Great Bay Nutrient Monitoring, Partnerships, and Getting Data to Management

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and
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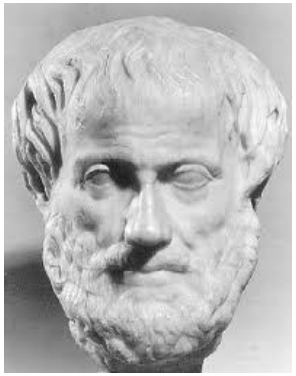
12 September 2013

GREAT BAY NATIONAL ESTUARINE RESEARCH RESERVE

FISH and GAME

A little philosophy…



Aristotle 384-322 BC

Nature does nothing uselessly

H. L. Mencken
Prejudices: Second Series, 1920

"There is always an easy solution to every human problem – neat, plausible, and wrong."

FEDERAL WATER POLLUTION CONTROL ACT (The Clean Water Act)
TITLE 33—NAVIGATION AND NAVIGABLE WATERS
CHAPTER 26—WATER POLLUTION PREVENTION AND CONTROL

SUBCHAPTER I—RESEARCH AND RELATED PROGRAMS

SEC. 101. [33 U.S.C. 1251] CONGRESSIONAL DECLARATION OF GOALS AND POLICY†

(a) **RESTORATION AND MAINTENANCE OF CHEMICAL, PHYSICAL AND BIOLOGICAL INTEGRITY OF NATION'S WATERS; NATIONAL GOALS FOR ACHIEVEMENT OF OBJECTIVE**—The objective of this chapter is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. In order to achieve this objective it is hereby declared that, consistent with the provisions of this chapter—

(1) it is the national goal that **the discharge of pollutants into the navigable waters be eliminated by 1985**;

(2) it is the national goal that ***wherever attainable***, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983;


Law
Science
Management

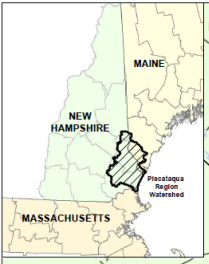
Monitoring to Outcomes

- Science: Understanding of Ecosystems
  - Structure & Function → Human Services
- Law: Regulate for the Common Good
  - Designated Uses → Set Standards
- Management: Protect and Restore, Adapt
  - Goals & Plans → Human Services

CWA LEGAL TOOLS

- Standards, Criteria and Classifications
- Regulation and Permits
- Total Maximum Daily Loads (TMDL – Sec.303(d))

Monitoring Programs and Needs in the Piscataqua Region Estuaries



Monitoring Partnerships:
- University of New Hampshire
- Piscataqua Region Estuaries Partnership
- Great Bay National Estuarine Research Reserve
- NH Dept. of Environmental Services

Legend

PREP Watershed

Town Boundaries

Sampling Stations

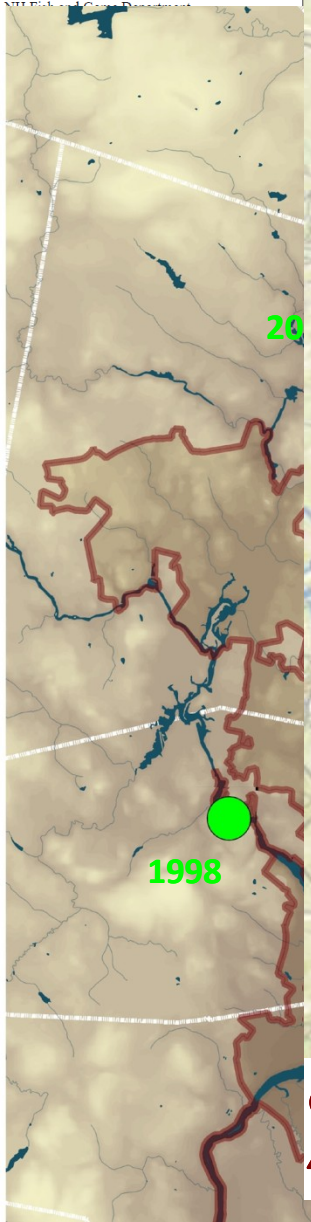
- Datasondes
- Estuary Water Quality
- River Water Quality
- Mussel Tissue for Toxic Pollution
- Oyster & Clam Populations
- Diadromous Fish Returns
- Beach Water Quality Monitoring

Funding Status

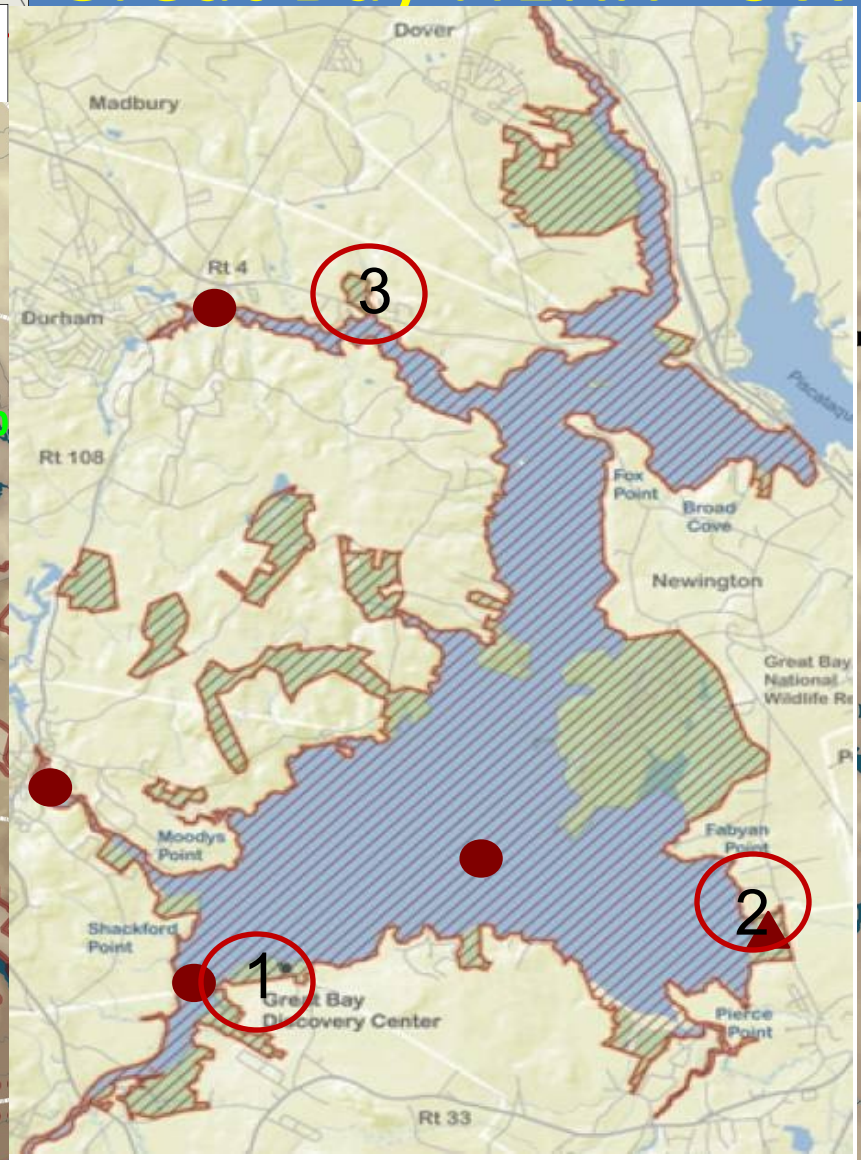
- Fully Funded
- Under Funded
- Not Funded

Eelgrass Habitat Monitoring:
Eelgrass is a submerged aquatic plant that provides essential habitat for fish, shellfish, waterfowl, and other animals. The boundaries of eelgrass habitat in the Piscataqua Region Estuaries are mapped each year.

Impervious Surface Monitoring:
Parking lots, roadways, and building roofs prevent rain water from infiltrating into the ground, increase pollutant loads and runoff during storms. Impervious surfaces in towns of the Piscataqua Region watershed are calculated using satellite imagery every five years.



Great Bay NERR - SWMP



- SWMP water quality station
- SWMP weather station

United States Environmental Protection Agency | Office of Water 4304 | EPA-822-B-01-003 October 2001

Nutrient Criteria Technical Guidance Manual

Estuarine and Coastal Marine Waters

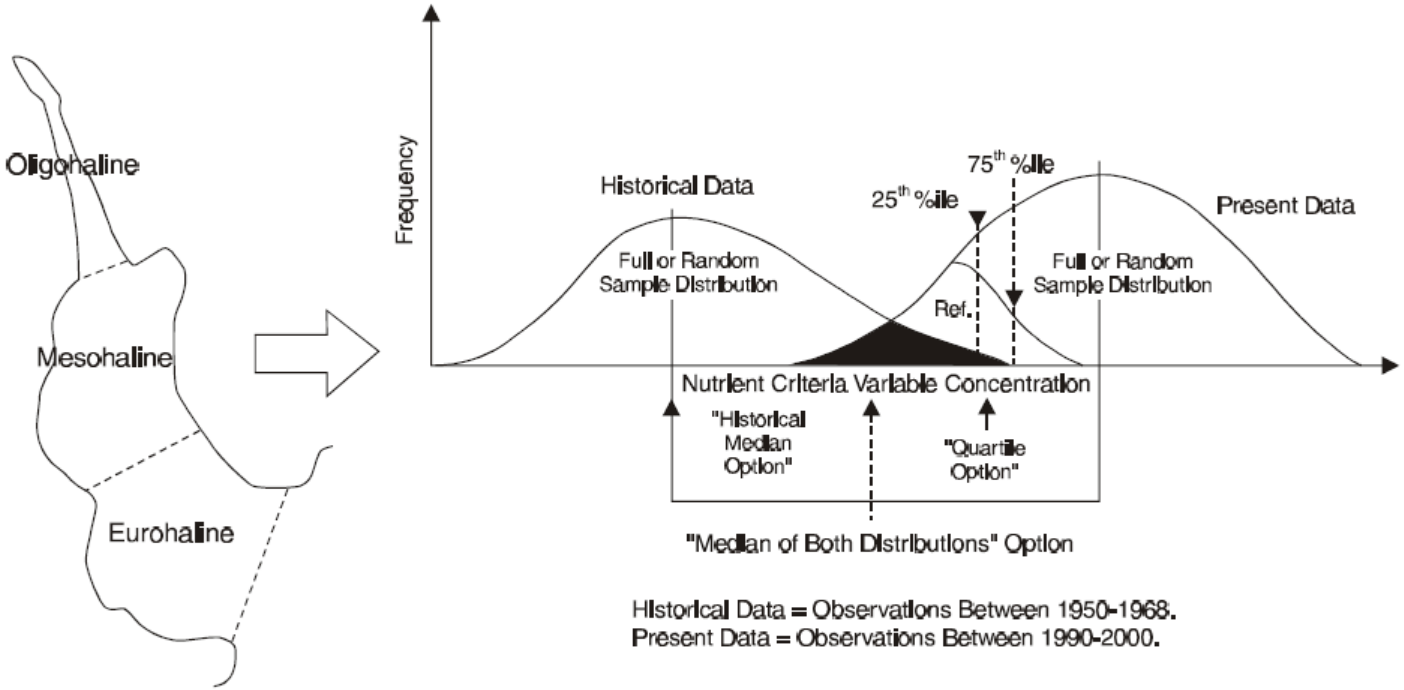
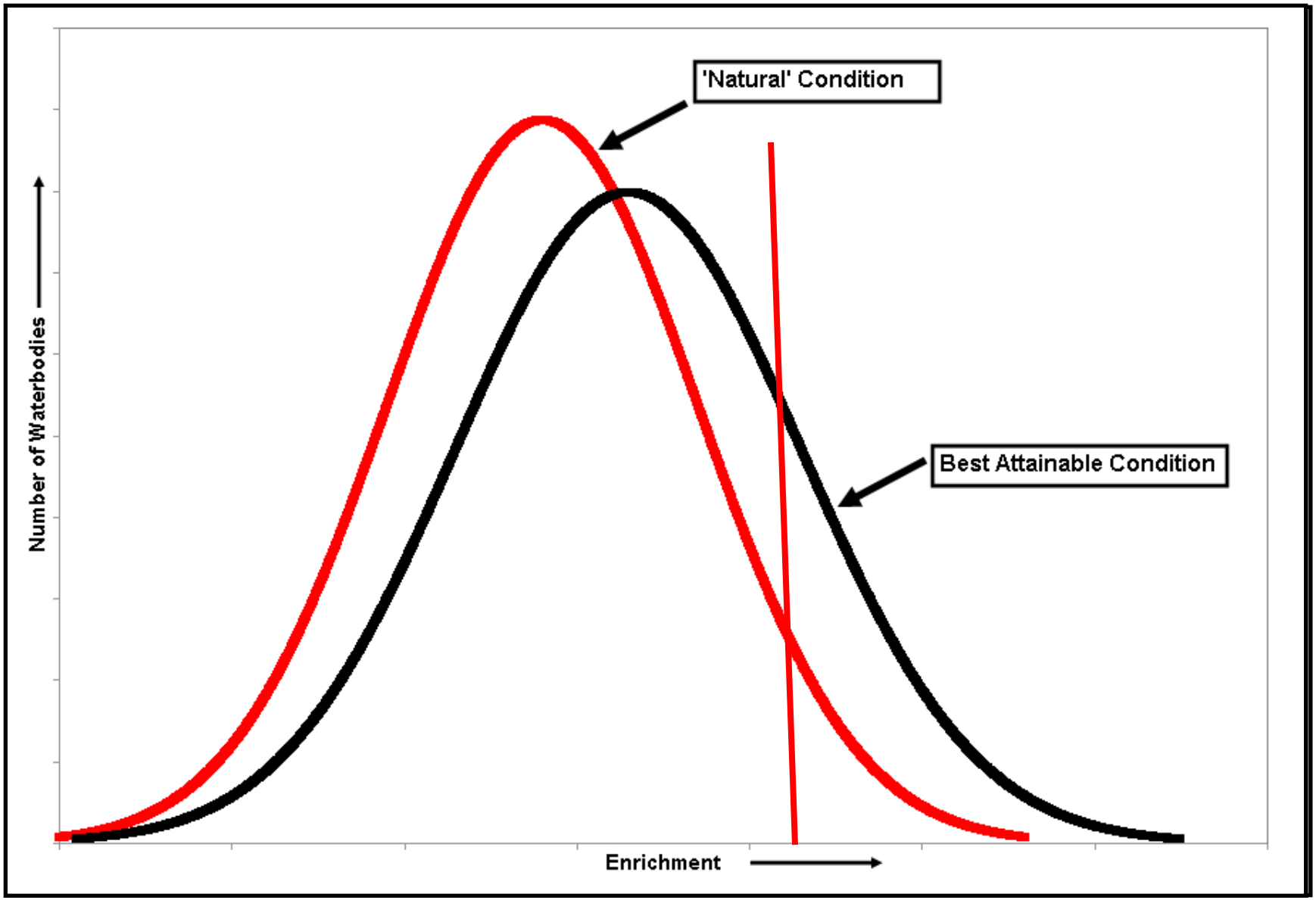
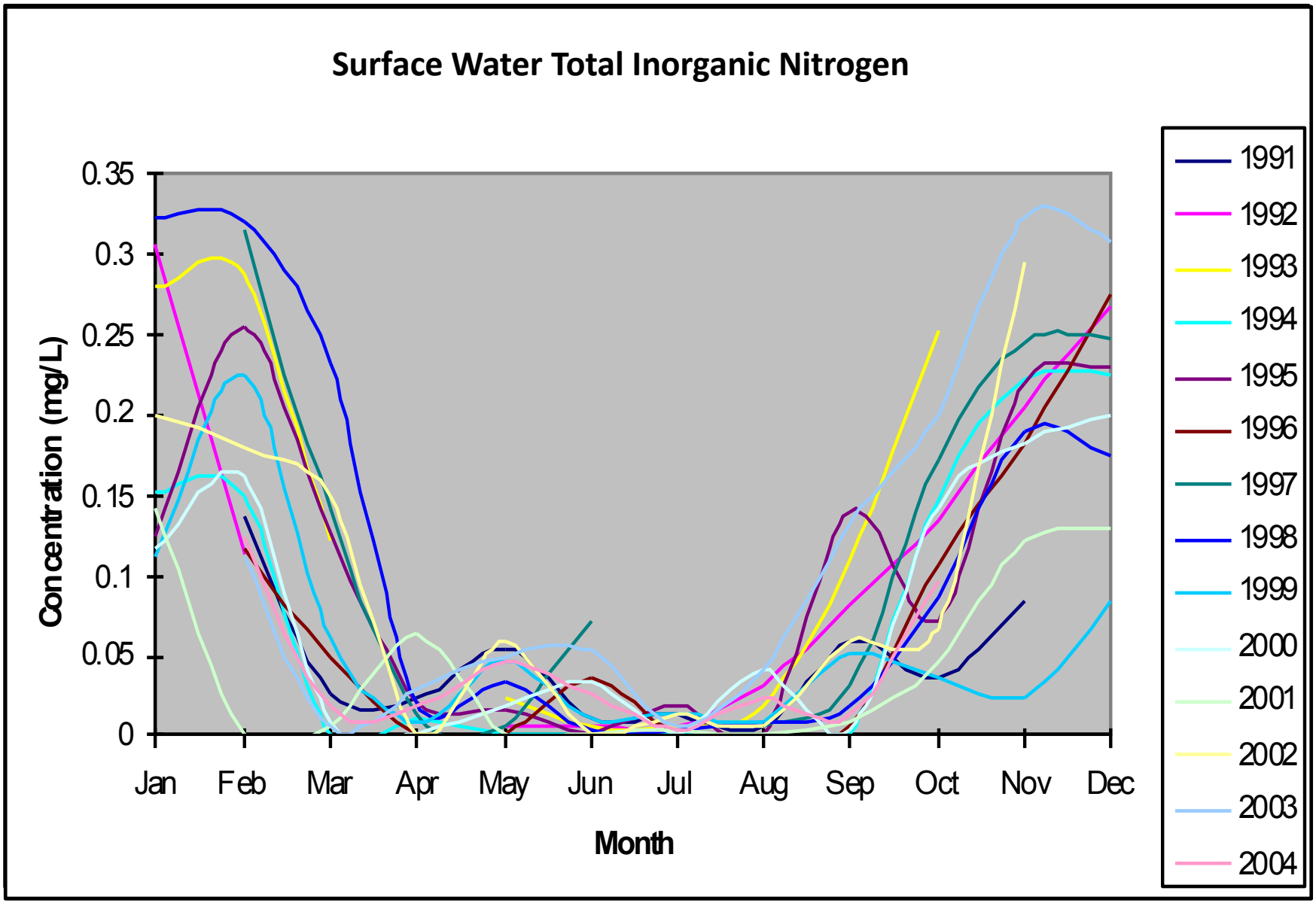


Figure 6-4. An illustration of the comparison of past and present nutrient data to establish a reference condition for intensively degraded estuaries. The option of selecting the distributions from both time periods is compared to an expected frequency distribution if the observations were available.

Standards and Criteria for Nutrients



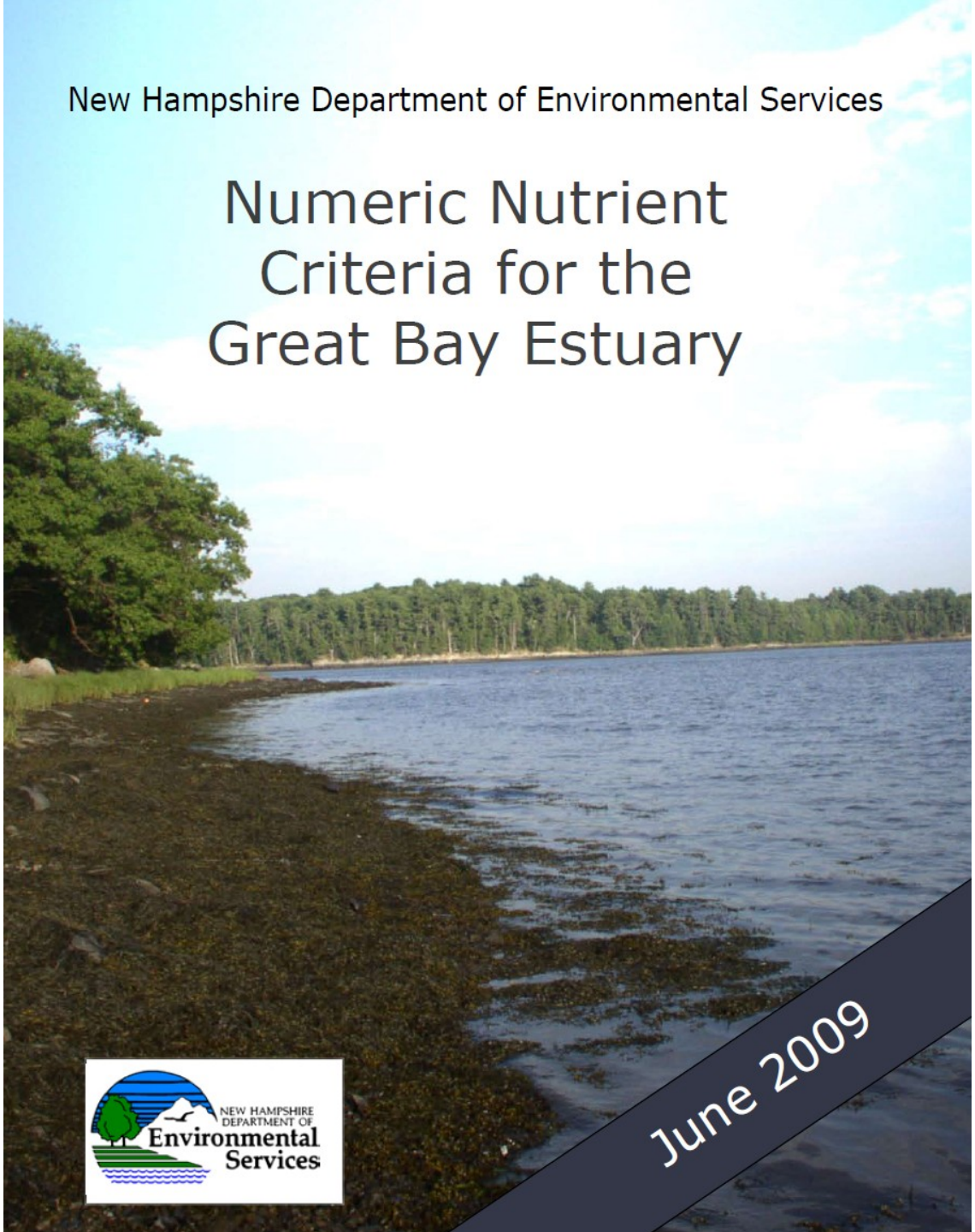
Monitor What? Where? When?



Summary of Proposed Numeric Nutrient Criteria

1. DES is proposing the following numeric nutrient criteria for New Hampshire estuarine waters in the Great Bay Estuary. These values will first be used as interpretations of the water quality standards narrative criteria for DES' Consolidated Assessment and Listing Methodology for 305(b) assessments. Later, DES will promulgate these values as water quality criteria in Env-Wq 1700.

Designated Use / Regulatory Authority	Parameter	Threshold	Statistic[5]	Comments
Primary Contact Recreation [1,2] (Env-Wq 1703.14)	Chlorophyll-a	20 ug/L	90th percentile	This criterion has been used by DES for 305(b) assessments since 2004.
Aquatic Life Use Support – to protect Dissolved Oxygen [1,3] (RSA 485-A:8 and Env-Wq 1703.07)	Total Nitrogen	0.45 mg N/L	Median	
	Chlorophyll-a	10 ug/L	90th percentile	
Aquatic Life Use Support – to protect Eelgrass [1,4] (Env-Wq 1703.14)	Total Nitrogen	0.30 mg N/L 0.27 mg N/L 0.25 mg N/L	Median	The range of values for the criteria corresponds to the range of eelgrass restoration depths: 2 m, 2.5 m, and 3 m.
	Light Attenuation Coefficient (Water Clarity)	0.75 m^{-1} 0.60 m^{-1} 0.50 m^{-1}	Median	



GBNERR SWMP Data used
but
Referenced as UNH Data

R-WD-13-10

DRAFT FOR REVIEW

Great Bay Nitrogen Non-Point Source Study

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Nitrogen SWMP Data

STATE OF OUR ESTUARIES
2013

PREP
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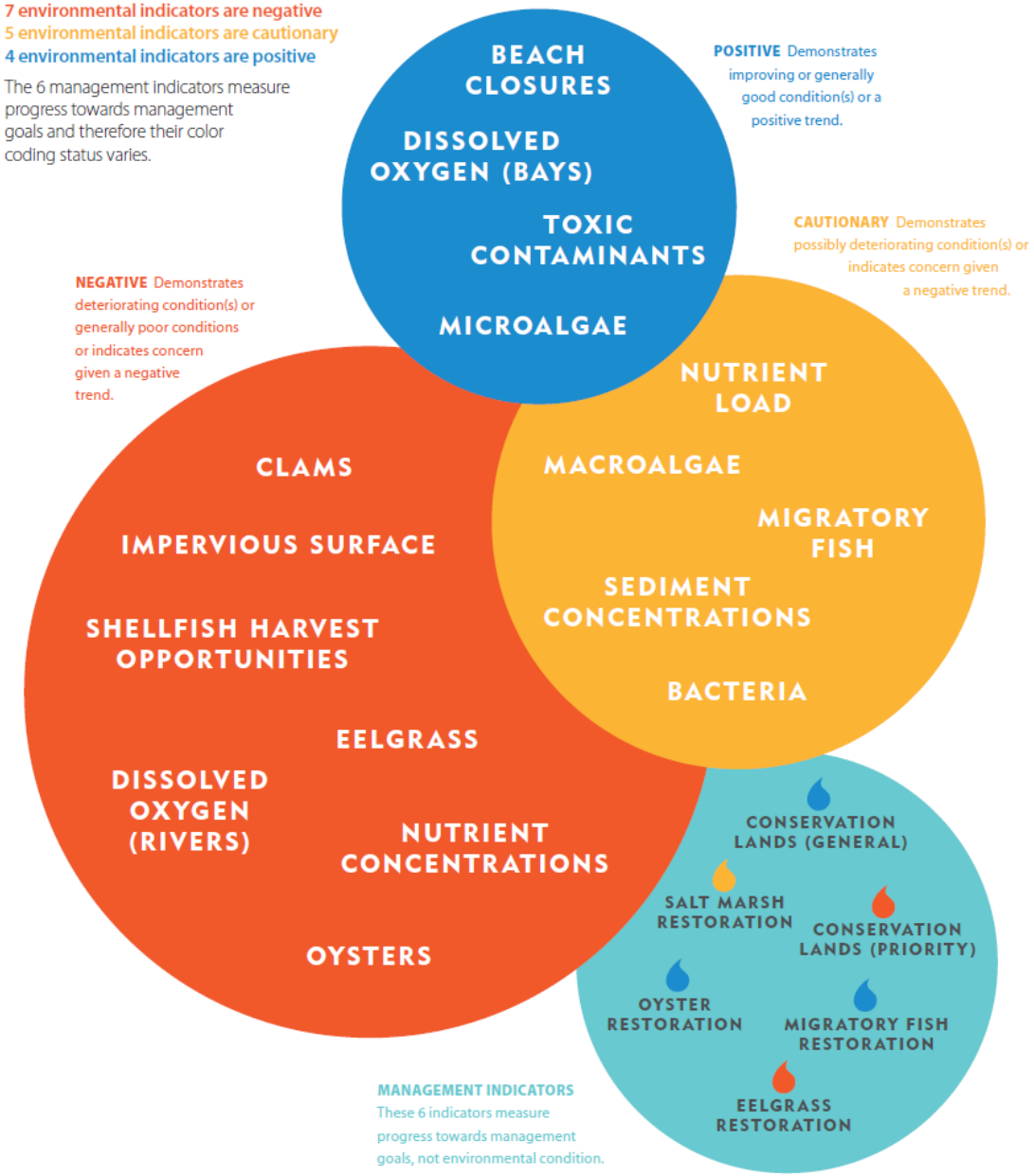
INDICATOR SUMMARY

There are 16 environmental indicators and 6 management indicators presented in this report:

7 environmental indicators are negative
5 environmental indicators are cautionary
4 environmental indicators are positive

The 6 management indicators measure progress towards management goals and therefore their color coding status varies.



POSITIVE Demonstrates improving or generally good condition(s) or a positive trend.

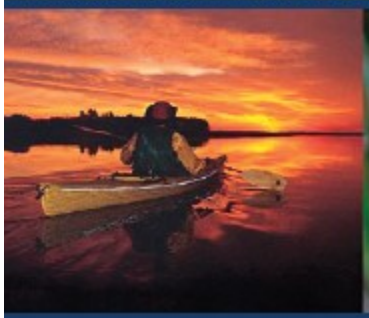
CAUTIONARY Demonstrates possibly deteriorating condition(s) or indicates concern given a negative trend.

NEGATIVE Demonstrates deteriorating condition(s) or generally poor conditions or indicates concern given a negative trend.

MANAGEMENT INDICATORS
These 6 indicators measure progress towards management goals, not environmental condition.

ECOLOGICAL TRENDS in the GREAT BAY ESTUARY

GREAT BAY NATIONAL ESTUARINE RESEARCH RESERVE



CELEBRATING 20 YEARS 1989 2009 GBNERR

GREAT BAY NATIONAL ESTUARINE RESEARCH RESERVE

20 Year Anniversary Report

GBNERR SWMP

Data is not collected by GBNERR staff

Collected by the contractor UNH

This has both positive and less positive consequences

Success *and* Challenge:

- Some Key Partners
  - Great Bay NERR
  - Piscataqua Region Estuaries Partnership
  - University of New Hampshire
  - NERACOOS

Summary

SWMP is essential to GBNERR and Mission

SWMP is used by GBNERR and many partners for both

- education and outreach
- policy

The keys to our success are the partnerships involved

Figure 4.3. (a) Map of overall eutrophic condition (OEC) and (b) the combination of individual eutrophic symptoms which constitute OEC ratings in the North Atlantic region.

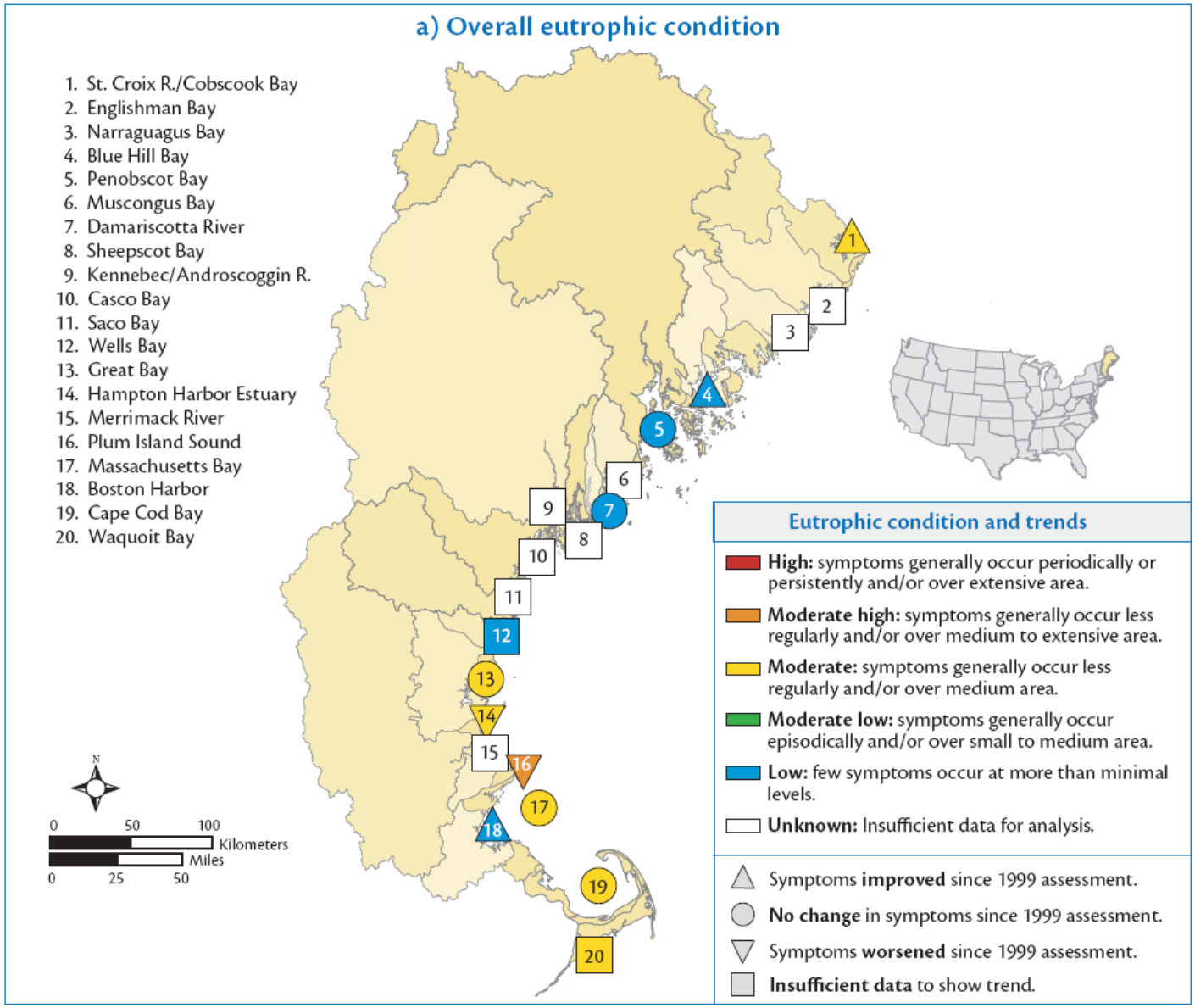


Figure ES-1. Nationa

Figure 3-20. Water quality index data for the New Hampshire Estuaries, 2000–2001 (U.S. EPA/NCA).

Extras -

NERRS SSP - Structure

NERRS SSP – CORE INDICATORS

STRESSOR	PHYSICAL	CHEMICAL	BIOLOGICAL
Temperature	Air Water	Dissolved Oxygen Nutrients	Chla/Productivity Peri/Phyto-plankton Salt Marsh Veg. SAV/Macroalgae Nekton
Weather • ***Precipitation*** • ***Extreme Events*** ***- Flood*** ***- Wind***	Hydrology/ Hydrodynamics Salinity Temperature Erosion/ Sedimentation	Salinity Nutrients	Chla/Productivity Peri/Phyto-plankton Salt Marsh Veg. SAV/Macroalgae Nekton
Sea Level Rise	Level Sensors SETs Salinity Erosion/ Sedimentation	Salinity	Upland Veg. Salt Marsh Veg. SAV/Macroalgae Nekton
Carbon Dioxide		pH Dissolved Oxygen	Chla/Productivity

INDICATOR	STATUS	STATE OF THE INDICATOR	PAGE
CONDITION INDICATORS: THE CURRENT STATE OF CONDITIONS IN THE ESTUARY			
Nutrient Concentration	↑	Between 1974 and 2011 data indicates a significant overall increasing trend for dissolved inorganic nitrogen (DIN) at Adams Point, which is of concern. When examining variability at other monitoring stations with shorter periods of data, no consistent patterns can be found. Recent data considered in the context of long-term data show no pattern or trend.	14
Microalgae		Microalgae (phytoplankton) in the water, as measured by chlorophyll-a concentrations, has not shown a consistent positive or negative trend in Great Bay between 1975-2011.	16
Macroalgae		Macroalgae, or seaweed, populations have increased, particularly nuisance algae and invasives.	16
Dissolved Oxygen (Bays)		State standards for dissolved oxygen are nearly always met in the large bays and harbors.	18
Dissolved Oxygen (Rivers)		State standards for dissolved oxygen in the tidal rivers are not met for periods lasting as long as several weeks each summer.	18
Eelgrass	↓	Data indicate a long-term decline in eelgrass since 1996 that is not related to wasting disease. Due to variability even recent gains of new eelgrass still indicate an overall declining trend.	20
Sediment Concentrations	↑	Suspended sediment concentrations at Adams Point in the Great Bay Estuary have increased significantly between 1976 and 2011.	22
Bacteria		Between 1989 and 2011, dry weather bacteria concentrations in the Great Bay Estuary have typically fallen by 50 to 92% due to pollution control efforts in most, but not in all, areas.	23
Shellfish Harvest Opportunities		Only 36% of estuarine waters are approved for shellfishing and, in these areas, periodic closures limited shellfish harvesting to only 42% of the possible acre-days in 2011. The harvest opportunities have not changed significantly in the last three years.	24
Beach Closures		Poor water quality prompted advisories extremely rarely in 2011. There are no apparent trends.	26
Toxic Contaminants	↓	The vast majority of shellfish tissue samples do not contain toxic contaminant concentrations greater than FDA guidance values. The concentrations of contaminants are mostly declining or not changing.	28
Oysters		The number of adult oysters decreased from over 25 million in 1993 to 1.2 million in 2000. The population has increased slowly since 2000 to 2.2 million adult oysters in 2011 (22% of goal).	30
Clams		The number of clams in Hampton-Seabrook Harbor is 43% of the recent historical average. Large spat or seed sets may indicate increasing populations in the future.	32
Migratory Fish		Migratory river herring returns to the Great Bay Estuary generally increased during the 1970-1992 period, remained relatively stable in 1993-2004, and then decreased in recent years.	34

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