inadequately treated human sewage and domestic and wild animal wastes. Some of the primary sources of pathogens to the Sound are older sewer systems that have combined stormwater and sanitary systems that overflow during rainfalls (called combined sewer overflows), failing septic systems, illegal connections to storm sewers, STP malfunctions, and vessel sewage discharges. To protect public health, beaches are periodically closed, and many of the Sound's prime shellfish beds are closed, due to indications of pathogen contamination. People can become sick by swimming in waters contaminated by pathogens or by eating raw or partially cooked shellfish that contain pathogens. As a result, pathogen contamination can seriously affect the region, economically and socially.



CT DEP and NYSDEC

Yearly variations are a product of rainfall patterns and incidents such as sewer-line ruptures. In 1999, the relatively dry summer led to significantly fewer closings than in previous years.

Beach Closure Days

There are 240 monitored beaches along Long Island Sound (131 in Connecticut and 109 in New York) that provide valued recreational opportunities. Combined sewer overflows and stormwater runoff associated with rainfall events are the major causes of beach closures. As a result, the number of days beaches are closed to swimming increases with increased rainfall. Over time, however, the number of beach closure days can be used to assess the effectiveness of pathogen control activities, such as:

- abatement of combined sewer overflows;
- control of stormwater runoff and other nonpoint pollution; and,
- minimizing mechanical breakdowns in sewer systems and STPs that result in releases of untreated sewage.

Are Fish and Wildlife Populations More Abundant?

The coastal environs of Long Island Sound represent a unique and highly productive ecosystem. A diverse array of living resources ranges from microscopic plants and animals that drift with the currents to seaweeds and economically important finfish, shellfish, and crustaceans. Many other types of wildlife, such as birds, sea turtles, and marine mammals, spend all or part of their lives in the Sound, on its shores, or in its watershed.

The abundance and diversity of living resources such as oysters, clams, lobsters, finfish, and birds are indicators of ecosystem health and human impact. These organisms respond to environmental conditions, habitat availability, and disease. These living resources contribute billions of dollars to the regional economy through commercial and recreational fishing. Moreover, the opportunity to observe and appreciate the Sound's plants and animals is in itself an enjoyment for millions of the region's residents and visitors.

SHELLFISH

Long Island Sound produces some of the finest shellfish in the country. More than 60,000 acres of shellfish grounds are cultivated in Connecticut's coastal water by the aquaculture industry with additional acres cultivated in New York. Although oysters are the dominant commercial shellfish resource in the Sound, commercial and recreational shellfishers also harvest hard clams (or quahogs), soft-shell clams (or steamers), bay scallops, blue mussels, surf clams, and razor clams.

Photo by CT DEP

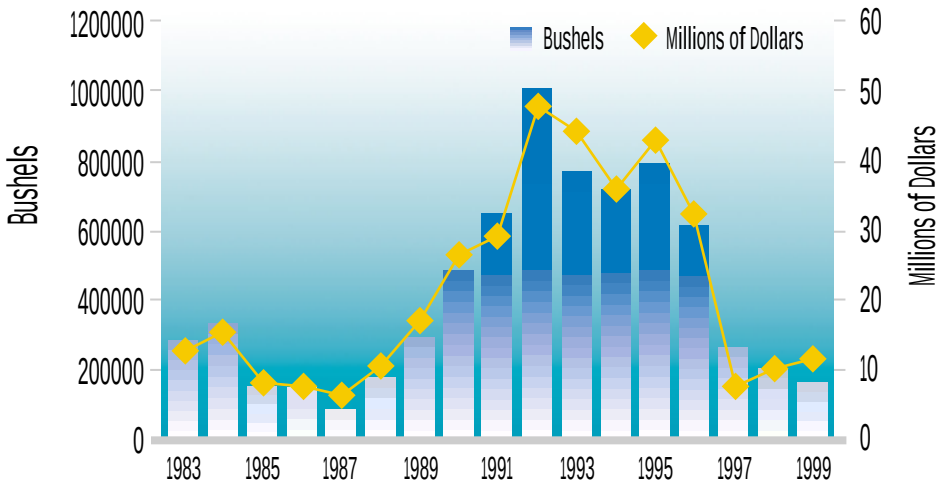
Oyster Harvest

Oyster farming developed into a major industry in the Sound by the late 19th century. Today, after a long period of decline, the Sound's oyster industry is once again one of the largest in the nation. The Sound's oysters are marketed throughout the country, and their high quality commands a premium price. The oyster is, by far, the most economically important shellfish harvested from Long Island Sound. The volume of oyster and other shellfish harvests is indicative, in part, of improved water quality and successful oyster culture practices.

Today, disease is the number one threat to oysters. Since 1997, two parasitic diseases, MSX and Dermo, have decimated the oyster. MSX kills juvenile oysters, while Dermo kills adult oysters before they are big enough to reproduce or be harvested. Nevertheless, oysters continue to endure changing conditions in the Sound. Officials, scientists, and citizens are working together to develop oyster habitats, such as constructed reefs, as well as disease-resistant oysters.

Photo by CT Department of Agriculture

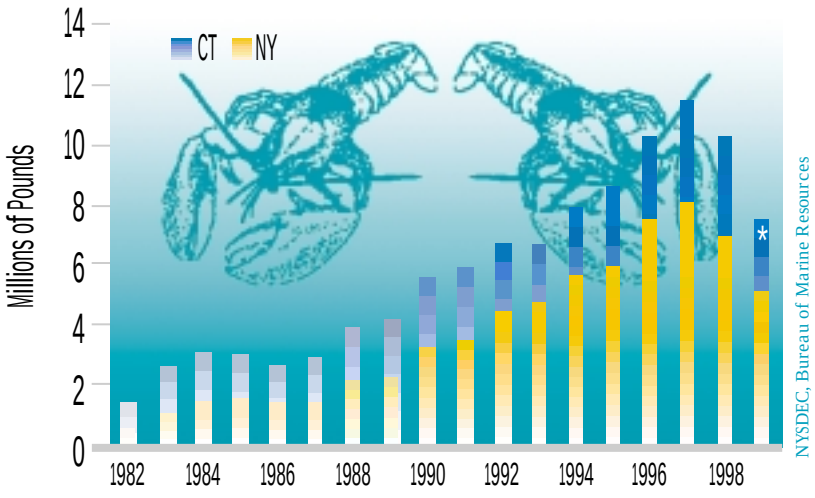
Oyster Harvest and Value



CT Department of Agriculture, Bureau of Aquaculture, and NYSDEC Shellfisheries Division

The oyster harvest peaked in 1992 and has declined since mainly due to disease outbreaks.

Lobster Landings



NYSDEC, Bureau of Marine Resources

* Includes projected lobster catch for New York

Over the past two decades, there had been a tremendous increase in lobster landings, with the peak occurring in 1997. However, over the last two years, a die-off of lobsters, most severely in the western Sound, has reduced the harvest.

Lobster Landings

The American lobster is one of the most important and valuable seafood products harvested in New York and Connecticut. Long Island Sound's lobster fishery was the third largest in the country behind Maine and Massachusetts, earning a dockside value in New York alone of over $29 million in 1998.

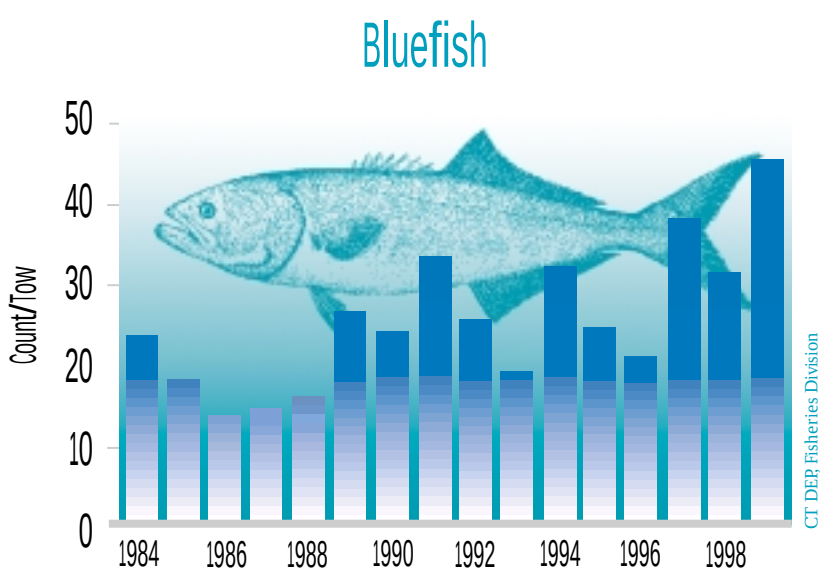
However, the health of the Long Island Sound lobster industry is now in question. Lobster fishermen and dealers began reporting dead and dying lobsters in their gear in the western third of Long Island Sound in mid-September of 1999. Continuing through 1999 and 2000, the die-off was unprecedented in scope and catastrophic to the lobster fishery. To make matters worse, over the past few years, the incidence of shell disease, in which bacteria forms a black mass that rots through the shell, had increased in lobsters from eastern Long Island Sound. In response, the federal government, Connecticut, and New York have provided funds for economic assistance and research.

Scientists are unsure what is causing the lobsters to die in the western Sound, but University of Connecticut scientists found that all the dead lobsters had the same protozoan parasite called *Paramoeba*. Part of solving the lobster mystery will be to research whether changes in weather conditions (such as storms or average temperature fluctuations), pollutants in the water or sediments, hypoxia (lack of oxygen), dietary change, or management practices (such as dredging and pesticide applications) could have weakened the animals so that they became susceptible to disease and parasites. Research is underway to determine the long-term effect on the lobster fishery and on the Long Island Sound ecosystem as a whole.

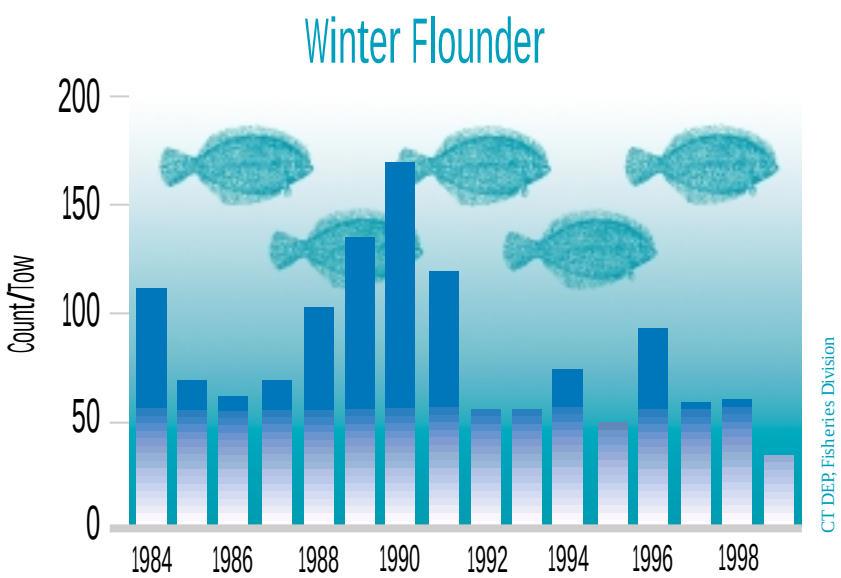
FINFISH

In the late 1980s and early 1990s, marine fish stocks plummeted in Long Island Sound. All of the principal species supporting the recreational and commercial fisheries of the Sound were considered overfished. These included bluefish, striped bass, winter flounder, fluke, scup, tautog, and weakfish. These fish comprise 95 percent of the species sought by anglers and commercially-licensed seafood producers. All of the species listed are now managed by the Atlantic States Marine Fisheries Commission. A combination of environmental conditions leading to improved recruitment (the number of young produced per year) for some species and fishery management measures to limit exploitation and rebuild stock for others has helped “turn the corner” for Long Island Sound fishery productivity. However, there still remains a great deal of work to be done to improve fish stocks.

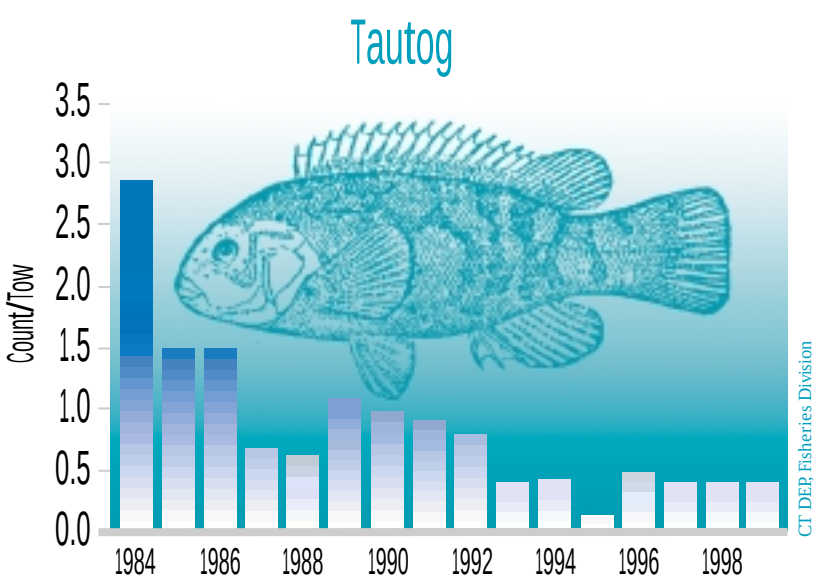
Bluefish, Winter Flounder, and Tautog Abundance



Bluefish are one of the more highly migratory of Long Island Sound’s principal fishery resources. Availability of prey in the Sound, exploitation elsewhere, and oceanography all have a substantial effect on the abundance and distribution of bluefish and their availability in the Sound. Currently, the bluefish is considered overfished throughout its range and additional management options are being considered.



Winter flounder is a commercially and recreationally important species that resides in Long Island Sound waters. Winter flounder was severely overfished in the 1980s. The fishery has been recovering in response to restrictive management measures. While stocks have shown modest improvement in the last three years, they remain far below the long-term average.



Tautog, or blackfish, find the rocks and boulders left by glacial deposition in Long Island Sound an ideal "reef" habitat. Continuing low tautog counts indicate that the species has not yet responded to more stringent management measures that were implemented in 1997.

FISH CONSUMPTION ADVISORY

This advisory refers to sport fish that people catch. It does not apply to fish bought in stores. Due to the possibility that ingested fish will have elevated concentrations of contaminants, the following marine organisms have consumption advisories issued by the NYS Department of Health and CT Department of Public Health:

Marine Bluefish and Eels—

NY: Eat no more than one meal per week of bluefish or eels. (PCB contamination) CT: Bluefish 13-25" - Eat no more than one meal per month. Bluefish over 25" - Eat no more than one meal per 2 months; high risk group (women of childbrearing age, pregnant women, and children under 6) should not eat bluefish over 25". Eels: Do not eat eels.

Marine Striped Bass—

NY: Women of childbearing age and children under 15 should not eat striped bass taken from Long Island Sound west of Wading River. Others should eat no more than one meal per month from the above-mentioned area. Everyone should eat no more than one meal per week of striped bass taken from Long Island Sound east of Wading River. (PCB contamination) CT: High risk group should not eat striped bass. All others should eat one meal per 2 months.

Crabs and Lobsters—

CT/NY: Hepatopancreas (green meat or mustard) should not be eaten (PCB, cadmium, and dioxin contamination).
For more information, visit
www.health.state.ny.us/nysdoh/environ/fish
www.state.ct.us/dph/BCH/eech/webfsh

COASTAL BIRDS

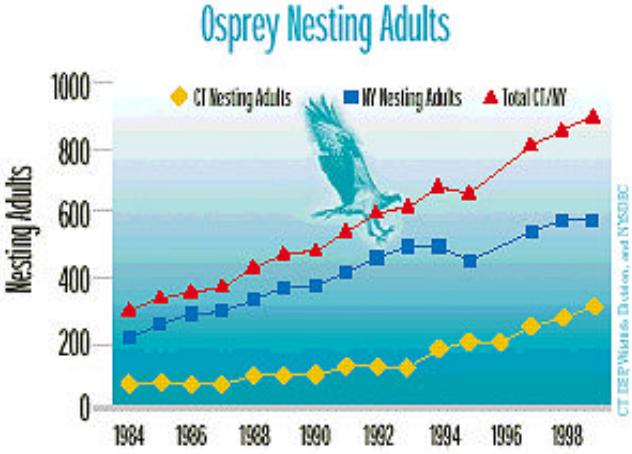
There are more than 125 species of birds, mainly waterfowl, water birds, and raptors that rely on the Long Island Sound estuary system for food and habitat. Bird populations in and near the Sound vary seasonally. In winter, birders delight at large concentrations of mergansers, scaups, scoters, mallards, black ducks, loons, cormorants, and Canada geese. Spring brings the annual migration of a wide variety of plovers, terns, sandpipers, waterfowl, herons, egrets, and songbirds. During the summer months, birds are busy tending their nests and young. Fall, once again, brings masses of birds migrating along the coast on their way to southern wintering grounds.

Photo by CT Sea Grant

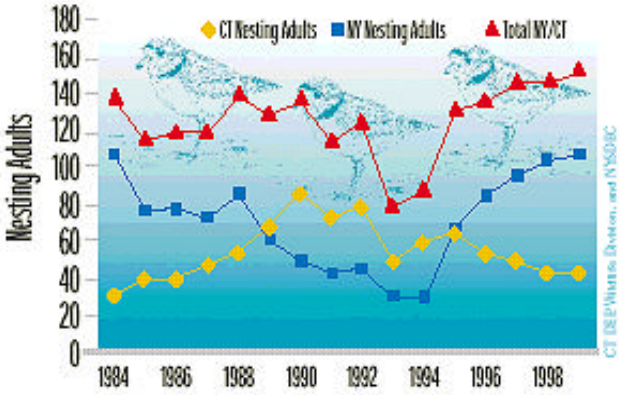
Osprey Nesting Adults

Ospreys are fish-eating birds of prey that live throughout the world. The availability of fish, water conditions, and health of the environment directly affects the health, reproduction, and nesting success of the Sound's osprey population. Ospreys are important indicators of the health and integrity of the Sound, since they are high in the marine and coastal food web.

The osprey population around Long Island Sound fell sharply during the 1950s and 1960s due to the effects of pesticides, particularly DDT. Since the ban on DDT, which occurred during the 1970s, and the placement of nesting platforms in wetlands all along the Sound, the osprey population has been making a recovery.



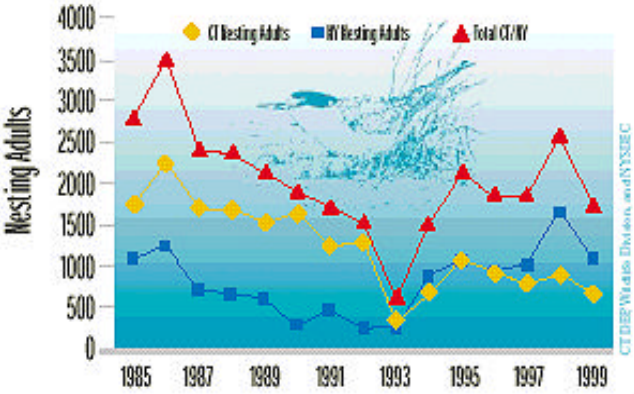
Piping Plover Nesting Adults



Piping Plover Populations

Piping plovers are small shorebirds that nest on beaches, often with least terns. Their nesting and reproduction are threatened by human intrusion, storm tides, and predators. Since protection and monitoring efforts began in 1984, nesting success has improved, resulting in more returning adults in subsequent years. The piping plover was given federal threatened species status in 1986.

Least Tern Nesting Adults



Least Tern Populations

The least tern is likely to be seen around the Sound from May to early August. They were hunted to near-extinction for the hat trade in the 1800s. Numbers rebounded after hunting was banned. More recently, disturbances, loss of habitat, and habitat degradation are affecting the population of least terns in the Sound area. The least tern population fluctuated over the last fifteen years, with relatively lower numbers present during the late 1980s and the early 1990s. Overall, between 1985 and 1997, there has been no statistically significant trend.

Least terns have been on the rebound from an all-time low of 610 birds in 1993.

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Are Fish and Wildlife Habitats Being Protected and Restored?

A habitat is a place where plants and animals live. While there is still much healthy habitat in and around Long Island Sound, the overall abundance and diversity of habitats have diminished. Incompatible human uses of the Sound and its resources since the 1700s have resulted in the loss of wetlands, eelgrass beds, and terrestrial habitats. The good news is that many habitats are now protected and restoration is occurring.

In 1998, the LISS Habitat Restoration Initiative adopted goals to restore 2000 acres of coastal habitat (e.g. dunes, inland wetlands, tidal wetlands, forests, submerged aquatic vegetation) by the year 2008. In addition, bi-state efforts are focusing on open space protection. For example, in 1999, Connecticut acquired 2,910 acres for open space at a cost of nearly $10.6 million, while assisting municipalities, land trusts, and water companies with the purchase of another 4,203 acres with $10 million through the state Department of Environmental Protection's Open Space and Watershed Land Acquisition Grant program. New York State has an Open Space Management Plan that lists the region around Long Island Sound as a priority for land acquisition.

Miles of Stream Accessible to Anadromous Fish

Anadromous fish live in the ocean but swim up rivers to reproduce in fresh water. The migration of anadromous fish such as alewives, smelt, blueback herring, American shad, and Atlantic salmon have been limited by physical barriers (including dams, culverts, tide gates, and sections of river with inadequate water volume) that block access to spawning areas. These travel routes are now being made accessible through fishways and bypasses, removal of obstacles, and altering dam releases.

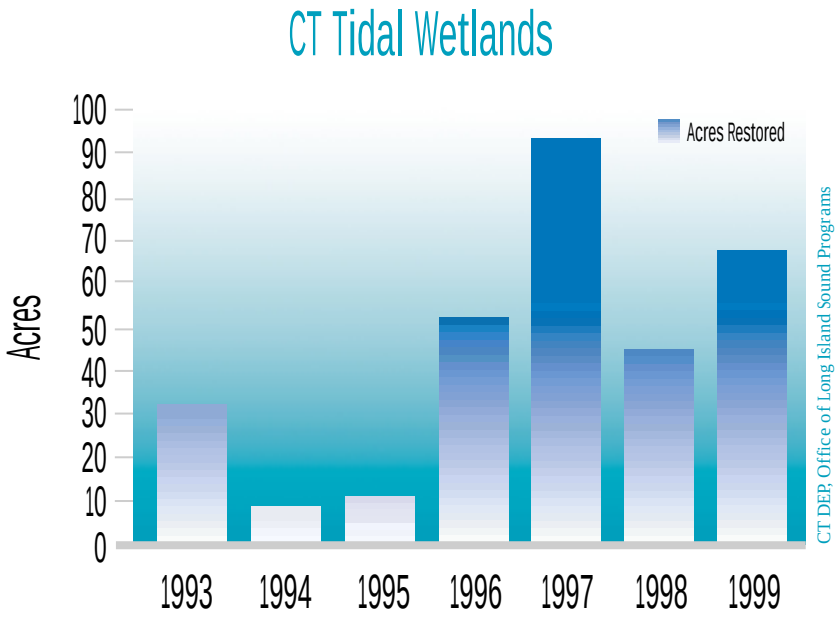
In 1998, LISS adopted a goal of restoring 100 miles of riverine migratory corridors for anadromous fish within ten years. In the past two years, 33.4 river miles have been opened to anadromous fish, leaving 66.6 miles of riverine migratory corridors to be restored by the year 2008.

Photo by Kim Zimmer

Acres of Tidal Wetlands Restored

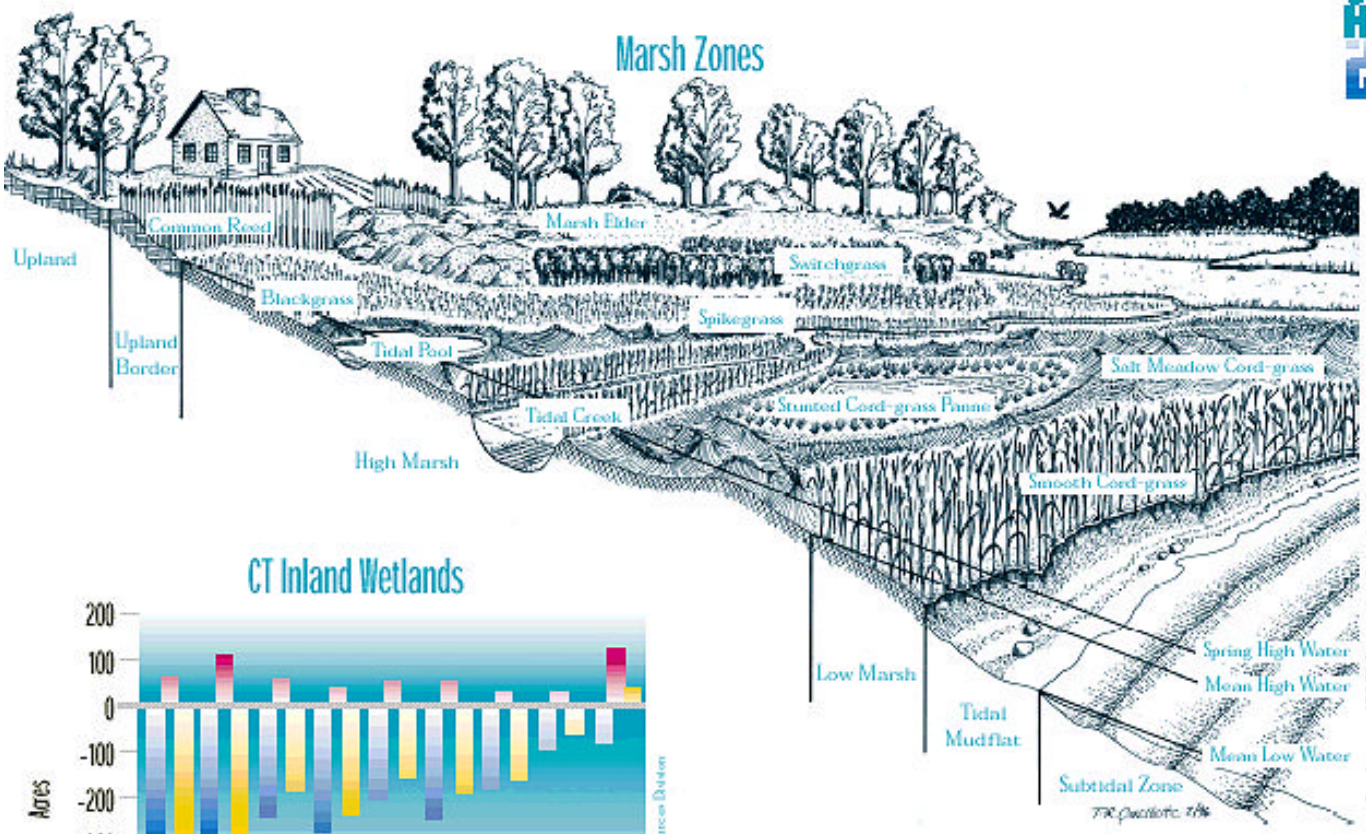
Tidal wetlands, or marshes, are grasslands located between land and sea that form an important link to adjacent estuaries. Tidal wetlands are among the most productive ecosystems in the world. Decaying marsh grass fragments that wash into Long Island Sound are an important part of the food web, supporting many species of fish, invertebrates, and birds. Marshes provide food, shelter, and breeding or nursery grounds for many species of wildlife. Marshes also protect the land from flooding and erosion in stormy weather and filter pollutants from the water.

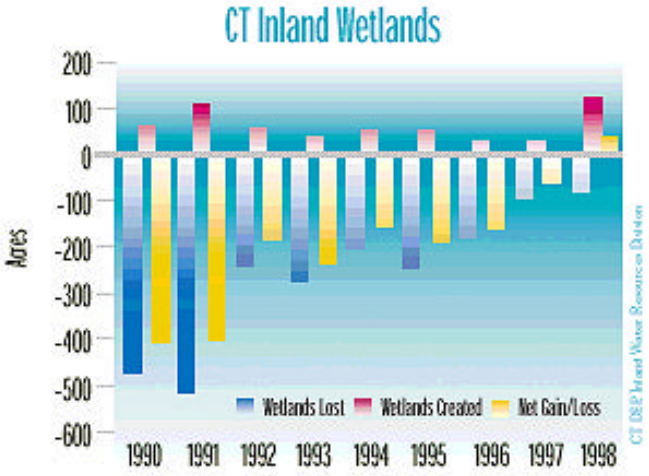
Approximately 25 percent to 35 percent of the Sound's tidal wetlands had been destroyed over the past 100 years by filling, dredging, and development. This trend was halted following passage of federal and state legislation in the early 1970s to protect tidal wetlands. The emphasis is now on restoration. Both Connecticut and New York have funds dedicated to wetland restoration. Connecticut has restored 1500 acres of tidal wetlands since the early 1970s. New York has restored about 65 acres of tidal wetlands since passage of the 1996 Clean Air/Clean Water Bond Act. Tidal wetland restoration is an integral part of the LISS goal to restore 2000 acres of coastal habitats by the year 2008.



CT DEP, Office of Long Island Sound Programs

Since 1993, more than 308 acres of tidal wetland habitat have been restored in Connecticut. Since 1996, New York has restored approximately 65 acres of tidal wetlands. Additional restoration projects are underway.





Since 1990, wetland alterations and losses have consistently declined and wetland creation has gained. As a result, in 1998, Connecticut had a net gain in inland wetlands. While freshwater wetlands are mapped in New York, no trend analysis has been done to date.

Acres of Inland Wetlands

Like tidal wetlands, inland wetlands serve many valuable functions, including fish and wildlife habitat, flood storage, groundwater recharge, and pollutant removal. Wetlands act as natural sinks for nutrients and other pollutants that otherwise would find their way into the numerous rivers and streams that eventually lead to Long Island Sound. Before their value was realized, wetlands were routinely filled in or drained to accommodate the construction of buildings, parking lots, and roads. Federal and state laws enacted in the early 1970s to protect wetlands began to halt this practice and are beginning to show positive results.

Photo by CT DEP

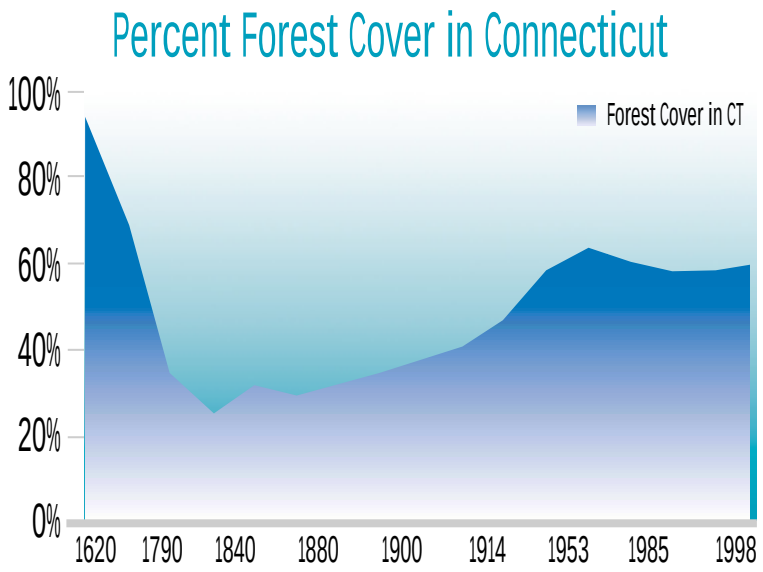
How is the Landscape Changing Due to Human Activities?

Many of the changes in the quality of Long Island Sound are driven by changes that have occurred in the surrounding landscape. Of particular concern are the loss of wetlands, forests, farms, and other open space to development. Following World War II, the area around Long Island Sound experienced rapid population growth. Residential, commercial, and recreational development increased pollution, altered land surfaces, reduced open spaces, and restricted access to the Sound. The use of the Sound as a place to dispose of human and other wastes increased dramatically. The "paving over" of the land increased runoff and reduced the filtration and processing functions of natural landscapes. Development destroyed or altered many vital habitats, harmed native wildlife populations, and reduced breeding grounds and nursery areas for many native species.

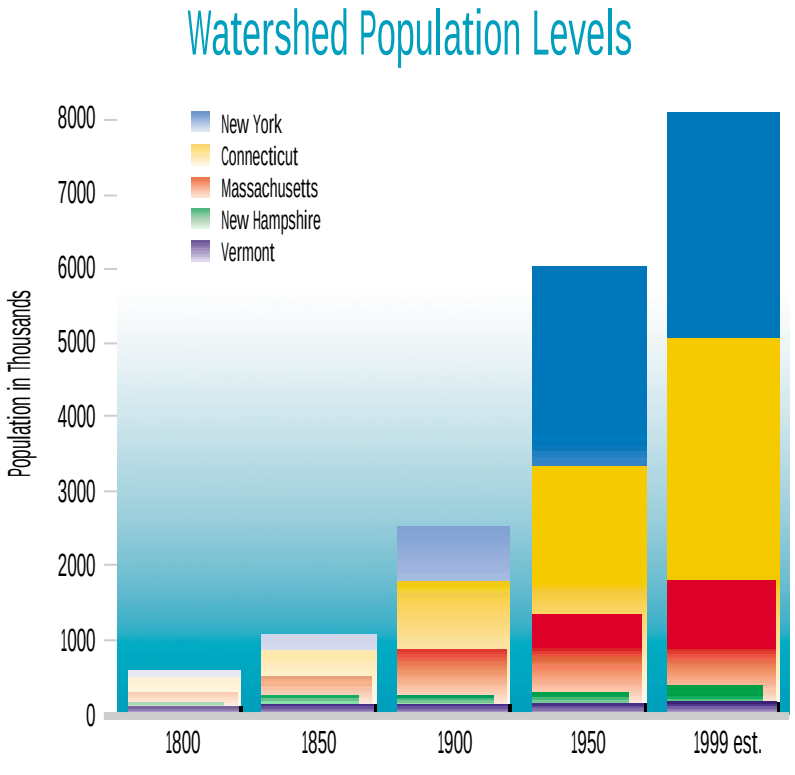
Back in the 1800s and early 1900s, compact towns and cities, surrounded by farms and forests, dotted the watershed. After World War II, the automobile made it easy to live out of town and suburbia was born. Suburban sprawl has now brought a new set of environmental problems to manage.

Forest Cover

From the 1600s through the 1800s, forest area decreased as land was cleared for agriculture, housing, and industry. However, in the 1900s, many farms were abandoned and trees grew back. This has caused a huge increase in the amount of forest area during the last 100 years. Healthy forests contribute to healthy rivers and, ultimately, a healthy Long Island Sound. Forests are important because they capture rainfall, reduce stormwater runoff, maintain stream flow, reduce erosion, trap nutrients, and stabilize soil. They provide places for recreation, and supply the raw materials for fuel, lumber, and paper. Forests also provide many kinds of habitat important to the survival of fish and wildlife. When streams and shorelines are buffered by forests, the amount of nutrients and soil washing into Long Island Sound is reduced.



USDA US Forest Service and Landsat World Referencing System, Laboratory for Earth Resources Information Systems (LERIS), University of Connecticut



Compiled by M.E. Hastings, USGS Coastal and Marine Geology Team, Woods Hole Field Center, from population data maintained by the U.S. Census Bureau (1999) at http://fisher.lib.virginia.edu/census and Inter-University Consortium for Political and Social Research (ICPSR) (1999) at http://www.census.gov/population/www/index.html

Photo by Regional Water Authority

Watershed Population Levels

More than 8 million people live in the Long Island Sound watershed. More than 21 million people live within a 50-mile radius of the Sound. While population levels in the Long Island Sound watershed are expected to remain fairly stable in the future, there has been an increasing population shift toward the coast.

What Can You Do?

As a resident of the Long Island Sound watershed, here are some simple things you can do to help restore and protect Long Island Sound:

In The Home

- Use environmentally friendly landscaping techniques that require less fertilizer, prevent erosion, and use native plants. This helps prevent sediments and nutrients, like nitrogen and phosphorus, from reaching Long Island Sound, and provides habitat for native species.
- Leave grass clippings on the lawn to recycle nutrients. Start a compost pile to reduce the amount of waste you put into the garbage disposal or garbage can.
- Use a soil test kit to determine the amount of fertilizer needed. More is NOT better for your plants or for reducing the effects of overloading the Sound with nutrient-rich runoff. Learn how to practice environmentally sound gardening.
- Preserve any wetlands on your property, even small areas.
- Conserve water at home and in the office to reduce the volume of wastewater that must be treated by a sewage treatment plant or septic system. This will increase the efficiency of treatment and save you money.
- Use safe, non-toxic alternatives for cleaning and for controlling pests.
- Take household chemicals to a recycling center instead of pouring them down drains or putting them in the trash. REMEMBER: substances poured down drains, storm sewers, or on the land are likely to be transported to Long Island Sound.
- Never pour motor oil or other auto fluids down a drain or sewer or discard them with the trash (in Connecticut and New York, it's against the law!)
- Maintain your septic system by having it pumped out every three to five years.
- Scoop up pet waste and dispose of it in the toilet. If local laws allow, pet waste can either be buried or sealed in a plastic bag and put in the garbage.
- Wash your car on a grassy area if possible, so the ground can filter the water naturally. Use soap sparingly and try to use non-phosphate detergents. Empty the bucket of soapy water down the sink, not in the street.

In and On the Sound

- Don't be a litterbug. Never throw litter, especially plastic, into the street, down storm drains, or onto the beach. Rainfall carries the trash into the sewers where it eventually travels into the Sound.
- Be a responsible boater. Remember, it is illegal to discharge wastes from a Type III (holding tank) marine sanitation device. Pumpout facilities must be used to prevent release of pathogens directly into coastal waters.
- Never feed water birds. This encourages them to stay through the winter and gather in flocks. Their droppings, which contain bacteria and nitrogen, can contaminate shellfish beds and may cause the closing of bathing areas.

How Do We Know We Still Need to Do More?

While progress is being made toward achieving the Comprehensive Conservation and Management Plan (CCMP) goals of clean water and sediments, abundant and diverse fisheries and wildlife, sustainable ecosystems, and multiple commercial and recreational use of Long Island Sound, much remains to be accomplished. Examination of the environmental indicators in this report allows us to identify our successes and recognize the needs for further study. It is apparent that continued research is necessary to answer the questions:

- What caused the 1999 lobster die-off in the Sound?
- What effects do temperature, hypoxia, and toxic contamination have on living resources in the Sound?
- How will the Long Island Sound ecosystem respond to continued nitrogen reductions?
- What effect does sediment disposal have in the Sound?
- How does atmospheric deposition of pollutants affect water quality in the Sound?
- What more can people do to help restore and protect Long Island Sound?
- What will global warming and sea level rise mean for the Sound?

As we continue our efforts to implement the goals and priorities of the CCMP, we leave the answers to these questions for the next State of the Sound report.

The LISS Citizens Advisory Committee

The Voice of the People

The LISS has a unique pipeline for citizens to provide advice to the Management Conference on issues of concern to the Long Island Sound community at large. Established in 1988, the Citizens Advisory Committee includes representatives of environmental groups, industry, marinas, marine trades and business associations, planning agencies, commercial fisheries organizations, education, and research. The citizens on the committee provide a two-way link between government and the public to increase understanding of the LISS, its goals and commitments, and the ongoing efforts to restore and protect Long Island Sound.

In Your Community

- Participate in policy decisions and attend public meetings, such as your local planning and zoning, conservation, or wetlands commission meetings. Speak out on local issues that can have ramifications for your town and Long Island Sound.
- Support local harbor management plans.
- Organize and/or volunteer for citizen water quality monitoring projects in your community.
- Organize a storm drain stenciling project in your neighborhood.
- Participate in beach grass plantings and beach clean-up activities.
- Get involved in local organizations that monitor land management and participate in efforts to manage growth.
- Encourage government officials to improve existing infrastructure and encourage them to engage citizens in smart growth decisions.
- Use public transportation.

SOUND HEALTH 2001

Who Do You Call?

The Long Island Sound Study is a partnership of federal, state, and local government agencies, private organizations, and educational institutions working together to restore and protect Long Island Sound. For additional information, contact these key agencies and organizations:

EPA Long Island Sound Office
CT (203) 977-1541
NY (631) 632-9216
www.epa.gov/region01/eco/lis

New York State Department of Environmental Conservation
(631) 444-0467
www.dec.state.ny.us

State of Connecticut Department of Environmental Protection
(860) 424-3000
dep.state.ct.us

CONNECTICUT

Department of Health
Septic Systems
(860)509-7296

Department of Health
Shellfish Quality
(860) 509-7750

DEP Hazardous Spills/Oil & Chemical
(24 hour)
(860) 424-3338

DEP Hazardous Waste/
Enforcement/Complaints
(860) 424-3023

DEP Hazardous Waste
Collection/Schedules
(860) 424-3242

Turn in Poachers/Report Violations
(860) 842-4357

Department of Agriculture
Bureau of Aquaculture
(203) 874-0696

Connecticut Sea Grant
(860) 405-9105

NEW YORK

DEC Debris Line
(718) 482-4955

DEC Spill Hotline
(800) 457-7362

DEC Marine Resources
(631) 444-0430

Department of Health
(800) 458-1158

New York Sea Grant
(631) 632-6905

GENERAL CONTACTS

National Response Center
(dumping/spills)
(800) 424-8802

Long Island Sound Watershed Alliance
(203) 327-9786

U.S. Geological Survey
Woods Hole Field Center
(508) 548-8700
www.marine.usgs.gov

Are You on Our Mailing List?

UPDATE is a quarterly publication featuring news from around the Sound. To sign up to receive your free copy, visit our website at **www.epa.gov/region01/eco/lis/feedback** and we'll place your name on our mailing list. The LISS also publishes fact sheets, educational pamphlets, and brochures on a variety of topics. Many of these publications can be obtained on the LISS website.

Acknowledgments

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United States Environmental Protection Agency
Long Island Sound Office
Stamford Government Center
888 Washington Boulevard
Stamford, CT 06904-2152