Nitrogen Reduction Strategies in Northeast National Estuary Programs: Successes, Setbacks, Lessons Learned

Long Island Sound

RAE-TCS Summit
December 13, 2016
Long Island Sound

MA/NH/VT: Tributary

CT/NY: In-basin

Connecticut

New York
Problem: Hypoxia

The frequency of hypoxia in Long Island Sound bottom waters is shown in the map. The areas with the highest percentage of hypoxic years are marked in red. The image also shows a Menhaden fish kill in Hempstead Harbor, NY from the 1990s.
### Long Island Sound Total Maximum Daily Load

#### 2000 TMDL to Attain DO

<table>
<thead>
<tr>
<th>Category</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-Basin WWTPs</td>
<td>Range from 58.5% to 86% reduction</td>
</tr>
<tr>
<td>In-Basin NPS</td>
<td>10% reduction for SW and NPS</td>
</tr>
<tr>
<td>Upper Basin WWTPs</td>
<td>25% reduction for point source wastewater</td>
</tr>
<tr>
<td>Upper Basin NPS</td>
<td>10% reduction for SW and NPS</td>
</tr>
<tr>
<td>Atmospheric Deposition</td>
<td>18% reduction expected (not required) from implementation of 1990 CAAA</td>
</tr>
<tr>
<td>Alternatives to Nitrogen Reduction</td>
<td>Aeration, bioextraction, etc.</td>
</tr>
</tbody>
</table>
Success: Declines in big sources of N  
Challenge: diffuse sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Trend</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WWTPs (CT, NY)</td>
<td>↓</td>
<td>98% of WLA trade equalized target</td>
</tr>
<tr>
<td>Atm. Deposition</td>
<td>↓</td>
<td>26% ↓ TN, 50% ↓ NO$_3$</td>
</tr>
<tr>
<td>Agricultural</td>
<td>↓</td>
<td>25-40% ↓ in fertilizer and livestock</td>
</tr>
<tr>
<td>Urban storm water</td>
<td>↑</td>
<td>2-3% ↑ in impervious areas</td>
</tr>
<tr>
<td>Septic</td>
<td>↑</td>
<td>8% ↑ in basin population (1990-2010)</td>
</tr>
<tr>
<td>Turf Fertilizer</td>
<td>↑</td>
<td>1-2% ↑ in turf/grass areas</td>
</tr>
</tbody>
</table>

![N from STPs](image)

Adjusted from Mullaney, USGS
Success: Hypoxia less severe

Maximum Area of Hypoxia (state acute criteria < 3 mg/l)

Area in mi² (total LIS area = 1,320 mi²)

- Pre-TMDL Area Ave. = 205 mi²
- Post-TMDL Area Ave. = 167 mi²

Five-year rolling average
Second smallest area in 28 years
Historical eelgrass (black dots) versus current (orange circle)

Tackling the Unfinished Agenda

Source: Dr. Christopher Gobler, SBU/SOMAS
December 23, 2015

Clark Freise, Commissioner
NH Dept. of Environmental Services
29 Hazen Drive, P.O. Box 95
Concord, NH 03302-0095

Rob Klee, Commissioner
CT Dept. of Energy & Environmental Protection
79 Elm Street
Hartford, CT 06106-5127

Alyssa B. Schuren, Commissioner
VT Dept. of Environmental Conservation
1 National Life Drive, Main 2
Montpelier, VT 05620-3520

Basil Seggos, Acting Commissioner
NY State Dept. of Environmental Conservation
625 Broadway
Albany, NY 12233-1011

Martin Sunberg, Commissioner
MA Dept. of Environmental Protection
1 Winter Street
Boston, MA 02108

Dear Commissioners Freise, Klee, Schuren, Seggos and Sunberg:

Our agencies have worked together for many years to repair the environmental damage caused by excessive nitrogen in Long Island Sound. We appreciate the investments you and your communities have made, and welcome the progress we have begun to see in the Sound. It is clear, however, that more must be done if we are to fully restore this vital resource. We are writing this letter to invite you to partner with EPA on our plan to implement a comprehensive nitrogen reduction strategy for Long Island Sound (LIS). As you know, implementation of the Total Maximum Daily Load to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound (2000 TMDL) has resulted in significant progress toward reducing dissolved oxygen (DO) impairments in the open waters of the Sound. EPA commends the States for their collective efforts to implement the measures necessary to meet the load reductions specified in the 2000 TMDL. Upgrades to 106 wastewater treatment facilities in Connecticut and New York have resulted in the discharge of 40 million fewer pounds of nitrogen in calendar year 2014 compared to baseline levels, a 51.5 percent reduction. Annual monitoring has documented a 40 percent reduction in the area of hypoxia compared to pre-TMDL levels.

Despite this progress, there is more to do. It is clear based on monitoring and modeling that current and planned actions by the states will fall short of fully implementing the 2000 TMDL and will be insufficient to address other adverse impacts to water quality in Long Island Sound, and its embayments and near shore coastal waters. First, an assessment of stormwater and nonpoint sources of nitrogen suggests that loads from urban stormwater, on-site wastewater

“Aggressively continue progress on nitrogen reductions, in parallel with the States' continued implementation of the 2000 TMDL, and achieve water quality standards throughout Long Island Sound and its embayments and near shore coastal waters.”
Nitrogen Reduction Strategy

Customize the application of nitrogen thresholds to develop targets for each of three watershed groupings:

- **Coastal watersheds** that directly drain to embayments or nearshore waters
- **Tributary watersheds** that drain inland reaches
- **WLIS coastal watersheds** with large, direct discharging WWTFs
Use of sea grass restoration goals to establish N caps in Tampa Bay, FL

**KISS: Empirical Modeling Approach Pursued**

- **Step 1:**
  - TN Load to Chl-a Concentrations

- **Step 2:**
  - Chl-a to Light @ Depth Target

**Step 1: TN Load to Chl-a Relationships**

- Monthly TN Loading Data
  - Industrial Point Sources
  - Domestic Point Sources
  - Atmospheric Deposition
  - Non-Point Sources (all watershed loads)
  - Port Fertilizer Losses
  - Groundwater
  - Springs

*Various Monthly TN Load Lags Tested*

- Monthly Chl-a Data
  - 45 Stations in 4 Main Bay Segments

*1985-1994 Data Used*

Relationship between N load and chlorophyll-a in Tampa Bay, FL

**Future Challenges**

1. Setting numeric N targets based on ecological goals
2. Being accountable while fostering local collaboration and innovation
3. Building science feedback into adaptive implementation
Long Island Sound Comprehensive Conservation and Management Plan 2015
Returning the Urban Sea to Abundance
N Strategy information

http://longislandsoundstudy.net/issues-actions/water-quality/nitrogen-strategy/

Q/A and Discussion