

# The Great Bay Estuary: Protecting a Natural Treasure



**Peter Wellenberger**  
Great Bay-Piscataqua WATERKEEPER  
Conservation Law Foundation

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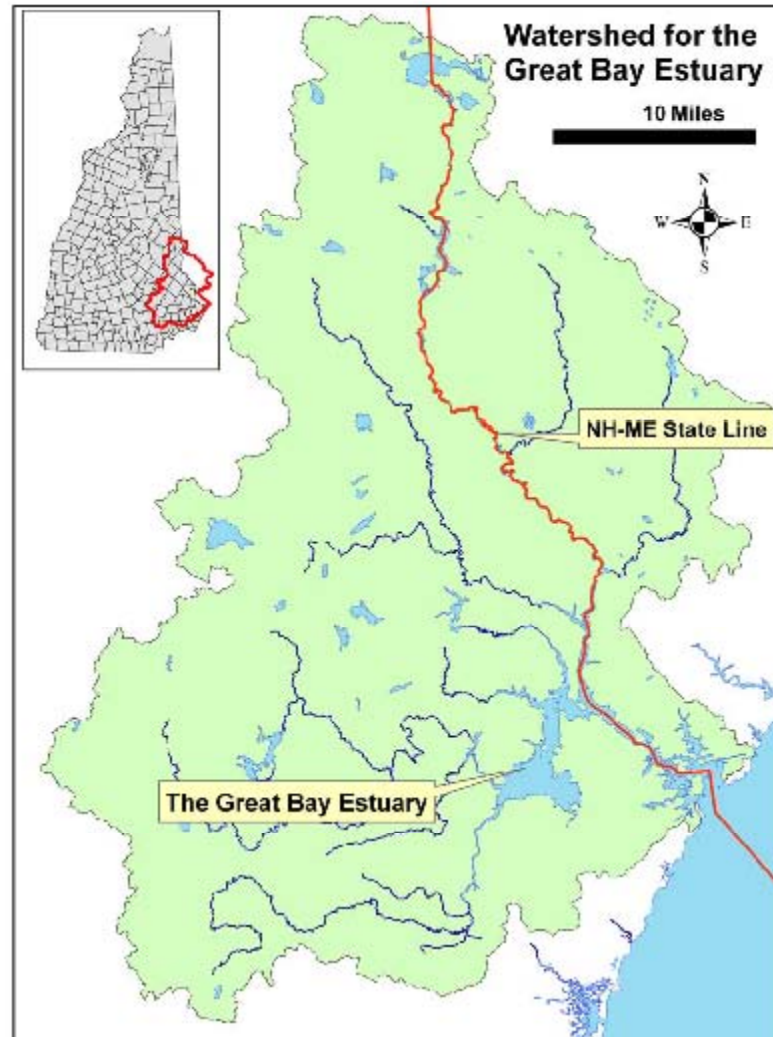
conservation law foundation

Great Bay-Piscataqua WATERKEEPER®

For a thriving New England

## The Great Bay Estuary

- Watershed covers 1,023 square miles
- Partially in Maine
- Home to 22% of the NH population
- Designated an “Estuary of National Significance” by EPA
- Part of NOAA National Estuary Research Reserve Program



# 1962 Land Use Rockingham County, NH

- Urban Classes**
- Residential
  - Industrial/commercial
  - Mixed urban
  - Transportation/roads
  - Railroads
  - Auxiliary transportation
  - Playing fields/recreation
- Agricultural Classes**
- Active agriculture
  - Farmsteads
- Natural Communities**
- Forested
  - Water
  - Open wetlands
- Other**
- Idle/other open

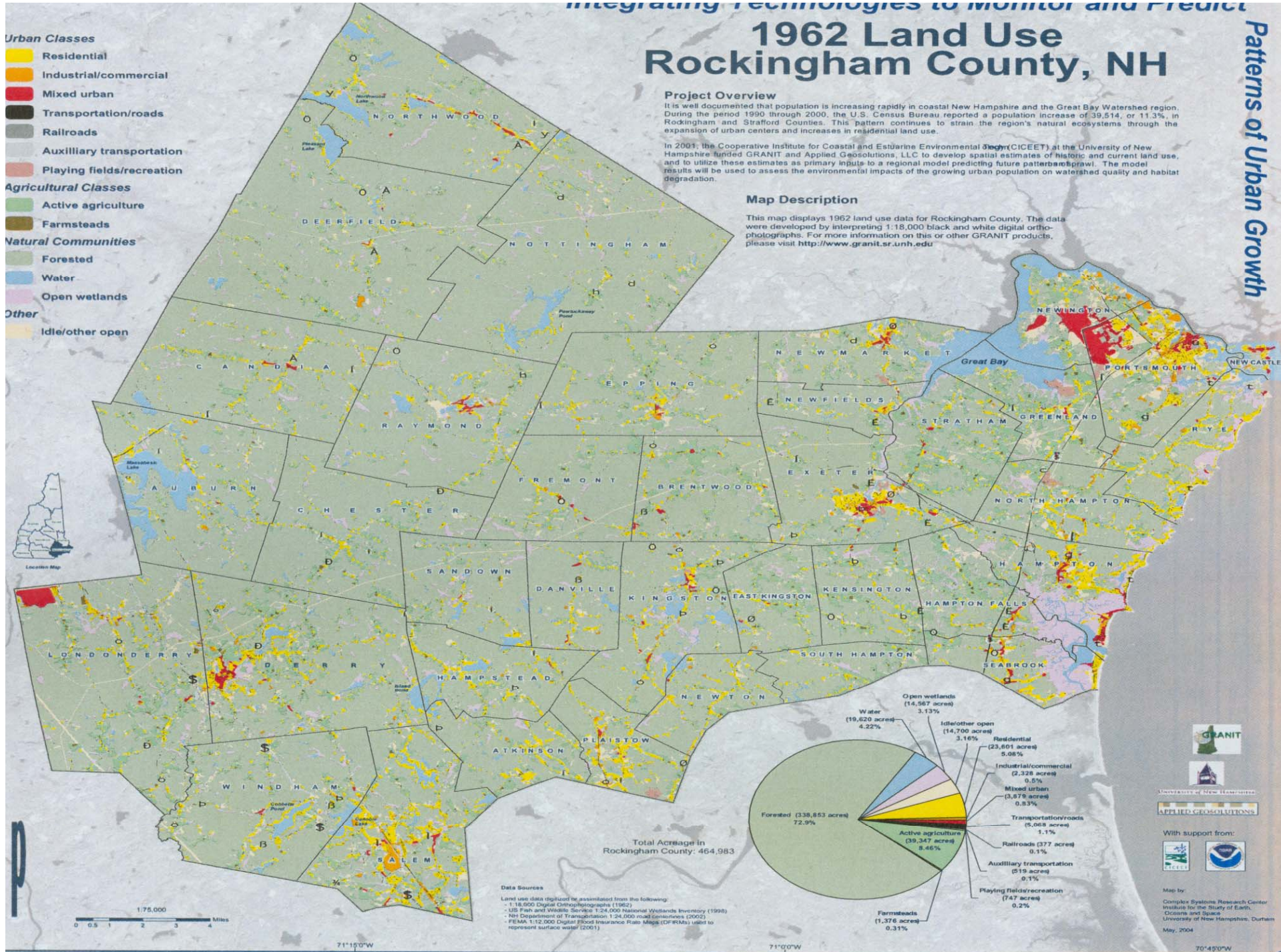
**Project Overview**

It is well documented that population is increasing rapidly in coastal New Hampshire and the Great Bay Watershed region. During the period 1990 through 2000, the U.S. Census Bureau reported a population increase of 39,514, or 11.3%, in Rockingham and Strafford Counties. This pattern continues to strain the region's natural ecosystems through the expansion of urban centers and increases in residential land use.

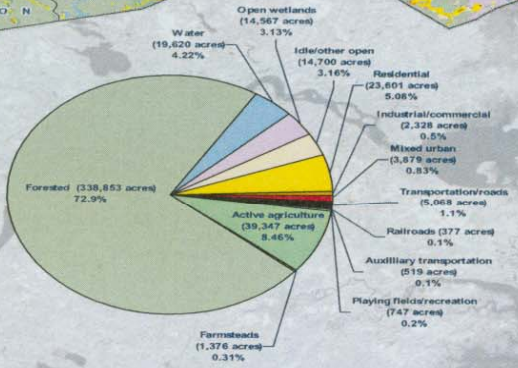
In 2001, the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) at the University of New Hampshire funded GRANIT and Applied Geosolutions, LLC to develop spatial estimates of historic and current land use, and to utilize these estimates as primary inputs to a regional model predicting future patterns of urban growth. The model results will be used to assess the environmental impacts of the growing urban population on watershed quality and habitat degradation.

**Map Description**

This map displays 1962 land use data for Rockingham County. The data were developed by interpreting 1:18,000 black and white digital orthophotographs. For more information on this or other GRANIT products, please visit <http://www.granit.sr.unh.edu>



Total Acreage in Rockingham County: 464,983



**Data Sources**

- 1:18,000 Digital Orthophotographs (1962)
- US Fish and Wildlife Service 1:24,000 National Wetlands Inventory (1998)
- NH Department of Transportation 1:24,000 road centerlines (2002)
- FEMA 1:12,000 Digital Flood Insurance Rate Maps (DFIRMs) used to represent surface water (2001)

  
  
  
 With support from:  
  
  
 Map by:  
 Complex Systems Research Center  
 Institute for the Study of Earth,  
 Oceans and Space  
 University of New Hampshire, Durham  
 May, 2004



71°15'0"W

71°0'0"W

70°45'0"W

# 1998 Land Use Rockingham County, NH

### Project Overview

It is well documented that population is increasing rapidly in coastal New Hampshire and the Great Bay Watershed region. During the period 1990 through 2000, the U.S. Census Bureau reported a population increase of 39,514, or 11.3%, in Rockingham and Strafford Counties. This pattern continues to strain the region's natural ecosystems through the expansion of urban centers and increases in residential land use.

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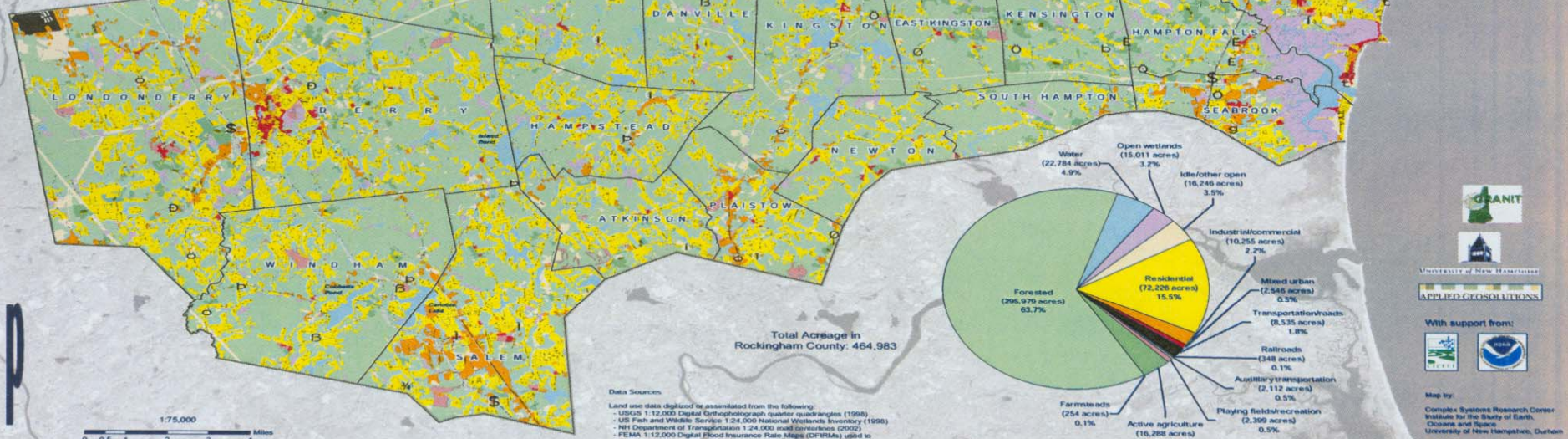
### Map Description

This map displays 1998 land use data for Rockingham County. The data were developed by interpreting 1:12,000 black and white digital orthophotographs. For more information on this or other GRANIT products, please visit <http://www.granit.sr.unh.edu>

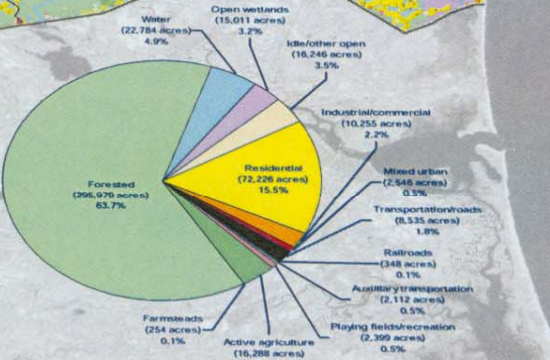
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- Farmsteads
- Natural Communities**
- Forested
- Water
- Open wetlands
- Other**
- Idle/other open



Location Map



Total Acreage in Rockingham County: 464,983



**Data Sources**  
 Land use data derived from the following:  
 - USGS 1:12,000 Digital Orthophotograph quarter quadrangles (1998)  
 - US Fish and Wildlife Service 1:24,000 National Wetlands Inventory (1988)  
 - NH Department of Transportation 1:24,000 road centerlines (2002)  
 - FEMA 1:12,000 Digital Flood Insurance Rate Maps (DFIRM) used to represent surface water (2001)



71 15'W

71 0'W

70 45'W



With support from:

Map by:  
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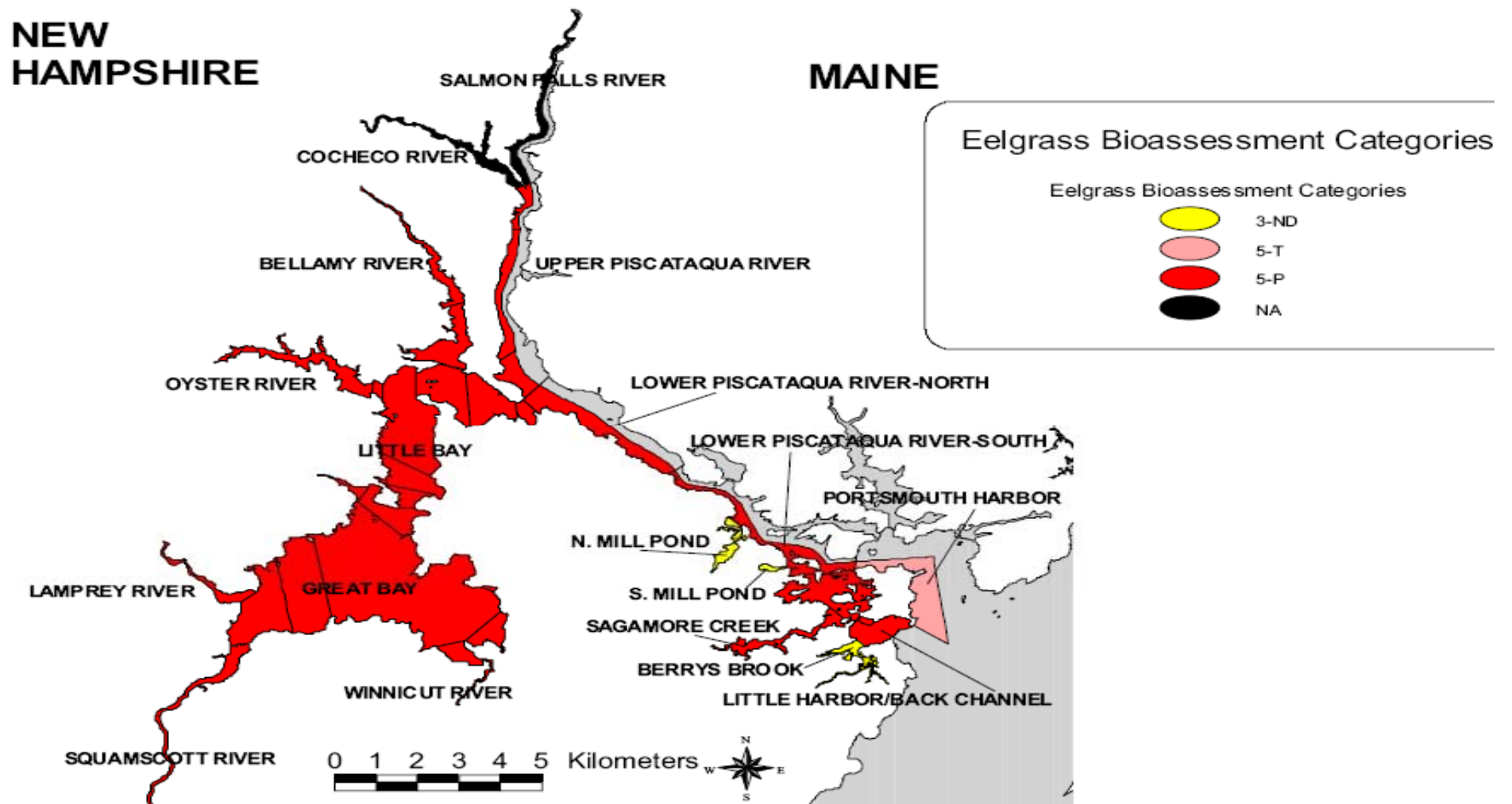
STATE OF THE ESTUARIES  
2009



WWW.PREP.JHU.EDU



Figure 3: Categories for estuarine assessments for significant eelgrass loss



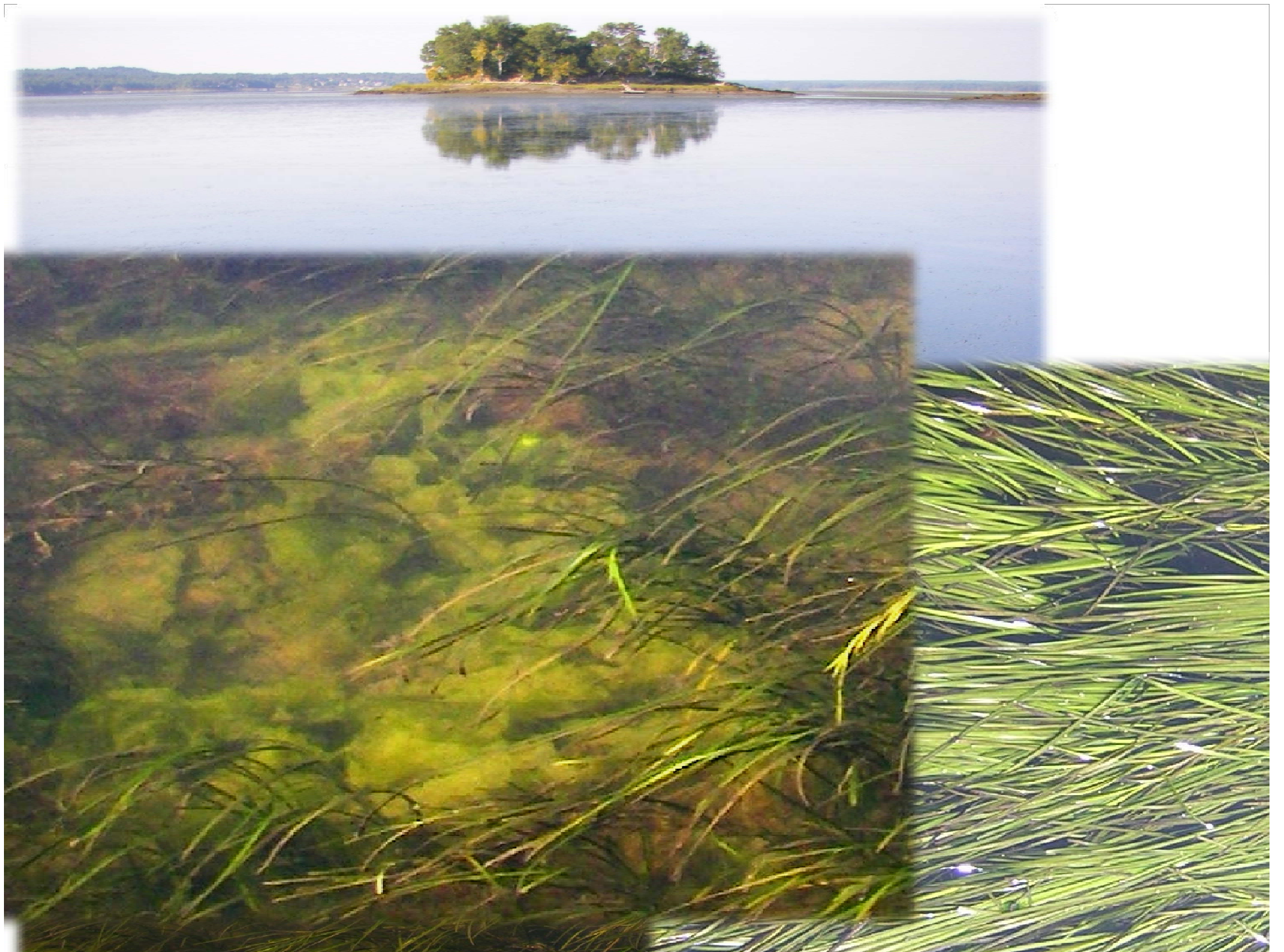
NHDES, Amendment to NH 2008 Section 303(d) List (2009), R-WD-09-14

# Nitrogen Causes Eelgrass Loss in Great Bay

Plankton clouds the water  
and shades eelgrass

Nuisance seaweed overgrows eelgrass







# Macroalgae Proliferation

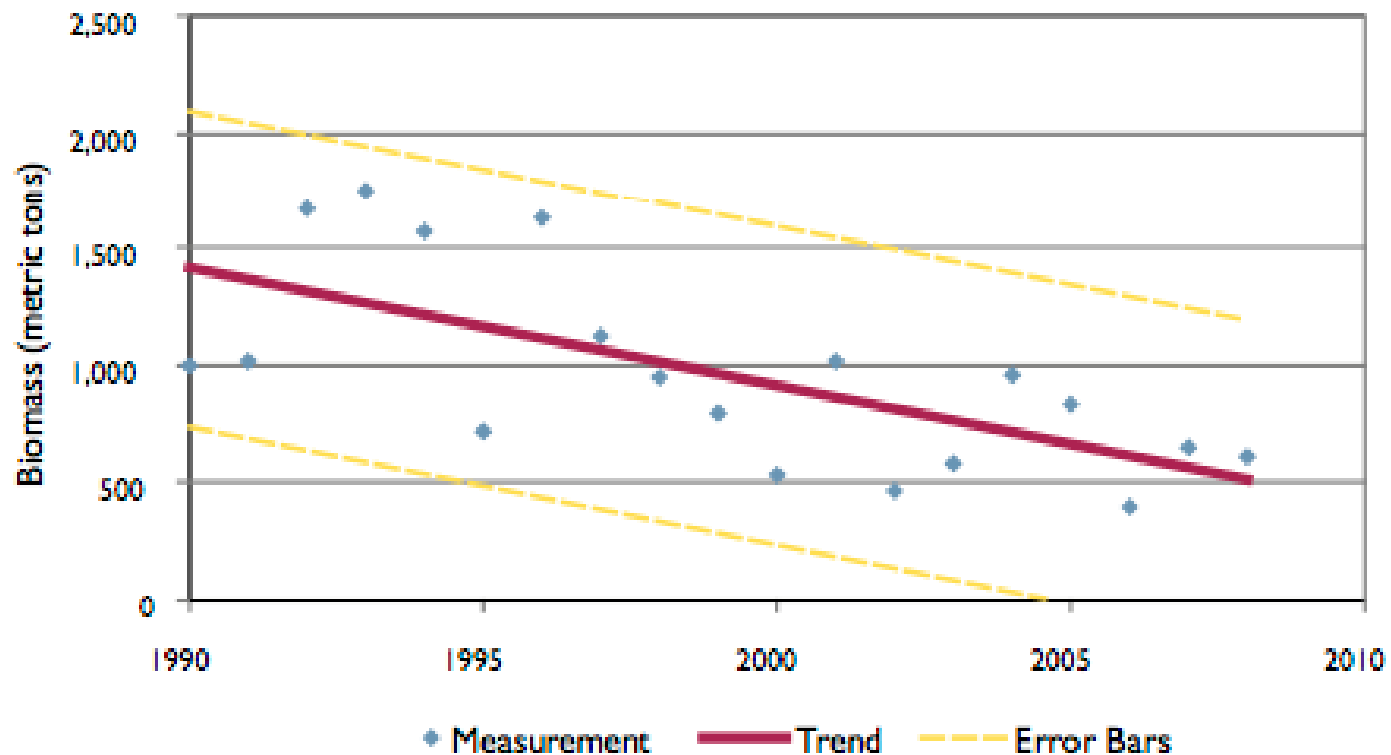
- Elevated nitrogen favors proliferation of macroalgae, which form dense mats that deplete oxygen and crowd out eelgrass.
- This effect is additive with water column light attenuation.



Macroalgae mats (*Ulva* and *Gracilaria*) in Great Bay near Lubberland Creek. Photo credit: Jeremy Neddleton (2008).

# Eelgrass Monitoring in New Hampshire

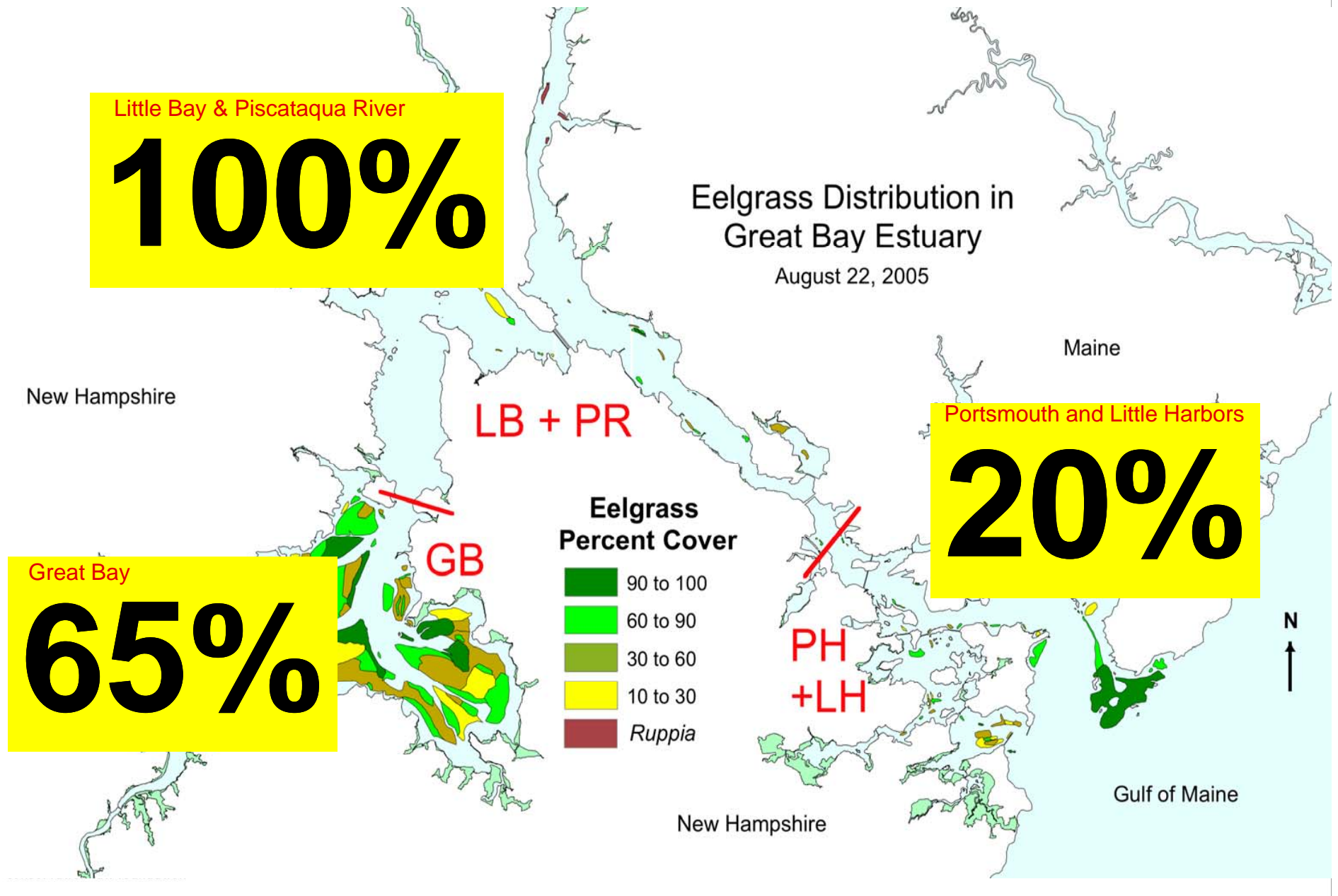
## Eelgrass biomass in Great Bay (Figure 15)



Data Source: UNH Jackson Estuarine Laboratory, Seagrass Ecology Group

From: NH State of the Estuary Report 2009 - PREP

# Eelgrass Biomass Losses (2005-2009)



# The Health of the Estuary Depends on Eelgrass

- Cleans the Bay waters
- Attracts more fish (flounder, striped bass, etc.)
- Nursery for fish and shellfish
- Feeds waterfowl
- Produces oxygen



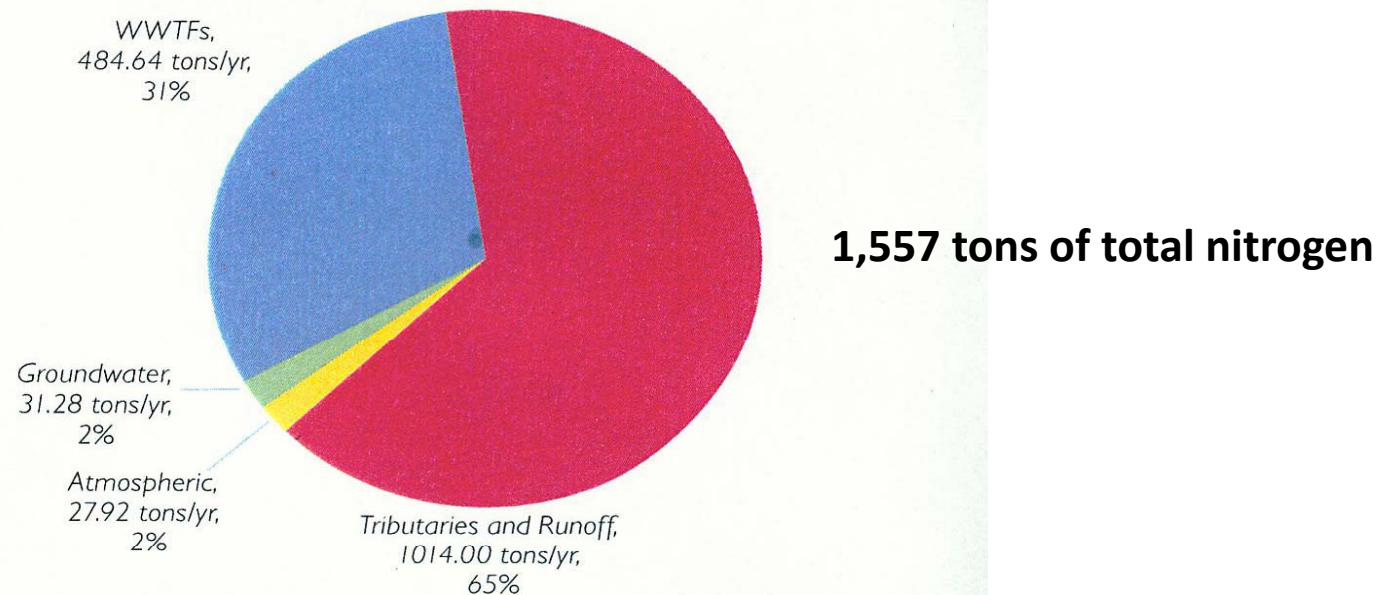
Young Lobster



Adult Flounder

# Sources of Nitrogen Pollution in the Great Bay Estuary

**Total nitrogen loads to the Great Bay Estuary from different sources in 2006-2008 (Figure 11)**



**Data Source:** PREP (2009)

Piscataqua Region Estuaries  
Partnership, *State of the Estuaries*  
2009

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# So what's the big deal?

## Value of the Great Bay Estuary

- Economic impacts
- Recreational opportunities
- Historical significance
- Cultural importance



# NH Marine Fisheries Economic Impact



## Recreational:

- 63,000 coastal recreational license holders

*Source NOAA 2008 Economic Impacts of Recreational Fishing*

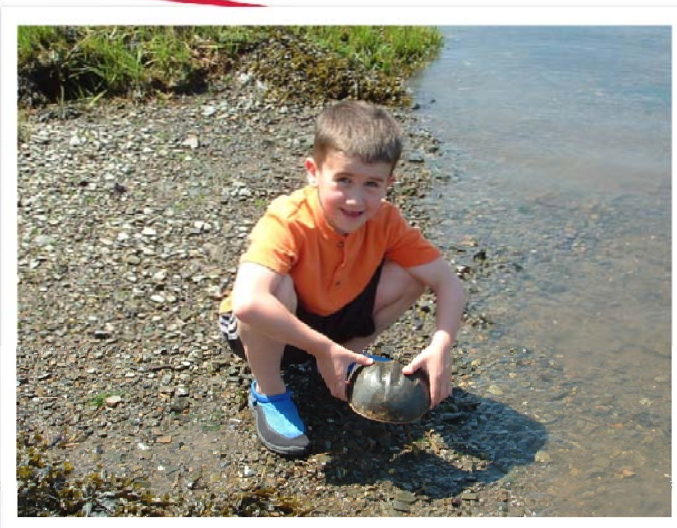
## Commercial

- Lobster business generates \$15,845,000 in NH
- Great Bay is a critical area for juvenile lobsters, crabs, smelt, herring, horseshoe crabs, oyster aquaculture, etc.

*Source PREP State of the Estuaries Report 2009*



# We all Benefit from Clean Water



# The Cost of Delaying



- If the estuary crashes, it will cost more to restore.
- Construction costs tend to increase over time.
- Bond interest rates are currently at historic lows and are likely to increase in the years ahead.
- Poor water quality will negatively impact our local economy.

# What happened in Chesapeake Bay?



- Delay of action led to ecological collapse.
- It will cost \$11 billion between 2012 and 2017 for Maryland alone (conservatively).
- “It is clear that the Chesapeake Bay TMDL will bring significant costs and may not come close to achieving the goals of cleaning up the Bay.”

*Source: The Sage Report, Chesapeake Bay Foundation*



# 32 Years

1982-2017

## Total Suspended Solids – Peirce Island WWTP



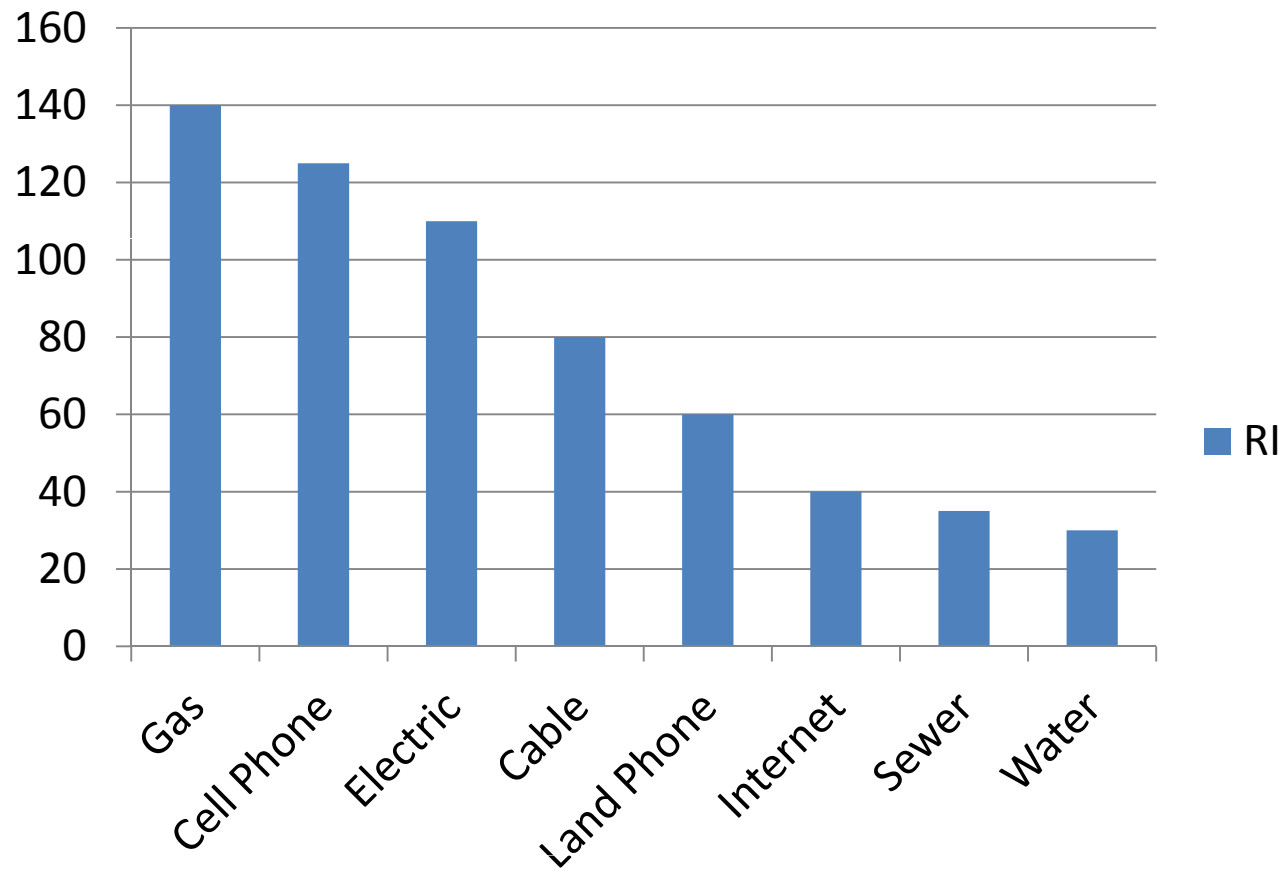
949,730 pounds  
per year

## Total Suspended Solids – Peirce Island WWTP



**30,391,360 pounds  
over a 32-year  
period**

# Comparison of Utility Costs



## Credits:



- Great Bay Stewards and Great Bay NERR
- Map of Great Bay watershed provided by NHDES
- Environmental Protection Agency (EPA)
- Dr. Frederick Short, Jackson Estuarine Research Lab, UNH
- Peter Whelan, Recreational Fishing Tour Guide, Portsmouth



## Contact Information



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