The Regional Watershed Spreadsheet Model: A Tool for Estimating Regional Loads

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Presenting on work developed by:

The Small Tributaries Loading Strategy Workgroup

BASMAA * SFEI * SF Bay Water Board

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10. Improved Loads Estimates

9. Simple to understand model

inputs:

watersheds

soils

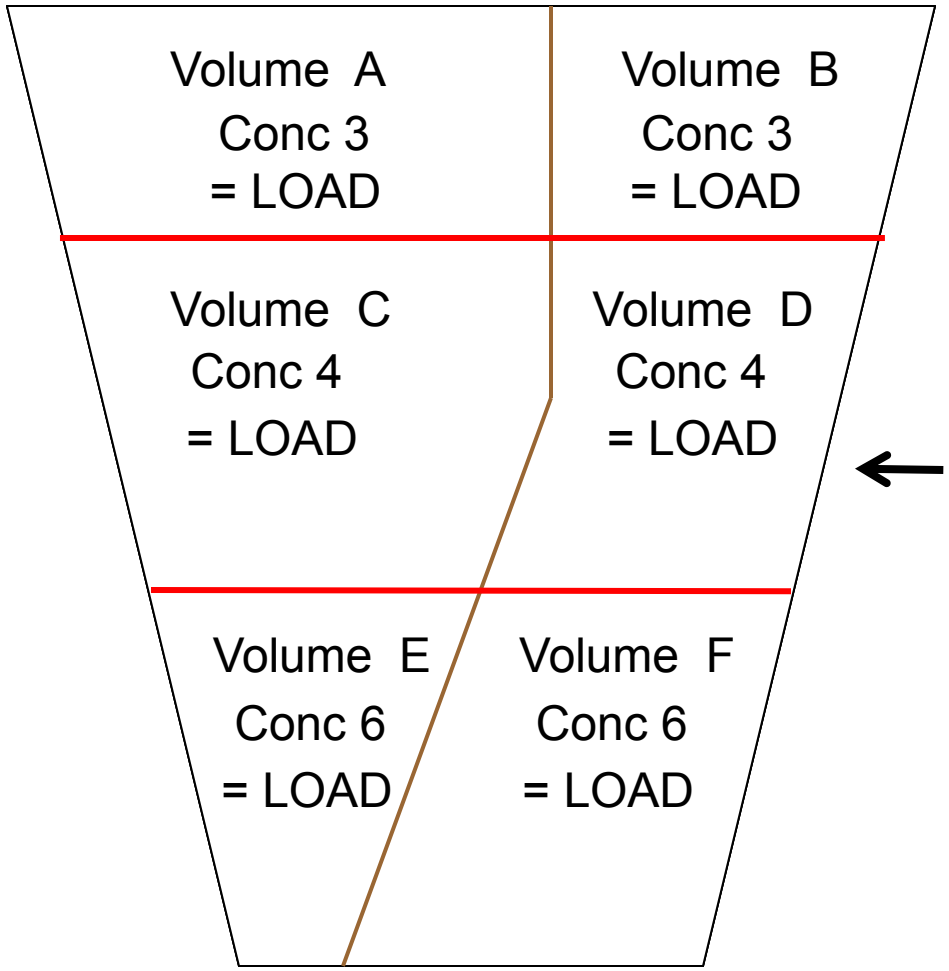
land use

slope

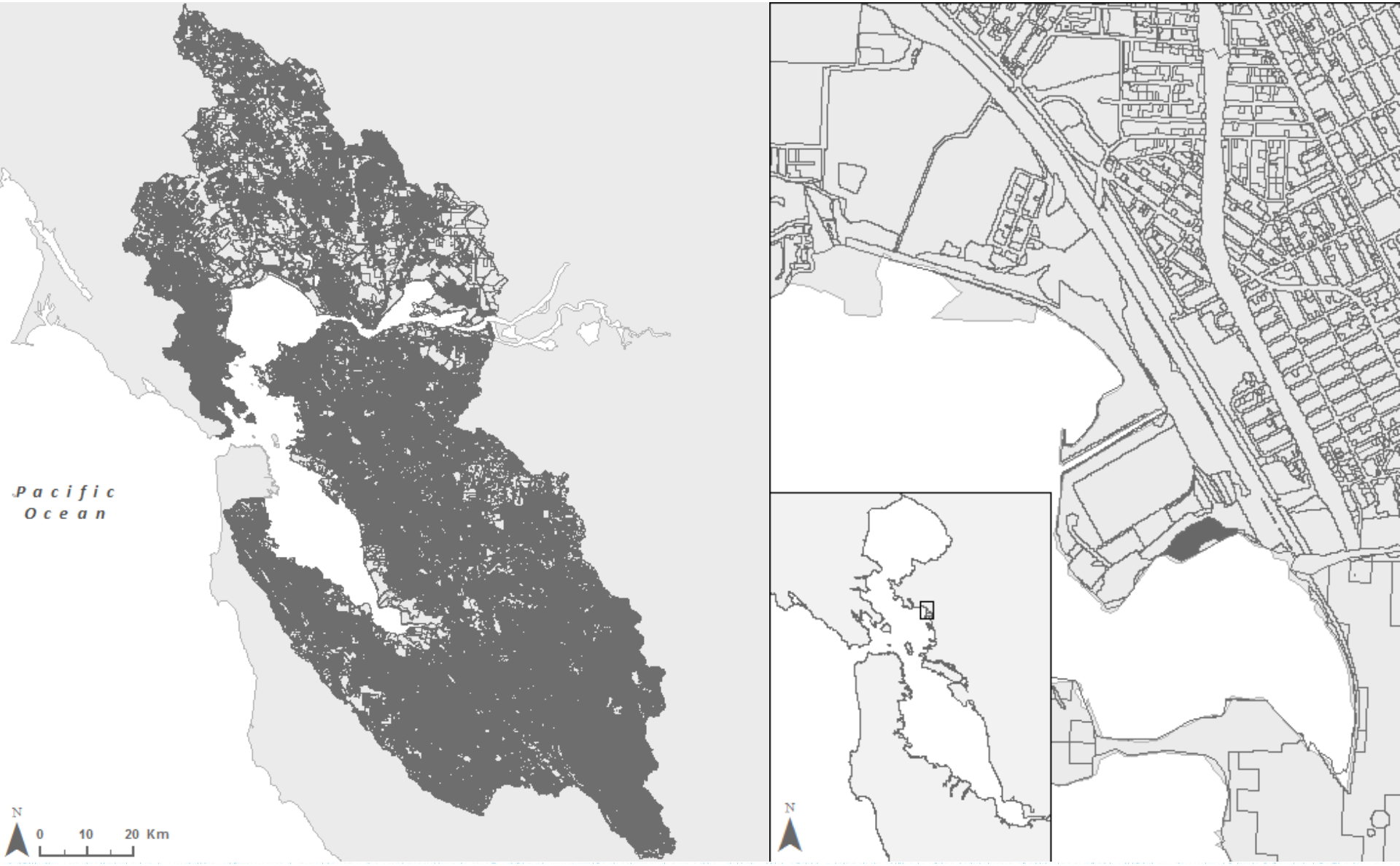
runoff coefficient lookup table

precipitation

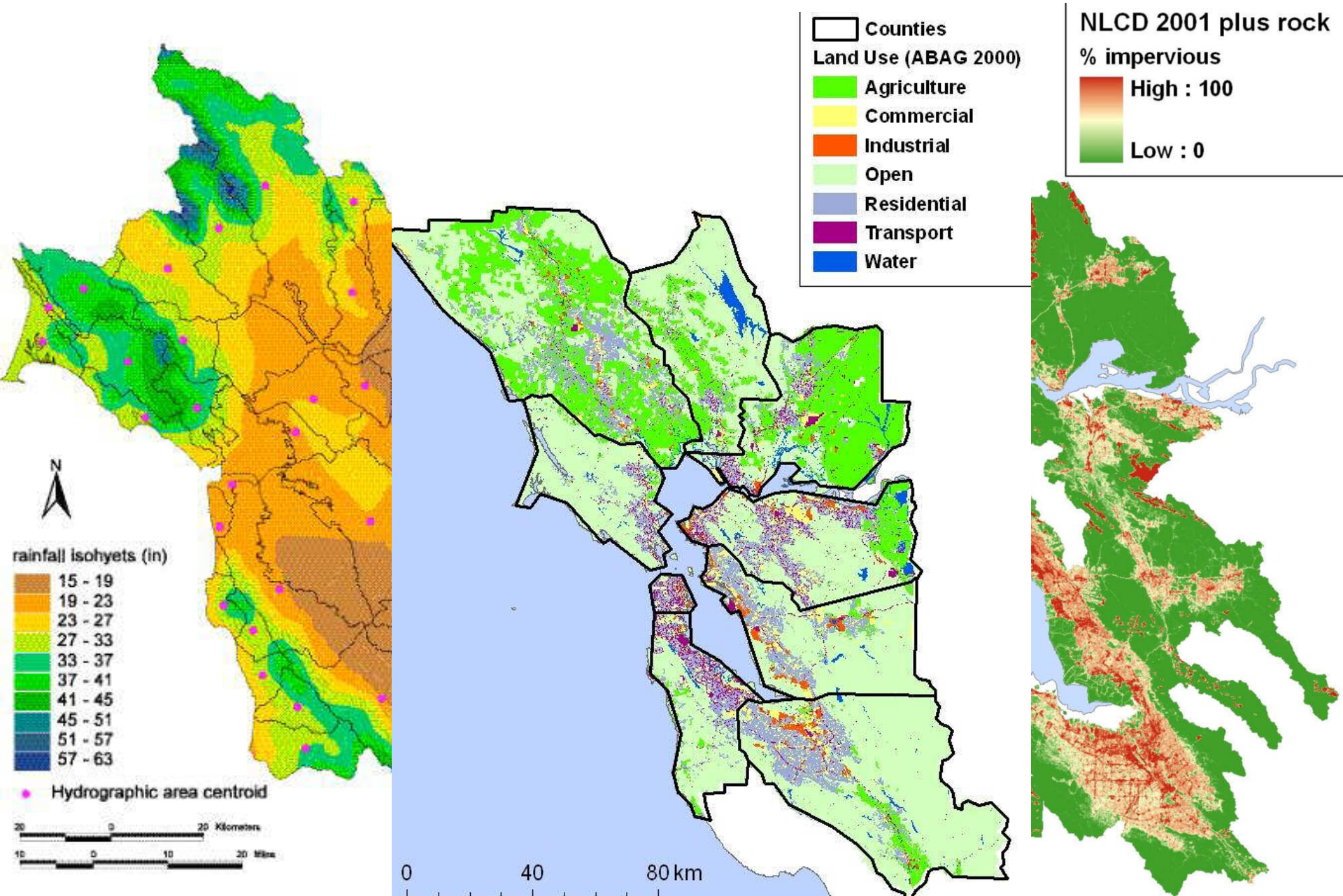
mean concentration lookup table



Land Use	Mean Conc
1	9
2	15
3	30
4	30
5	20
6	50
7	50
Slp 2	
Soil B	0.58

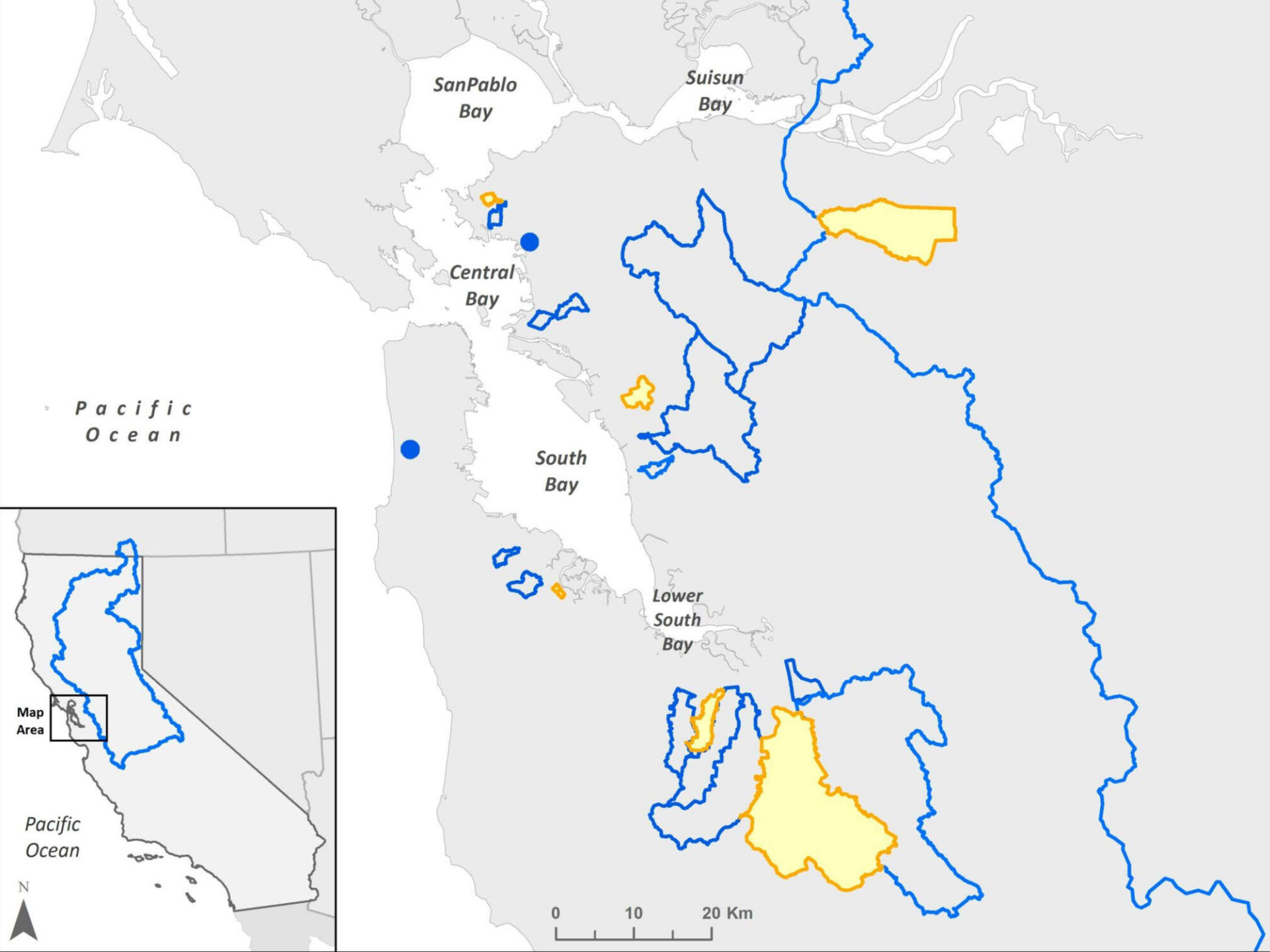

Pacific
Ocean
N
0 10 20 Km
N

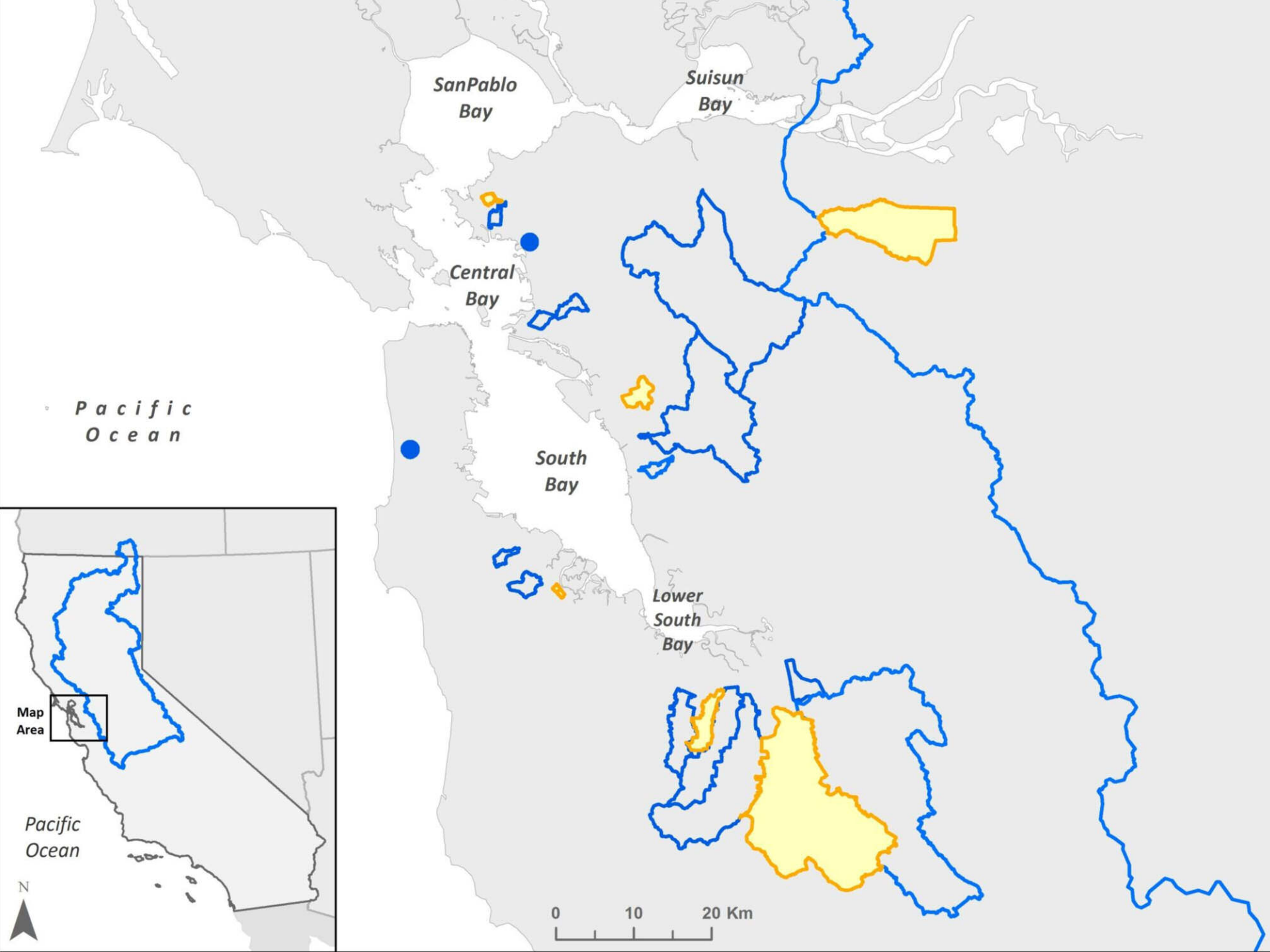
8. Much of the data is already developed



7. Creating Spatial Data Sources

1) Electrical Transformers
2) Military Areas
3) Drum Recycling
4) Cement Production
5) Crematoria
6) Oil Refineries/petrochemicals
7) Metals manufacture
8) Rail Transport
9) Shipping Transport
10) Metals Recycling
11) Auto Recycling
12) Old Industrial Areas
13) Power Plants


SanPablo Bay
Suisun Bay
Central Bay
South Bay
Lower South Bay
Pacific Ocean
Map Area
Pacific Ocean
N
0
10
20 Km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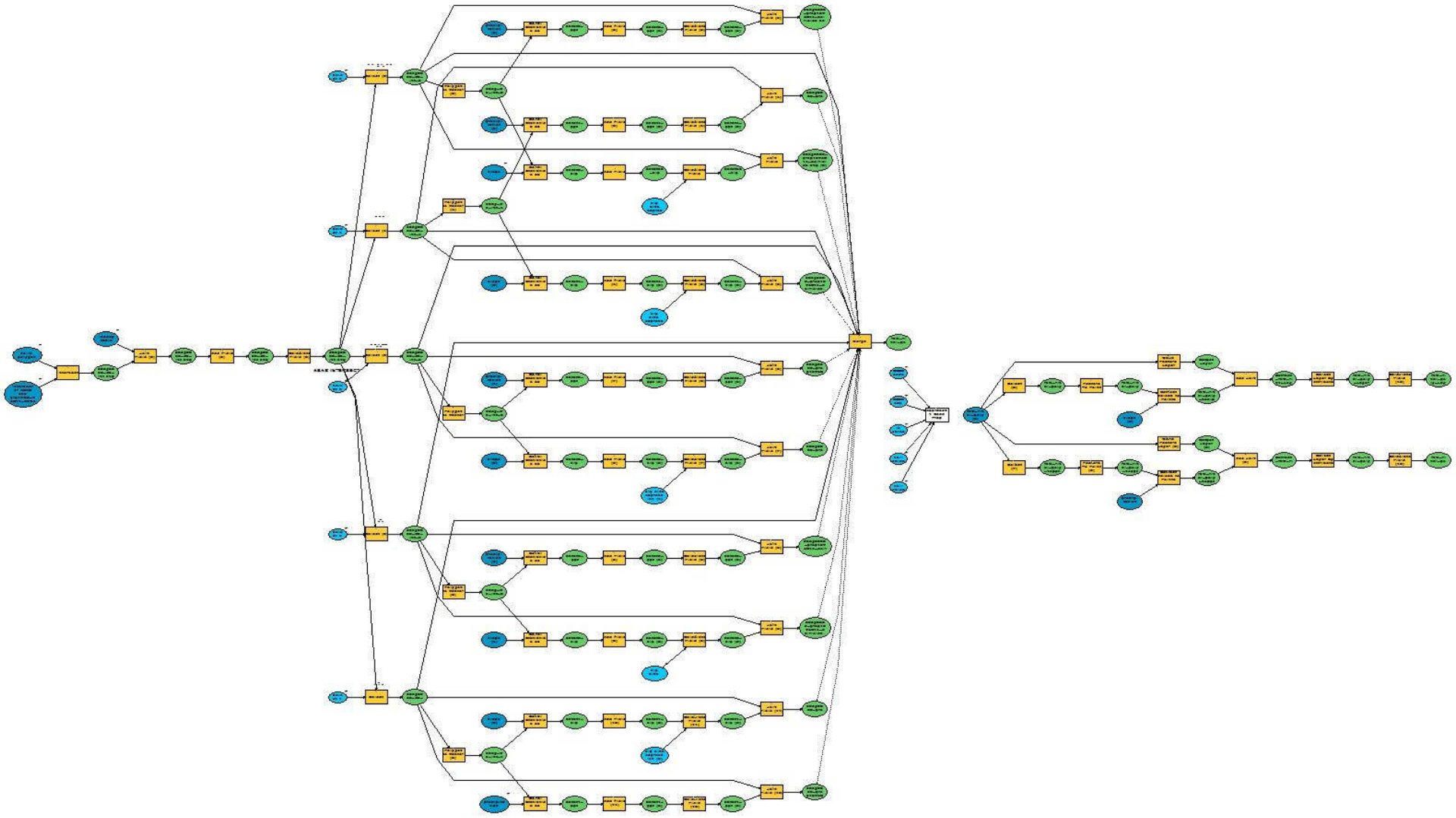
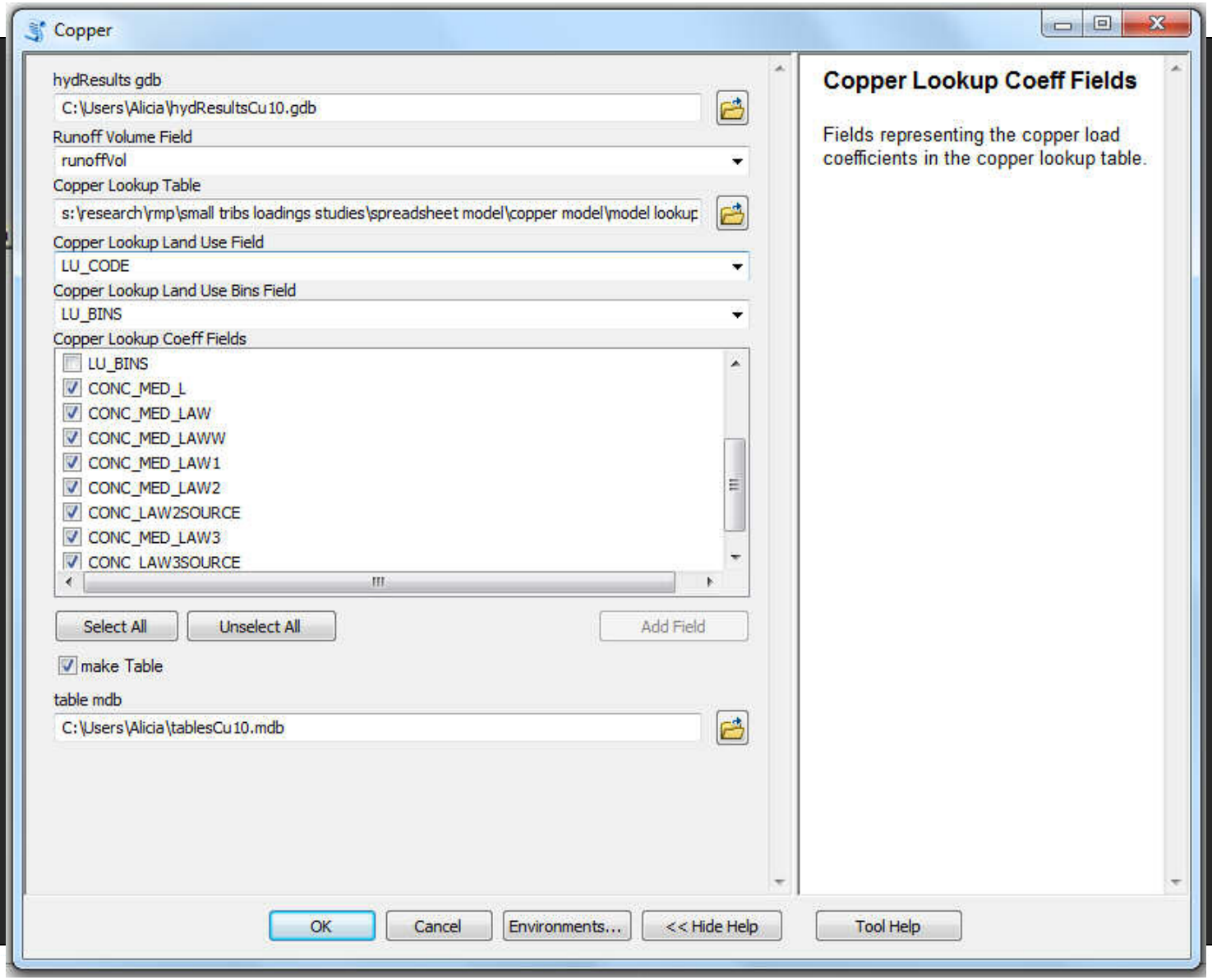
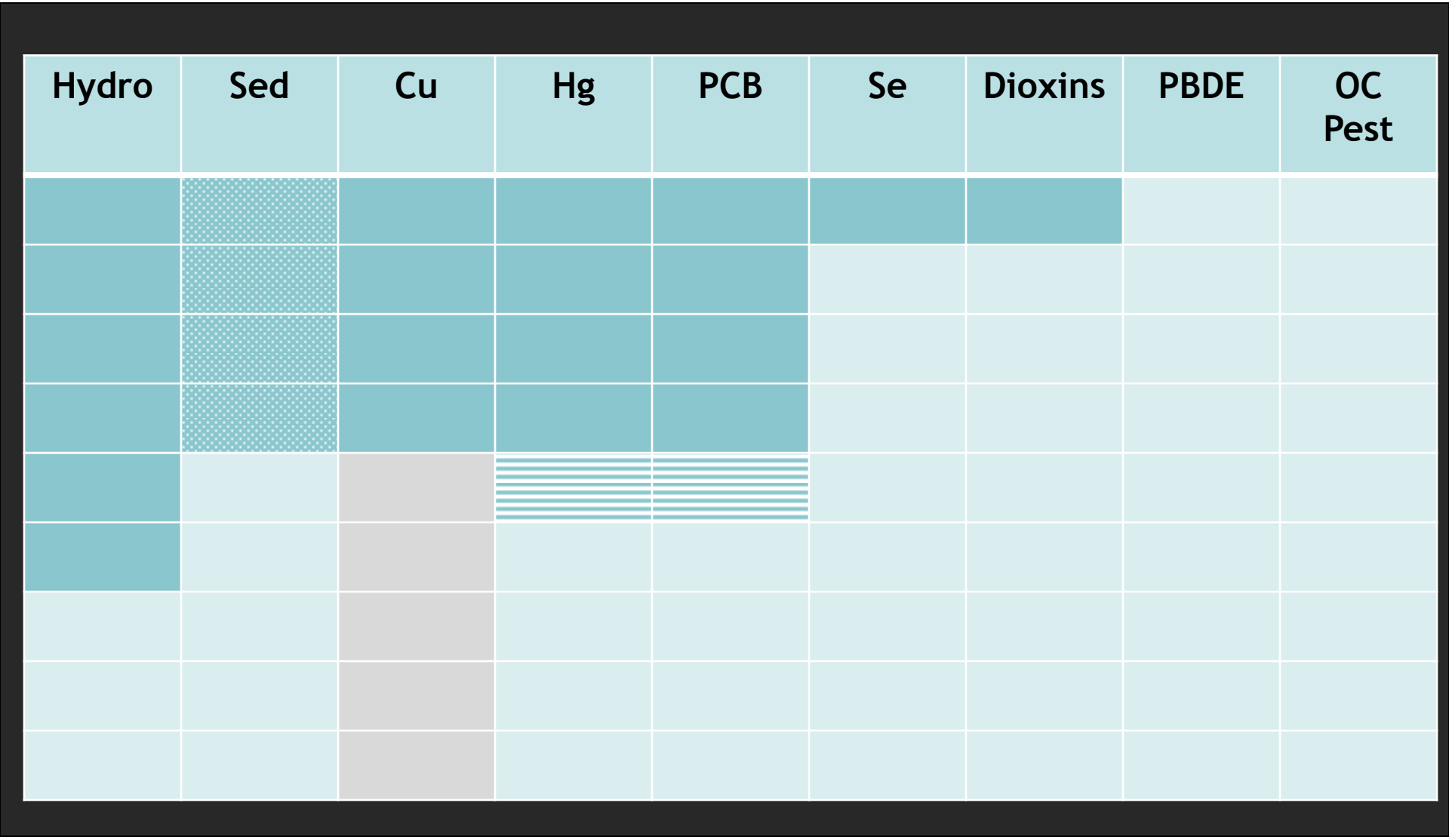


4. Simple User Interface + Flexibility



3. The RWSM has a plan

2. We've already completed some of this plan…



And the # 1 reason to be excited about the RWSM is….

1. Compliance with the MRP

- **C.11/12.g Monitor Stormwater Pollutant Loads and Loads Reduced**
- **C.14.a Control Program for PBDEs, Legacy Pesticides, and Selenium**
- **C.8.e Pollutants of Concern and Long-Term Trends Monitoring**
- **C.8.g Reporting**

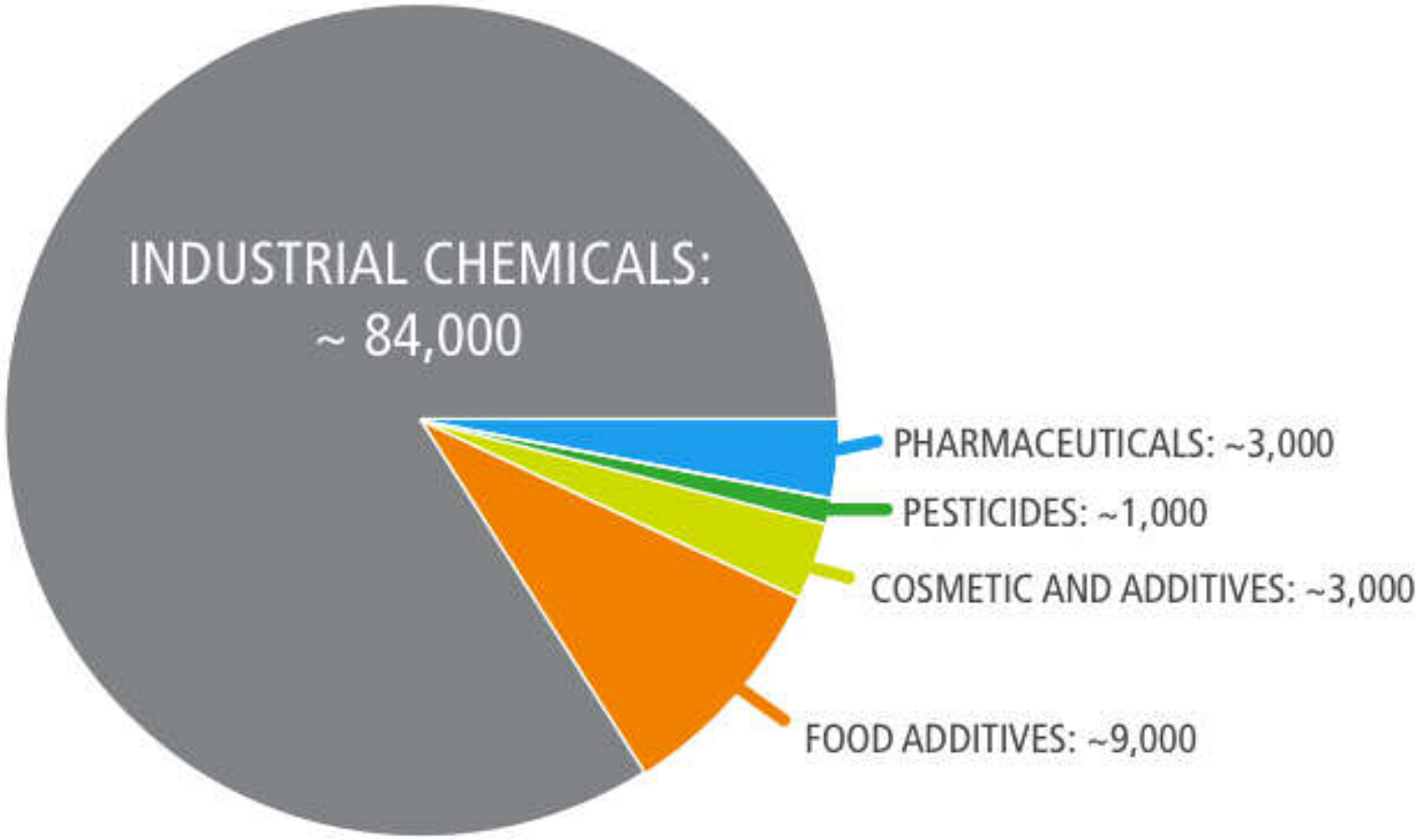
= **HAPPY** BASMAA Reps …..
and Water Board Regulators

Contaminants of Emerging Concern: Synthesis and Strategy

Presentation at 2012 RMP Annual Meeting

Meg Sedlak

The Universe of Chemicals to Monitor



Risk-based Approach to CECs

- Occurrence
  - Detected elsewhere
  - High volume/high production chemical
- Toxicity
- Fate
- BPJ
- Review by Workgroup, TRC, & SC

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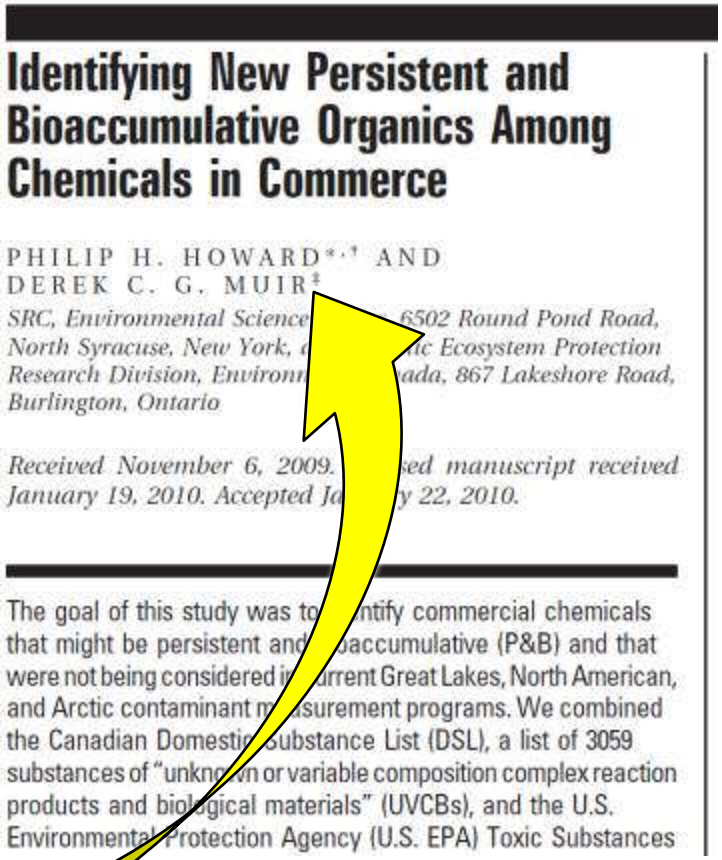


Identifying New Persistent and Bioaccumulative Organics Among Chemicals in Commerce

PHILIP H. HOWARD*,† AND DEREK C. G. MUIR‡

SRC, Environmental Science … 6502 Round Pond Road, North Syracuse, New York, … ic Ecosystem Protection Research Division, Environ… ada, 867 Lakeshore Road, Burlington, Ontario

Received November 6, 2009. …ed manuscript received January 19, 2010. Accepted Ja… y 22, 2010.

The goal of this study was to …ntify commercial chemicals that might be persistent and …accumulative (P&B) and that were not being considered i… urrent Great Lakes, North American, and Arctic contaminant m…asurement programs. We combined the Canadian Domesti… Substance List (DSL), a list of 3059 substances of "unkn…vn or variable composition complex reaction products and biological materials" (UVCBs), and the U.S. Environmental Protection Agency (U.S. EPA) Toxic Substances

610

Examples of emerging contaminants evaluated by RMP

- Able to leverage a lot of pro bono work
- Pharmaceuticals and Personal Care Products
- Alkylphenols
- Flame retardants
- Perfluorinated chemicals
- Current use pesticides
- Chlorinated paraffins

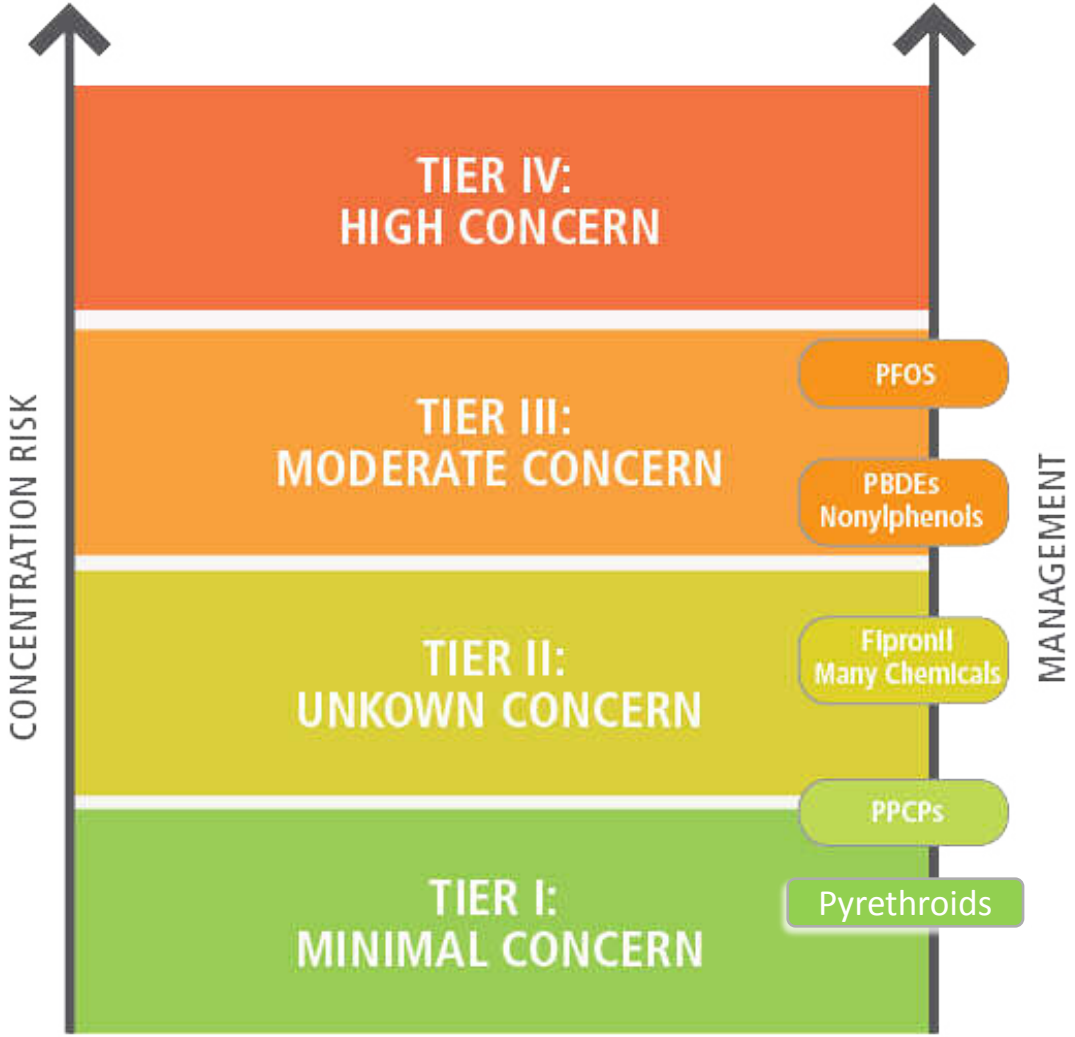
State Panel List for Estuaries

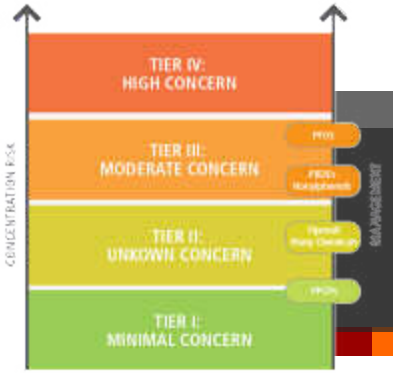
Table 1. CECs identified by the Advisory Panel for monitoring in coastal embayments

Surface waters	Sediments	Tissue
17-beta estradiol (hormone)	Bifenthrin (pesticide)	PBDEs 47, 99 (flame retardants)
Estrone (hormone)	Permethrin (pesticide)	PFOS (PFC)
Bisphenol A (PPCP)	PBDEs 47, 99 (flame retardants)	
HHCB - Galaxolide (PPCP)	PFOS (PFC)	

- ✓ Bifenthrin (pesticide)
- ✓ Permethrin (pesticide)
- Chlorpyrifos (pesticide)

Synthesis of Results to Date

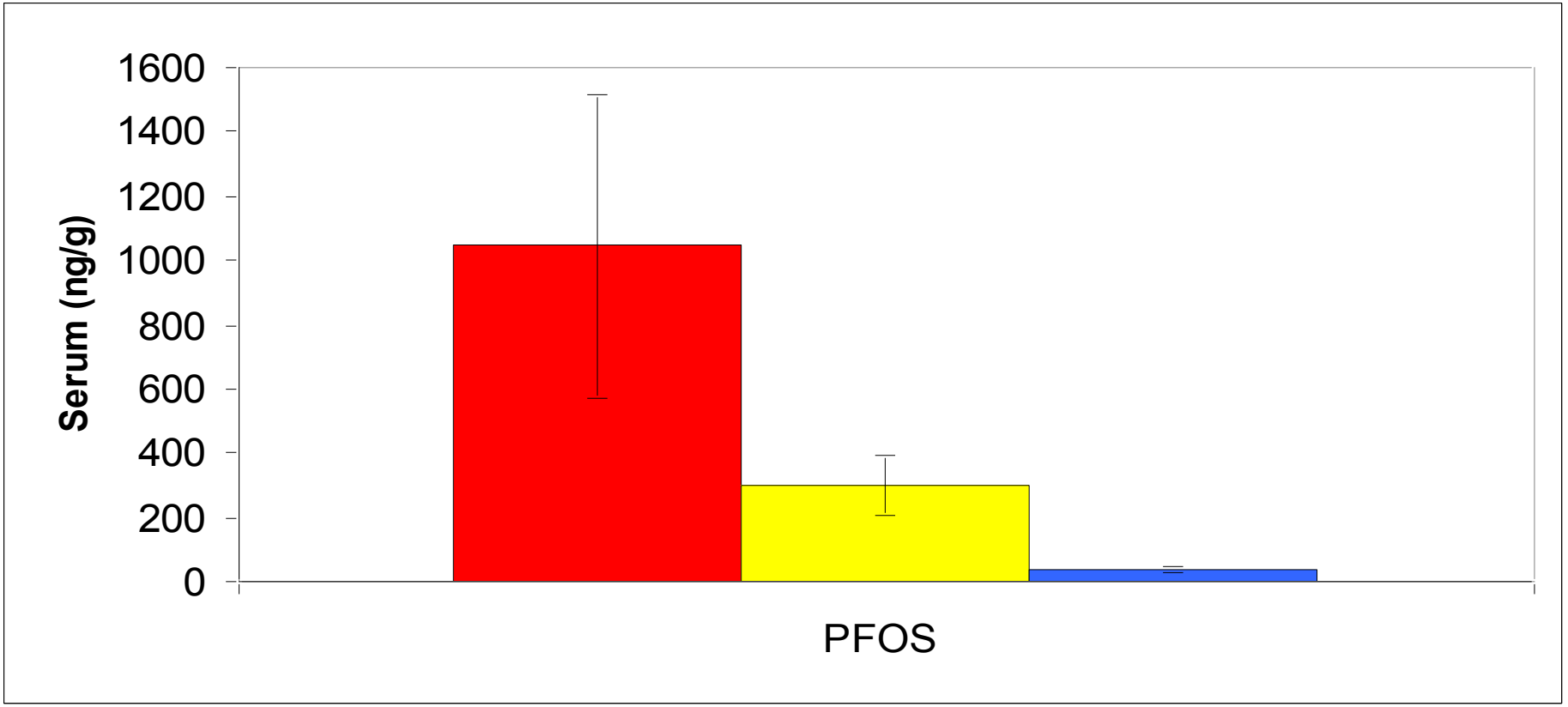




PFOS – Why Tier III?

- Usage
  - Stain repellant, processing aid for fluoropolymers, metal finishing, pesticide, electroplating
  - Use of PFOS phase-out in 2002
    - In 2000, 3M alone produced 3 million kilograms
  - Large reservoir from historic use and continued use of precursors
- Toxicity
  - Carcinogenic
  - Developmental toxicity
  - Immunotoxic
  - Endocrine disruptor

PFOS in Seals



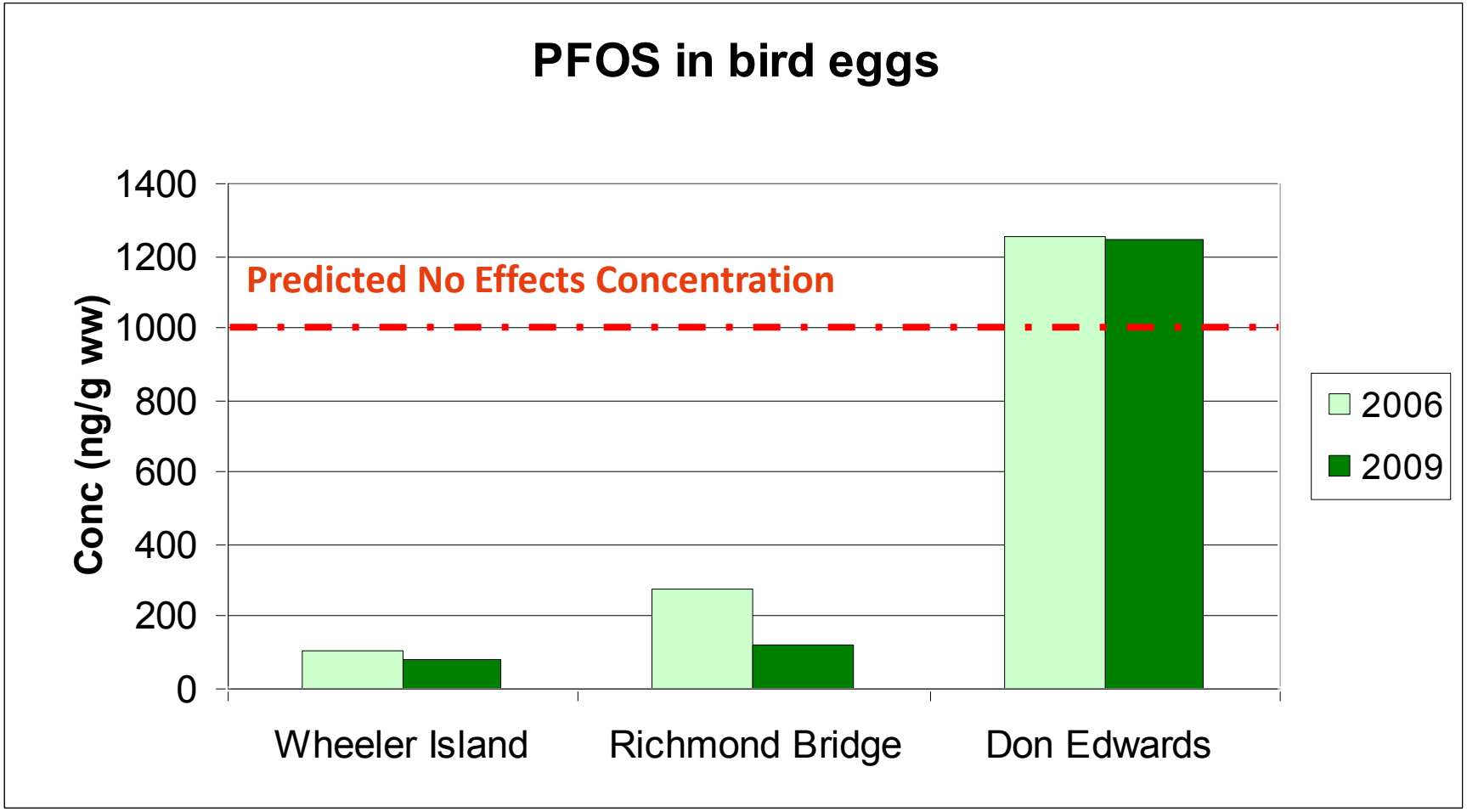
Source: Sedlak and Greig 2012 JEM

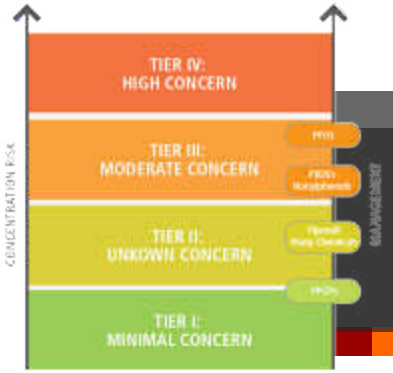
Mowry Slough (n=6)

Richmond Bridge (n=34)

Tomales Bay (n=21)

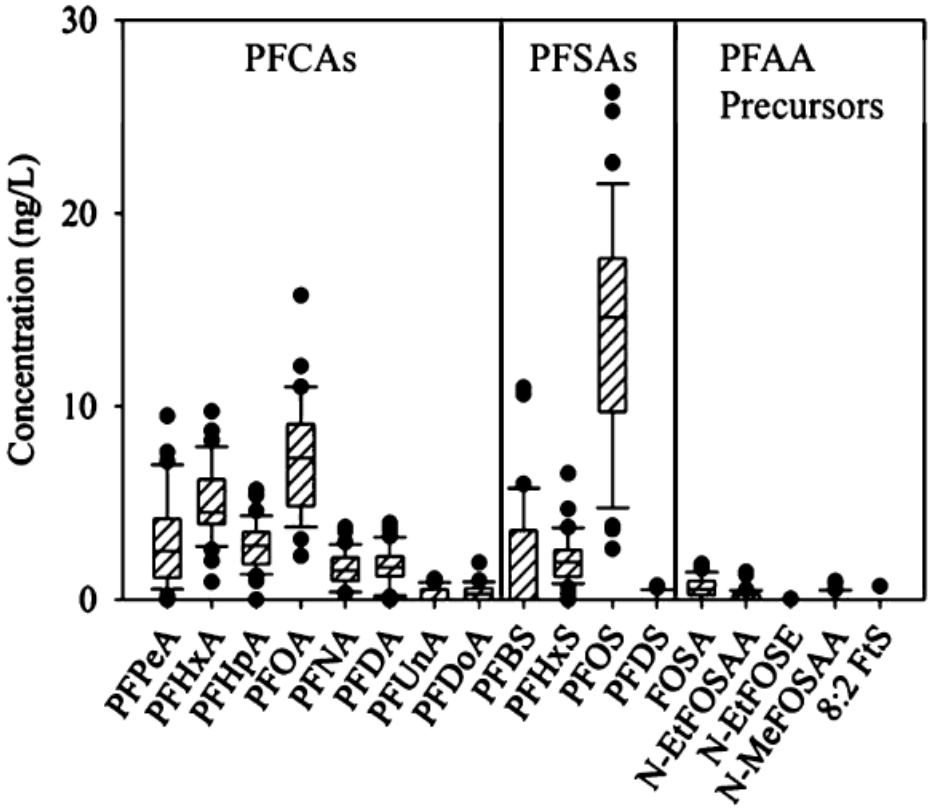
PFOS in Bird Eggs





Tier III – Moderate Concern

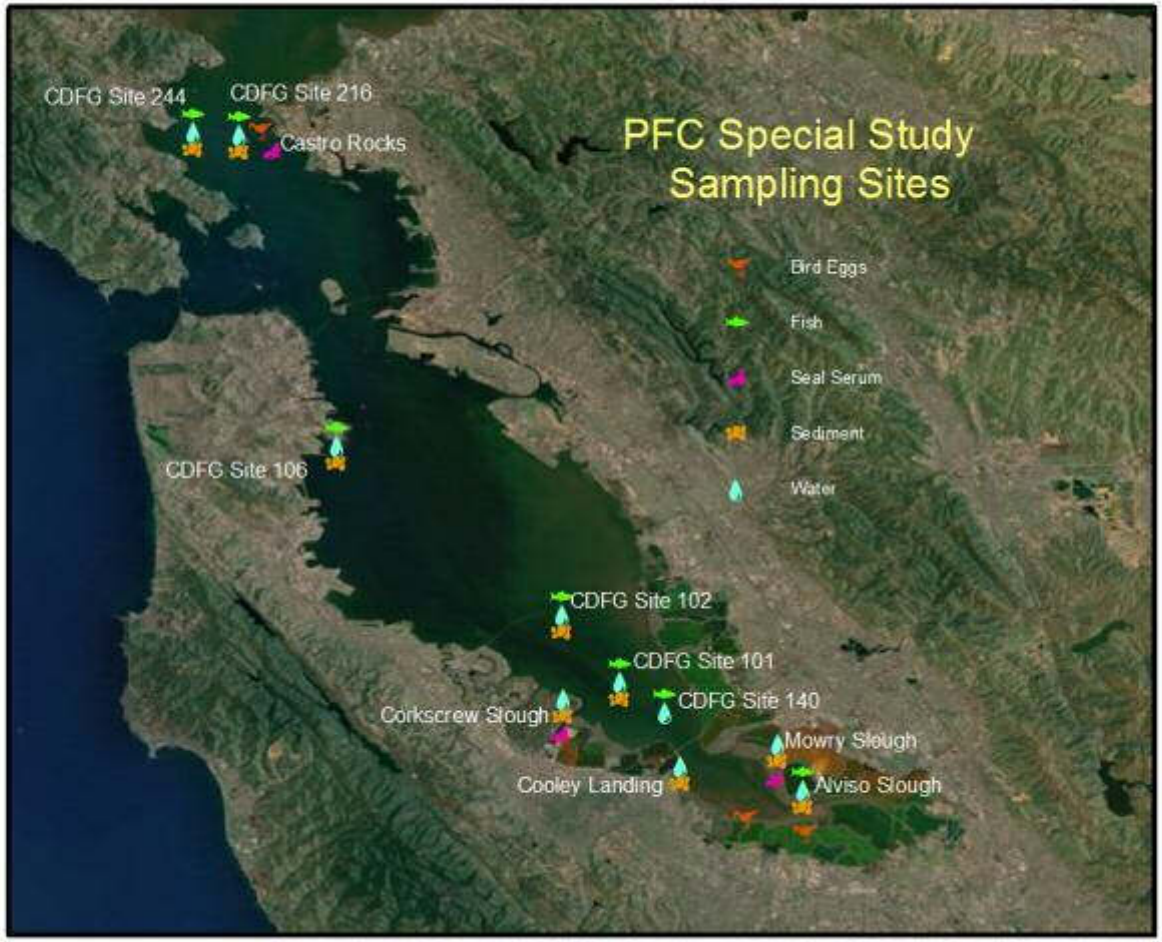
- Elevated concentrations above a threshold
- Detected in apex predators
  - No sign of decline
- Continued use of precursors
- Large reservoir

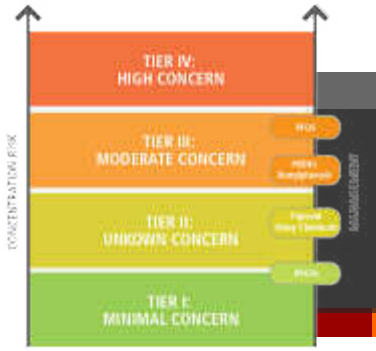


PFCs in Bay Area Stormwater (n=33)

Source: E. Houtz and D. Sedlak ES&T 2012

RMP 2012 PFOS Study

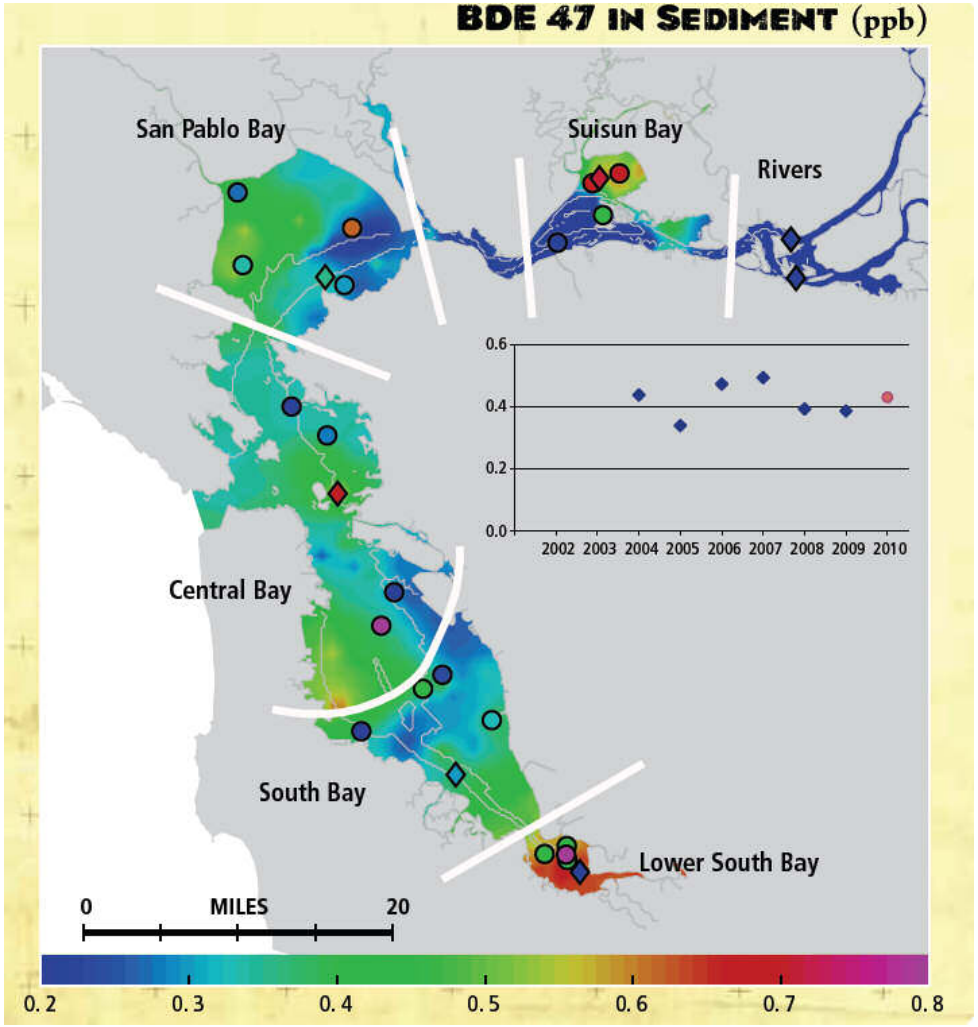




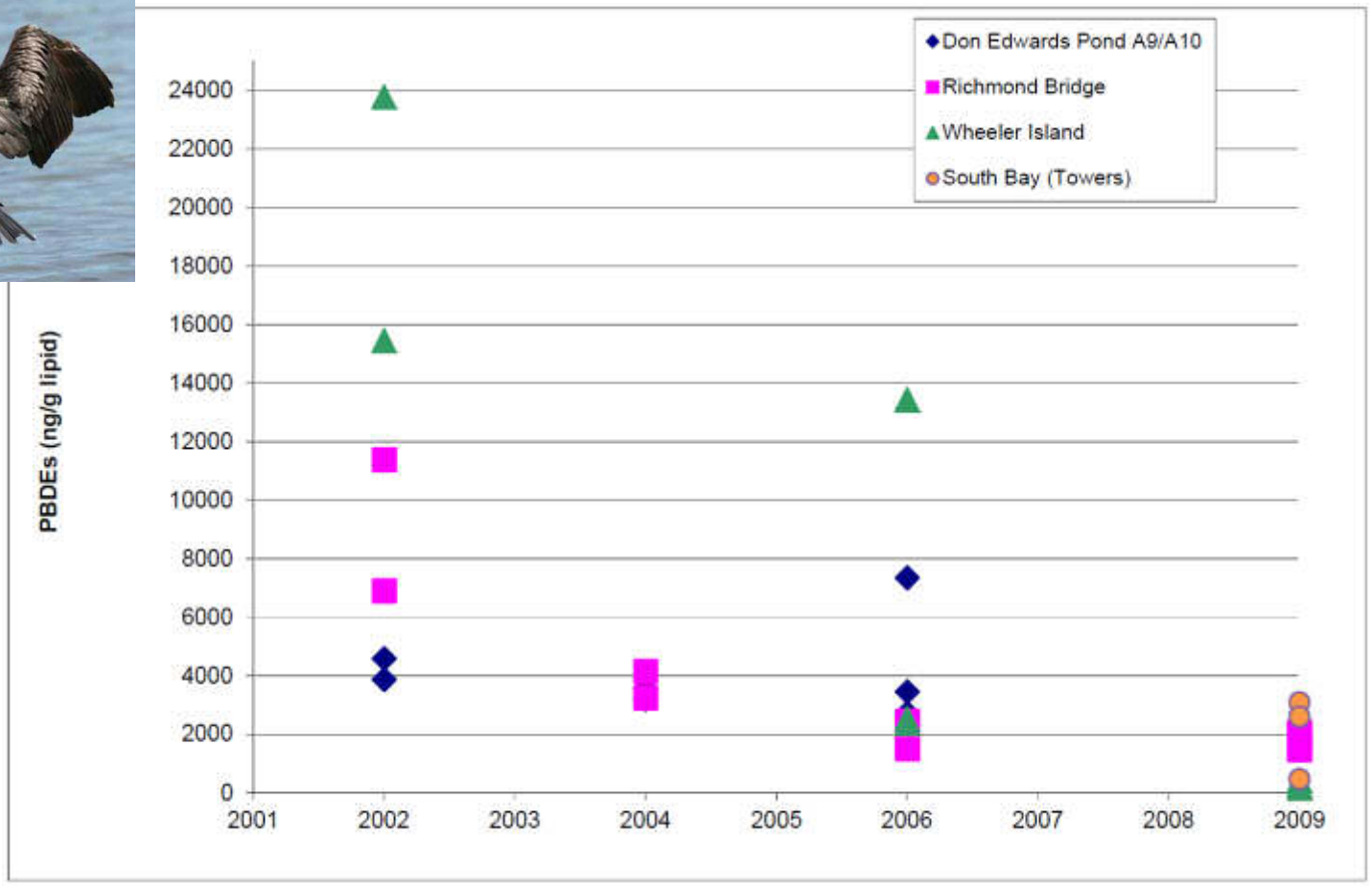
Why Tier III for PBDEs?

- Usage
  - Phase-out of Penta and Octa in 2006
  - Voluntary phase-out of Deca by 2013
- Toxicity
  - Endocrine disruptor
  - Impairs nervous system

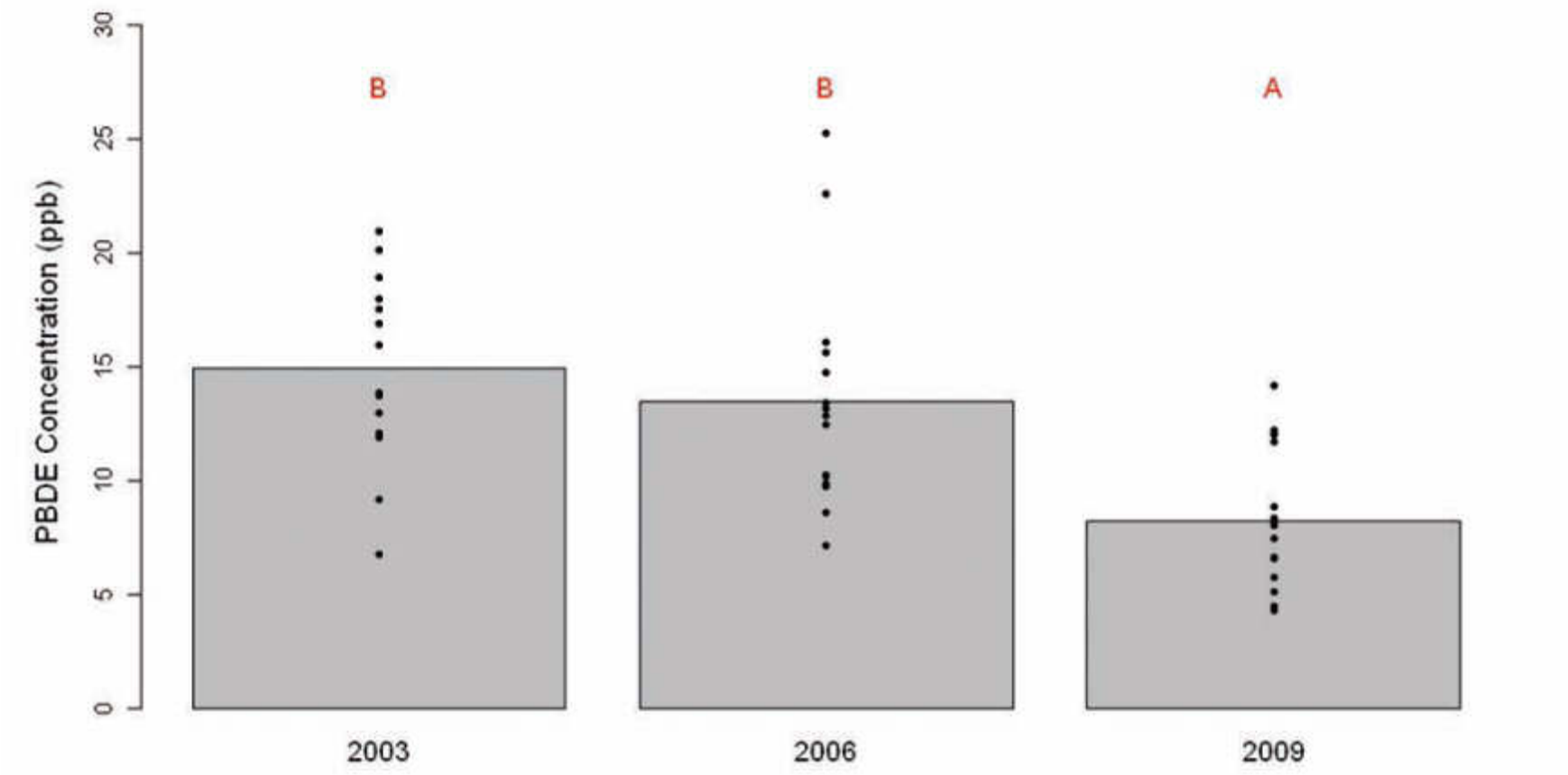
PBDEs in Sediment



PBDEs in Cormorant Eggs

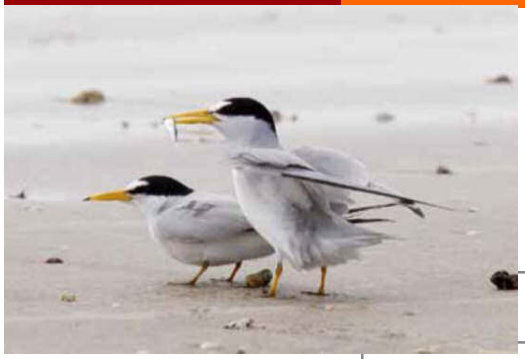


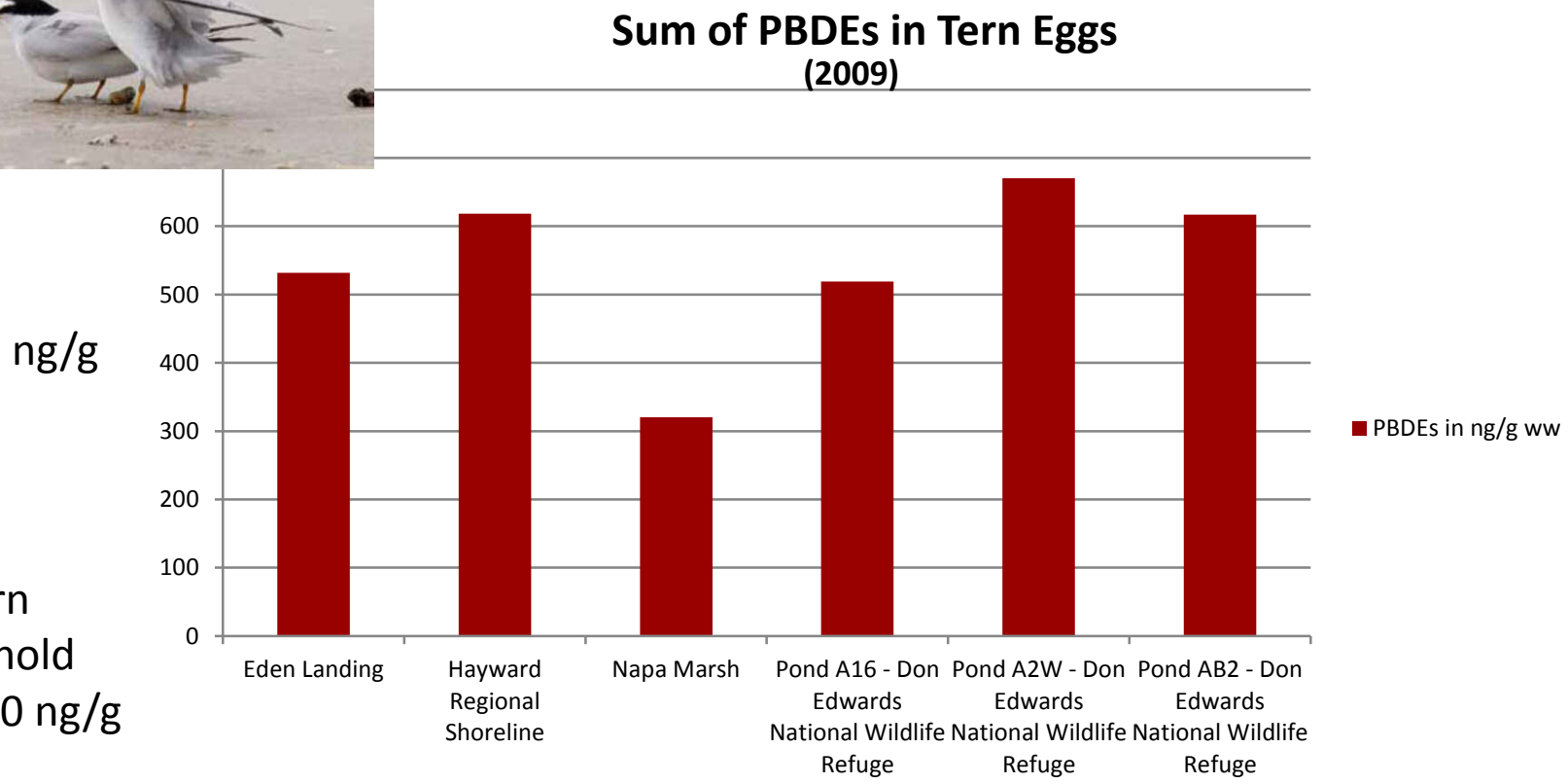
PBDEs in Sport Fish



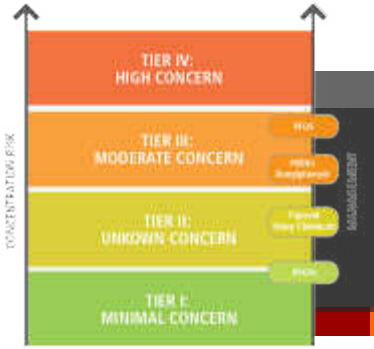
PBDE concentrations (ppb wet weight) in shiner surfperch
<< 100 ppb Fish Advisory Tissue Level (3 meals/week)

PBDEs in Tern Eggs



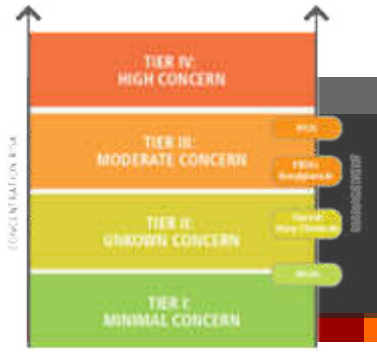


<< tern threshold 20,000 ng/g



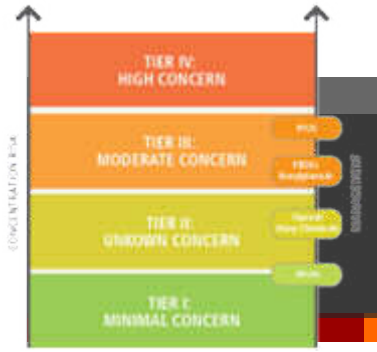
Tier III - Moderate Concern

- Detected in water and sediment
  - No clear trends
- Detected in Bay wildlife
  - Declining trends
  - << tern effects levels
  - << CA sport fish contaminant goal/ advisory tissue level
- Management actions taken/ Usage declining



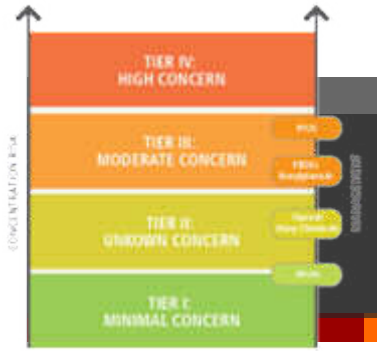
Why Tier II for Fipronil?

- Use
  - Urban structural pest control and landscape (no ag)
  - Consumer products such as pet flea control (Frontline)
  - Use almost doubled between 2003 to 2008
- RMP monitoring in sediment
  - 0.01 to 0.56 ng/g
  - Sediment toxicity to midge
    - LC-50 ~150 ng/g OC (Maul 2008)



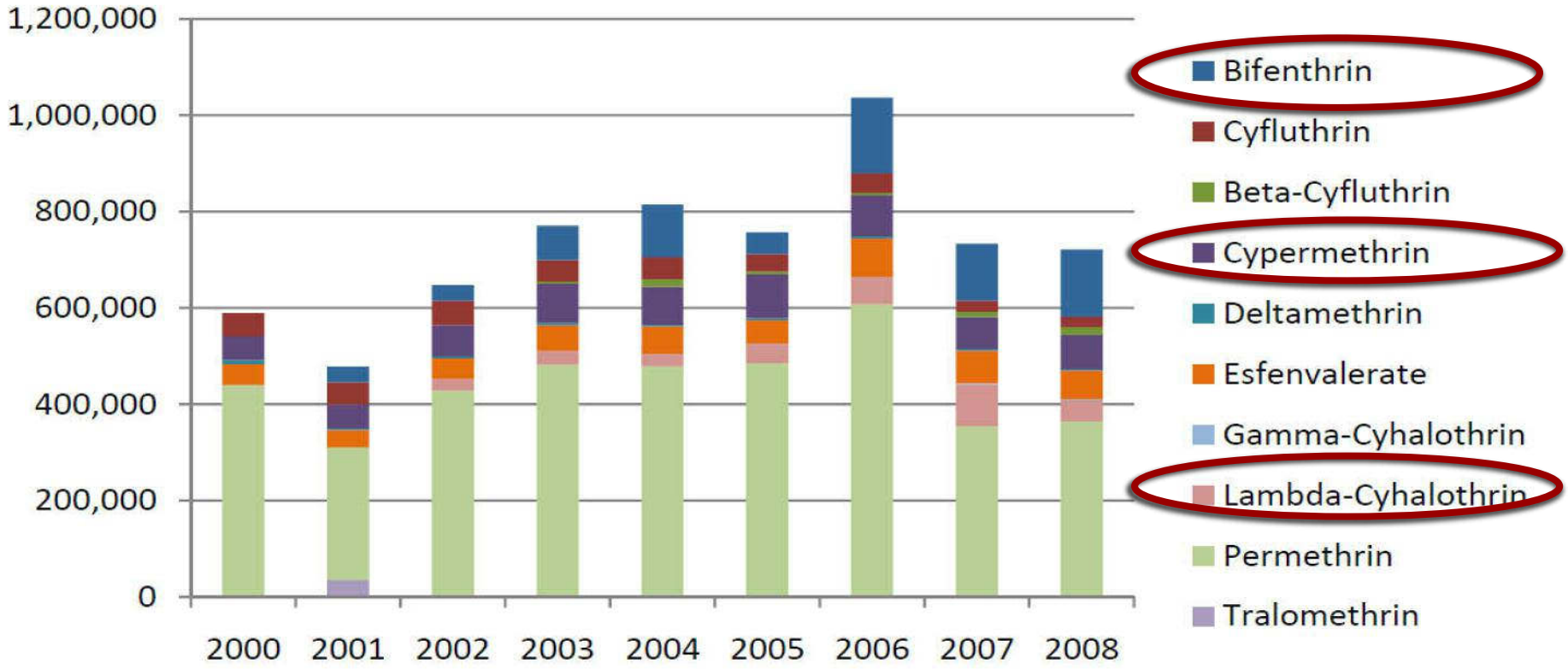
Tier II –Unknown Concern

- Detected in sediment
  - Below levels of concern
- Water
  - No data for Bay
  - May be of concern based on sediment concentrations
  - Evidence of toxicity in CA urban creeks (Gan et al. 2012)

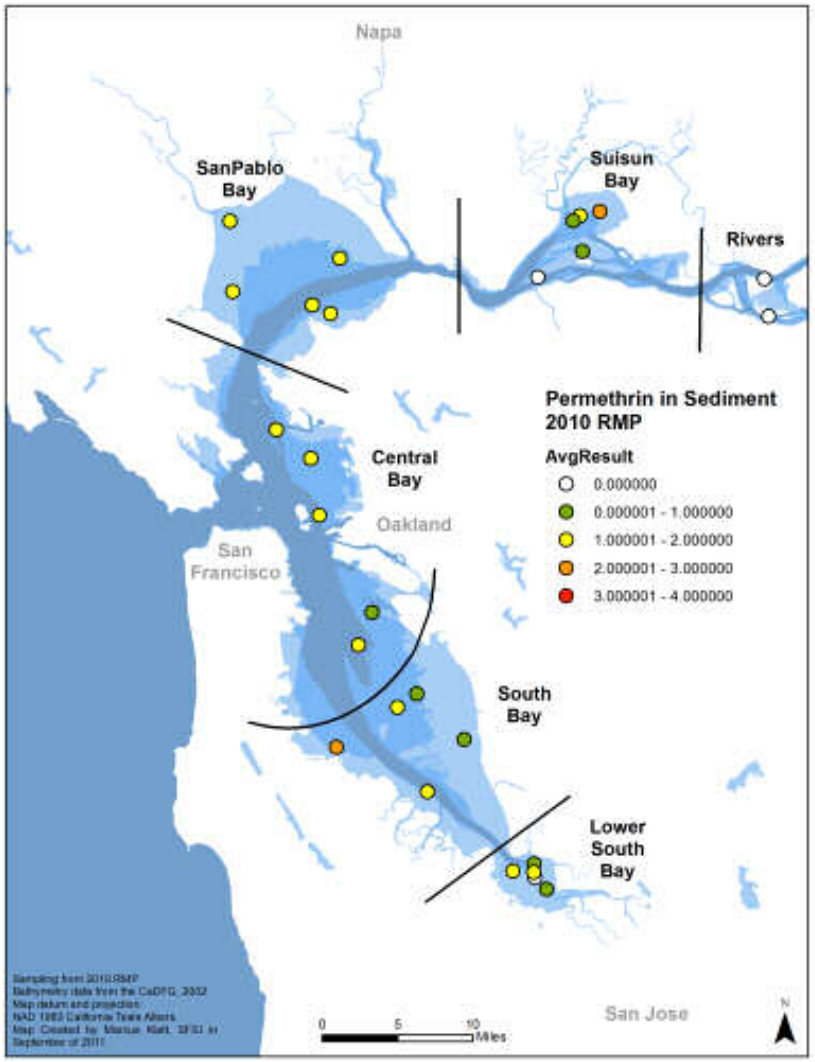


Why Tier I for Pyrethroids?

Figure 1. California Urban High-Use Pyrethroids Sales 2000-2008 (Pounds of Pesticide Active Ingredient)



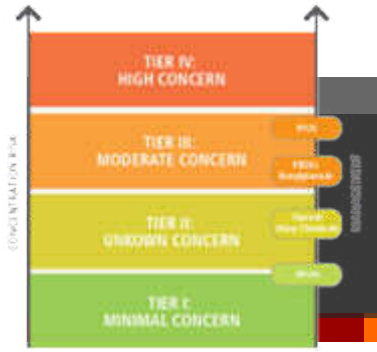
Pyrethroids in Bay Sediment



- Low levels detected of the least toxic pyrethroid
- LOEC of 73 ng/g

Pyrethroids in Storm Water

- Monitored industrialize storm channel in 2010 (Hayward)
  - 14 Pyrethroids
- Detected sporadically during storms
  - Bifenthrin (2.2 – 46.3 ng/L)
  - Permethrin (4.6 – 285 ng/L)
  - Cyhalothrin (3.5 – 6.1 ng/L)
  - PNEC-NOEC (4 to 10 ng/L)
- Will monitor in 2012/2013 in 6 Bay Area watersheds

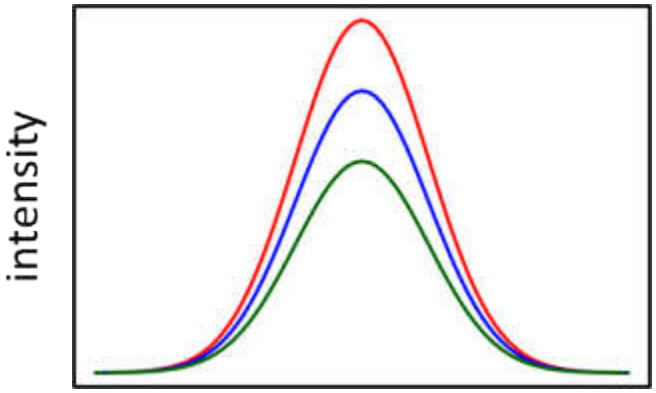


Tier I – Minimal Concern

- Minimal concern for Bay concentrations
- Tributary concentrations are significant
  - Will continue to monitor watersheds

Using New Techniques to Identify CECs

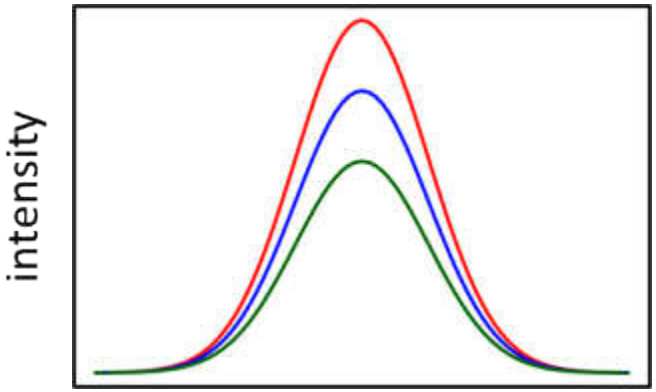
co-eluting peaks 1st GC column



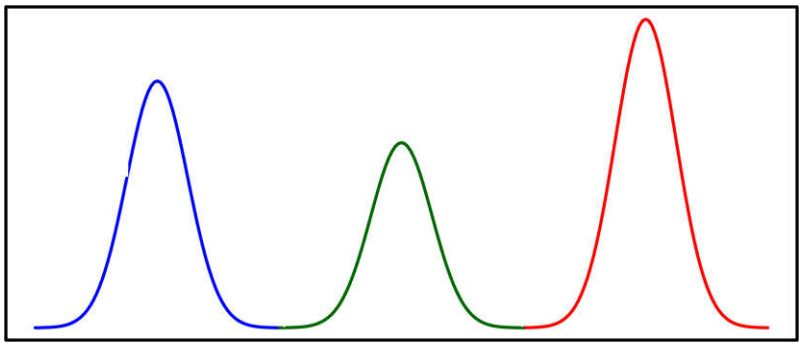
transfer to
2nd column

Using New Techniques to Identify CECs

co-eluting peaks 1st GC column

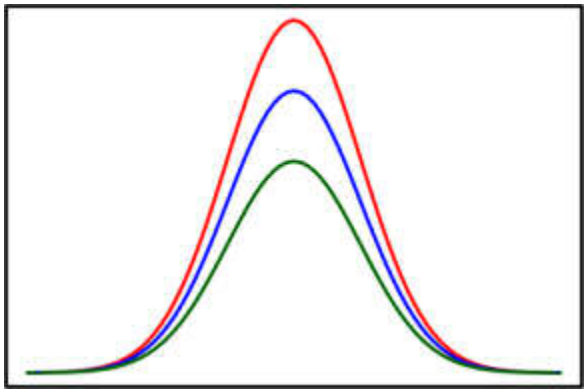


transfer to
2nd column



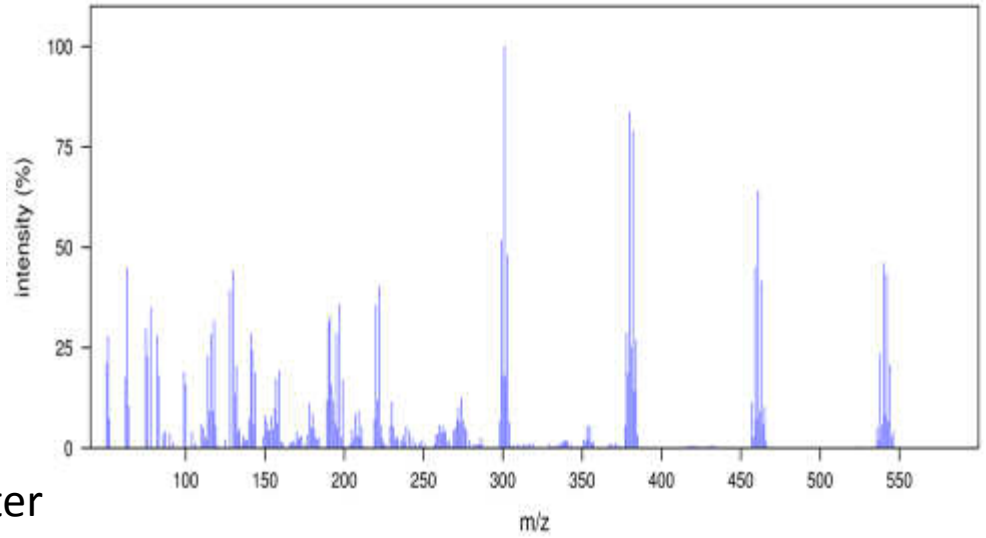
Using New Techniques to Identify CECs

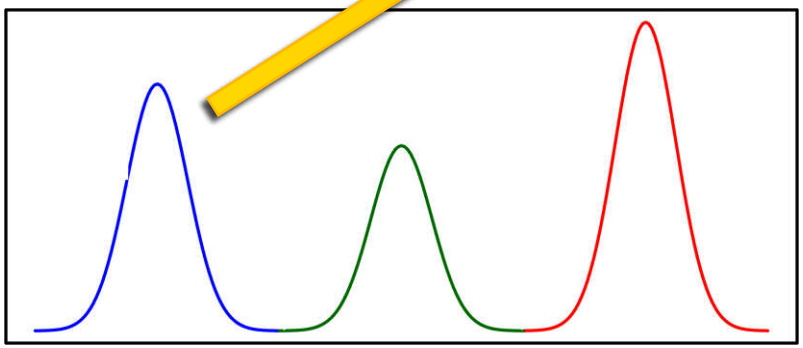
co-eluting peaks 1st GC column



transfer to 2nd column

to mass spectrometer





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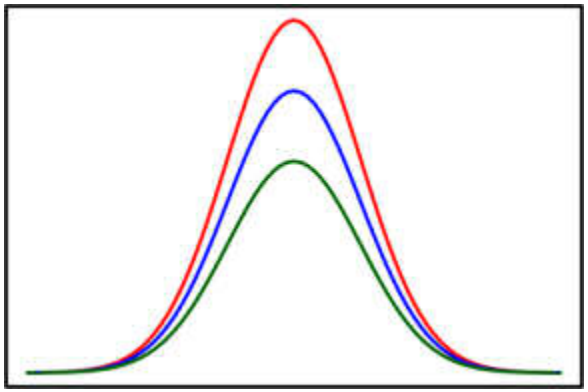

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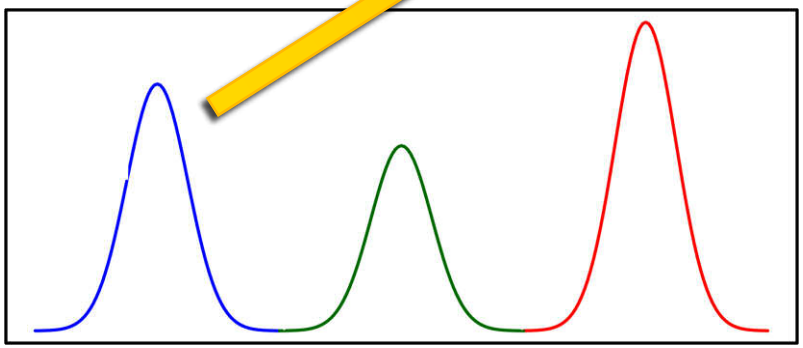
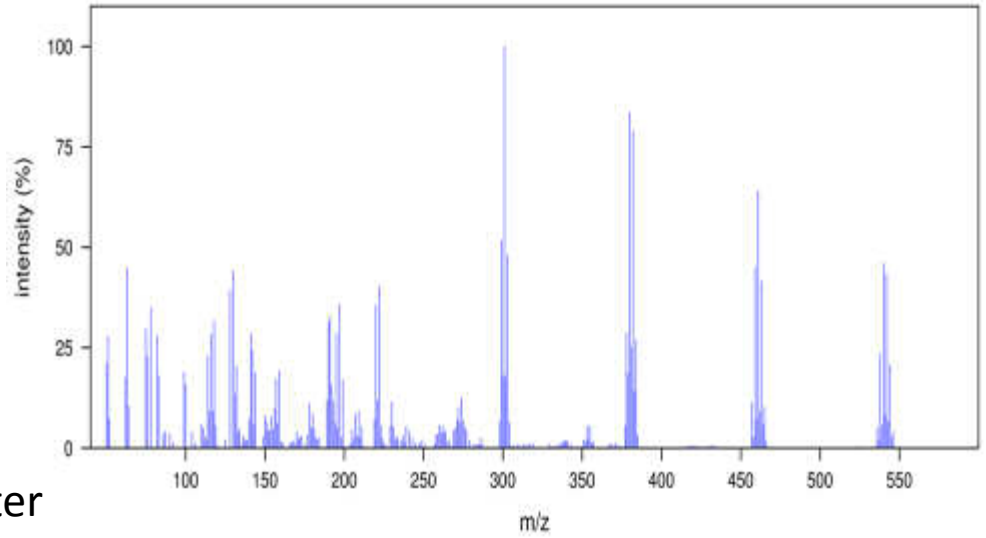


Compares MS output to library

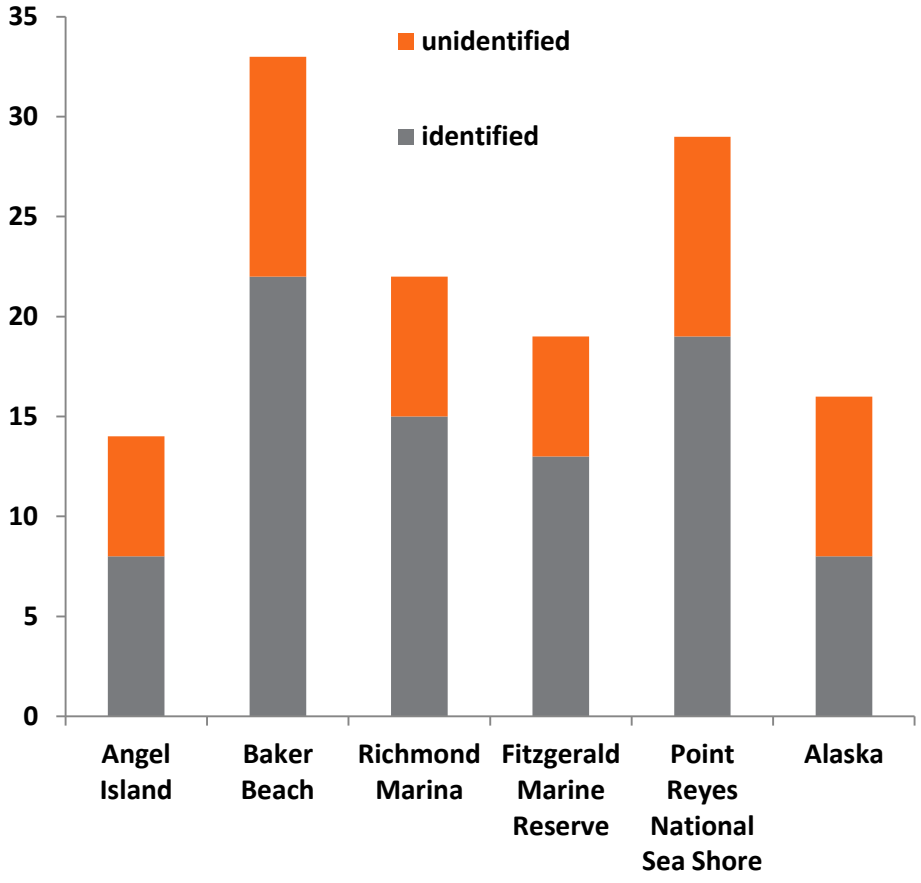


610


Identifying New Persistent and Bioaccumulative Organics Among Chemicals in Commerce

PHILIP H. HOWARD*,† AND DEREK C. G. MUIR‡

Nontargeted Analysis



- Evaluating seal and mussel tissue
- Approximately 35 new compounds identified
- Most are known (in library)

Bioanalytical tools

- Linking exposure to relevant effects
  - Joint study with ECWG and EEWG
- Bioassays developed for EDCs
  - Linking cellular effects (hormone signalling) to organism effects (cell growth, sexual differentiation, growth/metabolism)
- Method for addressing estrogenic effects

CEC Strategy: Next Steps

- Evaluate CECs in upper tiers
- Review State CEC Advisory Panel recommendations for estuaries
- Identify “New” CECs
  - Review results of nontargeted analyses (due end of 2012)
  - Update prioritization table with new information as it comes available

2013 State of the Estuary & RMP Annual Meeting

- Combined meeting in downtown Oakland
- Focus on Contaminants of Emerging Concern
  - Latest RMP results
  - Leading scientists
  - Regional Board policy
  - Green Chemistry Initiative update

Thanks!

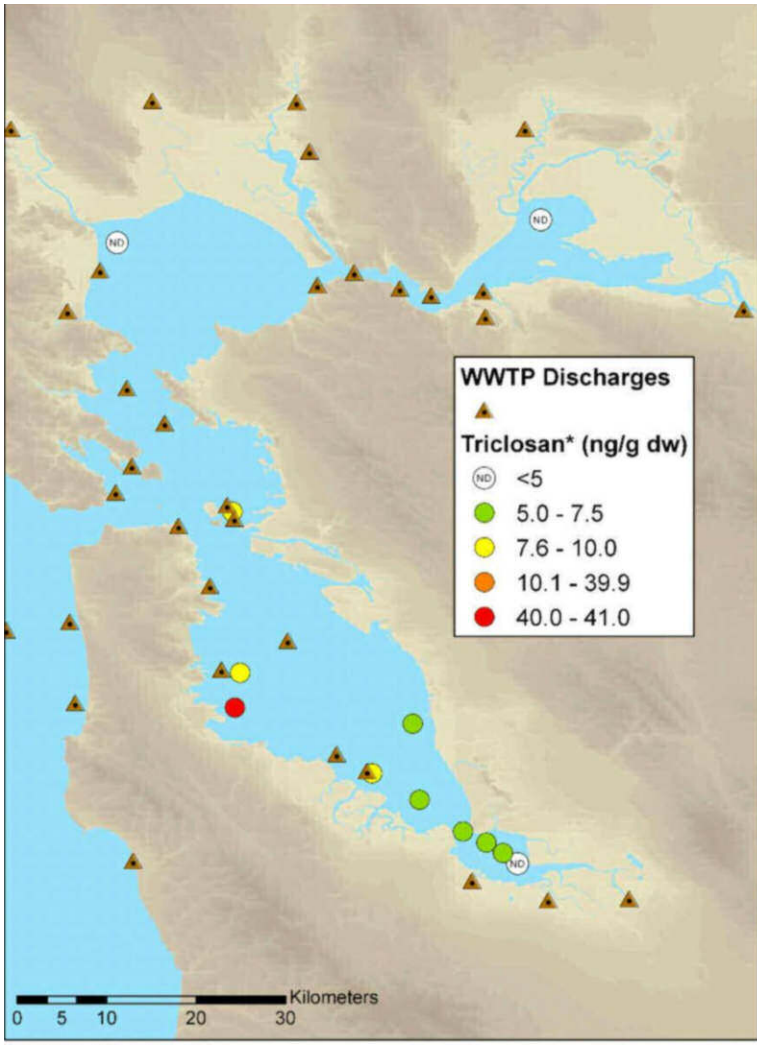
- Many thanks to:
  - Paul Salop Applied Marine Sciences and AXYS Analytical
  - RMP Data Management Staff
    - Amy Franz, Adam Wong, Cristina Grosso, John Ross
  - Emerging Contaminant Workgroup
    - Derek Muir, Lee Ferguson, Jen Field, David Sedlak
    - Karin North, Tom Mumley, Naomi Feger, Eric Dunlavey, Eva Agus, and Denise Greig

The END

Tier I Limited concern

- Alt flame retardants (TDCPP, TCEP, PBPH, DBDPE, DP PBEB, BTBPE, HBB, HBCD, TPP and OP)
- TDCPP, TCEP, TBEP, DP and BTBPE detected in Bay. TDCPP and TCEP are associated with toxic effects to mammals not much aquatic toxic information.
- HBCD ant TPP detected in Bay at conce well below tox thresholds (well characterized in aquatic env.).

Tier I: Triclosan



- High usage – 10 mil. lbs
- Toxic – EDC (fish/mammals), acute toxicity to algae (200 ng/L)
- Several studies
  - Low concentrations observed in sediment (2008)
  - Not detected in mussel, sediment and water (2010)
- Conc < available thresholds

Tier III -Nonylphenol

- Effects to barnacles
- Concentrations in Bay much lower than effluent dominated systems.
- Concentrations order magnitude below toxic effects in aquatic

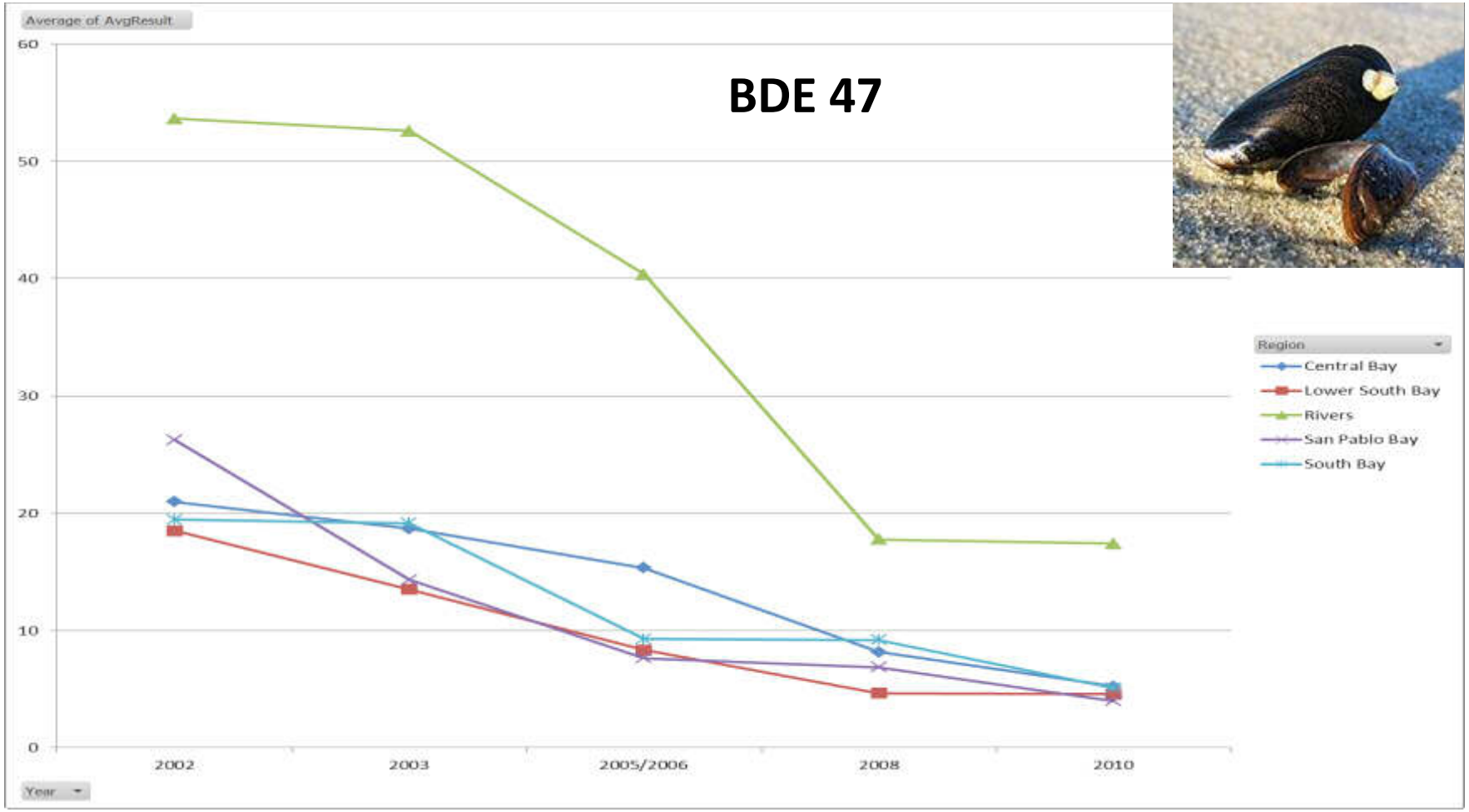
Tier II - Unknown Concern CECs

Compounds	Rationale
Bis(2-ethylhexyl) phthalate (DEHP)	• Sediment ≥ LAET, HAET
Butylbenzyl phthalate	• Sediment ≥ LAET
Other Br, Cl flame retardants	• Some low level detects in sediment, bird eggs • Some toxicity in mammalian models • Some high volume use, PBDE replacements
Other PFCs	• Some detects • Possible PFOA impacts to marine mammals
Short chain Cl paraffins	• Detected in wildlife • Uncertainties in existing tox data?
Other pesticides	• Water < tox thresholds
Carbon nanotubes	• Not detected, high volume use
Bisphenol A	• Not detected, high volume use, PNEC=60 ng/L

Tier I - Low Concern CECs

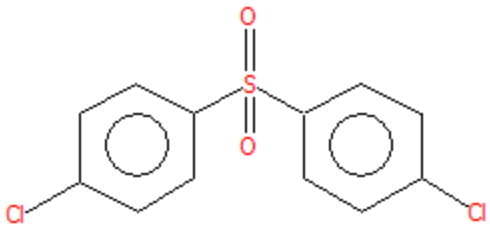
Compounds	Rationale
PPCPs	• Concentrations < tox thresholds
HBCD, Triphenylphosphate	• Concentrations < tox thresholds
Chlorpyrifos	• Concentrations < tox thresholds • Declining use
Galaxolide	• Concentrations (POCIS) < tox thresholds

BDEs in Bivalves

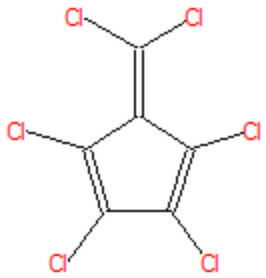


Chlorinated Compounds

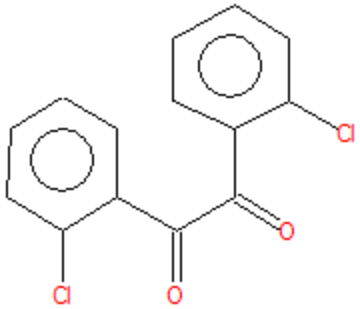
Compound	CAS#	Comments
Dechlorane 602	31107-44-5	flame retardant
p,p'-Dichlorodiphenyl sulfone	80-07-9	polymer starting material for "Udel"
Hexachlorofulvene	6317-25-5	polymer use?
Dichlorobenzil	21854-95-5	dyes, resins, disinfectant?
Dichlorobenzophenone	5293-97-0	?
Dichloroanthracene	605-48-1	combustion product?



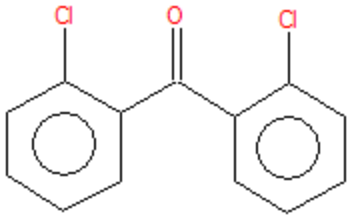
Dichlorodiphenylsulfone
On Howard and Muir List



Hexachlorofulvene



Dichlorobenzil



Dichlorobenzophenone

Conceptual Model of Contaminant Fate on the Margins of San Francisco Bay

Craig Jones, Sea Engineering, Inc.

Donald Yee, Jay A. Davis, Lester J. McKee, Ben K. Greenfield, Aroon R. Melwani, and Michelle A. Lent San Francisco Estuary Institute

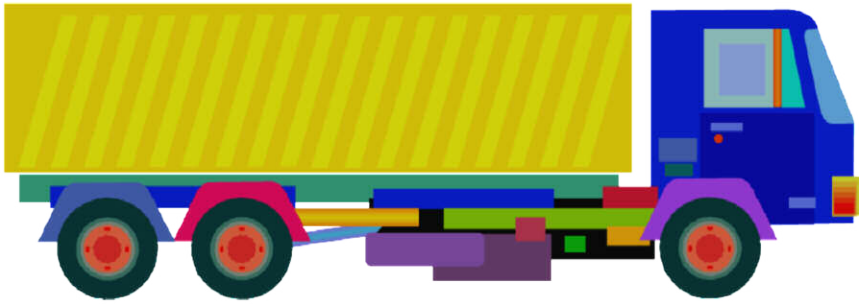
RMP TRC September 18, 2012

Project Background

- Layout of the objectives, groundwork, and rationale for numerical modeling of Bay & its margins
  - Underlying assumption that some variant of quantitative modeling would be needed
  - Work on SUNTANS started and suspended
- CFWG called for refocused attention on model needs and final output

Objectives Objectives Objectives

- What characteristics does the model need?
  - Depends on what we need to predict, i.e. what are the questions to answer?
    - Determines focus of temporal scale, spatial scale



    - Arrival time? Maximum load? Braking distance? Time to engine failure? CO_2 emissions? # Road kills?

Elements in Common

- Regardless of question or scale, some model elements necessary and shared, even if differing in level of detail:
  - Hydrodynamics
  - Sediment loads & transport
  - Contaminant loads & ambient processes
  - Biouptake
- Each element can range from simple empirical (e.g. regression) to mechanistic model

What Are The Questions

Temporal

- POPs (PCBs, PBDEs, dioxin, ??)
  - Decadal focus
- Biotransformed pollutants (MeHg/Hg, Se?)
  - Decadal and seasonal components
- Shorter lived water pollutants (Nutrients, PPCPs)
  - Seasonal or shorter responses?

What Are The Questions

- Spatial
  - Sites, segments, regional?
- Need to define what scales you care about
  - May help to define the universe of options within the realm of probable (possible?)
    - Work backwards from there what scenarios you would need to compare/distinguish
- Not resolved in the report
  - Need a manager co-author or companion document in the future

System Elements to Include

- Hydrodynamics
  - Water sources
  - Climactic variation
  - Estuarine circulation processes shallow & deep
- Sediment transport
  - (History of) sediment loads
  - Shallow and deep water processes
  - Sediment characteristics

System Elements to Include

- Chemical fate
  - Contaminant loads
  - Partitioning and transport
  - Degradation/transformation processes
- Bioaccumulation
  - Initial uptake (often the most concentrating)
  - Food web structure (localized or mobile biota)
  - Excretion/loss processes

System Characteristics to Capture

- Hydrodynamics
  - North vs South flows
  - Wet & Dry season
- Sediment
  - Loads history (hydraulic mining pulse) & predicted sediment budget (dams, erosion)
  - Spatial differences in sediment quality, residence time
  - Long term bathymetric trends

System Characteristics to Capture

- Chemical fate
  - Historic responses to improved treatment & chemical bans
  - Patchiness & persistence at various margin sites
  - More uniform dispersion in deeper Bay
- Bioaccumulation
  - Lack of trend in regionally mobile species for POPs
  - Patchy high concentrations of margin species
- Not all contaminants considered in report

One Model?

- May be advisable to use one platform, different implementations
  - Shared programming language, data structure, gridding approach
- Desire for open source & widely used
  - SUNTANS open source but small community
  - EFDC, Delft3d, wider usage, & no dealbreaker limitations ID'ed so far
- Maintenace & update plan not in report

Status & Timeline

- Third revision (after 2 rounds of external comment) done
  - Internal review for readability (typos/grammos)
  - Final layout
  - Post to web
- Discussion w/ managers/stakeholders to define coherent modeling abilities/needs.
  - Modeling strategy white paper & discussions

Conceptual Foundations for Modeling Bioaccumulation in San Francisco Bay

RMP Technical Report

by
Aroon R. Melwani
Ben K. Greenfield
Donald Yee
Jay A.Davis

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Current State of Affairs

- Mechanistic model developed for PCBs and OC pesticides at the Bay scale
- Need to model margins on finer scale, link sources to accumulation in the food web
- Need to cover other pollutants
- Need to forecast conditions under different management scenarios

Objectives of the Report

- Summarize key datasets and current knowledge
- Identify priorities for future monitoring and modeling
- Focus on support for development of bioaccumulation models

Section 2: Pollutants of Greatest Concern

- Methylmercury
- PCBs
- Selenium
- Dioxins
- Organochlorine pesticides
- PBDEs
- PFCs

Section 3: Key Attributes of Primary Indicator Species

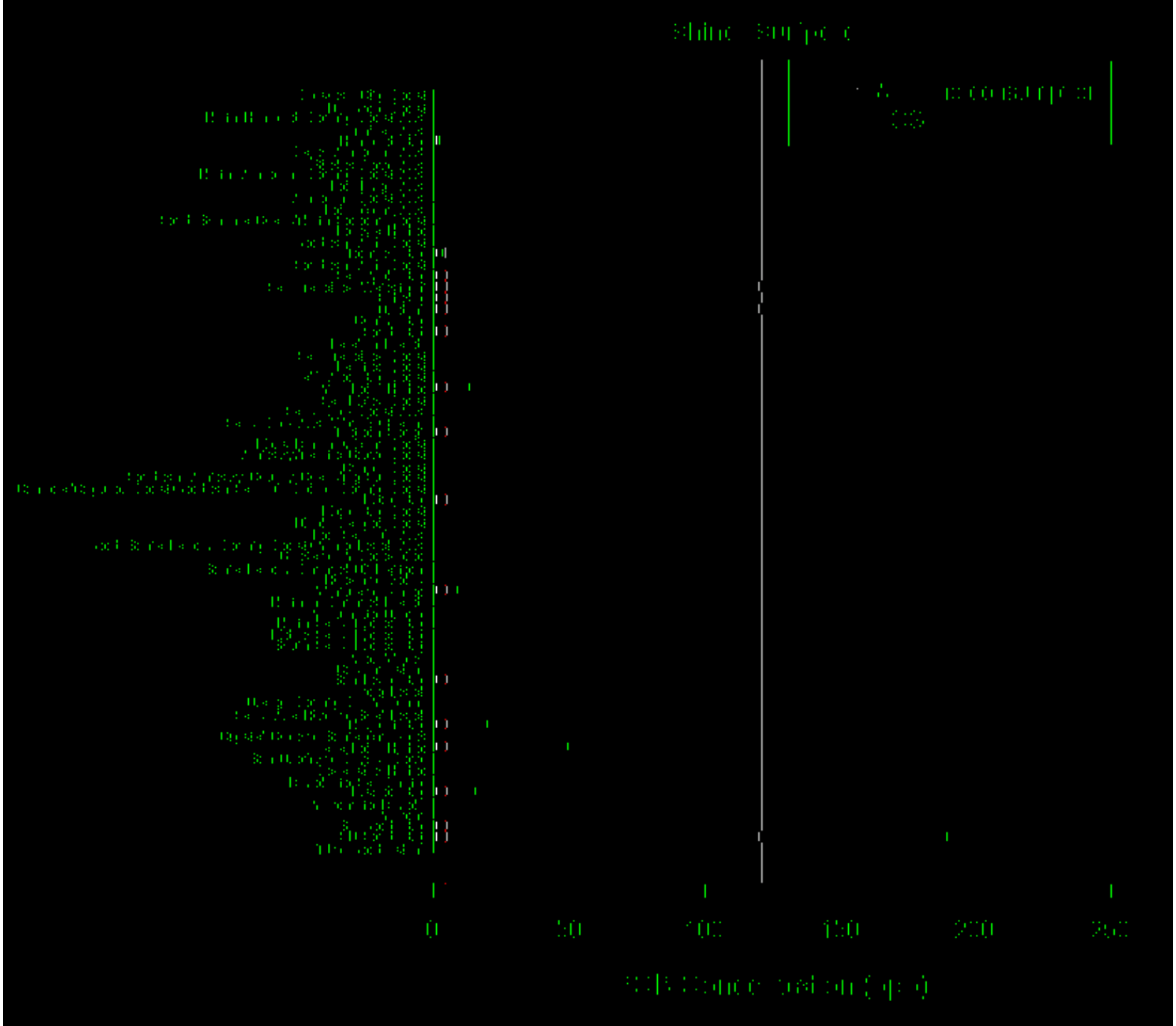
- Sport fish: striped bass, white sturgeon, jacksmelt, white croaker, shiner surfperch, California halibut
- Small fish: Mississippi silverside, topsmelt, longjaw mudsucker,
- Birds: Least Tern, Forster's Tern, Clapper Rail, Song Sparrow, Double-crested Cormorant
- Bivalves: California mussel
- Mammals: Harbor seal

Section 4: Key Concepts

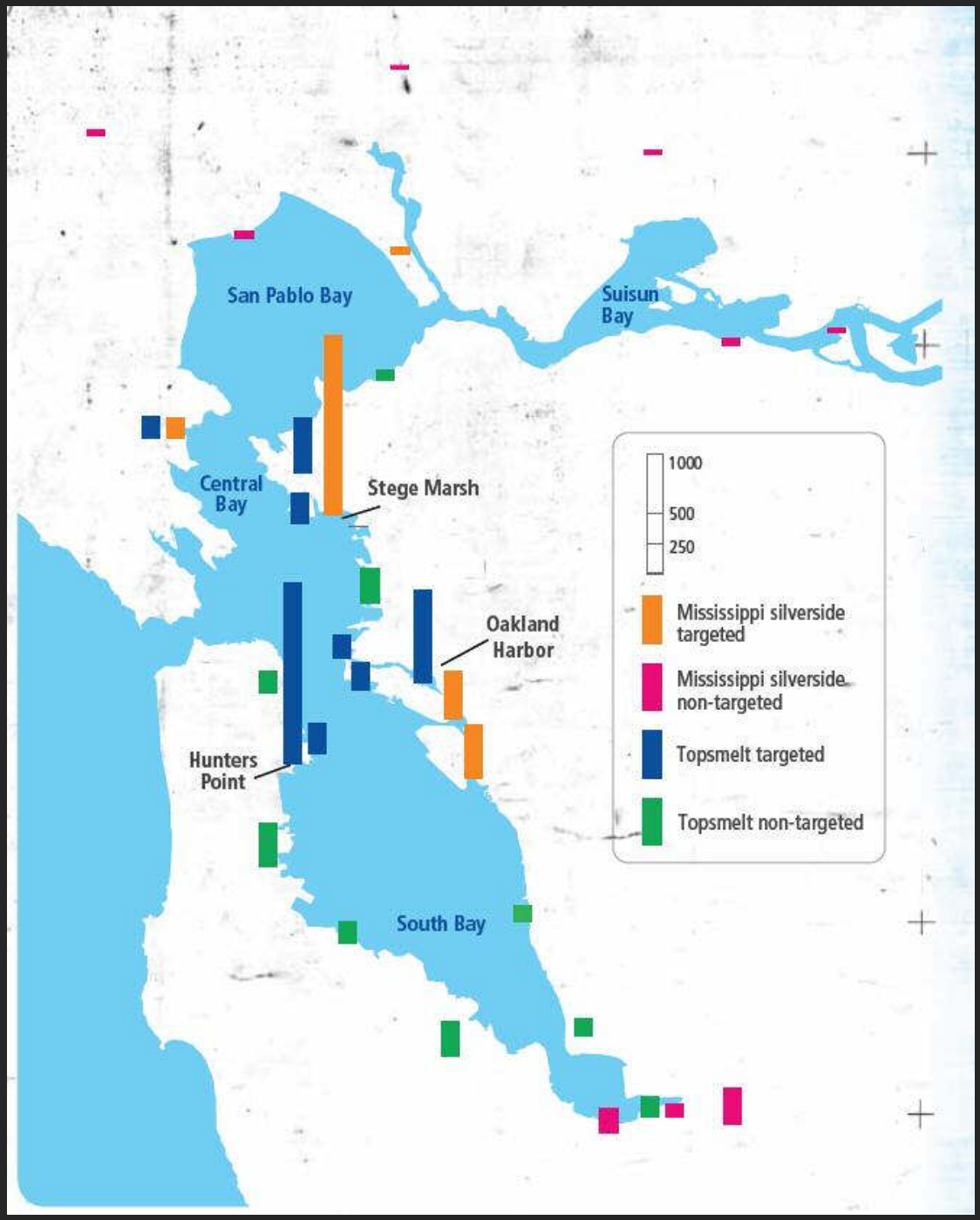
- Important factors
  - Spatial distribution of contaminants
  - Management actions
  - Seasonal variation
  - Long-term trends
  - Habitat types
  - Spatial scale and movement
- Uptake into the food web

Section 4: Key Concepts

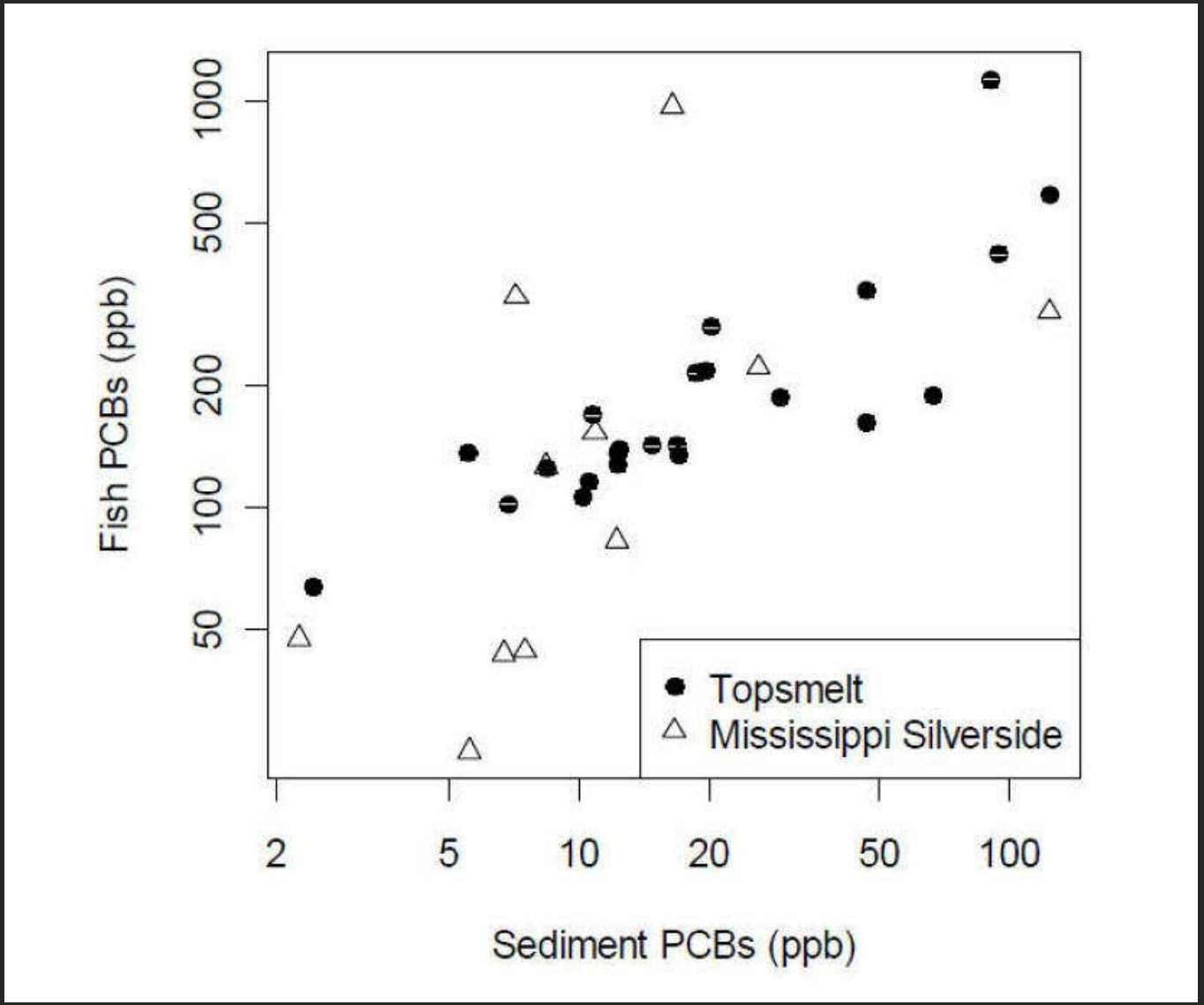
- Mechanisms of uptake and elimination
  - Dietary uptake
  - Elimination
  - Growth
  - Ecological attributes
  - Abiotic covariates



PCBs in Small Fish



PCBs in Small Fish



Section 5: Summary

- MeHg and PCB concentrations in Bay sport fish are exceptionally high
- Small fish PCB concentration equal or exceed those in sport fish
- No discernible trends for any contaminant in sport fish
- Organics declines in bivalves

Section 5: Summary

- MeHg in small fish varies at regional scale and at a local scale but is not clearly correlated with sediment or sources
- But we do have evidence that links uptake of MeHg to sediment contamination (isotope study)

Section 5: Summary

- PCBs in small fish clearly associated with sediment contamination
- “Bathtub ring” on the margins appears responsible for PCB persistence in the Bay food web

Section 5: Recommendations

- Thoughtfully articulate the management decisions to be made based on bioaccumulation model outcomes
- Develop a comprehensive plan for creating the linked models for fate in water and sediment and for bioaccumulation in species of interest

Section 5: Recommendations

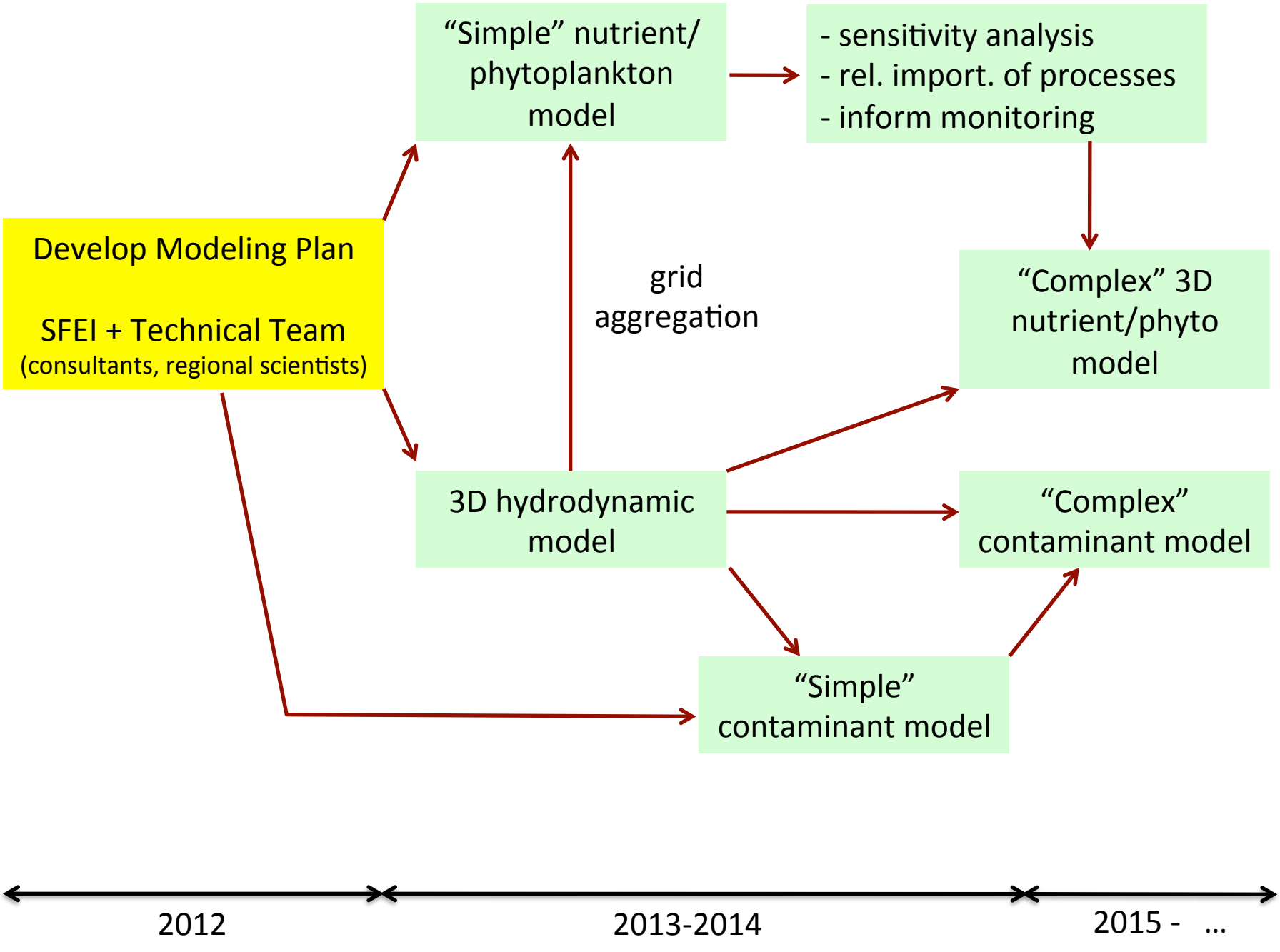
- Existing models could be adapted to time-dependent and individual-based applications
- Evaluate and address empirical data needs
- Empirical correlational bioaccumulation models can be a very useful first step

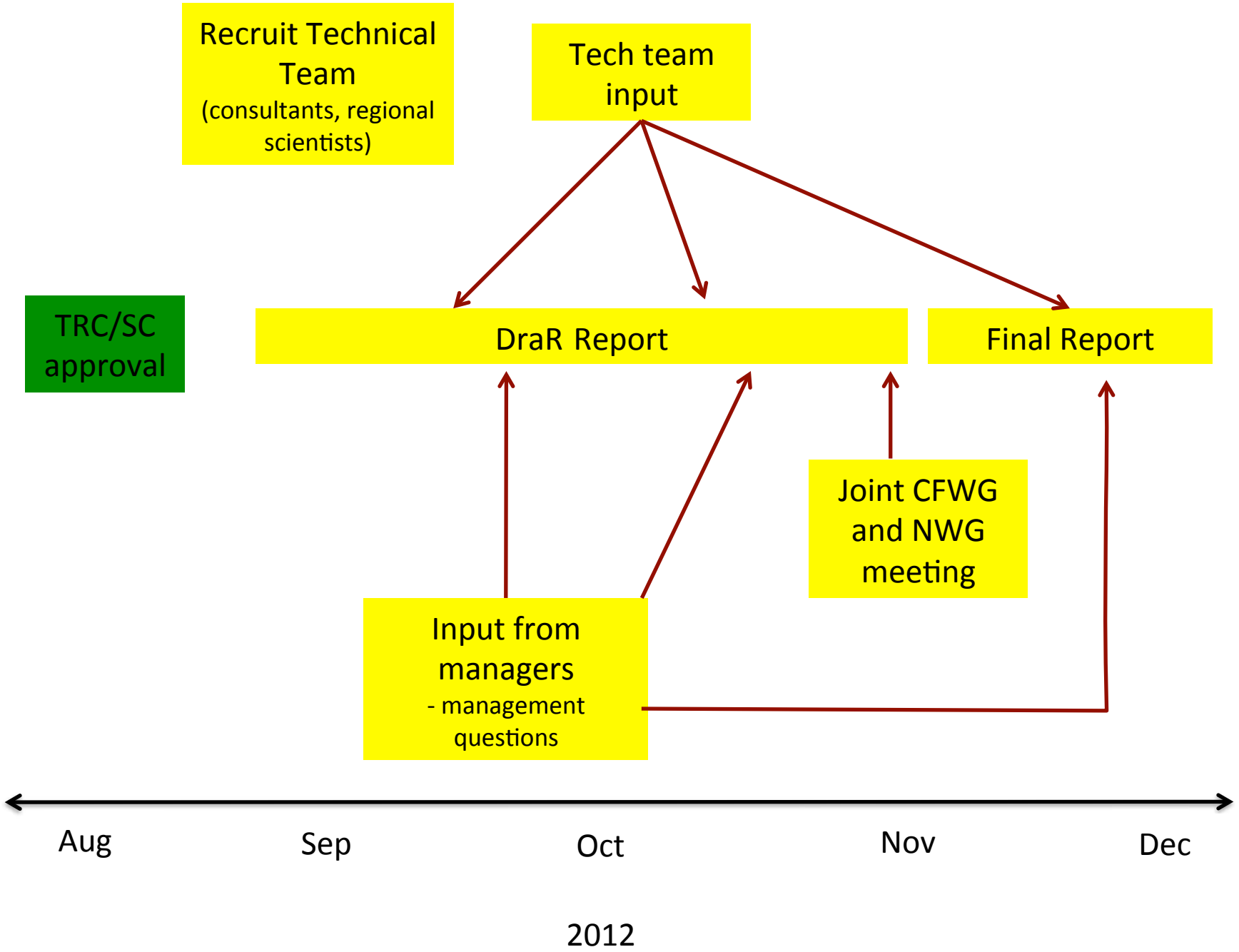
Section 5: Recommendations

- The heterogeneous, dynamic, and poorly understood nature of MeHg cycling poses a formidable challenge

Modeling Update

- Developed strawman approach (Davis, Yee, Jones, Senn)
- Meetings with CFWG modeling team (May 1,June 4)
- June/Aug - ftMP agrees to move forward with a modeling approach that…
  - Can be used for multiple issues…
    - 'contaminants'
    - nutrients, phytoplankton, biogeochem.
    - sediments
    - sea-level rise?
  - Driven by nutrients in near-term
  - Develop strawman approach using Delft 3D


"Simple" nutrient/ phytoplankton model
- sensitivity analysis
- rel. import. of processes
- inform monitoring
Develop Modeling Plan
SFEI + Technical Team
(consultants, regional scientists)
grid aggregation
"Complex" 3D nutrient/phyto model
3D hydrodynamic model
"Complex" contaminant model
"Simple" contaminant model
2012
2013-2014
2015 - ...


Recruit Technical Team
(consultants, regional scientists)
Tech team input
TRC/SC approval
DraR Report
Final Report
Joint CFWG and NWG meeting
Input from managers
- management questions
Aug
Sep
Oct
Nov
Dec
2012

Draft primary management questions

Nutrients

1. Which nutrient sources, pathways, and transformation processes contribute most to concern?

   -

2. What nutrient loads can the Bay assimilate (without impairment of beneficial uses)?

3. What future impairment is predicted for nutrients in the Bay?

Draft primary management questions

Contaminant Modeling

1) What pac erns of biota exposure to contaminants of concern are forecast for major segments of the Bay under various management scenarios?

2) What is the contribution of contaminated Bay margins to Bay impairment?

3) What are the projected impacts of Bay margin management actions to Bay recovery?

On-going work

- Planning meeting – August (SFEI and Jones)
- ftecruiting technical team (Sep). Potential list…
  - J Fitzpatrick, F Gobas, D Schoellhamer, E Gross, M Stacey
- Developing draft outline (Sep/Oct)
  - Identify primary management questions
  - Develop draft approach to address management questions
- Technical team meeting – October 9
- Convene CFWG and NWG (November)

National Mussel Watch Monitoring of the California Coast

A collaborative effort between NOAA and California

California Water Quality Monitoring Council Meeting
Aug. 29th 2012

Dominic Gregorio*, Yujie Jin*, Nathan Dodder**
*State Water Resources Control Board
** Southern California Coastal Water Research Project

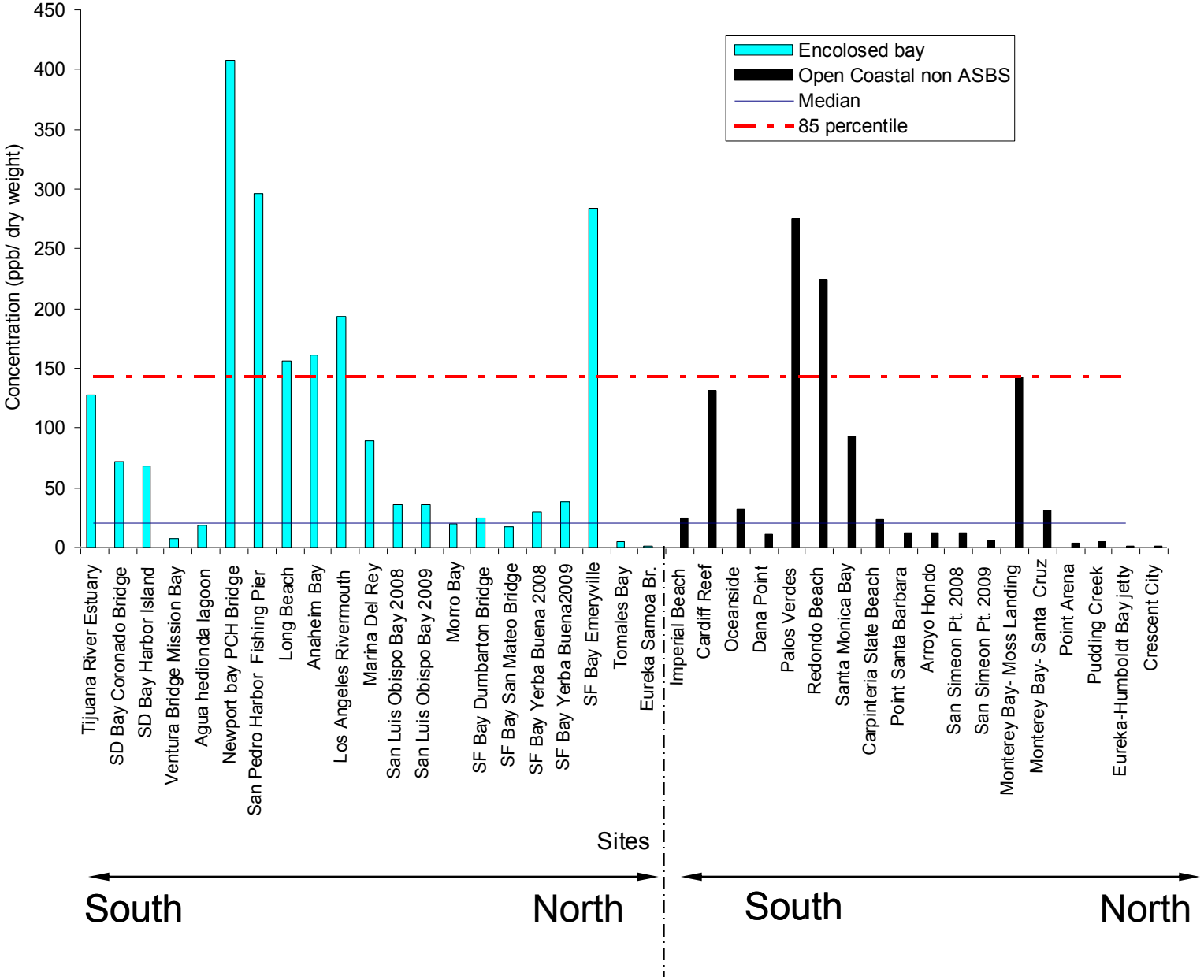
NOAA National Mussel Watch Program

- 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

Historical Data
1986 - 2009

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



DDT trends

Significant decrease at Royal Palms (White Point)

Highest concentration

Increasing trend,

but not significant

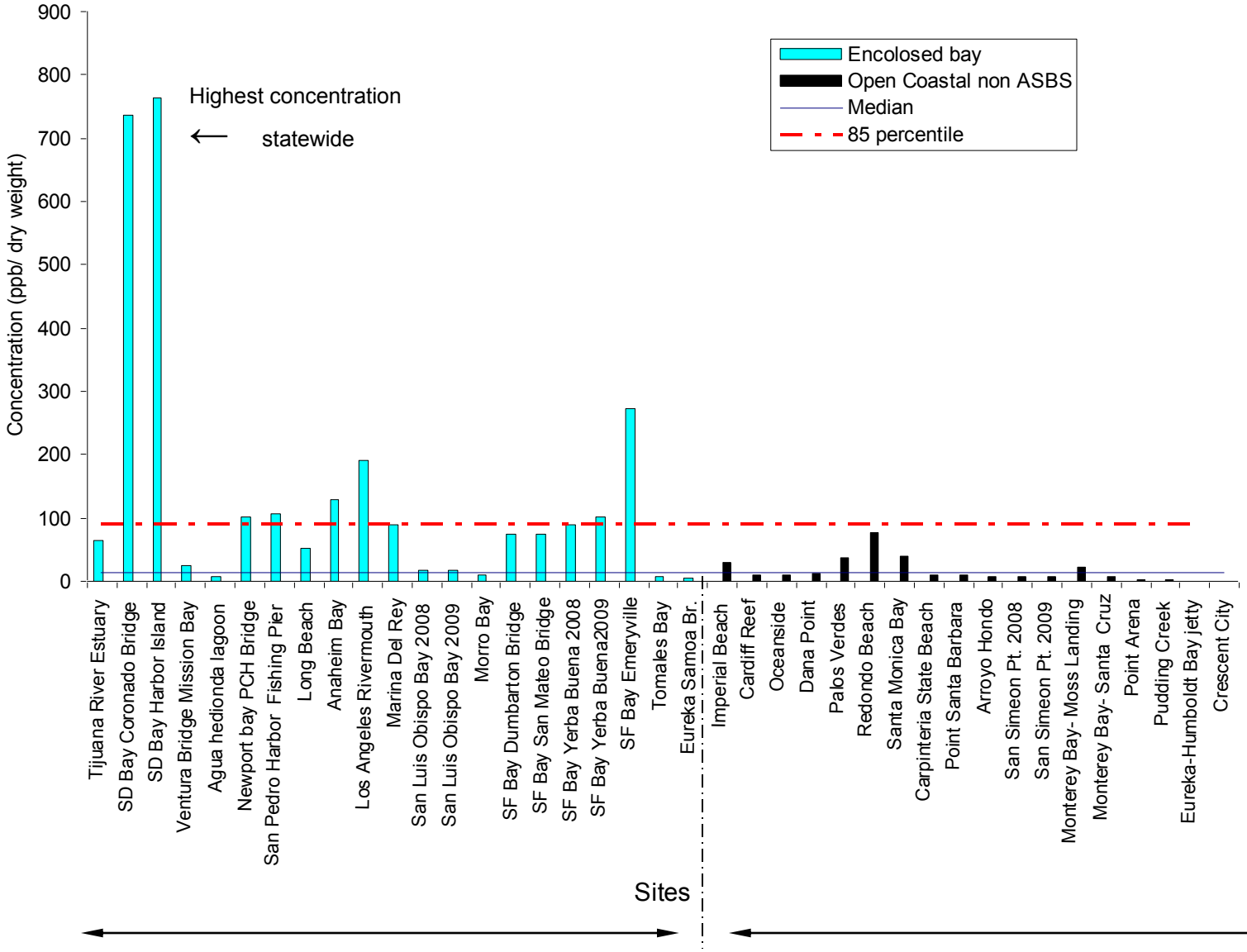
DDT Status and Trends (1986-2009)

• Highest DDT concentration in the state was at San Francisco Bay Emeryville site (2100 ppb dw in 1998).

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

• Biggest downward trend at Royal Palms (White Point) on the Palos Verdes Peninsula, where DDT dropped from 1100 ppb dw in 1986 to 280 ppb dw in 2008.

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



PCBs Trend

PCB trends

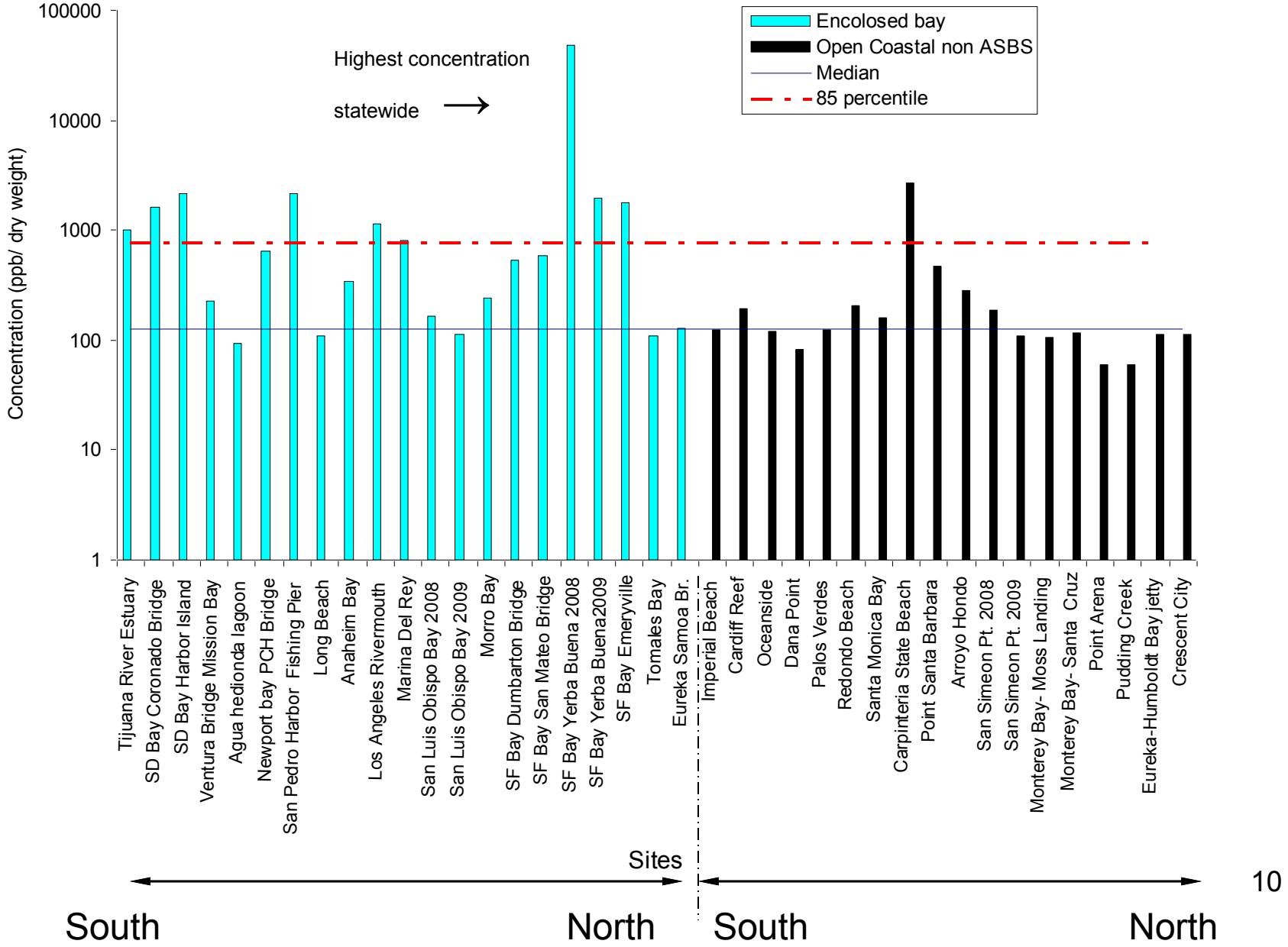
Significant decrease at Royal Palms (White Point)

Significant decrease at San Francisco Bay (San Mateo Bridge)

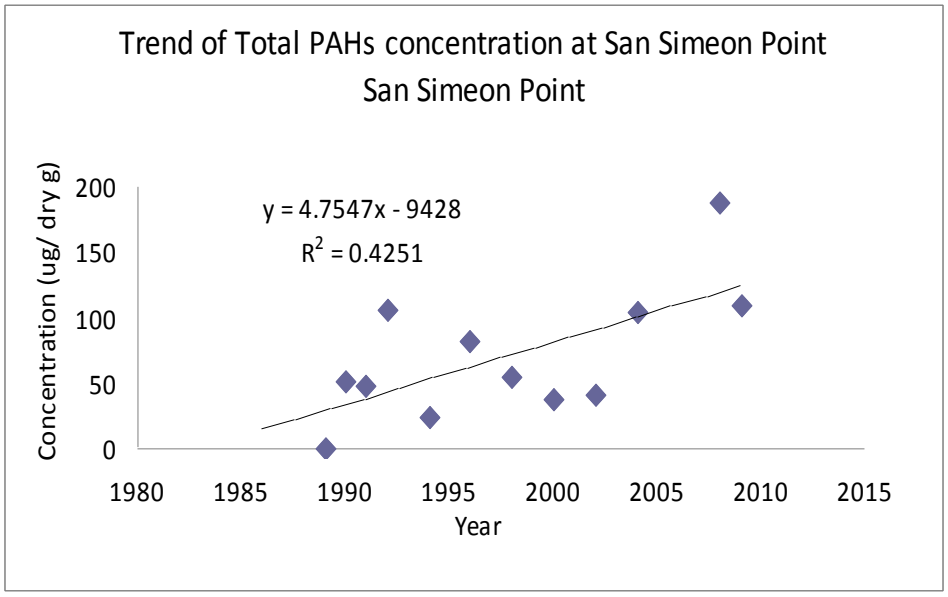
PCBs Status and Trends (1986-2009)

- 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, open coast & enclosed bays)



Total PAHs Trends (1986-2009)



Total PAHs Status and Trends (1986-2009)

- The largest PAH concentrations (48 ppm dw) were 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

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 & 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

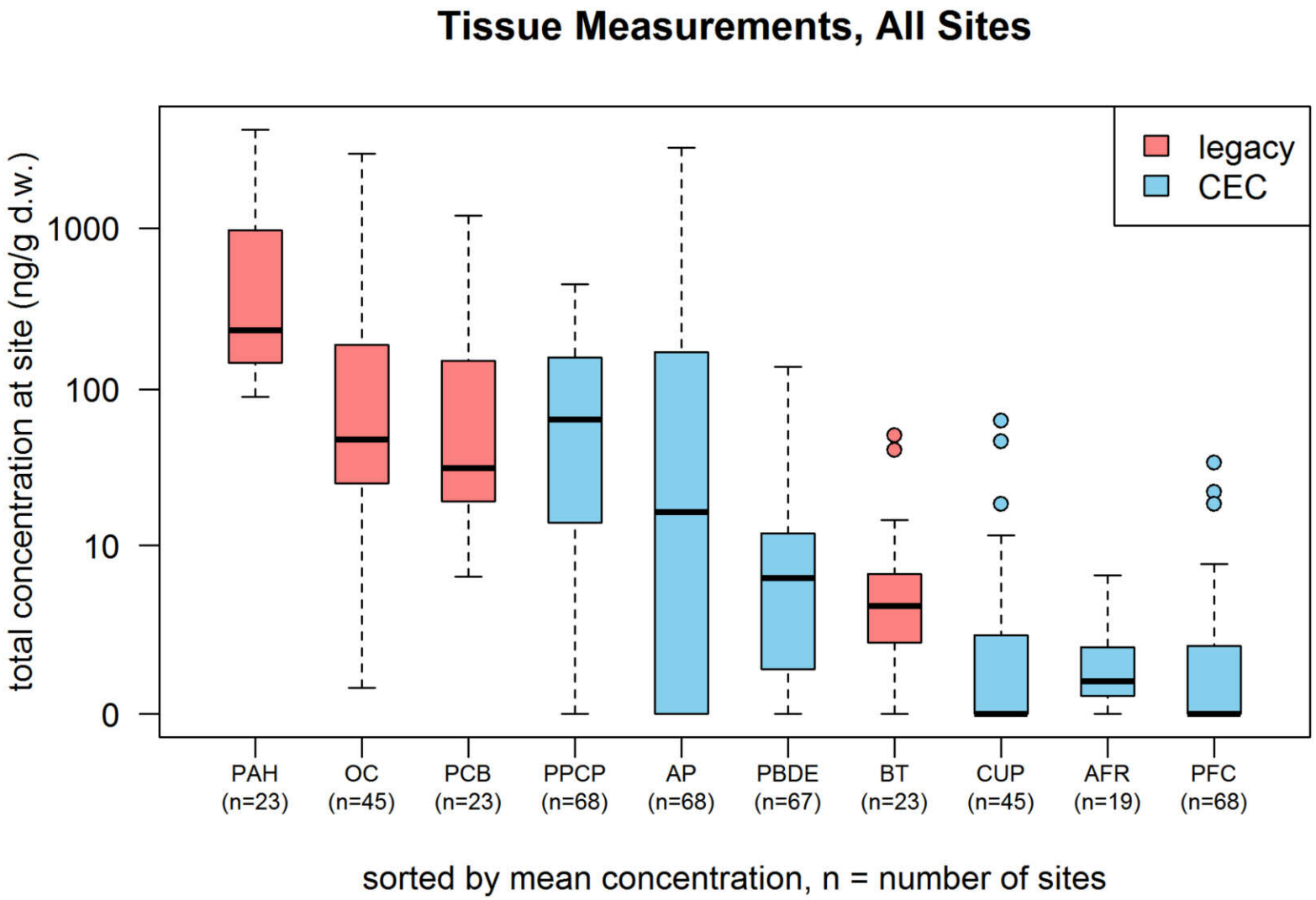
Analyte Class	Examples	No. analytes	No. Stations
Pharmaceuticals & Personal Care Products (PPCPs)	DEET, fluoxetine, ibuprofen, triclosan	86	All
Industrial and Commercial CECs*	4-nonylphenol, bisphenol A, BDE47, HBCD	54	Partial
Current Use Pesticides	chlorpyrifos, dachthal, permethrin	27	All
Legacy Organohalogens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

Different land uses/sources

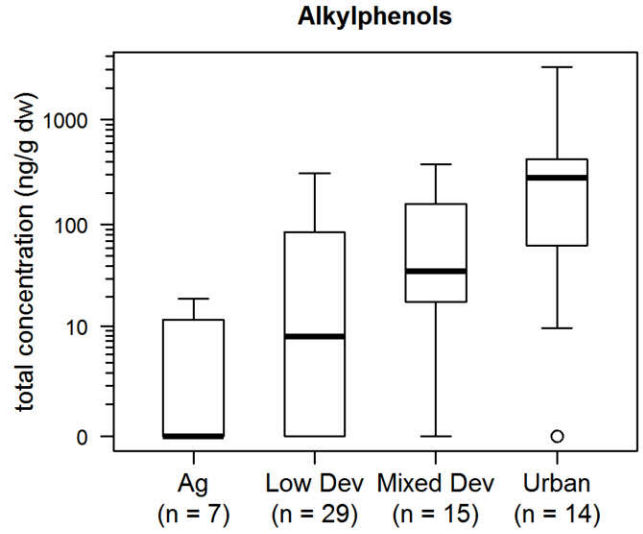
- Land uses:
  - Agriculture
  - Low development
  - Mixed development
  - Urban

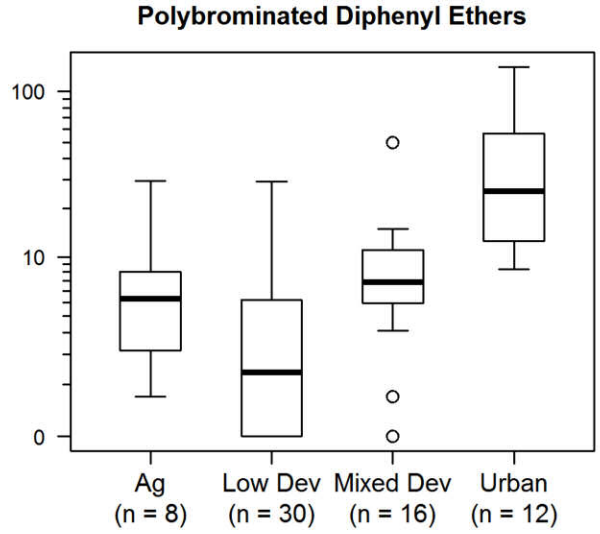
- Sources:
  - Storm water discharges
  - Sewage Treatment (POTWs)
  - No significant sources: ASBS, but note that some ASBS do have SW or POTW sources

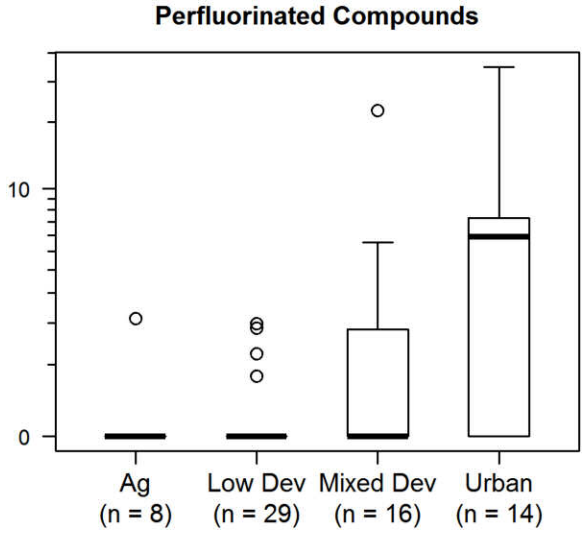
Concentration comparison of CEC and legacy pollutants

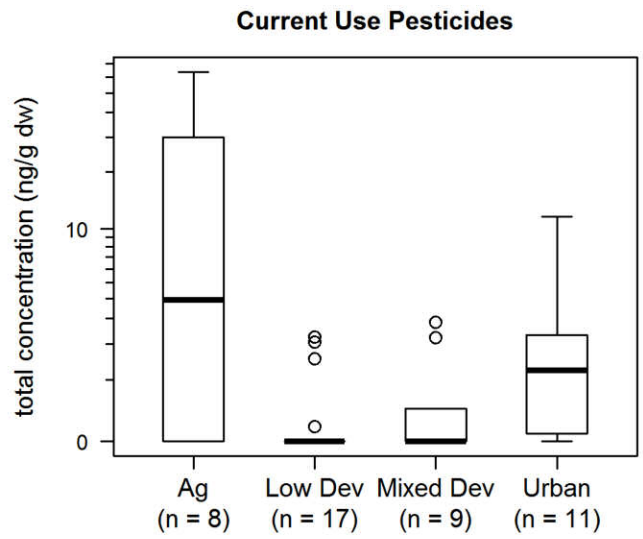


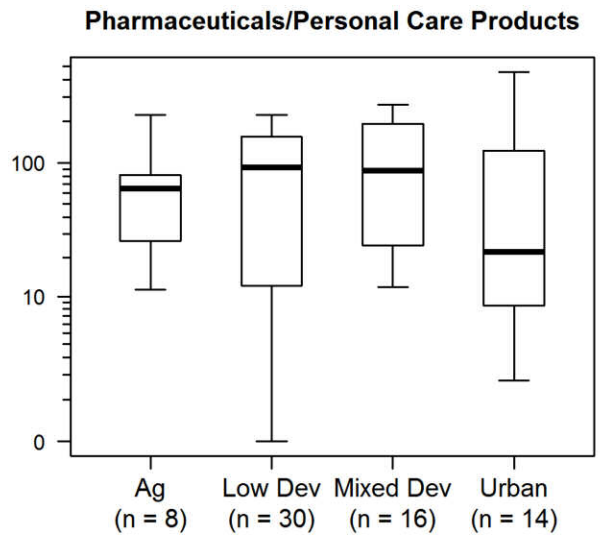
Tissue CEC concentrations by land use category

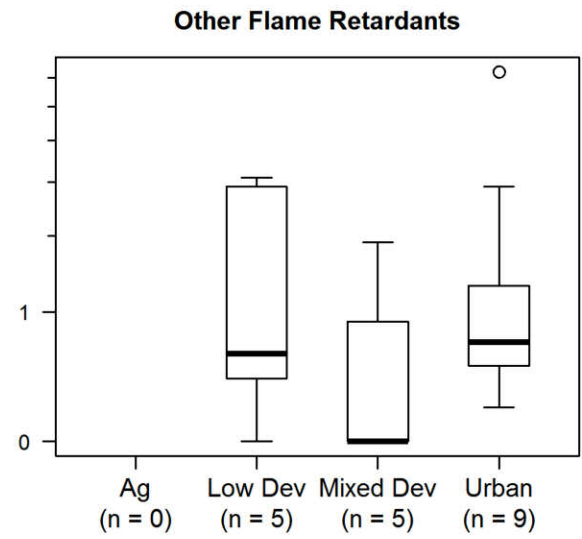




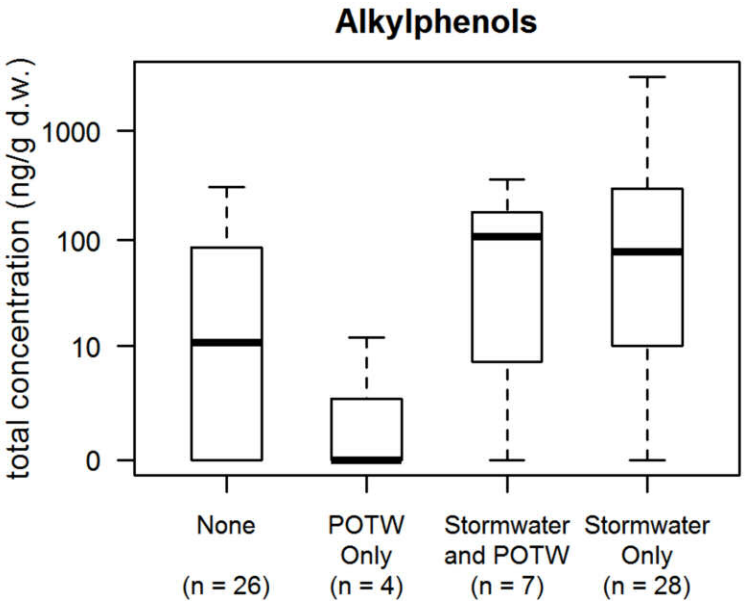


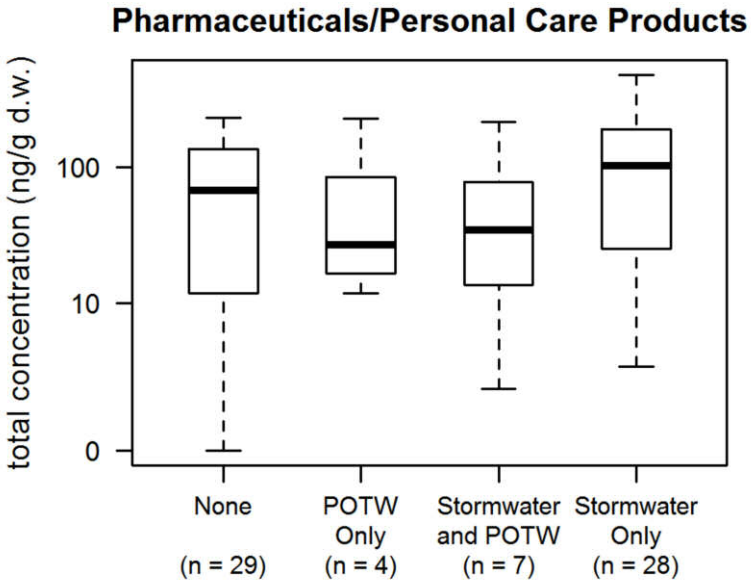


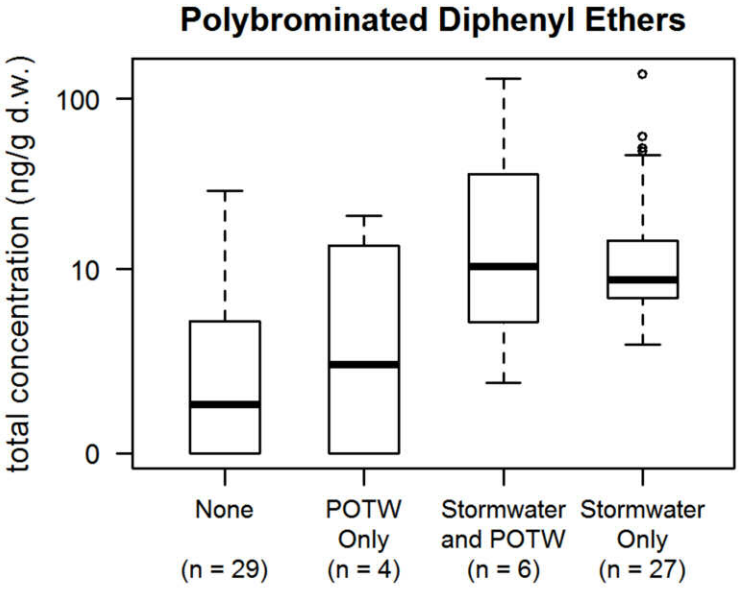


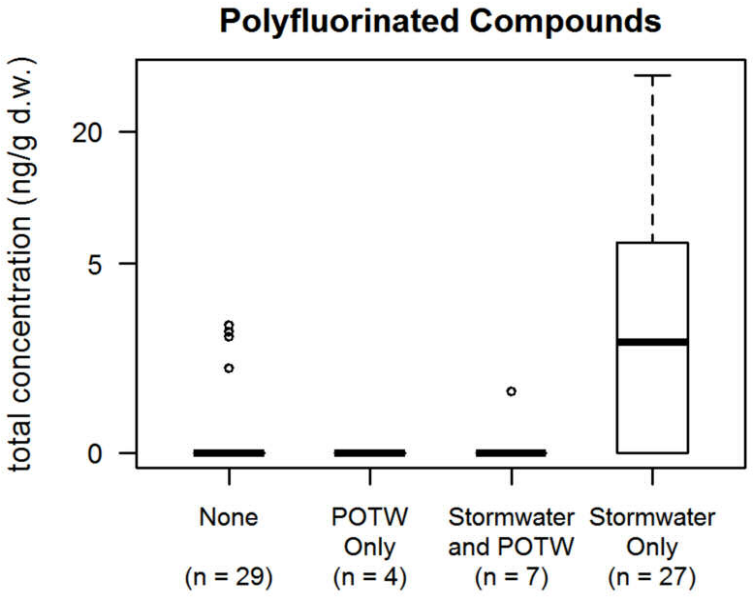


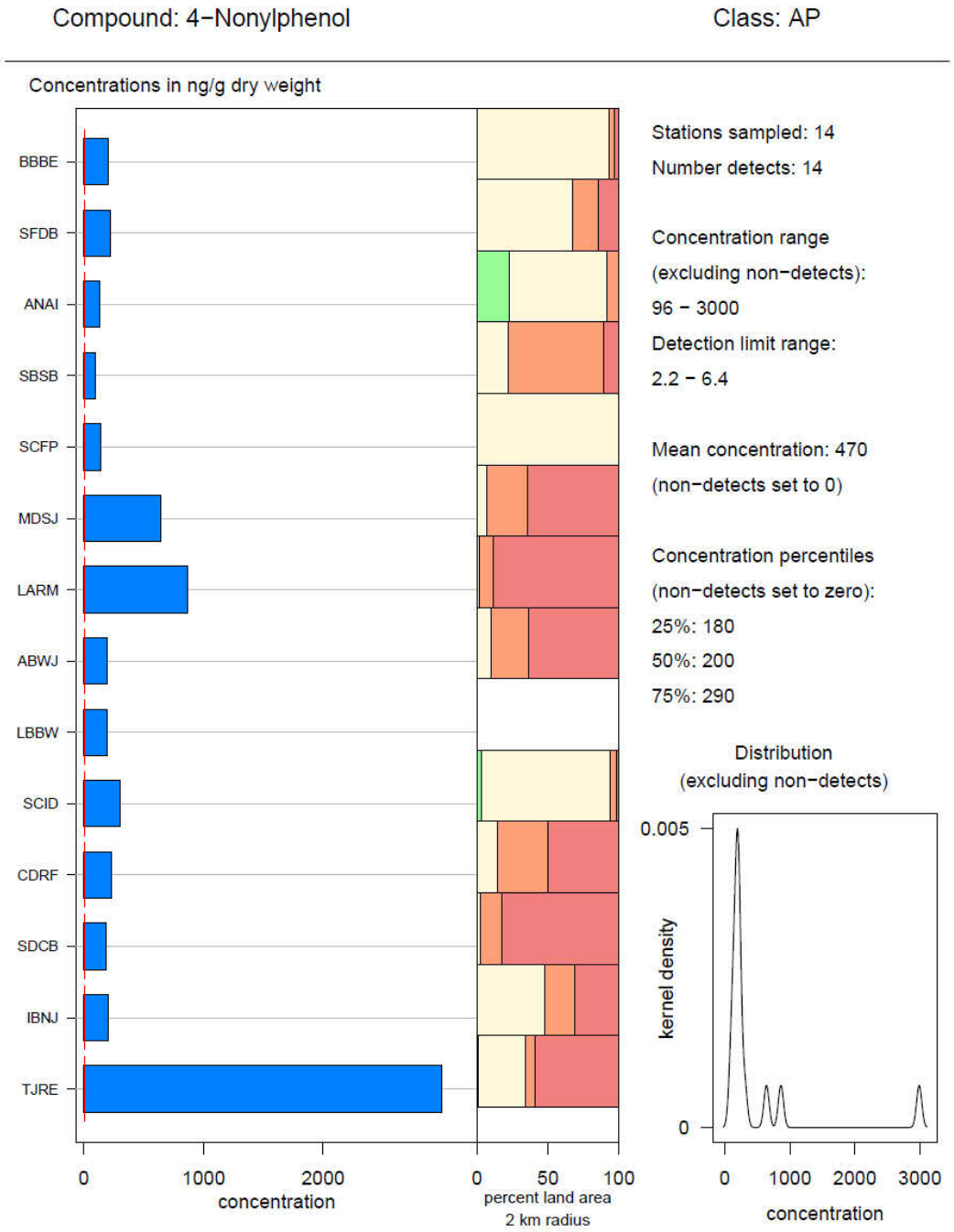
Tissue CEC concentrations by discharge category



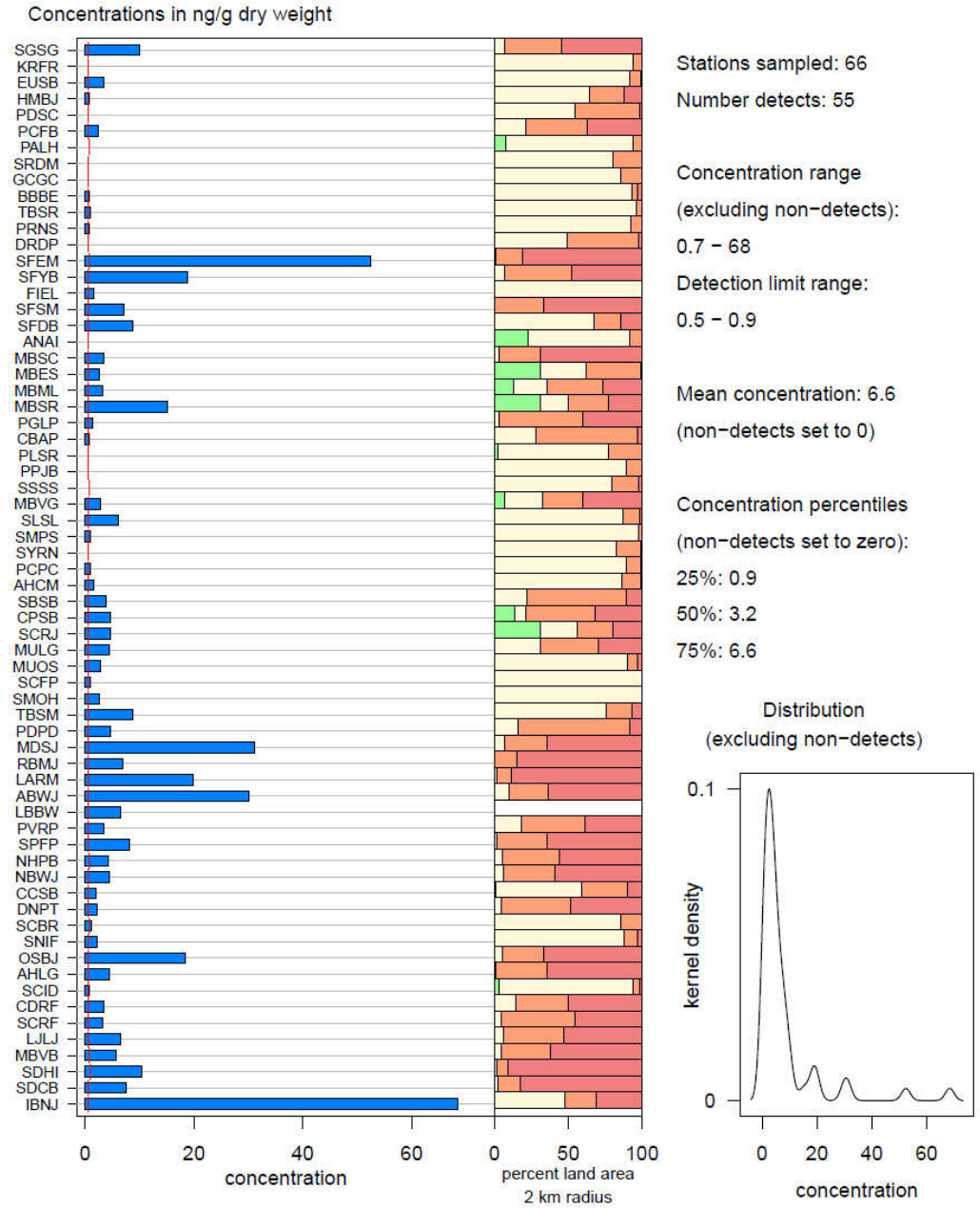






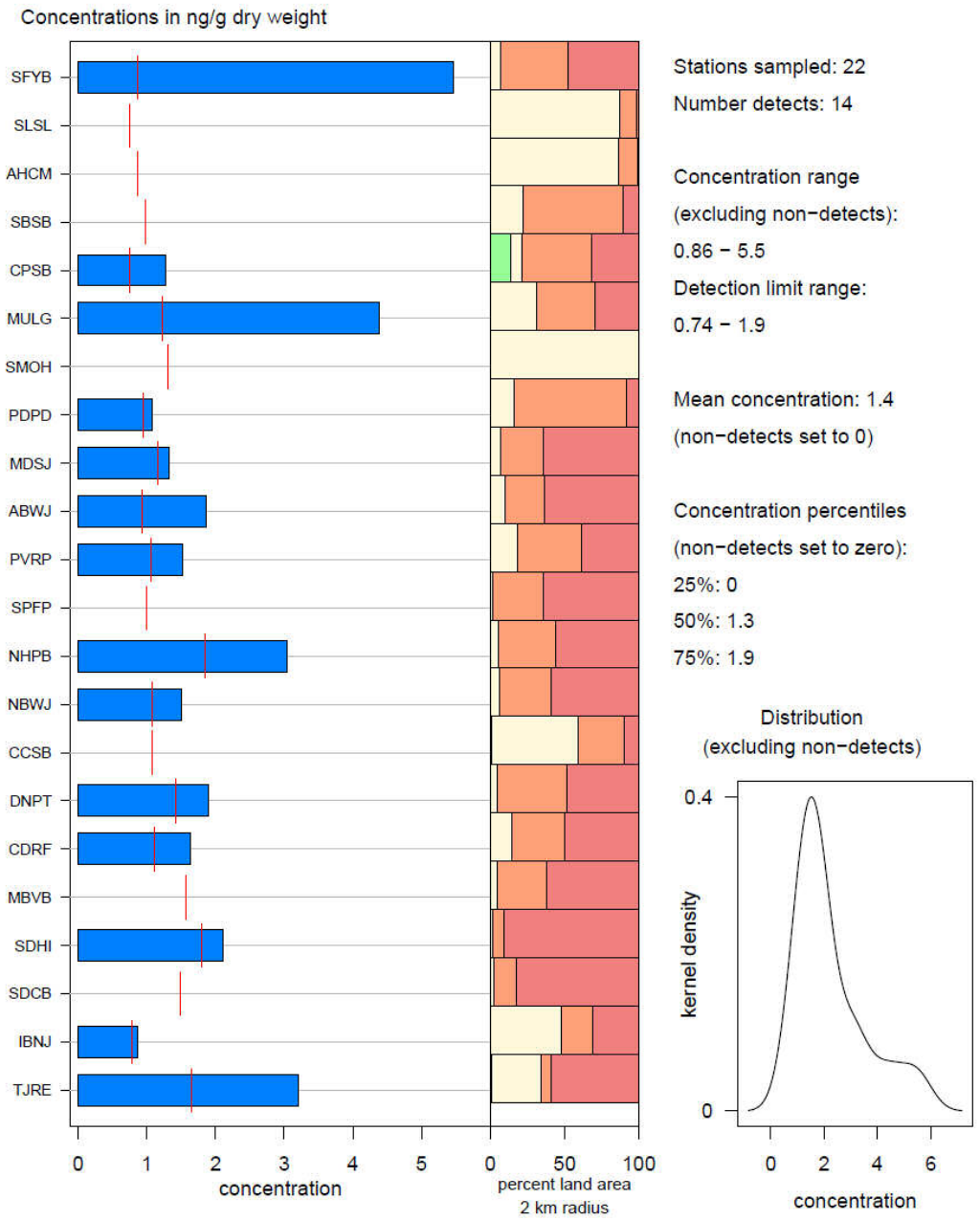

Compound: 4−Nonylphenol
Class: AP
Concentrations in ng/g dry weight
BBBE
SFDB
ANAI
SBSB
SCFP
MDSJ
LARM
ABWJ
LBBW
SCID
CDRF
SDCB
IBNJ
TJRE
0
1000
2000
concentration
0
50
100
percent land area
2 km radius
Stations sampled: 14
Number detects: 14
Concentration range
(excluding non−detects):
96 − 3000
Detection limit range:
2.2 − 6.4
Mean concentration: 470
(non−detects set to 0)
Concentration percentiles
(non−detects set to zero):
25%: 180
50%: 200
75%: 290
Distribution
(excluding non−detects)
0.005
0
kernel density
0
1000
2000
3000
concentration

Compound: BDE-47 Class: PBDE



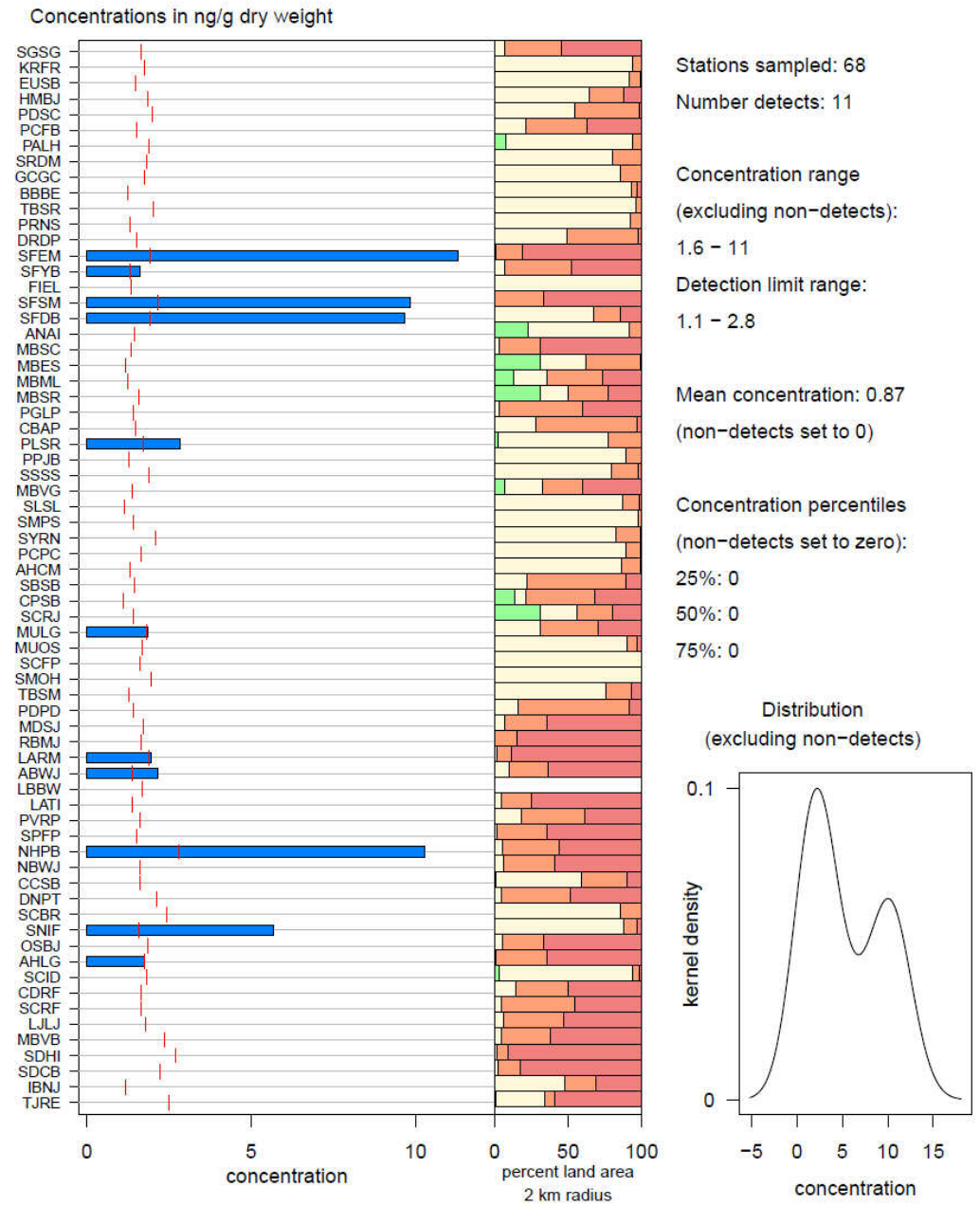
Compound: Sertraline

Class: PPCP



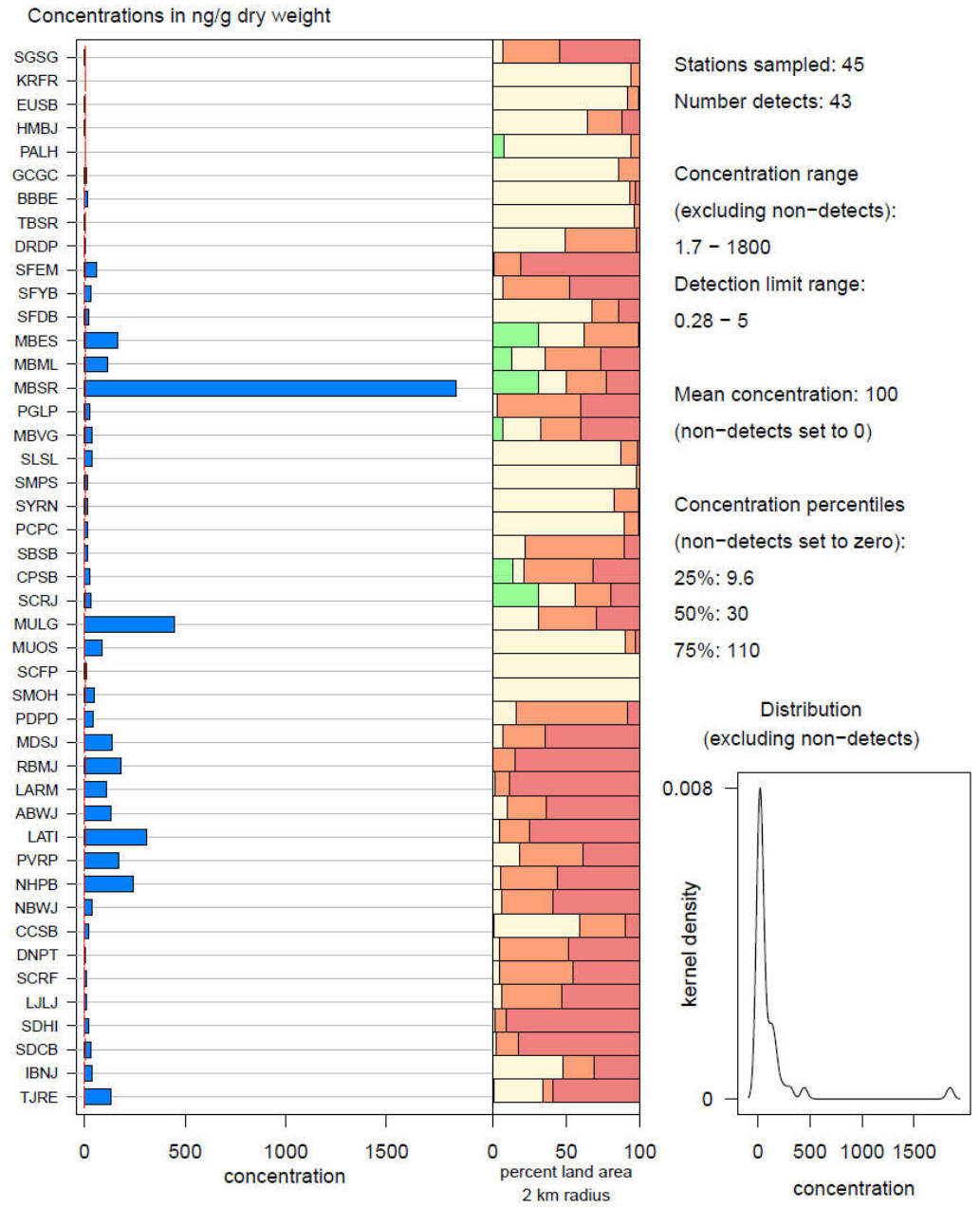
Compound: Diphenhydramine

Class: PPCP



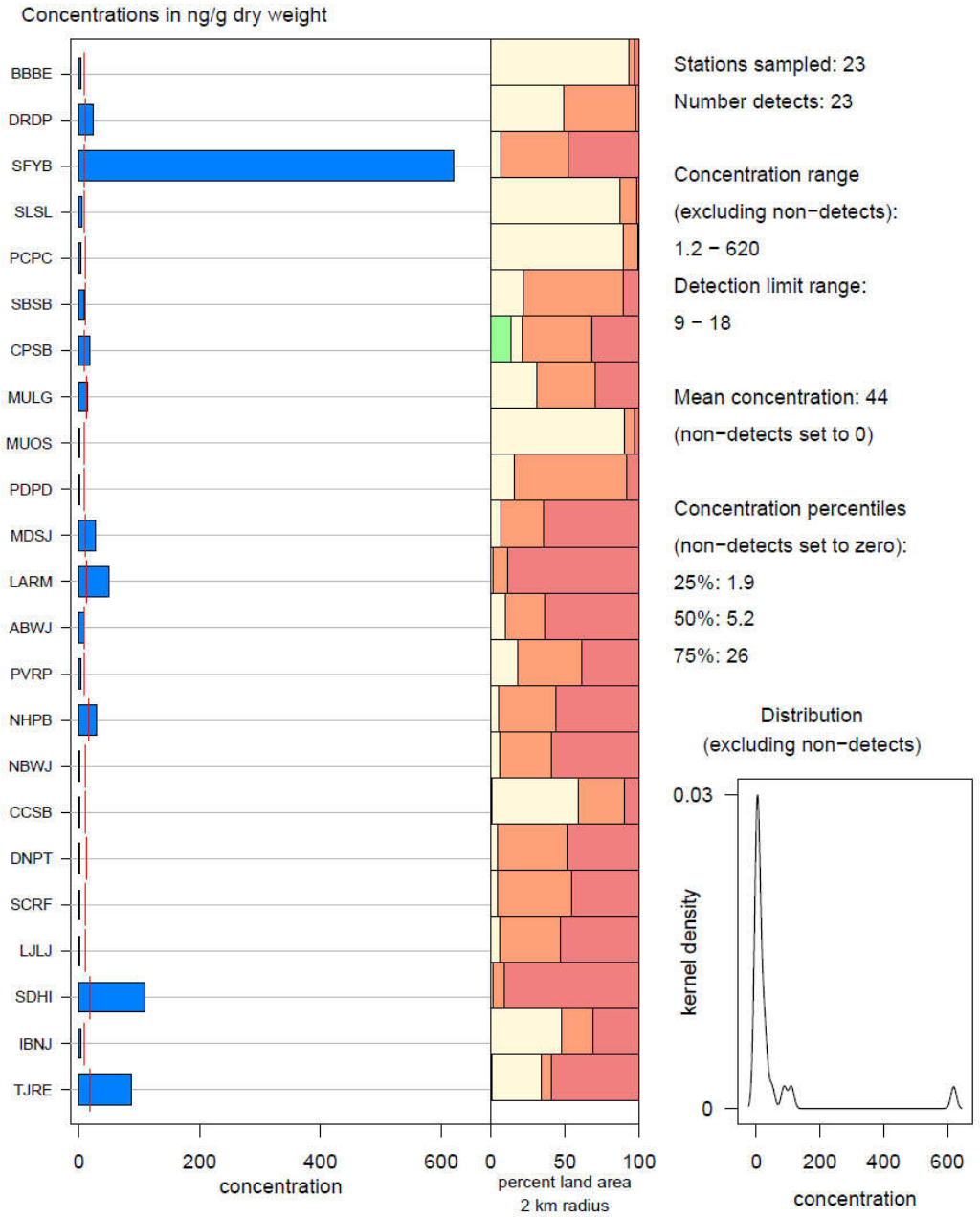
Compound: 4,4'−DDE

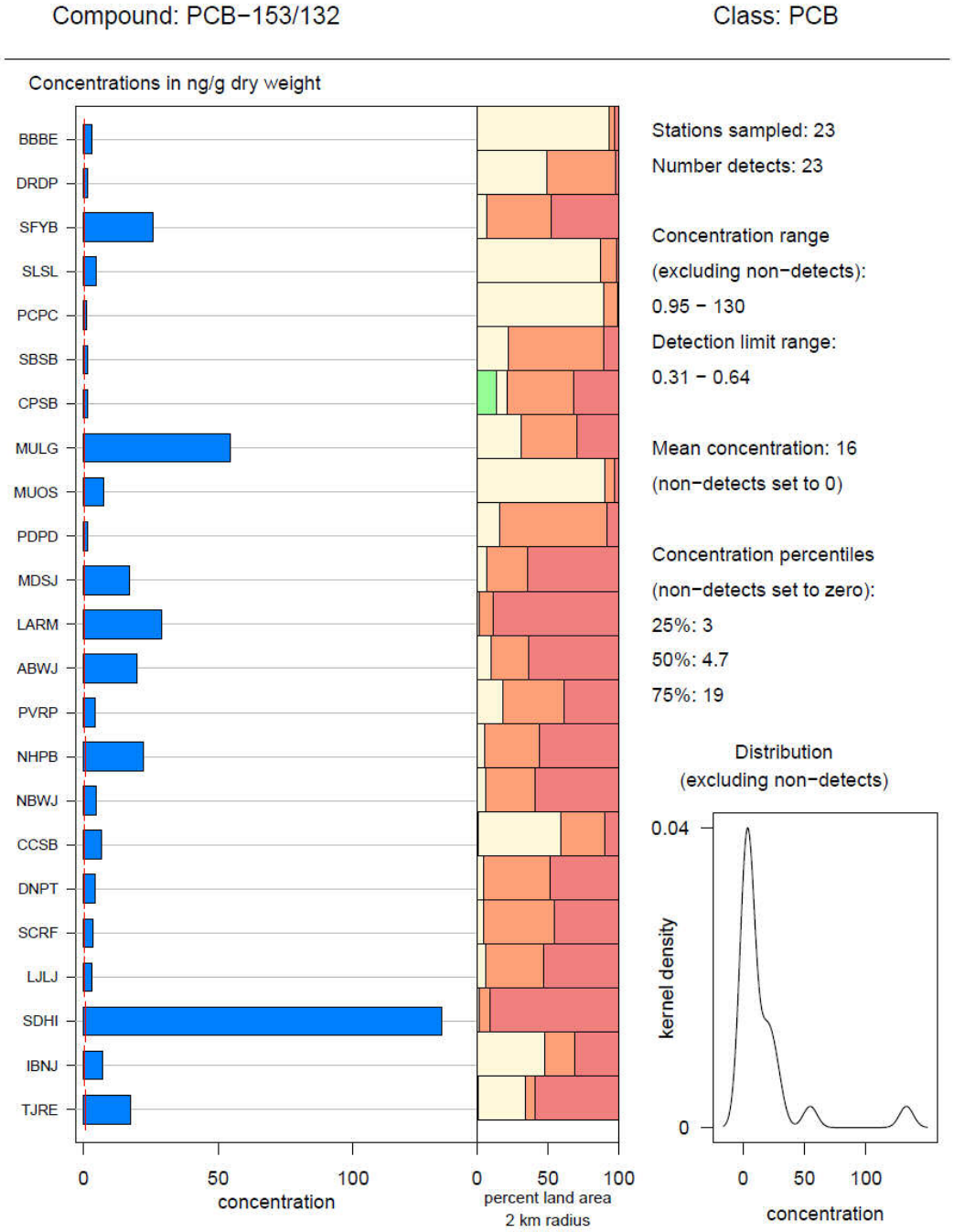
Class: OC



Compound: Fluoranthene

Class: PAH




Compound: PCB−153/132
Class: PCB
Concentrations in ng/g dry weight
BBBE
DRDP
SFYB
SLSL
PCPC
SBSB
CPSB
MULG
MUOS
PDPD
MDSJ
LARM
ABWJ
PVRP
NHPB
NBWJ
CCSB
DNPT
SCRF
LJLJ
SDHI
IBNJ
TJRE
0
50
100
concentration
0
50
100
percent land area
2 km radius
Stations sampled: 23
Number detects: 23
Concentration range
(excluding non−detects):
0.95 − 130
Detection limit range:
0.31 − 0.64
Mean concentration: 16
(non−detects set to 0)
Concentration percentiles
(non−detects set to zero):
25%: 3
50%: 4.7
75%: 19
Distribution
(excluding non−detects)
0.04
0
kernel density
0
50
100
concentration

Conclusions

- PBDEs, Alkylphenols (APs) & 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 (eg. 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 have a special session to present on CECs