

**Presentation of Findings
To
Mass. Department of Environmental
Protection (MA DEP)
And
UMASS Dartmouth School of Marine Science
and Technology (SMAST)**

**Town of Orleans
Wastewater Management Validation and
Design Committee**

June 10 , 2009

Review of The Health of Eelgrass and Benthic Community in Pleasant Bay

**Wastewater Management
Validation & Design Committee**

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BENTHONIC HEALTH OF PLEASANT BAY

- Physiographic-Oceanographic Setting
- Health of Eelgrass Habitats
- Health of Benthic Fauna
- Nutrient-Related Health Issues
- Summary Questions

EELGRASS STUDIES IN PLEASANT BAY

- 1990-91, Frederick Short, UNH
- 1995 & 2001, Charles Costello, DEP
- 2006, results of latest survey by DEP?
- 2003-2009, USGS & NPS

EELGRASS DISTRIBUTION IN PLEASANT BAY

Acreege of Coverage [as % of submerged area]

Date of Survey:	1951^[1]	1995^[2]	2001^[2]
SMAST Analysis MEP 2006^[3]	2,390 Ac. [64%]	1,899 Ac. [50%]	1,807 Ac. [48%]
Bioactive Nitrogen at PBA12 ^[4]	NO DATA	NO DATA	0.128 mg/l

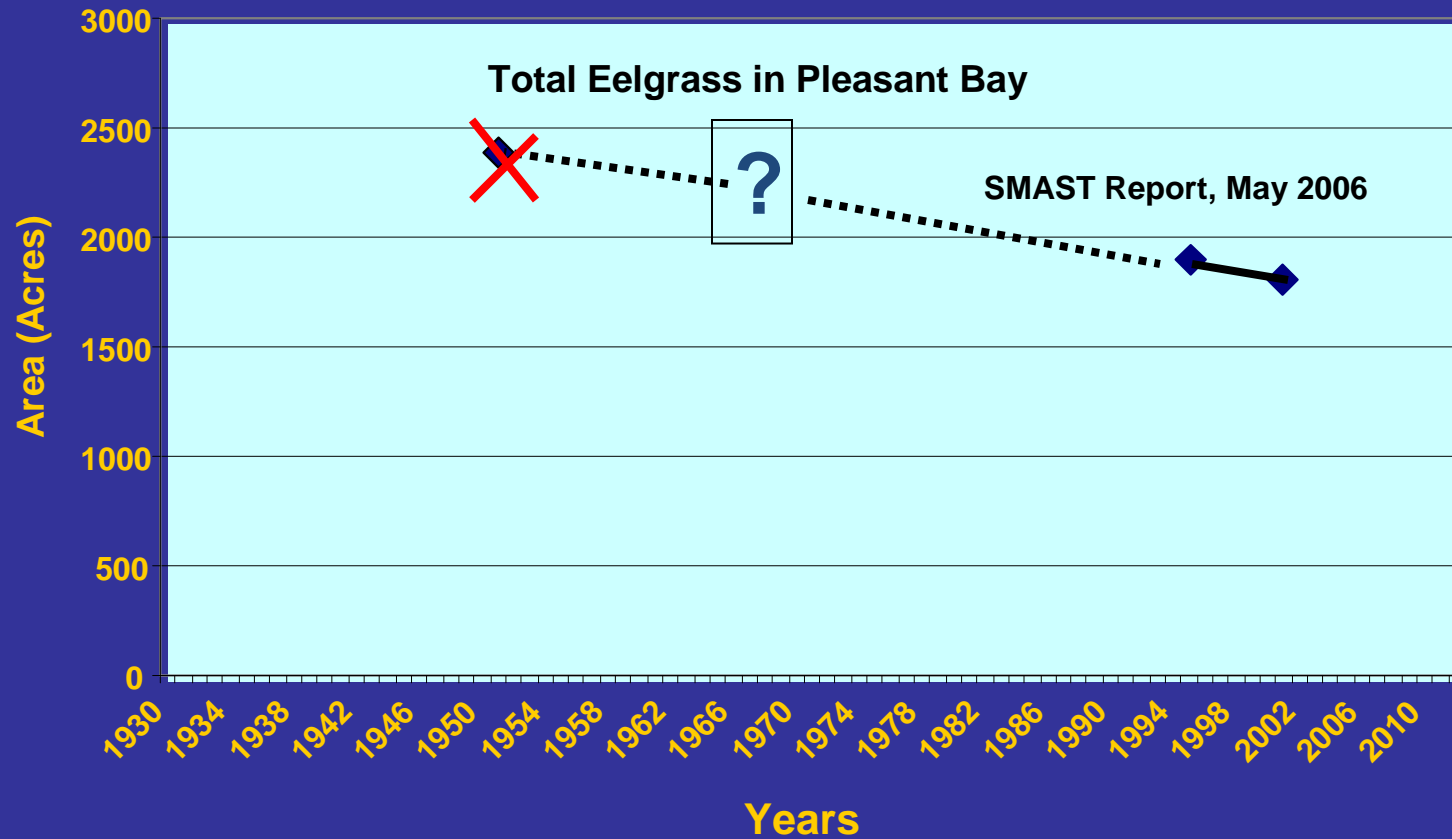
^[1] Mass. Dept. Highway B&W aerial photography at 1:60,000 scale, not field checked or validated.

^[2] Mass. DEP/MEP standard spectra color aerial photography at 1:20,000 scale, field checked.

^[3] SMAST report on Linked Watershed-Embayment Model ... Pleasant Bay, May 2006.

^[4] DEP/MEP maximum threshold concentration for bioactive N at the Pleasant Bay Sentinel Station should not exceed 0.16 mg/l.

SMAST Pleasant Bay Eelgrass History

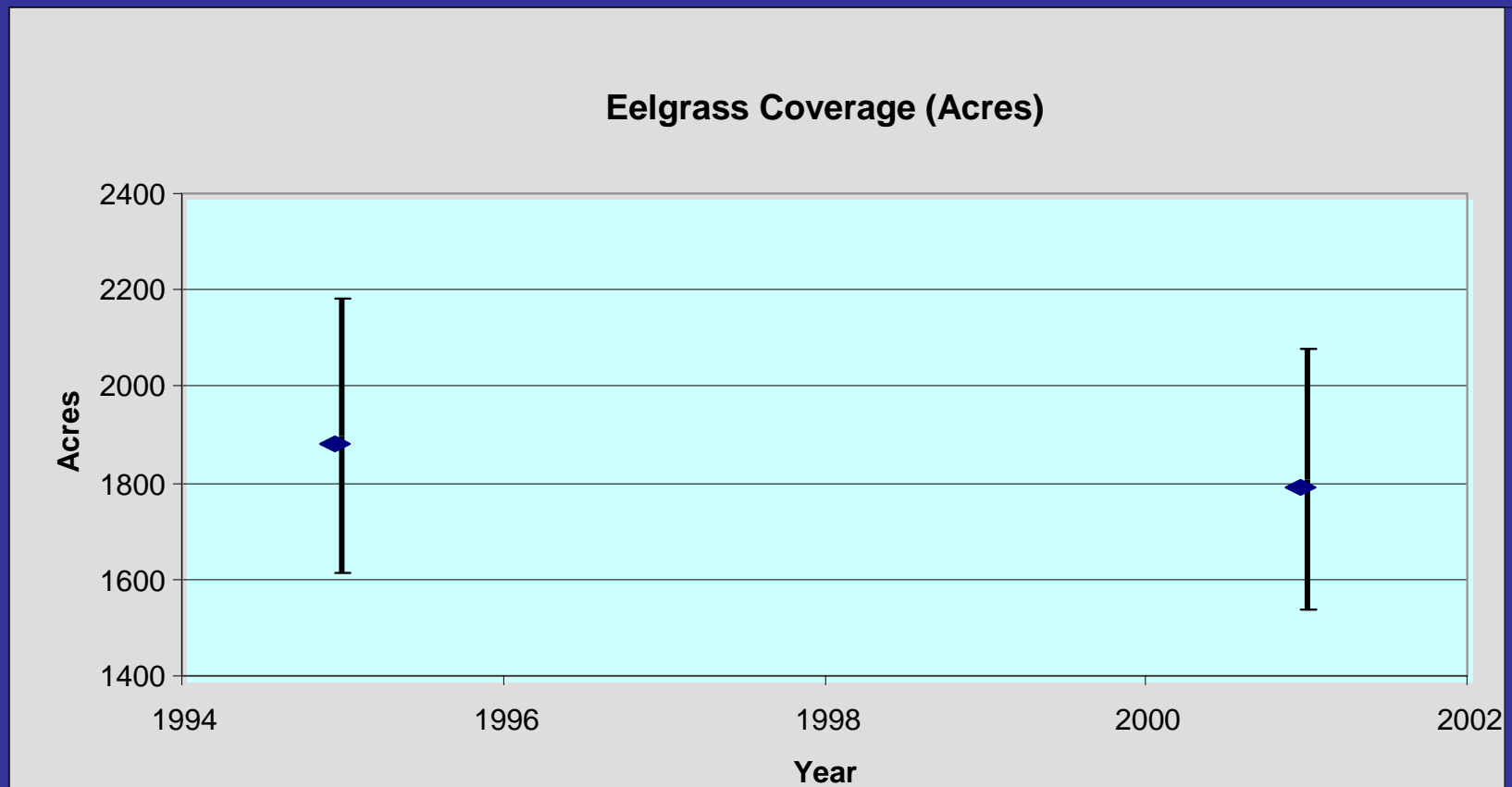


Source: Pleasant Bay Report, May 6, 2006, p 188.

Threshold Criteria

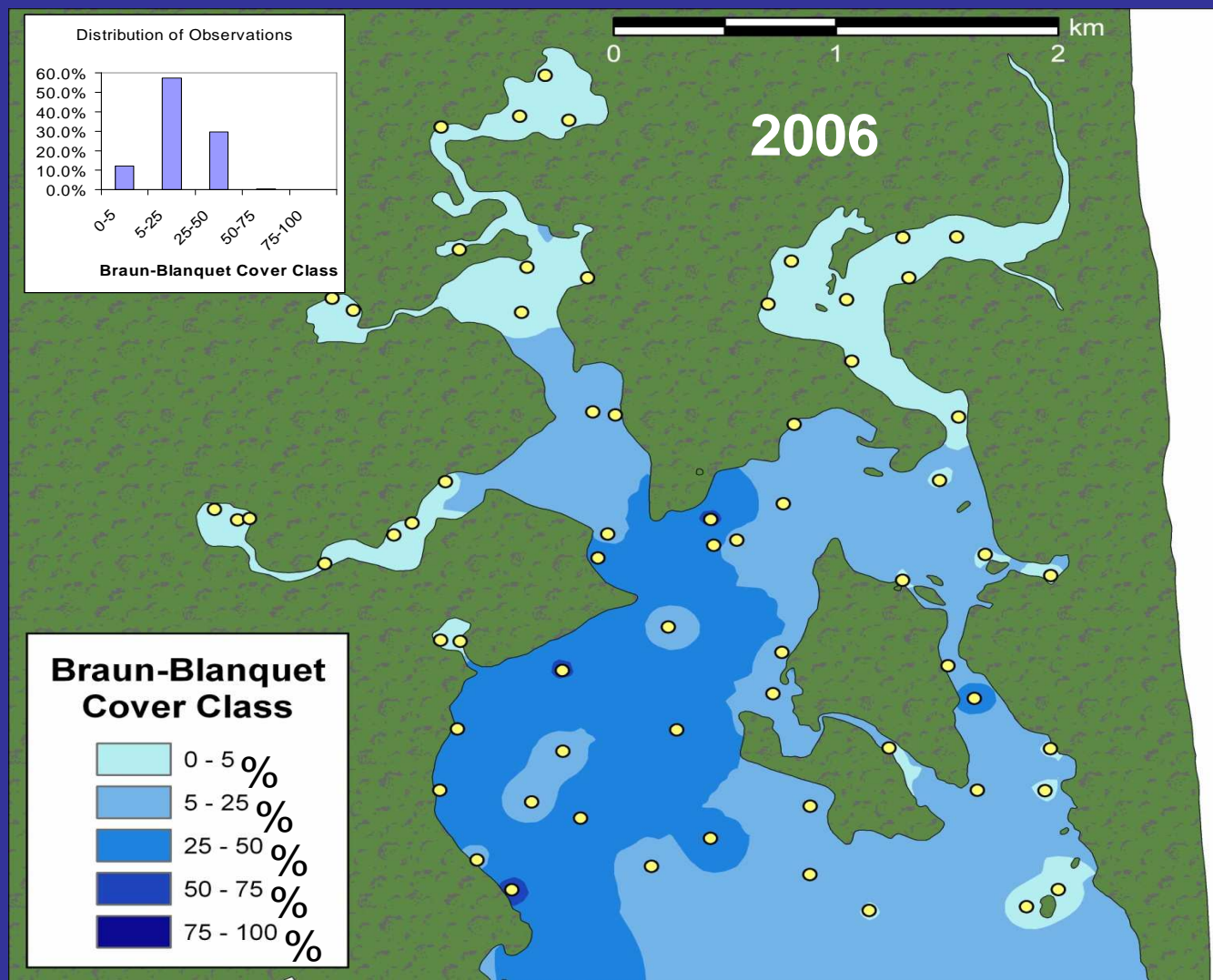
Eelgrass Specification

Error bands: 1995 and 2001: = +/- 10%



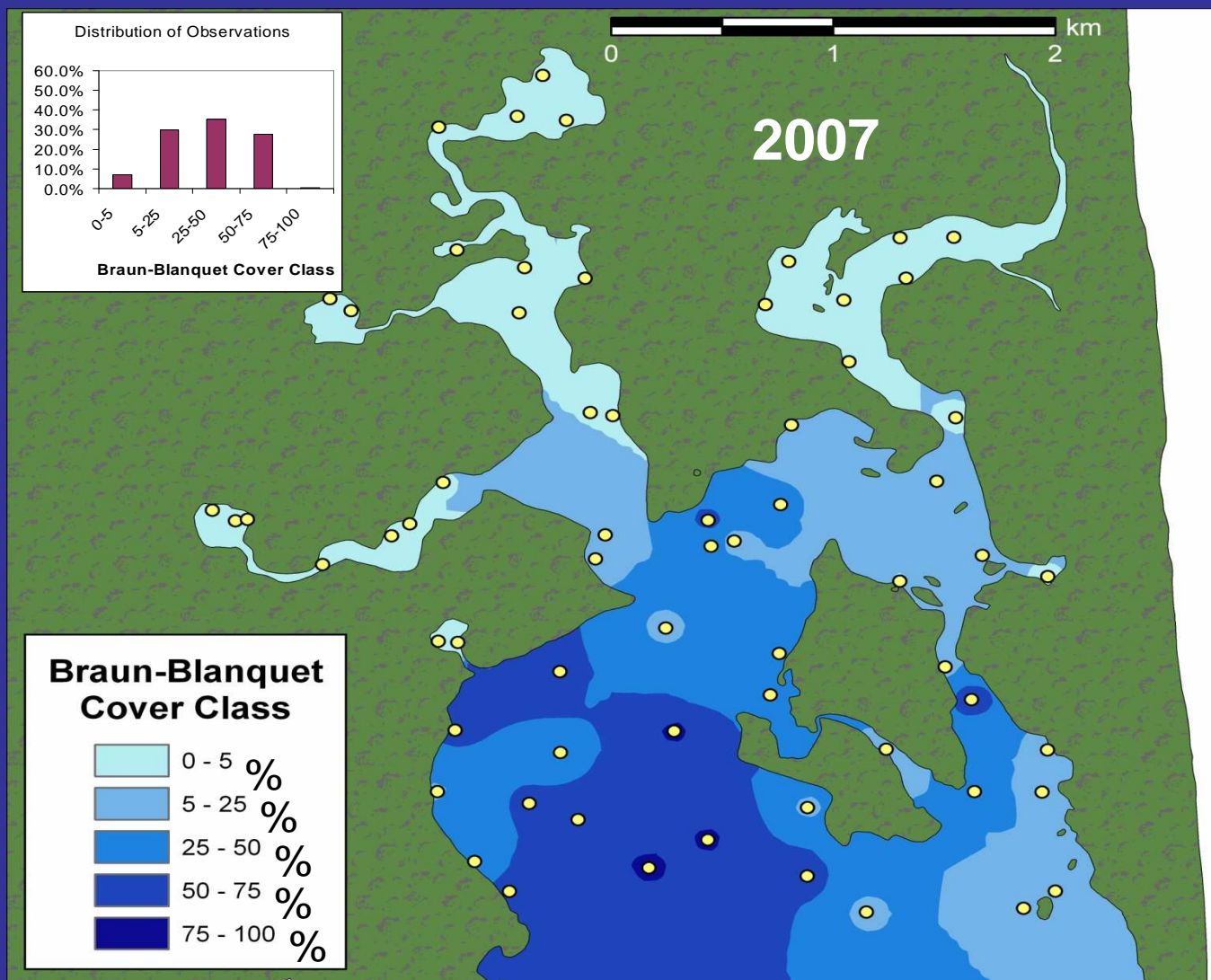
Source: Pleasant Bay Report, May 6, 2006, p 188.

Tier 2: Status 2006



Source: USGS/NPS, 2009.

Tier 2: Status 2007



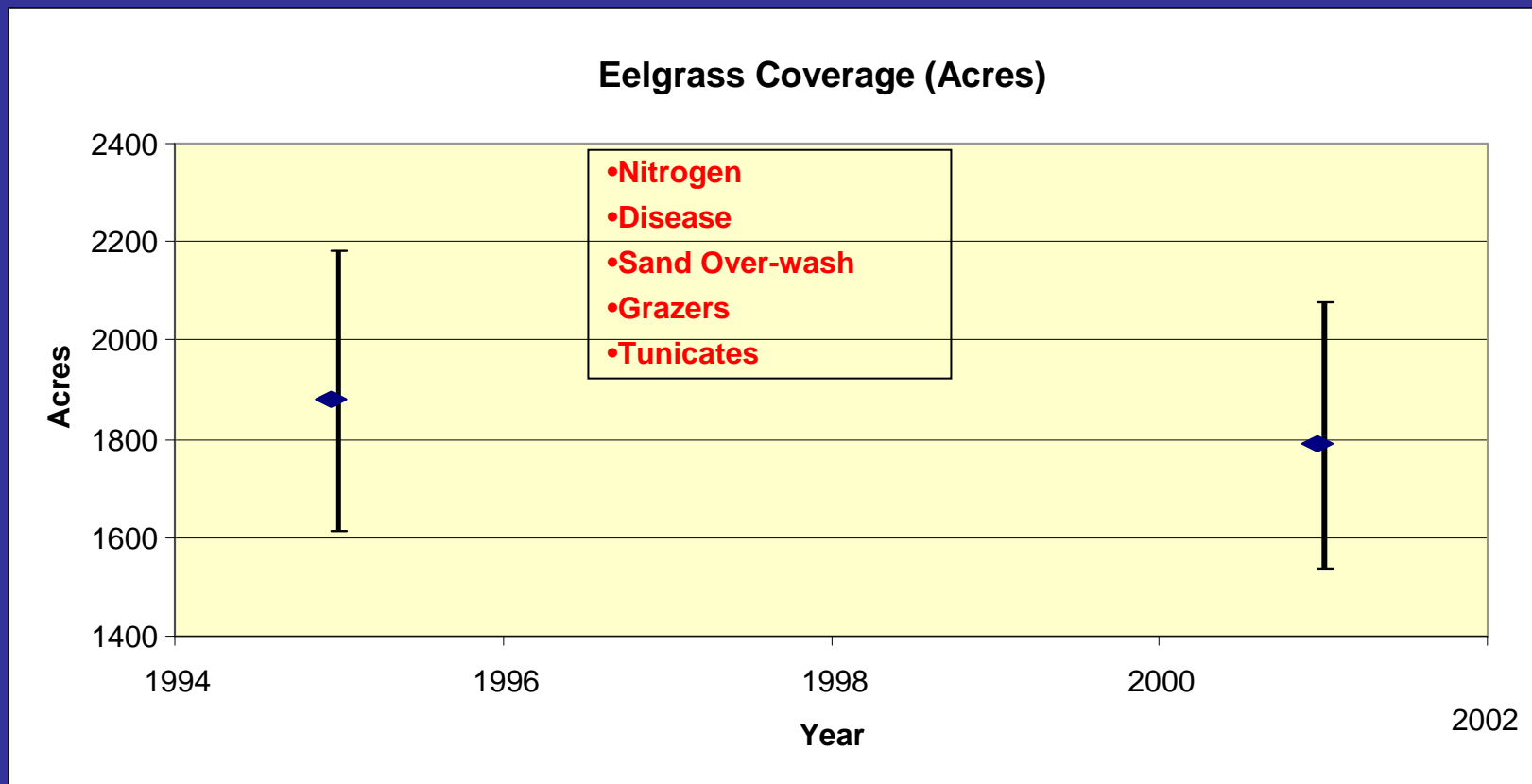
Source: USGS/NPS, 2009.

DETRIMENTS TO EELGRASS HEALTH IN PLEASANT BAY

- Shading by phytoplankton blooms
- Burial by storms & over-wash deposits
- Exhumation by mobilized substrate
- Commercial shellfish harvesting
- Infection by pathogens & epibionts
- Grazing by herbivores
- Recreational boating

Threshold Criteria Eelgrass Specification

Error bands: 1995 and 2001: = +/- 10%



Source: Pleasant Bay Report, May 6, 2006, p 188.

FINDINGS ON EELGRASS

- No reliable basis for claiming significant declines in distribution or quality over past several decades.
- No ecologic basis for ranking probable causes of presumed declines and claiming septic effluent is to blame.
- Codification of “sentinel species” is at odds with basic ecosystem concepts.

Pleasant Bay

Shellfish Harvest Booms

Year	Product	Quantity
1975	Quahogs	11,000 bushels
1981	Steamers	4,000 bushels
1983	Scallops	70,000 bushels
1987	Steamers	1,500 bushels
1996	Razor Clams	475,000 pounds
1997	Steamers	1,800 bushels
2004	Razor Clams	675,000 pounds
2005	Steamers	3,000 bushels

Source: Pleasant Bay Resource Management Plan, 2008 Update.

Namequoit Point Station

Y2003

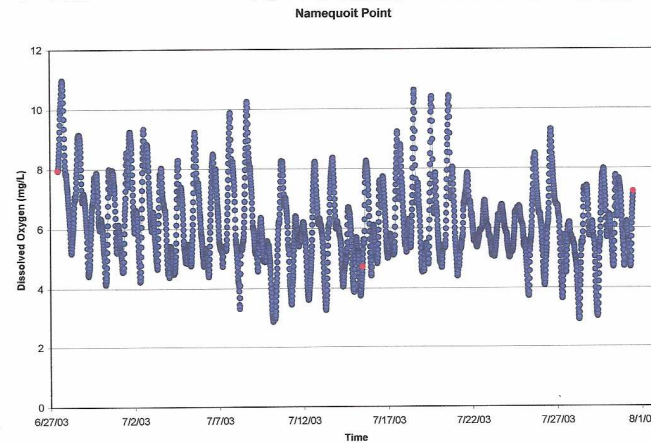


Figure VII-10. Bottom water record of dissolved oxygen in Namequoit Point station, Summer 2003. Calibration samples represented as red dots

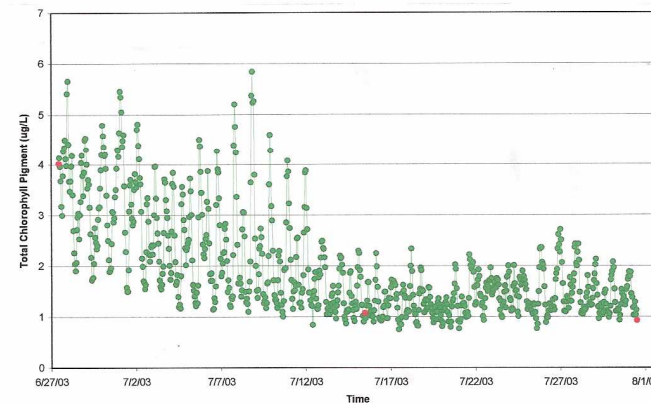


Figure VII-30. Bottom water record of Chlorophyll-a in Namequoit Point station, Summer 2003. Calibration samples represented as red dots

Source: Pleasant Bay Report,
May 2006, p. 160 and p. 170.

Arey's Pond Station

Y2003

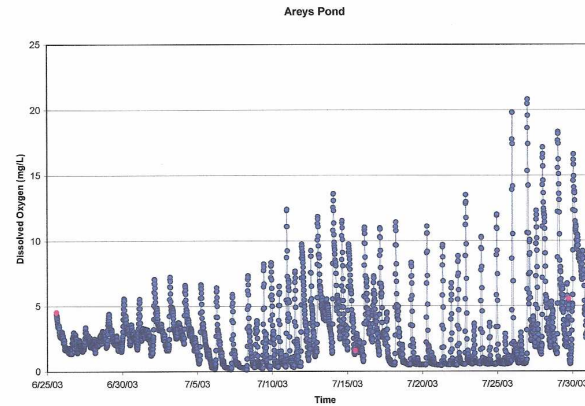


Figure VII-8. Bottom water record of dissolved oxygen in Arey's Pond station, Summer 2003. Calibration samples represented as red dots.

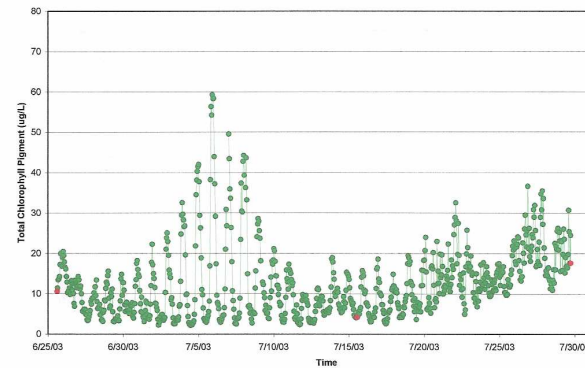


Figure VII-28. Bottom water record of Chlorophyll-a in Arey's Pond station, Summer 2003. Calibration samples represented as red dots.

Source: Pleasant Bay Report,
May 2006, p. 159 and p. 169.

Pleasant Bay

Lagoons & Kettles

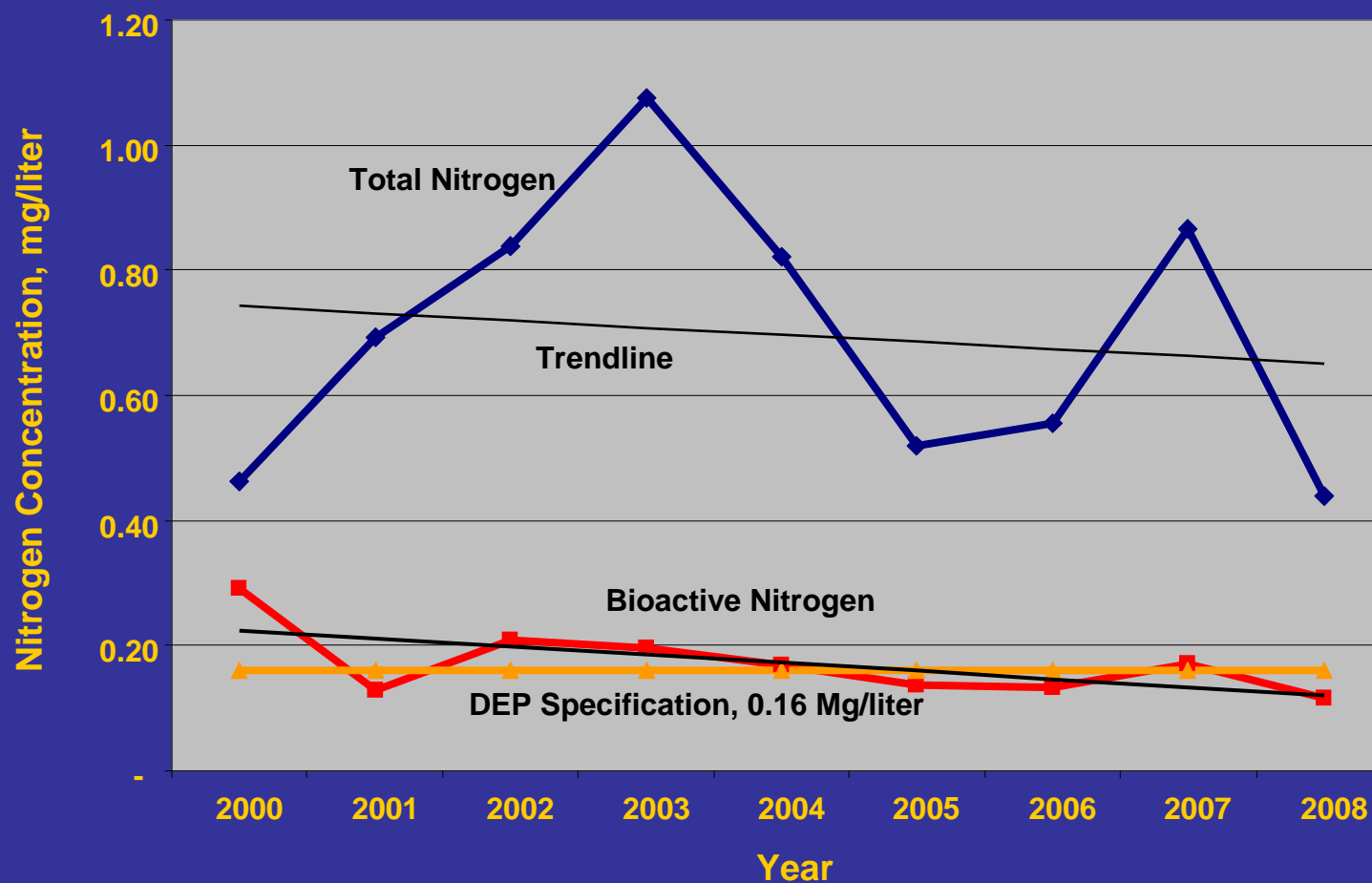
Environmental Attribute	Open Bays & Lagoons	Drowned Kettles
Substrate	well washed sand	fetid black mud
Organic Matter	low concentration	high concentration
Turbidity	low throughout	increases with depth
Dissolved Oxygen	>6 mg/l, Class SA	altern. hypoxic-oxic
Groundwater N	comparable	comparable
Residence Time	approx. 1 day	approx. 1 day
Eelgrass	widespread ~50%	not significant
Benthic Fauna & Other Factors	healthy & diverse shellfish harvests	stressed & depleted >330 boat moorings

FINDINGS ON BENTHIC FAUNA

- Major lagoonal embayments have healthy and diverse faunal communities.
- Deep bottoms of drowned kettles are stressed and hypoxic with depaupered communities.
- Relationship between anthropogenic or natural causes of stress is unresolved and moot.

PBA12 Namequoit Point

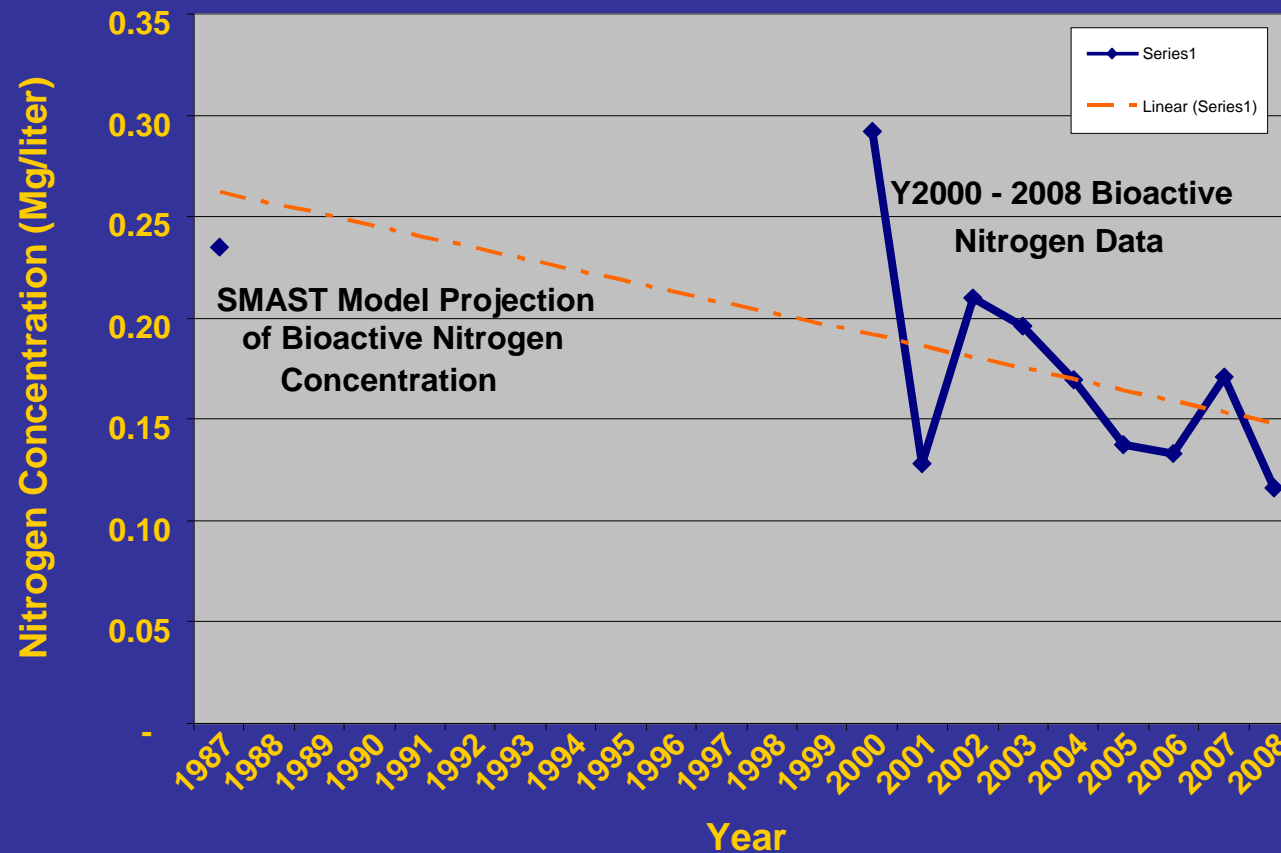
Nitrogen Data



Source: Pleasant Bay Resource Management Alliance

PBA12 Namequoit Point

Data Extrapolation



Sources: Pleasant Bay Resource Management Alliance, and Pleasant Bay Report, May 2006, p. 219.

FINDINGS ON NUTRIENT-RELATED HEALTH

- Assumption that health controlled by bioactive nitrogen levels is not evaluated or supported by factual evidence.
- Nitrogen threshold levels are arbitrary and without empirical foundation.
- No evidential basis for evaluating relative health of benthic communities in drowned kettles through time.

SUMMARY QUESTIONS

1. Where is the Y2006 eelgrass measurement data?
2. Why are eelgrass declines mainly in more shallow and cleaner southern and eastern areas of Pleasant Bay?
3. How can one species be proxy for influence of only one environmental parameter?
4. Why are drowned kettles relatively “impaired”?
5. Is this “impairment” amenable to remediation?
6. Where is the evidence for defining optimal nitrogen levels in marine ecosystems?