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Comparative Systems Approaches for Assessment of Biological Responses to Nutrients in Estuaries

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LTG 1 Poster 04

Science Questions

Long Term Goal 1: Provide the approaches and methods to develop and apply nutrient criteria that will support designated uses for aquatic systems

What are the quantitative and causal relationships between varying levels of nutrients and the biological responses of aquatic ecosystems and the resulting services such systems provide?

How Research Addresses the Water Quality MYP Goals

The research will provide the scientific basis and nutrient load-response models required to develop numeric nutrient criteria protective of aquatic life for US estuarine and Great Lakes ecosystems.

Research Objectives

Overall Objective: to construct nutrient load ecological response models for Estuarine and Great Lakes Ecosystems

Specific Objectives for New England Region

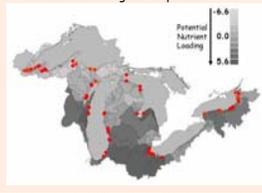
- Estimate nitrogen load to estuaries
- Determine eelgrass extent, chlorophyll-a and benthic habitat quality metrics along N gradient
- Estimate residence time
- Construct nitrogen load-ecological response models using residence time or other factors to minimize uncertainty



Research Objectives

Specific Objectives for Great Lakes Region

- Identify metrics for characterizing responses to nutrient inputs
- Determine methods for estimating nutrient loading
- Determine relationships between nutrient stress and ecological responses

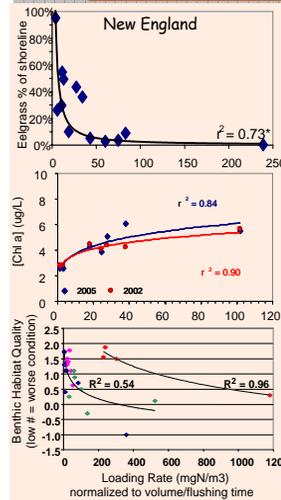


Specific Objectives for Pacific NW Region

- Estimate nutrient loading and sources of nutrients (natural versus anthropogenic)
- Determine regional patterns of eelgrass, nutrients, and chlorophyll a
- Identify habitat susceptible to anthropogenic nutrient loading



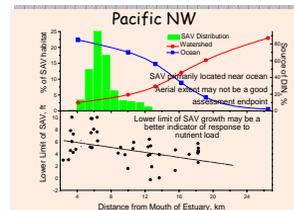
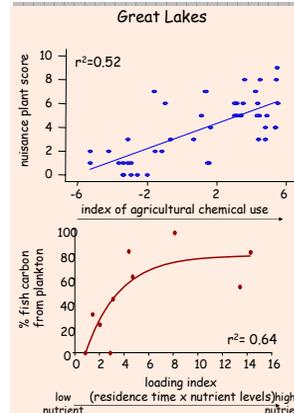
Research Results



Research Conclusions & Future Directions

Within Increasing Nutrient Inputs

- Aquatic Vegetation:**
- Decrease in eelgrass extent (NE estuaries)
 - Increase in nuisance species (GL wetlands)
- Food webs:**
- Increase in phytoplankton levels (NE/PNW estuaries/GL wetlands)
 - Increase in importance of plankton in fish diet (GL wetlands)
- Hypothesis:**
- Decrease in benthic habitat quality (NE estuaries)



In Pacific NW estuaries, Lower estuary SAV habitat less susceptible to nutrient input than upper estuary SAV habitat.

Interactions with Customers

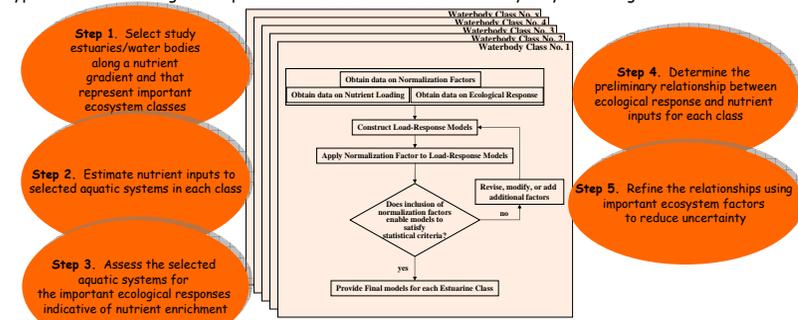
- Advisors to/collaborators with:**
- EPA Long Island Sound Study
 - EPA Office of Water National Nutrient Coordinators
 - EPA Office of Water National Nutrient Implementation Workgroup
 - EPA Office of Water National Estuaries Nutrient Criteria Workgroup
 - EPA Regions 1,2,10
 - NOAA National Ocean Service
 - State of New Hampshire Estuarine Nutrient Criteria Development
 - State of Connecticut Eelgrass Steering Committee
 - State of Rhode Island TMDL program
 - Great Lakes Ecological Indicators Project

How Research Contributes to Outcomes

- New England Estuaries**
- Nitrogen load-ecological response models will be used by the state of CT as part of weight of evidence to determine critical nitrogen loading limits protective of designated uses.
 - Working with state of RI to use of load-response models to determine critical loads protective of estuarine waters
 - Utility of load-response models in NH determination of critical nitrogen loads protective of estuarine waters
- Great Lakes Wetlands**
- Methodology and data in support of regionally based nutrient criteria development
- Pacific Northwest Estuaries**
- Development of west coast nutrient criteria
 - Identification of vulnerable habitats

Research Methods

The approach is based on comparative ecology Hypothesis: that ecological responses will be observable and that they vary according to the level of nutrient inputs.



- Step 1.** Select study estuaries/water bodies along a nutrient gradient and that represent important ecosystem classes
- Step 2.** Estimate nutrient inputs to selected aquatic systems in each class
- Step 3.** Assess the selected aquatic systems for the important ecological responses indicative of nutrient enrichment

- Step 4.** Determine the preliminary relationship between ecological response and nutrient inputs for each class
- Step 5.** Refine the relationships using important ecosystem factors to reduce uncertainty