

Key Issues/Biases

Issue	Bias	Significance*	Recommendation
Uncertainty of eelgrass coverage in past	Not known	Uncertain	Focus on upper end of Bay
Importance of eelgrass wasting disease	Not known	Certainly has/had some effect	Ignore
Herbivory on eelgrass	Not known	Certainly exists	Ignore
Effects of boat moorings on eelgrass	Not known	Probably exists	Ignore

* Based on opinion and best available information; not supported by direct calculations or data.

Reason for ignoring:

Studies around world show that high bioavailable nitrogen concentrations lead to decreases in eelgrass abundance (and that of other seagrasses).

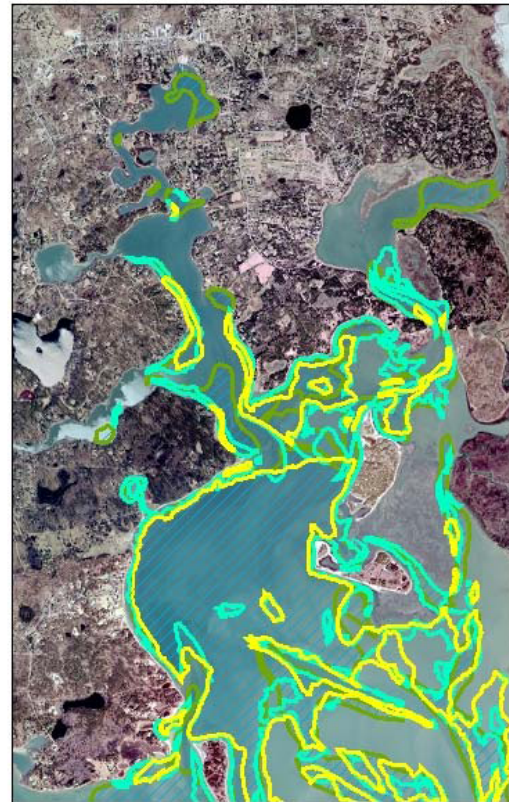
The data available do not allow us to assign relative importance to the various possible causes of eelgrass decline. We do know that high nitrogen levels will result in eelgrass disappearance regardless of what else is going on.

Department of Environmental
Protection
Eelgrass Mapping Program

Upper Pleasant Bay





1951 Historic Eelgrass
Mapping
(not field-verified)



Composite of
1951, 1995 and 2001
Eelgrass Datasets

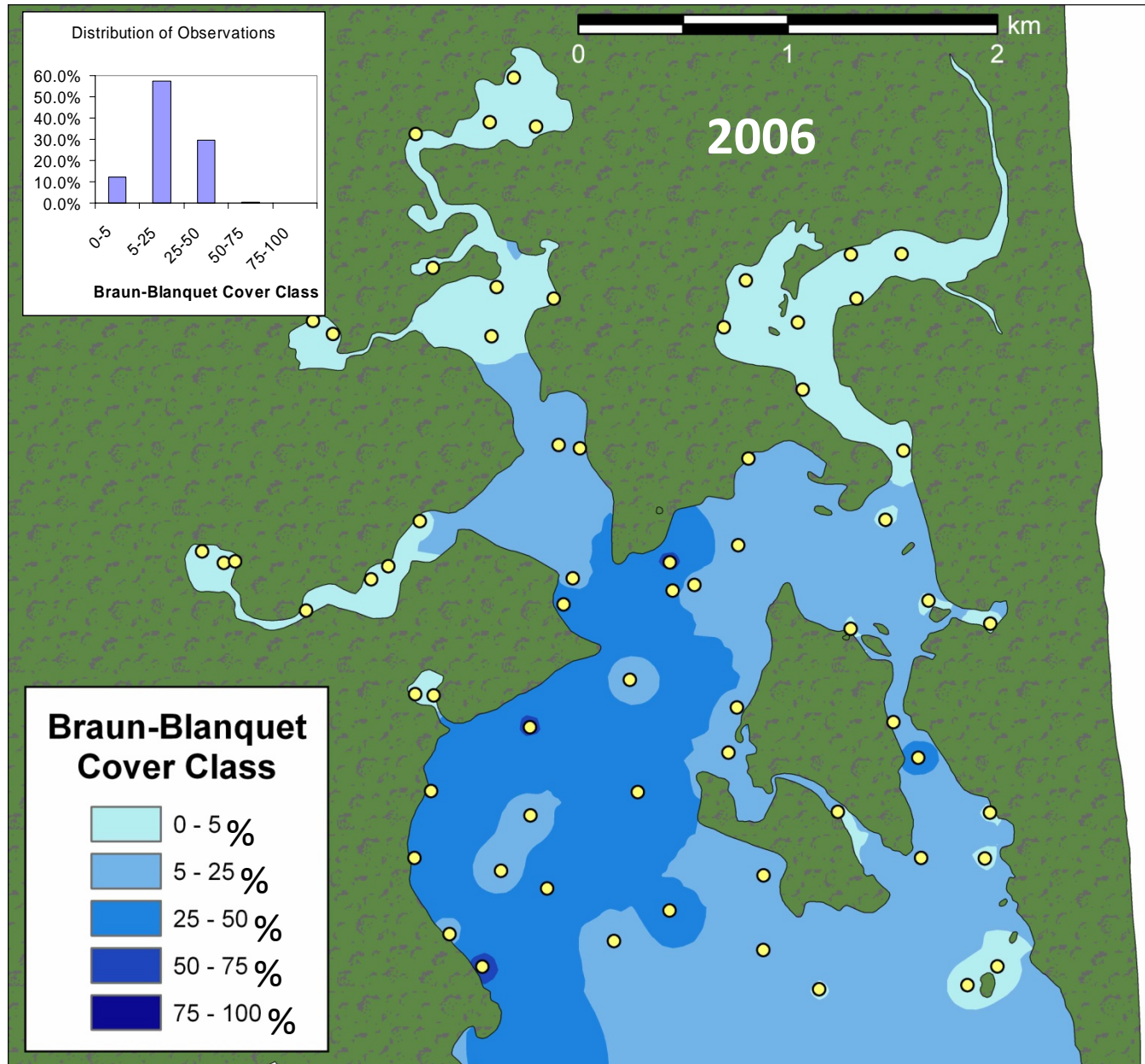
Legend

-  1951 Historic eelgrass resource
-  Yellow = 2001 extent of eg resource
-  Green = 1995 extent of eg resource

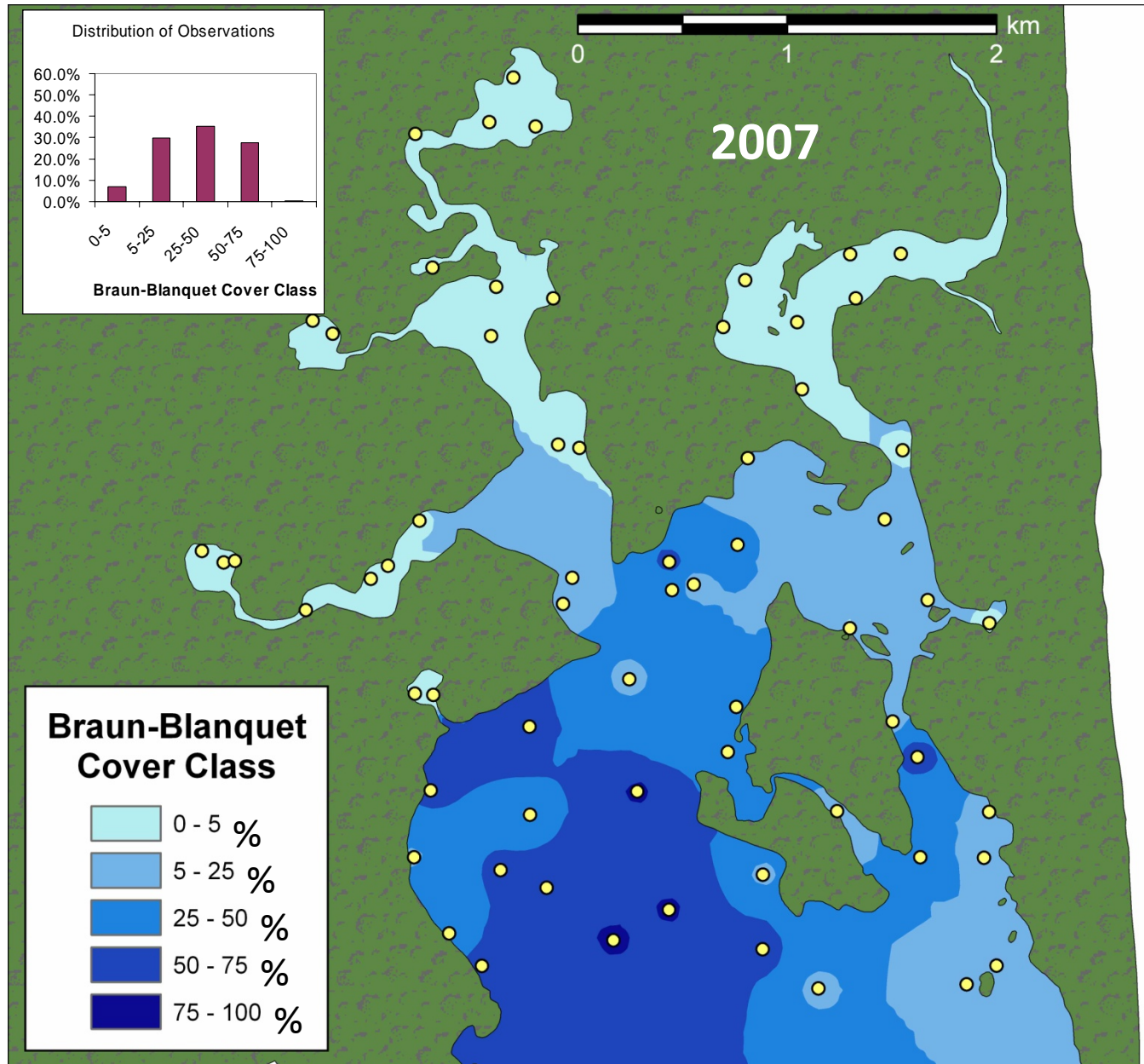
0 330 660 1,320 1,980 2,640
Meters



Tier 2: Status 2006

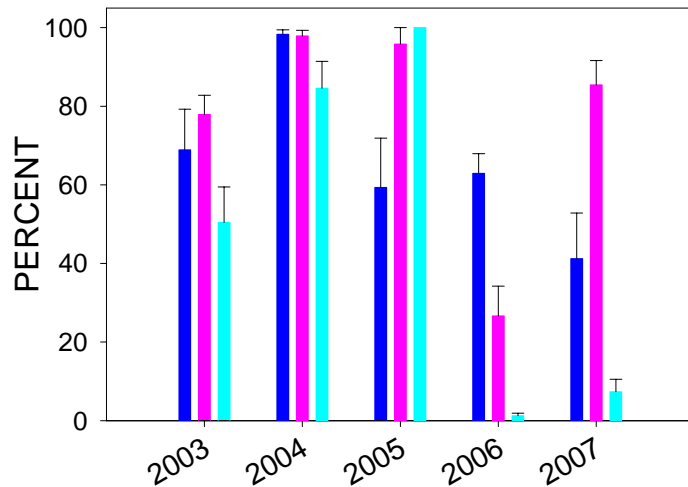


Tier 2: Status 2007

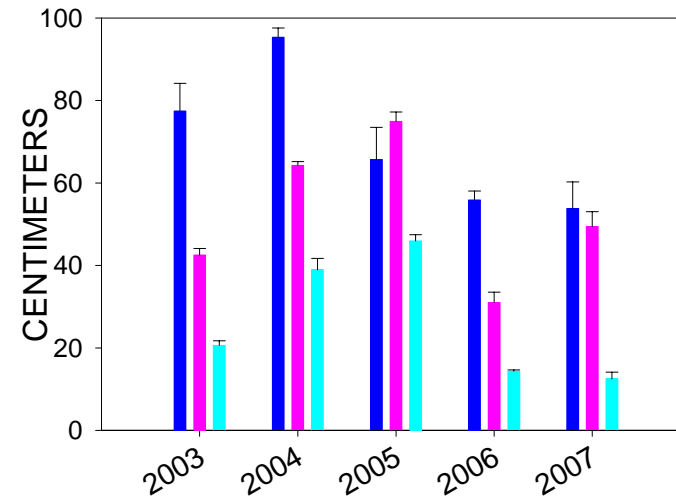


Little Pleasant Bay Tier 3 SeagrassNet Monitoring

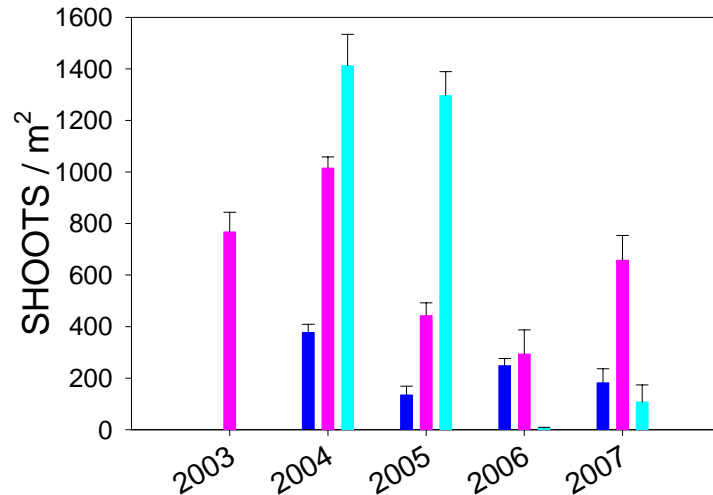
PERCENT COVER



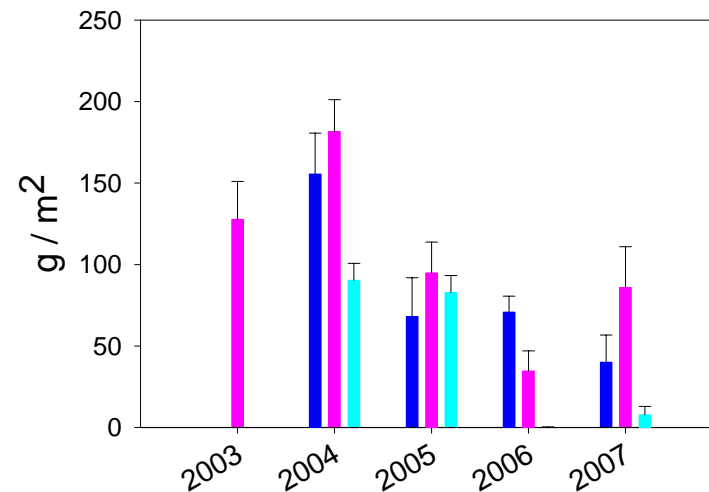
CANOPY HEIGHT



SHOOT DENSITY



ABOVEGROUND BIOMASS



Deep

Mid-depth

Shallow

DEP Eelgrass Mapping Project PLEASANT BAY SOUTH

Map 47
PLEASANT BAY

Eelgrass Mapped

-  2001 ONLY
-  1995 AND 2001
-  1995 ONLY
-  Limits of Project
-  Municipal Boundary
-  Limited Access Highway
-  Multilane Highway
-  Other Numbered Highway

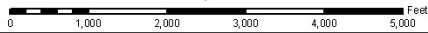


Map Statistics

Eelgrass Area in Acres:

1995	307.8
2001	181.5
Change	-126.3
	41%

1:20,000



Mitt Romney, Governor
Stephen R. Pittchard, Secretary
Executive Office of Environmental Affairs



DEP Eelgrass Mapping Project PLEASANT BAY MID

Map 45
PLEASANT BAY

Eelgrass Mapped

-  2001 ONLY
-  1995 AND 2001
-  1995 ONLY
-  Limits of Project
-  Municipal Boundary
-  Limited Access Highway
-  Multilane Highway
-  Other Numbered Highway

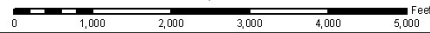


Map Statistics

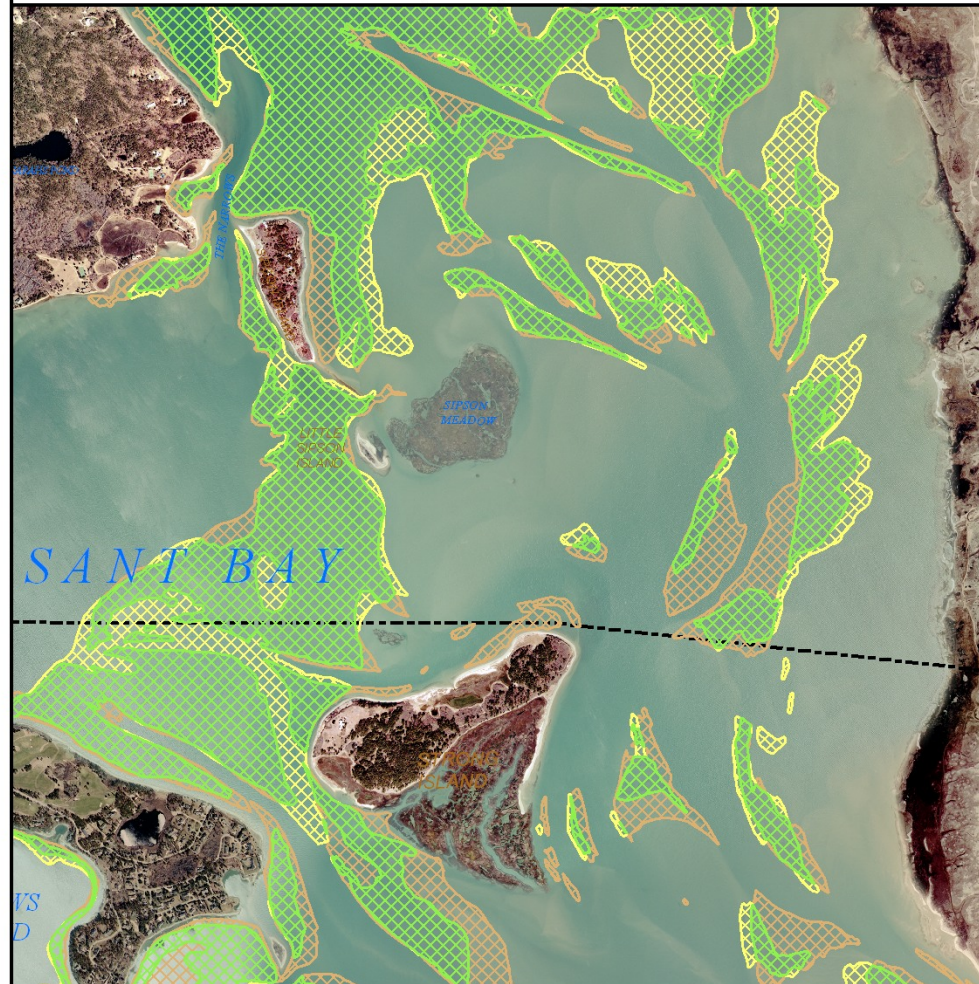
Eelgrass Area in Acres:

1995	739.6
2001	750.4
Change	+ 10.8
	1.5 %

1:20,000



MIT Romney, Governor
Stephen R. Pritchard, Secretary
Executive Office of Environmental Affairs



DEP Eelgrass Mapping Project RYDERS COVE

Map 46
PLEASANT BAY

Eelgrass Mapped

-  2001 ONLY
-  1995 AND 2001
-  1995 ONLY
-  Limits of Project
-  Municipal Boundary
-  Limited Access Highway
-  Multilane Highway
-  Other Numbered Highway



Map Statistics

Eelgrass Area in Acres:

1995	502.9
2001	470.5
Change	- 32.4
	6.4%



Mitt Romney, Governor
Stephen R. Fitzcharl, Secretary
Executive Office of Environmental Affairs

MASS GIS
Massachusetts Geographic Information System



Key Issues/Biases

Issue	Bias	Significance*	Recommendation
Does boating contribute to hypoxia?	Not known	Probably low	Modify boaters behavior
Why does phytoplankton data and oxygen data sometimes seem out of sync	Chaotic nature of natural tidal systems	Only when trying to understand details of relationship	.
Does a lack of data on benthic infauna affect MEP results	MEP mentions faunal composition changes and gives results in diversity and evenness values		
There are no data on eelgrass herbivores and their possible role in eelgrass decline	Herbivores and colonizing animals are certainly present	Their presence can be good or bad. We don't have any data.	

- Nitrogen causes hypoxia/anoxia by stimulating organic productivity (algal growth) in the water. Algae respire (use up oxygen) throughout the day. This is more than offset by photosynthesis, but **only during the day**. At night, algae respire and use up oxygen. When algae die their decomposition by bacteria uses up oxygen. The results is more oxygen consumption than production, thus hypoxia/anoxia.

- The resulting oxygen conditions at any site are modified by tidal exchanges.

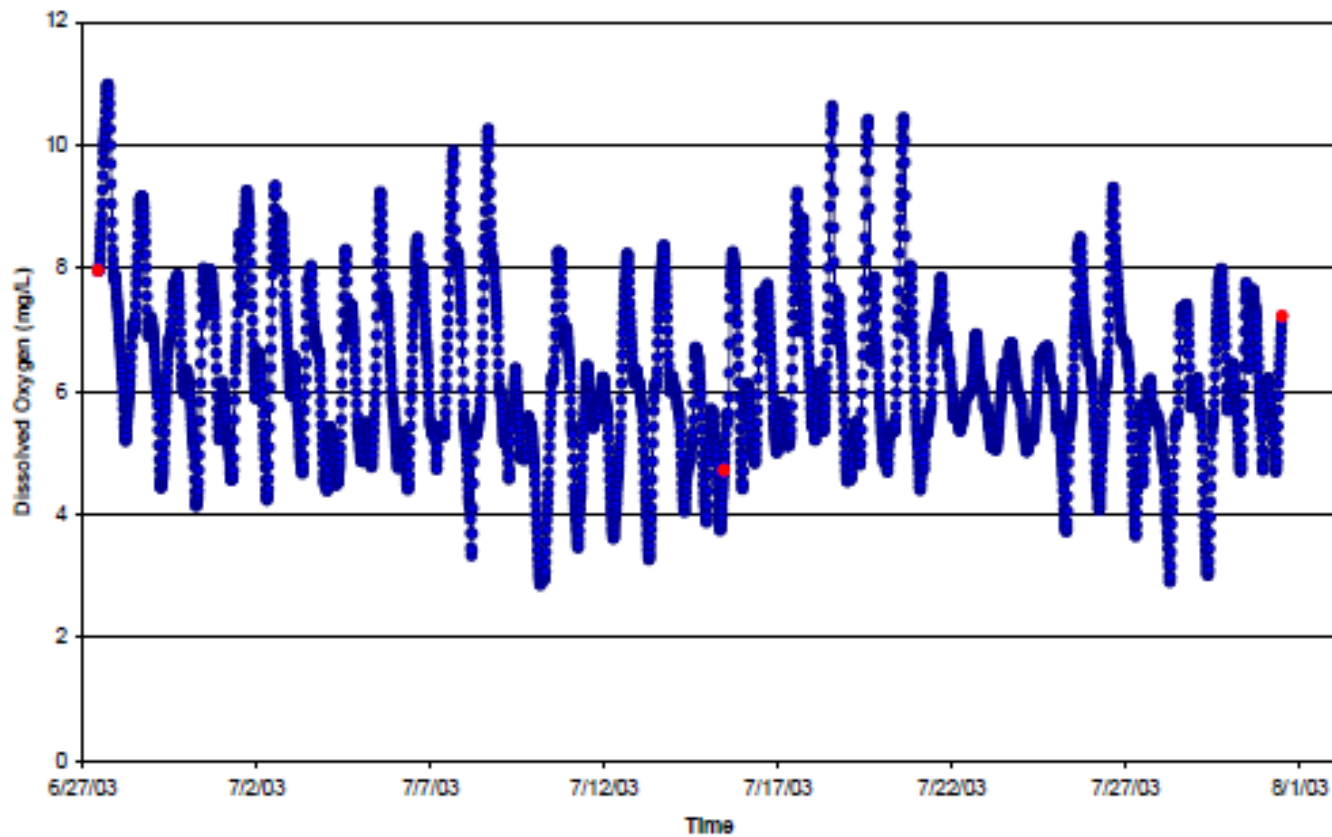


Figure VII-10. Bottom water record of dissolved oxygen in Namequoit Point station, Summer 2003. Calibration samples represented as red dots

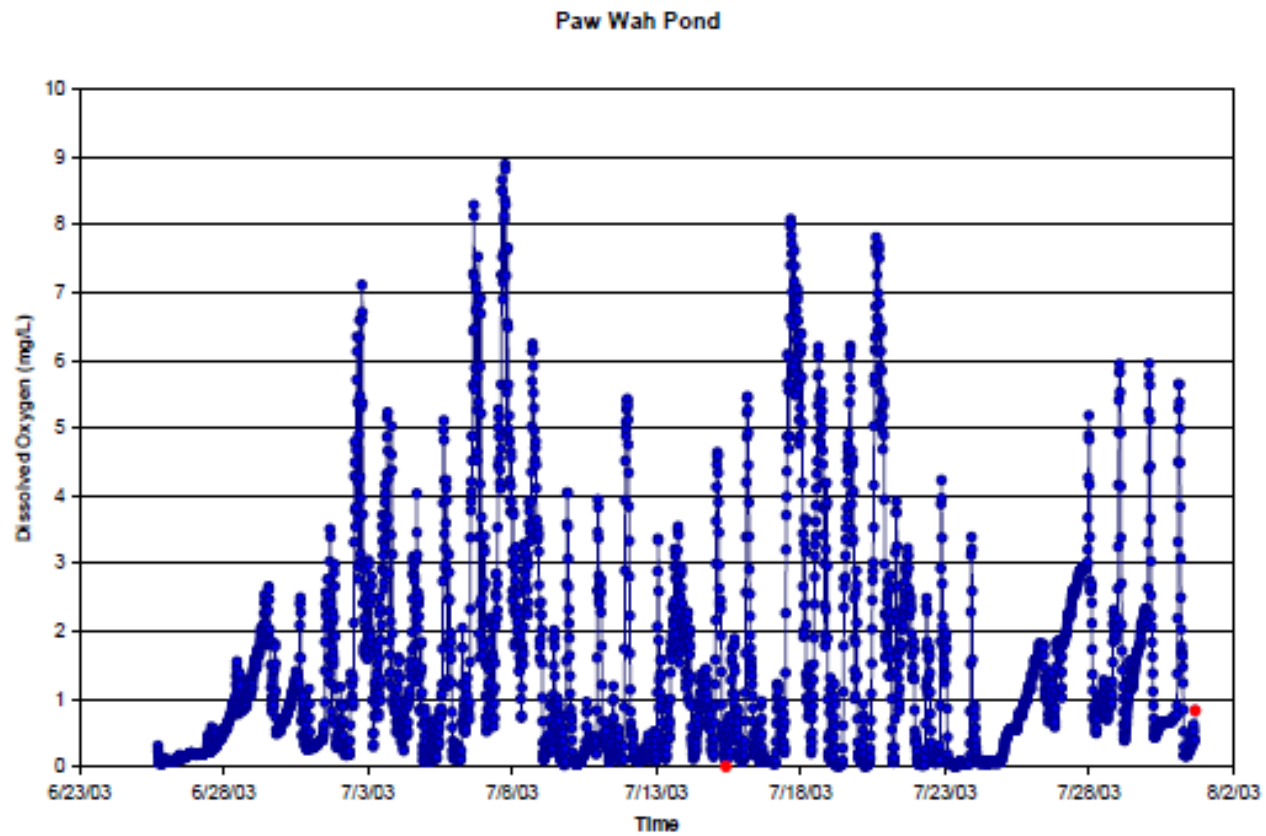


Figure VII-11. Bottom water record of dissolved oxygen in Paw Wah Pond station, Summer 2003. Calibration samples represented as red dots.

Q: Can sediment metabolism dominate nitrogen inputs even in the presence of elevated concentrations of nitrogen?

A: Sediment metabolism is supported by organic inputs from somewhere, typically from plant production in the waters that dies and sinks to the sediments. So the two are linked.

Q: Drowned kettles can accumulate thick organic-rich, anoxic mud. This sort of mud constitutes the substrate of the drowned kettles, and when disturbed it exerts a strong influence on the chemistry of the overlying water column. Moreover, by its very nature it is not a healthy habitat for sessile benthos. Note that eelgrass historically has never been known to successfully inhabit the drowned kettles in Pleasant Bay, as indicated on p.182 of the SMAST-MEP report. This situation may not have anything to do with septic effluent, and it may not be amenable to remediation.

A: Anoxic sediments are a very suitable for benthic animals as long as the overlying waters contain oxygen.

Some snails and amphipods can benefit eelgrass by consuming the algae growing on the eelgrass surface. This aids light penetration into the eelgrass leaves and thus their growth.

In other circumstances herbivores consume the eelgrass itself. The latter is important in more southern waters but its importance in Pleasant Bay is not known.

Q: Is hypoxia in salt marshes independent of N inputs and could this also be the case with shallow ponds?

A: Salt marshes are very productive; this can result in hypoxia in isolated ponds at low tide. Marsh plants fix nitrogen if it is deficient round their roots supporting the high productivity. The process stops if N is supplied from elsewhere. I do not know of nitrogen fixers that grow on pond bottoms except for blue-green bacteria, but they would also stop N-fixing if sufficient N were present from elsewhere.

Q: The examples of environmental declines in Narragansett, San Francisco and Chesapeake Bays, where the water columns have been the depository for millions of gallons per day of raw sewage over many years, are not valid comparisons to the situation in Pleasant Bay.

A: The point is to give examples of how excess nitrogen has resulted in declines in environmental quality in estuaries. There is no suggestion that Pleasant Bay has received amounts of pollutants in any way comparable to those other bays.

Q: Discussion of the specific scientific justification provided in the MEP report for selection of bioactive nitrogen thresholds rather than total nitrogen thresholds, as for other estuaries in southeastern Massachusetts;

A: Total nitrogen includes nitrogen in compounds that are slow to degrade and do not readily release their nitrogen for use by plants. Lignin is an example. It is not correct to include them when calculating the amount of nitrogen that causes eutrophication. Bioactive nitrogen is nitrogen contained in compounds that are readily degraded and release their nitrogen for uptake by plants. Some nitrogen is already inorganic and usable by plants. When there is high **total nitrogen** it is essential to use just the bioactive portion in any system where adequate flushing will remove the resistant fraction. MEP did not include PON in their active fraction. If they had, the available nitrogen would have been larger; I do not know if this would have made a significant difference. We do not know why the TN is so high within the system. We agree it would be good to know “why”, but not knowing “why” does not make the number wrong.

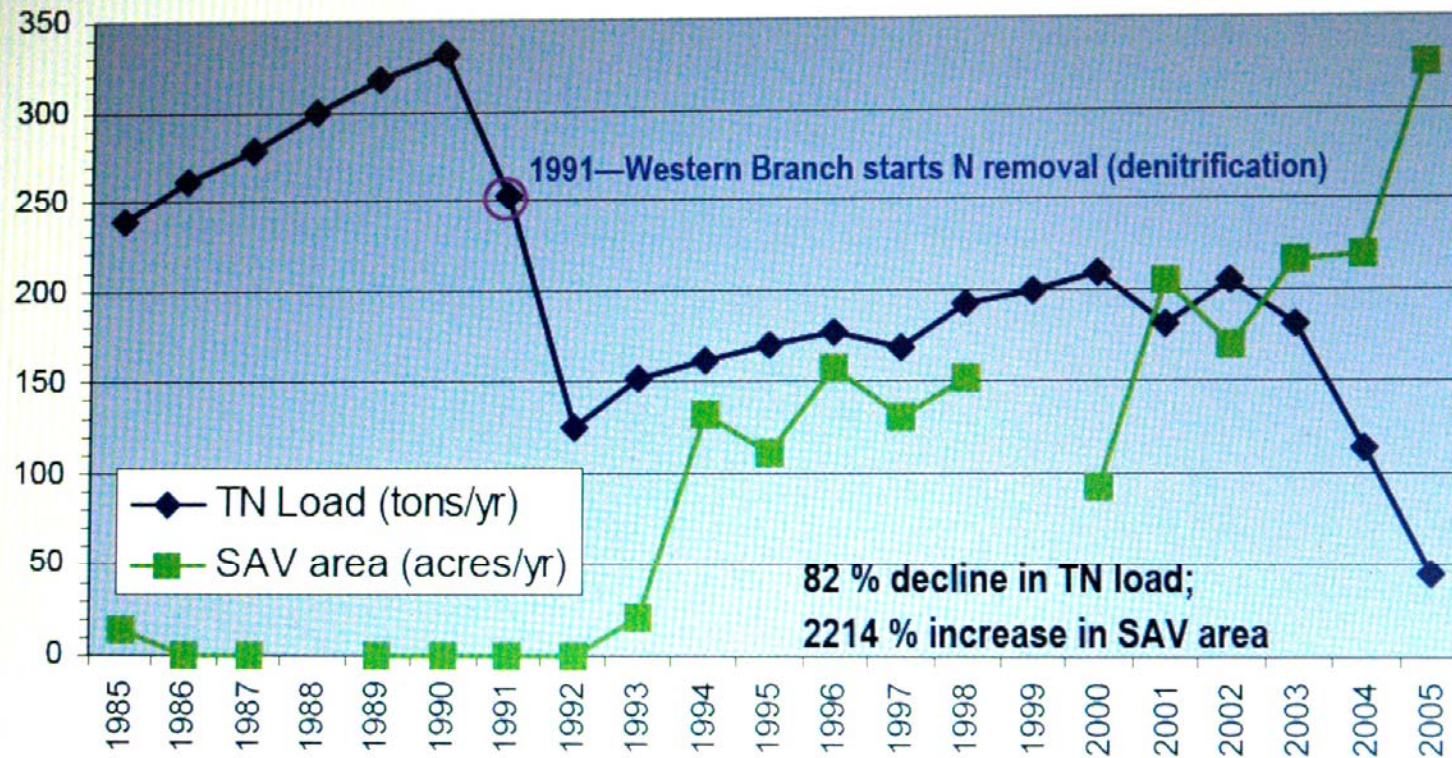
Q: Discussion of the justification provided for the specific bioactive nitrogen threshold concentrations selected by MEP, including comparison with nitrogen threshold concentrations selected in other estuaries for restoration of eelgrass and benthic community habitats;

A: The bioactive nitrogen threshold selected by MEP is reasonable since the selected local embayments do not show damage. A recent summary of eelgrass in Chesapeake Bay recommends a N threshold of <0.15 mg/l, similar to that recommended by MEP for Pleasant Bay.

Q: Are there cases where the removal of nitrogen pollution has resulted in the recovery of eelgrass?

A: An example from “Connecticut Fish Tips and News” from the work of Vaudrey at U. Conn. showed recovery of eelgrass in Mumford Cove after the removal of a sewage outfall in 1987. The article is from August 2007. This is 20 years after the nitrogen removal but recovery was probably much quicker.

Western Branch TN load and nearby SAV area (PAXTF)



(Western Branch can treat 30 million gallons of sewage per day)

Science, Service, & Stewardship

Source: CBP, VIMS

Peter Bergstrom at NOAA