

# Emerging Contaminants Research

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Principal Scientist, Chemistry Dept.



# **SCCWRP MEMBER ORGANIZATIONS**

**City of Los Angeles**

**Los Angeles County Sanitation  
Districts**

**Orange County Sanitation District**

**City of San Diego**

**Ventura County Watershed  
Protection Division**

**Los Angeles County Department  
of Public Works**

**Orange County Department of  
Public Works**

**County of San Diego**

**San Diego Regional Water Quality Board**

**Santa Ana Regional Water Quality Board**

**Los Angeles Regional Water Quality Board**

**State Water Resources Control Board**

**U.S. Environmental Protection Agency**

**California Ocean Protection Council**

# **OUR MISSION**

- 1) Contribute to the scientific understanding of linkages among human activities, natural events, and the health of the Southern California coastal environment**
  - o develop research plan with M/A technical advisors
  - o foster collaboration with scientific & stakeholder communities
- 2) Communicate this understanding to decision makers and other stakeholders**
  - o Quarterly Commission Meetings
  - o Workshops/Symposia, Annual Report, Conferences
  - o [www.sccwrc.org](http://www.sccwrc.org)
- 3) Help develop strategies for protecting the coastal environment for this and future generations**

# INTERNAL STRUCTURE

- **46 full-time staff**
  - About 40% hold PhDs
  - An additional 30% hold Master's degrees
- **Five departments**
  - Biology
  - Chemistry
    - Wet and instrumental (GC-MS) labs
  - Information Management
  - Toxicology
    - Temp. controlled exposure labs
  - Watersheds
- **Costa Mesa facility (26K sq ft) opened in 2007**

# Effects of Emerging Contaminants on Southern California Flatfish

*Steven Bay*  
*Principal Scientist, Toxicology Dept.*



## **Steering Committee**

**Jeff Armstrong (Orange County Sanitation District)**

**Michael Baker (UC San Diego)**

**Curtis Cash (City of Los Angeles)**

**Joe Gully (LA County Sanitation Districts)**

**Kevin Kelley (Cal State Long Beach)**

**Dan Schlenk (UC Riverside)**

**Tim Stebbins (City of San Diego)**

**Steve Bay, Doris Vidal-Dorsch, Keith Maruya  
(SCCWRP)**

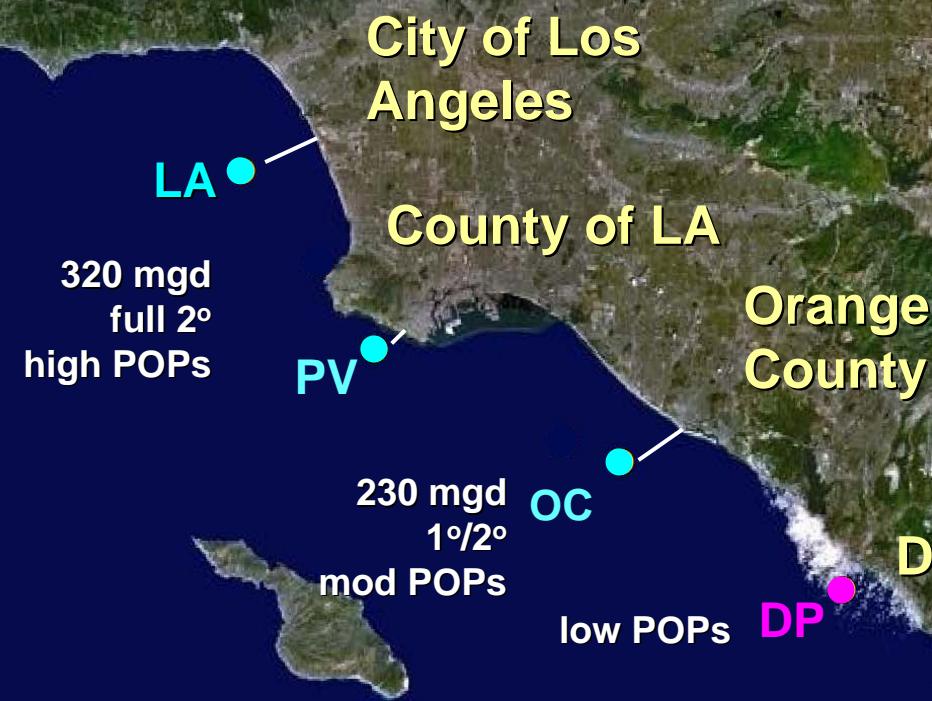
## **Additional Collaborators**

**S. Snyder, B. Vanderford (So. NV Water Authority)**

**K. Xia, K. Armbrust (Mississippi State Chemical Lab)**

# Southern California Study Sites

- Outfall
- Reference



## 2003 Pilot Study

- elevated VTG, testis-ova in >30% male flatfish
- estrogenic activity in outfall sediment extracts
  - o 16-82% fines; 0.43 – 2.5% TOC
  - o  $E_1, E_2 \leq 0.6 \text{ ng/g dw}$
  - o 4-nonylphenol: 120-3200 ng/g dw

Schlenk et al. ET&C (2005)



adv  
low POPs

SD

San Diego

# Evaluation of Exposure and Effects

- **What chemicals are discharged?**
  - Analyze POTW effluent (n=16)
- **Are fish exposed?**
  - Analyze site water (n=20), sediment (n=5), & flatfish liver (n=10)
- **Are there biological effects?**
  - Plasma VTG & hormones (E2, 11-KT)
  - Gonad histology & development
  - Gender ratios
  - Population (trawl) estimates

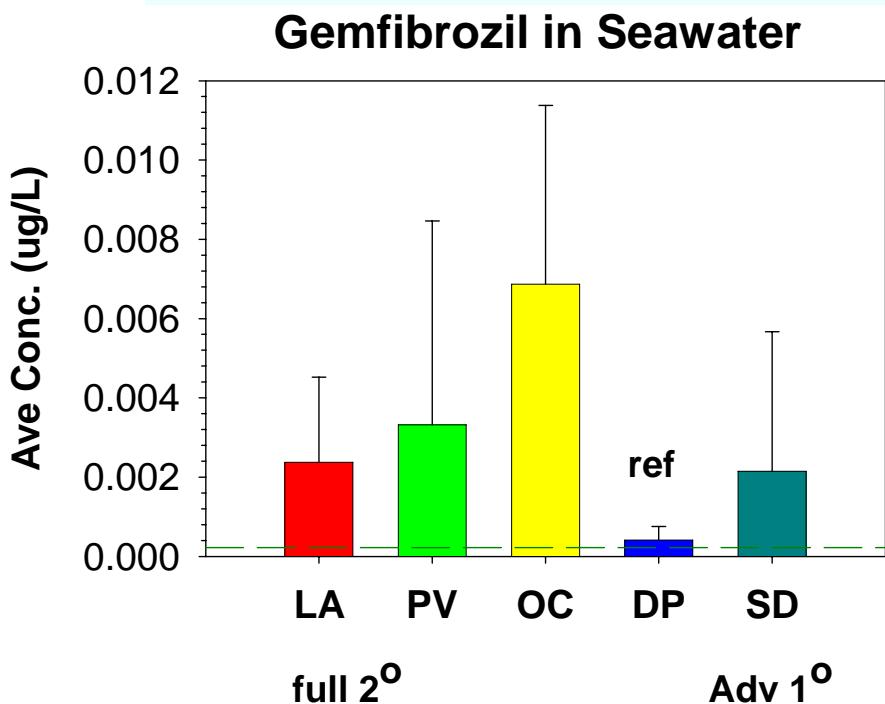
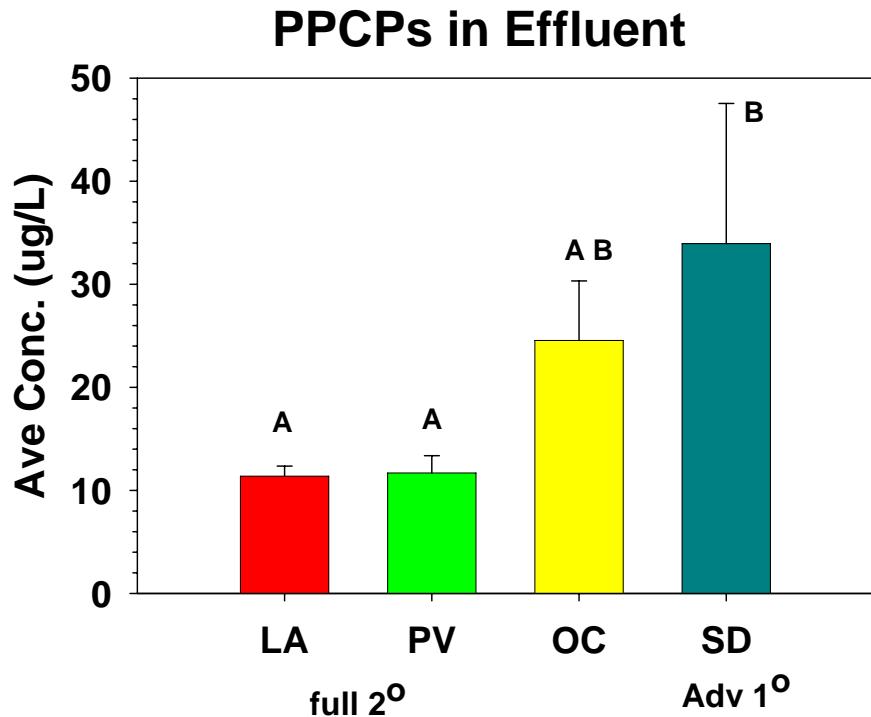


# CECs in Effluent and Site Water

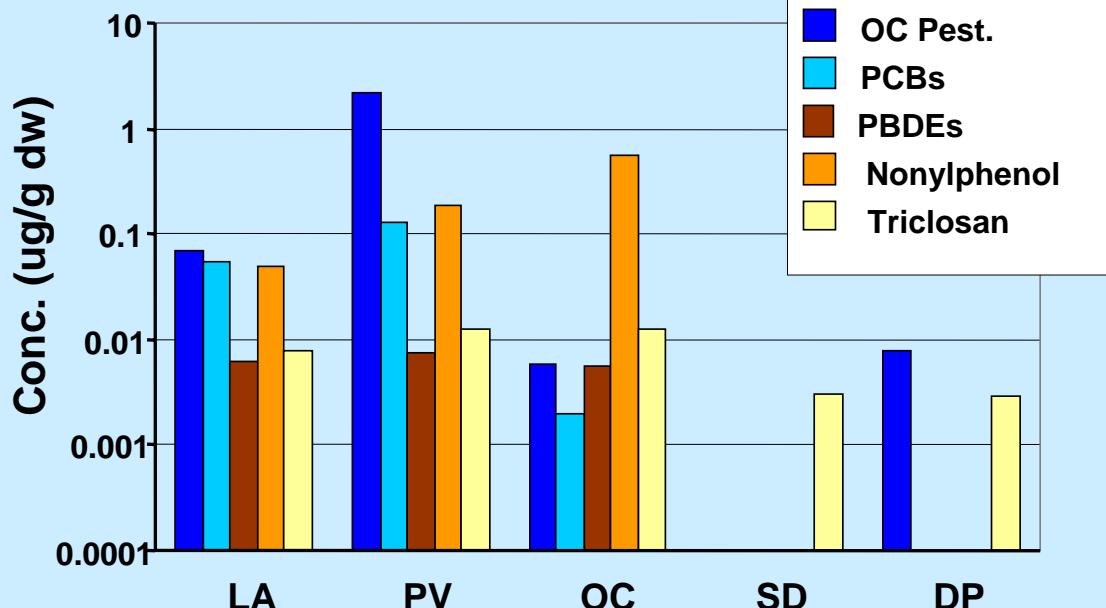
Use	Chemical	Seawater		Effluent		Dilution Factor
		Mean (µg/L)	Occurrence %	Mean (µg/L)	Occurrence %	
		Name				
Pain reliver	Naproxen	0.0035	75	4.26	100	1200
Antibiotic	Trimethoprim	0.0005	60	0.62	100	1160
Antibiotic	Sulfamethoxazole	0.0008	70	0.92	100	1110
Cholesterol regulator	Gemfibrozil	0.0030	90	3.15	100	1050
Tranquilizer	Meprobamate	0.0004	50	0.38	100	990
Beta-blocker	Atenolol	0.0023	90	2.13	100	909

Likely direct exposure from water for some PPCPs

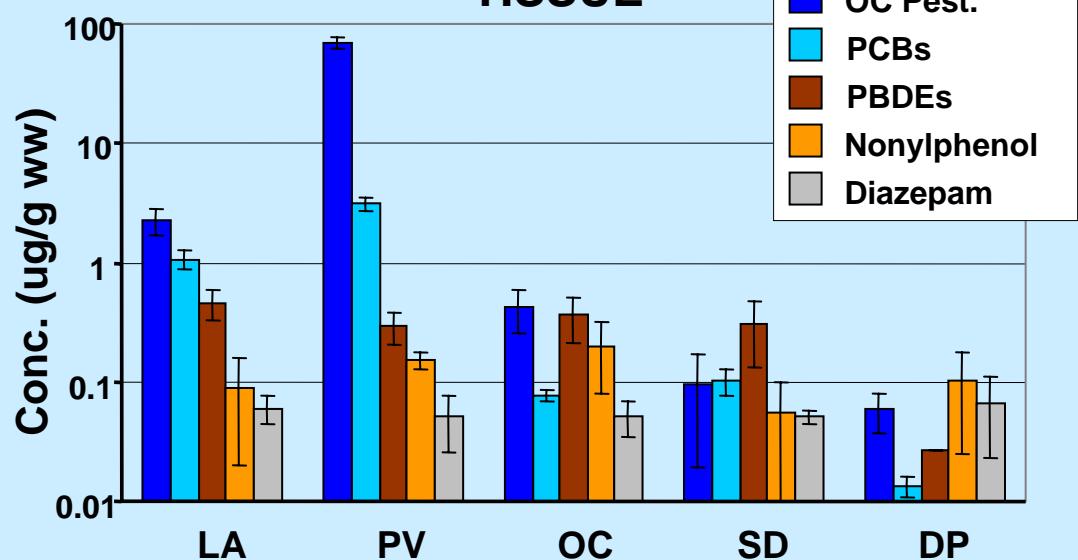
# *Treatment Level Effect?*



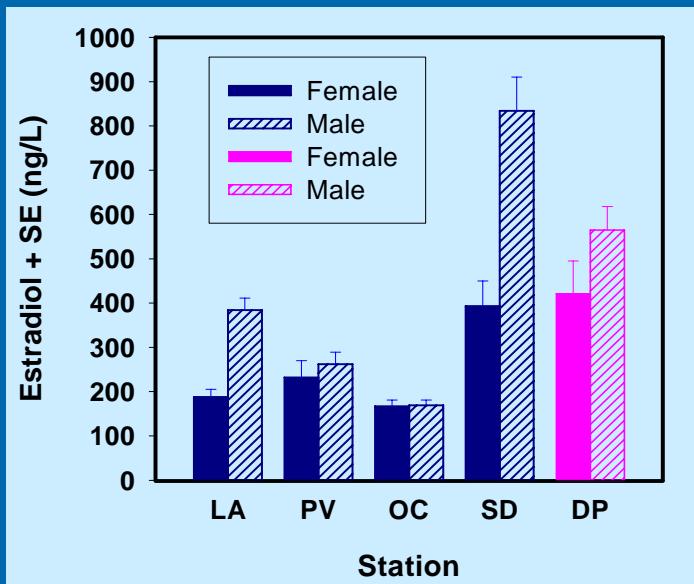
# SEDIMENT



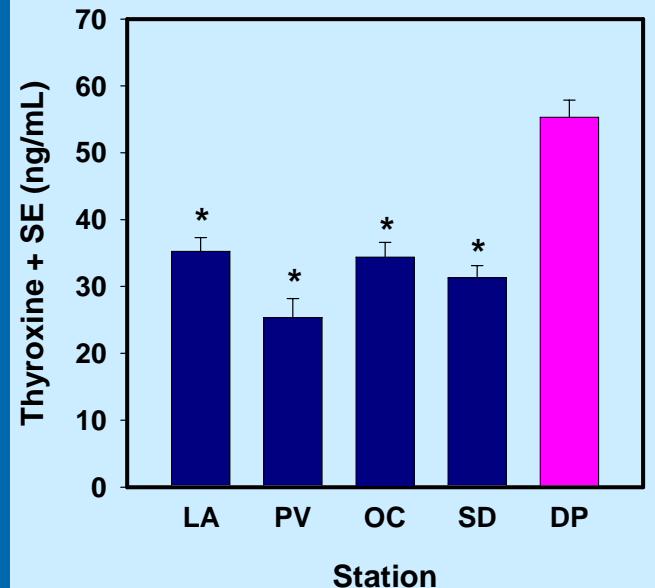
# TISSUE



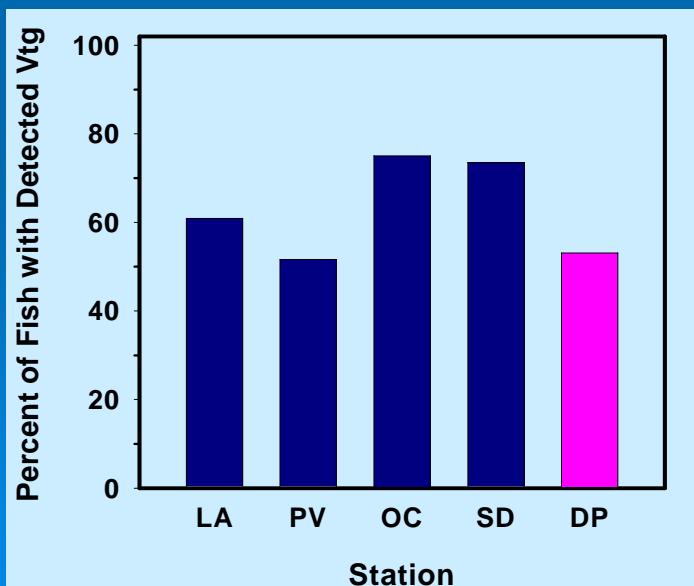
## Plasma Estradiol



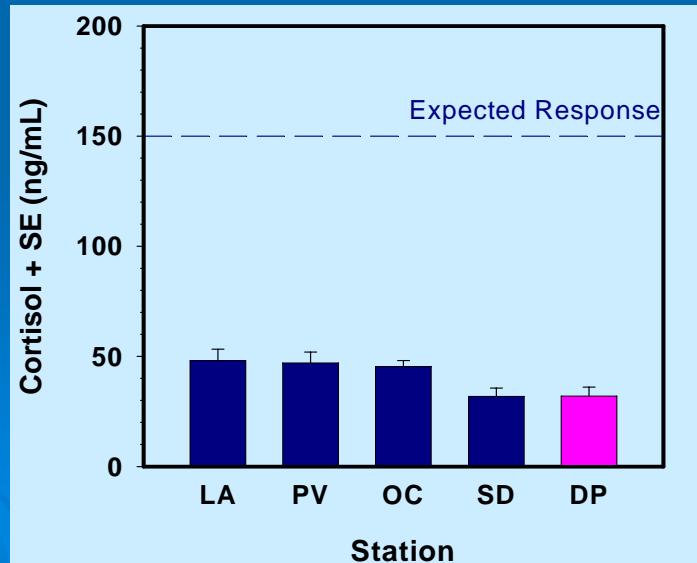
## Thyroxine



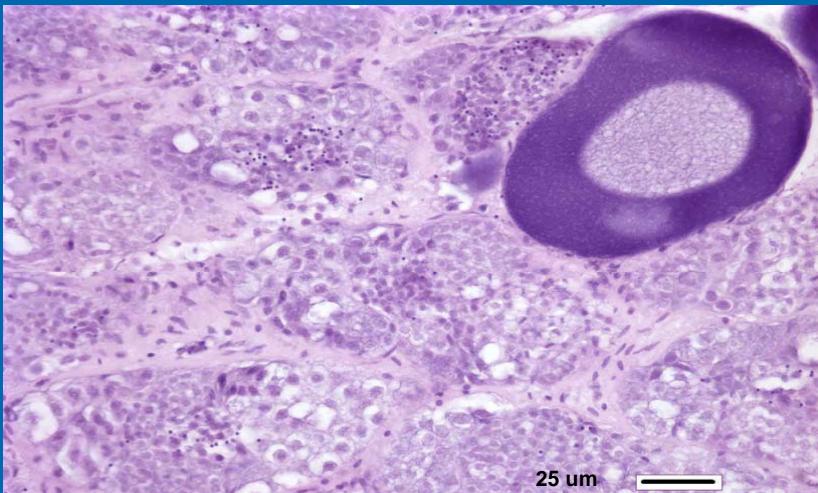
## Plasma Vitellogenin: Males



## Cortisol

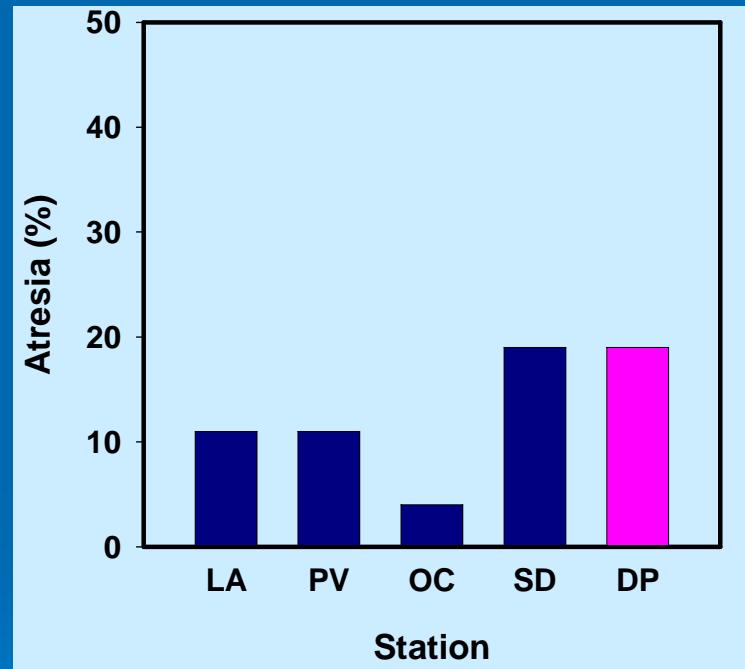


## Intersex



1 occurrence/373 males

## Ovary Degeneration (Atresia)



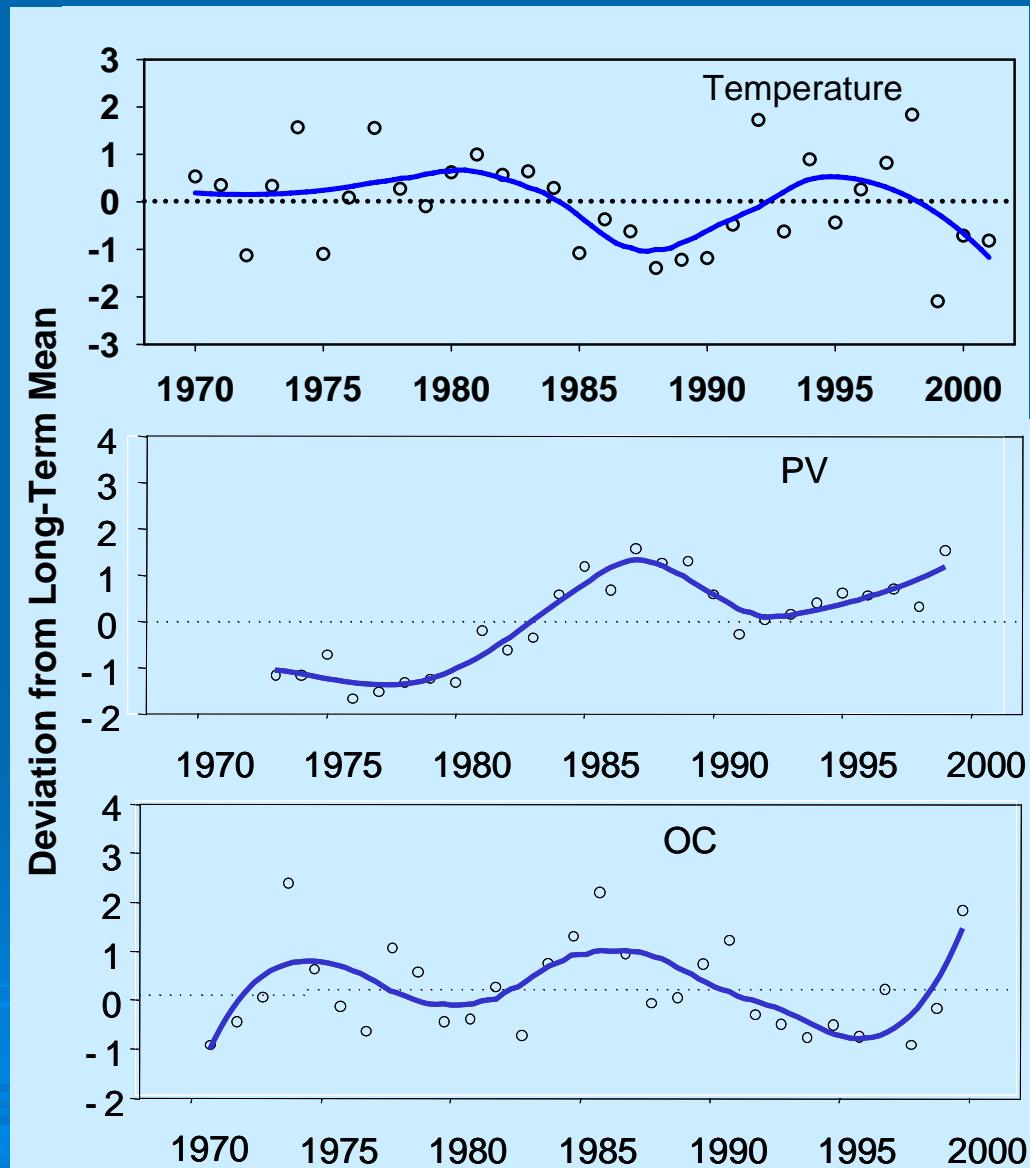
*Much lower frequency of intersex occurrence than in 2003 study*

# Population Trends

No recent evidence of declines

Population changes likely due to ocean climate

M.J. Allen,  
Pers. Comm.



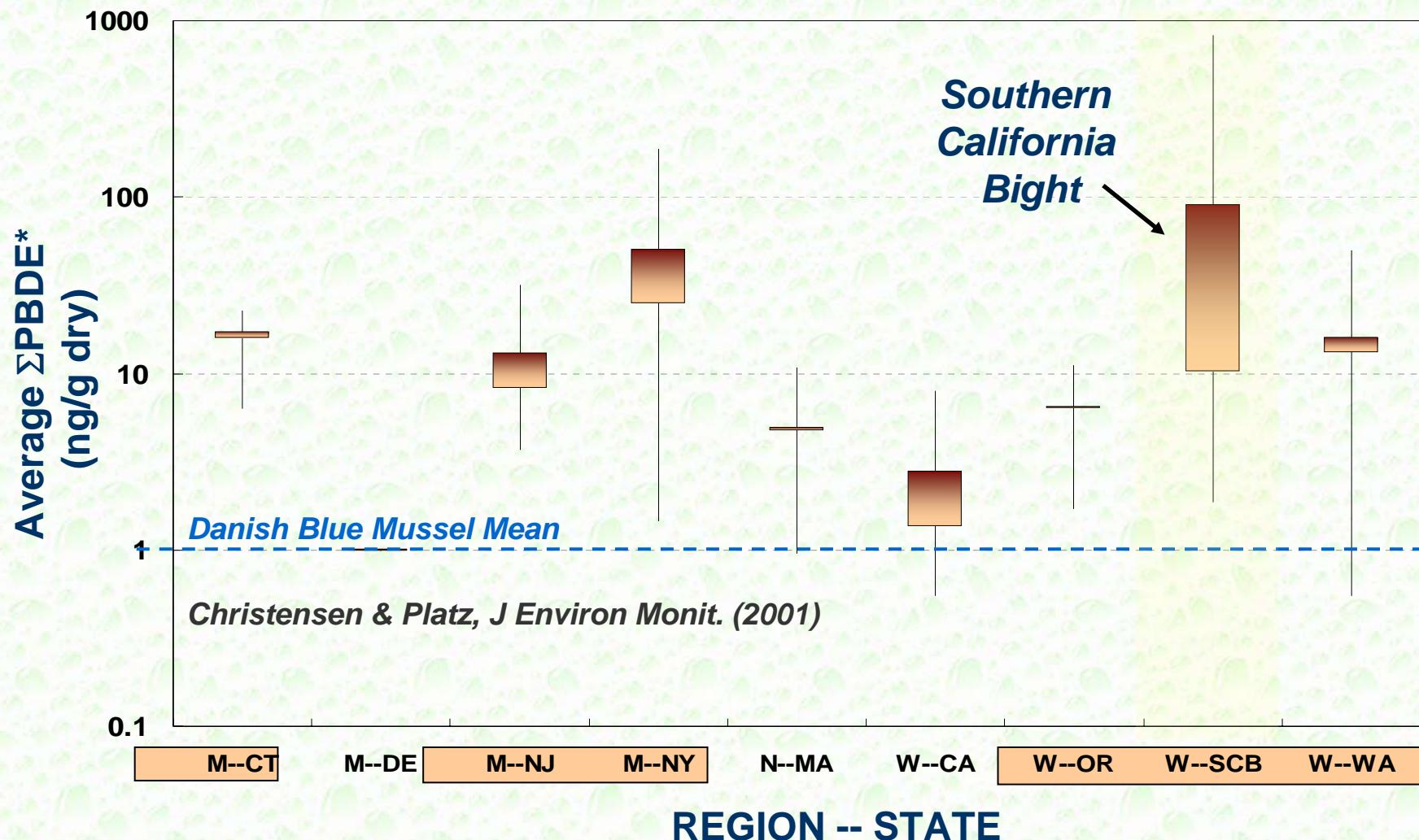
# Next Steps

- **What is normal?**
- **What are the best indicators?**
- **Which chemicals are of greatest concern?**
  - Additional tissue analyses
  - Other habitats
  - TIEs
    - Sediment extracts
    - Effluents
    - Model CECs
    - Molecular tools

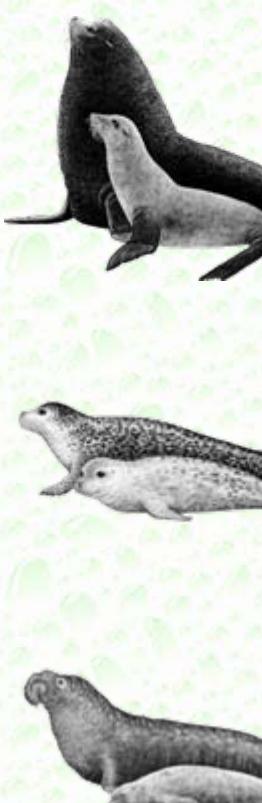


## National Status & Trends Program – Mussel Watch

### ► Polybrominated Diphenyl Ethers in *Mytilus spp.*: A National Perspective



# Levels in higher tropic levels?



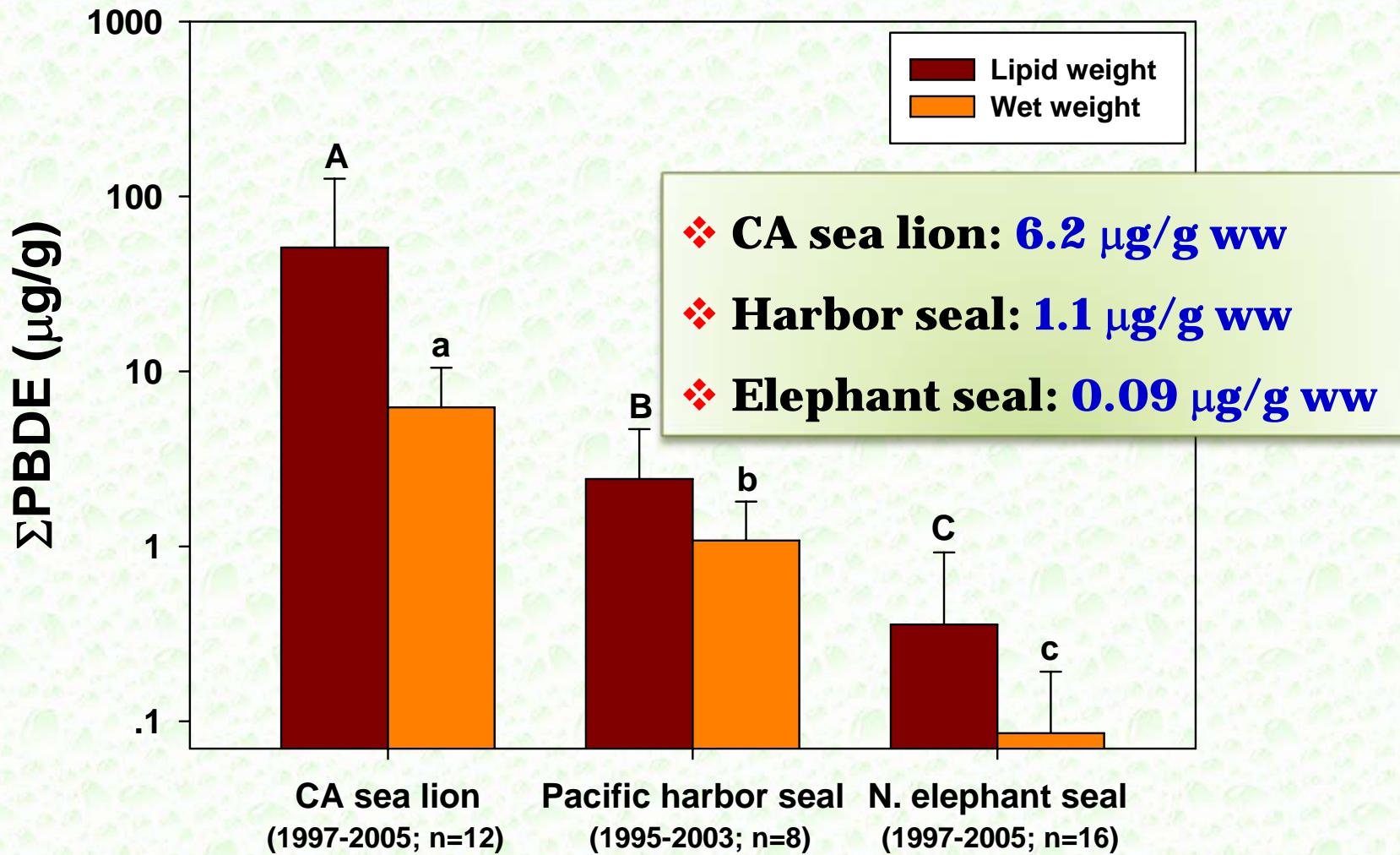
	Pup (M&F)	Yearling (M&F)	Subadult (M&F)	Adult (F)	Adult (M)
California sea lion (n = 63)	1997 (n = 1) 1998 (n = 1) 2000 (n = 3) 2001 (n = 1) 2003 (n = 3) 2004 (n = 2) 2005 (n = 1)	1996 (n = 1) 1997 (n = 3) 1998 (n = 1) 2000 (n = 1) 2001 (n = 1) 2003 (n = 3) 2004 (n = 3) 2005 (n = 3)	1997 (n = 2) 1998 (n = 3) 2000 (n = 3) 2001 (n = 1) 2003 (n = 1) 2004 (n = 3) 2005 (n = 2)	1997 (n = 3) 2000 (n = 3) 2001 (n = 3) 2003 (n = 2) 2004 (n = 3) 2005 (n = 1)	1994 (n = 2) 1998 (n = 1) 2004 (n = 1) 2006 (n = 1)
Pacific harbor seal (n = 9)	1995 (n = 3) 1997 (n = 1) 2001 (n = 2) 2003 (n = 2)	1998 (n = 1)			
Northern elephant seal (n = 16)	1997 (n = 2) 1998 (n = 1) 1999 (n = 1) 2000 (n = 3) 2001 (n = 3) 2004 (n = 3) 2005 (n = 3)				

Collaborators: CSULB

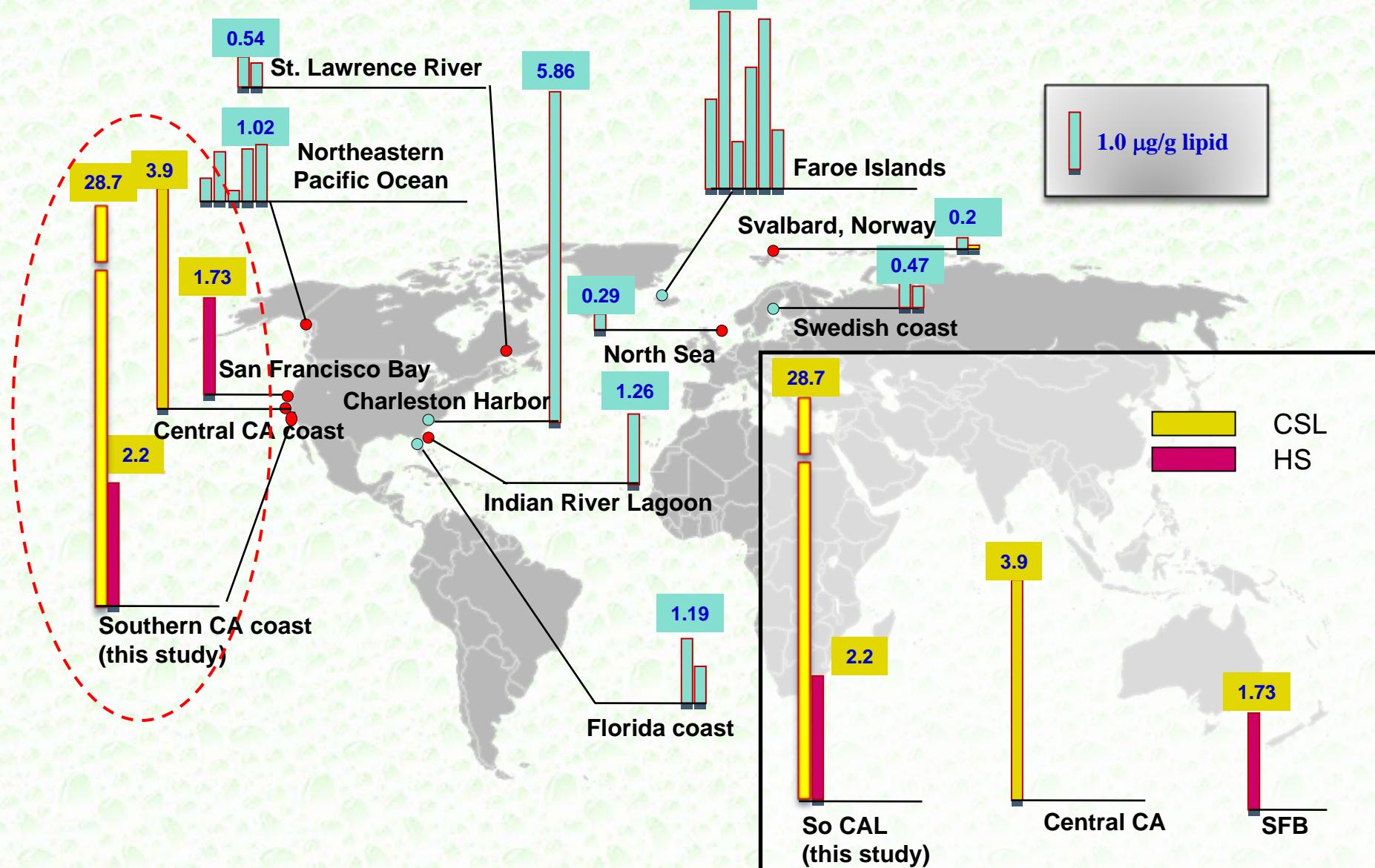
N= 88 (extracts)

Strandings blubber -- Fort MacArthur (LA)  
& Pacific (OC) Marine Mammal Centers

# PBDE levels by species



# A global perspective



# Toxic impacts -- ???

- *Very little known* on PBDE effects thresholds
  - Blood thyroid hormones vs. PBDEs in grey seal (Hall et al. 2003)
  - Evidence of immunosuppression in European porpoises (Beineke et al. 2007)
  - “No data on critical effects levels in wildlife” (Elliott et al. 2005)
- **No concentration thresholds available**

# Related Efforts

- Method development for CECs of regional interest
  - alkylphenols
  - alternative BFRs
- Distribution & input history of CECs in So Cal Bight
  - Surface & sediment cores
    - PBDEs (LACSD, NOAA)
    - PPCPs (NOAA, USGS)
  - Edible sportfish tissue (SFEI, Cal DFG & Cal EPA)
- **Prioritization for future research & monitoring**
  - NOAA Mussel Watch reconfiguration
  - Multiagency Workshop to guide management of CECs in CA
  - Blue Ribbon Panel on CECs in Recycled Water (SWRCB/CDPH)

# Thanks

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