Narragansett Bay

A variety of data collected by local, state, and federal agencies, as well as academia and other non-governmental organizations, have been used in integrated assessments of water quality in Narragansett Bay and support recent management decisions to reduce nutrient loadings to the Bay.

- Probabilistic survey data from estuaries
- Real-time measurements in estuaries from moored instrumentation to document stratification and hypoxia
- Targeted monitoring during anticipated hypoxic events
- Water and nutrient flux measurements from fixed stations in streams, affecting both bay stratification and productivity
- Estuarine and river models to estimate nitrogen mass balance
- Data on heat flux, wind speed & direction, and tides affecting stratification and hypoxia

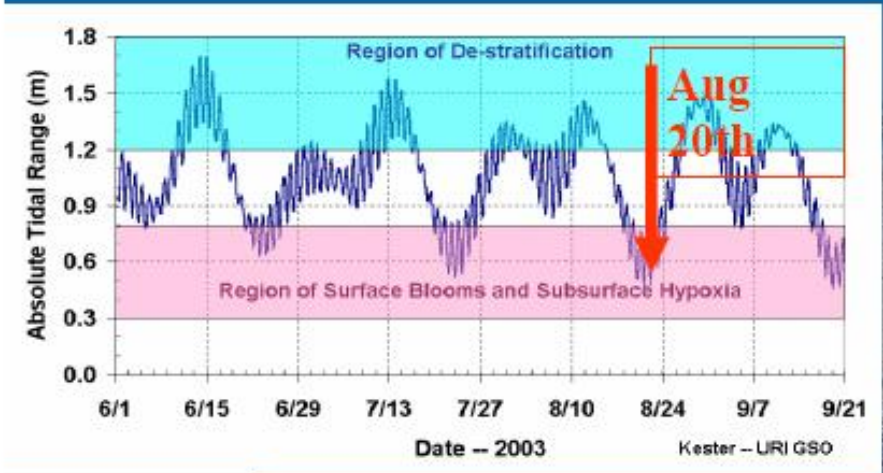
Issue – Nitrogen loading impacting biotic conditions including macroalgal growth, and episodic fish kills in upper Narragansett Bay

(Chris Deacutis, URI Coastal Institute)

Probable causes: Transient acute low dissolved oxygen documented in the upper Bay using moored instrumentation and automated time-series measurements.

Dissolved Oxygen in Narragansett Bay

Summer of 2003



Weak, 3rd quarter neap tides and tidal currents, result in less turbulence, increasing risk of hypoxic events.

Wind driven overturning of hypoxic water can coral and kill fish.

A nitrogen mass balance calculation to relate nitrogen sources to Bay wide nitrogen concentration

The Estuary Nitrogen Model.

Dettmann (2001)

N Loading

$$\frac{dN}{dt} = L_{land} + L_{sea} - E - \alpha N$$

Export Internal Losses

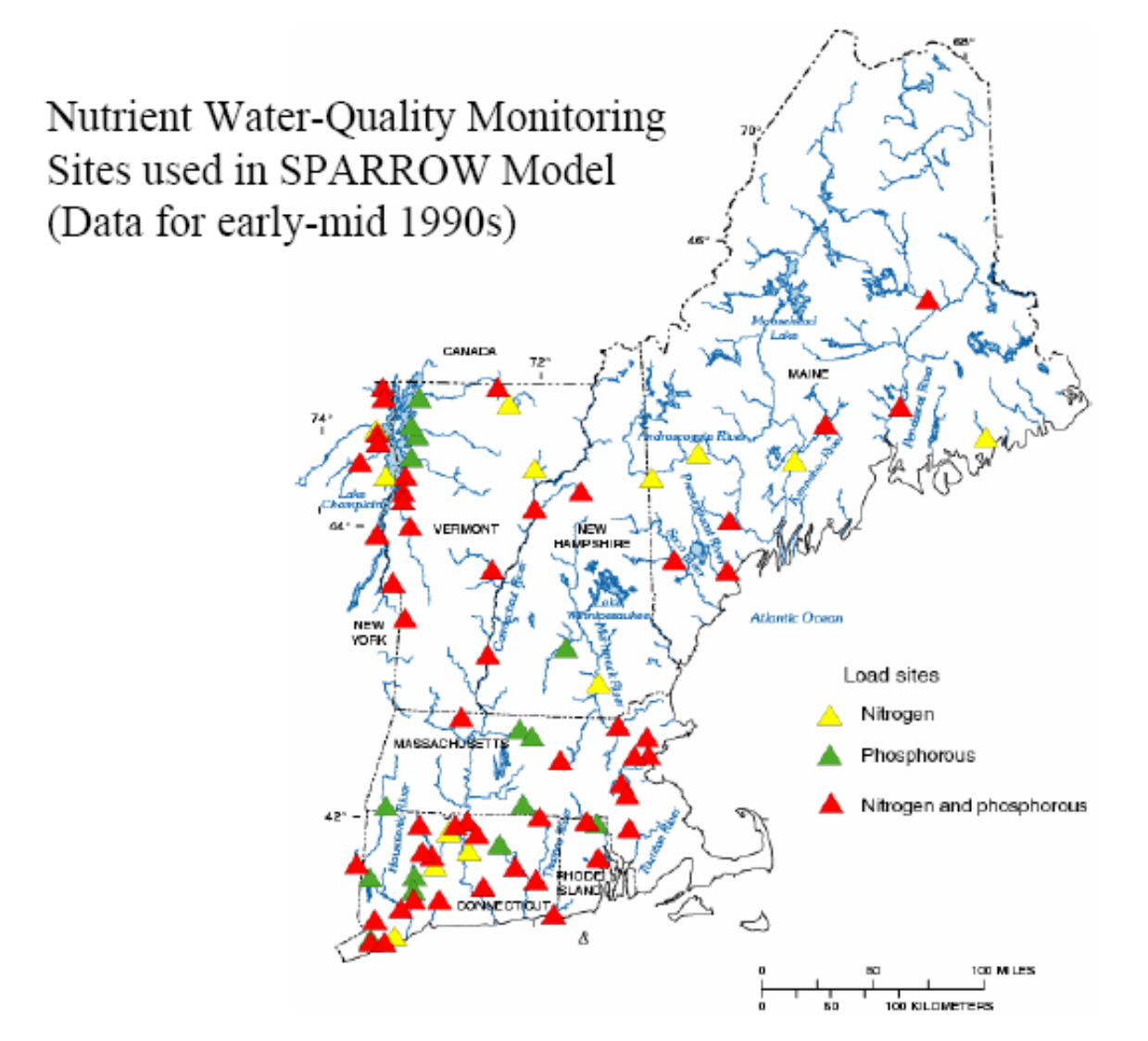
Assumptions:

Model deals with long-term (e.g. annual or multi-year averages.

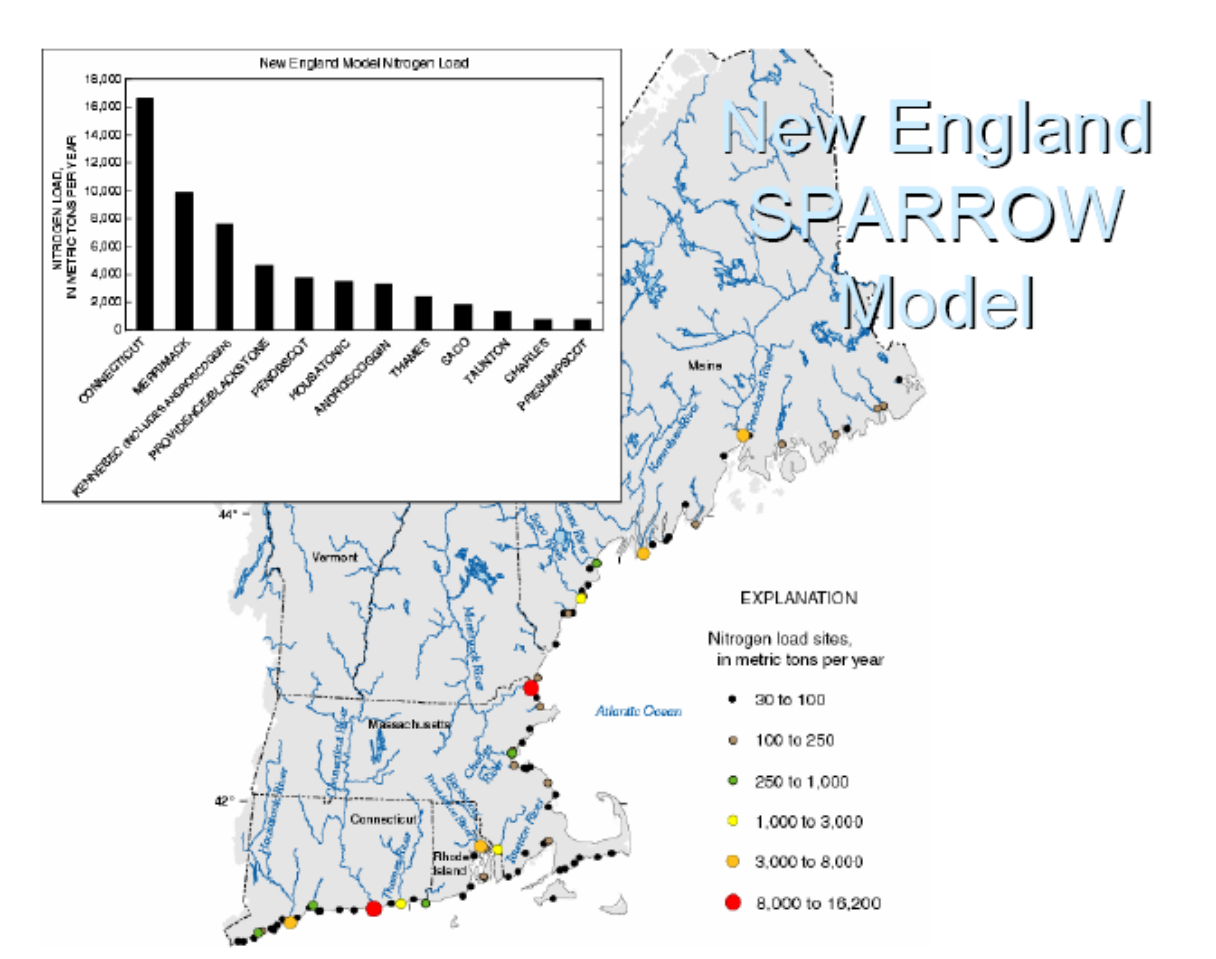
Approximate steady state at scale of yearly cycle, i.e.

$$\frac{dN}{dt} = 0$$

Terrestrial inputs of nitrogen and other constituents are monitored throughout the year, over the long term, at a number of fixed sites in New England by USGS and States.



Predictions of nutrient loads were made for 42,000 stream reaches throughout New England on the basis of fixed station monitoring and modeling (USGS-SPARROW), calibrated to 1992 conditions.



Note: Updated estimates of nutrient loads will be available in 2010 from the Northeast SPARROW model, calibrated to early 2000 conditions.

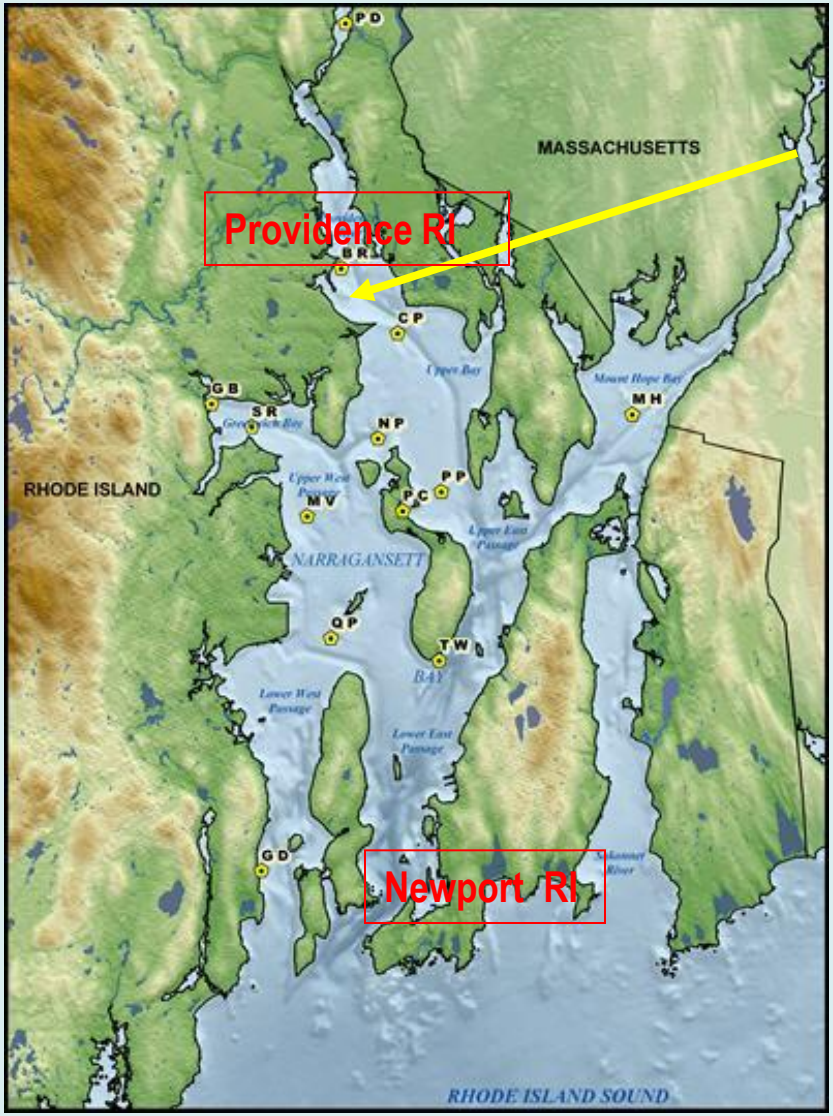
Sources of these nitrogen loadings in 1992 to the Bay were estimated with the New England SPARROW model, which identified point sources as a major source of nitrogen flux from rivers to Narragansett Bay.

- Atmospheric: 17.4%
- Urban: 18.4%
- Agriculture: 2.6%
- Point Sources: 61.2%

Management Decisions and Outcomes

- Tertiary treatment was implemented by Rhode Island to reduce nitrogen loading to Narragansett Bay.
- EPA Region 1 and sewage treatment plants in Massachusetts have agreed upon a schedule for additional denitrification.
- Methods to assess the effectiveness of these collective management actions are being developed by NOAA and other federal and state organizations.

Ongoing and future work: Continue to assess the effectiveness of nitrogen flux reductions in terms of changes in hypoxia extent and duration during stratification events. Several factors affect stratification and hypoxic events , which can be difficult to forecast, but can be analyzed retrospectively.



Factors that significantly affect stratification and hypoxia in upper Bay (Bullocks Reach):

RF3	River Flow (3 day average)
WSC3	Wind Speed Cubed (3 day average)
SLDifff7	Sea Level Difference from Providence to Newport (7-day average)
TRC3	Tidal Range Cubed (3 days average)
HF3	Heat Flux (3 day average)

Major partners: Rhode Island Department of Environmental Management; U. of Massachusetts; University of Rhode Island Coastal Institute, and Graduate School of Oceanography; Brown University, Roger Williams University, New England Interstate Water Pollution Control Commission; U.S. Geological Survey; National Oceanic and Atmospheric Administration, National Marine Fisheries Service, U.S. Environmental Protection Agency,

Web access:

http://www.narrbay.org/d_projects/buoy/buoydata.htm

http://www.geo.brown.edu/georesearch/insomniacs/

http://www.epa.gov/emap/html/pubs/docs/groupdocs/symposia/symp2007/abstracts/moore.html

http://nh.water.usgs.gov/projects/sparrow/

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