

NUMERIC NUTRIENT CRITERIA FOR THE GREAT BAY ESTUARY IN NEW HAMPSHIRE

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The Piscataqua Region Estuaries Partnership (PREP), formerly called the New Hampshire Estuaries Project, documented increasing nitrogen concentrations, dissolved oxygen impairments, and decreasing eelgrass habitat in the Great Bay Estuary as part of its State of the Estuaries Report in 2006. These trends highlighted the importance of developing numeric nutrient criteria for the estuary. Numeric nutrient criteria were needed because New Hampshire's water quality standards contain only narrative criteria for nutrients to protect designated uses. Narrative standards are difficult to apply for impairment and permitting decisions. PREP accelerated the nutrient criteria development process in New Hampshire by dedicating staff time to develop methods, forming a technical working group to review approaches and proposed criteria, and supporting additional research to fill data gaps. The New Hampshire Department of Environmental Services used the methods developed by PREP to establish proposed numeric nutrient criteria for the estuary.

A variety of data sources were evaluated to provide multiple lines of evidence relative to appropriate thresholds for nutrients in the Great Bay Estuary. Each data source was chosen because of its relevance to the conceptual model for eutrophication in estuaries from the National Estuarine Eutrophication Assessment Update. First, water quality measurements from different sections of the estuary were used to develop linear regressions between total nitrogen concentrations and chlorophyll-*a*, dissolved oxygen, and water clarity. Second, continuous monitoring of dissolved oxygen with in-situ sensors provided detailed information related to dissolved oxygen impairments. Finally, relationships between water quality and water clarity were quantified based on light attenuation measurements by in-situ sensors and hyperspectral imagery.

As a result of the research, the New Hampshire Department of Environmental Services has proposed numeric nutrient criteria for the designated uses of "primary contact recreation" and "aquatic life use support" for the Great Bay Estuary. For "aquatic life use support" the endpoints of concern were dissolved oxygen and eelgrass habitat. For each of these designated uses and endpoints, a different threshold for total nitrogen concentrations was determined. Criteria were also developed for chlorophyll-*a* and water clarity for the dissolved oxygen and eelgrass habitat endpoints, respectively. The numeric criteria will first be used to implement the narrative criteria as thresholds for impairment determinations in the State of New Hampshire 303(d) list in 2010. Later, the thresholds will be proposed as new water quality criteria in New Hampshire regulations, making New Hampshire one of the first states to establish numeric nutrient criteria for estuaries.

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