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%.

Source: Bothner and others in USGS circular 1302
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
Sewage tracer (*Clostridium perfringens*)

![Graph showing sewage tracer levels over time.](Image)

- **Near Stations**
- **Far Stations**

**X-axis:** Year (1989 to 2007)

**Y-axis:** Clostridium (#/gdw)
Contaminants

[Graph showing the concentration of a contaminant over years with data points for near and far stations.]

- **Near Stations**
- **Far Stations**

Year:
- 1989
- 1990
- 1991
- 1992
- 1993
- 1994
- 1995
- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007

Ag (µg/g):
- Near Stations
- Far Stations
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
Winter Flounder
Centrotubular Hydropic Vacuolation by Year for Each Station

Prevalence (%)

Year


Decreases in Early Liver disease in Harbor Flounder
Skin ulcers in flounder
Flounder skin lesions rare in 2007 and 2008

Winter Flounder
Incidence of Skin Lesions 2003-07

Year
Percent

Deer I. Flats
Nantasket
Outfall Site
Cape Cod Bay
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
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

Boston Harbor

Total Abundance

Mean +/- 1SE
Long-term Trends in Biodiversity

Boston Harbor

Number of Taxa

Log-series Alpha


Mean +/- 1SE
Sediment Profile camera
STATUS OF EELGRASS BEDS
2001

DATA FROM MA DEP
RECENT MILESTONES IN SEAGRASS RECOLONIZATION

1. 2001 - three seagrass beds (MA DEP)

2. 2004 - 2007 - restoration at four sites (MA DMF)

3. 2007 - 50 acre bed mapped (Massport)

4. 2008 - Observation of seagrass shoots at Stn R08 (MWRA)
EELGRASS SHOOTS AT SEDIMENT STN. R08

Photo from Bob Diaz