



Massachusetts Water Resources Authority



**Sediment and Flounder
Studies in Boston Harbor
Wastewater Advisory
Committee
February 6, 2009**





Sediment contaminants

- **Most contaminants of concern adhere to fine particulates.**
- **So contaminants build up in muddy, depositional areas of the Harbor**
- **Organic matter and SOD from sewage builds up in same areas**

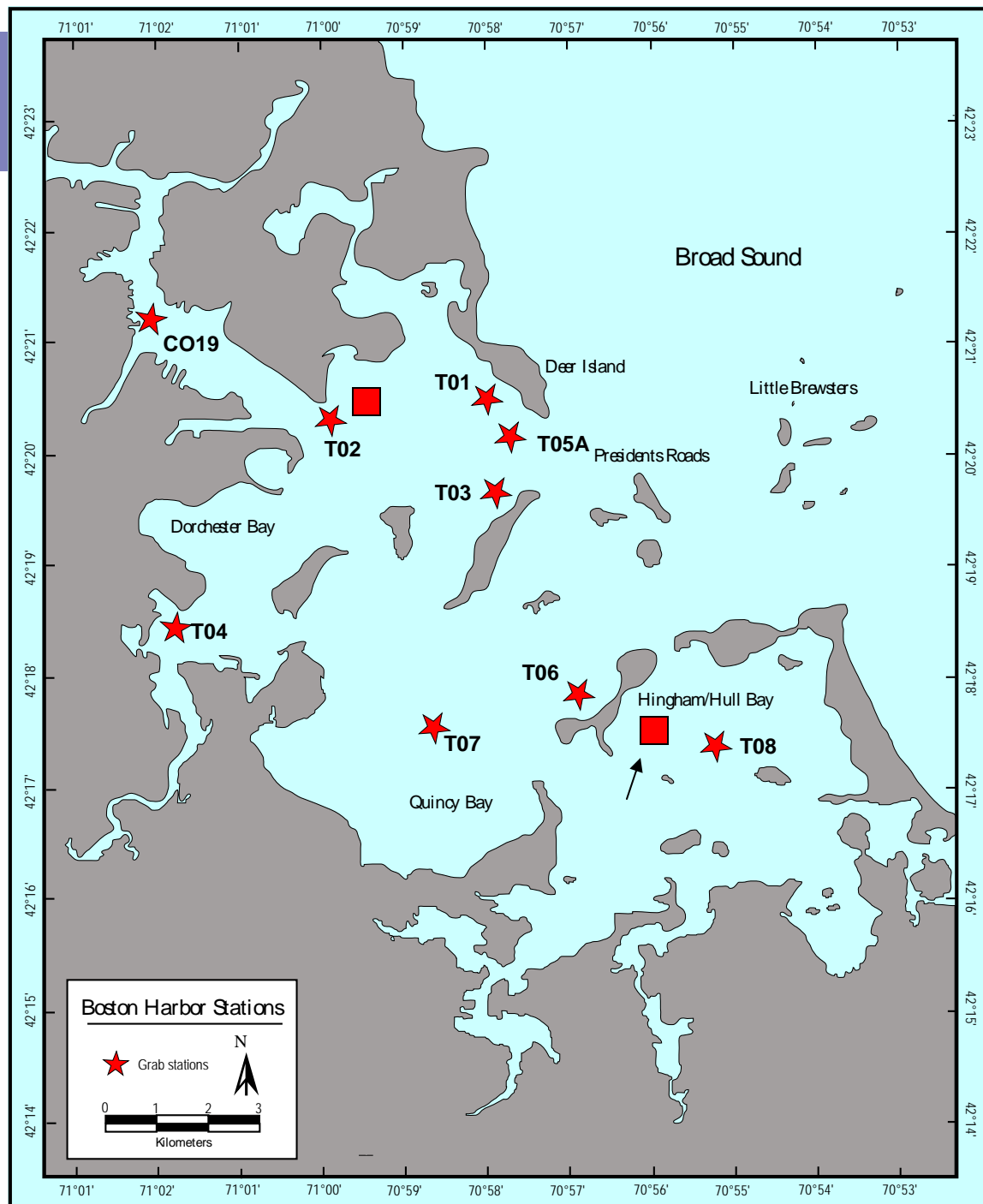
- **Mid-1980s Boston Harbor sediments were more contaminated than any other location sampled in a long-term NOAA study. “Dirtiest Harbor in the Nation” headlines resulted**





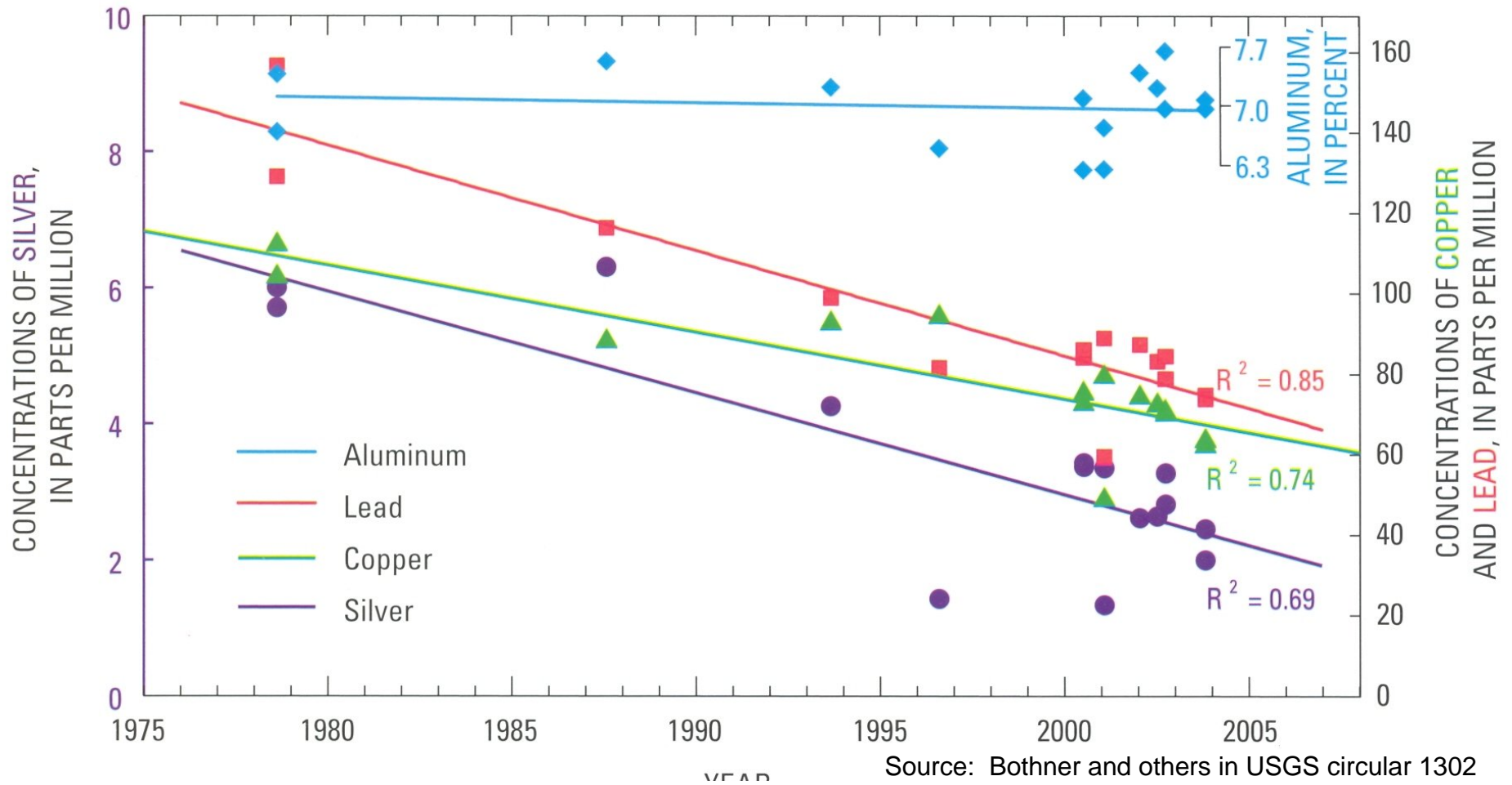
USGS Studies

- Long-term dataset at stations in Boston Harbor
- Sampling began in mid-1970s
- Stations reoccupied every couple years
- Time-series supplemented by analysis of deep cores





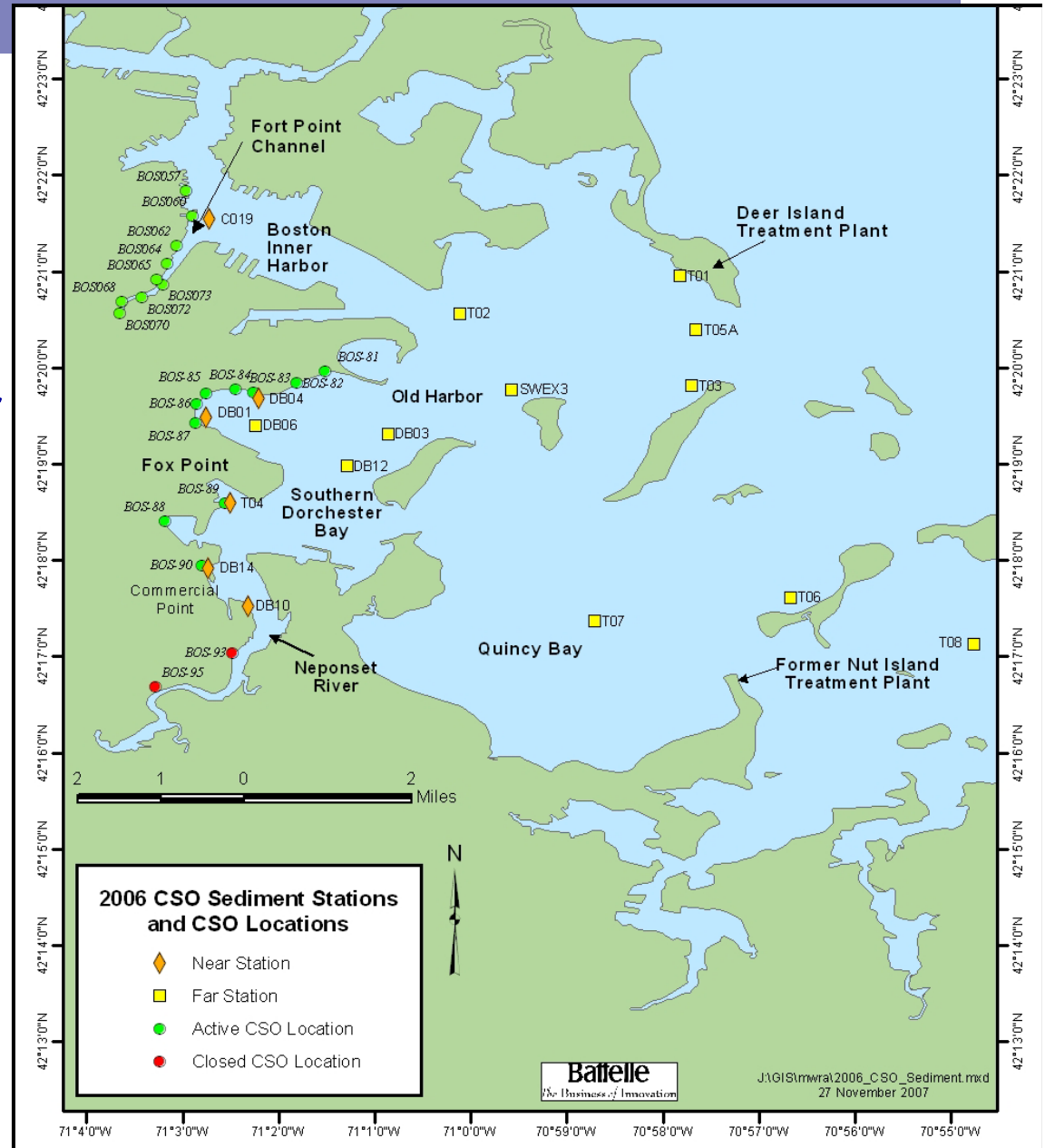
Metals in sediments from Hingham Bay have decreased by 50%





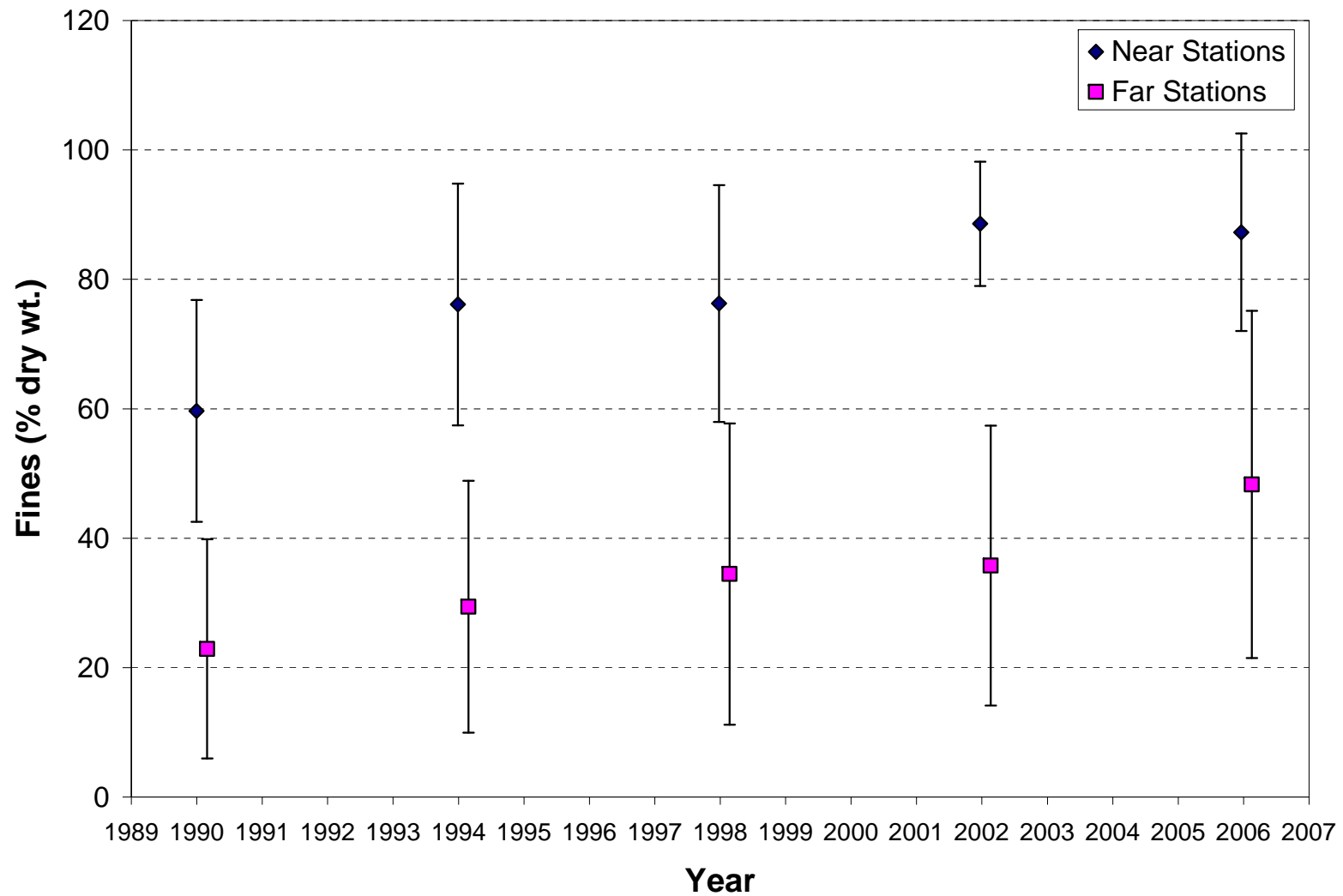
MWRA study

- Purpose to evaluate impacts of CSO discharges on adjacent sediments
- Focused on Dorchester Bay with reference stations elsewhere in Harbor
- Sampled every 4 years since 1990



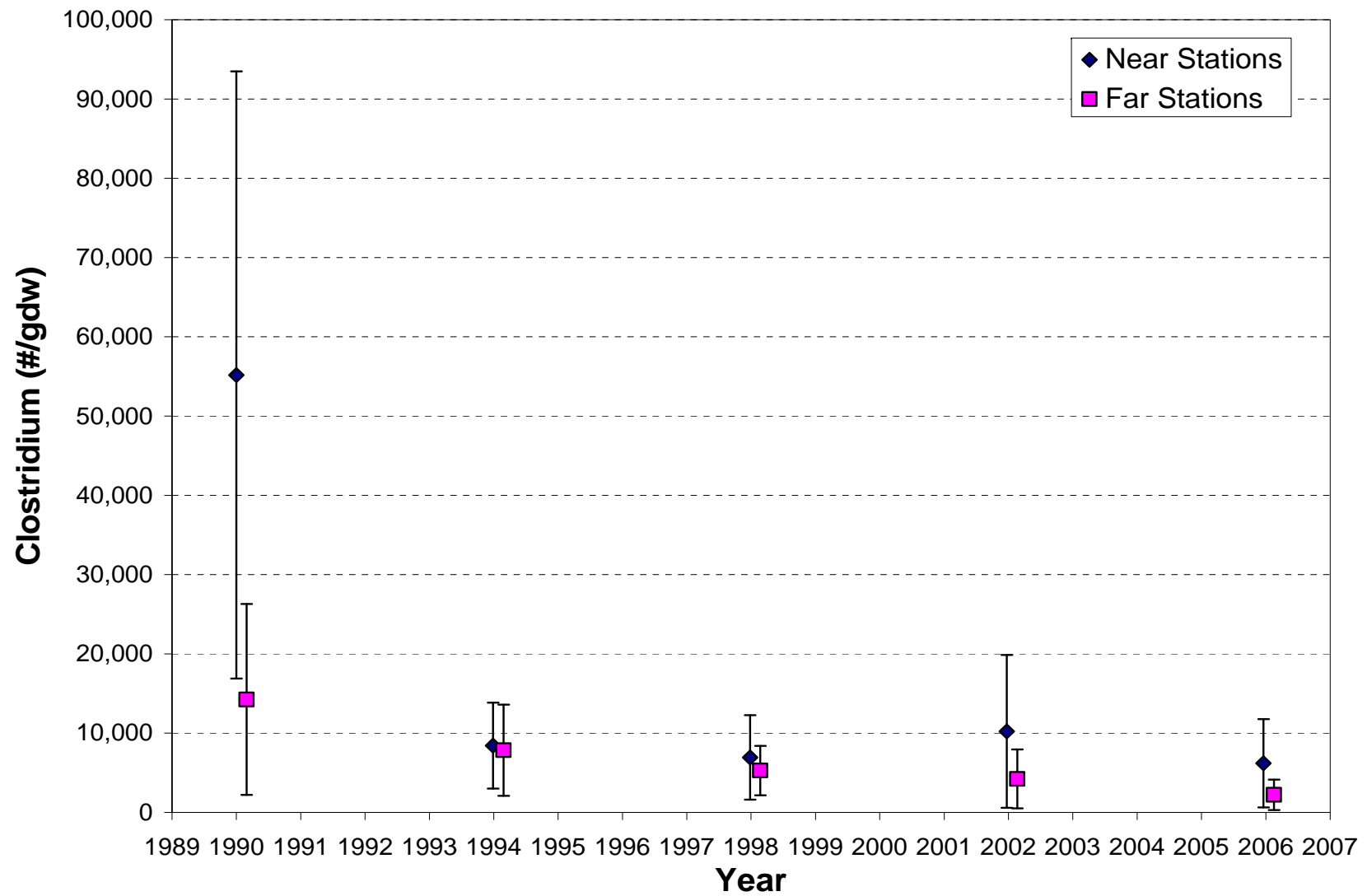


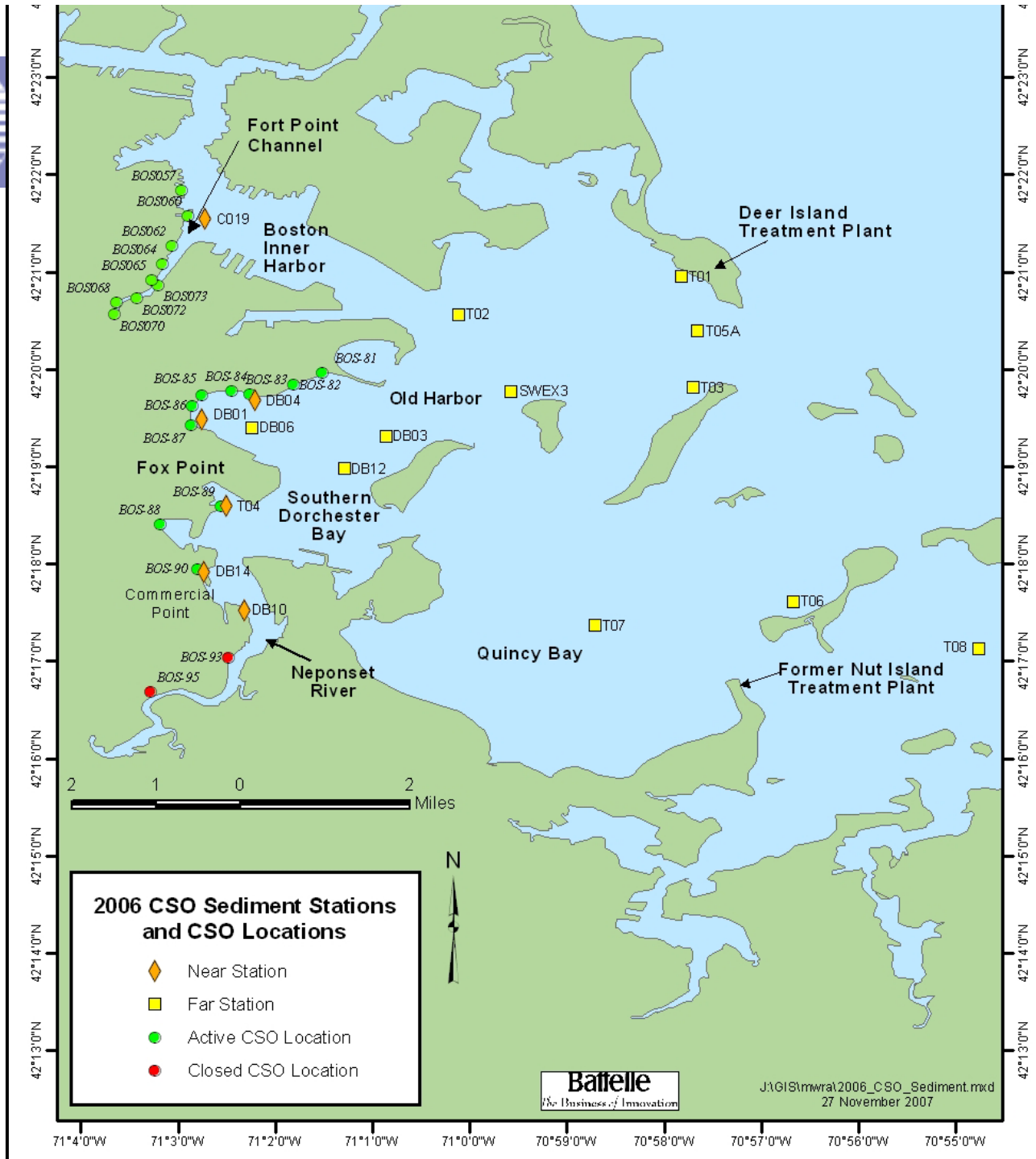
Changes in sediment texture through time





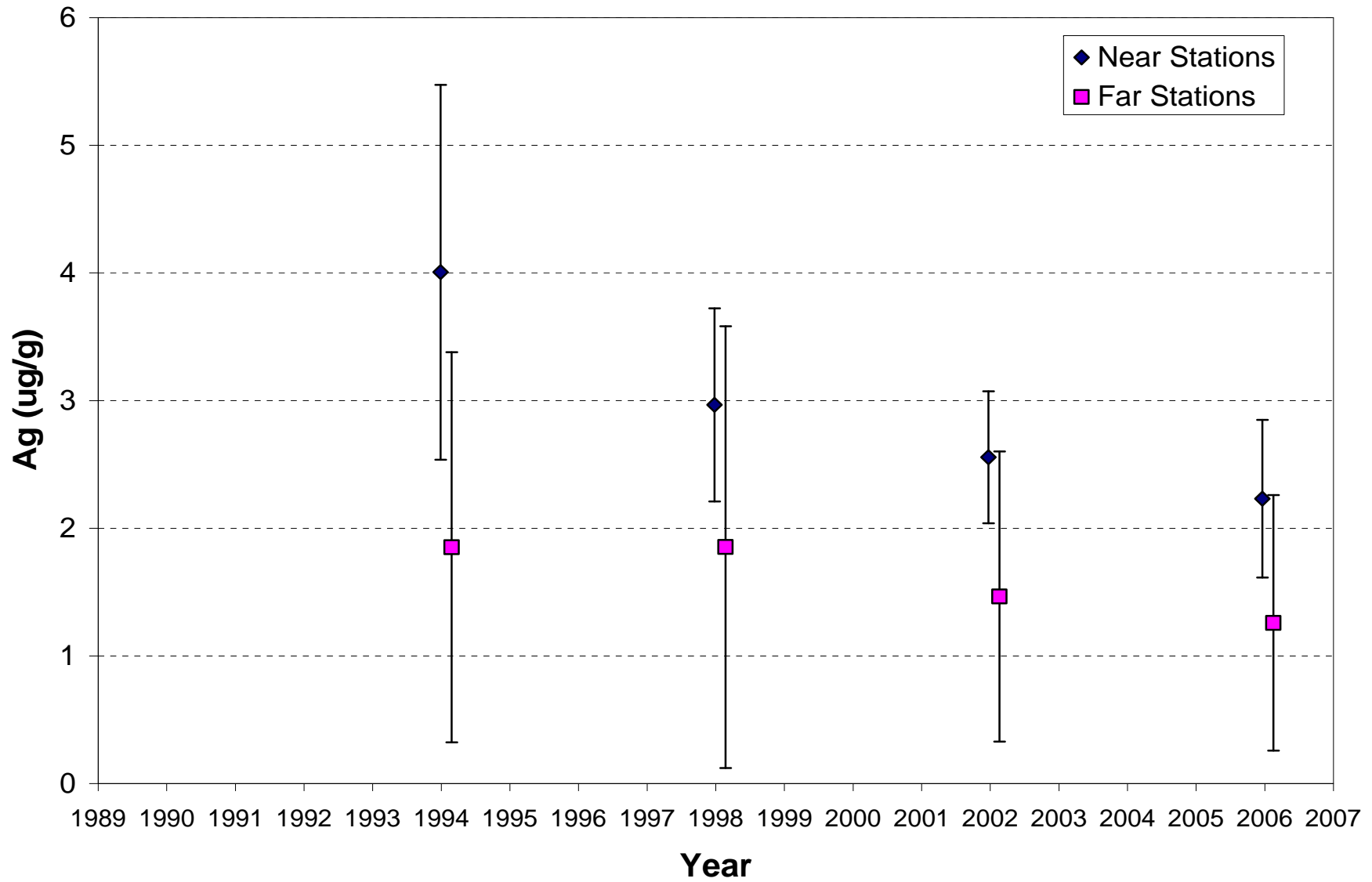
Sewage tracer (*Clostridium perfringens*)





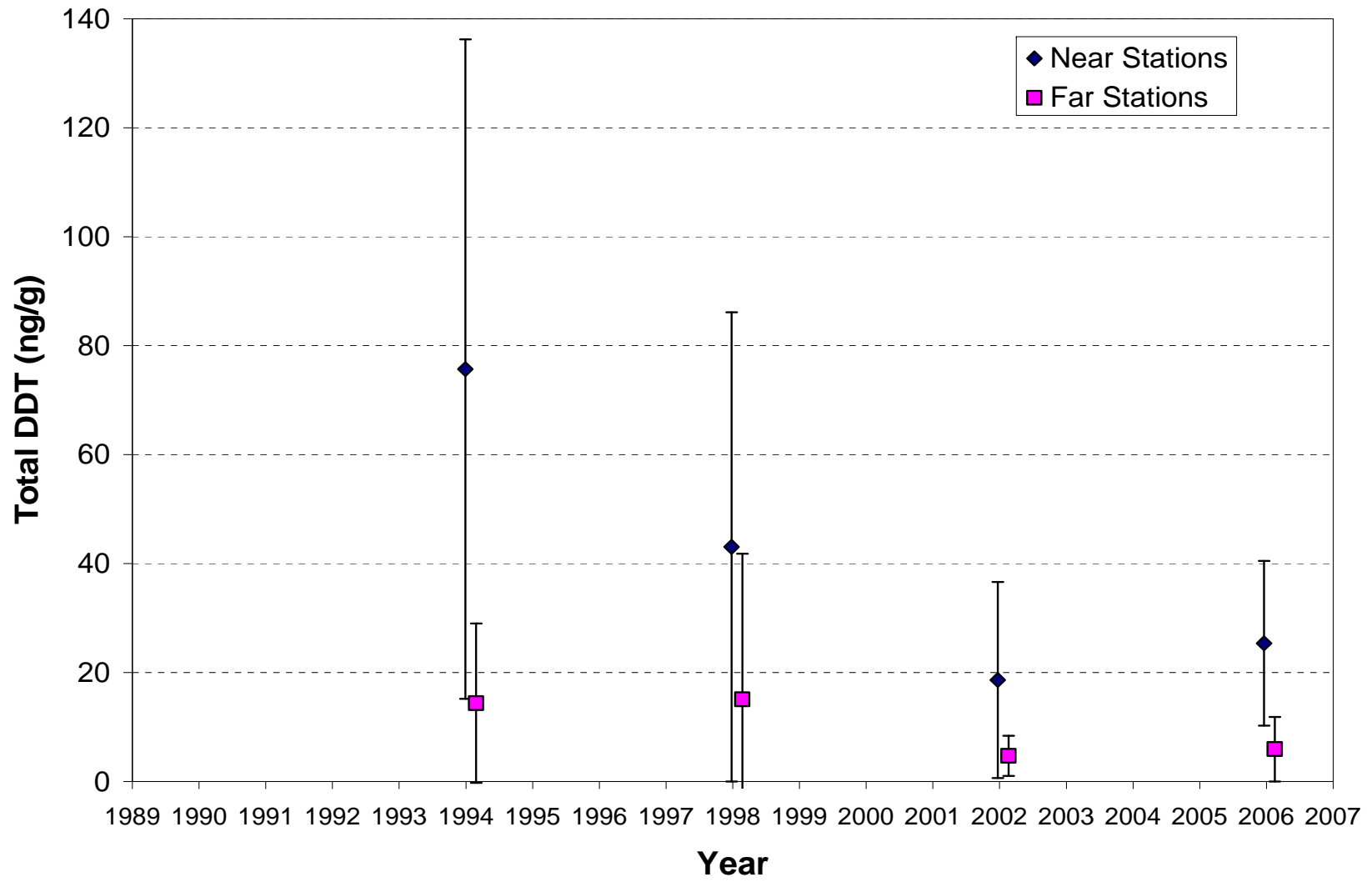


Contaminants





DDT





Winter flounder studies

Flounder live in contact
With the seafloor

Exposed to contaminants
through gills, prey, and
direct contact.

Fin rot and liver disease
in flounder were among the
the earliest signs of
degradation in Boston Harbor





Boston Harbor, mid-1980s

- Over 80% of fish showed signs of fin rot
- 60-80% of fish showed signs of liver disease linked to toxics exposure
- Up to 12% of fish bore liver tumors



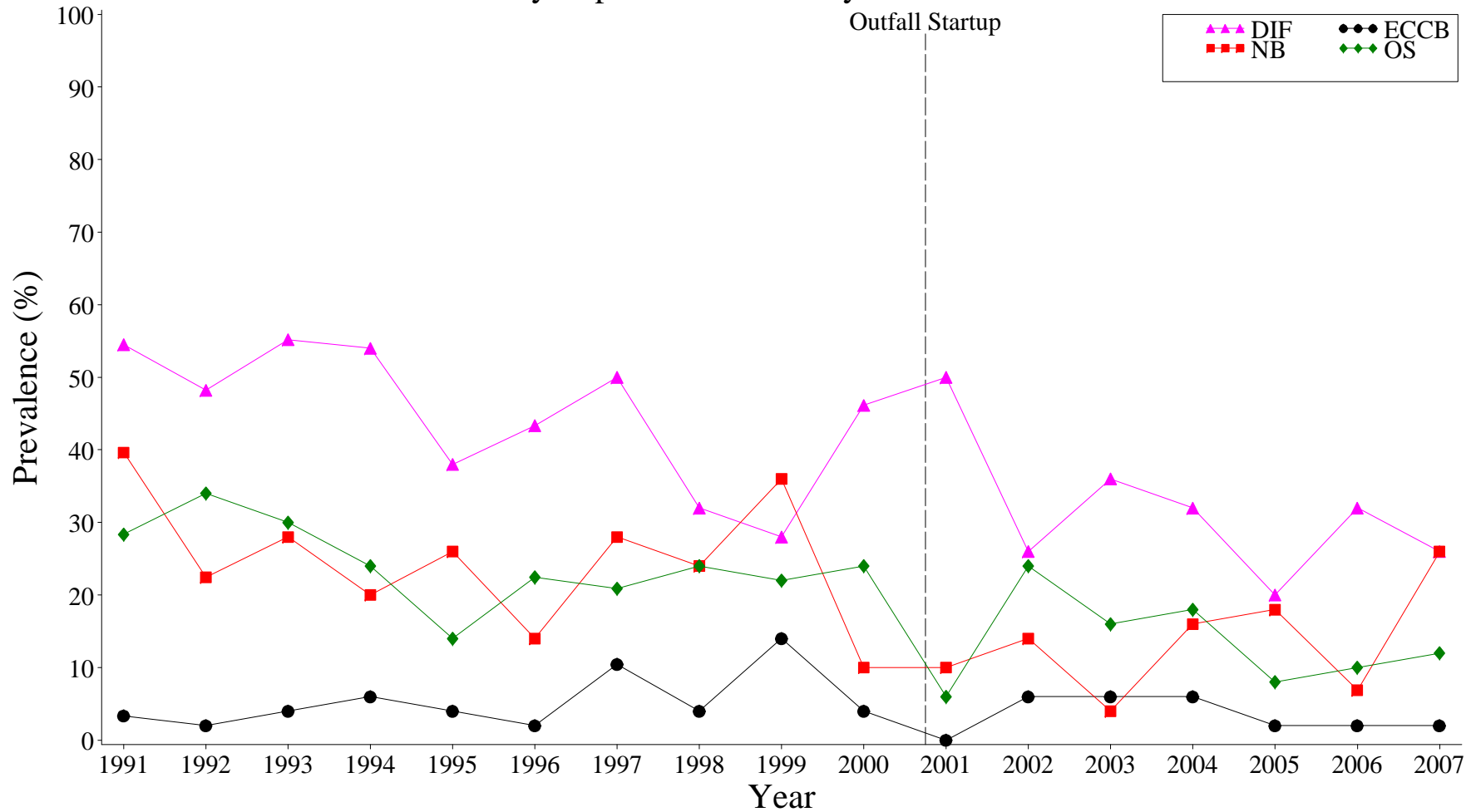


4 stations
Occupied annually
since 1991



Decreases in Early Liver disease in Harbor Flounder

Winter Flounder
Centrotubular Hydropic Vacuolation by Year for Each Station





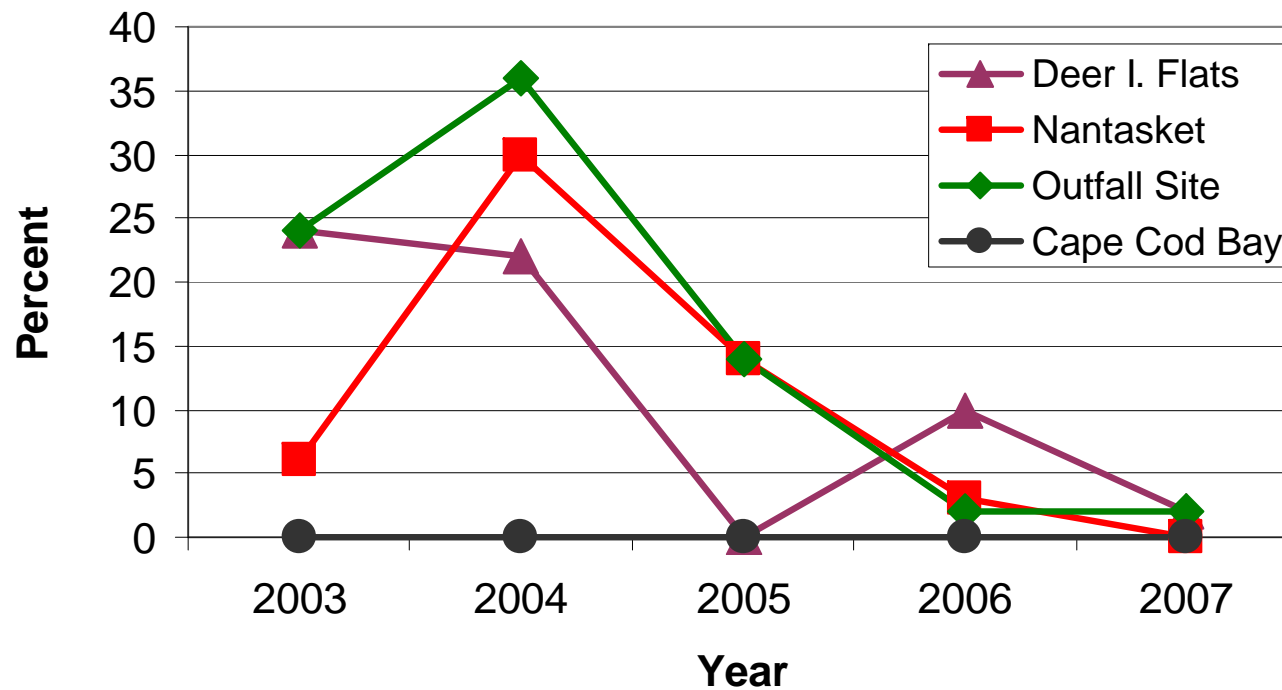
Skin ulcers in flounder





Flounder skin lesions rare in 2007 and 2008

Winter Flounder Incidence of Skin Lesions 2003-07





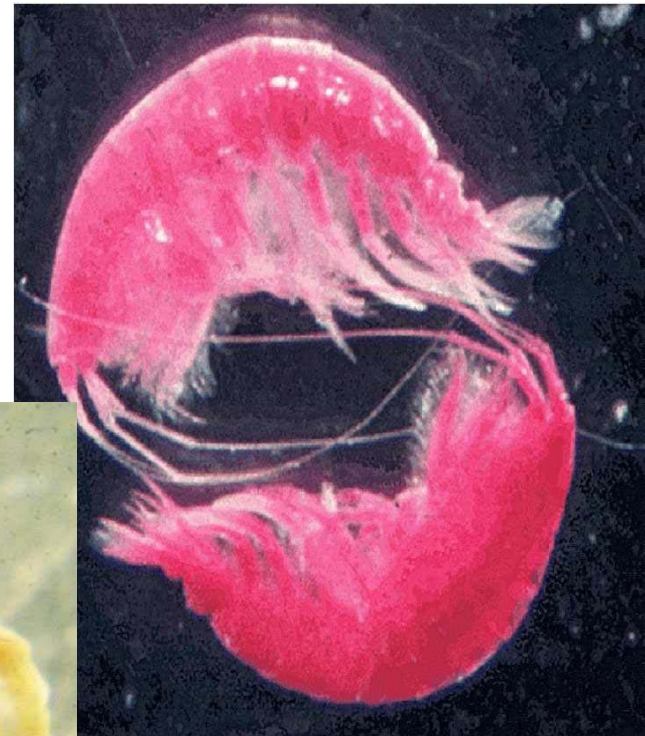
Soft sediment community studies

- Animals living on or in soft sediments are mostly sessile.
- Exposed to sediment contaminants continuously
- Communities and their response to pollution stresses are relatively well studied.



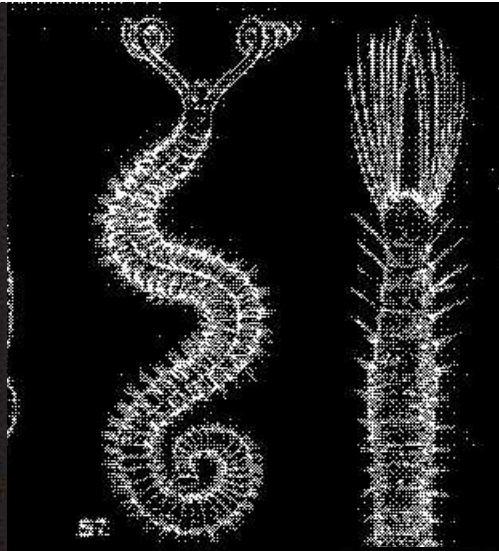


Common soft-sediment invertebrates



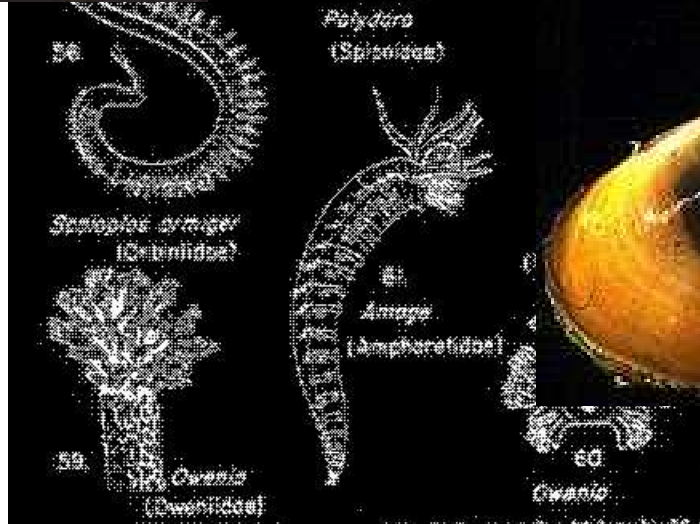


Common soft-sediment invertebrates



57

Polydora
(Sipuncidae)



58

Streblospio benedicti
(Terebellidae)

59

Cirratulus
(Cirratulidae)

60

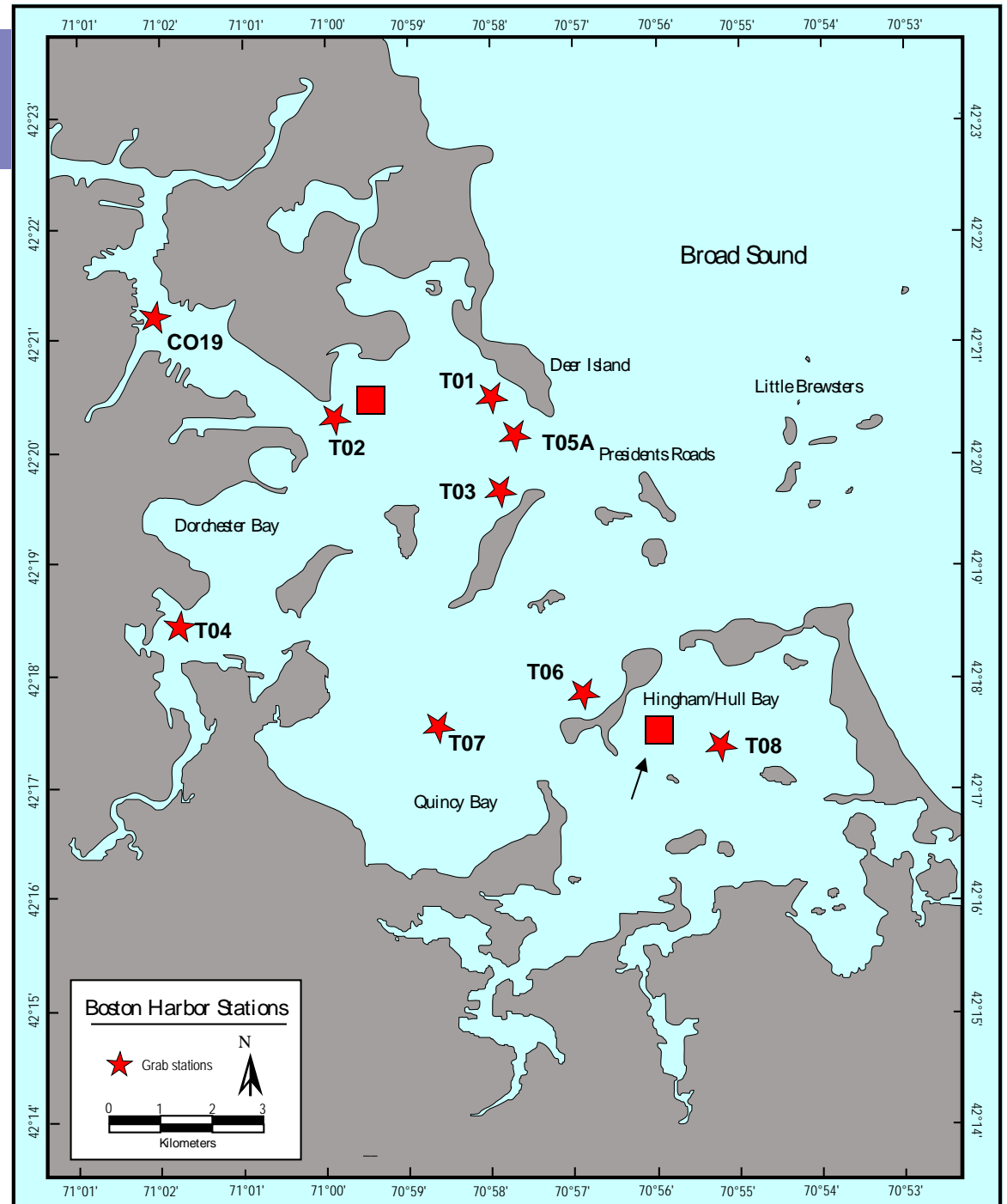
Ampelisca
(Ampeliscidae)





MWRA infauna studies

- **Sampling at 9 stations in Boston Harbor**
- **Samples collected annually for grain size, infauna, and sewage tracers**
- **Stations occupied annually since 1991**
- **Supplemented by camera images at 60 sites**



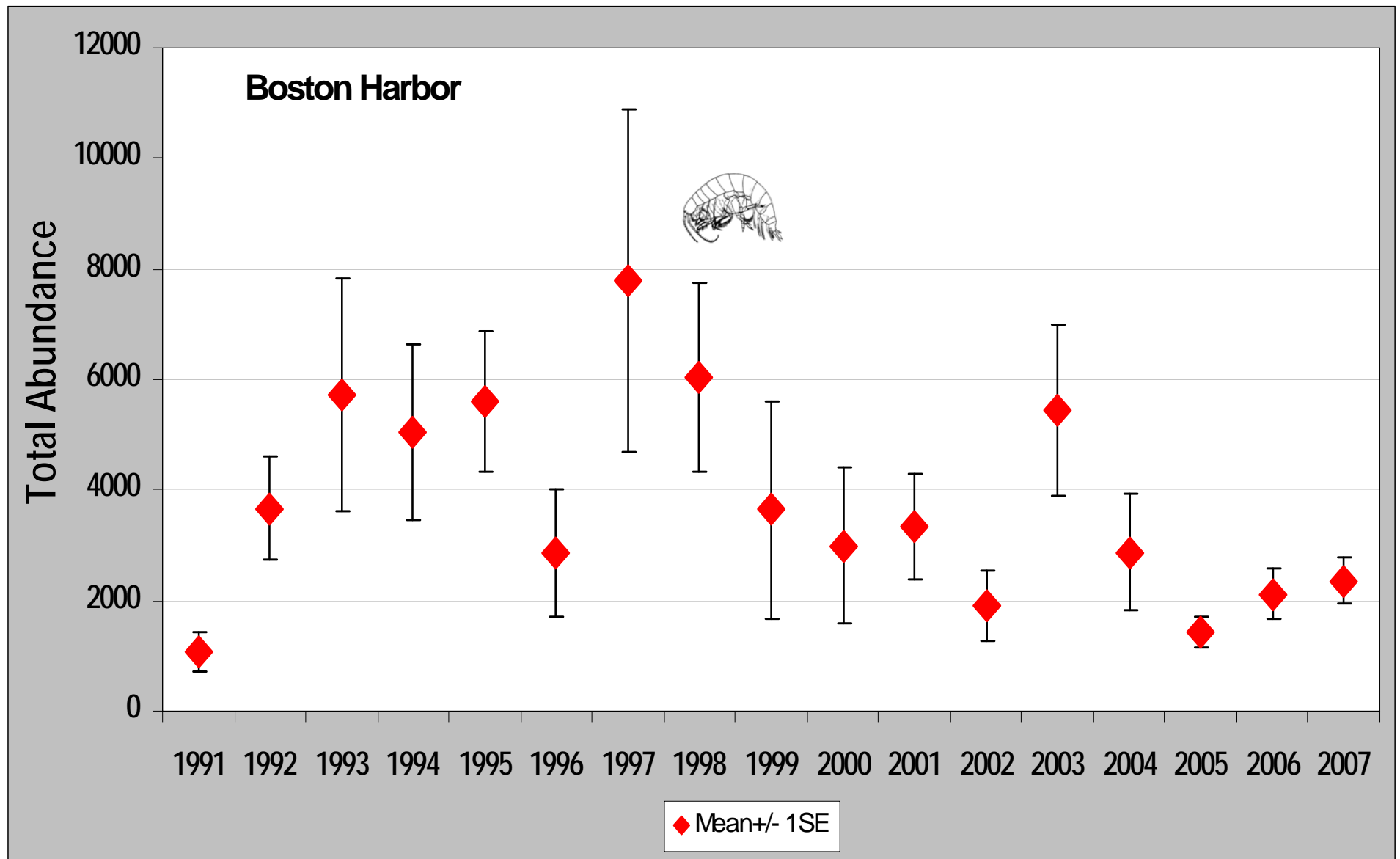


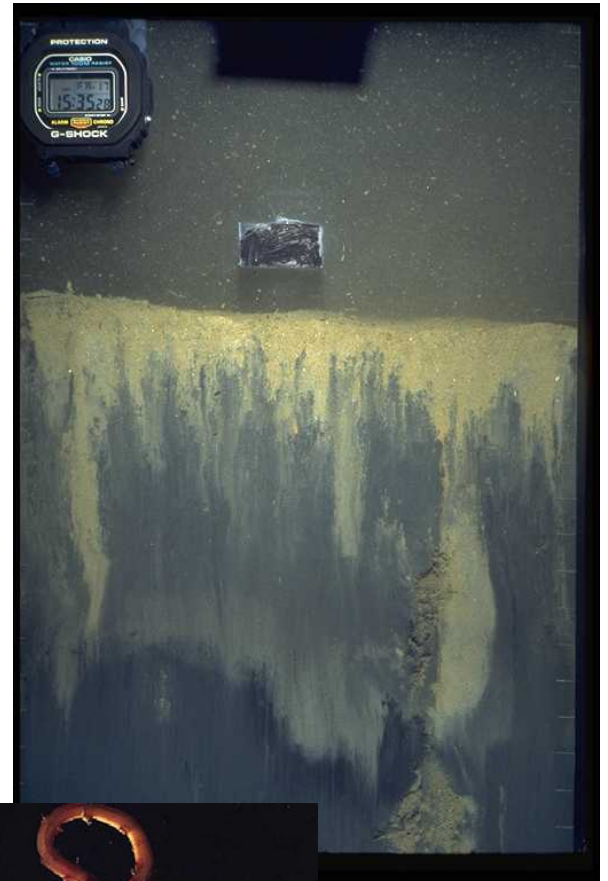
Looking for Evidence of Change

- **Changes in Faunal Abundance (density of organisms)**
- **Changes in Species Richness (numbers of species)**
- **Changes in Species Composition (*i.e.*, opportunistic or stress-resistant species replaced by others)**
- **Changes in Species Assemblages (community structure; functional groups)**



Changes in Faunal Abundance



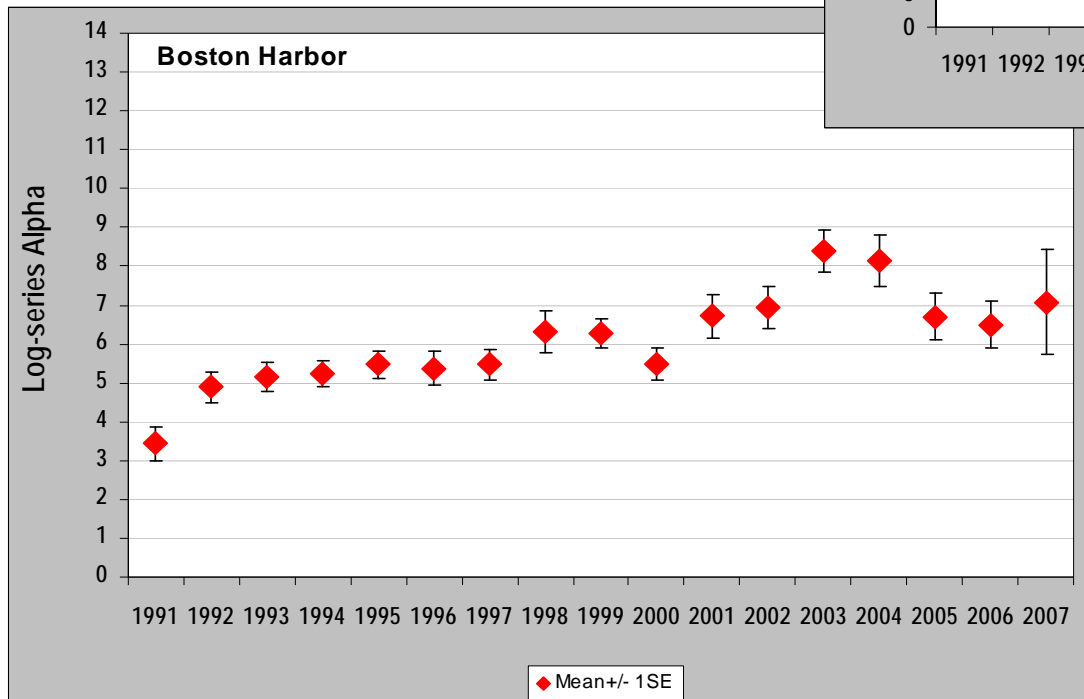
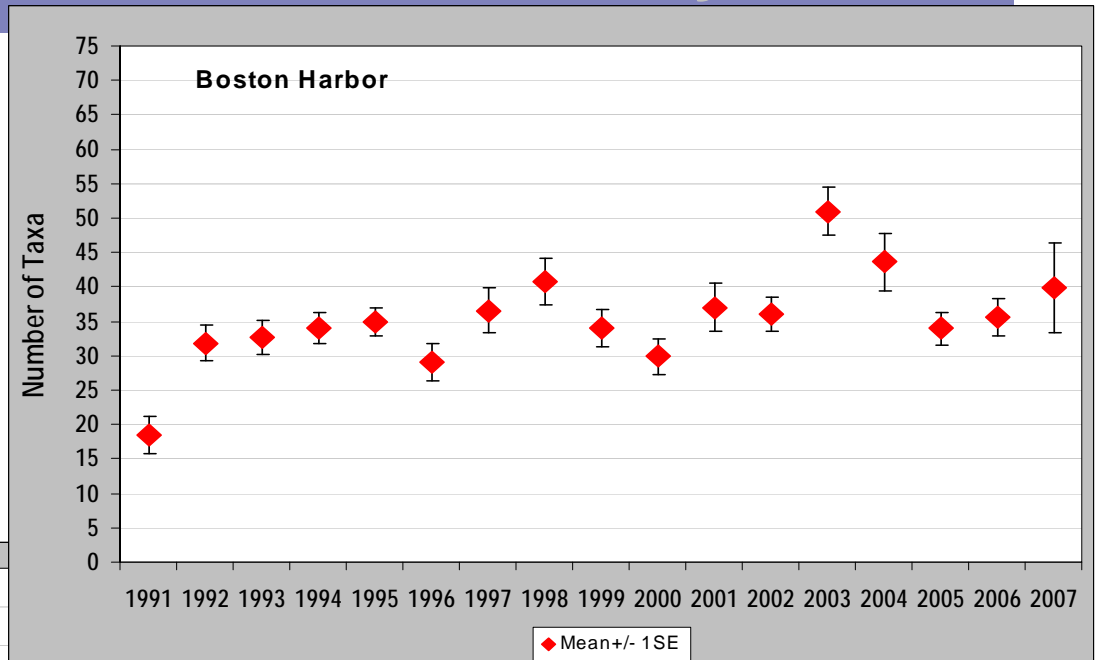


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Long-term Trends in Biodiversity



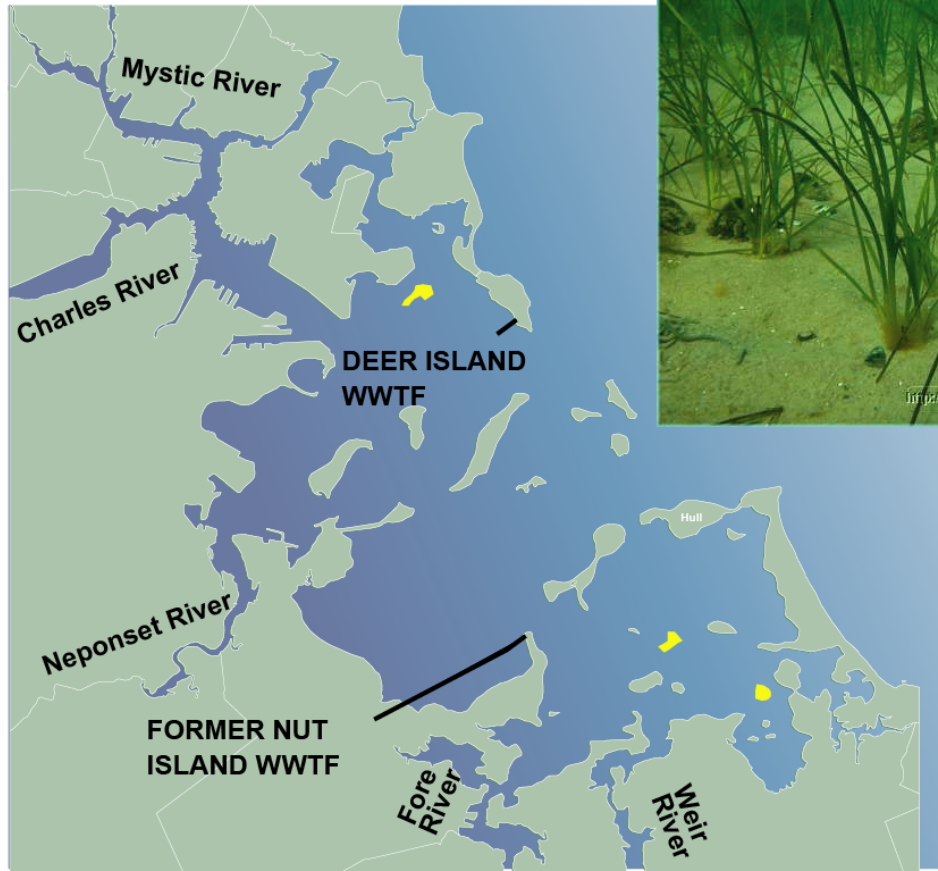


Sediment Profile camera



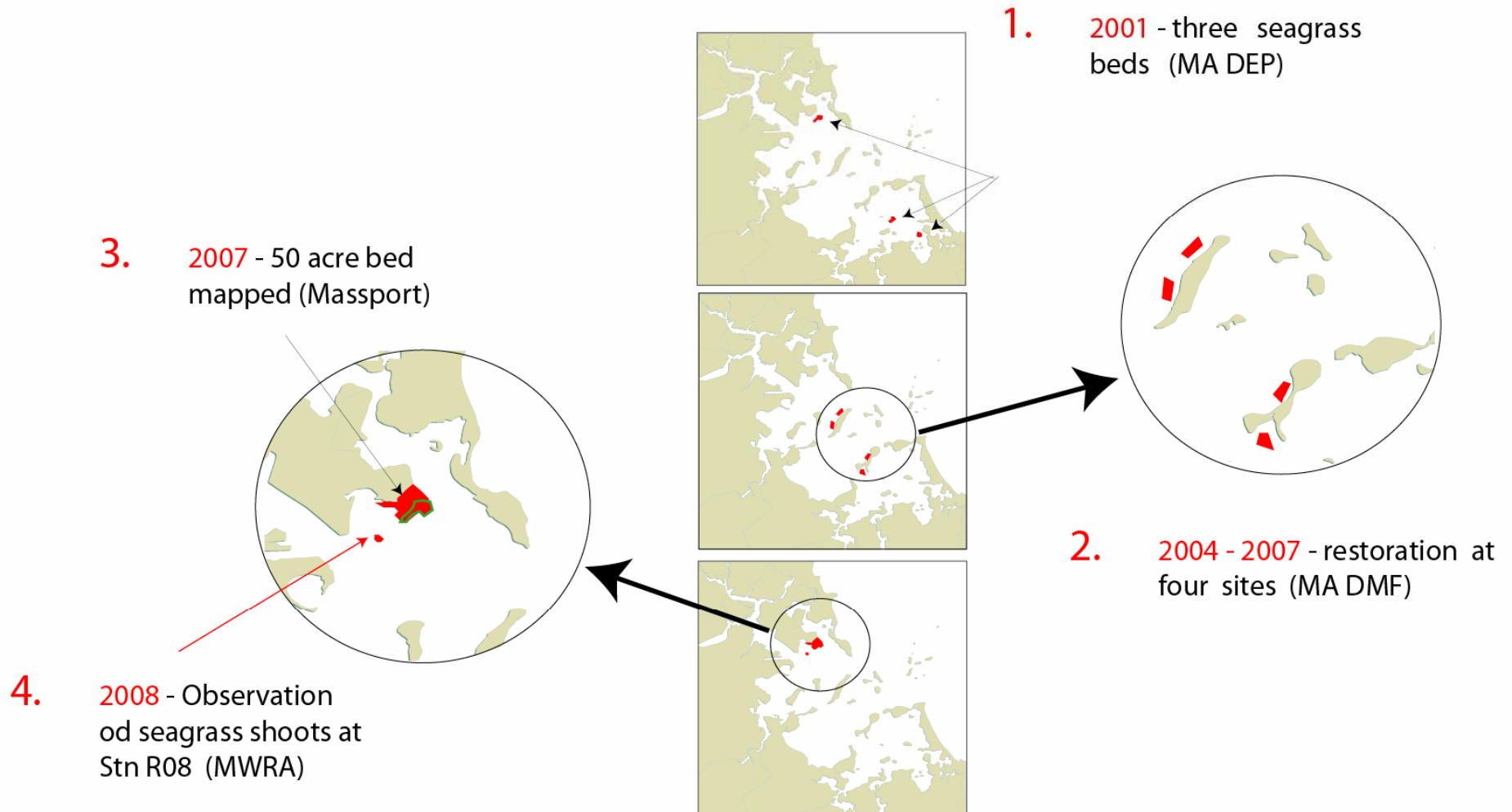


STATUS OF EELGRASS BEDS 2001



DATA FROM MA DEP

RECENT MILESTONES IN SEAGRASS RECOLONIZATION





EELGRASS SHOOTS AT SEDIMENT STN. R08

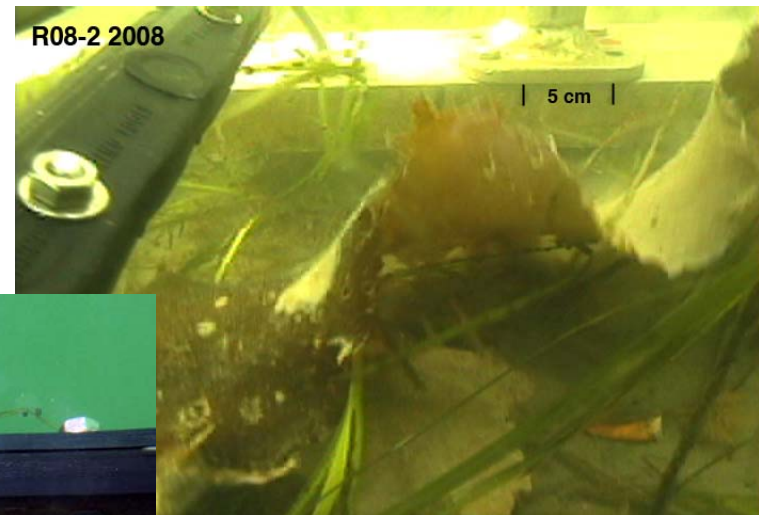
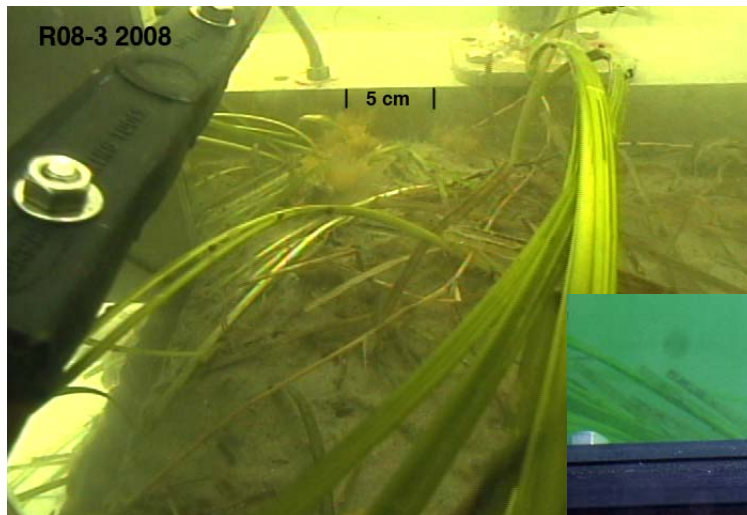


Photo from Bob Diaz