

CEC Special Studies

**David Tsukada, Wenjian Lao,
Nathan Dodder, Keith Maruya**

**CECs in Coastal & Marine Ecosystems
Science Advisory Panel Meeting#2**

Sep 30, 2010



Southern California Study Sites

- Outfall
- Reference

full 2°
highest POPs

LA ●

City of Los Angeles

County of LA

full 2°
high POPs

PV ●

Orange County

1°/2°
mod POPs

OC ●

Dana Point

low POPs

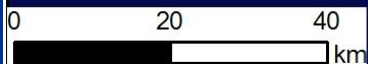
DP ●

- 16-82% fines; 0.43 – 2.5% TOC
- E1, E2 \leq 0.6 ng/g dw
- 4-nonylphenol: 120-3200 ng/g dw

San Diego

adv 1°
mod/low POPs

SD ●



Previous evidence of endocrine disruption

In 2003, **11 out of 89** male flatfish (two species) collected throughout SoCalBight identified as having oocytes in testis

Species	StationID	ID	POTW Zone	Original Description
English sole	4038	2	LACSD	Testis-ova
English sole	4038	8	LACSD	Testis-ova
English sole	4086	4	LA/ LACSD	Testis-ova
English sole	4137	1	OC	Testis-ova
English sole	4154	3	OC	Testis-ova
English sole	4154	4	OC	Testis-ova
Hornyhead turbot	4041	3	OC	Testis-ova
Hornyhead turbot	4041	4	OC	Testis-ova
Hornyhead turbot	4042	12	LACSD	Testis-ova
Hornyhead turbot	4045	7	LA	Testis-ova
Hornyhead turbot	4070	10	LACSD	Testis-ova

Re-analysis of gonad histopathology

Species	StationID	ID	POTW Zone	Original Description	Revised Description	Basis For Revision
English sole	4038	2	LACSD	Testis-ova	Normal	Oocyte contamination in testis
English sole	4038	8	LACSD	Testis-ova	Normal	Oocyte contamination in testis
English sole	4086	4	LA/ LACSD	Testis-ova	Normal	Oocyte contamination in testis
English sole	4137	1	OC	Testis-ova	Normal	Oocyte contamination in testis
English sole	4154	3	OC	Testis-ova	Normal	Oocyte contamination in testis
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Hornyhead turbot	4041	3	OC	Testis-ova	Normal	Oocyte contamination in testis
Hornyhead turbot	4041	4	OC	Testis-ova	Normal	Oocyte contamination in testis
Hornyhead turbot	4042	12	LACSD	Testis-ova	Probable testis-ova	-
Hornyhead turbot	4045	7	LA	Testis-ova	Equivocal testis-ova	Structural detail is not clear
Hornyhead turbot	4070	10	LACSD	Testis-ova	Probable testis-ova	-

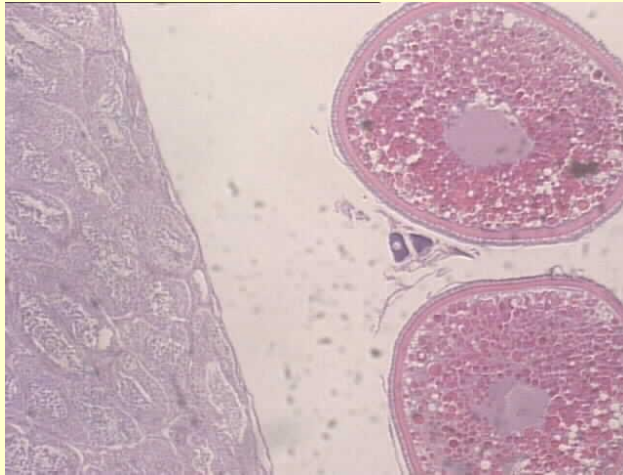
All slides from 2003 study re-examined by NOAA/NFSC (M. Myers)

Most observations of oocytes in testis due to contamination during sampling or slide preparation

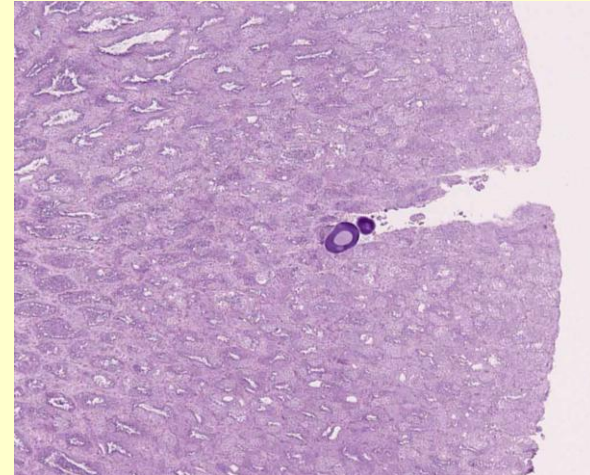
2 cases of testis-ova in hornyhead turbot confirmed; 1 possible

Oocyte Contamination

2003

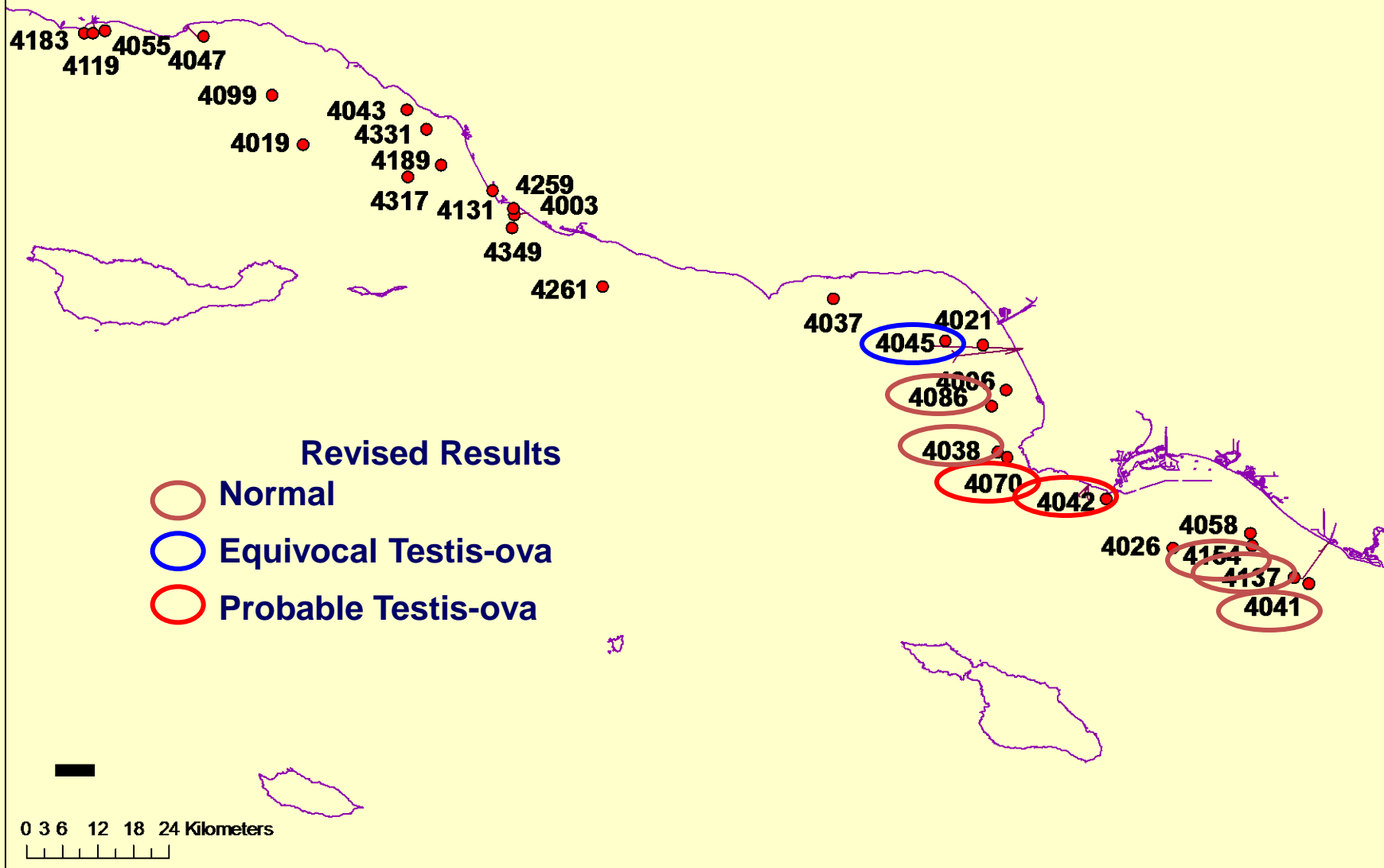


2006



- Oocytes in ducts or tissue tears/voids, ***not integrated into testis structure***
- 2006 example of testis-ova (**1 of 373 males**) also suspect (under review)

Bight 2003 Stations



What CECs occur in stormwater?

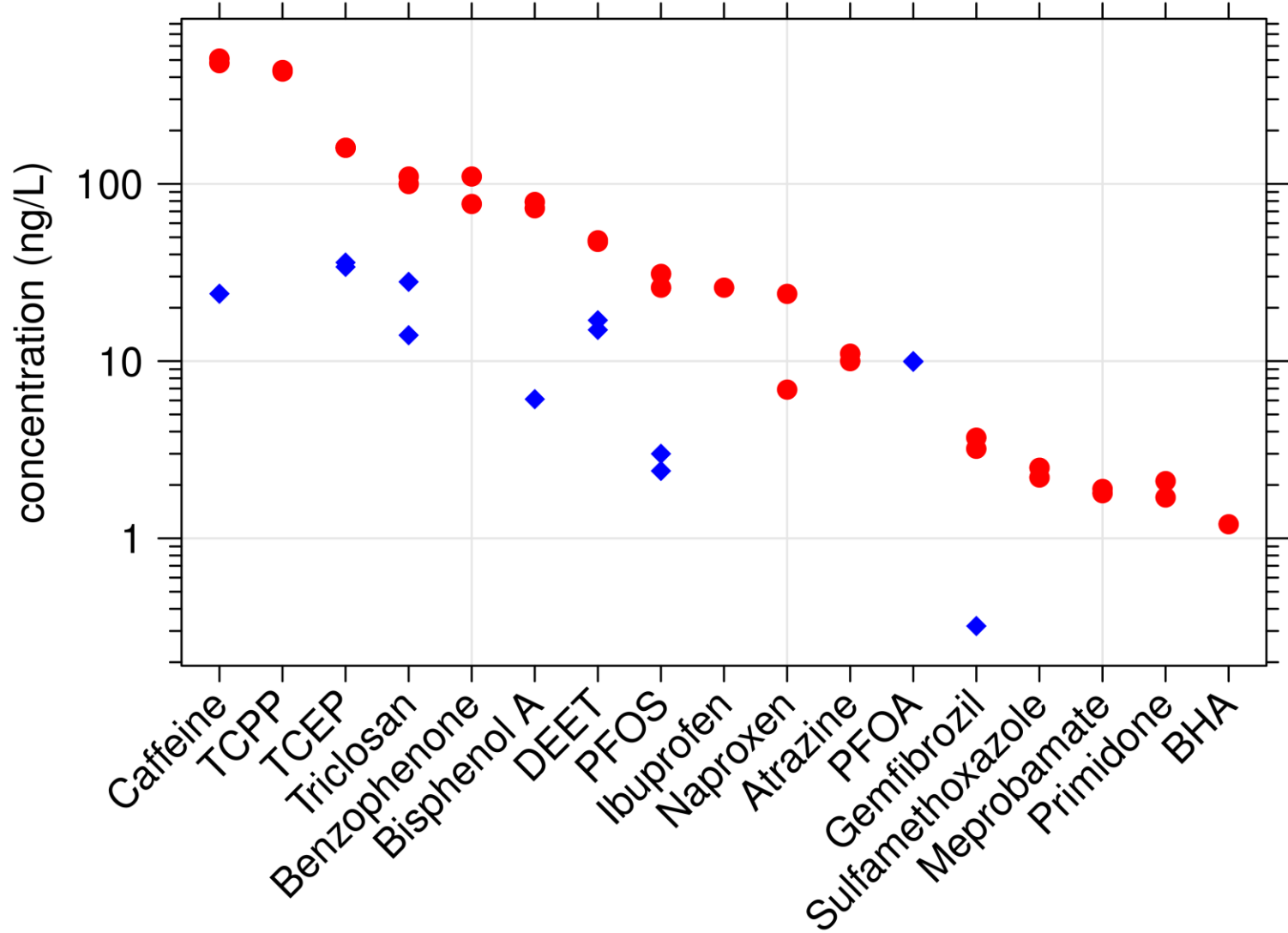


Stormwater methods

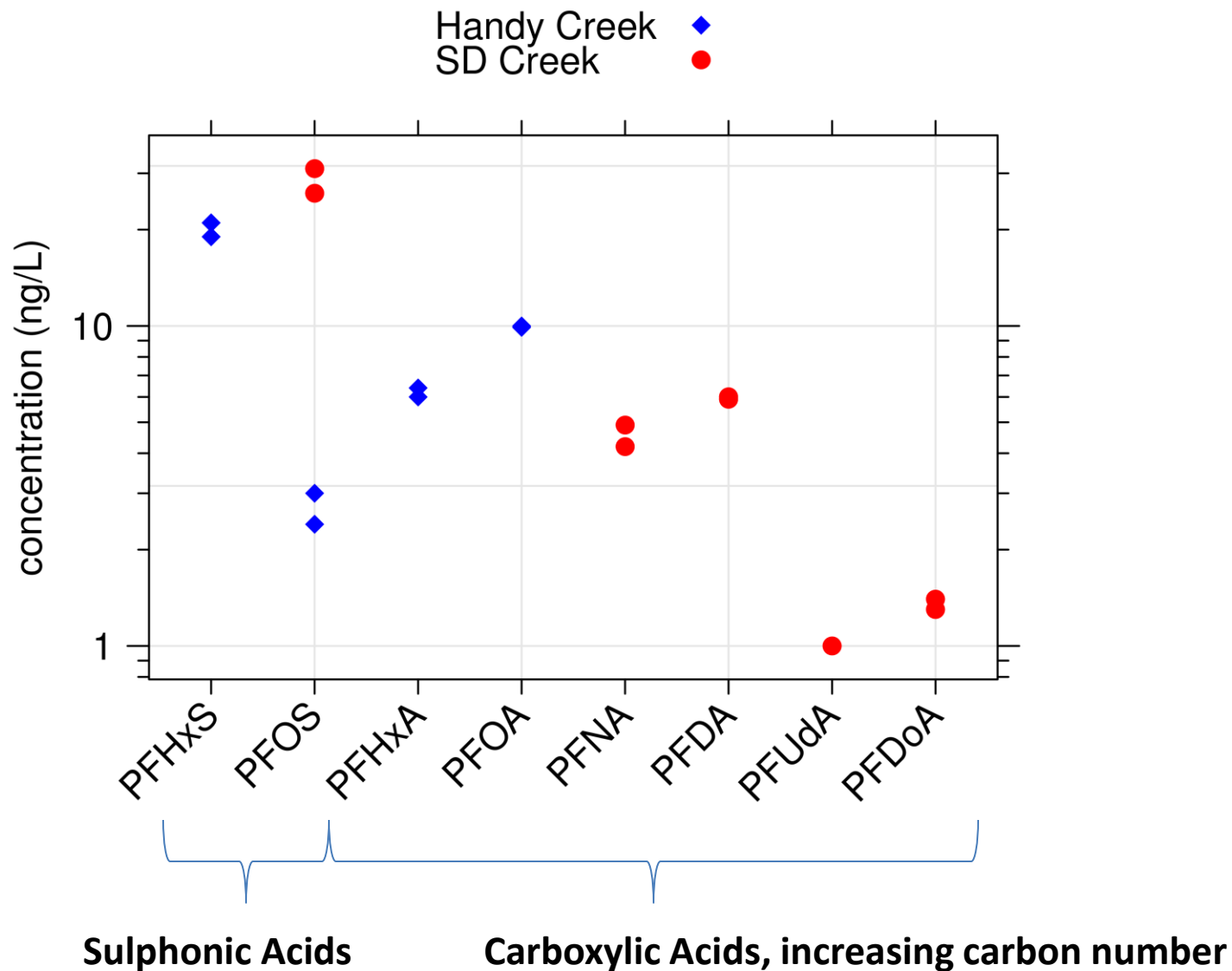
- **Grab samples (1 L) collected during March 2010 storm**
 - analyzed by Southern Nevada Watershed Authority for PPCPs, PFCs
- **Passive sampling devices (PSDs) deployed for 22 d in between storm events (March-April 2010)**
 - Solid phase microextraction (SPME) and polyethylene (PE)
 - Polar compound integrated sampler (POCIS)



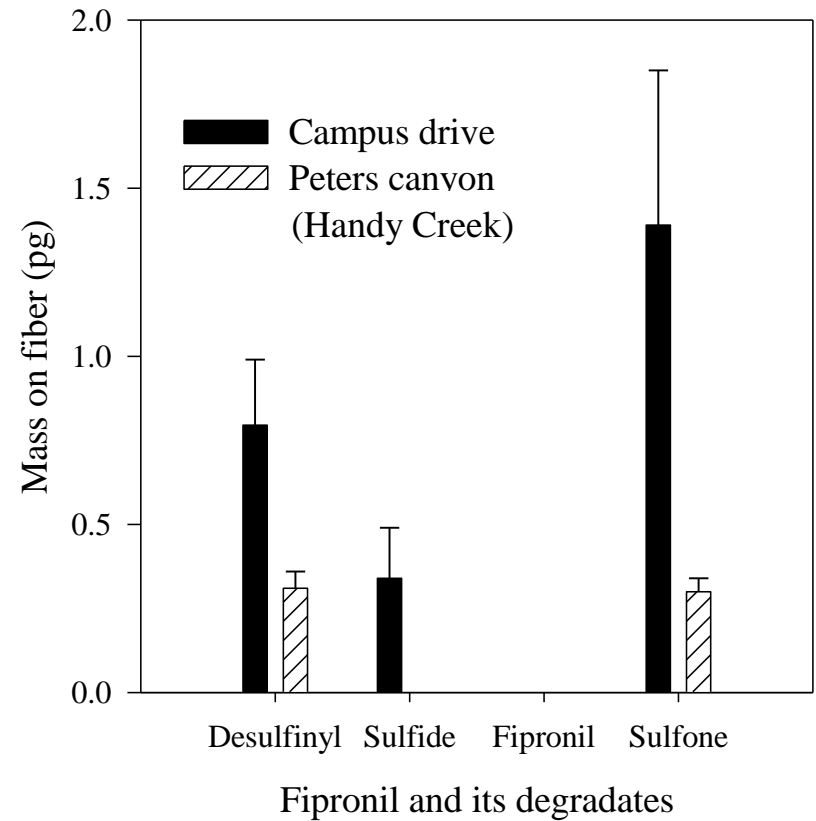
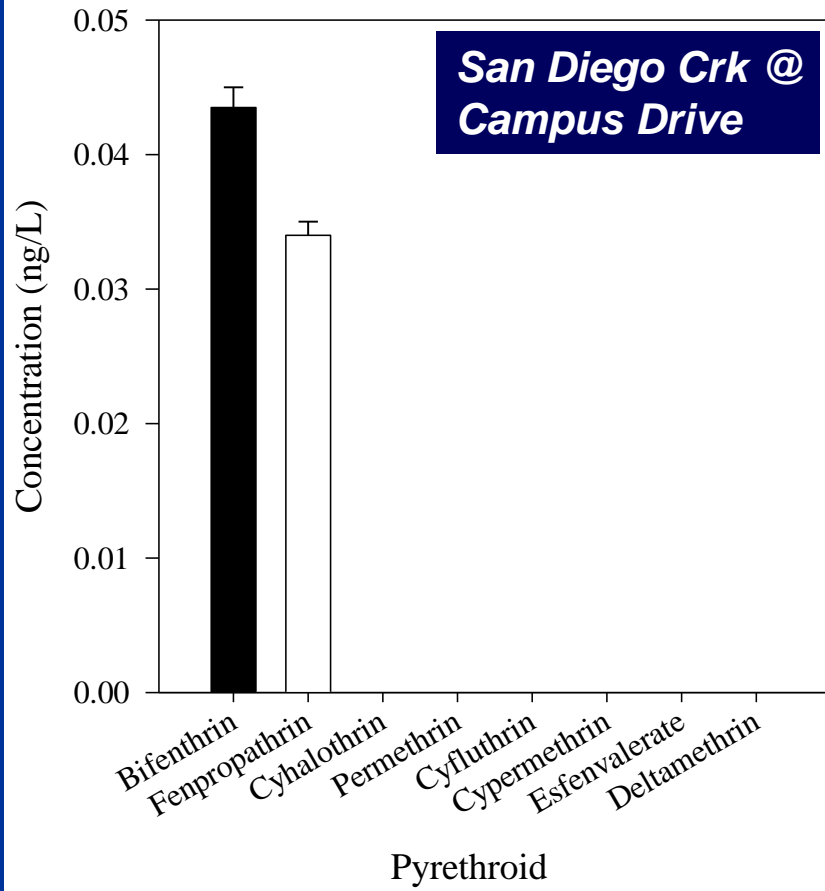
Handy Creek ◆
SD Creek ●



Storm water, 1L grab

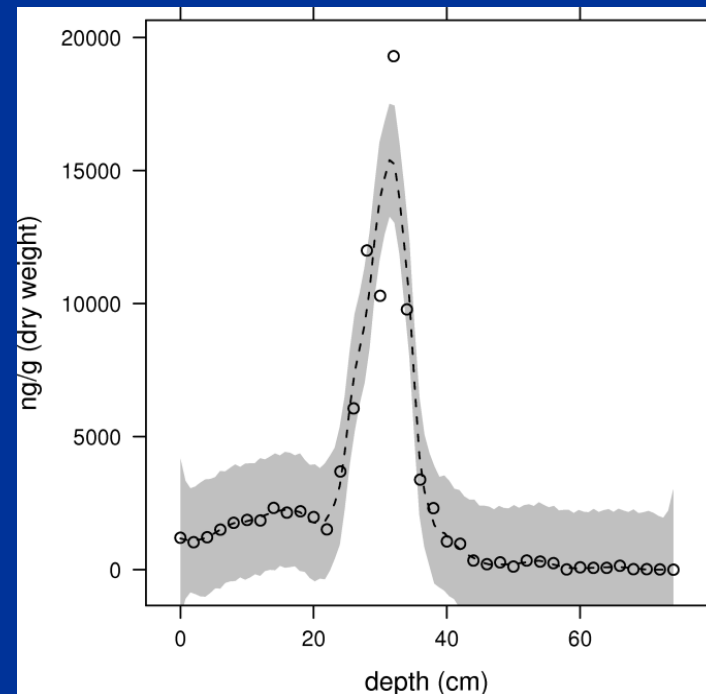


SPME results for current use pesticides

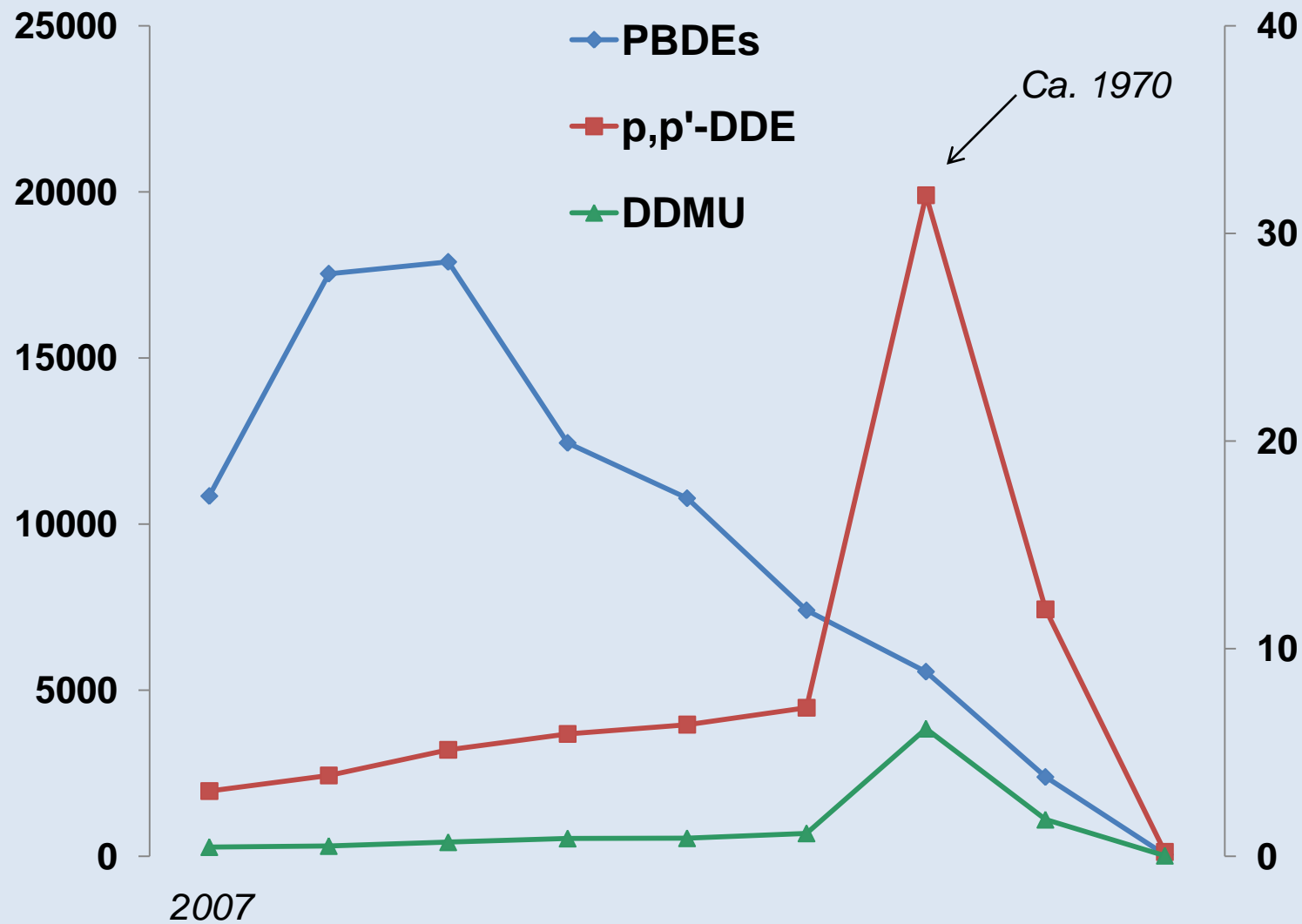


Sediment record of CECs

- **LACSD collected cores on Palos Verdes Shelf in 2007**
 - station 3C exhibited well preserved deposition record & relatively low interfering contaminant levels
- **Frozen core slices (2 cm) composited into 9 time horizons dating back to pre-1950**
- **Samples analyzed for**
 - PPCPs and alkyl-phenols by Axys
 - current use pesticides & PBDEs by SCCWRP



DDT Concentration (ng/g)



Core Horizon

ΣPBDE Concentration (ng/g)

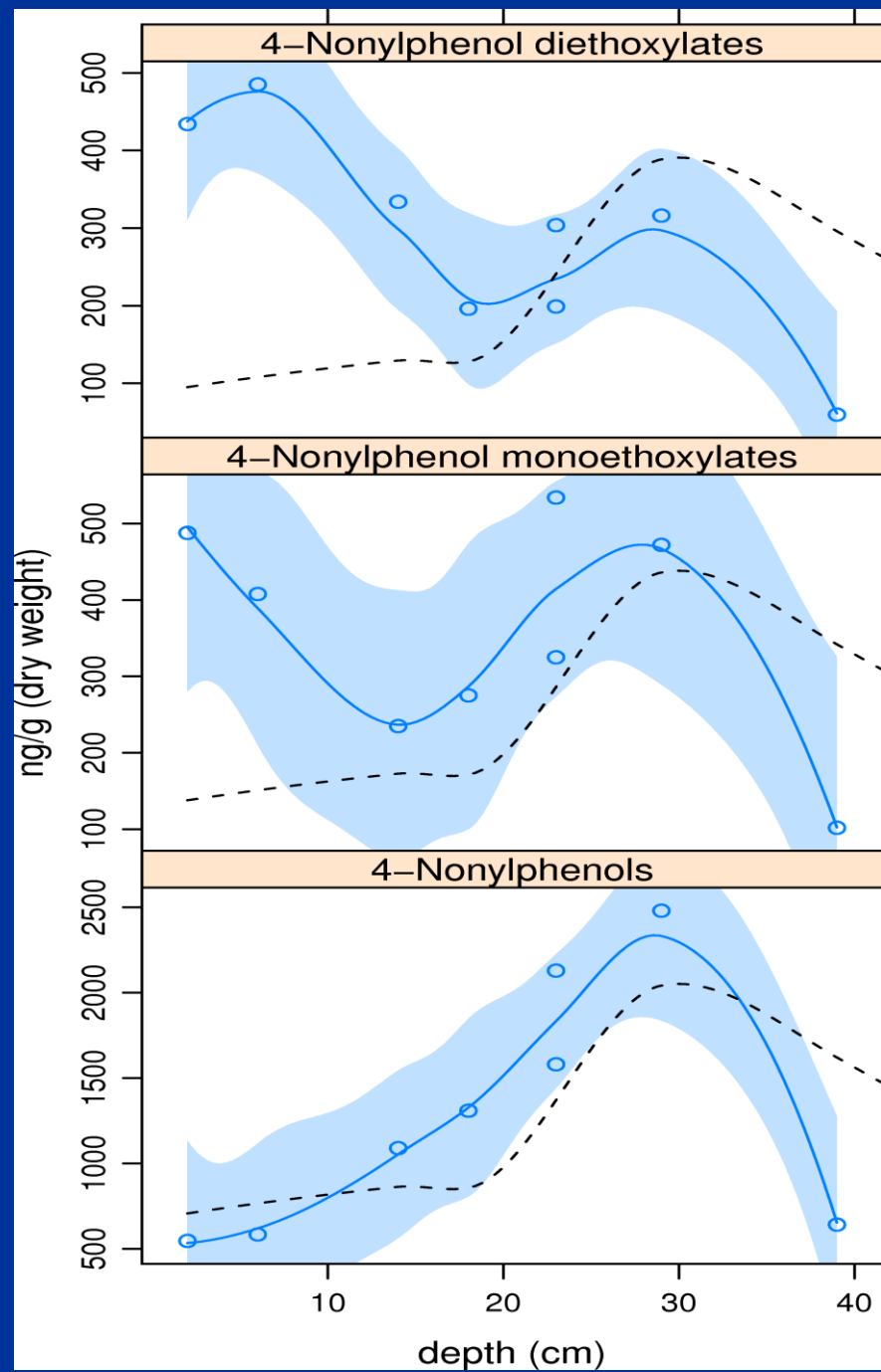
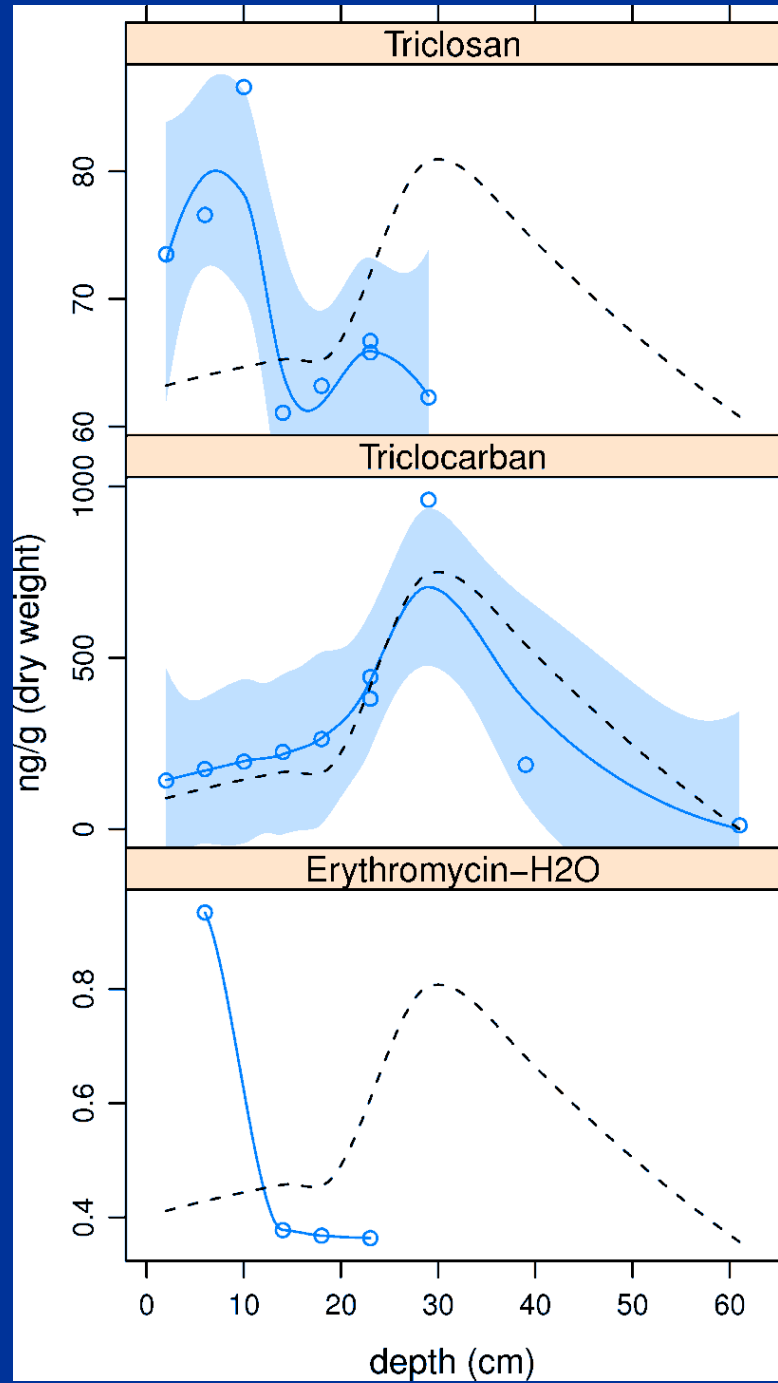
San Diego

LA Harbor-Long Beach

N=38	Σ PBDE (ng/g dry)	%BDE 209
Min	<1.0	26
Max	149	100
Mean	29.4	88
SD	30	14

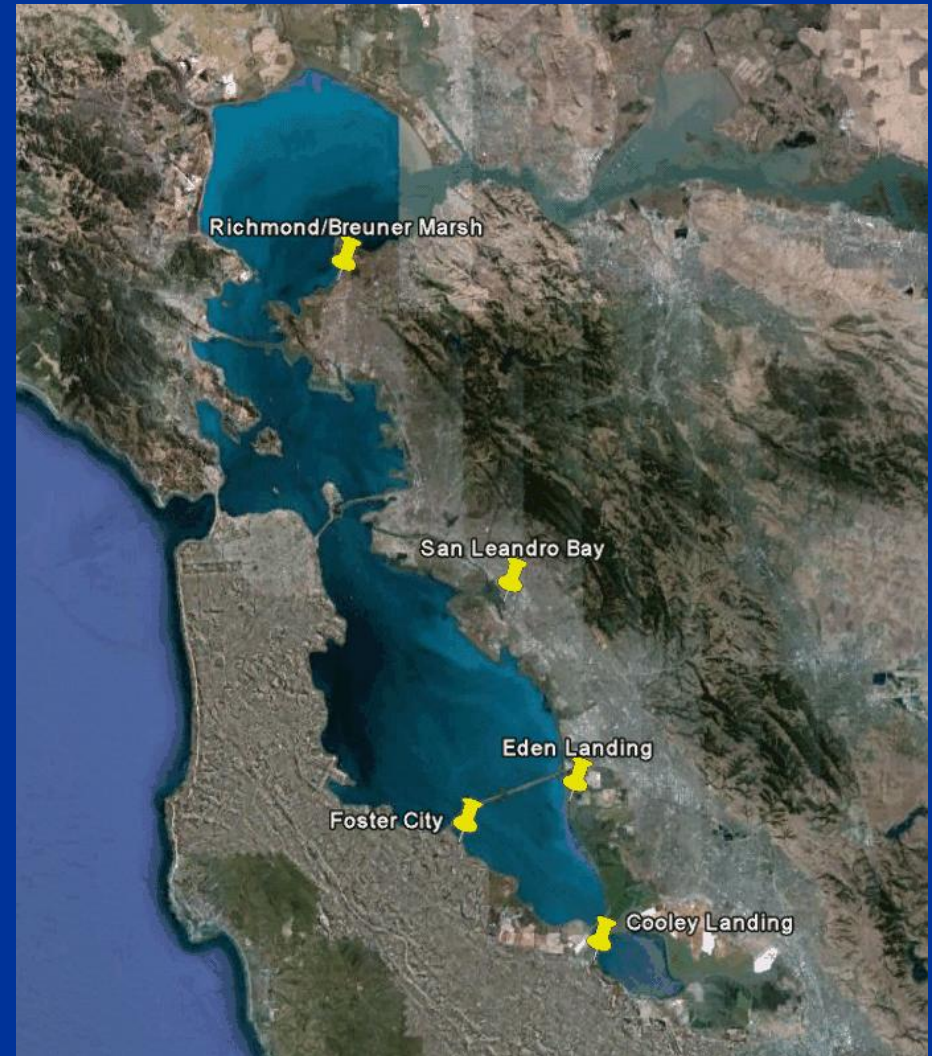


**Bight 08 special study data
courtesy of NOAA & TDI Brooks**



San Francisco Estuary Pilot Study

- SFEI - Axys partnership
- Water, sediment, mussels from 5 sites in 2009
- PPCPs, AP/APEOs, PFCs
- Guide target analyte selection statewide
- *Which CECs accumulate in sediments? mussels?*



17 PPCPs Detected in Mussels

Compound (# sites detected)	Use	ng/g wet wt	
		Max	Mean
<i>Diethyl-3-methyl-benzamide, N,N- (DEET) (5)</i>	<i>insect repellent</i>	14	7
<i>Digoxigenin (3)</i>	<i>cardiac drug metabolite</i>	10	5
<i>Carbamazepine (5)</i>	<i>anticonvulsant</i>	5	3
<i>Amphetamine (3)</i>	<i>stimulant</i>	4	1
<i>Triclocarban (2)</i>	<i>antimicrobial</i>	2	0.5
<i>Sertraline (5)</i>	<i>antidepressant</i>	1	0.5
<i>Dehydronifedipine (5)</i>	<i>antianginal</i>	0.7	0.4
<i>Triamterine (3)</i>	<i>antihypertensive</i>	0.6	0.2
<i>Ranitidine (3)</i>	<i>antacid</i>	0.4	0.2
<i>Diphenhydramine (3)</i>	<i>antihistamine</i>	0.3	0.2
<i>Atenolol (1)</i>	<i>beta blocker</i>	0.3	0.1
<i>Cocaine (2)</i>	<i>stimulant</i>	0.3	0.1
<i>Amitryptiline (2)</i>	<i>antidepressant</i>	0.2	0.1
<i>Sulphamethizole (1)</i>	<i>antibiotic</i>	0.2	0.04
<i>Erythromycin-H2O (4)</i>	<i>erythromycin metabolite</i>	0.2	0.1
<i>Enalapril (2)</i>	<i>antihypertensive</i>	0.1	0.04
<i>Diltiazem (2)</i>	<i>antianginal</i>	0.1	0.04

PFC Tissue Results (ng/g wet wt.)

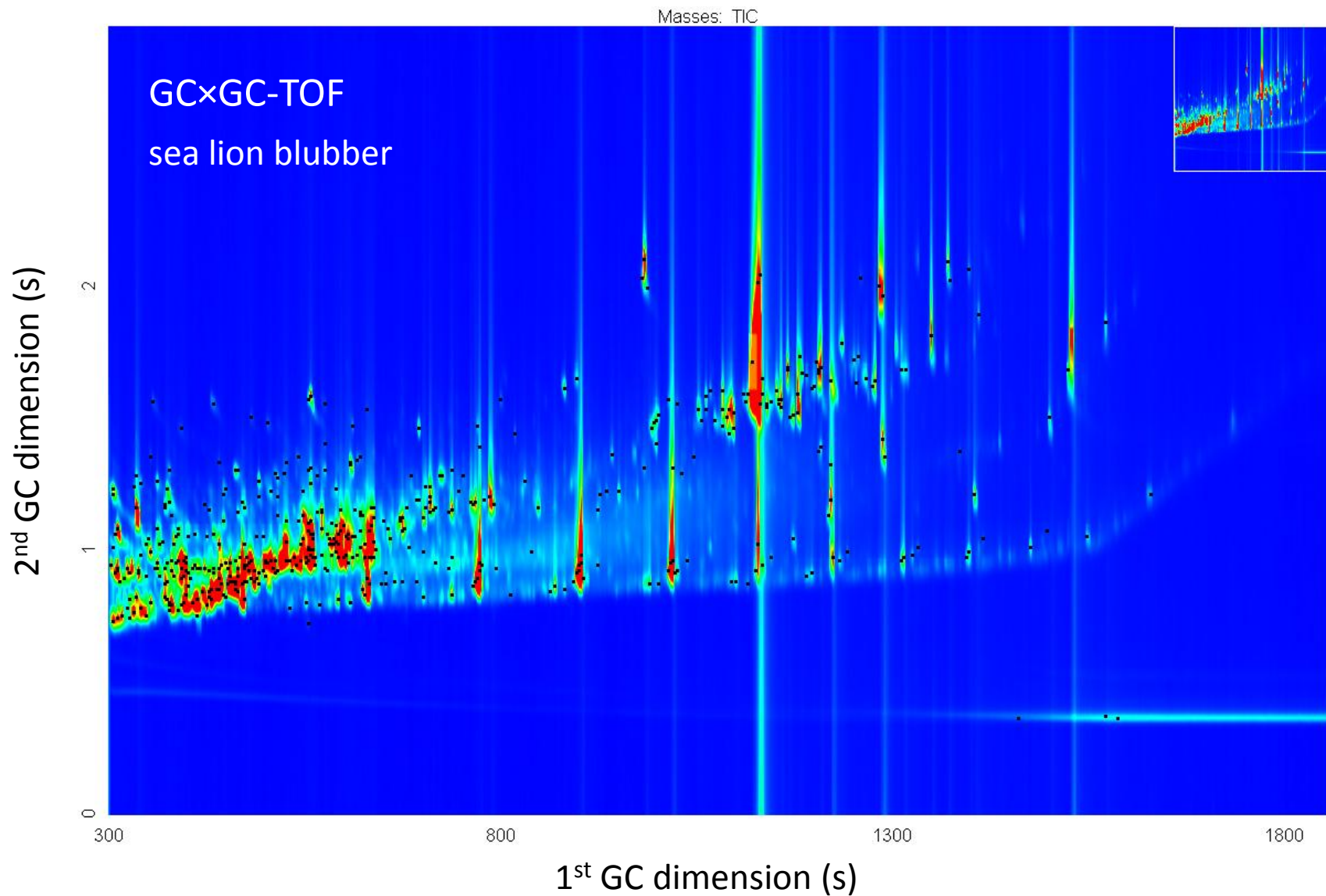
ANALYTE	# Detect n = 5	Minimum ng/g	Maximum ng/g
PFBA	1	ND (2.3 – 2.5) n	2.965
PFPeA	0	ND (2.3)	ND (2.5)
PFH_xA	0	ND (2.3)	ND (2.5)
PFHpA	0	ND (2.3)	ND (2.5)
PFOA	0	ND (2.3)	ND (2.5)
PFNA	0	ND (2.3)	ND (2.5)
PFDA	0	ND (2.3)	ND (2.5)
PFUnA	1	ND (2.3)	ND (2.5)
PFDoA	0	ND (2.3)	ND (2.5)
PFBS	0	ND (4.5)	ND (4.9)
PFH_xS	1	ND (4.5)	5.1
PFOS	1	ND (4.5)	76.2
PFOSA	0	ND (2.3)	ND (2.5)

Alkyl-phenols

Analyte	Foster City	Cooley Landing	San Leandro Bay	Eden Landing	Richmond
NP	81	75	90	95	56
NPEO1	<=18	<=31	41	<=17	<=19
NPEO2	<=23	69	192	<=5	81
OP	ND	ND	ND	ND	ND

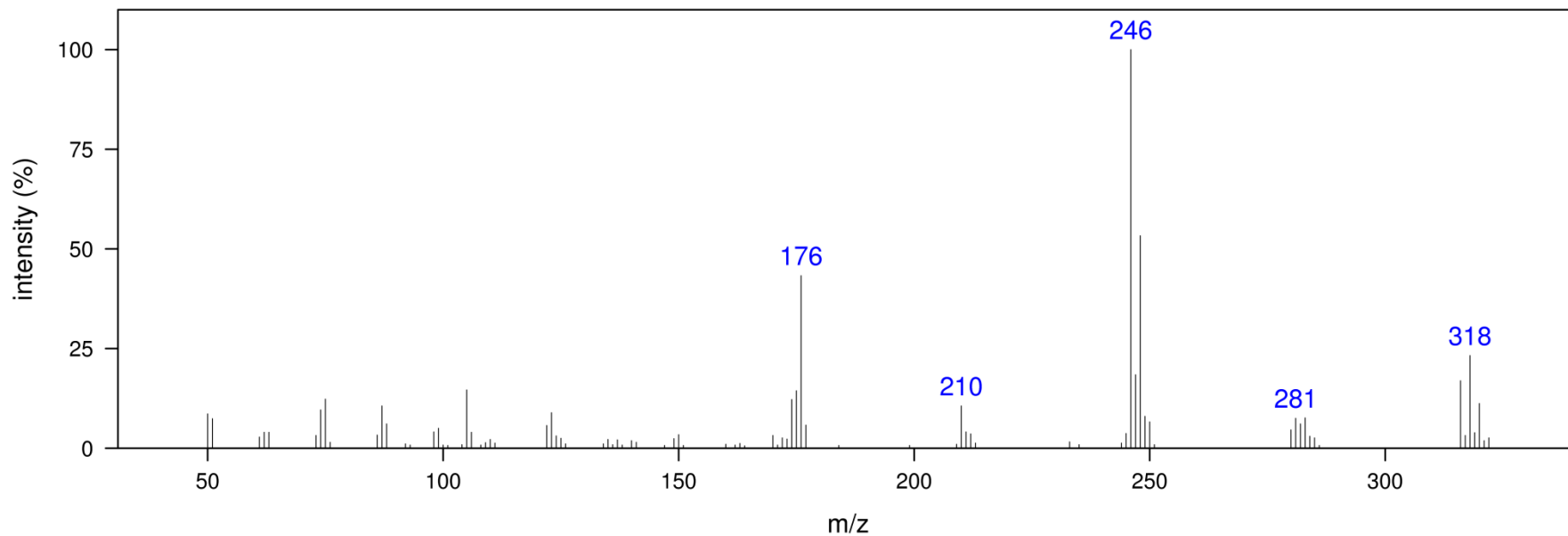
In units of ng/g wet tissue; <= blank impacted estimate

Untargeted Analysis by GC×GC-TOF

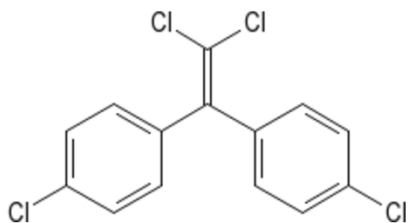


Untargeted Analysis by GC×GC-TOF

DDE electron impact mass spectrum

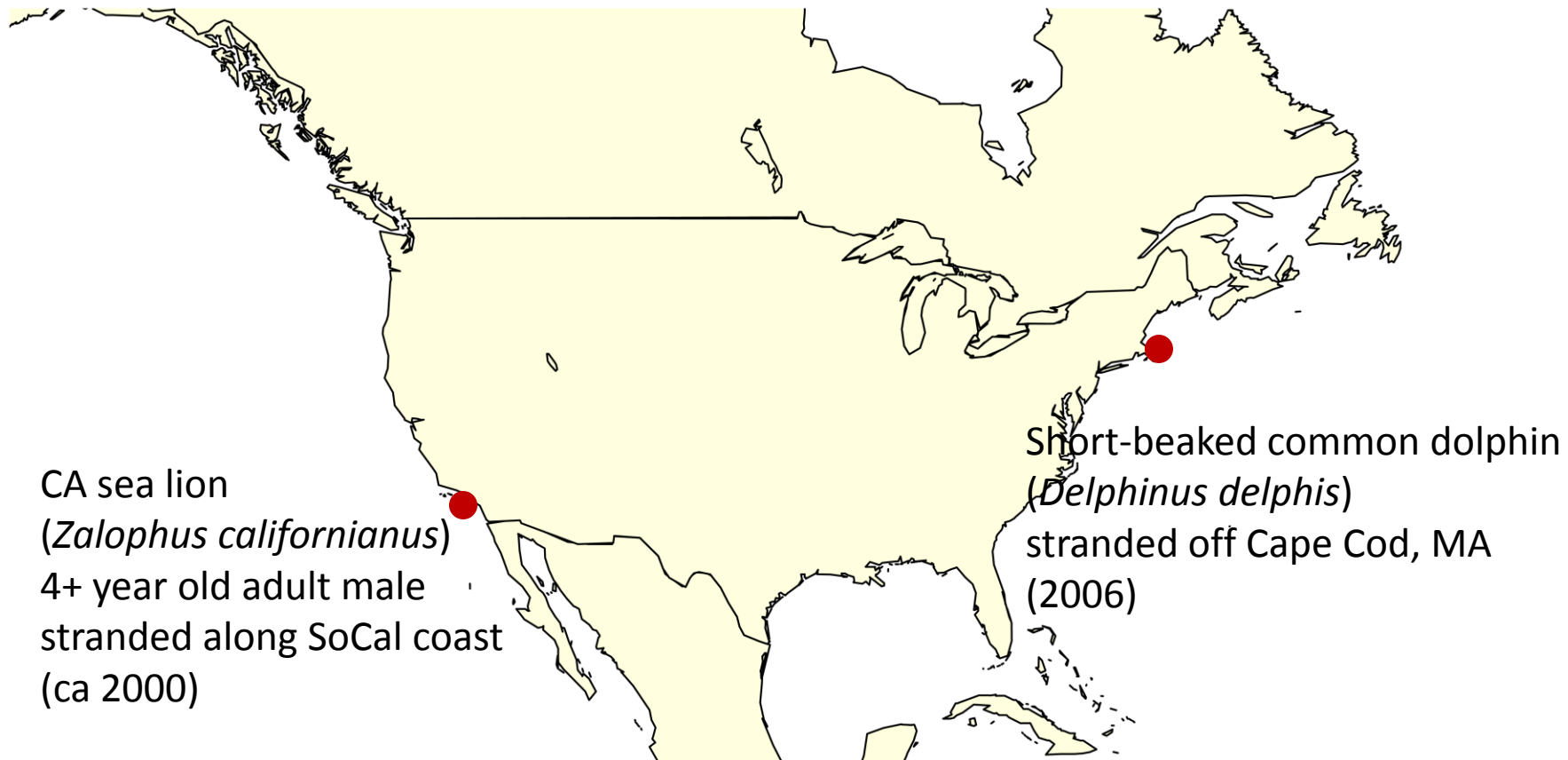


DDE



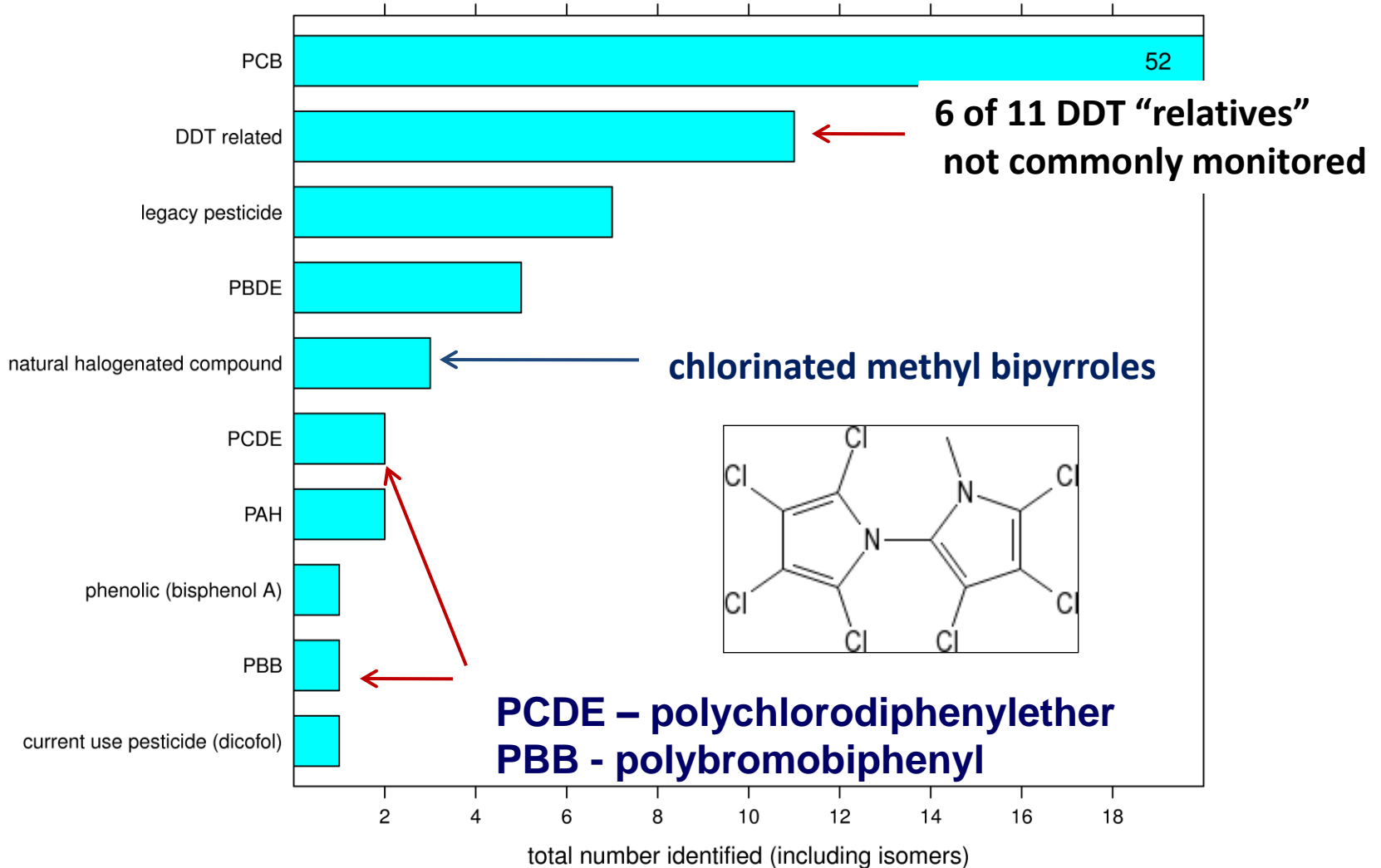
Peak m/z	Identity
176	[M-4Cl] ⁺
211	[M-3Cl] ⁺
246	[M-2Cl] ⁺
280	[M-Cl] ⁺
316	M ⁺

Study design – compare west coast pinniped vs. east coast cetacean to develop the instrumental and computational methods, and initial “broad-scan” spectral database

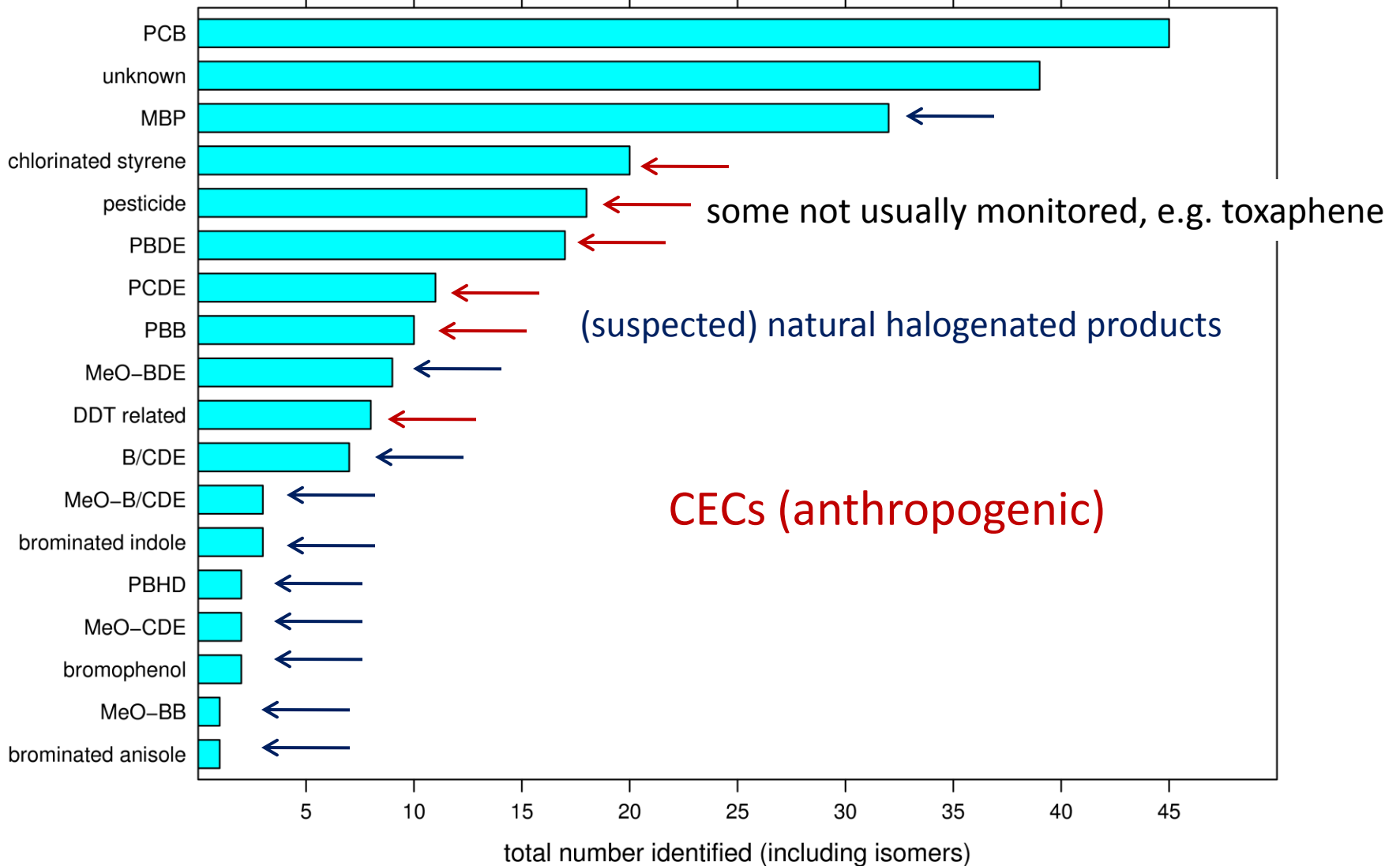


CA sea lion blubber

85 compounds identified to date



MA Dolphin Blubber – number of compounds identified (230 total)



Summary & Conclusions

- Low incidence of intersex in So Cal Bight flatfish
- Snapshot of stormwater: CECs present at <1 to 510 ng/L
 - Land use impacts “downstream” site
- Sediment record shows recent input of PBDEs & some but not all PPCPs, AP/APEOs
- Mussel tissue from SF Bay show elevated AP/APEOs
- Untargeted analysis can identify persistent, bioaccumulative chemicals not routinely measured

Next steps

- Compile & analyze results for
 - POCIS at San Diego Creek stormwater sites (Jan 2011)
 - archived mussel tissue (November 2010)
 - targeted CECs in marine mammal tissue (April 2011)
- Monitor progress/results from related CEC studies
 - Relationship between chemistry & biomolecular assay results
 - Mussel Watch CA Pilot Study (early 2011)
 - Broadscan analysis of marine mammal tissue
- Collate and analyze results for Panel (future meetings)
- Publish findings

Acknowledgments

- David & Lucile Packard Foundation
- Collaborators
 - SCCWRP Member Agencies (LACSD)
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- SCCWRP Staff