National Mussel Watch Monitoring of the California Coast

A collaborative effort between NOAA and California

California Water Quality Monitoring Council Meeting
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*State Water Resources Control Board

** Southern California Coastal Water Research Project

NOAA National Mussel Watch Program

- Historic data, years 1986-2009
- California collaboration initiated in 2007
- Total of 71 sites along CA coastline
- Resident mussels
- Historically, 150 contaminants monitored

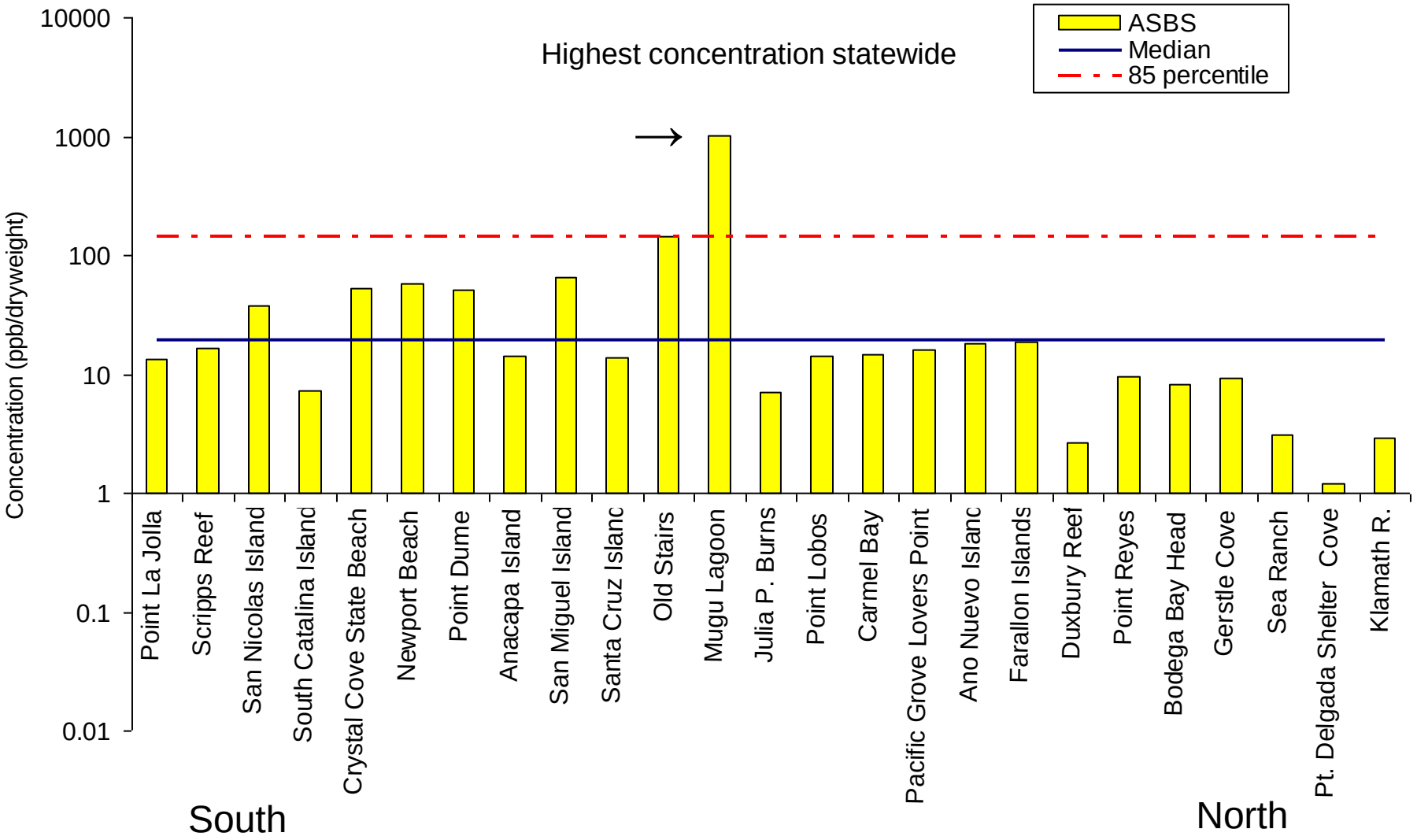
To support ecosystem-based management and describe the status and trends of contaminants

Why Mussel Watch?

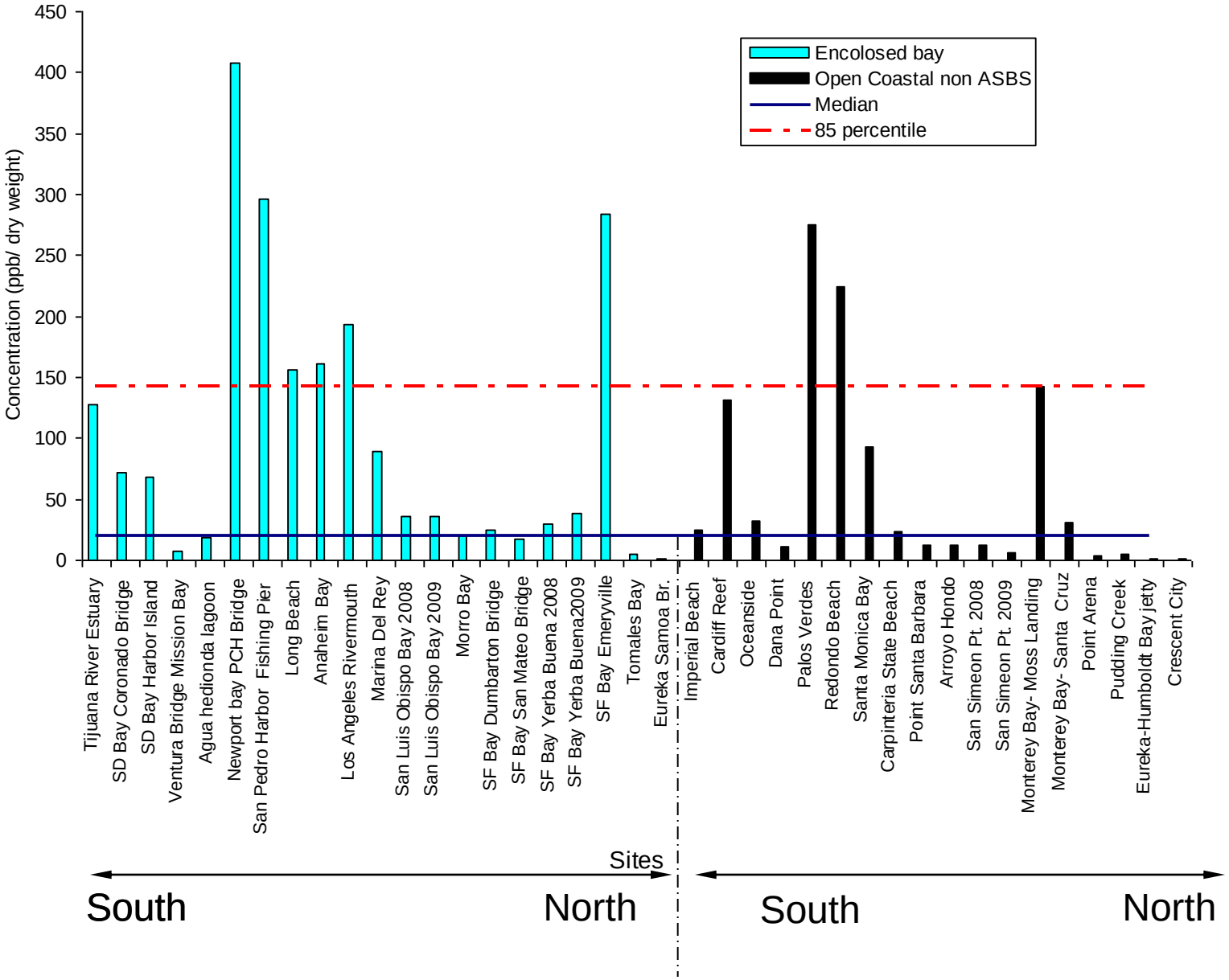
- Mussels are filter feeding bivalves
- Mussels are excellent concentrators of bioaccumulative pollutants
- Mussels are dominant organisms in rocky intertidal environments and are important members of the marine food chain

Historical Data
1986 - 2009

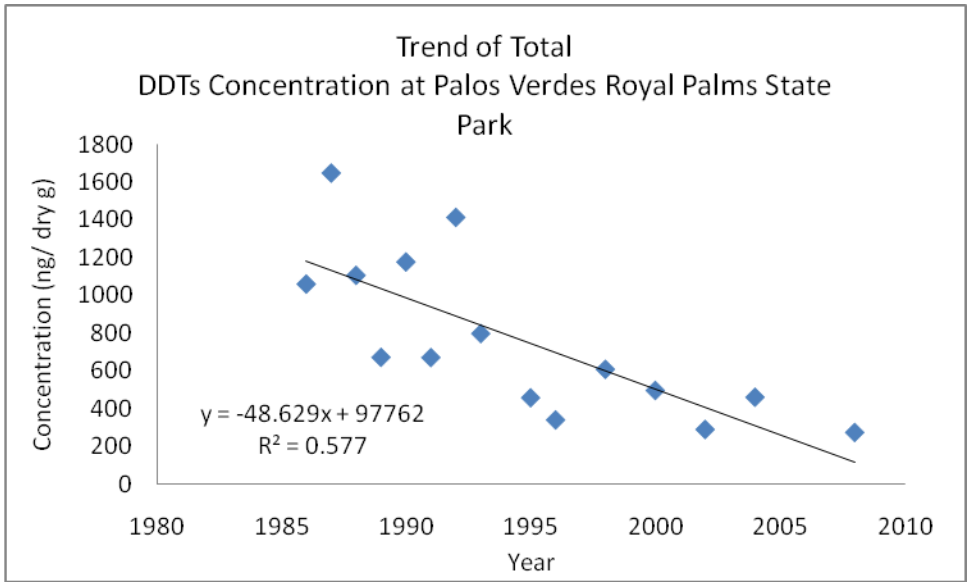
DDT Status (2007-2009 samples, in or adjacent to ASBS)



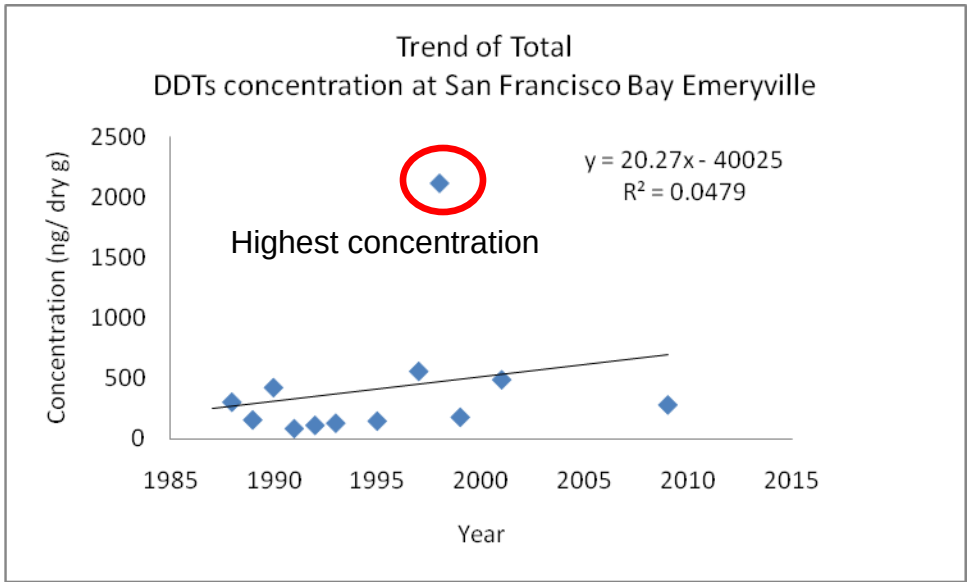
DDT Status (2007-2009 samples, coast and enclosed bays)



DDT trends



Significant decrease at Royal Palms (White Point)



Increasing trend,

but not significant

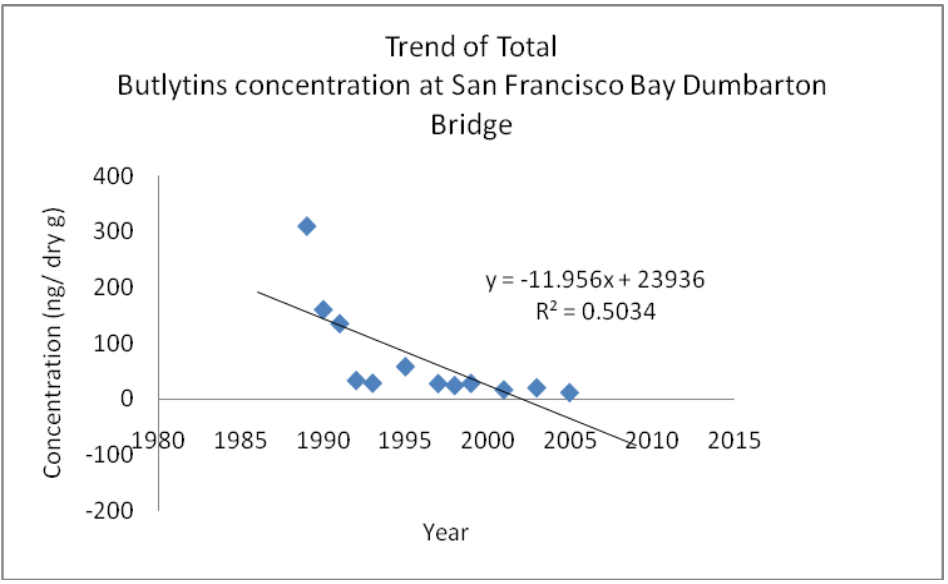
DDT Status and Trends (1986-2009)

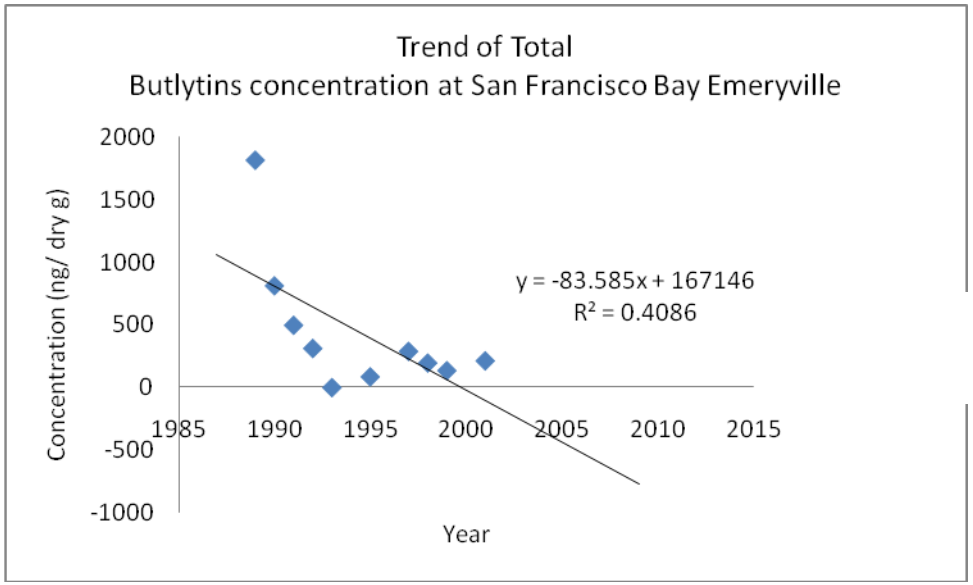
- Highest DDT concentration in the state was at San Francisco Bay Emeryville site.

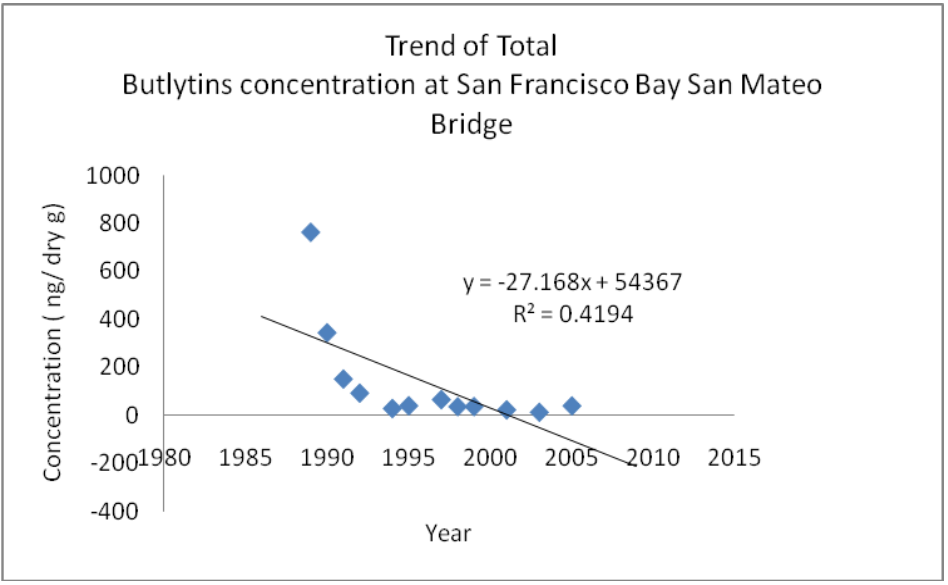
- DDT declined at 26 sites, significantly declined at 13 sites.

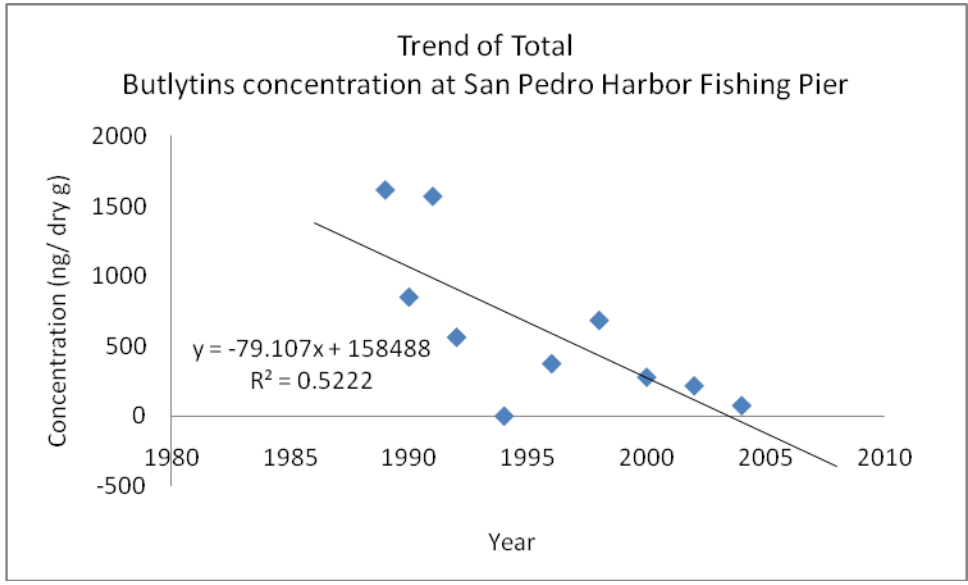
- Biggest downward trend at Royal Palms (White Point) on the Palos Verdes Peninsula

Total BT trend in SF Bay





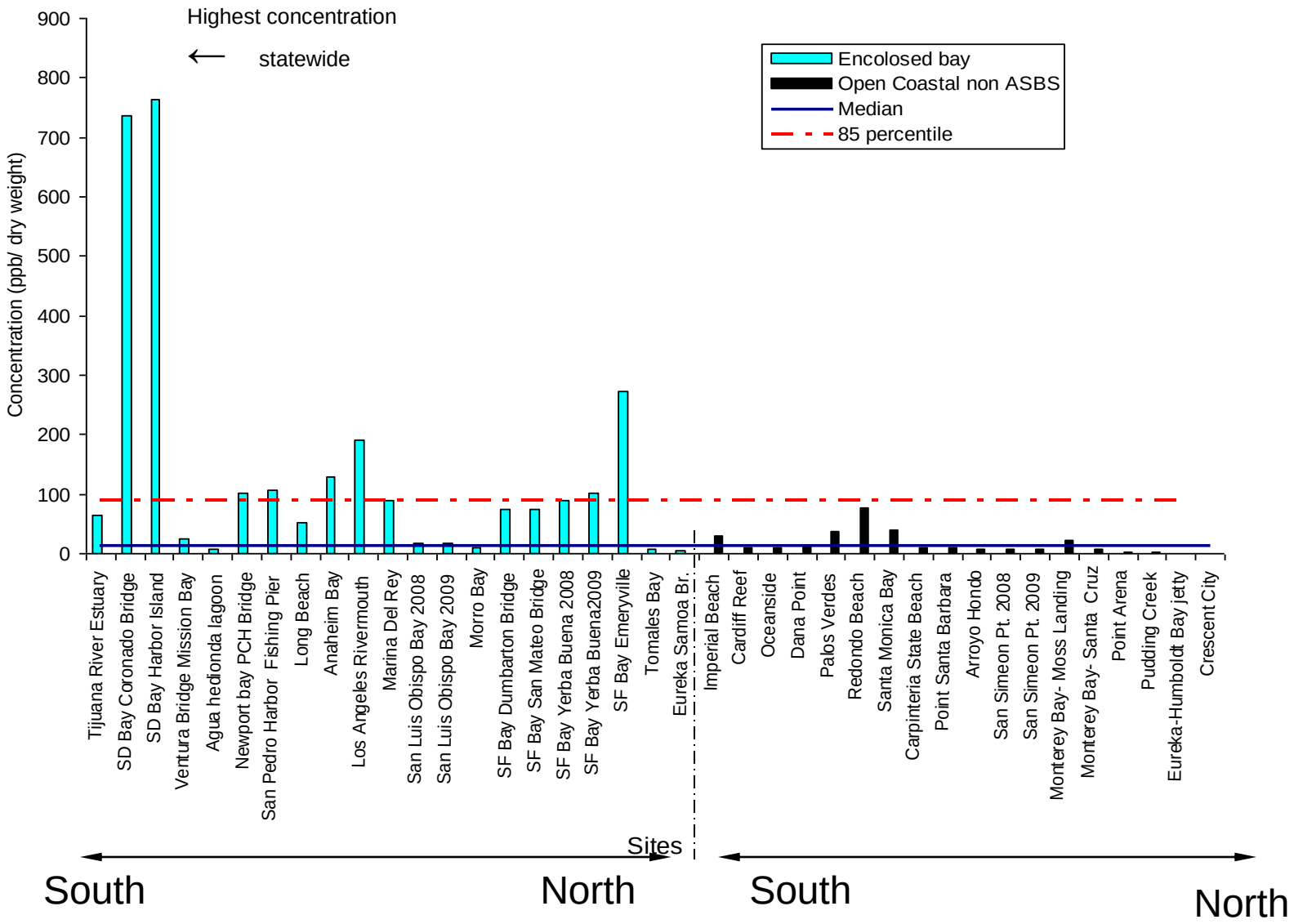




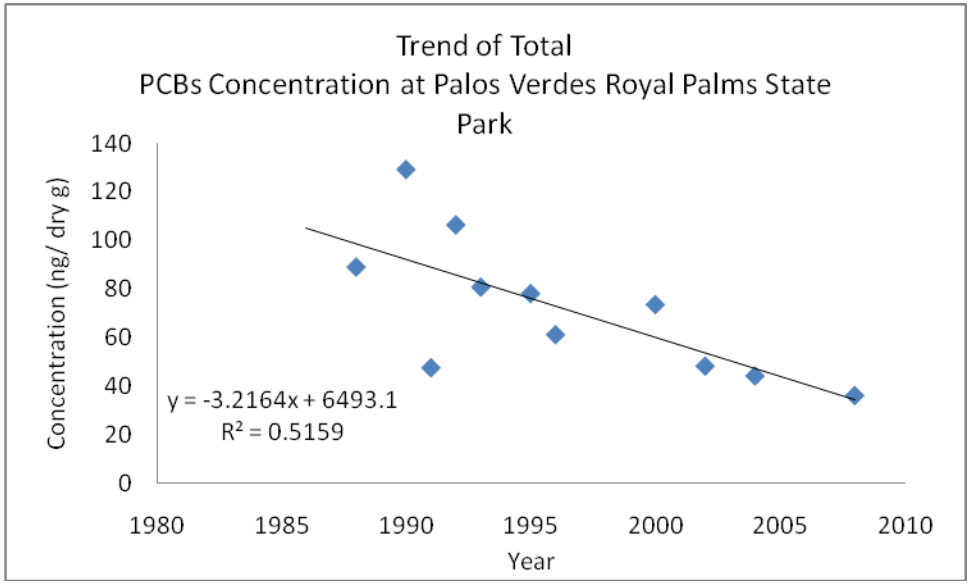
Total Butyltin Trend (1986-2005 samples)

- Total BT declined at 33 out of 35 stations,
- 18 out of 35 stations had significant declines.
- This is undoubtedly due to the phase out of TBT based hull coatings.

PCBs Status (2007-2009 samples, coast and enclosed bays)

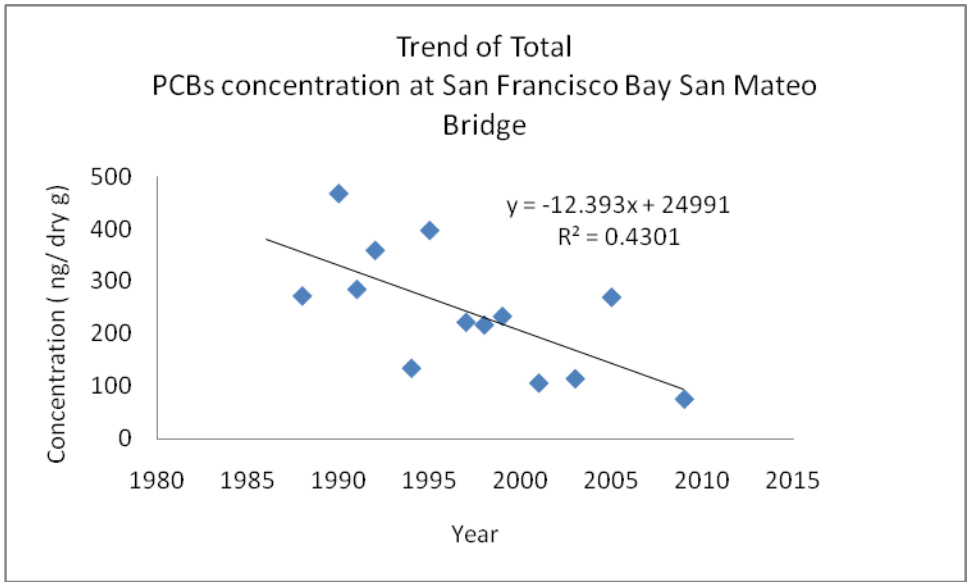


PCB trends



Significant decrease at Royal Palms (White Point)

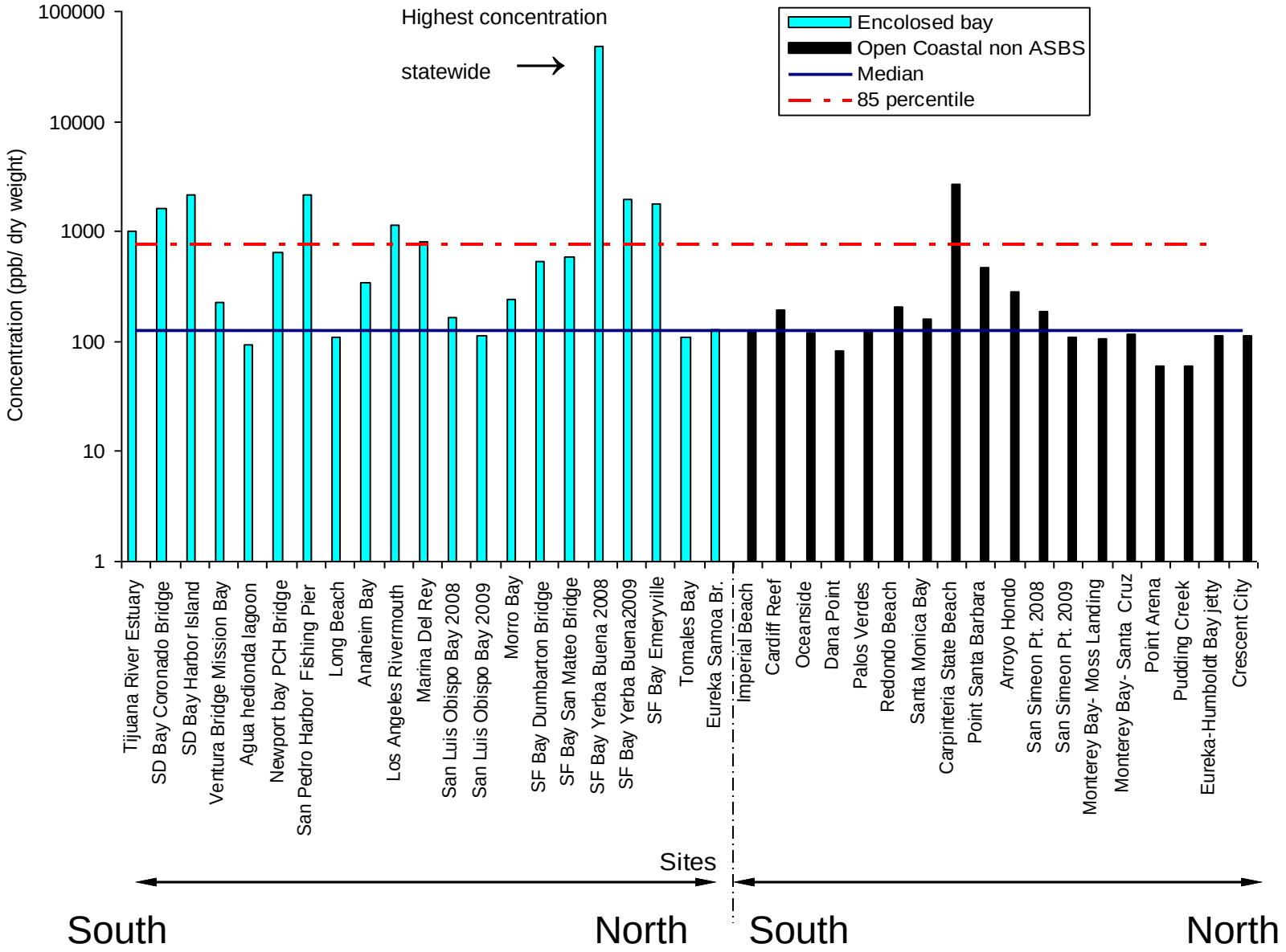
Significant decrease at San Francisco Bay (San Mateo Bridge)



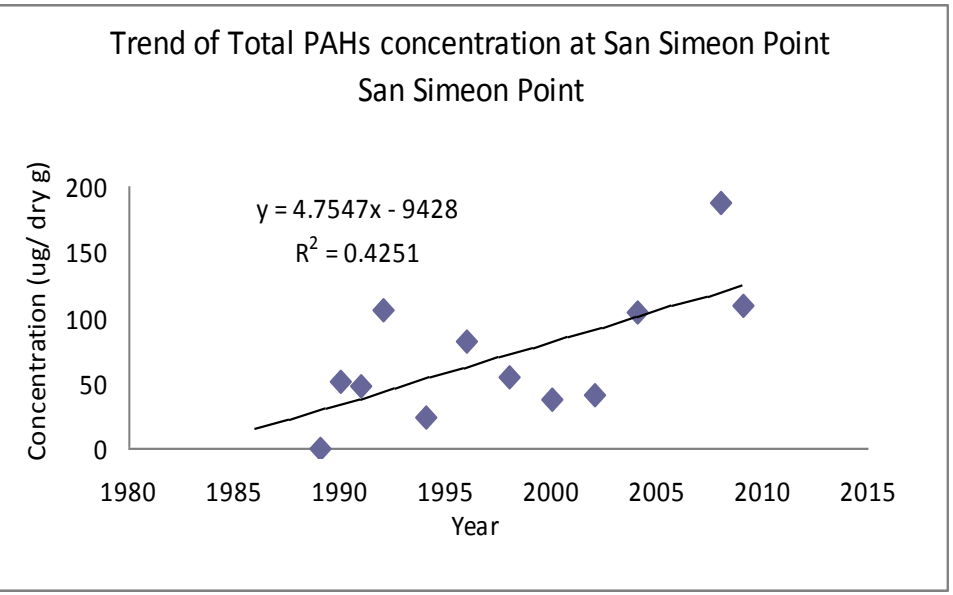
PCBs Status and Trends (1986-2009)

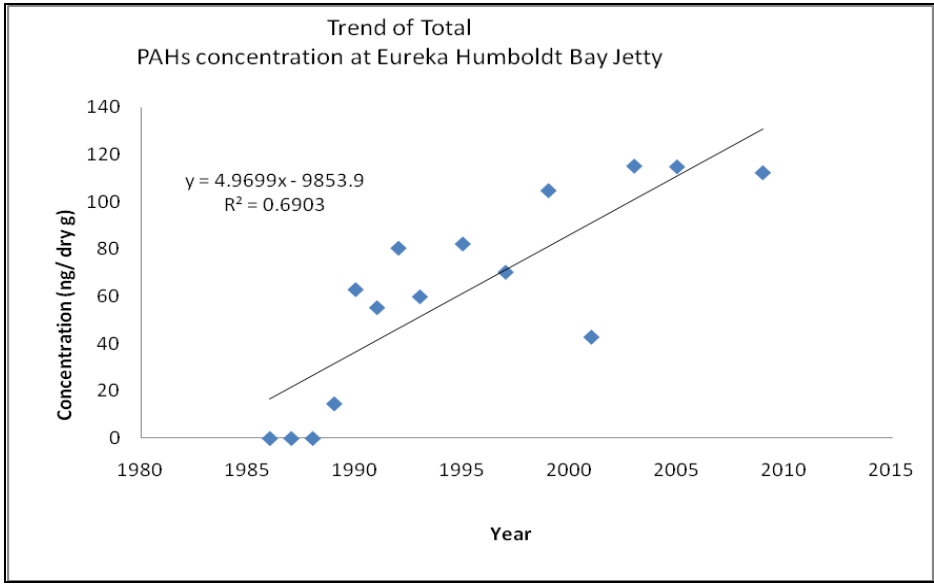
- Highest concentrations at two sites in San Diego Bay
- PCBs had either no trend or declined at most stations.
  - 21 showed no significant trend
  - 6 exhibited significant declines.
- Largest statistically significant decline was at Royal Palms

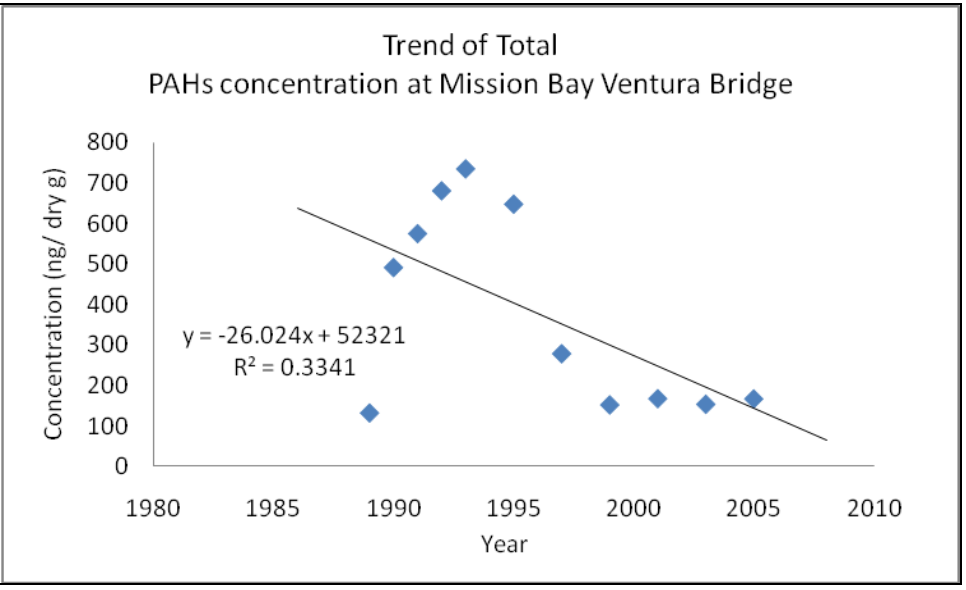
PAH Status (2007-2009 samples, coast and enclosed bays)

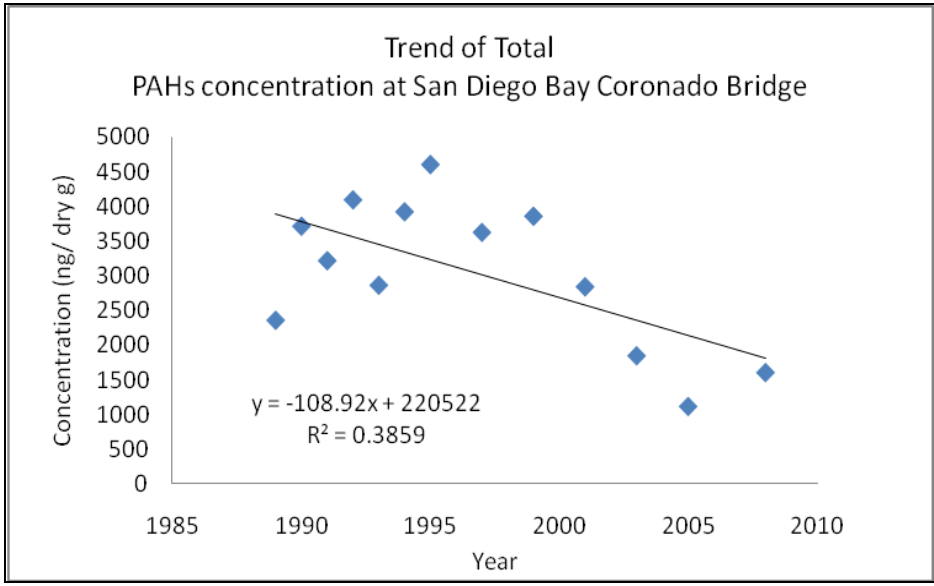


Total PAHs Trends (1986-2009)









Total PAHs Status and Trends (1986-2009)

- The largest PAH concentration was at Yerba Buena Island in San Francisco Bay (2008) following the Cosco Busan oil spill.

- No clear trend for PAHs
  - Twenty one out of 35 sites show upward trends, but only 5 of these were statistically significant increases
  - 4 sites had significant declines

Summary

- DDT, PCB, and Butyltins have generally decreasing at many stations
  - Consistent with the implementation of pollution controls
- No clear trend for Total PAHs
  - Highest recent concentrations in SF Bay after oil spill
- Mussel tissue pollutant concentrations vary depending on site conditions:
  - Enclosed bays generally have higher concentrations
  - Most ASBS have low concentrations of contaminants, except those near large watershed sources

Mussel Watch Pilot Study: Contaminants of Emerging Concern (CECs) - 2010

Mussel Watch CEC Pilot Study

- Pioneering study to inform future monitoring efforts on what CECs should be targeted
- To expand the relevance and utility of the National Status and Trends Mussel Watch program to regional, state and local stakeholders
- NOAA applied all its analytical resources toward CA mussel watch, with a focus on CECs
- Collaborators: NOAA, SCCWRP, SWRCB, SFEI, USGS

Mussel Watch Pilot Study Design

- Many new analytes selected (CECs)
  - Traditional pollutants were also analyzed at certain sites to maintain time series
- Contaminant concentrations were assessed according to different land uses and proximity to sources
- Resident mussels were sampled Dec. 2009 – May 2010

Candidate Contaminants/Classes

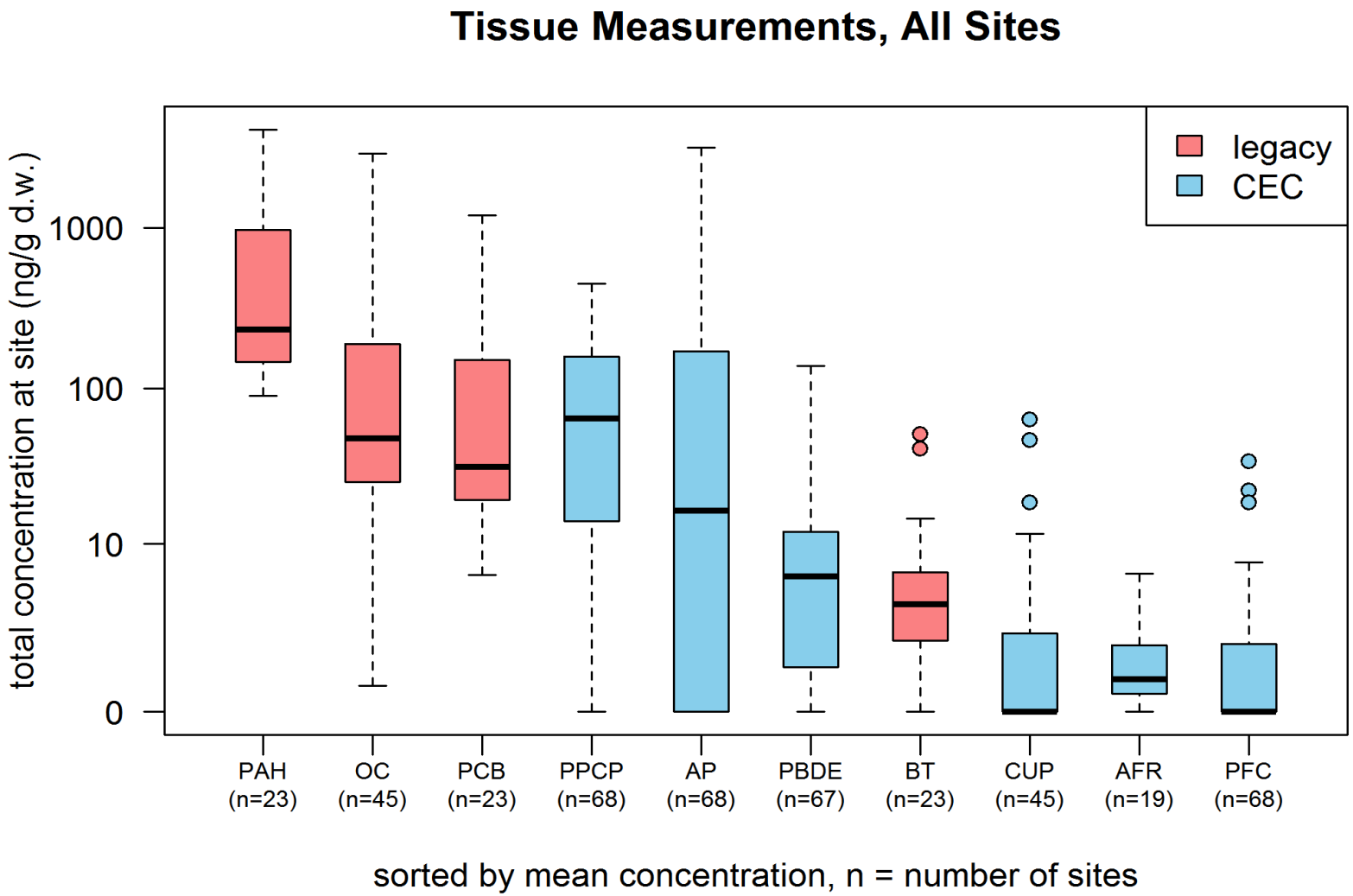
Analyte Class	Examples	No. analytes	No. Stations
Pharmaceuticals & Personal Care Products (PPCPs)	DEET, fluoxetine, ibuprofen, triclosan	86	All
Industrial and Commercial CECs*	4-nonylphenol, bisphenol A, BDE47, HBCD	54	Partial
Current Use Pesticides	chlorpyrifos, dachthal, permethrin,	27	All
Legacy Organohalogens & Butyltins	chlordanes, DDTs, endosulfan, PCBs, TBT	74	Partial
Polycyclic Aromatic Hydrocarbons (PAH)	Phenanthrene, benzo[a]pyrene, C1-fluorenes	66	Partial

Different land uses/sources

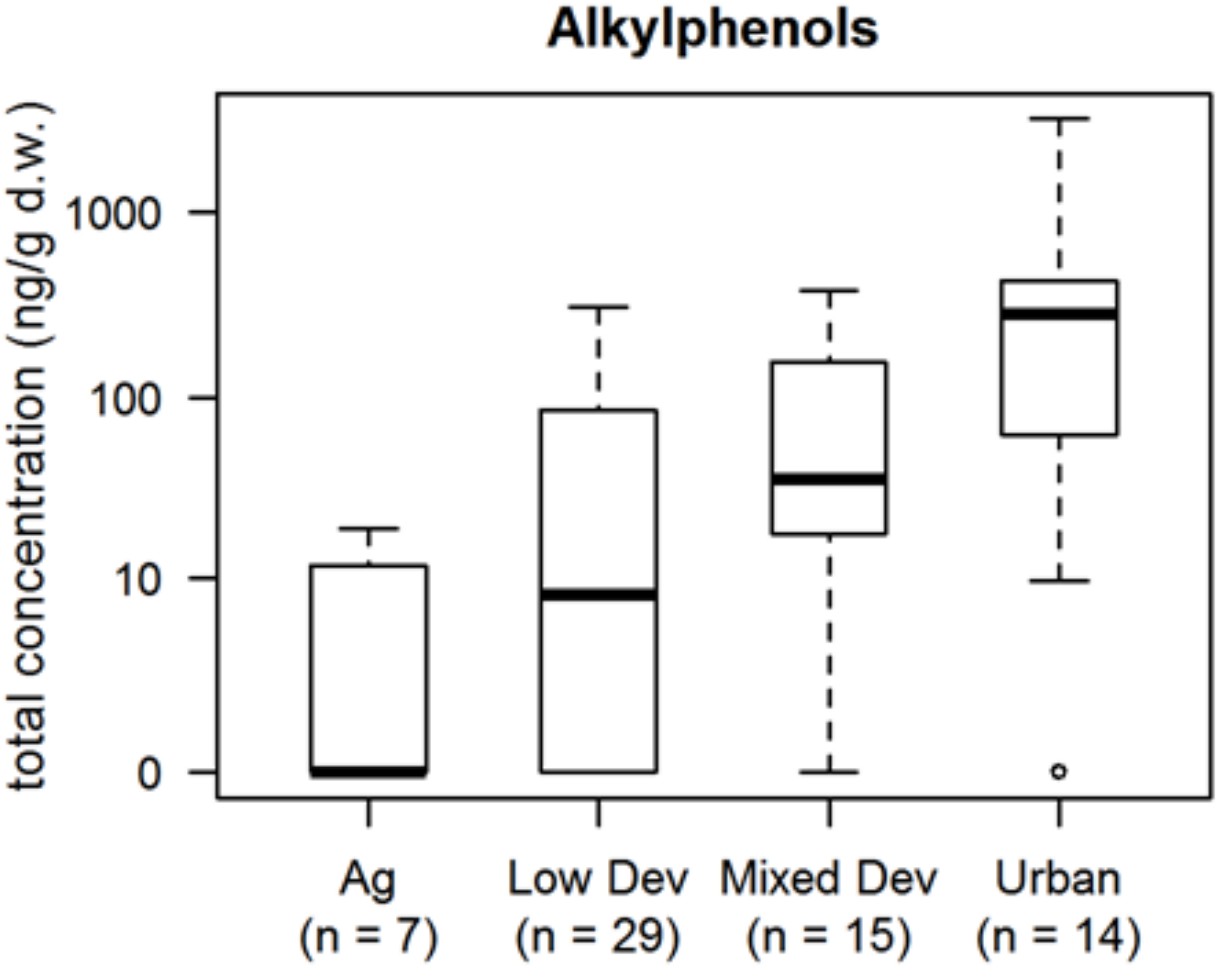
- Land uses:
  - Agriculture
  - Low development
  - Mixed development
  - Urban

- Sources:
  - Storm water discharges
  - Sewage Treatment (POTWs)
  - No significant sources: ASBS, but note that some ASBS do have SW or POTW sources

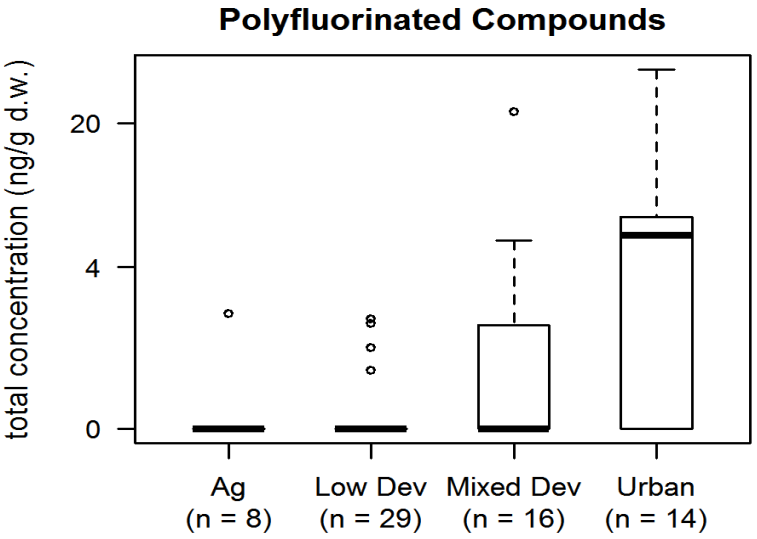
Concentration comparison of CEC and legacy pollutants

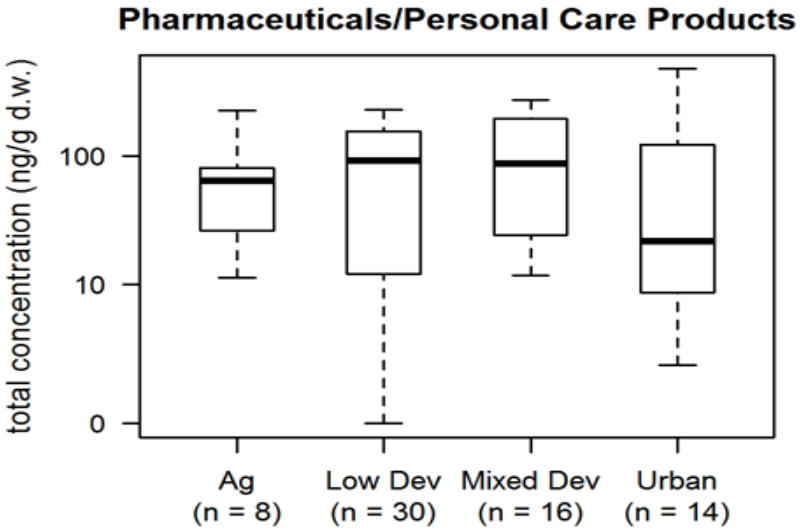


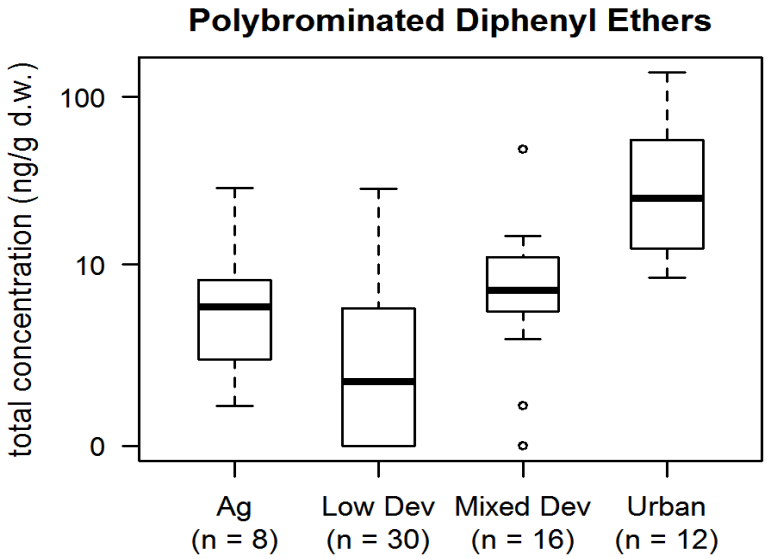
Tissue CEC concentrations by land use category
Example plot - APs

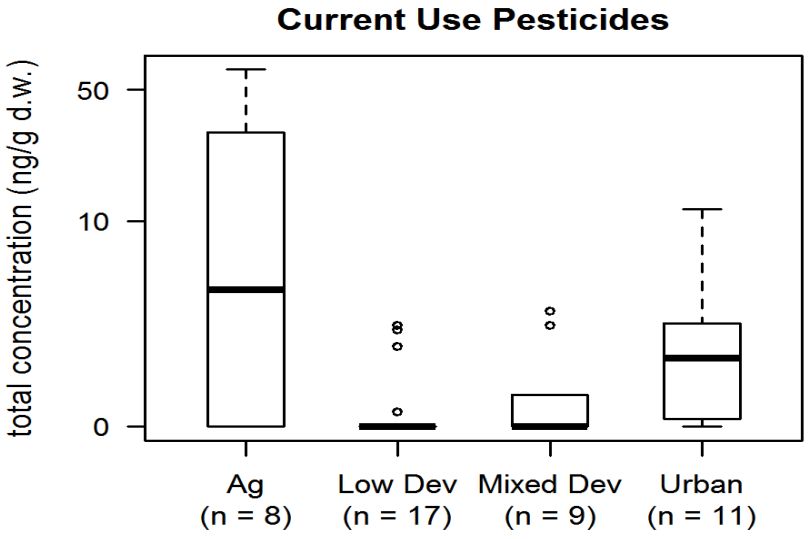


Tissue CEC concentrations by land use category

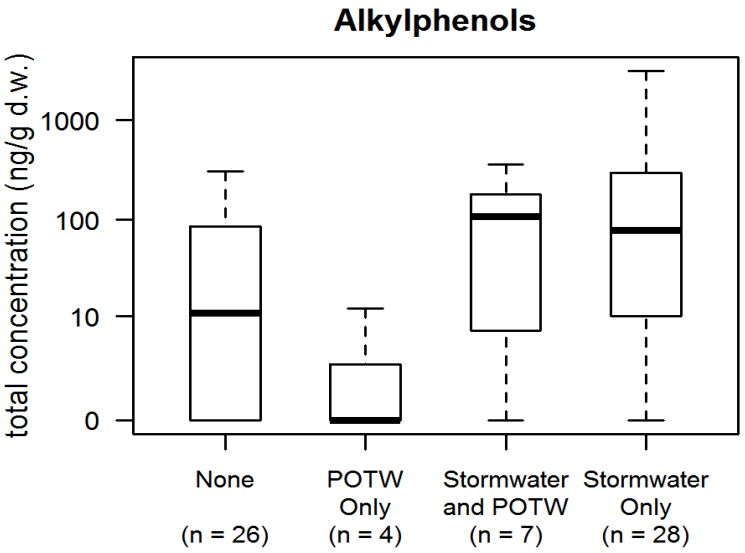


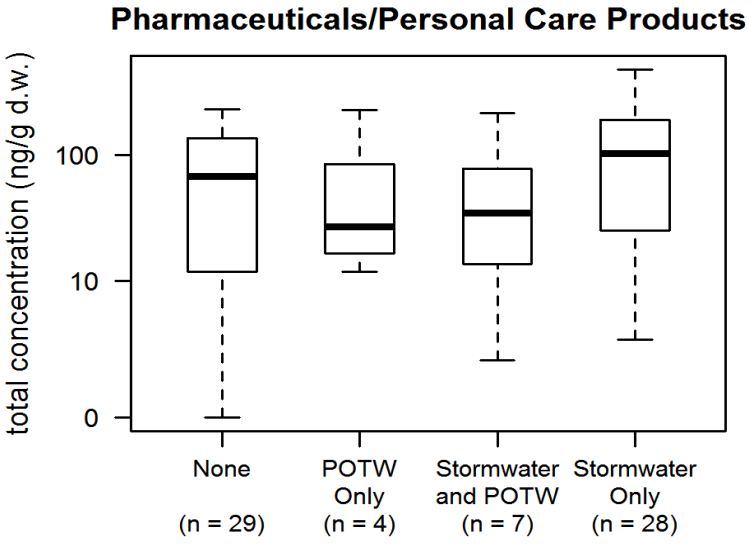


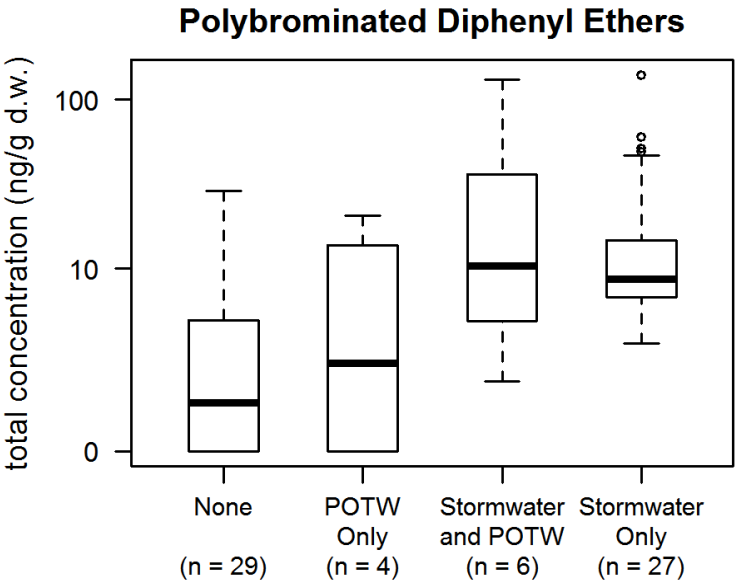


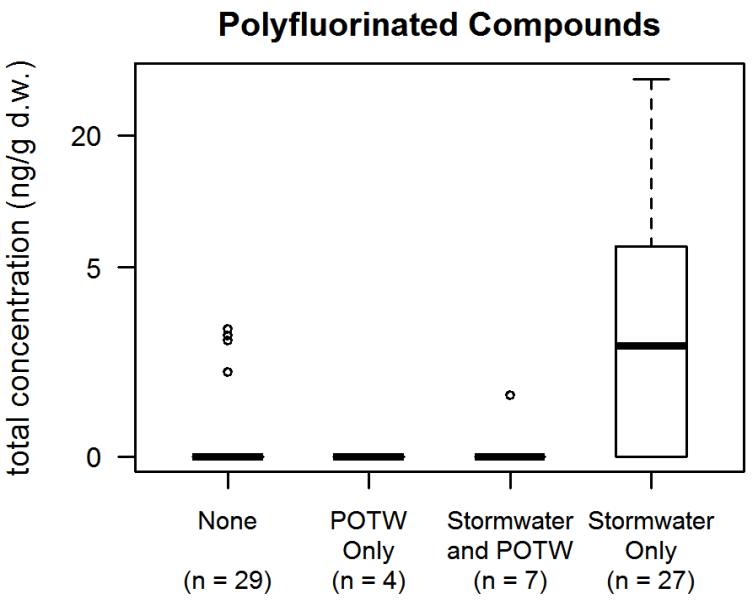


Tissue CEC concentrations by discharge category









Conclusions

- PBDEs, Alkylphenols (APs) and pharmaceuticals/personal care products (PPCPs) were the most frequently detected CECs.
- Urban land use stations generally had higher concentrations for many CECs (PFCs, APs and PBDEs).
- PPCPs were present in all land uses, including agriculture
- Current use pesticides were highest at agricultural areas, followed by urban land use.
- CECs had the highest concentrations at stations influenced by storm water discharges.
- Reinforces the need to monitor selected CECs (PBDEs, PFCs and APs) in coastal ecosystems, particularly in heavily urbanized regions.

Want to learn more?

- Special Issue of Marine Pollution Bulletin is being developed to publish all this data.
- SETAC (November, Long Beach) will have a special session to present on CECs