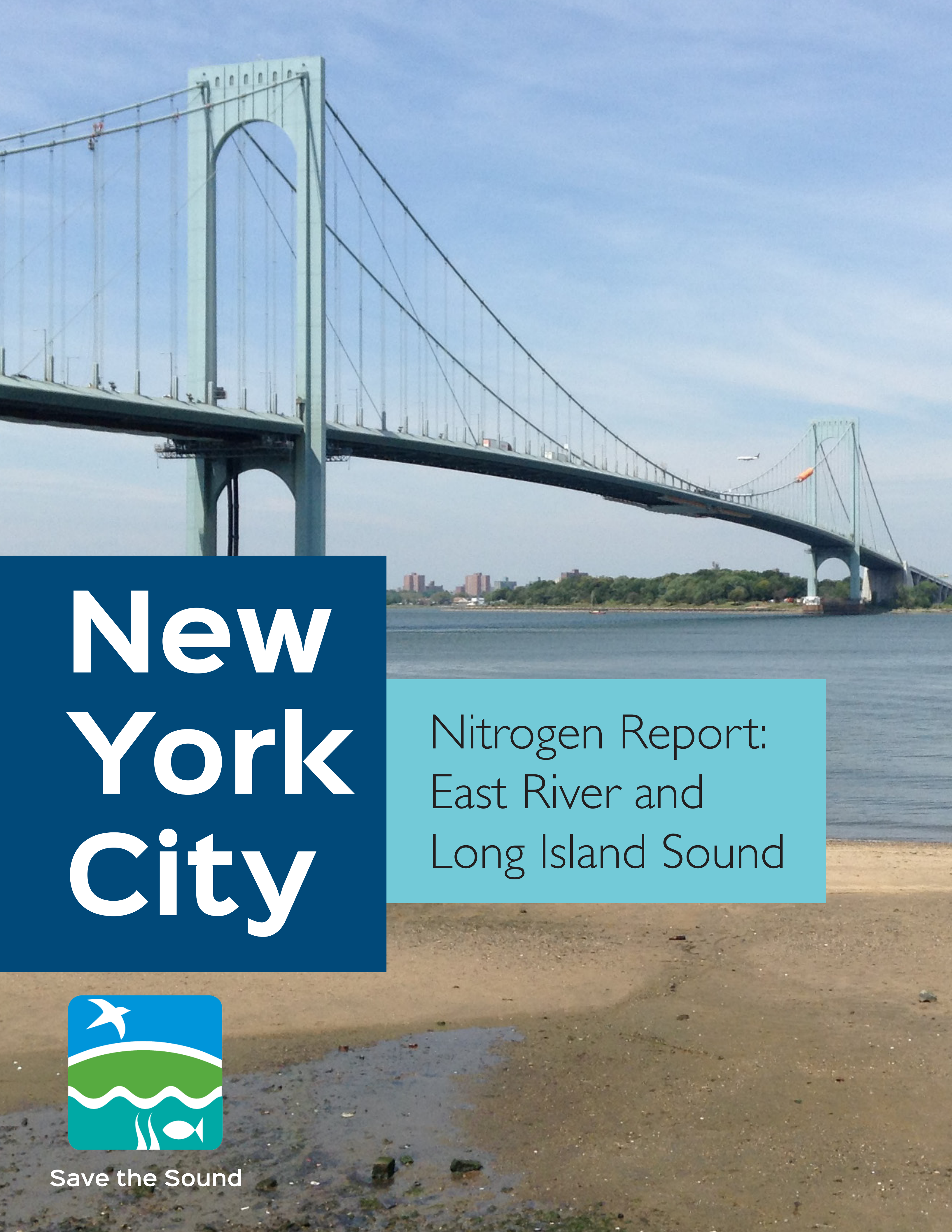


New York City

Nitrogen Report: East River and Long Island Sound

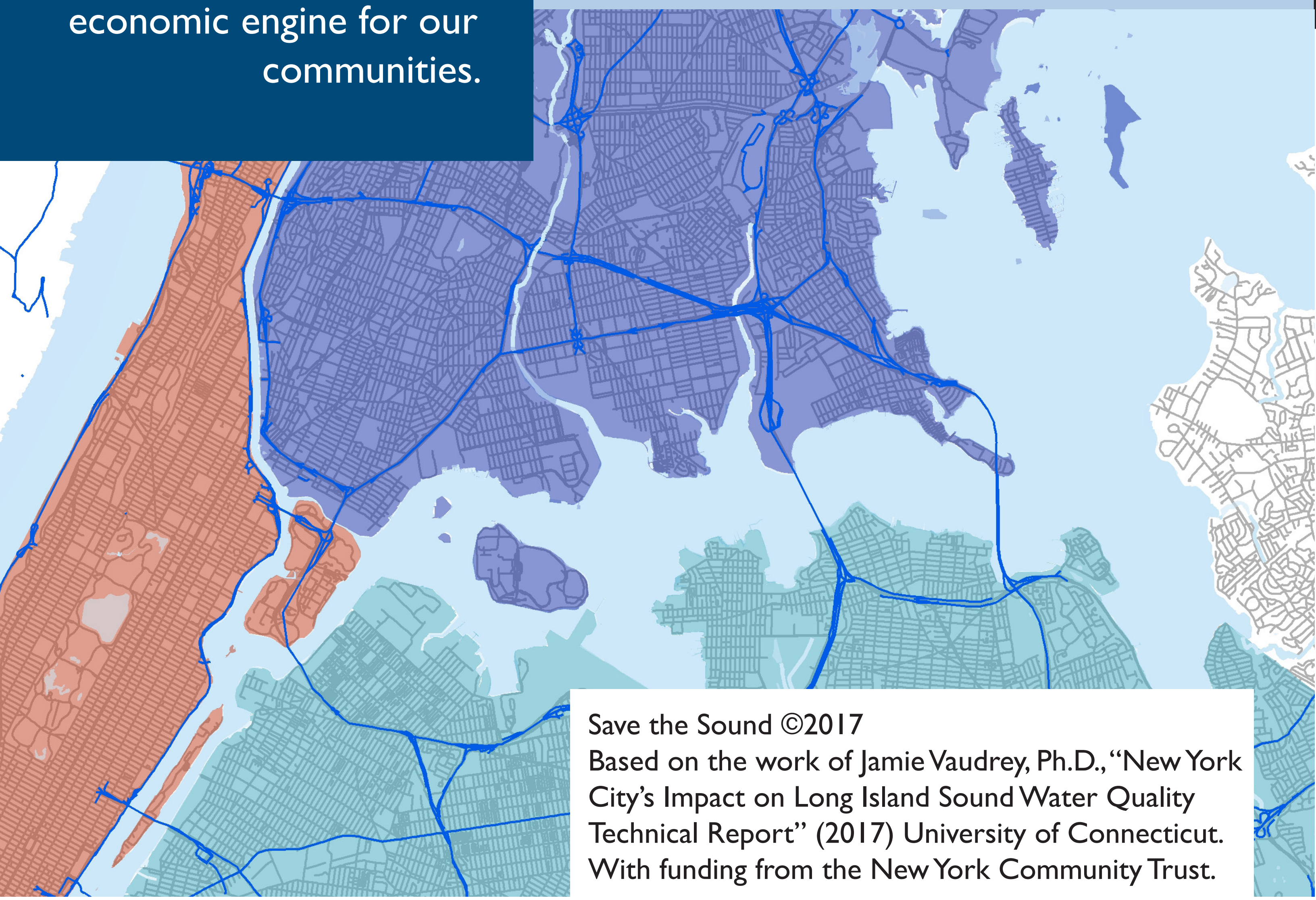
Save the Sound

Iconic bridges crisscross the East River as it flows through city neighborhoods into Long Island Sound. The East River, a "tidal strait," plays a critical role in the health of New York City's economy and environment—and in particular, the health and future of Long Island Sound.

This report aims to shed light on the connection between these waterways and their significance for our communities. 2017 marks a milestone for Long Island Sound as efforts to reduce nitrogen pollution, 15 years in the making, come to fruition. This is a time to take inventory of what has been accomplished and to make new plans for the future health of these critical waterways.

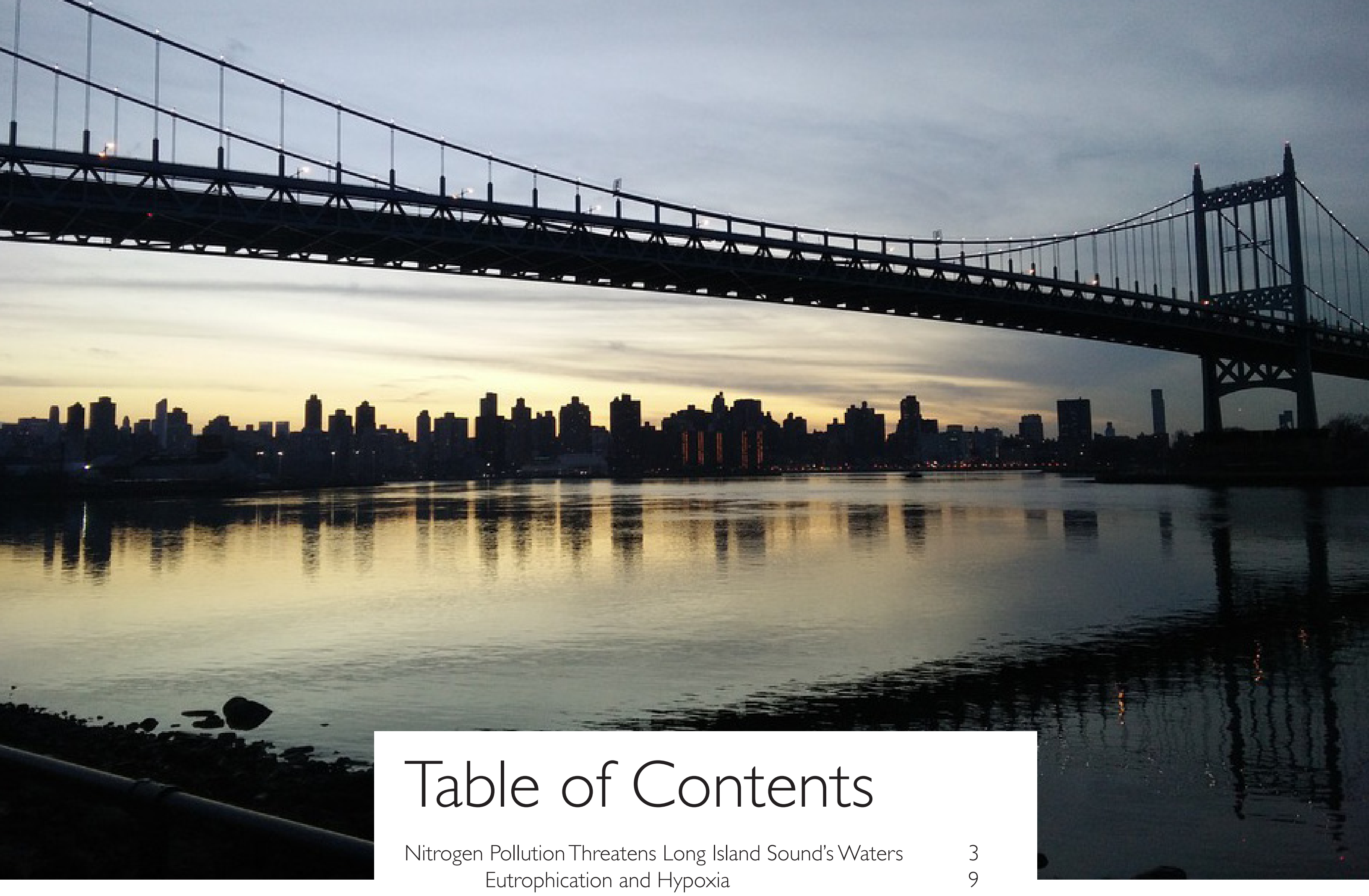
Save the Sound hopes the knowledge gleaned from this report will inspire New York City residents to call for and support a cleaner East River and Long Island Sound, with fishable and swimmable waters for all.

Long Island Sound is one of the most productive ecosystems on earth. This estuary serves as a feeding, breeding, and nursery area for countless species, and as an economic engine for our communities.



Based on the work of Jamie Vaudrey, Ph.D., "New York City's Impact on Long Island Sound Water Quality Technical Report" (2017) University of Connecticut.
With funding from the New York Community Trust.

Cover: Whitestone Bridge in Queens   Inside Top: RFK Bridge   Inside Bottom: Throgs Neck Bridge Copyright Giles Ashford @gilesashford_archphoto



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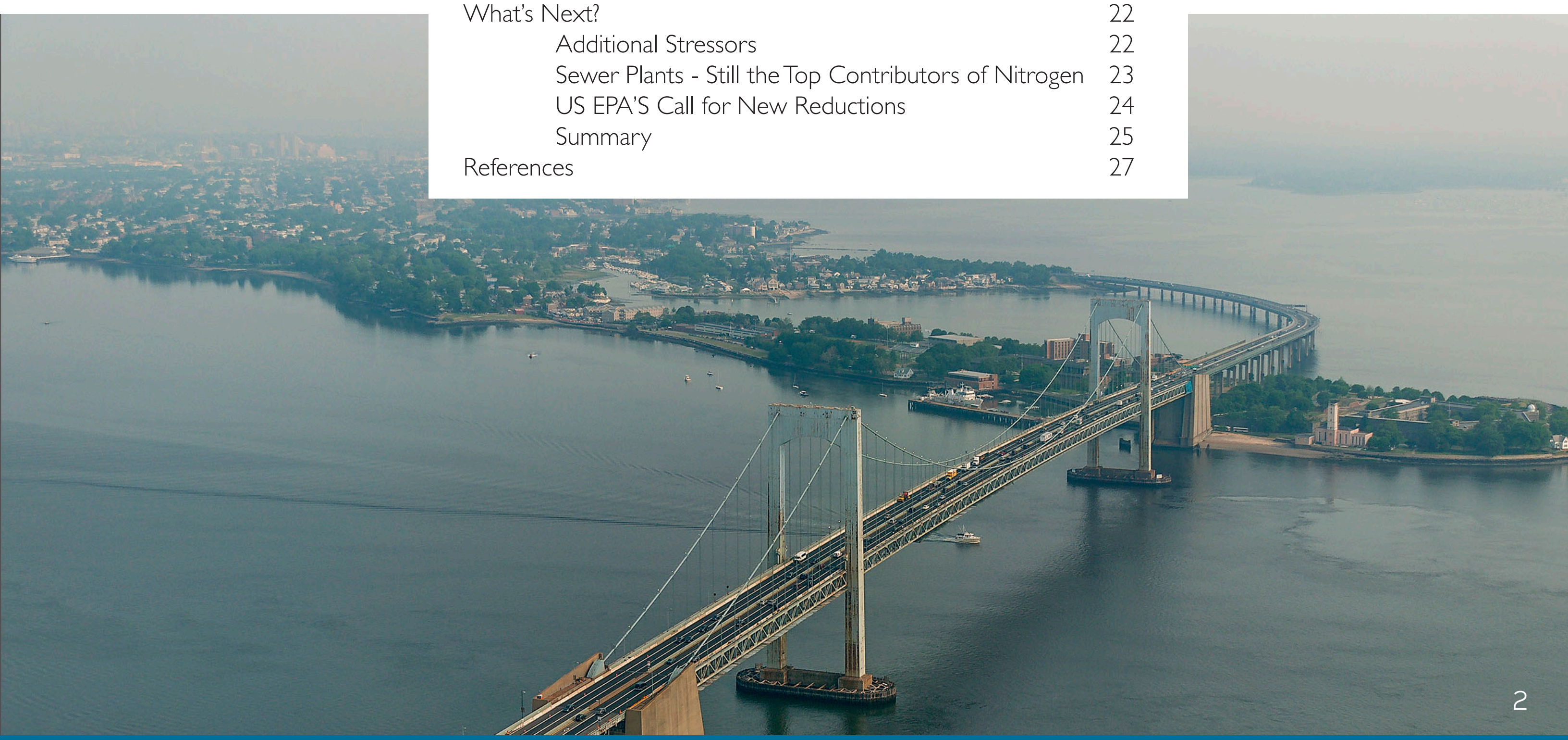


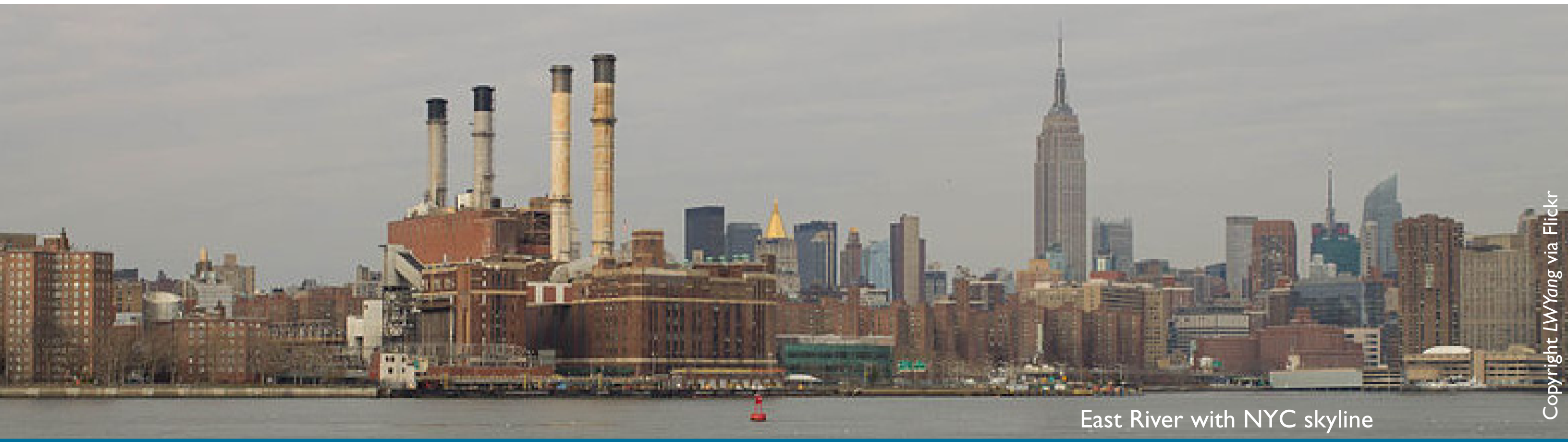
NITROGEN POLLUTION THREATENS LONG ISLAND SOUND'S WATERS

For decades, excess nitrogen entering our coastal waterways devastated the health of Long Island Sound[16]. The impacts are clear: low-oxygen waters and fish die offs, more algae blooms, murky waters, and coastal marshes with barren, flooded patches. The goals of swimmable and fishable waters are thwarted when low oxygen feeds algae blooms, reduces water clarity, and drives out desirable fish. We have reduced human generated ***nitrogen pollution*** over the last 20 years, but must make further reductions to get a healthy Sound that is safe for people and wildlife.

Long Island Sound's health is at risk because of the number of people living in the watershed, which is the area of land that drains to the Sound. **This watershed reaches into northern New England, including large portions of New York City, Connecticut, Massachusetts, Vermont, and New Hampshire** (Figure 1). These states have worked to limit nitrogen input from wastewater treatment plants and other sources, but this reduction is counteracted in part by an ever increasing population, especially in the coastal areas, and to a lesser degree by a changing climate.

In coastal salty waters, nitrogen stimulates growth of plant-like organisms[12], both microscopic (phytoplankton) and those visible to the human eye (seaweed). As on land, adding nitrogen fertilizes plant life in our coastal waters, but the amount of nitrogen being added to Long Island Sound is equivalent to or greater than what we would put on an intensely farmed agricultural field[33,41]. While a little nitrogen is beneficial to coastal waters, too much nitrogen changes the ecosystem—fueling the growth of nuisance and toxic algae blooms, creating low oxygen dead zones where fish can't survive, and killing the coastal marshes[20] that provide important wildlife habitat and protect coastal communities from extreme storms—a process called *eutrophication*.

The Long Island Sound watershed is home to approx. 9 million people of which nearly 4 million live in New York.



East River with NYC skyline

Algae Bloom at Hunter Island Bronx, NY

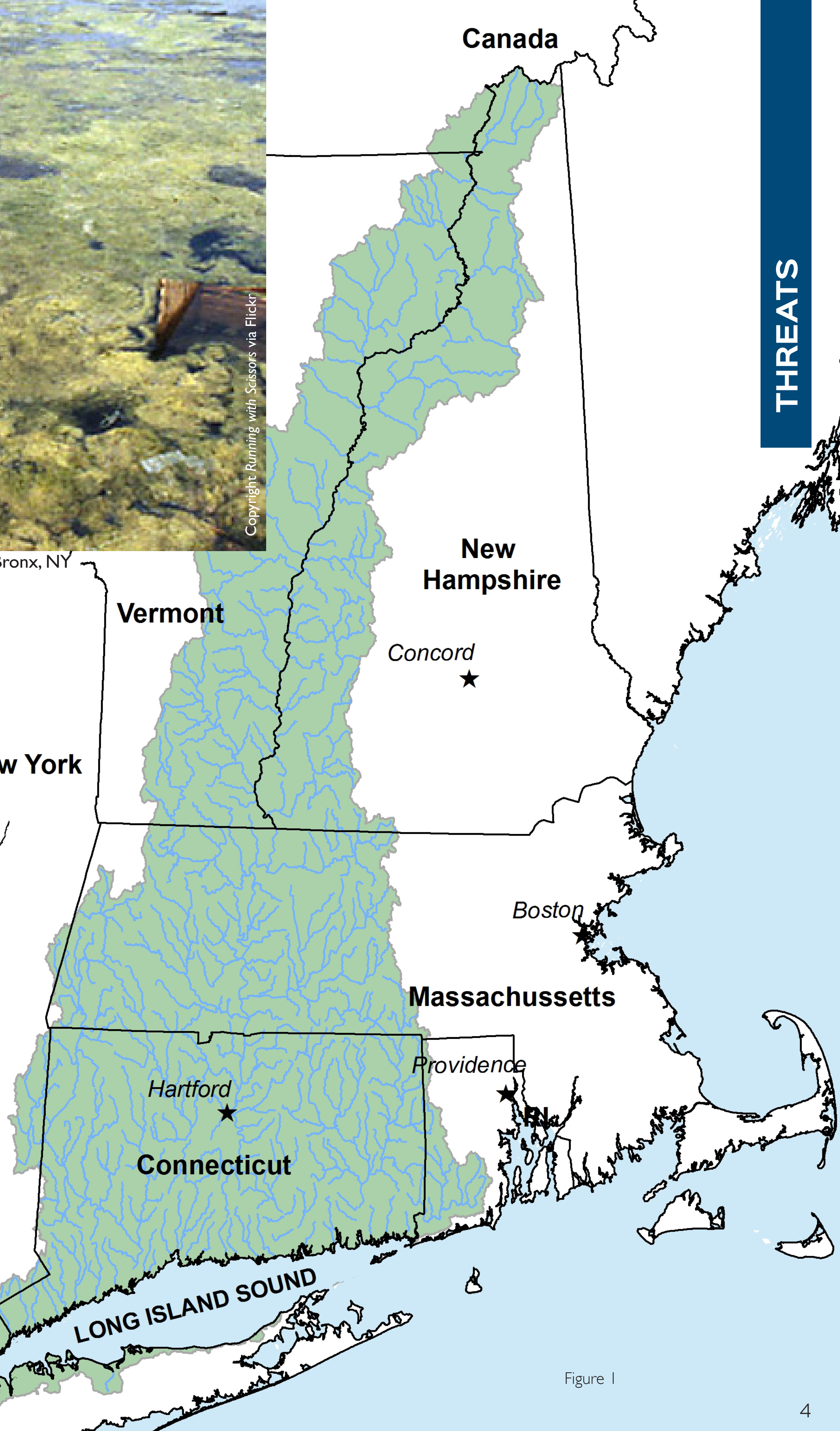


Figure 1

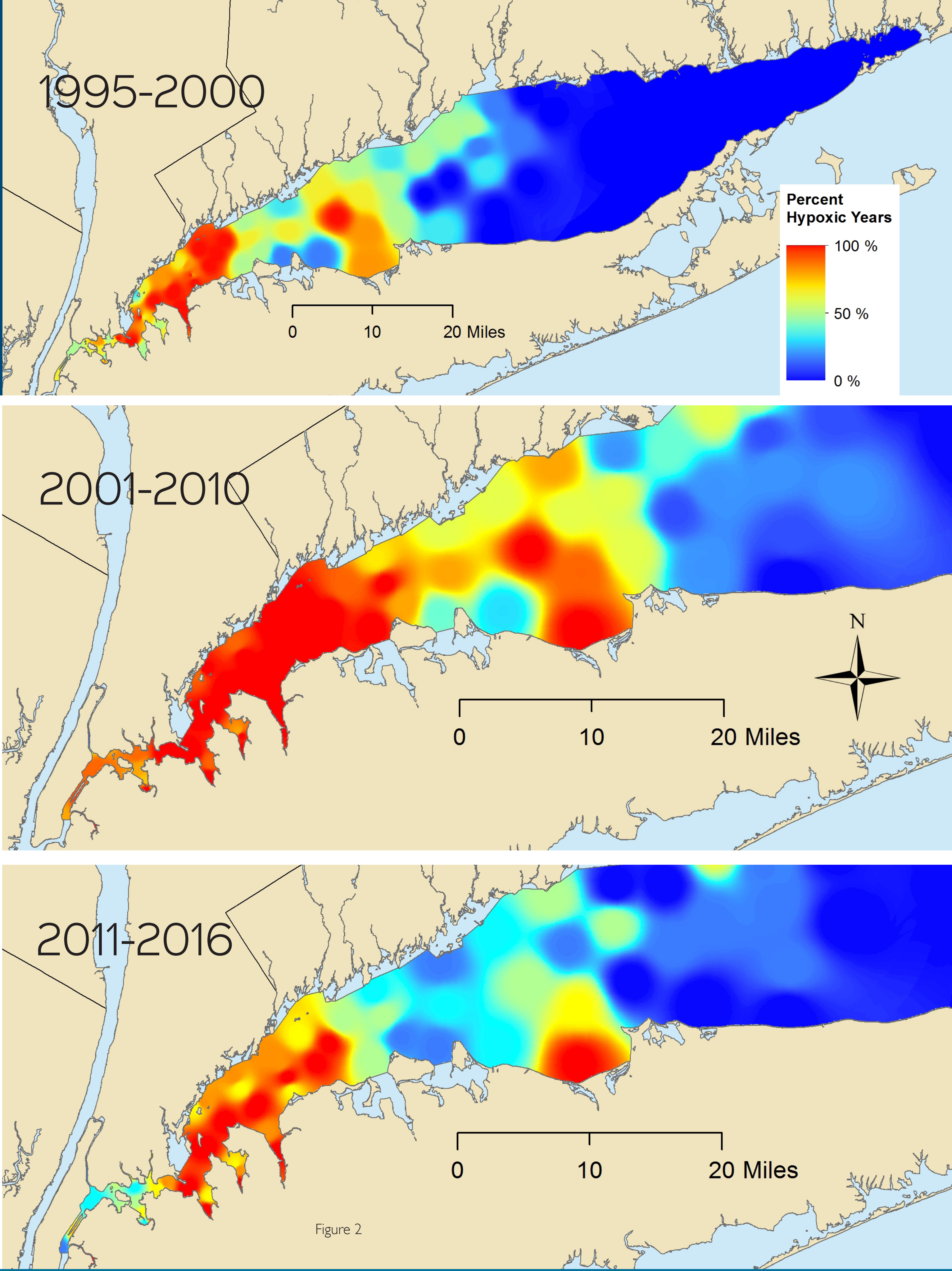

1995-2000
Percent
Hypoxic Years
100 %
50 %
0 %
0
10
20 Miles
2001-2010
N
0
10
20 Miles
2011-2016
0
10
20 Miles

Figure 2

Figure 2: Frequency of hypoxic (very low oxygen, < 3 mg/L) conditions in Long Island Sound from 1995 to 2016. Red indicates higher frequency, blue is lower frequency. Image credit: Save the Sound, with data from CTDEEP, NEI-WPCC IEC, NYCDEP.

Unacceptably low levels of oxygen in the waters, or ***hypoxia***, occur every summer as a result of the level of eutrophication in the East River and the western end of Long Island Sound (Figure 2). A comprehensive look at historic oxygen data collected by New York City Department of Environmental Protection (NYCDEP) and its predecessors [29] demonstrates hypoxia in the East River dating back to 1920. Nassau County and New York City monitoring data show hypoxia spreading as far as Cold Spring Harbor and becoming a near-annual summertime event in the early 1980s. In fact, the 1980s saw the spread of hypoxia into the Western and Central Basins of Long Island Sound [29]. A review of evidence going back 1,000 years reveals Long Island Sound summertime hypoxia did not occur until the 1800s, with a second ecosystem shift indicating worsening conditions in the 1970s [39].

Unacceptably low levels of oxygen in the waters, or hypoxia, occur every summer in the East River and the western end of Long Island Sound

Helpful Terminology

Nitrogen – A nutrient critical for growth of plant matter. Too much can create problems by stimulating too much growth.

Hypoxia – Low oxygen in the water, not supportive of marine life (< 3mg/L for Long Island Sound).

Eutrophication – The process by which a body of water becomes enriched in dissolved nutrients (such as nitrogen) that stimulate the growth of aquatic plant life usually resulting in the depletion of dissolved oxygen.

Atmosphere deposition – Gases and particulates released to the atmosphere from combustion sources such as motor vehicle emissions and power plants. They contain nitrogen which eventually settle to the ground as dust or fall to the earth in rain and snow.

Watershed – The area that ultimately drains to a single waterbody.

Effluent – Liquid waste or sewage – treated or untreated – discharged into a river or the sea.

Wastewater – Freshwater that has been used by humans. Originates from toilets, showers, sinks, washing machines, manufacturing processes, etc.

Wastewater treatment plant (WWTP) – A facility that converts wastewater to cleaner effluent that can be reused or discharged to the environment with few adverse effects. These plants have varying levels of treatment. Primary treatment removes solid material, secondary digests organic material and kills pathogenic bacteria (and achieves some nutrient removal), tertiary remove nutrients.

In response to the increasing occurrence of hypoxia in Long Island Sound, Connecticut Department of Environmental Protection (now Connecticut Department of Energy and Environmental Protection, CTDEEP) began an extensive monitoring program in 1987 encompassing most of Long Island Sound, to supplement the ongoing monitoring of the East River and adjacent Long Island Sound by NYCDEP. The good news is that the area of hypoxia in the Sound may have decreased by roughly half of what it was in 1987; we need a few more years of monitoring to confirm this decrease because it varies widely year-to-year (Figure 3). Investments in upgrades to wastewater treatment plants that discharge to the Sound over the last 20 years have driven this reduction.

Even with these reductions in area, hypoxia continues to be an annual occurrence in the East River and Western Sound. However, the overall hypoxic area of approximately 95 square miles in 2017 is still much larger than in 1920 when hypoxia was found only in the 11.5 square miles of the East River.

Eutrophied systems *can recover* and Long Island Sound is on that road to recovery. But rehabilitation of an ecosystem takes time, sometimes decades[7, 8]. The key is to identify the main causes and work to reduce those sources. In some cases, restoration efforts will be needed to bring back critical habitats like tidal marshes, seagrass beds, and oyster reefs. These habitats are part of a vibrant and diverse Long Island Sound, and once reestablished, can also help to maintain water quality. Efforts to restore these habitats are already underway, but to ensure their continued success and to expand these habitats throughout Long Island Sound, further reductions in nitrogen inputs are needed.

Investments in upgrades to wastewater treatment plants over the last 20 years have driven nitrogen reduction.

The overall hypoxic area of ~95 square miles in 2017 is still much larger than in 1920 when hypoxia was found only in the 11.5 square miles of the East River.

Area of Hypoxia in Long Island Sound 1991-2017

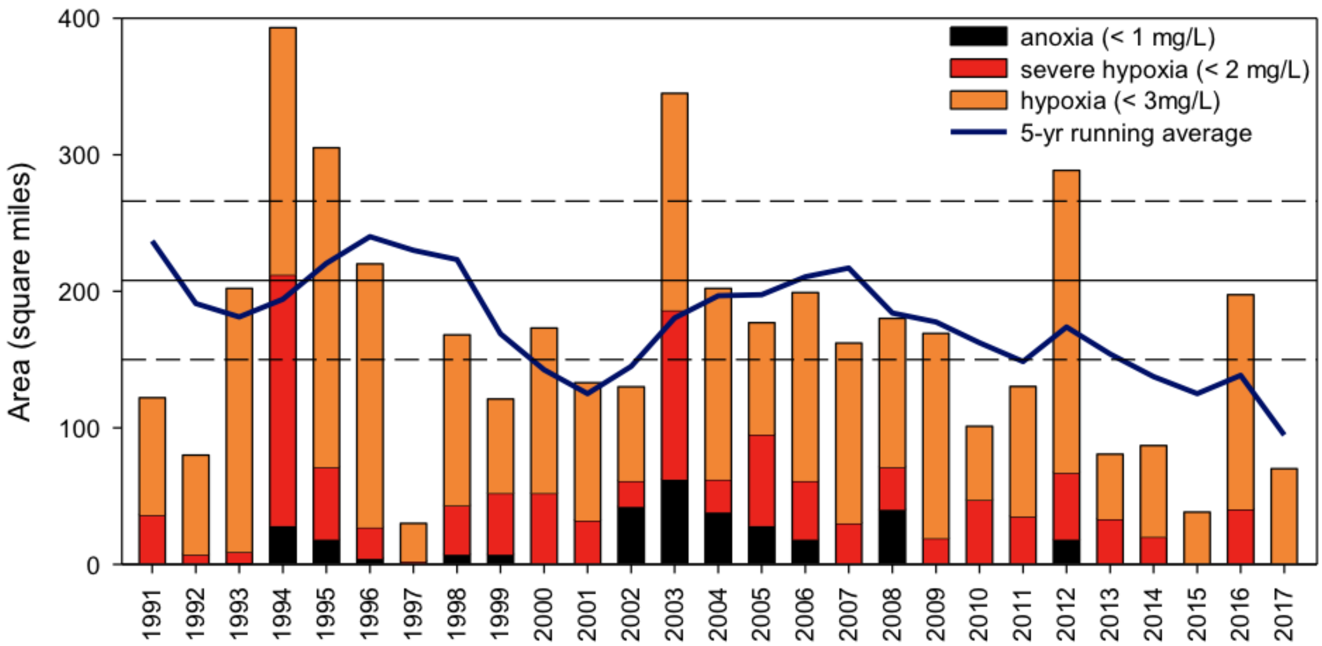


Figure 3: Square mileage of hypoxic area in Long Island Sound[21]. The bars show the area of hypoxia by year with colors differentiating sub-areas of severe hypoxia and anoxia (no oxygen). Hypoxia varies year-to-year based on differences in climactic factors including wind speed, temperature, and river discharge. When the 5-year running average (blue line) dips below the bottom dashed line, the reduction from the early 1990s average (solid black line) is considered significant. Since 2014, the area of hypoxia has been lower than this criterion.

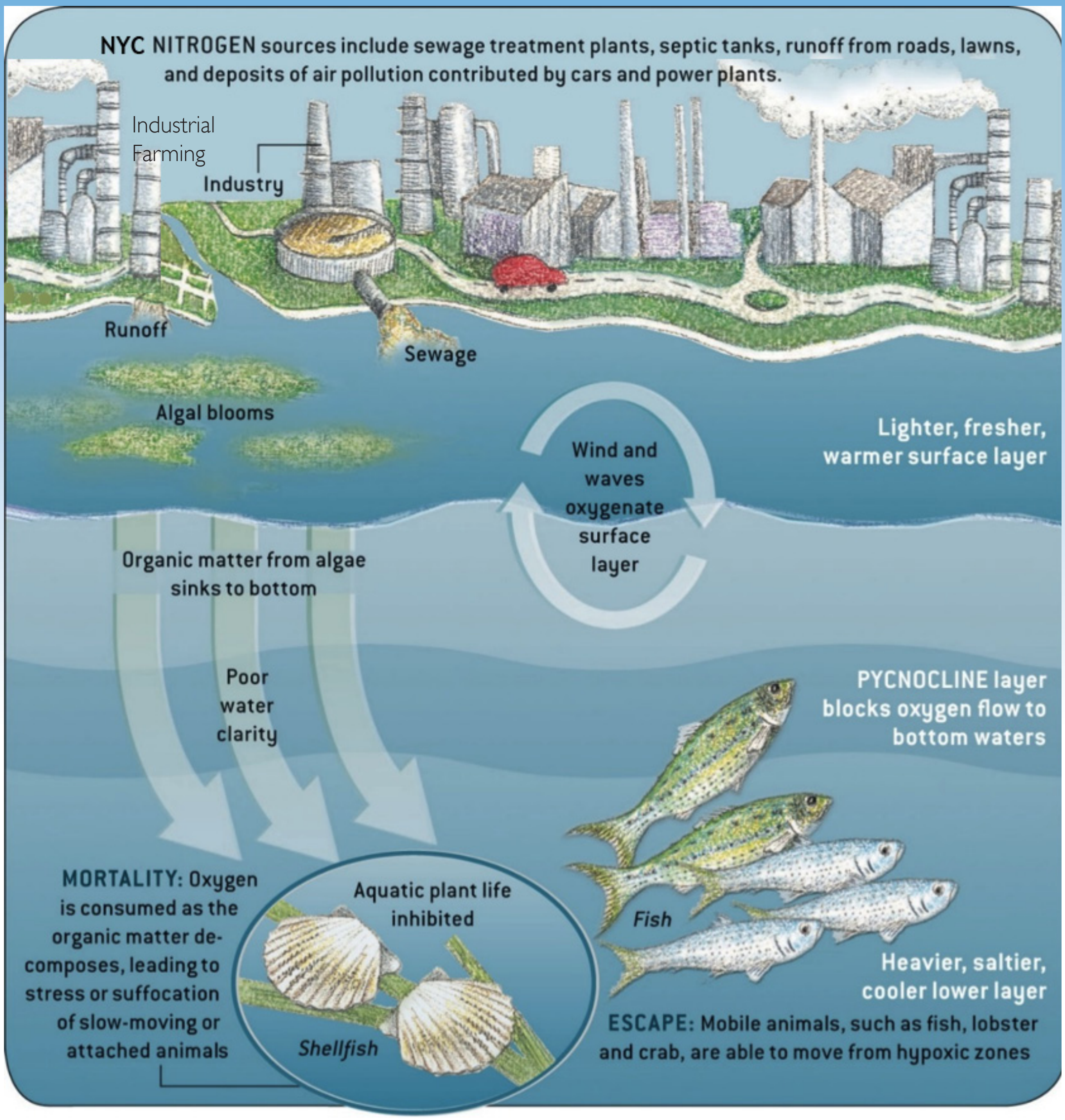


Figure 4: Hypoxia in Long Island Sound – a symptom of eutrophication. Image credit: Long Island Sound Study [19].

Eutrophication and Hypoxia

Nitrogen entering coastal waters fuels the growth of phytoplankton and seaweed, which form the basis of a food web that feeds animals like oysters and fish[46]. However, over-fertilization causes huge amounts of phytoplankton and seaweed to grow (Figure 4).

While phytoplankton and seaweed produce oxygen during the day, they are also respiring and using oxygen, both during the day and the night. A large mass of phytoplankton or seaweed can use all of the oxygen in the water overnight, leaving no oxygen for the fish to breathe. As the phytoplankton and seaweed die, the decomposition of that organic matter also uses oxygen. This process, called eutrophication, results in hypoxia (low oxygen) in the bottom water of Long Island Sound and in many of the small bays and harbors along the margin of Long Island Sound[6].

Hypoxia can lead to a shift in the types of plants and animals found in an area[13, 39]; only those that can tolerate periods of low or no oxygen remain. Eutrophication coupled with warming temperatures and acidification of the waters due to climate change exacerbates these changes; both the number of different types of marine life and the total number of individuals can decrease[6].

The Value of Long Island Sound

Long Island Sound provides a number of ecosystem services, defined as the *benefits people obtain from ecosystems*[23]. In 2015, an economic valuation of Long Island Sound and its watershed estimated Long Island Sound's natural capital at $17 billion to $37 billion every year[15]. These services are evaluated for a number of habitats, including: beaches, coastal wetlands, cultivated lands, estuaries, forests, fresh water, freshwater wetlands, grasslands, and seagrass. This type of valuation includes estimates for materials (freshwater, food, raw materials), impacts on the human economy (housing market, tourism, waste treatment), impacts on the natural world (pollination, soil formation, climate stability, habitat and nursery for wildlife), and intrinsic values (cultural and artistic inspiration, science and education, aesthetic information, recreation).

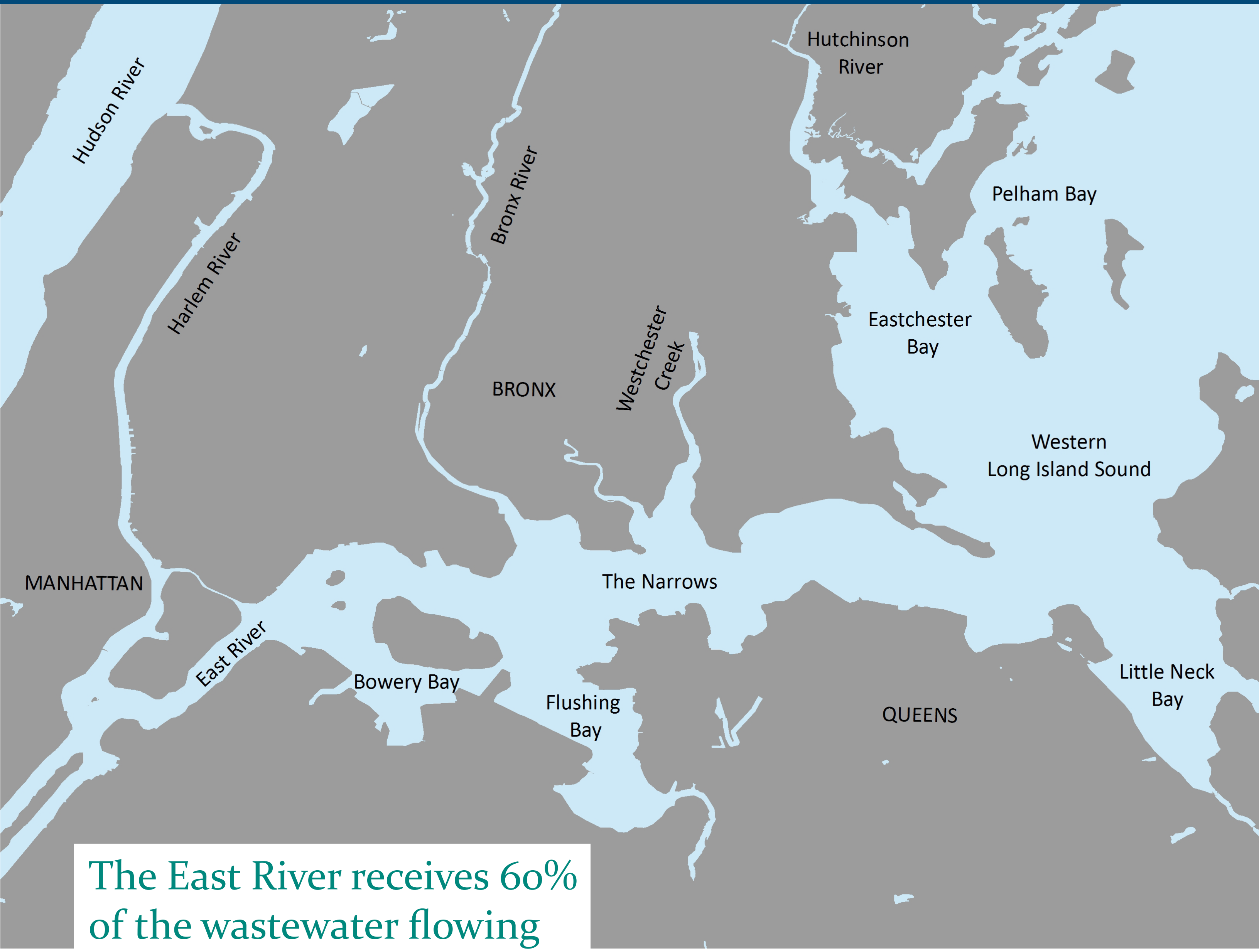
Economic value of Long Island Sound equated to $17-37 billion every year

Figure 5: The area of each block represents the fraction of the $17 to $37 billion attributed to a particular ecosystem service.

Abbreviations in the figure -
M: Moderation of Extreme Events 1.3%
W: Waste Treatment 1.3%.
S: Soil Formation <1%
H: Habitat and Nursery <1%
A: Aesthetic Information <1%
E: Energy and Raw Materials <1%

Image credit: Vaudrey, modeled after Figure 11 in Ko-cian et al. (2015) report.

NEW YORK CITY'S CONNECTION TO LONG ISLAND SOUND



The East River receives 60% of the wastewater flowing out of New York City, carrying with it a large burden of nitrogen pollution.

Figure 6: New York City is home to seven sizable bays and harbors that flow to the Sound: Bowery Bay, Flushing Bay, Little Neck Bay, Pelham Bay, Eastchester Bay, and the mouths of Westchester Creek and the Bronx River. Image credit: Save the Sound

Long Island Sound and the New York / New Jersey Harbor are two of the most urbanized estuaries in our country[37], with the Harbor also influencing Western Long Island Sound. Of the approximately 9 million people living in the Long Island Sound watershed[22], roughly 4 million are located in New York State and 1.7 million in the Connecticut coastal region[41]. This large coastal population has a direct impact on the water quality of Long Island Sound and other local ocean waters.

While New Yorkers often identify the Hudson River and New York Harbor as their emblematic waterways, as a city, they are intimately connected to Long Island Sound by the East River. In fact, the East River receives 60% of the wastewater flowing out of New York City, carrying with it a large burden of nitrogen pollution (Figure 6). The connection between Long Island Sound and the waters surrounding New York City is made clear by a satellite photo taken three days after Tropical Storm Irene made landfall in New York (Figure 7). The Hudson River was full of sediment washed off the land by heavy flooding in its watershed, which reaches into the Catskills and Adirondack Mountains in upstate New York. This sediment load in the Hudson River acts as a tracer of where the water goes, illustrating the connection to Long Island Sound by the muddy water visible in the East River and travelling into Long Island Sound.

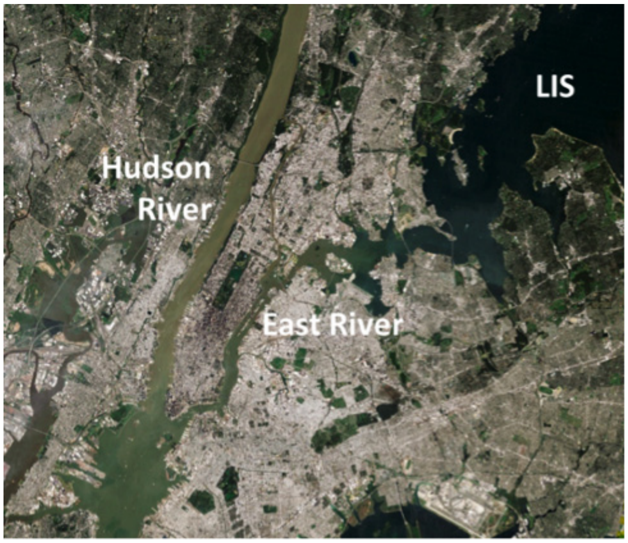


Figure 7: Sediment plume exiting the Hudson River on August 31, 2011, following Tropical Storm Irene's landfall in New York on August 28, 2011. The sediment can be seen traveling via the East River into Long Island Sound. Image credit: Robert Simmon[38].

While New Yorkers often identify the Hudson River and New York Harbor as their emblematic waterways, as a city, they are intimately connected to Long Island Sound by the East River.


Figure 8: A massive flow of sediment filled water passing Randall's Island and heading to Long Island Sound after Tropical Storm Irene. Image credit: Wind Against Current by V. Brezina and J.T. Johnson (CC BY-NC-ND 3.0).

Long Island Sound is home to popular parks and beaches, like Orchard Beach in Pelham Bay Park, the Bronx.

New York City residents benefit directly from a healthy Long Island Sound.

The most popular beach in the City is Orchard Beach, situated right on Long Island Sound in Pelham Bay Park, the Bronx. While there are many consumption advisories related to eating fish caught in the waters around New York City[25], healthy and delicious seafood from Long Island Sound is delivered fresh to city markets and restaurants daily, including the famed Long Island Sound oyster. The East River is a popular waterway for residents and tourists searching out the best views of the Manhattan skyline on the Circle Line or other boats. Many waterfront communities in Queens and the Bronx enjoy marinas and neighborhood swimming holes on the Sound such as Douglaston Manor Beach in Queens and the Mayhem Beach Club in the Bronx. All residents of the eastern United States rely on a healthy Long Island Sound for the critical role it plays as a breeding ground for fish on the eastern seaboard. The ability to interact and enjoy the bounty of our natural resources requires good water quality, achieved by reducing nitrogen inputs to these waters.

PUTTING LONG ISLAND SOUND ON A NITROGEN DIET

When a waterway is receiving too much of any one pollutant, the U.S. Environmental Protection Agency (USEPA) can put it on a diet for that pollutant. These water pollution diets are called Total Maximum Daily Loads (TMDLs). For the Long Island Sound TMDL, the goal was to achieve a reduction in nitrogen entering the Sound sufficient to improve water quality to a state where all of Long Island Sound is swimmable and fishable. Elimination of hypoxia throughout the Sound is used as the metric to measure progress towards this goal.

New York Department of Environmental Conservation (NYSDEC) and CTDEEP created a nitrogen TMDL for Long Island Sound in 2000 with a target of a 58.5% reduction from 1990 levels for nitrogen leaving wastewater treatment plants and a similar level of reduction for other sources in the watershed[27]. The target took into account reductions expected from existing programs throughout the Sound's watershed designed to lower nitrogen loads, so the majority of new efforts to curb nitrogen fell to the wastewater treatment plants.

Hell's Gate Bridge near Astoria Park, Queens

Sources of Nitrogen Pollution

Nitrogen entering coastal waters originates from three sources: human sanitary waste from sewer and septic systems (even well-functioning sewer systems release nutrients); fertilizer applied to lawns, parks, and agricultural fields; and the atmosphere (rain, snow, and dust) (Figure 9). Nitrogen travels to coastal waters carried by direct discharges from wastewater treatment plants and the storm drain system. Groundwater carries nitrogen from septic systems, fertilizers, and atmospheric sources, draining directly to coastal waters or to freshwater streams and rivers which eventually make their way to the coast. In addition to atmospheric sources falling on the land, rain and dust carrying nitrogen also settle directly onto the surface of Long Island Sound.

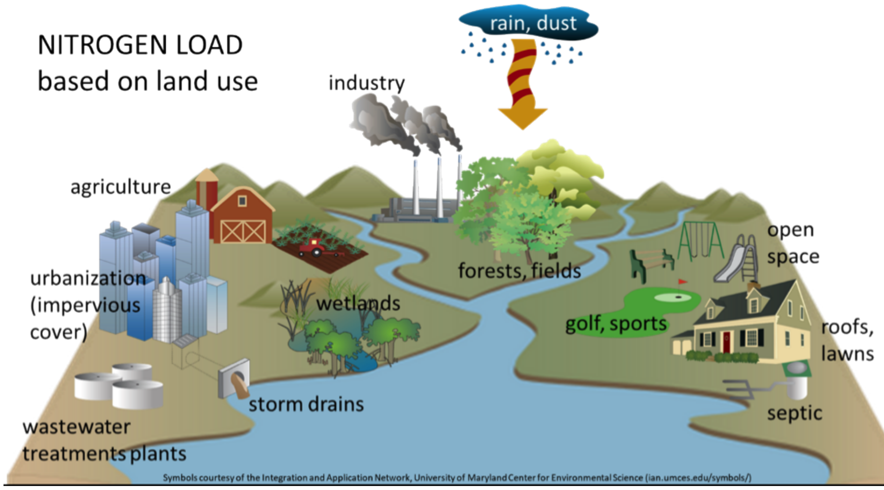
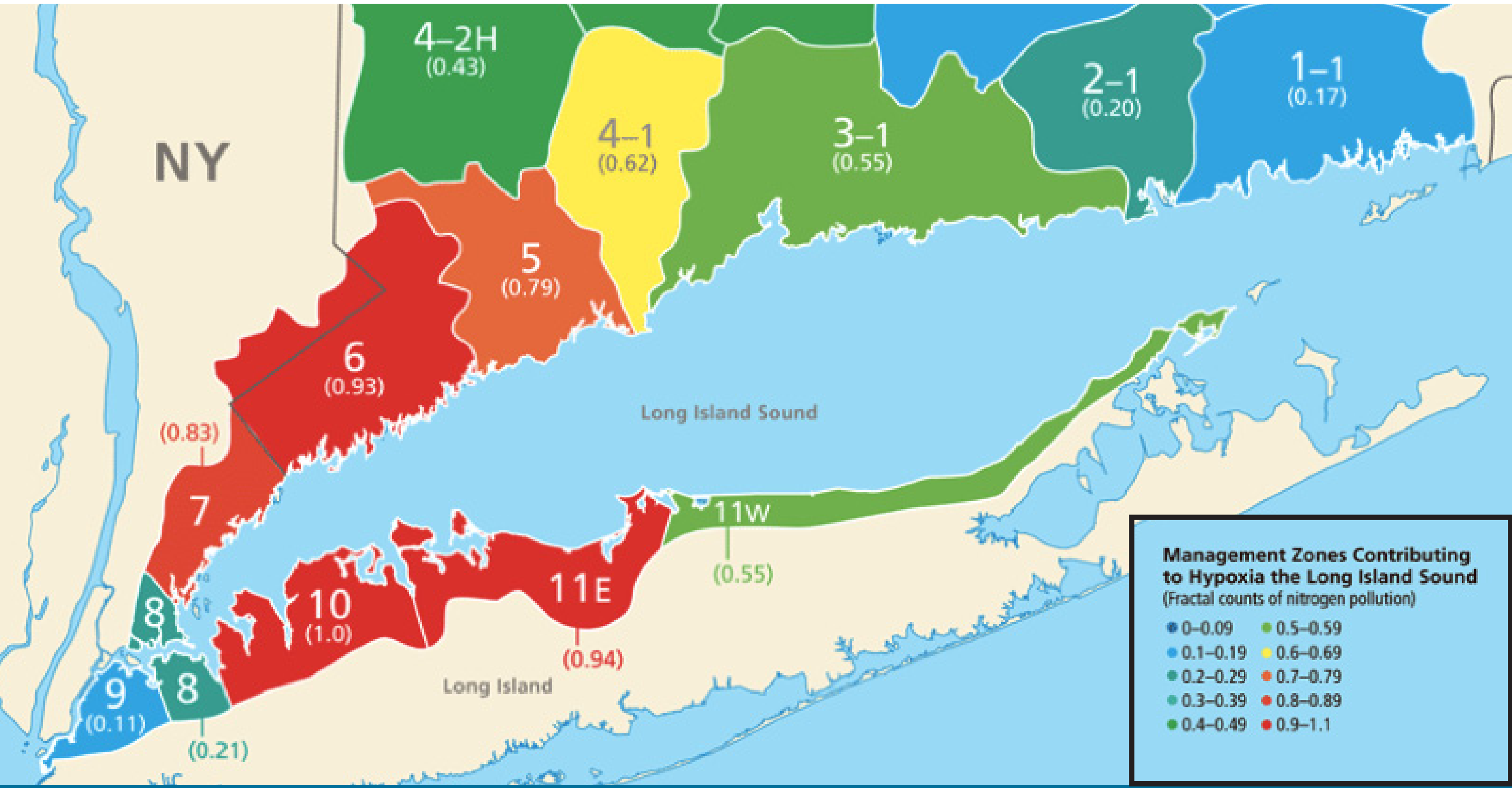


Figure 9

Measuring Nitrogen Impacts

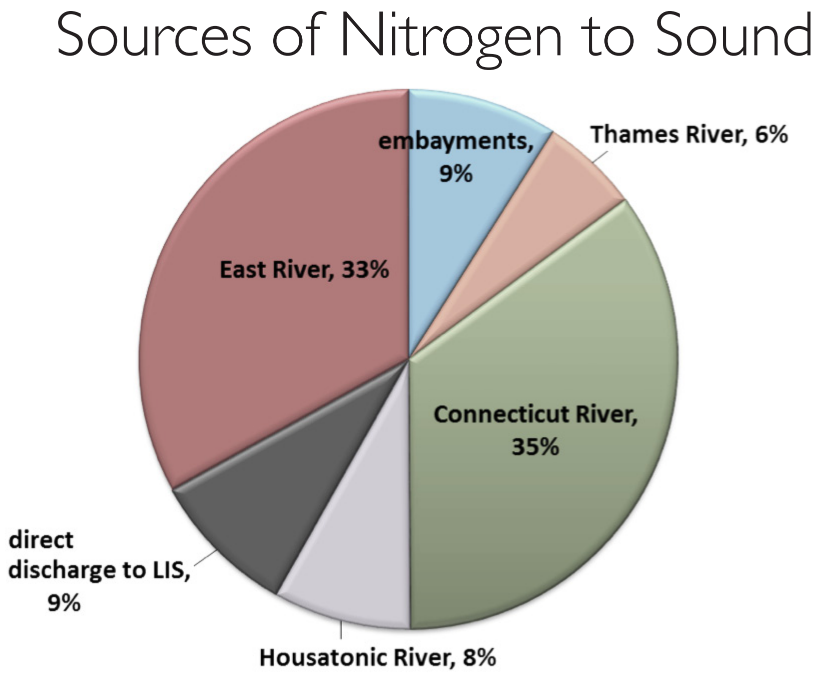
Figure 10: Management zones contributing to hypoxia in Long Island Sound. For each management zone, the fractional impact of the nitrogen load is shown in parentheses[27]. Using the eastern portion of the East River as an example (management Zone 8), 21% of the nitrogen load from Zone 8 is considered to have an impact on Long Island Sound hypoxia. The fractional multipliers are based on modeling of water flow and nitrogen cycling in Long Island Sound. Image credit: Long Island Sound Study [18].



Location Matters

Within the Long Island Sound watershed, nitrogen input from the East River and the Connecticut River dominate the load to the edge of the coastal waters (Figure 11, top panel). However, Long Island Sound communicates with the ocean at both its eastern and western ends. The East River, a tidal strait, connects the New York Harbor to Long Island Sound; due to riverine and tidal movement of water, it can also flow south into the Upper Bay of New York Harbor (Figure 7). The Connecticut River, which carries a similar load of nitrogen into Long Island Sound, flushes with the ocean through the open eastern end of Long Island Sound. The impact on water quality of various management zones in the Long Island Sound watershed (Figure 10), multiplied by the nitrogen load delivered to the edge of Long Island Sound, yields an estimate of the relative contribution of various zones' loads to Long Island Sound water quality (Figure11, bottom panel).

Figure 9 (previous page): Nitrogen sources in watersheds. Nitrogen applied to the land travels through the groundwater, to local streams and rivers, or directly to coastal waters. Point sources, or pipes which convey water directly to a river or coastal waters, carry effluent from wastewater treatment plants or storm water systems; in some cases, the two are combined into combined sewer overflows (CSOs). Image credit: Vaudrey.



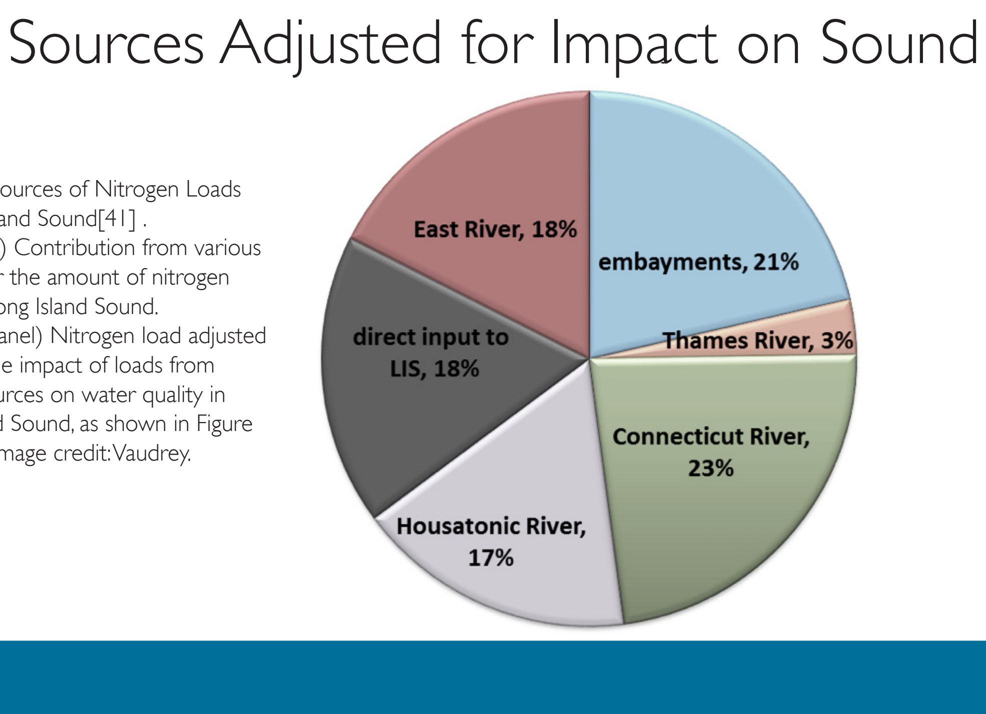
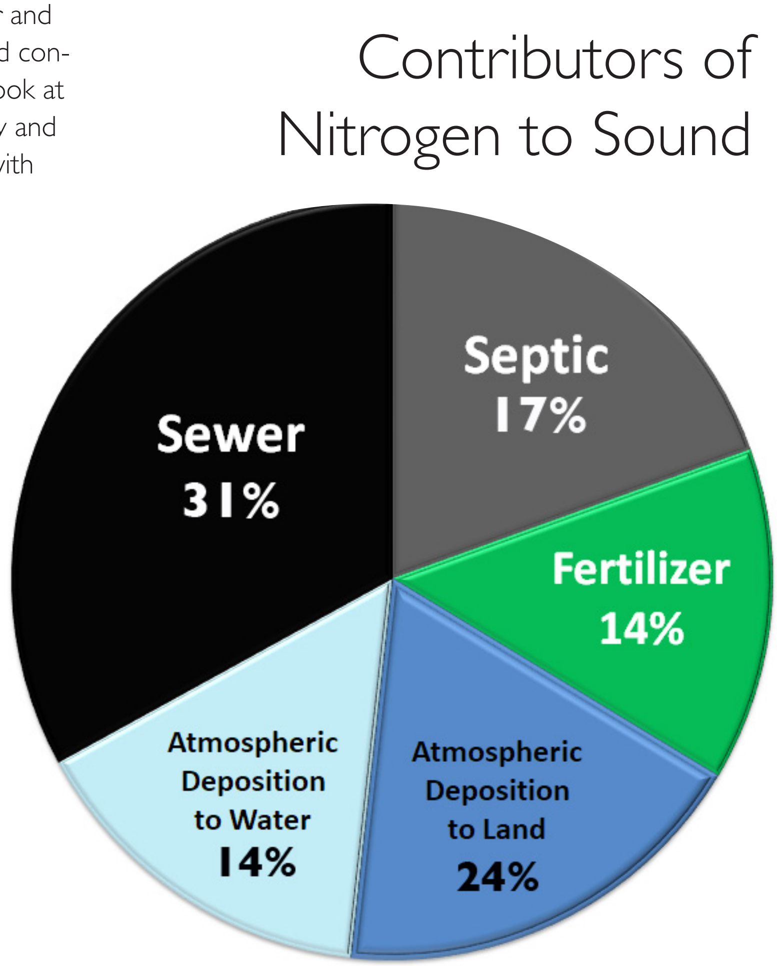


Figure11: Sources of Nitrogen Loads to Long Island Sound[41] . (Top panel) Contribution from various sources for the amount of nitrogen entering Long Island Sound. (Bottom panel) Nitrogen load adjusted to show the impact of loads from various sources on water quality in Long Island Sound, as shown in Figure 9[18, 27]. Image credit: Vaudrey.

Long Island Sound's Sources of Nitrogen

Looking at Long Island Sound as a whole, roughly 48% of nitrogen can be attributed to sewer and septic sources (Figure 12, pie chart). Marked contrasts in these sources are seen when we look at the highly urbanized areas of New York City and the coastal areas of the Sound compared with the rest of the Long Island Sound watershed (Figure 12, pie chart).

For the East River, 97% of the nitrogen load is attributed to wastewater treatment plants. This is in stark contrast to the rest of Long Island Sound's watershed (including all areas extending up to Canada), where atmospheric deposition dominates at 47% of the load; septic is 20% and sewer is 17% of the load (Figure 12, middle bar). Even well-functioning, nitrogen-removing wastewater treatment plants and septic systems output nitrogen, though plants can often be upgraded to remove more of the nitrogen.



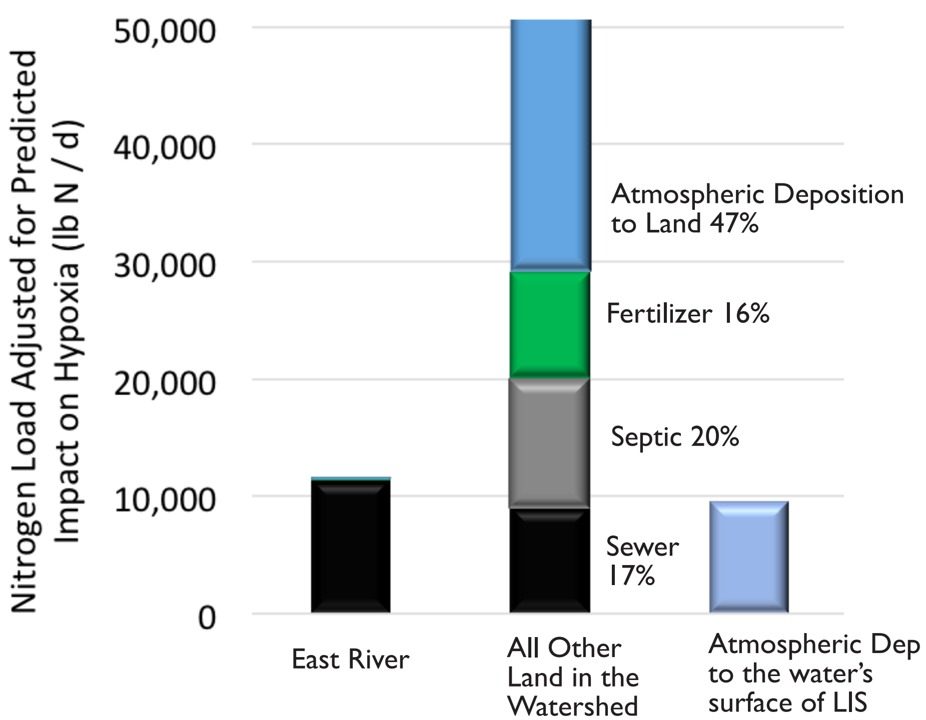


Figure 12: Source of nitrogen loads to Long Island Sound[41]. Nitrogen loads are adjusted to account for the impact of different entry points into the Sound on water quality. Values are based on wastewater treatment plant nitrogen loads from 2016 and current atmospheric deposition estimates. Septic and fertilizer were determined using the most recent census data (2010) and land cover data (2011). The pie chart shows the sum of all sources presented in the bar chart.

NEW YORK CITY'S PROGRESS IN REDUCING NITROGEN POLLUTION

In 2001, the USEPA approved the 2000 TMDL nitrogen reduction plan for Long Island Sound to address the mounting problems caused by the large amounts of nitrogen entering the Sound[9, 27]. Among other requirements, the plan mandated a 58.5% reduction of nitrogen discharged to the Sound from wastewater treatment plants serving New York City, Long Island, Westchester County, and Connecticut, through a phased approach over 15 years, using 1990 levels as the baseline.

As part of an agreement with the New York State Department of Environmental Conservation (NYSDEC) and the New York State Attorney General, the NYCDEP committed to reducing the combined nitrogen discharges from its wastewater treatment plants located along the East River by 58.5% by 2015. Specifically, the plan called for four of the six New York City wastewater treatment plants that directly impact Long Island Sound—Hunts Point, Bowery Bay, Wards Island, and Tallman Island in the Upper East River—to be upgraded to treat nitrogen. NYCDEP and NYSDEC decided to upgrade the four Upper East River plants to a degree that the nitrogen load from all six plants, adjusted for impact on water quality, would be reduced by the mandated 58.5%. Therefore, the two plants in the Lower East River—Newtown Creek and Red Hook—were not upgraded to treat nitrogen.

In September 2016, New York City reached that goal (Figure 13), after an approved deadline extension. According to NYCDEP reports, the East River wastewater treatment plants have reduced their nitrogen discharge by 60%[26]. By going above and beyond the required reductions, the East River plants were able to "trade away" their excess reductions to offset shortfalls by wastewater treatment plants in Westchester County that are still working to meet the 58.5% reduction.

Reductions in Nitrogen to Meet 58.5% Target: 2006 - 2017

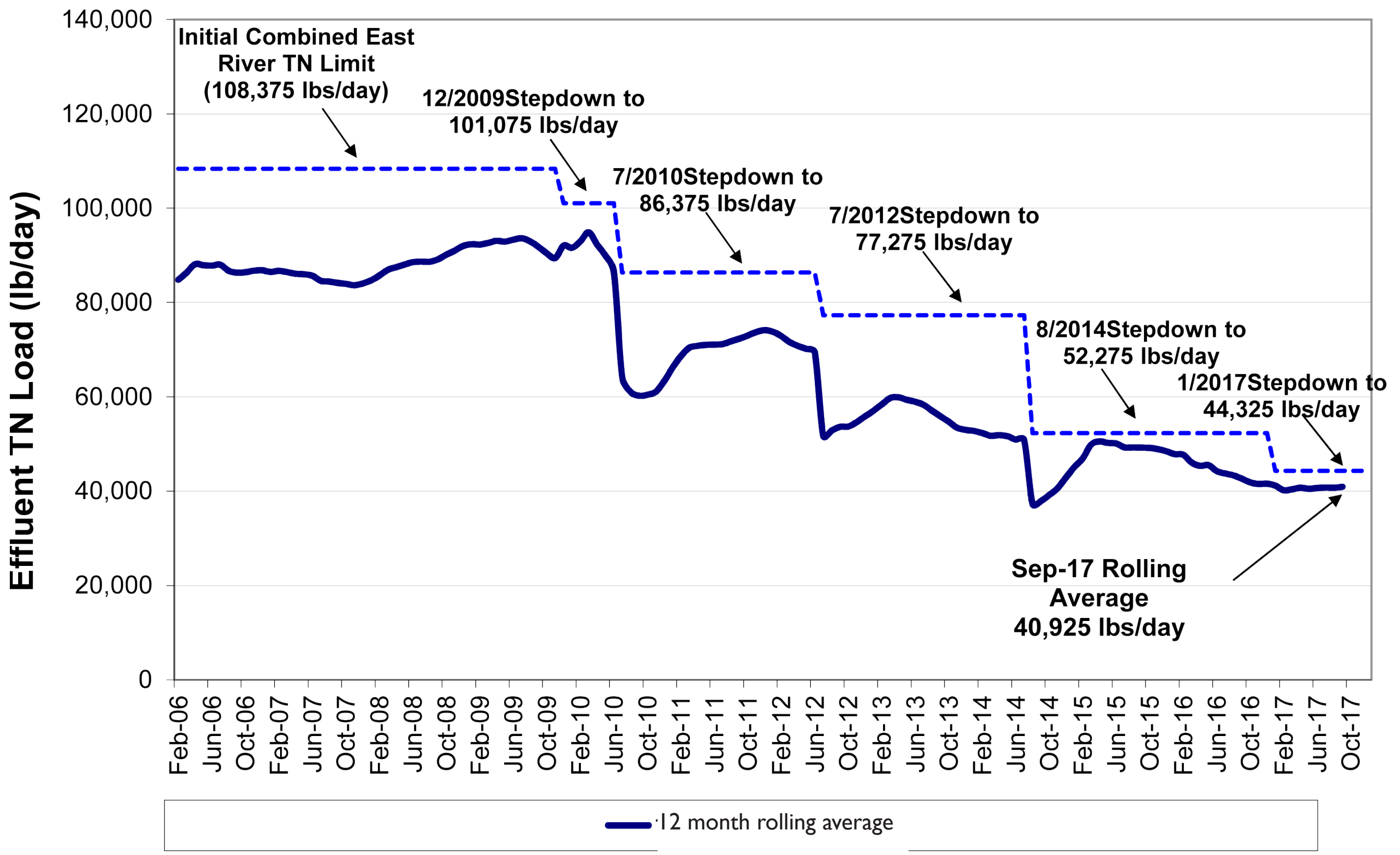


Figure 13: East River wastewater treatment plants' history of progress towards the 2000 TMDL goal of a 58.5% reduction (relative to 1994 levels) of nitrogen in effluent. In September 2017 these plants reached a 62% reduction rate. Image credit: NYCDEP.

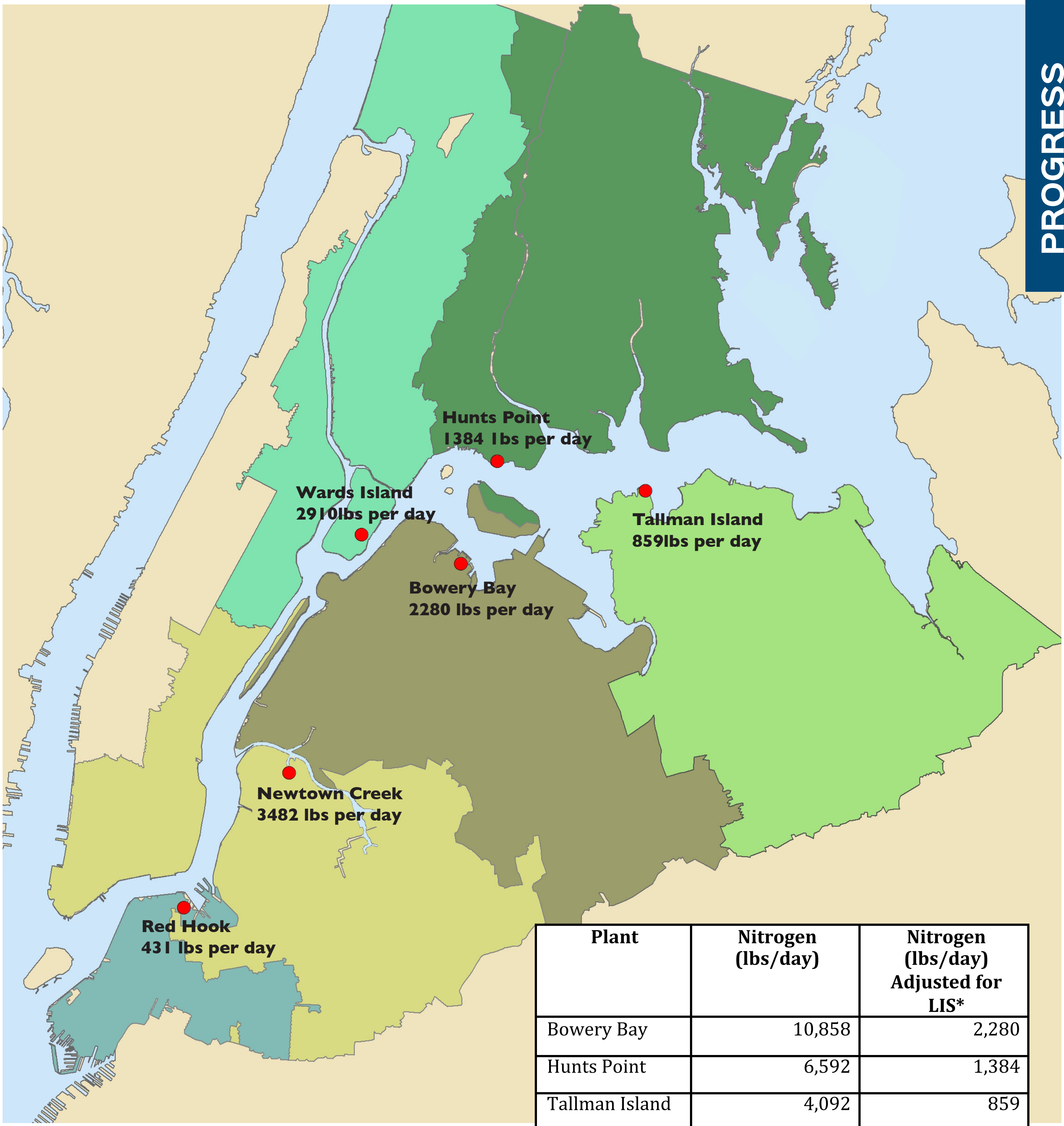
The nitrogen removal technology installed at the plants converts nitrogen present in wastewater into inert nitrogen gas that is released harmlessly into the atmosphere[26]. This work required significant upgrades to much of the plants' supporting infrastructure—an investment that not only reduced nitrogen discharges, but also brought the plants into a good state of repair for decades into the future.

The capital investments[26] made in each plant included:

- $277 million at the Hunts Point Wastewater Treatment Plant
- $388 million at the Wards Island Wastewater Treatment Plant
- $209 million at the Tallman Island Wastewater Treatment Plant
- $161 million at the Bowery Bay Wastewater Treatment Plant

The important investment made by New York City in improving the wastewater treatment technology at these four plants will support improved water quality today and for generations to come. The reduction in nitrogen pollution that has been achieved is critical to supporting the abundant and diverse marine life of Long Island Sound, a source of livelihood, food, and enjoyment for millions of people.

Wastewater Treatment Plants and Daily Pounds of Nitrogen Discharge



Plant	Nitrogen (lbs/day)	Nitrogen (lbs/day) Adjusted for LIS*
Bowery Bay	10,858	2,280
Hunts Point	6,592	1,384
Tallman Island	4,092	859
Wards Island	13,858	2,910
Newtown Creek	31,658	3,482
Red Hook	3,917	430

* 2016 Average Nitrogen Discharges: Adjusted for Impact on Long Island Sound Water Quality

Figure 14: The New York City wastewater treatment plants that impact Long Island Sound and the areas they serve (their "sewershed"). These wastewater plants handle 60% of NYC's wastewater. Image credit: Save the Sound.

Queensborough Bridge over East River

WHAT'S NEXT?

Additional Stressors

Adding to the challenge of restoring Long Island Sound to acceptable nitrogen and oxygen levels are other stressors, including rising population and climate change.

Population projections for New York City predict an increase from 8.2 million people in 2010 to 9 million in 2040[4]. The projected increase includes 194,000 additional people in the Bronx, 160,000 in Manhattan, 163,000 in Queens, and 288,000 in Brooklyn. All of the Bronx drains to the East River. The northern halves of Brooklyn and Queens, plus 70% of Manhattan, also drain to the East River. **This addition of a half-million people to the sewershed of the East River between 2010 and 2040 puts an ever-increasing burden on the wastewater treatment plants**. This in turn increases the amount of nitrogen delivered to the Sound.

To achieve a Long Island Sound and East River free of hypoxia and other water quality issues, our nitrogen reduction plans must anticipate this increasing load. Coupled with the impacts of climate change, this higher nitrogen load delivered to the wastewater plants will have an even greater impact on water quality.

The extent and duration of hypoxia in Long Island Sound is controlled by total nitrogen loads (especially the spring loads), summer wind speed, spring chlorophyll *a*, and maximum river discharge[17].

While physical factors such as wind speed and river flow contribute to the onset of hypoxia,[32, 43] *nitrogen inputs are the only component we can control*. Rising water temperatures and changes in how freshwater is delivered to Long Island Sound, both in timing and intensity of storm events and river flow, is related to changes in the climate[11, 42]. These changes to freshwater delivery may result in stronger stratification and changes in river flow, both of which can cause hypoxia to last longer and be more intense. [28, 44, 45].

Ocean acidification is also driven by climate change, with increasing carbon dioxide in the atmosphere resulting in corresponding increases in marine waters[14, 30]. Coupled with increasing temperature, this increased carbon dioxide in our oceans and coastal waters leads to more acidic waters. Both acidity and hypoxia are exacerbated by large nutrient loads, making our waters both lower in oxygen and more acidic[2, 3]. Hypoxia and ocean acidification act synergistically to make conditions worse, changing the community of sea life to organisms that can tolerate these lower oxygen and higher acidity conditions[10].

The influence of these stressors on the Sound work counter to the goals of the nitrogen reduction plan, resulting in unacceptably low oxygen levels. The result is loss of coastal marshes that once protected shoreline communities from storms and flooding[1], persistent low oxygen dead zones where fish cannot survive[13], and the overgrowth of seaweed and phytoplankton blooms[40].

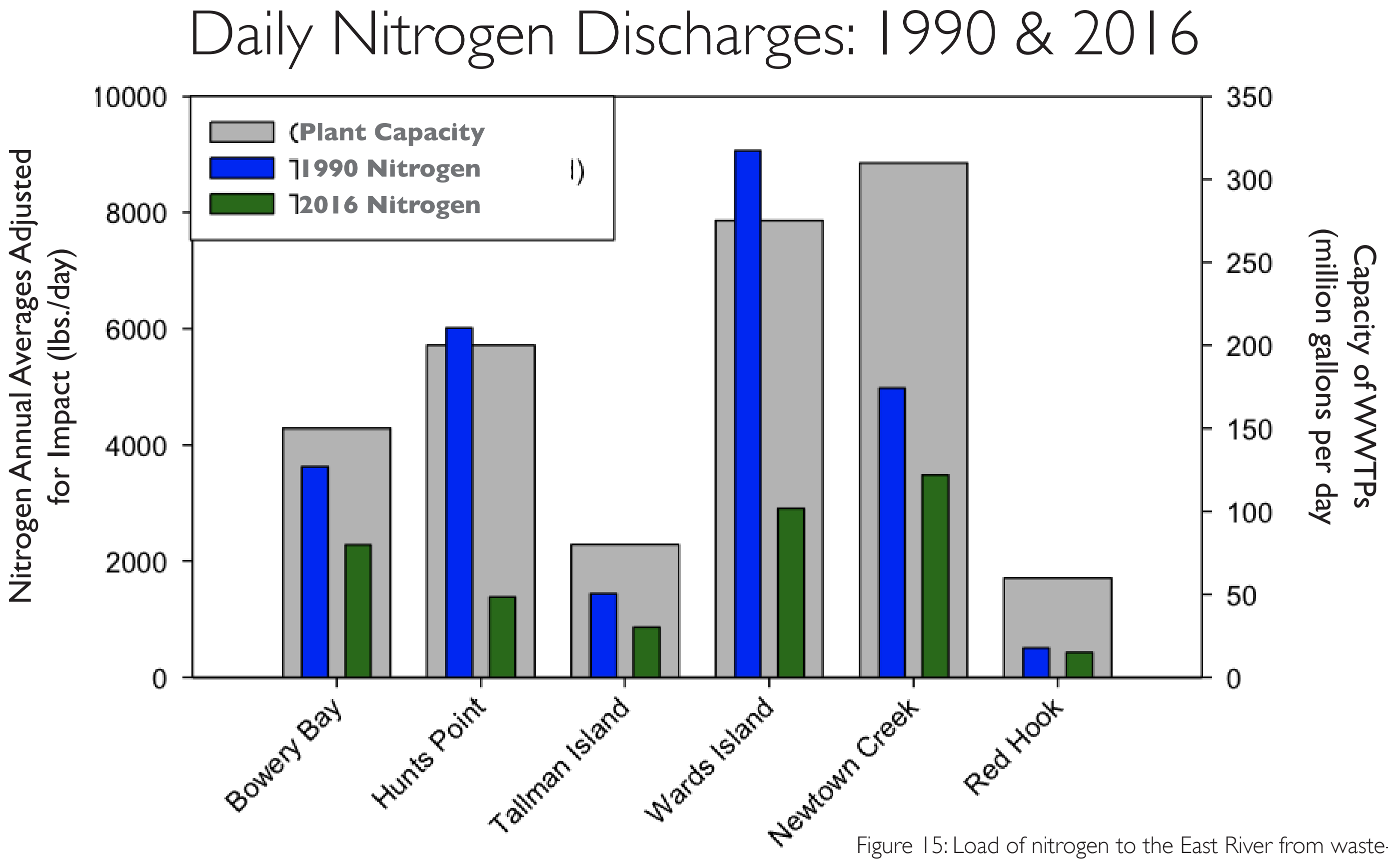


Figure 15: Load of nitrogen to the East River from wastewater treatment plants. Nitrogen in effluent adjusted for impact on Long Island Sound water quality for the six wastewater treatment plants in the East River sewershed as reported by the plants for 2016 versus the baseline of 1990. The nitrogen load was adjusted using the fractional impact of nitrogen loads on hypoxia in Long Island Sound as shown in Figure 10[18, 27]. Image credit: Vaudrey.

Sewer Plants Are Still the Top Contributors of Nitrogen

Even with the most recent upgrades to the wastewater treatment plants throughout the Long Island Sound area, nitrogen inputs impacting water quality are still dominated by this sewer source which contributes about 33% of the total nitrogen load when adjusted for impact on Long Island Sound water quality (Figure 12). Even after achieving the 58.5% reduction of nitrogen leaving wastewater plants, the East River wastewater treatment plants alone account for *18% of the total nitrogen load* to Long Island Sound, or *56% of the load* originating from all sewer sources in the Long Island Sound watershed (Figure 12). While great progress has been made reducing the nitrogen leaving wastewater treatment plants around the Sound, including New York City, additional reductions are needed to further improve water quality. Reductions in nitrogen loads to the East River are integral to this process.

The East River receives wastewater effluent from six treatment plants servicing the Bronx and portions of Manhattan, Queens, and Brooklyn (Figure 15). Taking into account the adjustment for impact on Long Island Sound water quality (Figure 10), 30% of the remaining nitrogen load is coming from one of plants that did not receive the upgrades to treat nitrogen, Newtown Creek (Figure 15). To further reduce nitrogen entering the Sound, New York City needs to continue to focus on its wastewater treatment plants and look for further reductions they can achieve in the six wastewater treatment plants that impact the Sound. This could be achieved by getting a higher reduction using the newly installed equipment at the four Upper East River plants and/or by installing nitrogen removing technology at the Newtown Creek Plant.

Save the Sound's new Long Island Soundkeeper

US EPA's Call for New Reductions

The target set for reducing nitrogen from wastewater treatment plants was met by Connecticut in 2015 and by New York State in 2016. After reviewing the response in the Sound, USEPA called for continuing efforts to reduce nitrogen, as detailed in the Long Island Sound Nitrogen Strategy issued in 2015[35, 36]. This new guidance document moves beyond wastewater treatment plants, recommending a more holistic approach to addressing the nitrogen pollution problem.

The four central recommendations are:

1. Complement Long Island Sound TMDL nitrogen management initiatives with efforts to address other eutrophication-related impacts; for instance, involving coastal communities in addressing local problems caused by nitrogen.

2. Convert the current nutrient criteria from a narrative which describes the desired goal (i.e. eliminate hypoxia) to numeric criteria (i.e. nitrogen in the water cannot exceed X kilograms per liter).

3. Customize the numeric criteria for each of three watershed groupings:
   a. Coastal watersheds that directly drain to embayments or nearshore waters.
   b. The three large rivers that drain into the Sound—the Connecticut River, Housatonic River, and Thames River.
   c. Western Long Island Sound coastal watersheds with large, direct discharging wastewater treatment plants (includes plants located in portions of New York City, Westchester County, Nassau County).

4. Continue to support monitoring, modeling, and researching the link between nitrogen loading and bottom-water dissolved oxygen conditions in the open waters of the Sound.

As noted in the cover letter accompanying the Long Island Sound Nitrogen Strategy, "Despite this progress, there is more to do."[35] Improving water quality in Long Island Sound, reducing the area of hypoxia, and providing habitats supportive of a diverse and vibrant community of sea life require a continuing commitment to reduce nitrogen inputs to the Sound.

Summary

- New York City succeeded in meeting its target to reduce nitrogen pollution entering Long Island Sound from East River wastewater treatment plants. This tremendous investment in the health of the Sound ($900 million) will pay dividends in clean water and a vibrant ecosystem for years to come.

- The hypoxic dead zone in Long Island Sound is now smaller, but still there, stretching from the East River past the coasts of Westchester and Nassau County in the hot summer months, wrecking havoc on marine life and critical ecosystems.

- New York City remains one of the top contributors of nitrogen to the Sound, discharging approximately 35 tons of nitrogen into the East River every day, contributing 18% of the nitrogen pollution that is degrading water quality in Long Island Sound.

- Six East River wastewater treatment plants still account for 97% of the city's nitrogen load to the Sound.

- Save the Sound calls on New York City to increase its nitrogen reduction at the four recently upgraded plants, targeting the months when hypoxia occurs.

- Save the Sound calls on New York City to develop plans to clean the bays and harbors of the East River and the Sound. These waterways, where the public most often comes into contact with the water, are stressed from nitrogen and bacteria pollution[31]. Communities should be engaged through local water monitoring and projects designed to reduce local pollution sources and restore natural habitats.

- If additional nitrogen reductions are needed, upgrading the Newtown Creek wastewater treatment plant to include nitrogen removal should be evaluated.

Save the Sound thanks USEPA, the Long Island Sound Study, NYSDEC, CTDEEP and NYCDEP for their ongoing research, monitoring, and investments in wastewater infrastructure and other initiatives that restore and protect Long Island Sound and the East River for future generations.


RFK Bridge over East River

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