Massachusetts Water Resources Authority

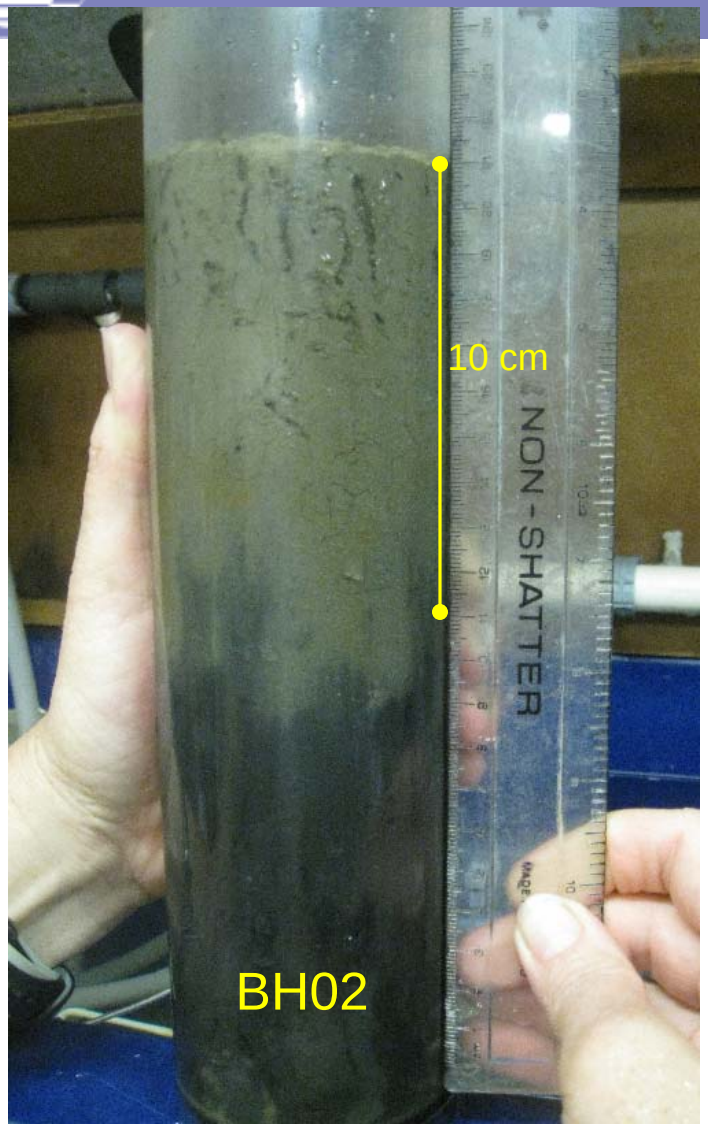
Sediment Studies in Mass. Bay
Wastewater Advisory Committee
January 7, 2011

Benthic Nutrient Flux Study

Study design

- Four stations in Boston Harbor, three stations in nearfield,one station in Stellwagen Basin
- Four surveys/year, May, July, August, October.
- Intact sediment cores obtained, and incubated at in-situ temperatures in Lab.

Incubated cores with burrows

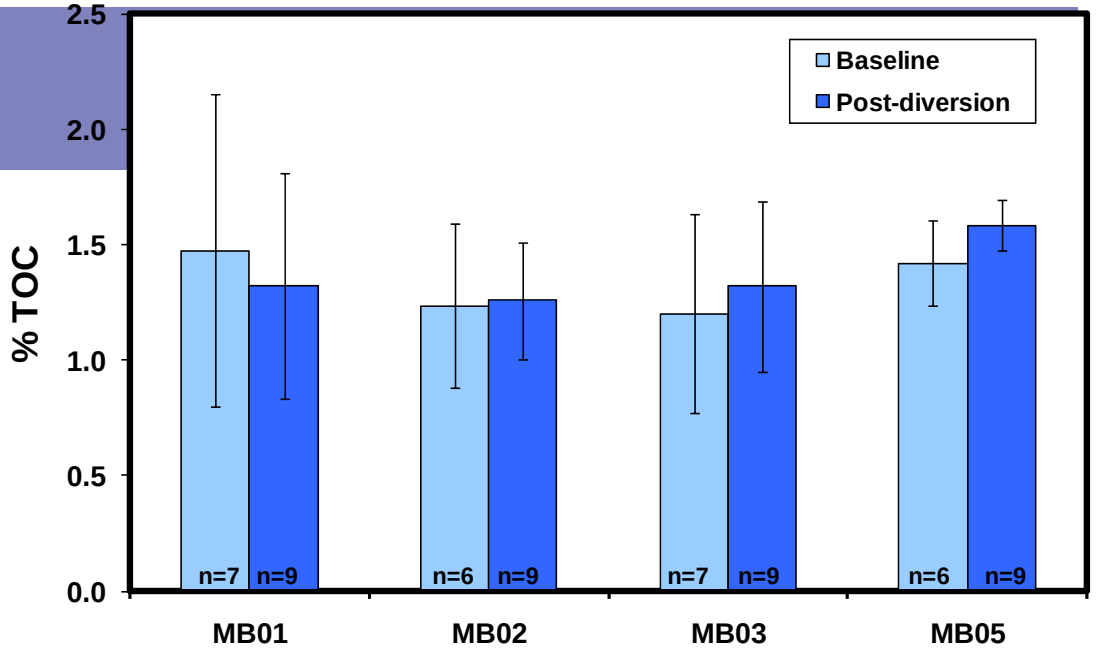


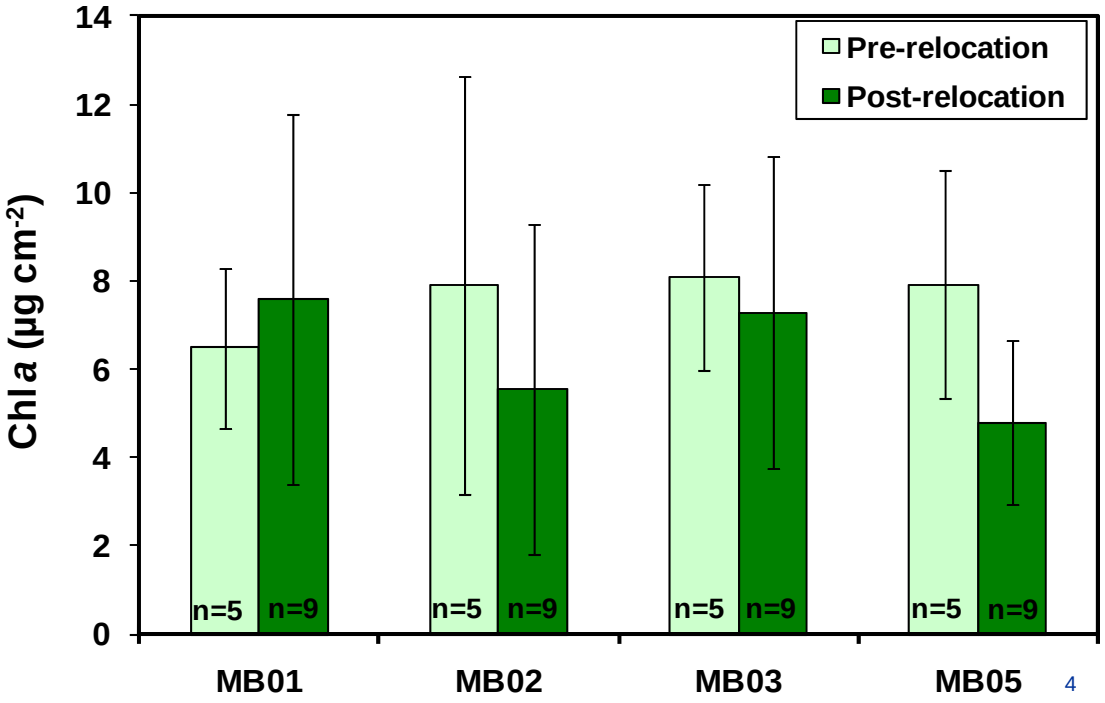
July 2008

Organic Carbon and Chlorophyll *a* content of surface sediments

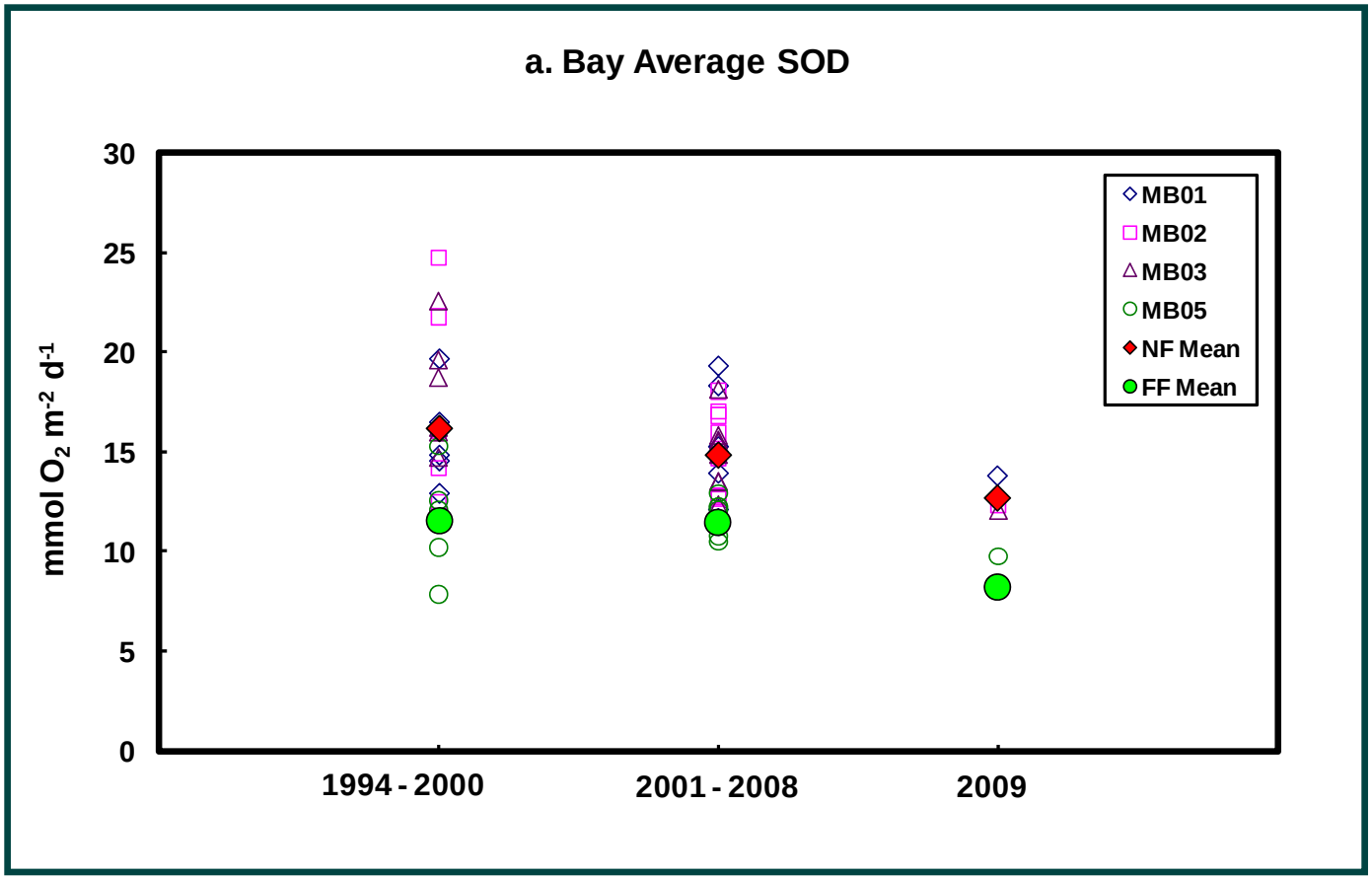
Means for the pre- (1993-2000) and post-relocation (2001-2009) periods show no change.

For TOC: May- Oct means and SD
For Chl *a*: May, Oct means and SD

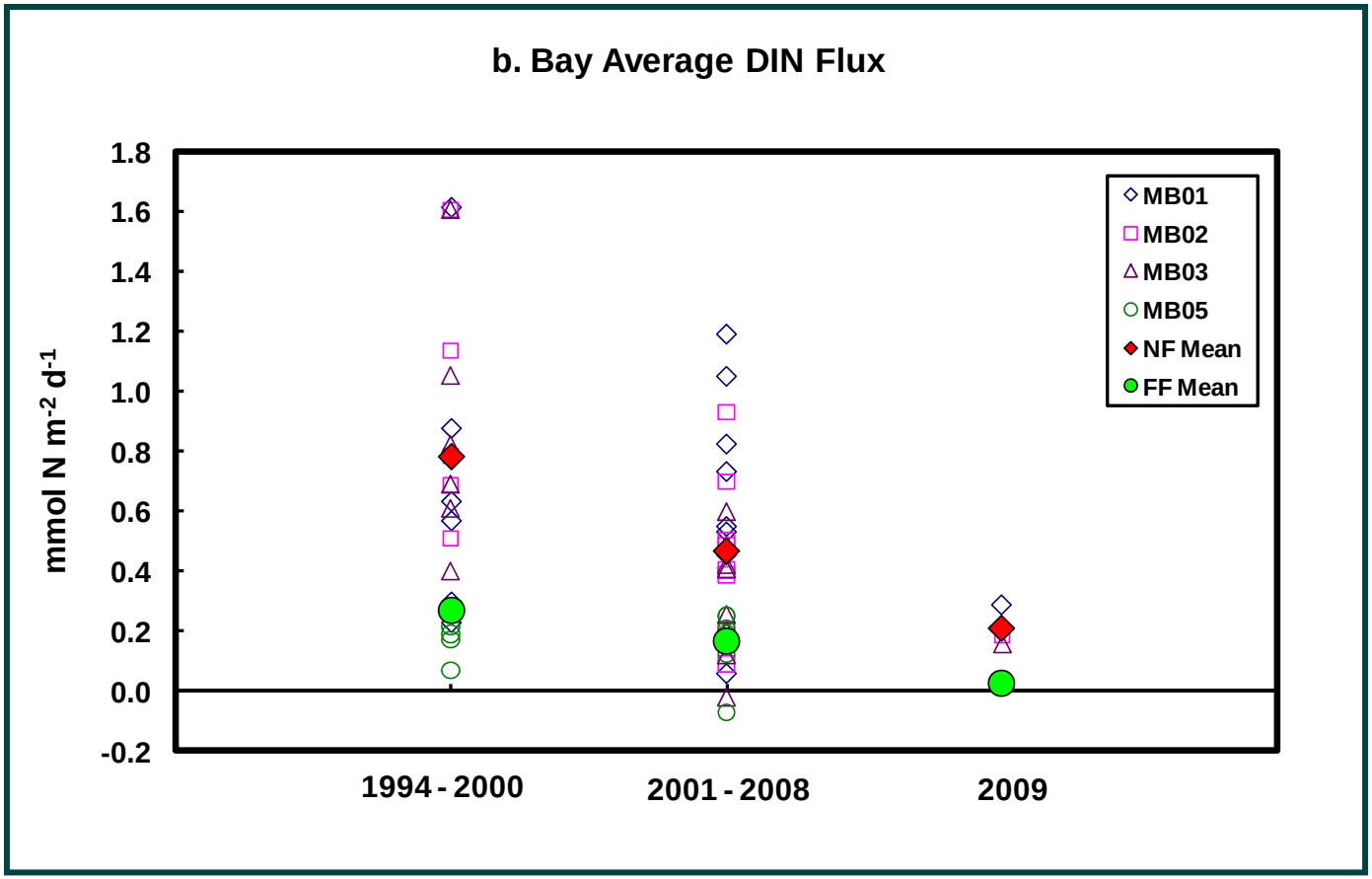




Sediment Oxygen Demand
Mass Bay



DIN Flux for Mass. Bay



Conclusions for 2009

Massachusetts Bay

No indication of increased OM loading to nearfield

No change in redox conditions

No increase in SOD or nutrient fluxes

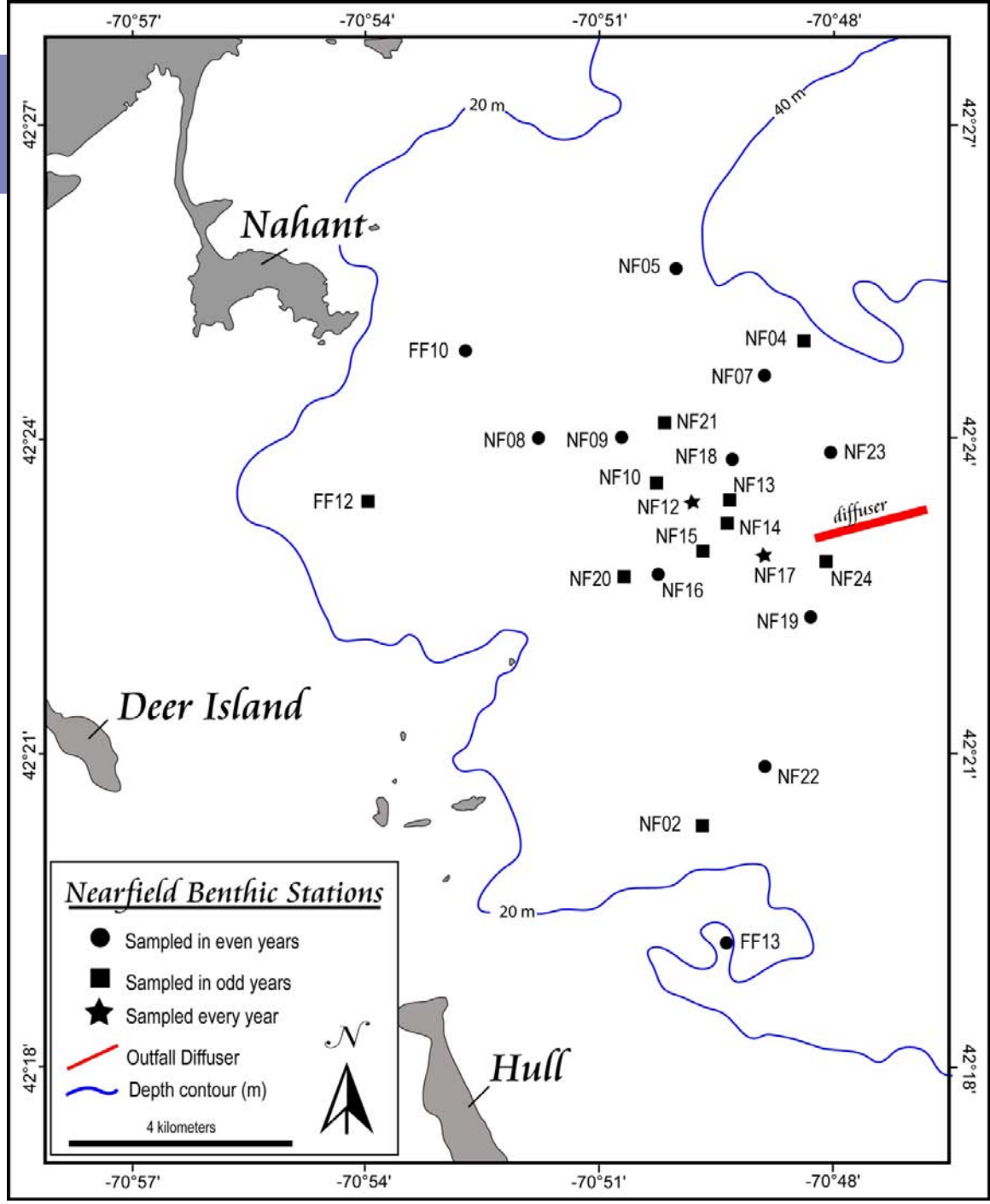
No discernible change in denitrification, which remains the major component of remineralized N

Sediment contaminants

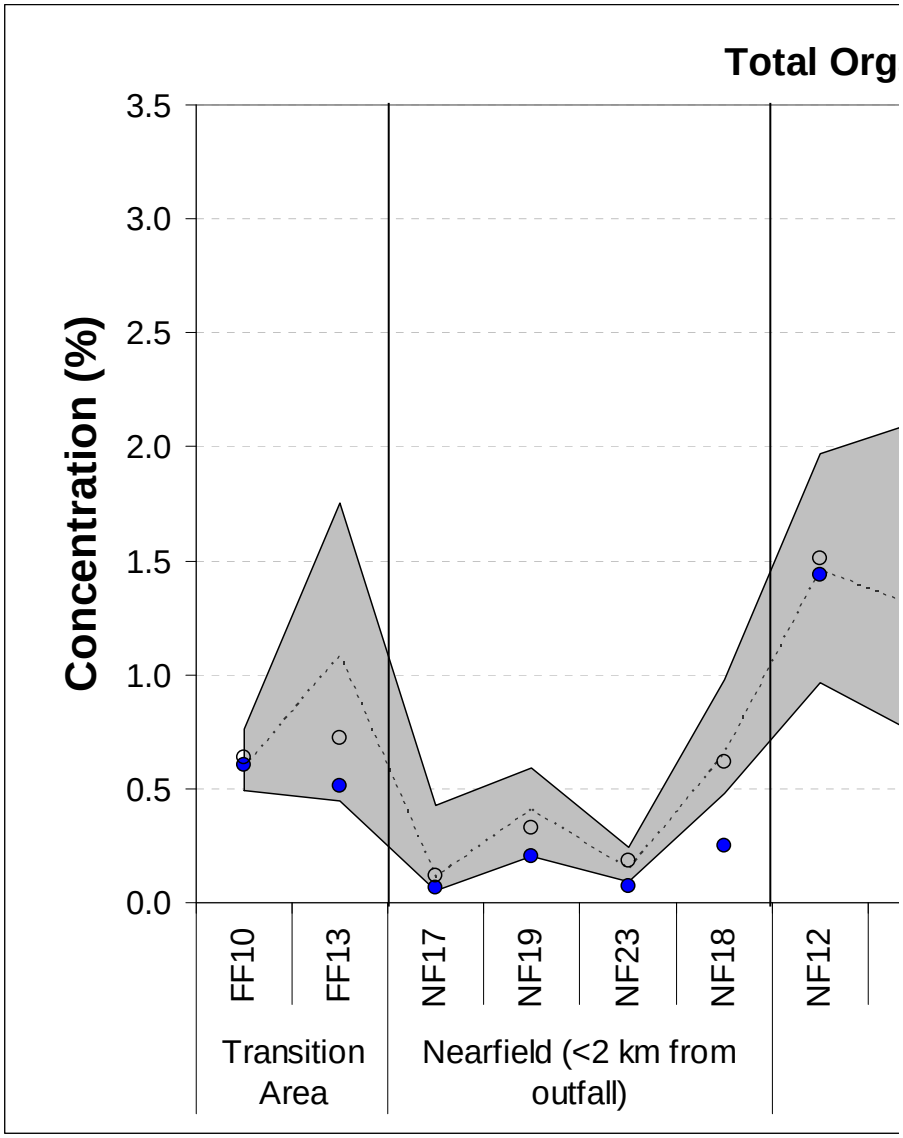
- **Most contaminants of concern adhere to fine particulates.**
- **So contaminants build up in muddy, depositional areas of the sea floor**
- **Organic matter and SOD from effluent would build up in same areas**
- **Mass Bay sediments relatively clean, though some contamination exists.**

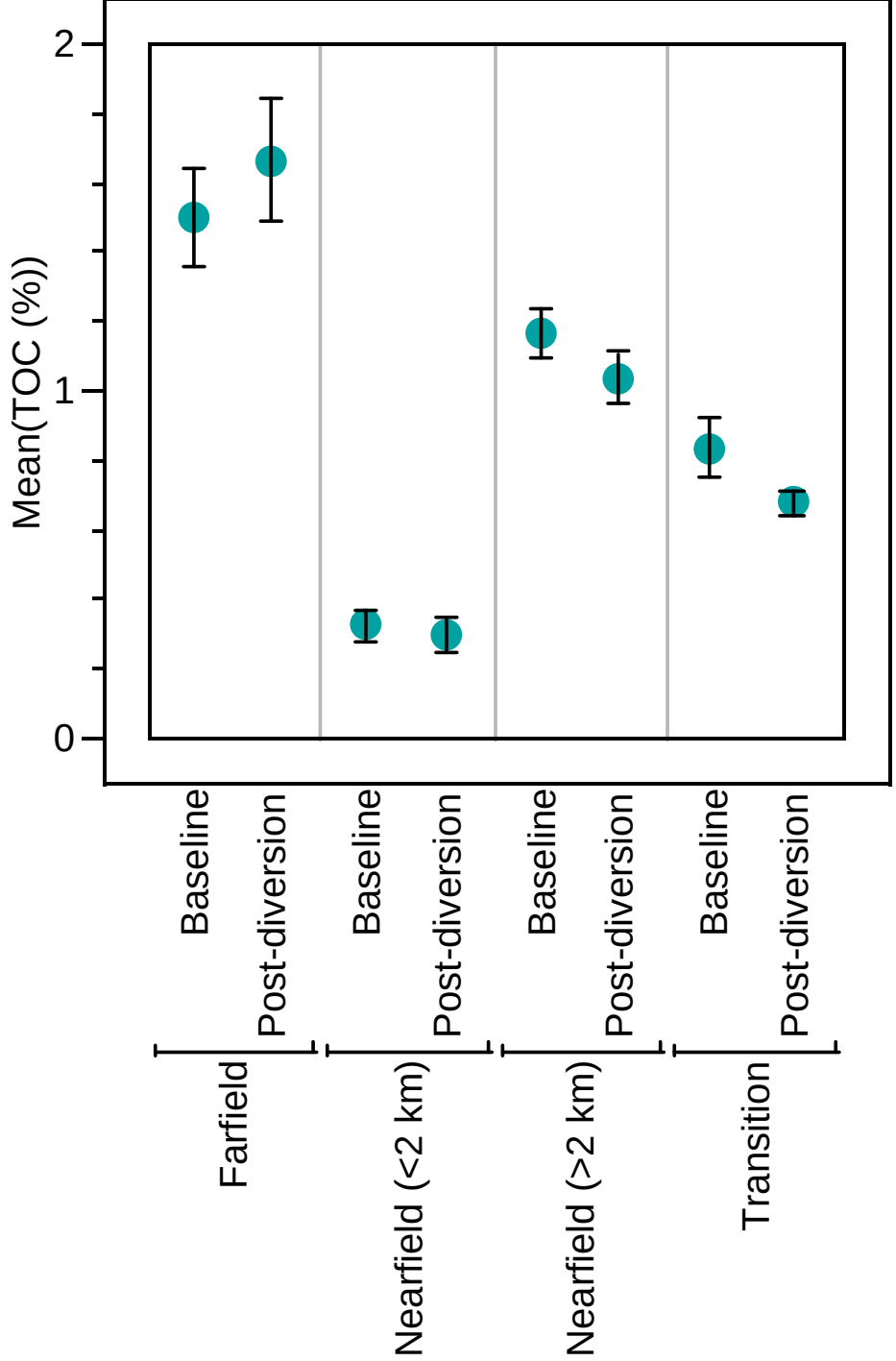
Contaminants

- Monitoring since 1992
- 23 nearfield and 8 farfield stations
- Since 2003, contaminants sampled every third year. Half of stations sampled annually
- 2008: 13 NF, 4 FF
- Surface (0-2 cm) sediments
- GS, TOC, *Clostridium*, Organic contaminants and metals

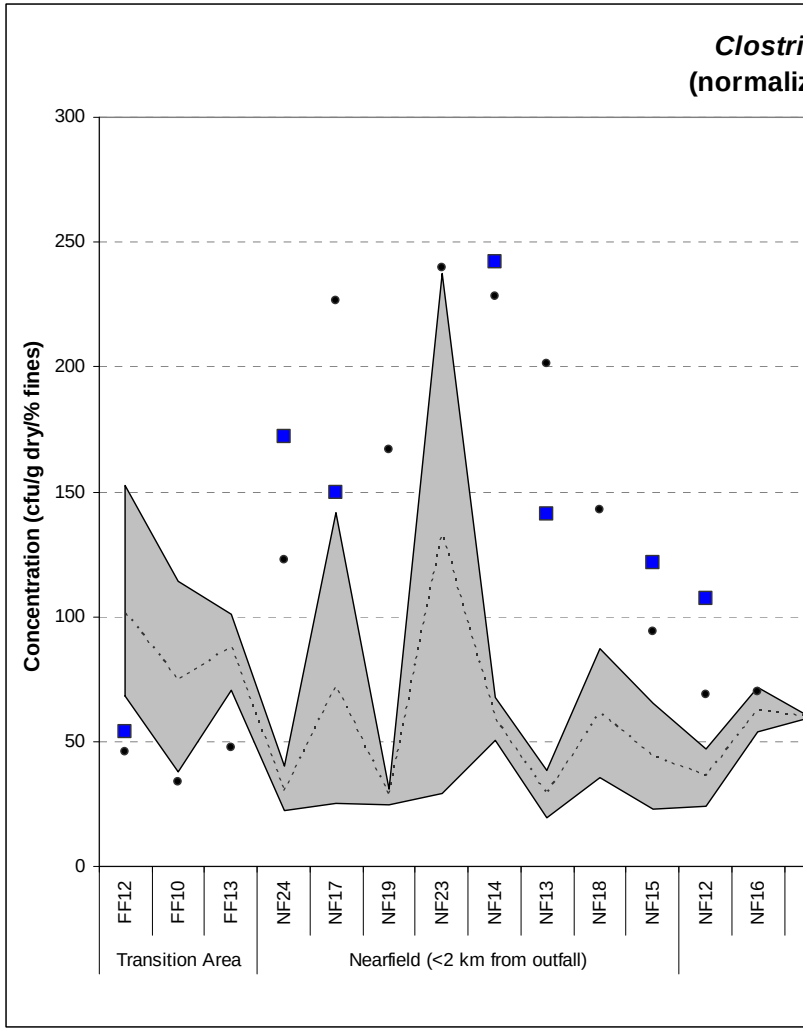


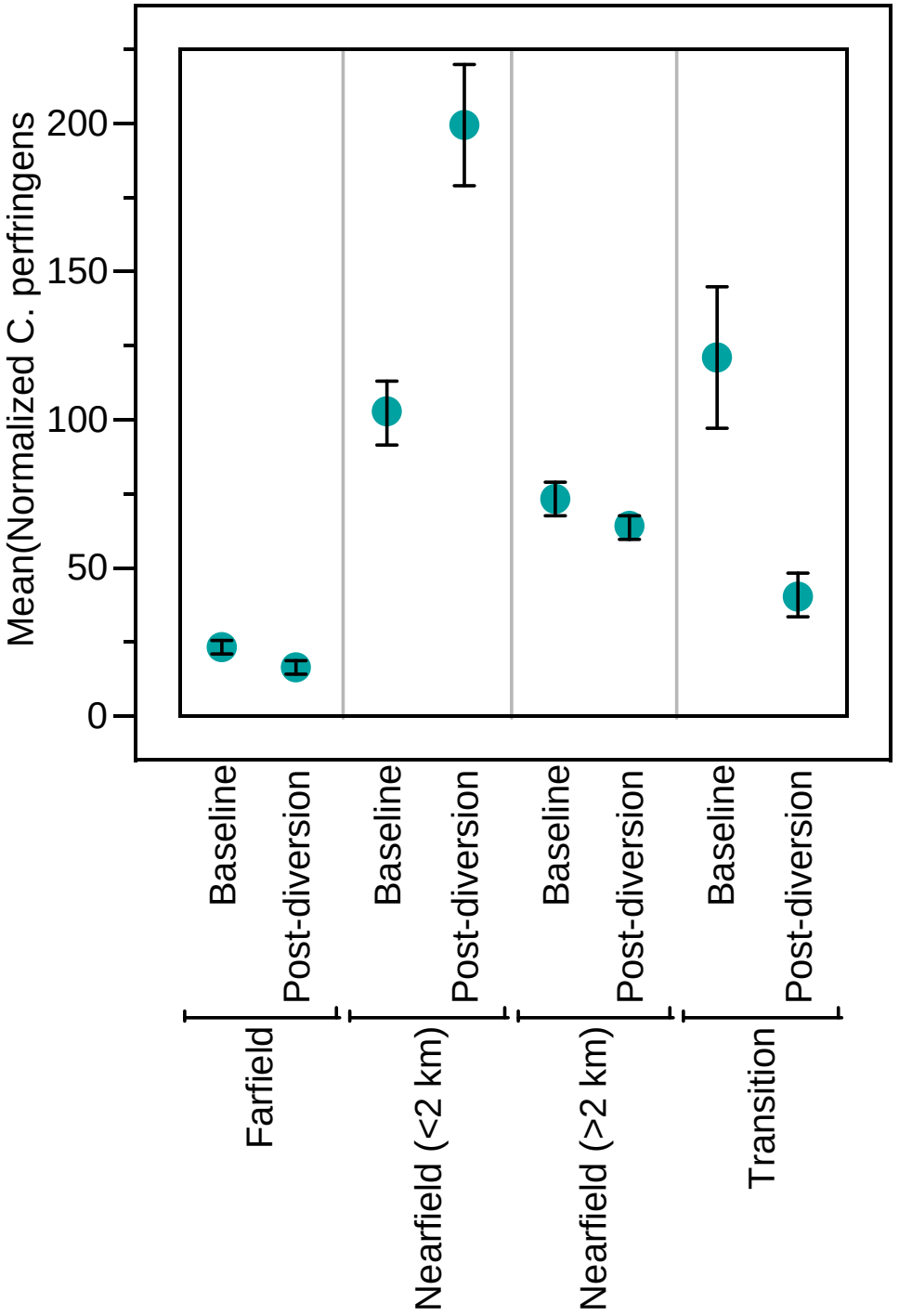
Total Organic Carbon



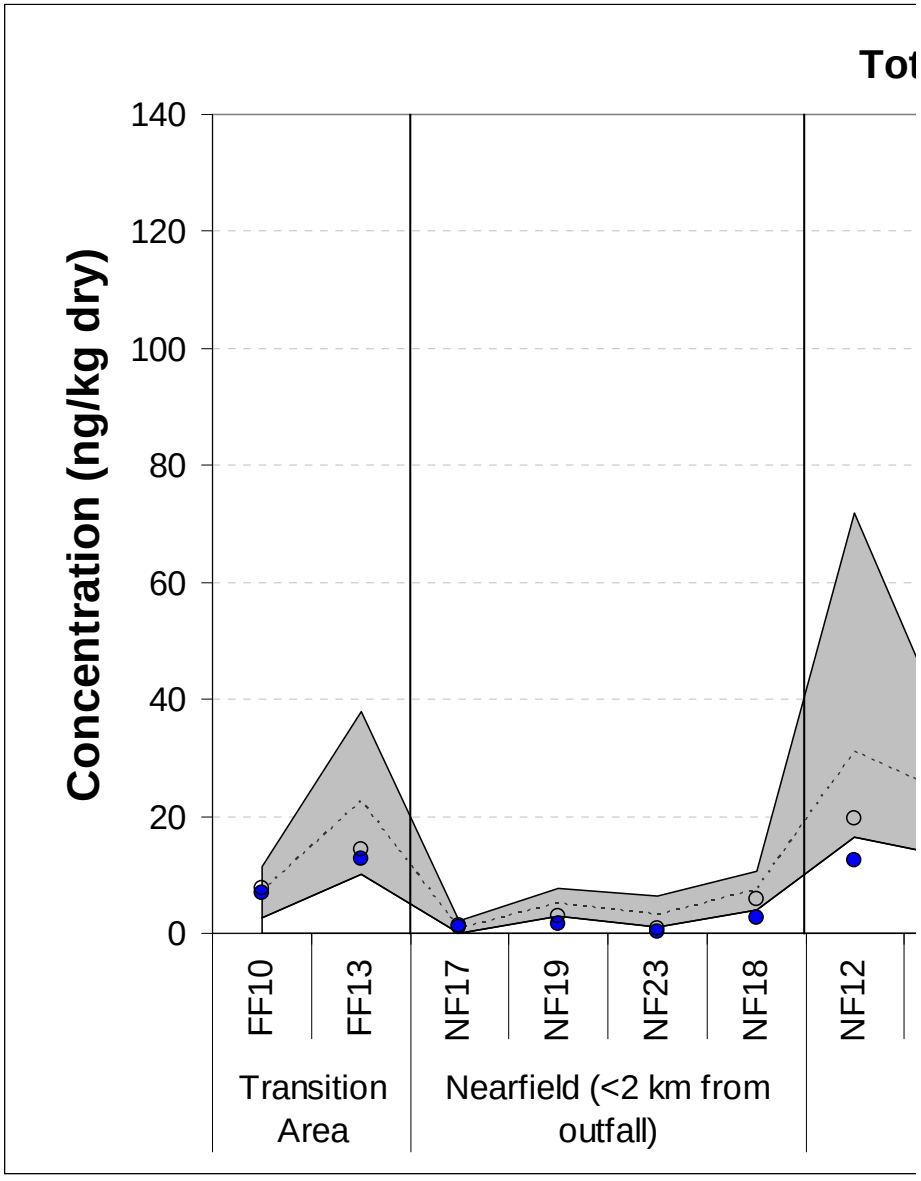


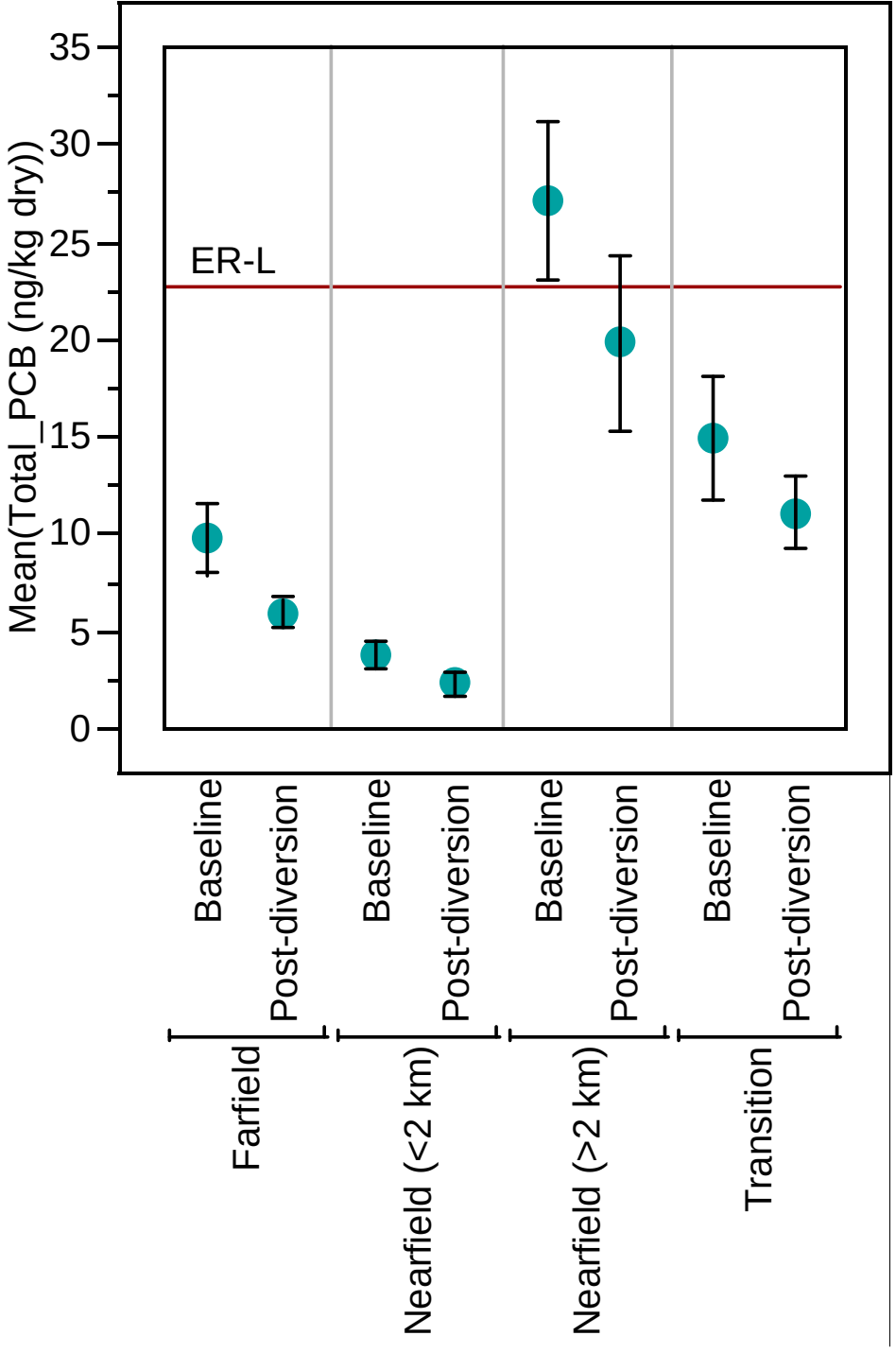
Clostridium perfringens



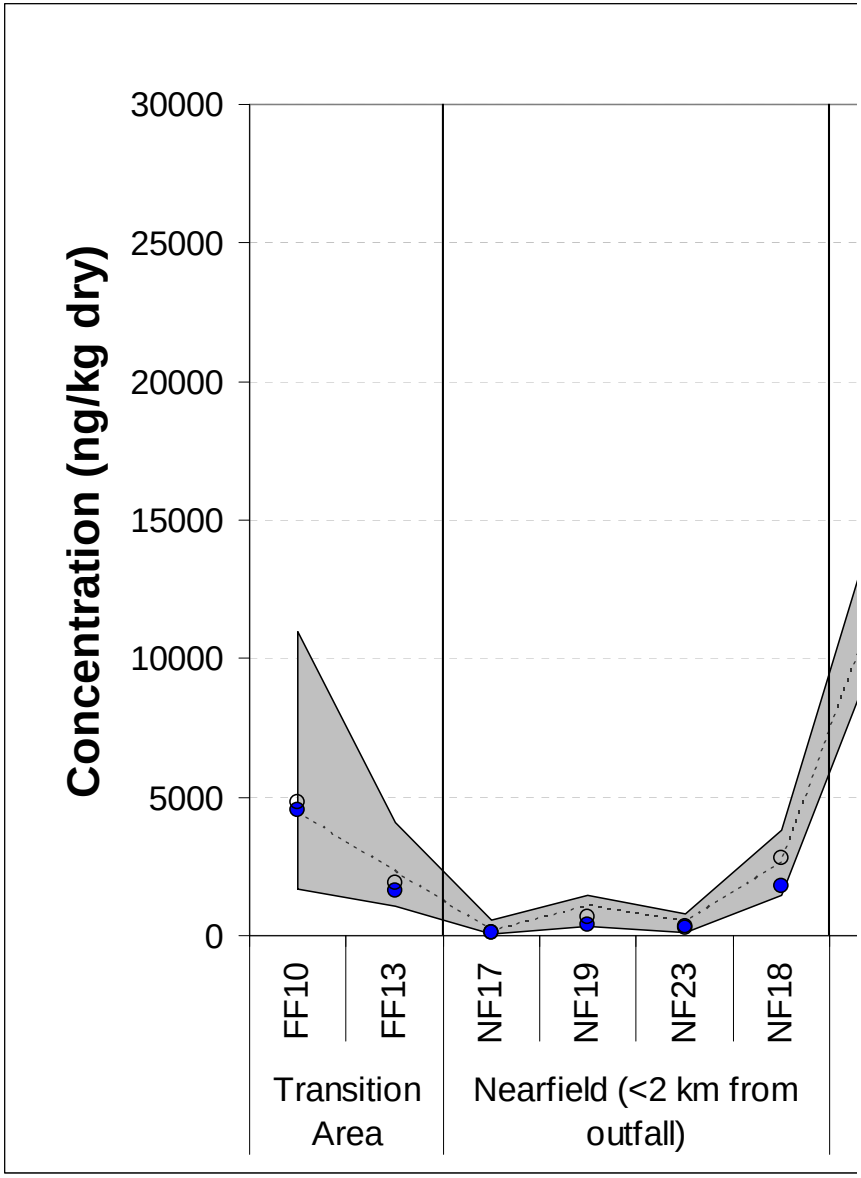


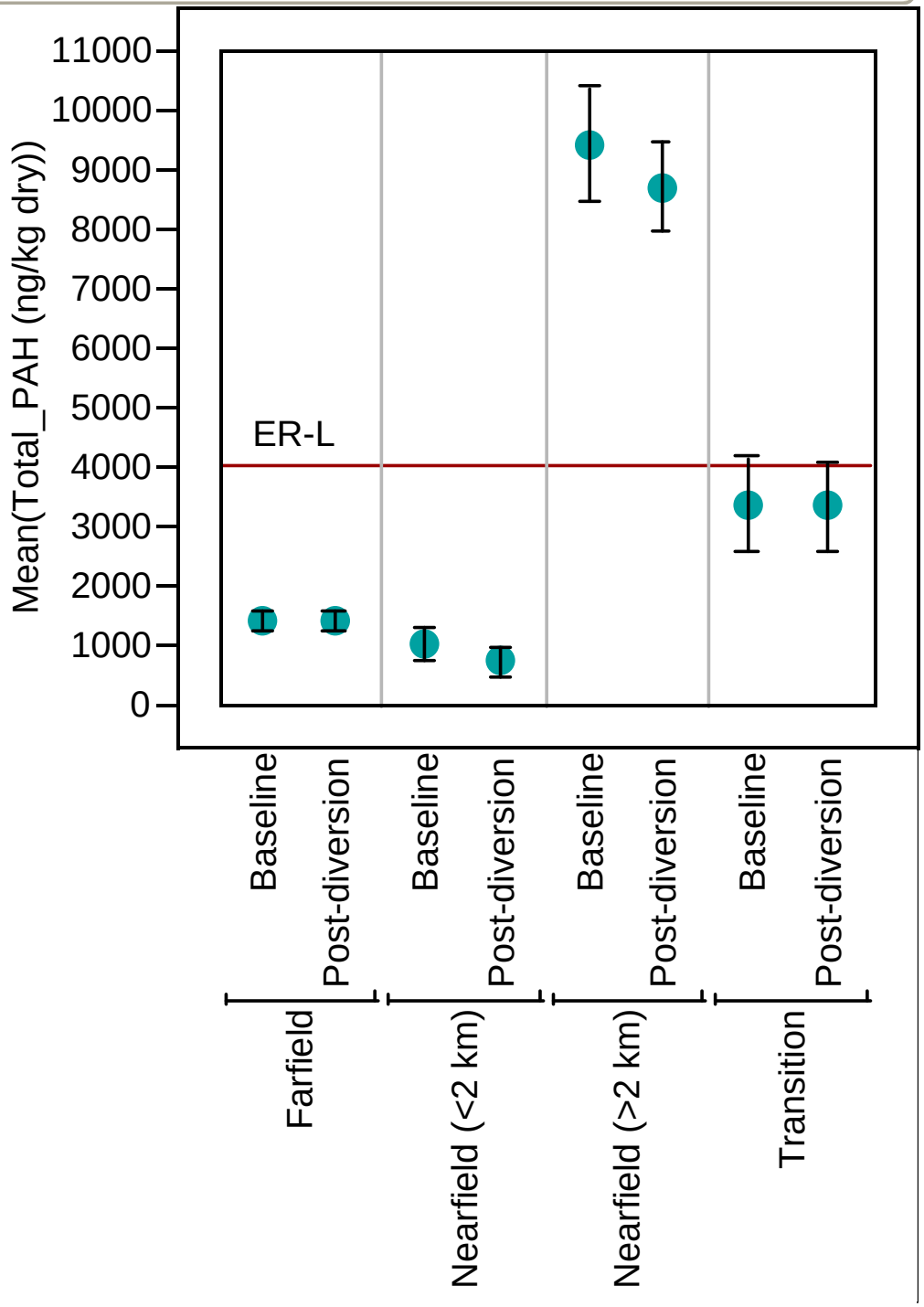
PCB


Tot
Concentration (ng/kg dry)
140
120
100
80
60
40
20
0
FF10
FF13
NF17
NF19
NF23
NF18
NF12
Transition Area
Nearfield (<2 km from outfall)


Mean(Total_PCB (ng/kg dry))
35
30
25
20
15
10
5
0
ER-L
Baseline
Post-diversion
Baseline
Post-diversion
Baseline
Post-diversion
Baseline
Post-diversion
Farfield
Nearfield (<2 km)
Nearfield (>2 km)
Transition

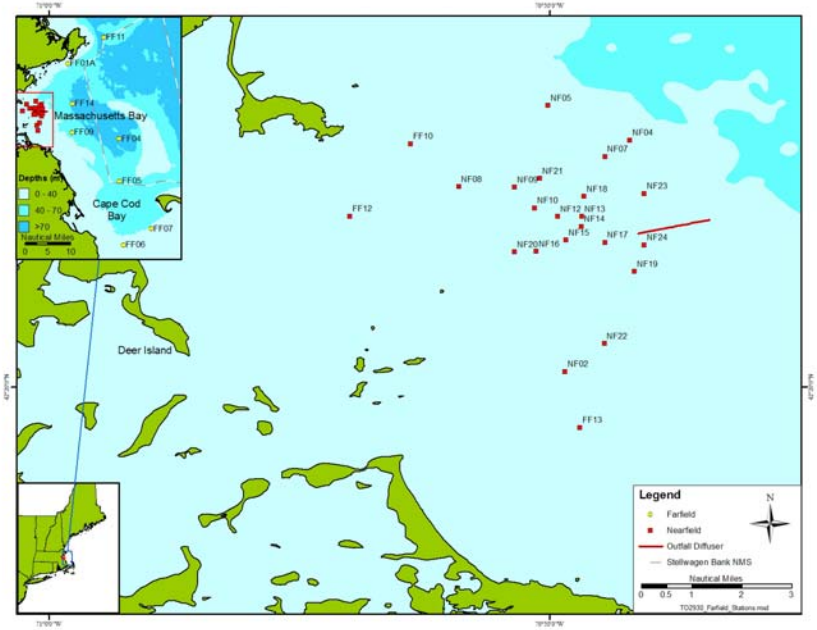
PAH


Concentration (ng/kg dry)
30000
25000
20000
15000
10000
5000
0
FF10
FF13
NF17
NF19
NF23
NF18
Transition Area
Nearfield (<2 km from outfall)


Mean(Total_PAH (ng/kg dry))
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
ER-L
Baseline
Post-diversion
Baseline
Post-diversion
Baseline
Post-diversion
Baseline
Post-diversion
Farfield
Nearfield (<2 km)
Nearfield (>2 km)
Transition

Conclusions

- **2008 data generally consistent with long-term data.**
- ***Clostridium* – clear signature of effluent discharge in nearby sediments**
- **No significant difference between baseline and post-diversion means for most chemicals, except**
  - **Total DDT and total PCB**
- **Long-term data indicate no accumulation of toxic chemicals following effluent diversion**



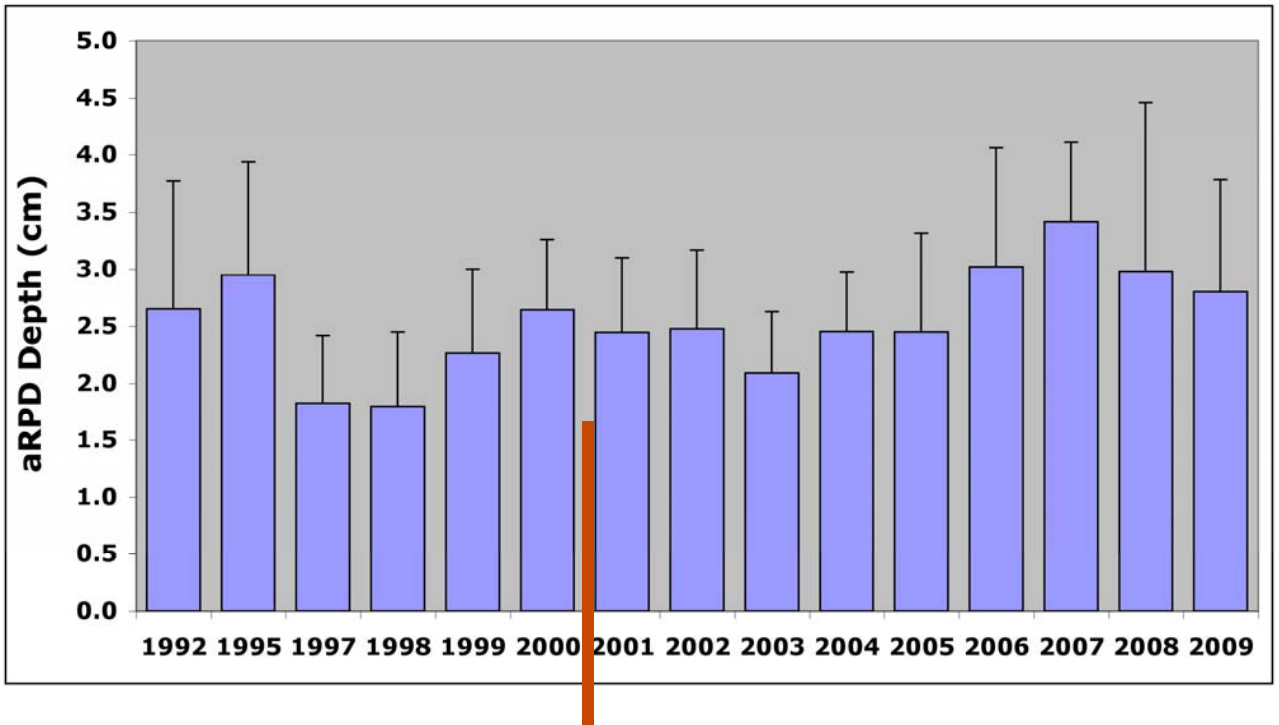
2009 Sediment Profile Imaging.

Sea-floor and sediment profile images

Burrow openings

Nearfield Summary for 2009

- Sediments similar to 2008.
- aRPD for 2009 trended shallower than 2008 but still deeper than Baseline.
- aRPD Post-Baseline deeper than Baseline.



Summary for Nearfield from 1995 to date

- Operation of outfall, starting in 2001, did not appear to effect benthic habitat quality.
- aRPD Post-Baseline was always deeper than Baseline.
- Sediment characteristics remained similar through time.