

## **Integrating Clean Water Act Requirements with Ecosystem Based Management Approaches in the Long Island Sound**

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Eutrophication is among the most serious threats worldwide to the function and services supported by coastal ecosystems (Boesch et al., 2001). Attempts to reverse coastal eutrophication have centered on reducing land-based sources of nutrients, such as fertilizer applications, wastewater treatment plant dischargers, and air emissions. Both regulatory and non-regulatory approaches to assign source control responsibility are aided by the perception of all parties that allocations are fair and equitable, using resources wisely to maximum environmental benefit. Balancing legal requirements for attaining water quality standards with the costs of attainment, who pays, and for whose benefit are primary challenges to arriving at equitable and implementable solutions.

In addition, historical alterations in habitat quality, food webs, and community structure in coastal systems can alter nutrient processing, thus modifying the ecosystem response to reduced nutrient loads (Duarte et al., 2009). A systems approach that integrates watershed load reduction programs with enhanced nutrient processing in coastal systems may prove more effective at restoring ecosystem services at less cost than load reduction programs alone, helping to arrive at cost-effective, affordable, and equitable solutions.

The United States Environmental Protection Agency is working with five catchment states to revise a Total Maximum Daily Load that was developed by the states of Connecticut and New York (CTDEP and NYSDEC, 2000) for nitrogen discharges to attain water quality standards for dissolved oxygen in Long Island Sound. Over the past decade investments of more than \$1 billion have been made to upgrade wastewater treatment plants in Connecticut and New York to remove nitrogen and to better manage nonpoint sources. Additional investments in watershed infrastructure and management practices of more than \$1 billion are possible. As part of the TMDL revision, equitable allocations for the states of Massachusetts, New Hampshire, and Vermont will also be evaluated. The presentation will focus on the challenges to arriving and implementing equitable allocations for nutrient control among both land-based source controls and the application of nutrient bio harvesting (defined here as removing nutrients from an aquatic ecosystem through the harvest of enhanced biological production, including but not limited to the aquaculture of suspension-feeding shellfish and/or algae) for the Long Island Sound ecosystem. Elements to a systems approach to Long Island Sound that integrates watershed load reduction programs with enhanced nutrient processing to attain water quality standards, restore designated uses, and restore ecosystem services will be emphasized.

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