USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2003CT25B

Title: Effects of Variation in Nitrogen and Phosphorus Ratios and Concentrations on Phytoplankton Communities of the Housatonic River

Project Type: Research

Focus Categories: Ecology, Nutrients, Water Quality

Keywords: algae, eutrophication, impoundments, nitrogen, nutrients, phosphorus, rivers, saline-freshwater interfaces, water chemistry, water quality

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Congressional District: 4th

Principal Investigators: Klug, Jennifer

Abstract: One of the most serious threats to freshwater and marine ecosystems is an overabundance of nutrients, particularly nitrogen and phosphorus. These nutrients fuel high algal growth (blooms), leading to numerous other changes in aquatic systems. Surface blooms reduce light and nutrient availability to other algal species leading to lower algal diversity. When algae die, they provide an organic carbon source for bacteria. Bacterial decomposition consumes oxygen and in temperature or salinity stratified systems, bottom waters are depleted of oxygen. In addition, algal blooms impair recreation and may cause taste and odor problems in drinking water systems. The series of symptoms including high nutrient levels, high algal growth, and low oxygen concentration is called eutrophication. Many freshwater and estuarine systems in Connecticut are highly eutrophic. The leading cause of eutrophication in estuarine systems is excess nitrogen (NYSDEC and CTDEP 2000), whereas the nutrient contributing to algal blooms in freshwater systems is typically phosphorus (Kalff 2002). Nitrogen and phosphorus enter freshwater and estuarine systems in many different chemical forms (dissolved vs. particulate and biologically available vs. biologically unavailable). Sewage treatment plants, runoff from urban and agricultural lands, storm sewer overflow, and atmospheric deposition are the main sources of nutrients in

Connecticut (NYSDEC and CTDEP 2000). In order to comply with the Clean Water Act, Connecticut and New York, in collaboration with the Environmental Protection Agency, have implemented the Long Island Sound Study, which aims to improve the water quality of Long Island Sound by reducing nitrogen input (NYSDEC and CTDEP 2000). Under that plan, phosphorus is not targeted for reduction and many of the methods used to reduce nitrogen will not alter phosphorus concentration. Because nutrients enter Long Island Sound via rivers and streams, these freshwater systems are targets for reduction. A model has been constructed to predict how dissolved oxygen levels in Long Island Sound will change with particular reductions in nitrogen loading (NYSDEC and CTDEP 2000), however, it is not clear how the proposed management will affect algal growth in freshwater systems. This study will address the impacts on freshwaters by assessing the effects of changing nitrogen and phosphorus ratios and concentrations on algal growth in the Housatonic River. To begin to identify how nutrient concentration and N:P ratios impact the phytoplankton on the lower Housatonic River, I plan to: 1) Identify seasonality of phytoplankton and nutrient concentrations in the lower Housatonic River, 2) Identify areas of nitrogen vs. phosphorus limitation from upstream to the mouth of the Housatonic River, and 3) Explore how changes in the nitrogen to phosphorus ratio (N:P ratio) in the Housatonic affect short-term phytoplankton growth. Accomplishing these three objectives will allow us to begin to understand how proposed changes in nutrient loading to Long Island Sound will affect one its major tributaries.

Kalff, J. 2002. Limnology: inland water ecosystems. Prentice Hall. 592 pages.

NYSDEC and CTDEP. 2000. A total maximum daily load analysis to achieve water quality standards for dissolved oxygen in Long Island Sound. Prepared in conformance with Section 303(d) of the Clean Water Act and the Long Island Sound Study.
