A multi-agency pilot project on contaminants of emerging concern (CECs) in California coastal bivalves

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"Mussel Watch"

A Sentinel for Safe, Healthy & Productive Coasts

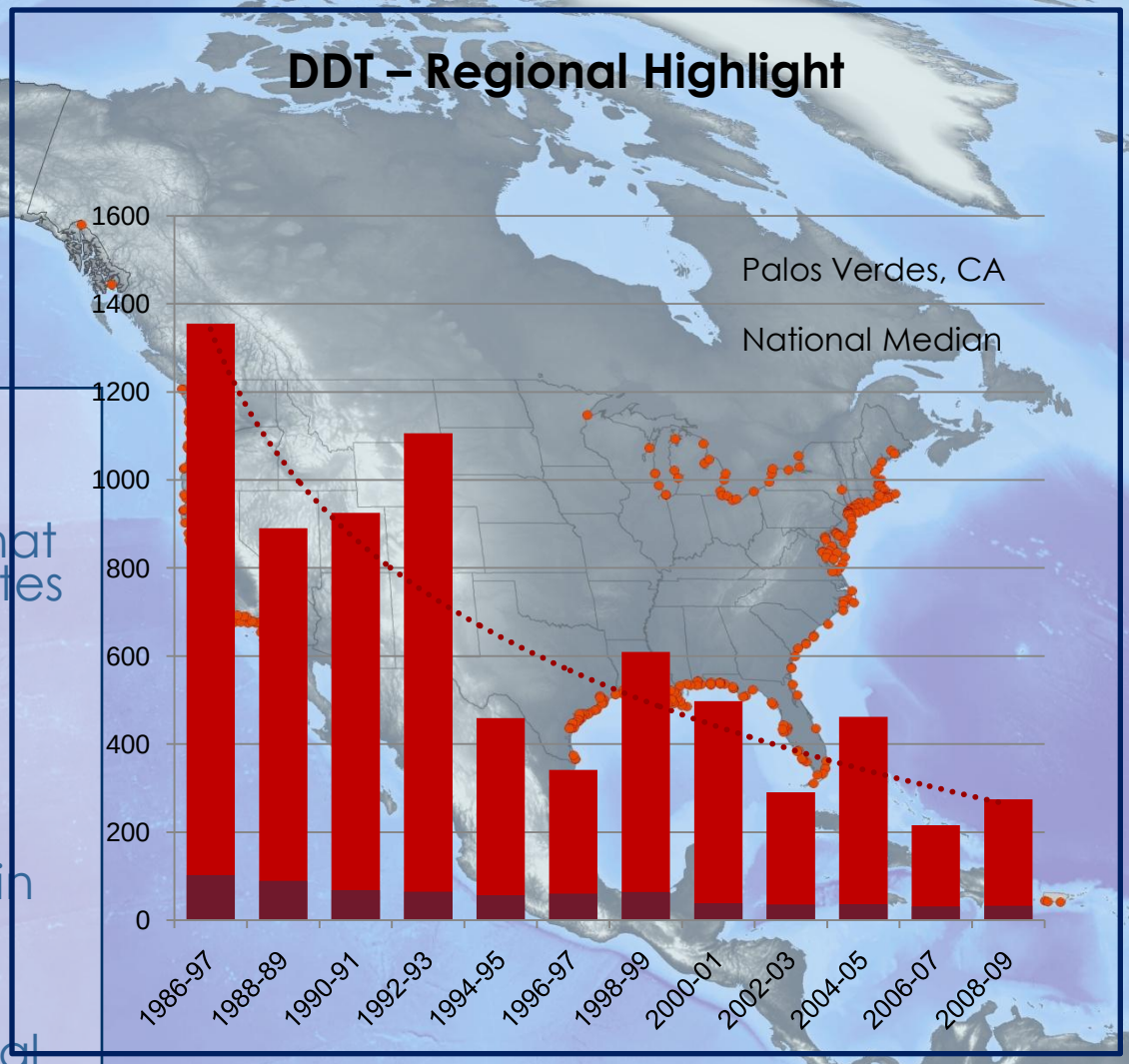
QUICK FACTS

Only program of its kind that is national in scope; 300 Sites nationwide

Longest running coastal contaminant monitoring program(25 years)

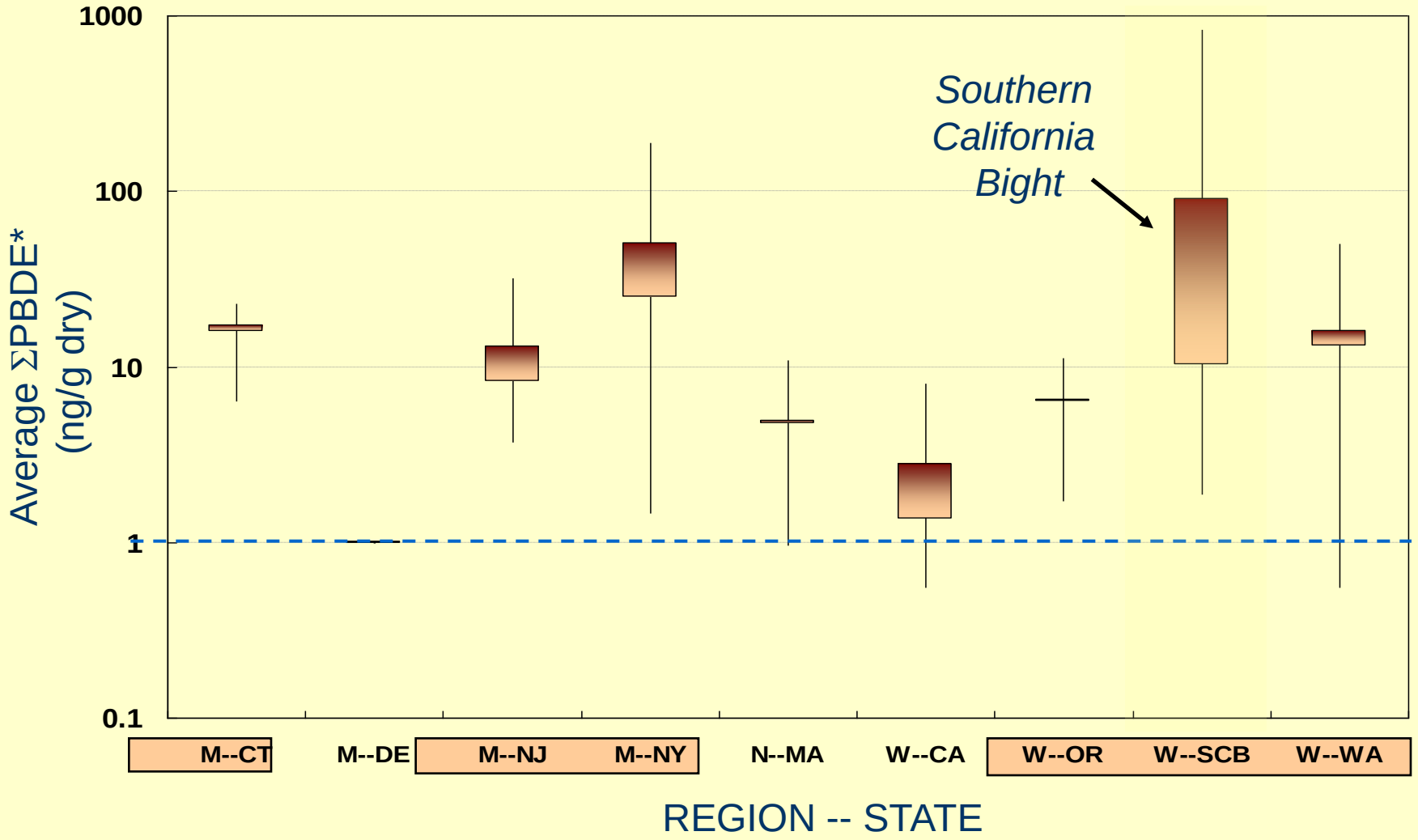
120 chemicals measured in oysters, mussels and sediment

Broad federal, state & local partnerships



National Status & Trends Program – Mussel Watch

- Polybrominated Diphenyl Ethers in *Mytilus spp.*: *A National Perspective (2006)*



REFOCUSING MUSSEL WATCH

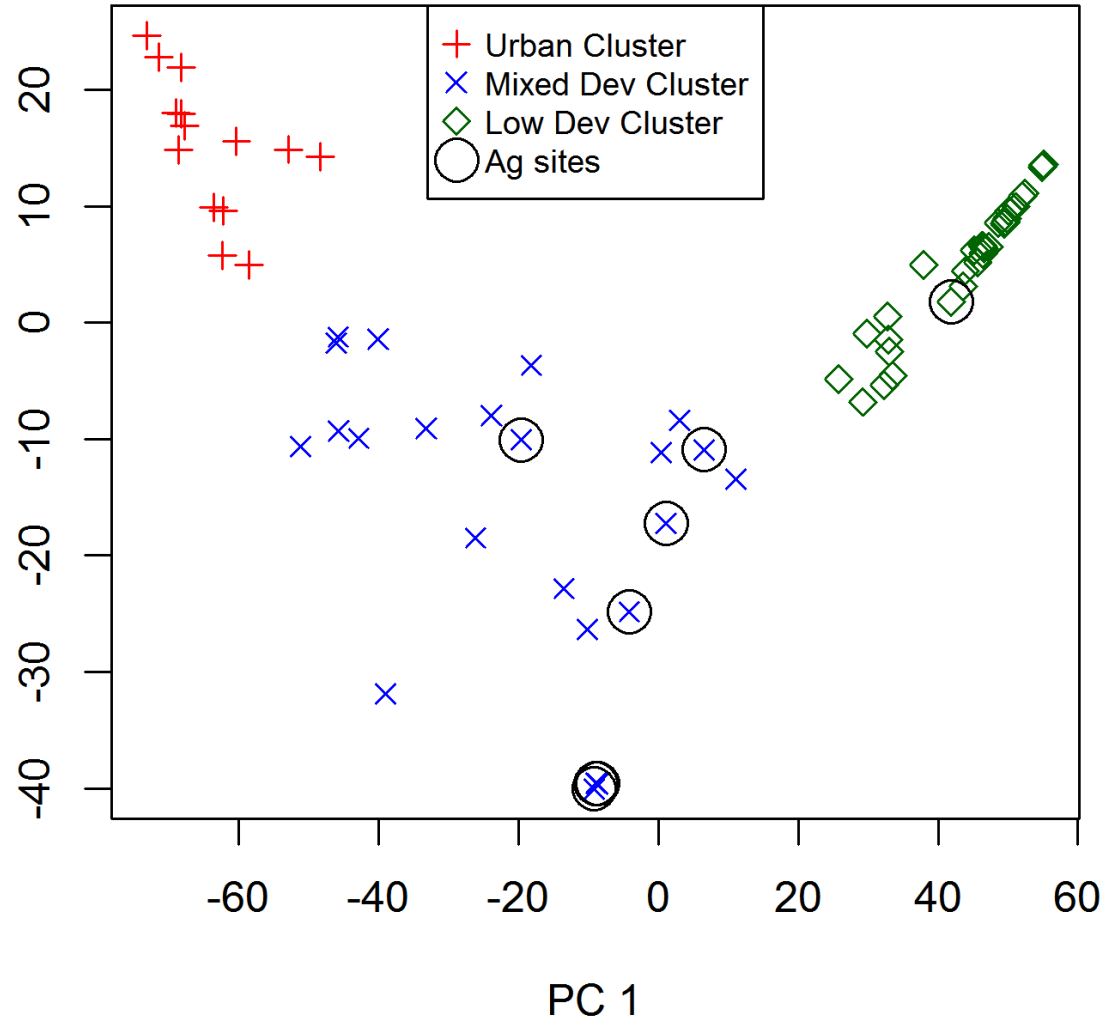
- **Stakeholders wanted more focus on CECs**
  - NOAA agreed and held a 2009 workshop in CA to redesign the program
- **Annual 2009 MW budget re-directed for CA pilot study**
  - $475K from NOAA; $360K for analytical costs
  - Leveraging from multiple partners doubled funds committed to study
  - Key capabilities and expertise also brought to table
- **Multiagency committee formed to establish study elements**
  - CEC analyte list
  - Expansion/relocation of sampling stations
  - Sampling schedule & logistics
  - Analytical performance goals
  - Data management & interpretation

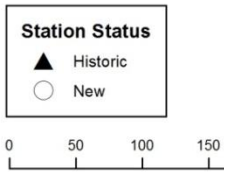
PARTICIPANTS

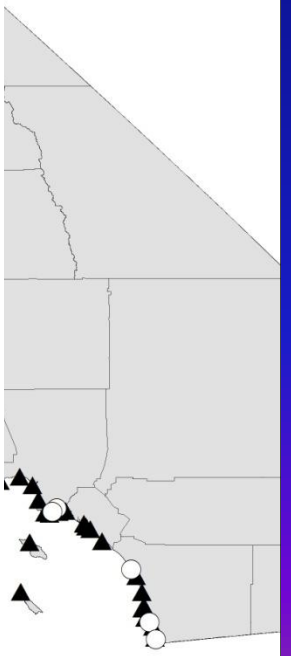
- **Planning**
  - K. Maruya, S. Bay, S. Weisberg (SCCWRP)
  - D. Gregorio, (SWRCB)
  - S. Klosterhaus, M. Sedlak, J. Davis (SFEI)
  - J. Christensen, G. Lauenstein, K. Kimbrough, T. Collier (NOAA)
  - D. Alvarez, E. Furlong (USGS)
  - T. Smith, L. Huff (EPA)
  - J. Kucklick (NIST)
- **Field Collection**
  - C. Beegan, E. Siegel, E. Duncan (SWRCB)
  - D. Tsukada, D. Diehl (SCCWRP)
  - P. Salop (Applied Marine Sciences)
  - J. Engle (Marine Science Institute, MARINe)

STUDY OBJECTIVES

- What is the occurrence (freq of detection, concentration) of CECs in the coastal California environment?
- How does CEC occurrence vary with land use?
- How does CEC occurrence vary with proximity to discharge of WWTP effluent and stormwater runoff?
- What CECs are detectable in the water column using passive sampling devices (PSDs)?
- What is the relationship between CEC accumulation by PSDs and bivalve tissue?


Urban Cluster
Mixed Dev Cluster
Low Dev Cluster
Ag sites
PC 2
20
10
0
-10
-20
-30
-40
-60
-40
-20
0
20
40
60
PC 1


Station Status
Historic
New
0
50
100
150



TARGET CECs

- **Mussel (*Mytilus* spp.) tissue**
  - Pharmaceuticals & personal care products (PPCPs)(88 analytes)
    - e.g. carbamazapine, triclosan
  - Industrial & commercial chemicals (52 analytes)
    - flame retardants (PBDEs, HBCD)
    - surfactants (4-nonylphenol)
  - Current use pesticides (27 analytes)
    - pyrethroids, chlorpyrifos, dachthal
  - Nanomaterials (single walled C nanotubes)
  - Persistent organic pollutants (120 analytes)
  - Trace metals (14)

- **PSDs**
  - Polyethylene & solid phase microextraction (SPME) devices
    - POPs (PCBs, DDTs, chlordanes) (>80 analytes)
  - Polar chemical integrated sampler (POCIS) (156 analytes)
    - water soluble CECs (e.g. synthetic musks)

MORE PARTICIPANTS

- **Analytical**
  - J. Ramirez, A. Brewster (TDI Brooks)
  - R. Grace, C. Navaroli (Axys Analytical)
  - M. LaGuardia (VIMS)
  - L. Ferguson (Duke)
  - W. Lao (SCCWRP)
  - K. Smalling (USGS)

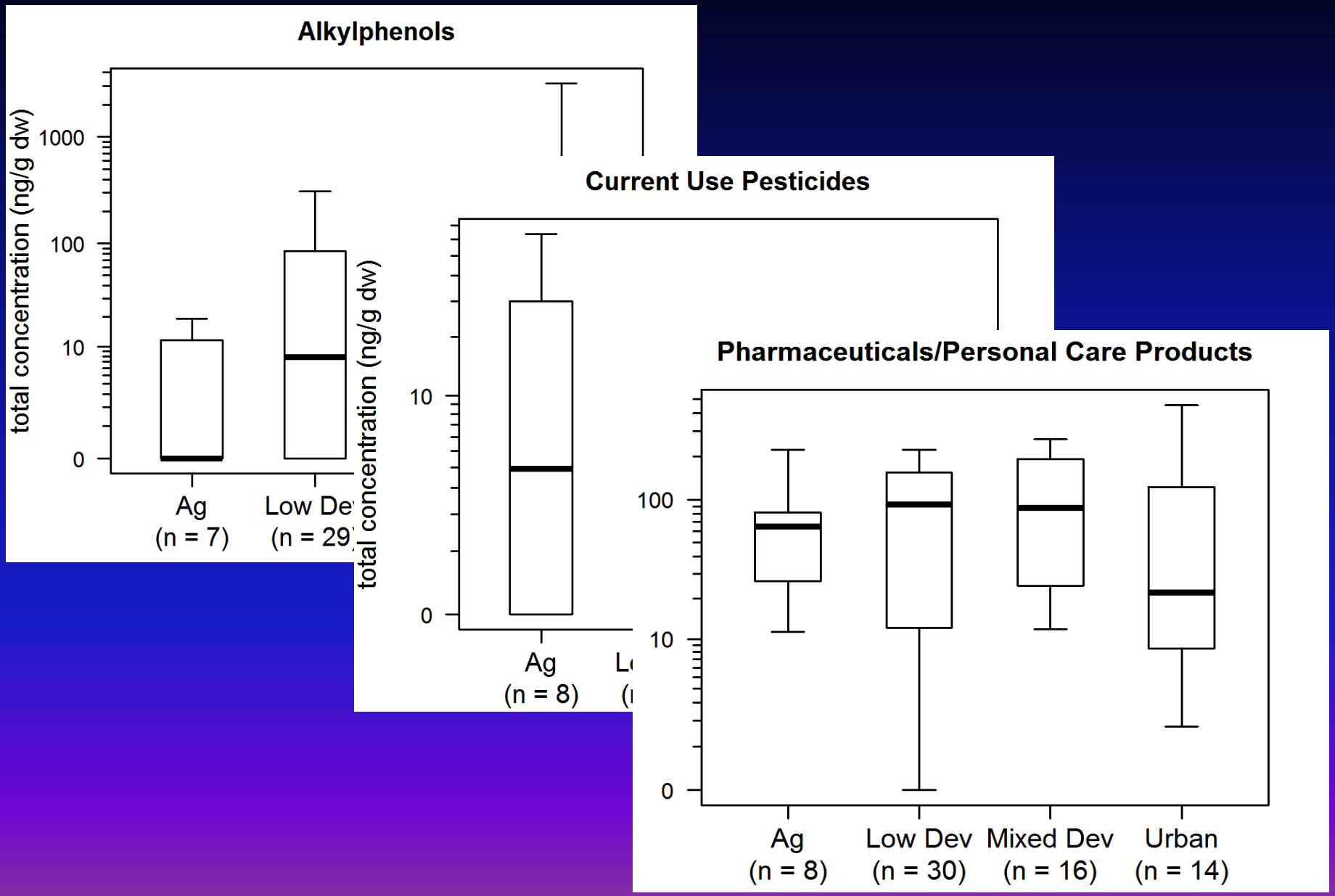
- **Data interpretation and synthesis**
  - N. Dodder. R. Schaffner (SCCWRP)
  - M. Edwards, A. Jacob, S. Bricker, G. Piniak (NOAA)

OCCURRENCE OF CECs

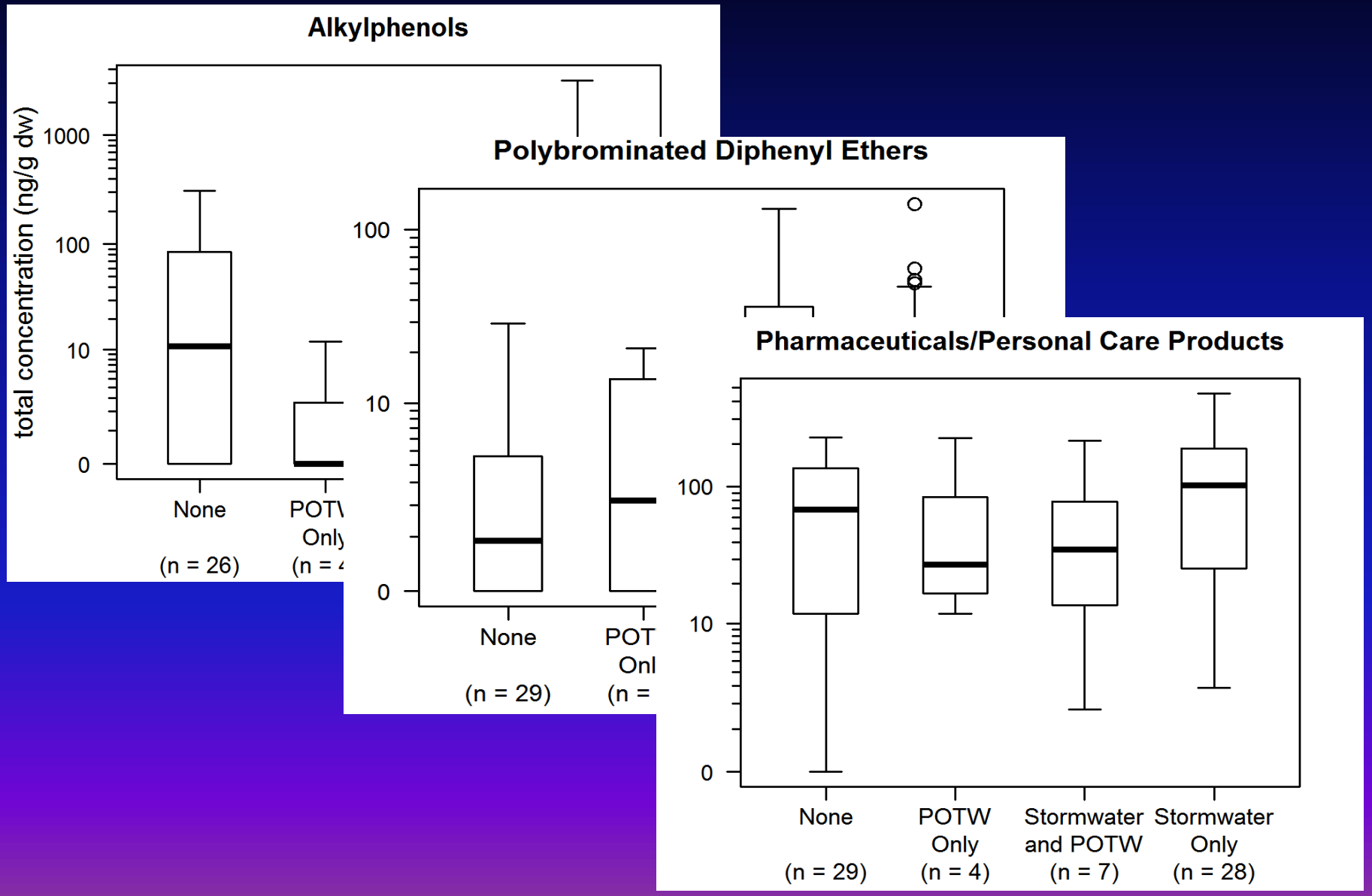
Tissue Analyte (ng/g
4-Nonylphenol Mon
4-Nonylphenol
4-Nonylphenol Diet
BDE-47
DDMU
Sertraline
Lomefloxacin
BDE-99
HBCD, gamma

POCIS Analyte	Water Concentration (ng/L)			
	Freq Det	Mean	Min	Max
Bromoform	100	32	5.3	77
Tris(1-chloro-2-propyl)phosphate (TCPP)	90	410	ND	3100
Diethyl phthalate	90	150	ND	600
Diethylhexylphthalate (DEHP)	80	400	ND	1105
Galaxolide (HHCB)	80	150	ND	1300
Acetophenone	80	11	ND	47
Cotinine	80	2.7	ND	6.3
d-Limonene	70	15	ND	46
Caffeine	70	10	ND	32
Tributyl phosphate	70	6.6	ND	25
Carbamazepine	70	2.6	ND	21
Trimethoprim	70	0.3	ND	2
N,N-diethyltoluamide (DEET)	60	10	ND	69
Tris(2-chloroethyl)phosphate (TCEP)	60	7.6	ND	56
Camphor	50	30	ND	92
Benzophenone	50	0.89	ND	5.1

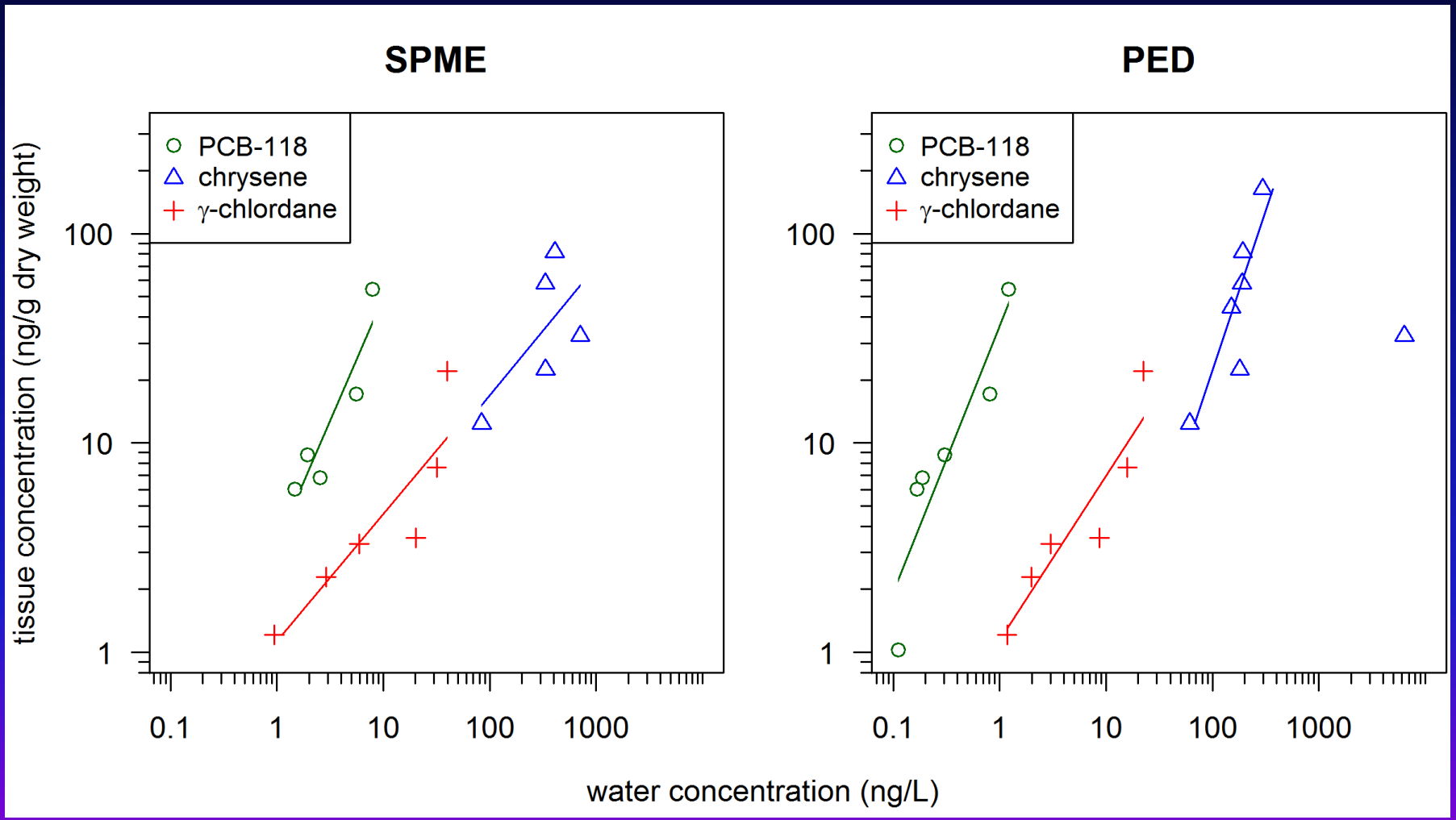
EFFECT OF LAND USE



EFFECT OF DISCHARGE



PSD VS. TISSUE ACCUMULATION



SUMMARY AND CONCLUSIONS

- **Most targeted CECs were very low or not detected**
- **PBDEs and alkylphenols were frequently detected in mussels at concentrations similar to POPs**
- **CEC concentrations were higher on average at stations**
  - in urban areas
  - impacted by stormwater

- ***Coastal water quality monitoring programs should focus on urbanized waterways impacted by stormwater runoff***

SUMMARY AND CONCLUSIONS (cont.)

- **A different suite of CECs were frequently detected in water at ng/L concentrations**
  - chlorophosphate flame retardants (e.g. TCEP)
  - phthalates
  - galaxolide

- ***Mytilus* tissue concentrations of POPs and PAH were correlated with water concentrations determined from PSDs**

- ***PSDs can be employed in coastal monitoring of CECs that***
  - ***are not taken up by bivalves (e.g. water soluble PPCPs)***
  - ***bioaccumulate in bivalves such as Mytilus***

SUMMARY AND CONCLUSIONS (cont.)

- **A multiagency partnership was created that resulted in**
  - the design and performance of a pilot study on CECs to inform coastal monitoring across CA
  - increased spatial coverage and relevance of coastal monitoring sites to State, regional and local stakeholders
  - leveraging of core federal program funds, key expertise and facilities, and in kind services from various partners that doubled the scope of the study
  - a more comprehensive coastal water quality monitoring strategy ("Beyond Mussel Watch")

- ***Results will inform future regional and national CEC studies***
  - *Background water quality (ASBS)*
  - *Great Lakes Initiative*
  - *Chesapeake/mid-Atlantic region*
  - *Puget Sound*