RMP QAQC Update 2013:
Cyanide and PCB Challenges

RMP TRC Dec 12 2013

Cyanide (CN) Background

- Colorimetric assay
- Weak acid dissociable (WAD) CN
  - Free CN ultimate concern, but WAD may be upper limit surrogate of readily “available” CN
- NTR 1 ug/L objective
- CCCSD ~0.5 ug/L MDL
  - No commercial labs with MDL <1 ug/L

CN Past Difficulties

- High blank signal (avg up to ~1 ug/L)
  - Some variation in buffer reagent lots
  - Often 100% of samples < 3x blank avg
- Drifting calibration signal
  - Low calibration point (0.5 ug/L) sometimes < initial blank
  - Mid calibration point ~20-30% decrease in signal over measurement period
- Few matched long path cells
  - Extended period of readings, exacerbating drift

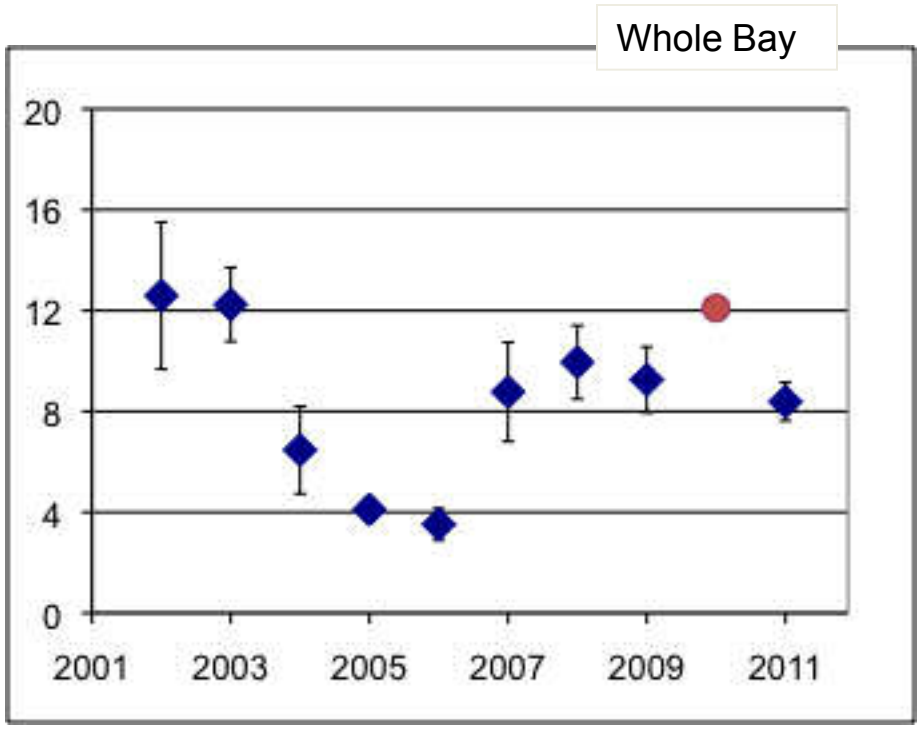
CN Method Improvements

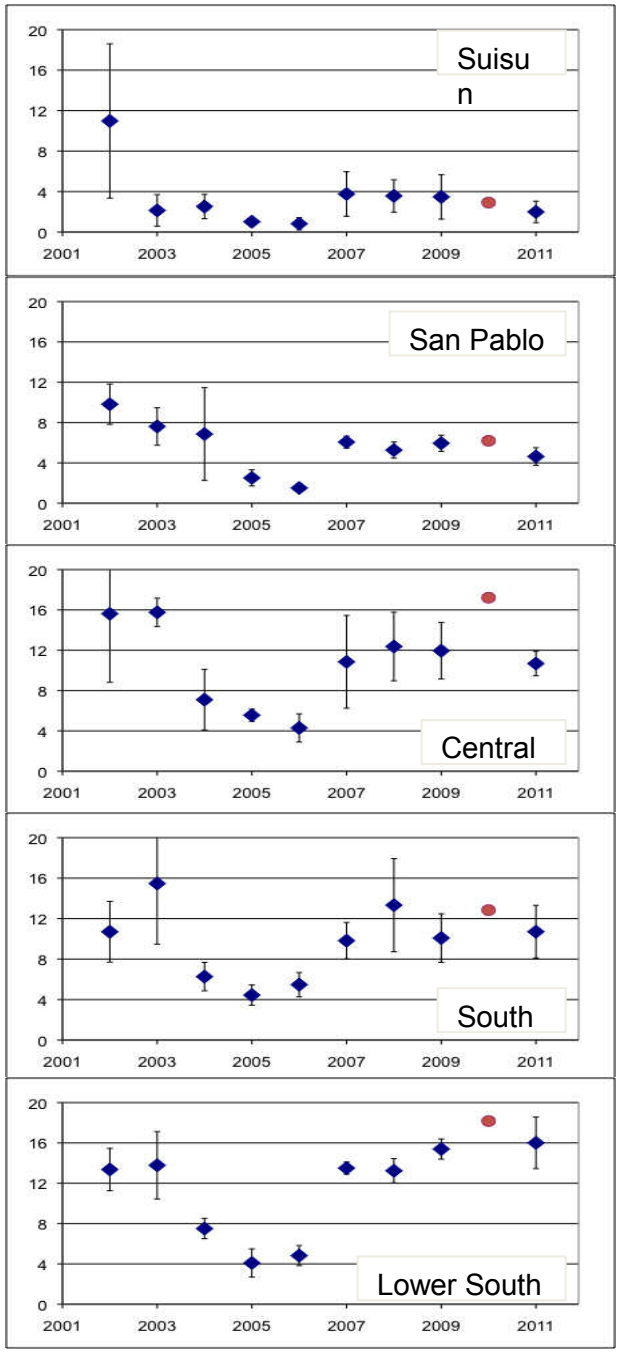
- Reducing blanks
  - Pre-testing of reagent lots
- Reducing drift
  - More matched long path cells
  - Smaller distillation groups
- Following the drift
  - Few sample readings continually bracketed by blank and (mid) calibration point readings

CN 2013 Results

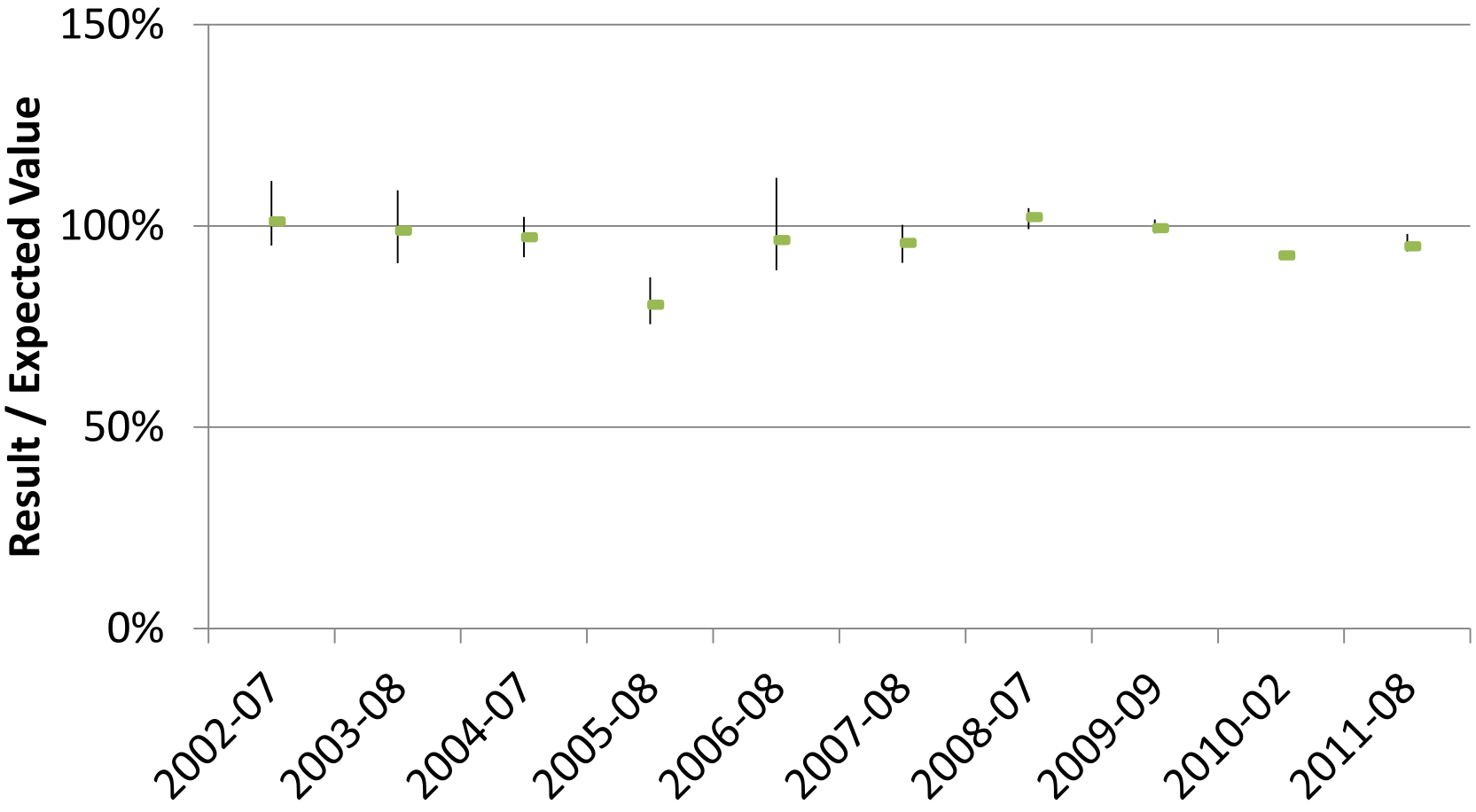
- WAD CN range ND – 0.97 ug/L
- Less blank contamination
  - 22% of samples < 3x blank
- Reduced drift, better accuracy and precision
  - MS RSDs 21%, LCSs 15%
  - MS average recovery 94%, LCS 100%

PCBs : 2004-2006 Mystery Dip

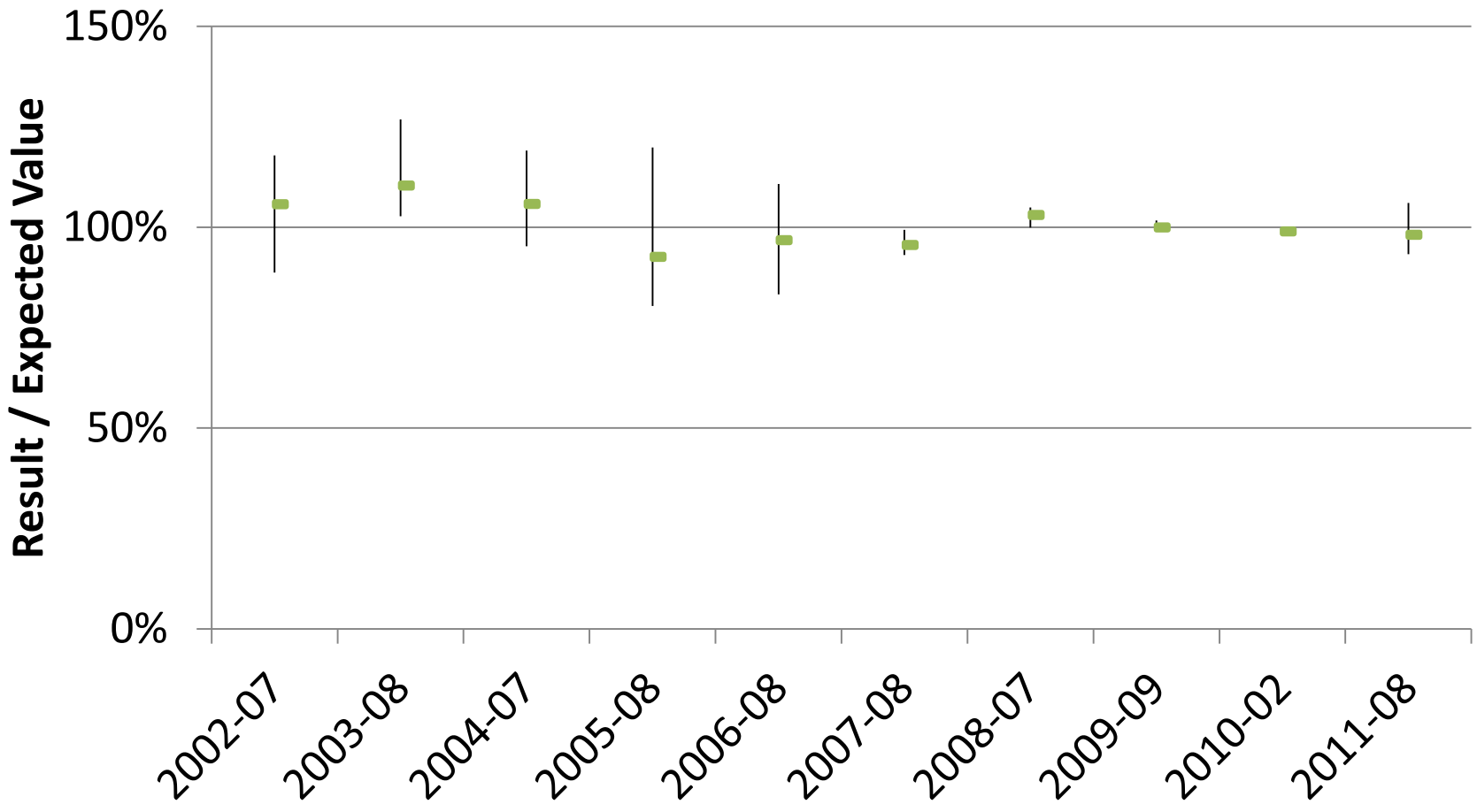




QAQC: CRM Recoveries Σ40 PCBs



QAQC: MS Recoveries (Σ40 PCB)

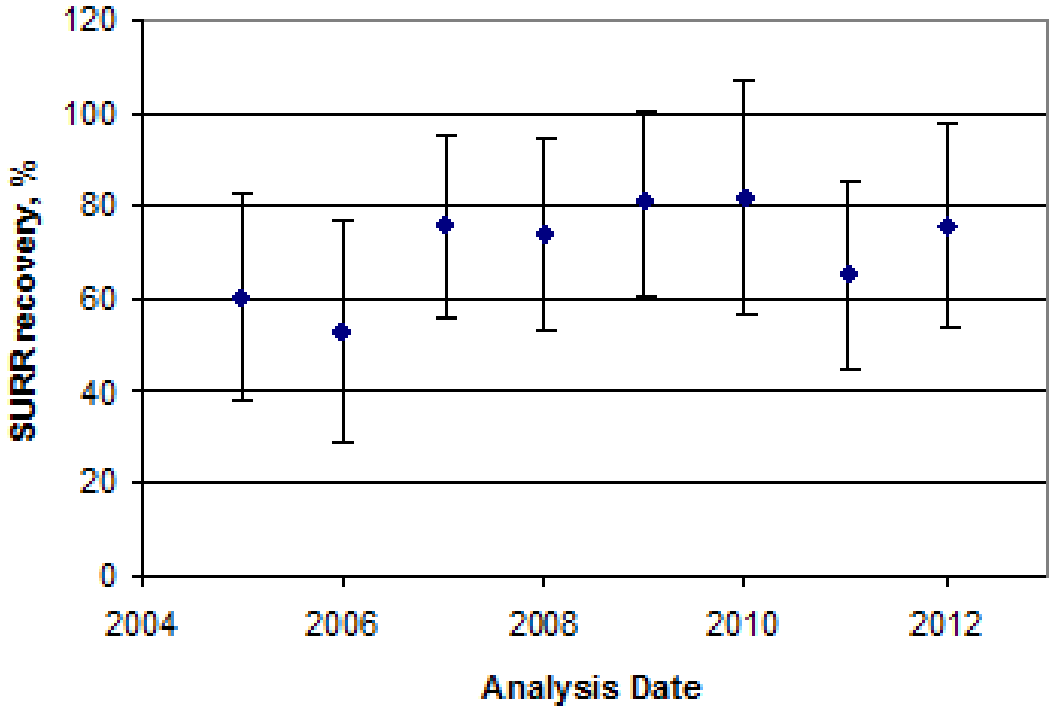


EBMUD Review

- 2002-2003 samples were reanalyses ca. 2010
- 2004-2006 “Low” period analyzed pre 2007
- Software peak calculation and data handling changes negligible impact

EBMUD Review: Surrogates

- Surrogate recoveries ~20% lower but within method limits – results surrogate corrected

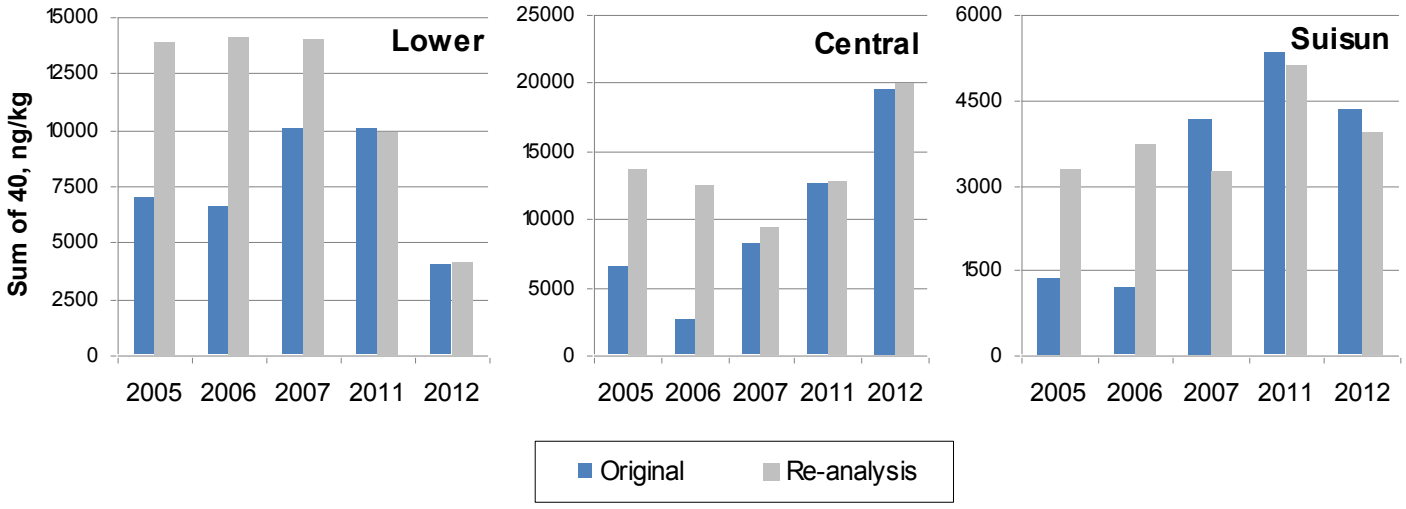


EBMUD Review

- Possible causes of change were improved sample drying and GPC cleanup
  - MS & CRM recoveries seem unaffected
  - Cleanup surrogate recoveries consistently high, likely minimal impact of GPC changes
- Sample drying method change most likely cause

Sample Reanalysis

- Samples from BA10, BC11, BF21
- Years 2005, 2006, 2007, 2011,2012
- Reanalyzed by current method



Reanalysis Summary

- Results of 2005 & 2006 samples by current method consistently higher
- Drying modification disproportionately affects field samples vs CRMs and MSs
  - Lower concentrations?
  - Lower percentage of total PCB mass embedded within matrix for MSs?
    - soluble PCBs spiked, no extended equilibration
  - CRM has 1.3% moisture, unaffected by drying mod

Lessons Learned

- Typical QC samples such as CRMs and MSs may not show some inter-lab and inter-year differences despite acceptable performance
  - Unaltered local samples needed to compare, despite challenges of homogeneity and possibly low concentrations
- Analyses in future years will include some retained samples for inter-year verification
  - Viable only for persistent analytes

2004-2006 Alternatives Discussion

- Data flagged as estimated with a likely low bias flag
- Data censored and not shown
- Only 2005 data reanalyzed (currently sediment on 2 year cycle).
  - will improved quantitation on old data change anything?
  - Pre 2002 data may have similar discontinuities from lab/sampling method differences

SSC station update:

- Continued operation of Mallard Island, Benicia, Richmond Bridge, and Alcatraz stations.
- Dumbarton moved back from railroad to vehicle bridge March 2013.
- New Exploratorium station being deployed as we speak, replacement for Hamilton disposal station and Golden Gate analysis.
- Corte Madera Creek discontinued October 1
- Alviso Slough funded until April 1

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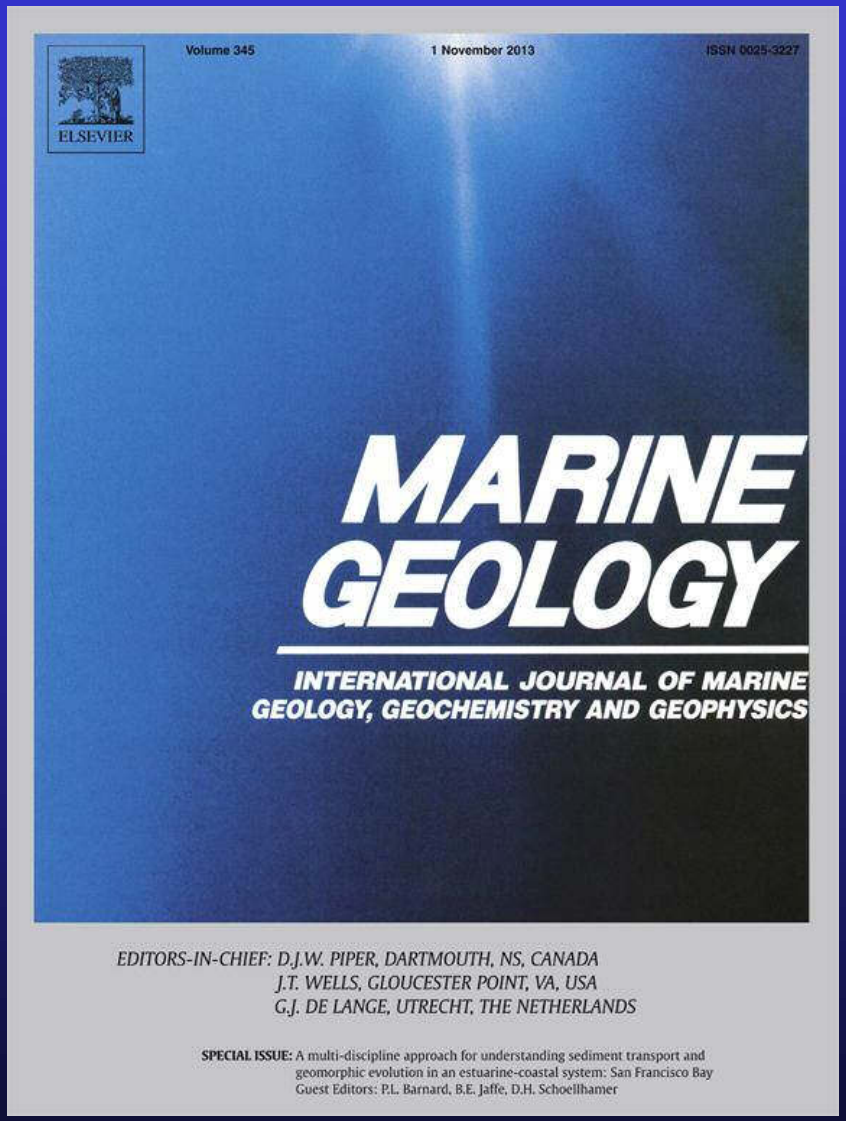
Marine Geology Special Issue

A multi-discipline approach for understanding sediment transport and geomorphic evolution in an estuarine-coastal system: San Francisco Bay

- 21 papers available on line and just published in *Marine Geology* volume 345
- Includes sand, mud, coast, watersheds, Delta, data, models, and more!
- Editors: Patrick Barnard, Bruce Jaffe, and David Schoellhamer



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A sediment budget for the southern reach in San Francisco Bay, CA: Implications for habitat restoration

Gregory G. Shellenbarger *, Scott A. Wright, David H. Schoellhamer

Data and results published, RMP fact sheet in review, can be published

The use of modeling and suspended sediment concentration measurements for quantifying net suspended sediment transport through a large tidally dominated inlet

Li H. Erikson [a,*], Scott A. Wright [b], Edwin Elias [c], Daniel M. Hanes [d], David H. Schoellhamer [b], John Largier [e]

Results of Golden Gate flux analysis

Seasonal variations in suspended-sediment dynamics in the tidal reach of an estuarine tributary

Maureen A. Downing-Kunz *, David H. Schoellhamer

Tributary traps Bay sediment

Adjustment of the San Francisco estuary and watershed to decreasing sediment supply in the 20th century

David H. Schoellhamer *, Scott A. Wright, Judith Z. Drexler

Larger Central Valley floods needed to supply sediment

USGS

Salinity station update:

- Funded by DWR and USGS
- Continued operation of Benicia, Carquinez Bridge, Richmond Bridge, Alcatraz, and San Mateo Bridge stations.
- Dumbarton moved back from railroad to vehicle bridge March 2013.
- New Exploratorium station being deployed as we speak, replacement for Hamilton disposal station and Golden Gate analysis.
- Corte Madera Creek discontinued October 1
- Alviso Slough funded until April 1

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DO station update:

- DO sensors deployed near-bottom at Benicia, Richmond Bridge, and San Mateo Bridge stations.
- Dumbarton moved back from railroad to vehicle bridge March 2013.
- New Exploratorium station being deployed as we speak, replacement for Hamilton disposal station and Golden Gate analysis.
- Corte Madera Creek discontinued October 1
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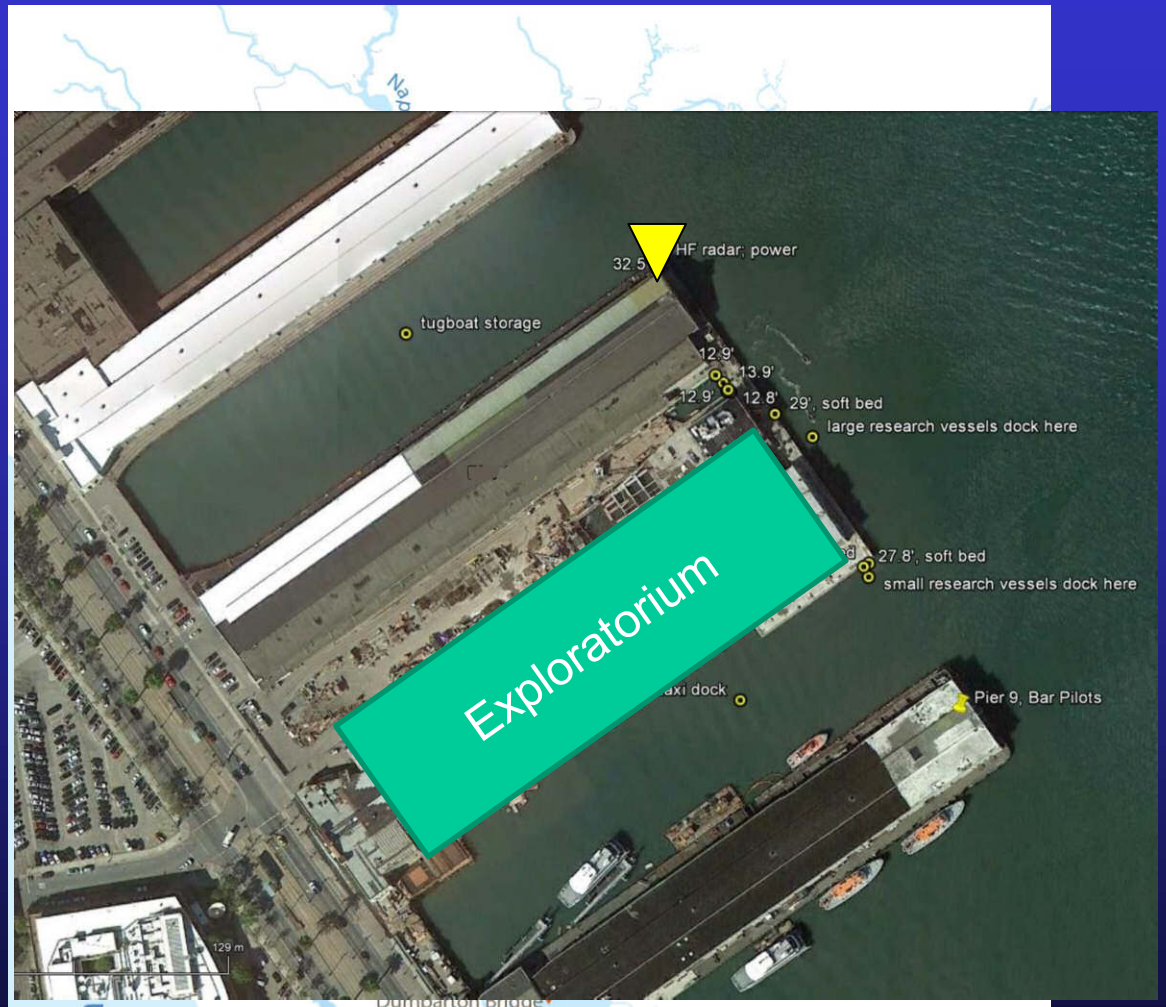
Exploratorium



Near-bed sonde
~30 feet MLLW

Parameters:
-Specific conductance
-Temperature
-Depth
-Turbidity
-Dissolved oxygen

Incorporating data visualization for Bay Observatory Gallery exhibit

USGS

Nutrient collaboration with RMP/SFEI

SFEI instruments installed:

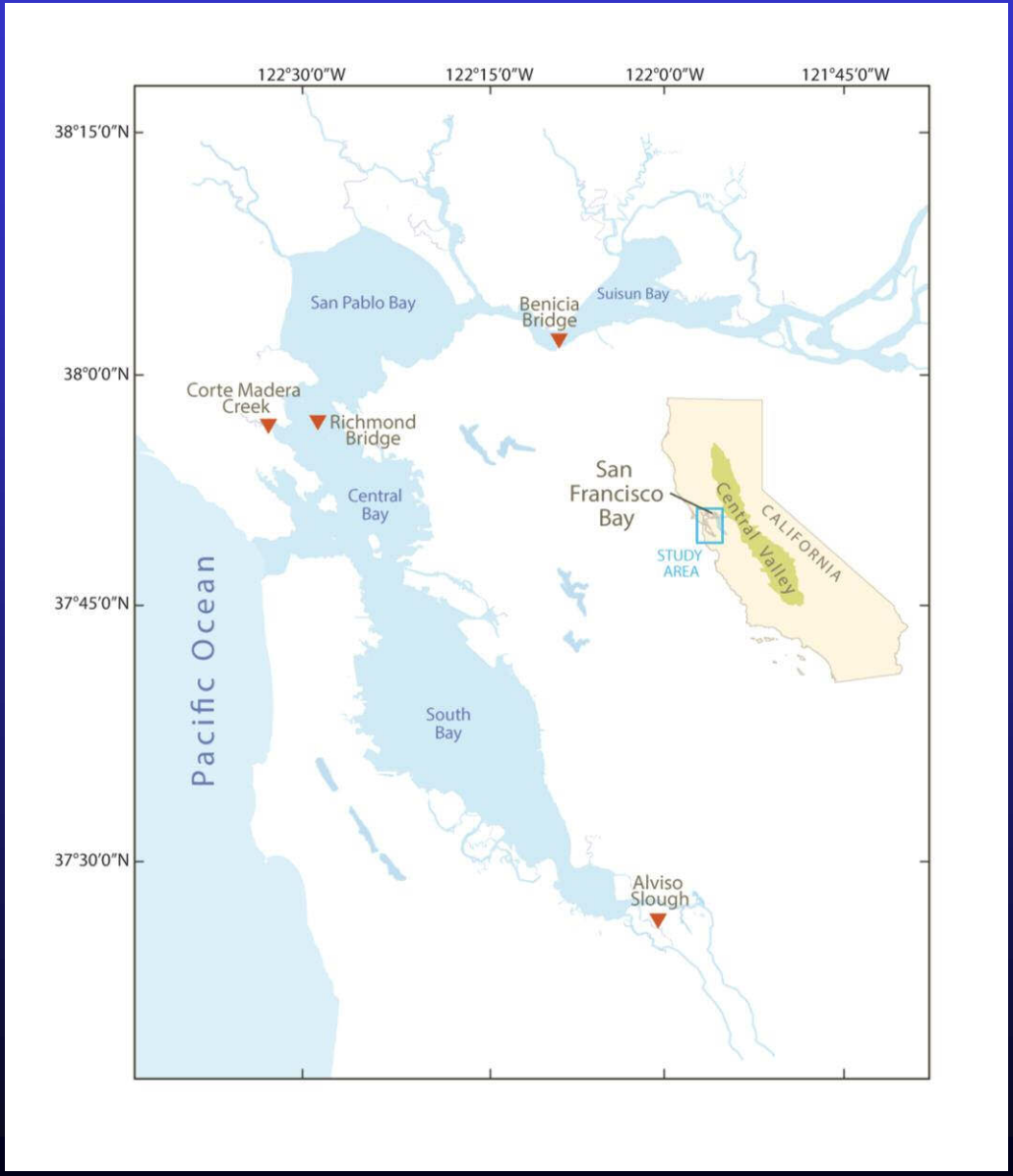
- Dumbarton
- San Mateo
- Alviso Slough

Collaborating on analysis & writing:

- Lower South Bay technical report
  - DO
  - SSC

Paul, Dave, and Emily
at San Mateo Bridge

SF Bay DO—Preliminary Findings



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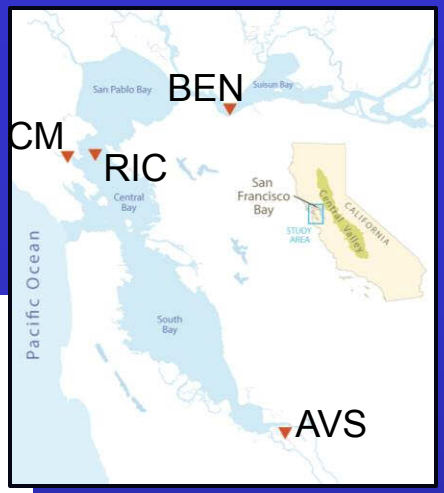
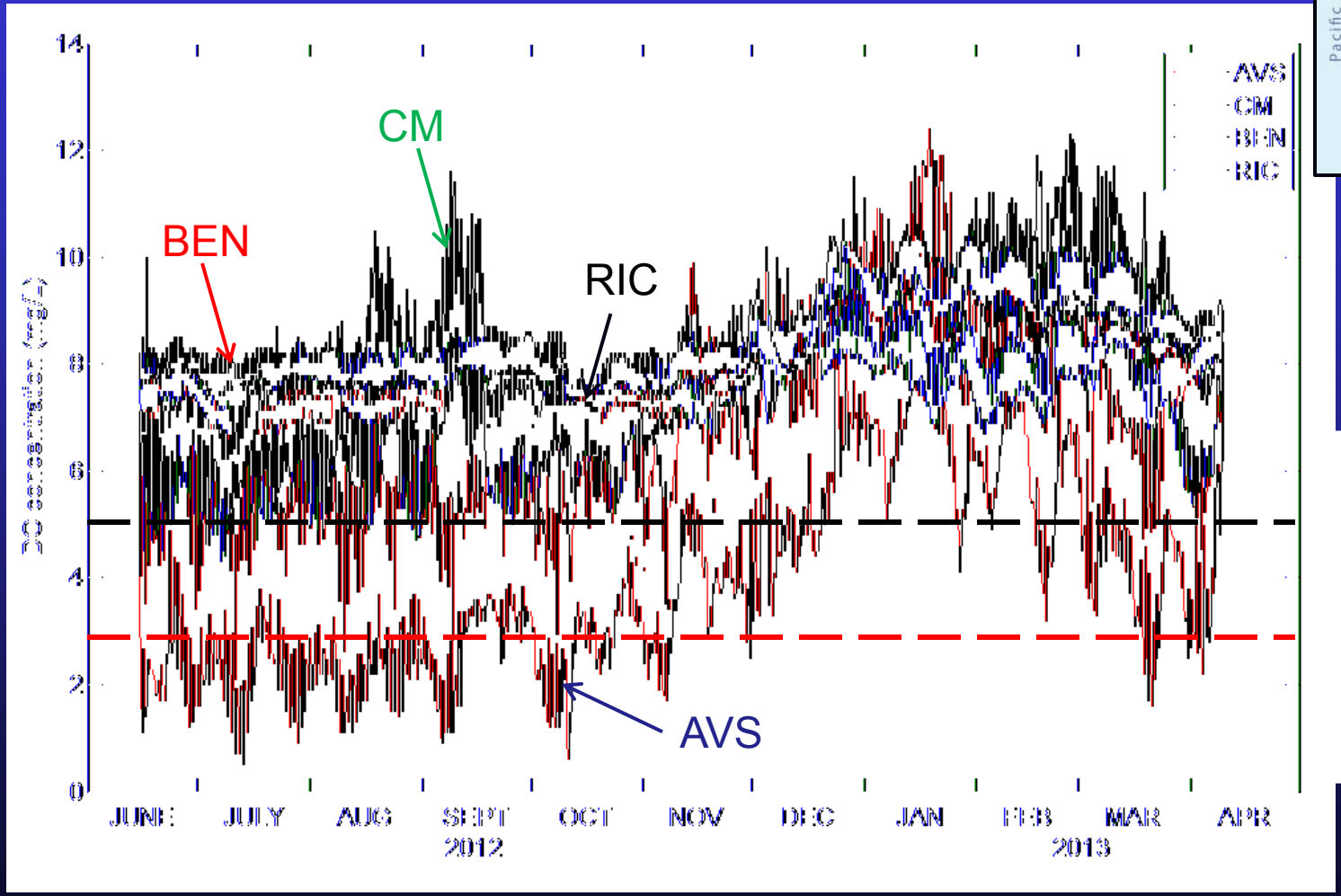
Main channel not necessarily indicative of perimeter





Low DO:
5.0 mg/L

Hypoxic:
2.8 mg/L

Main channel: BEN & RIC Perimeter: CM & AVS

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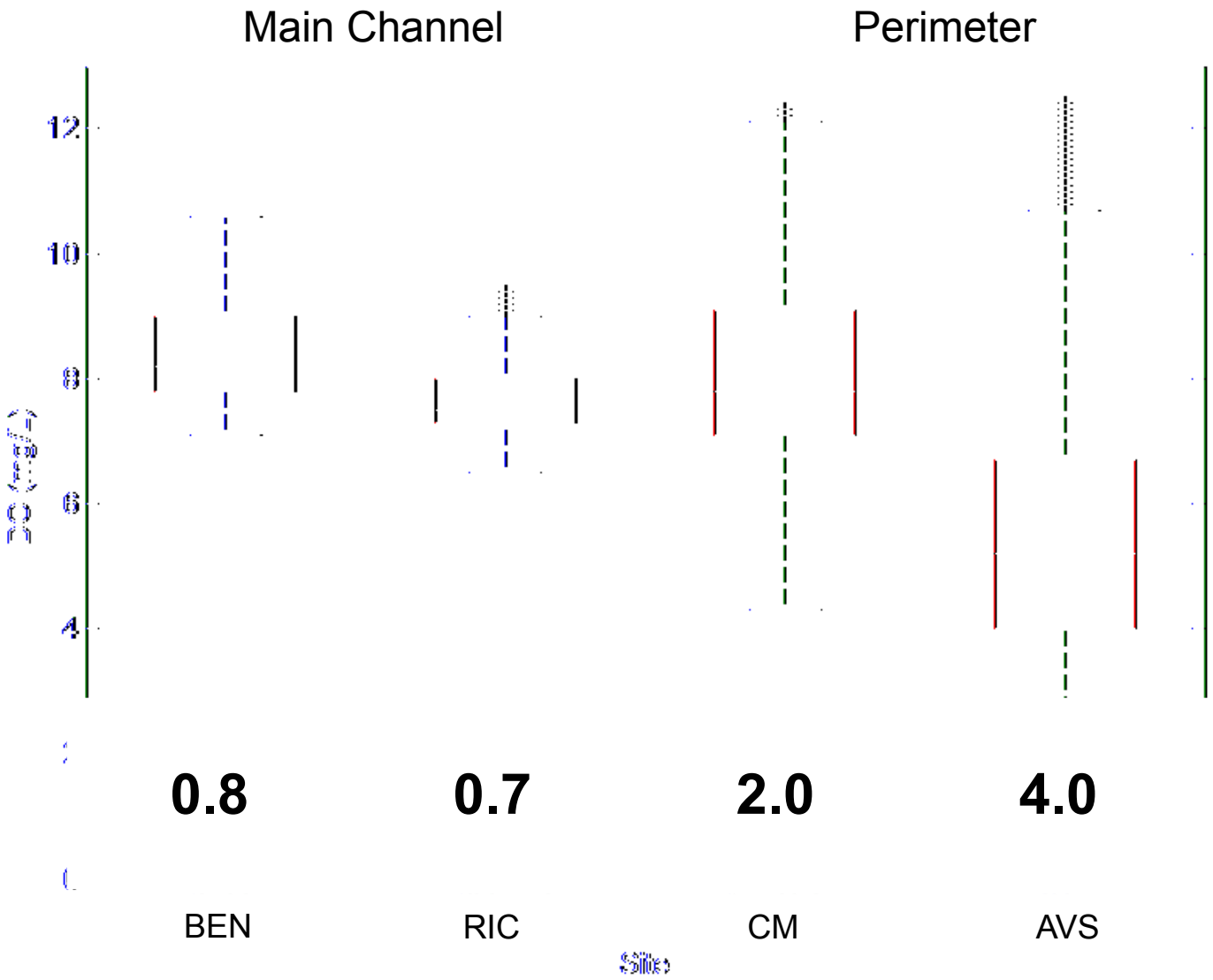
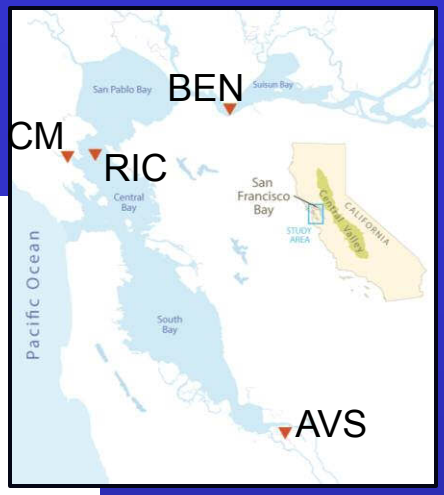
Higher variability at perimeter





Mean diel variation (mg/L)

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Cool observations along estuary perimeter

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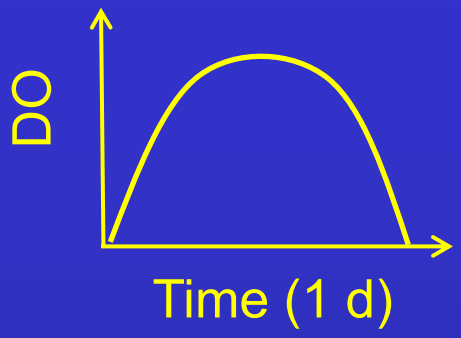
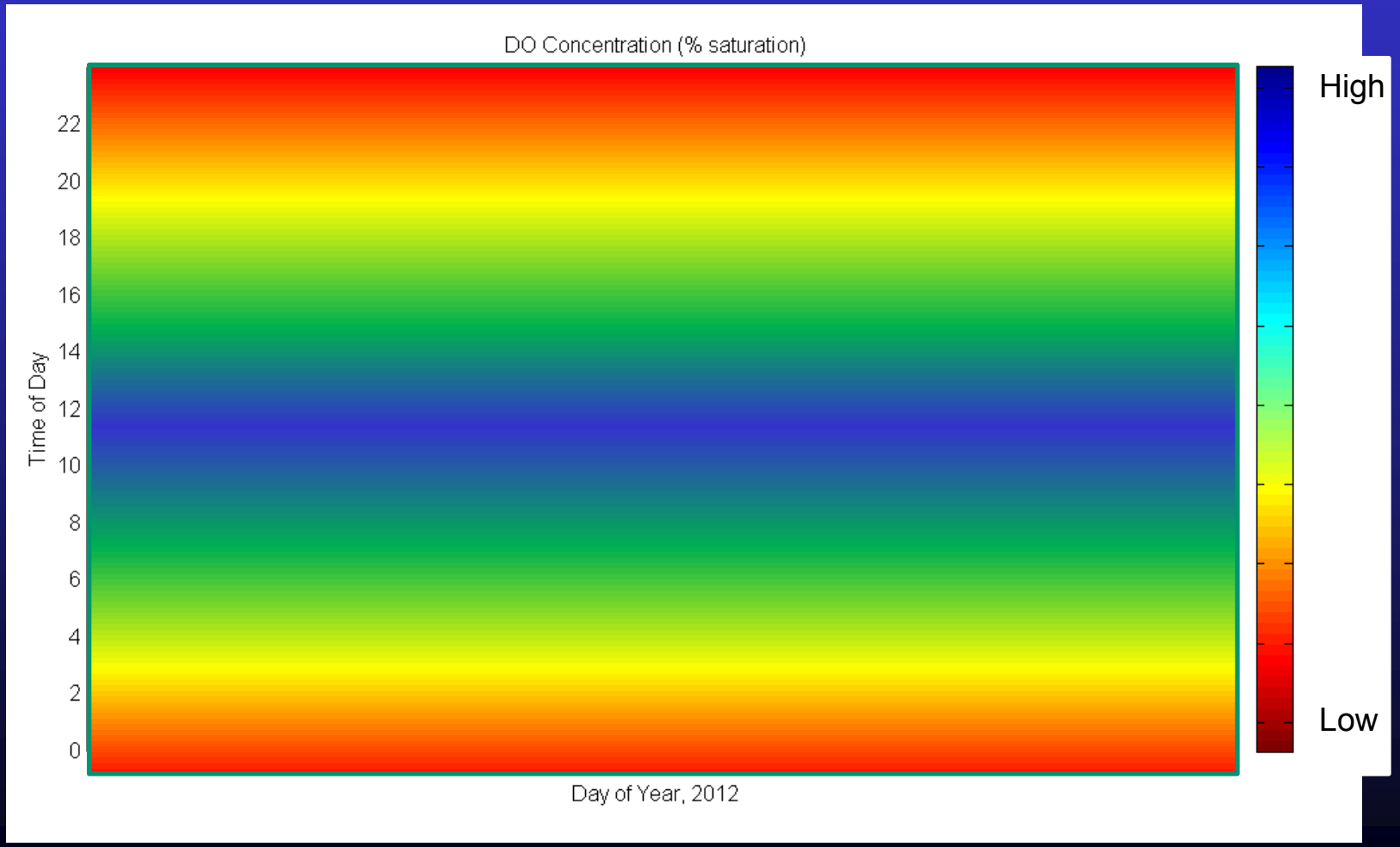
Diurnal DO pattern





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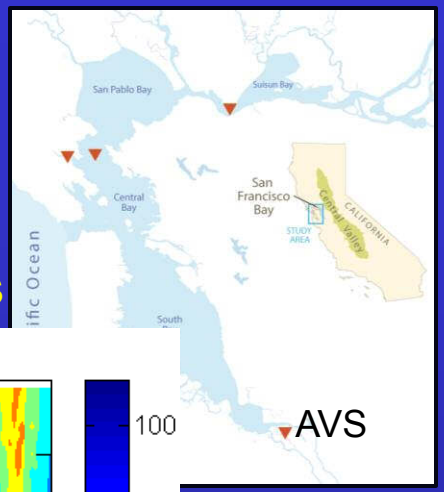
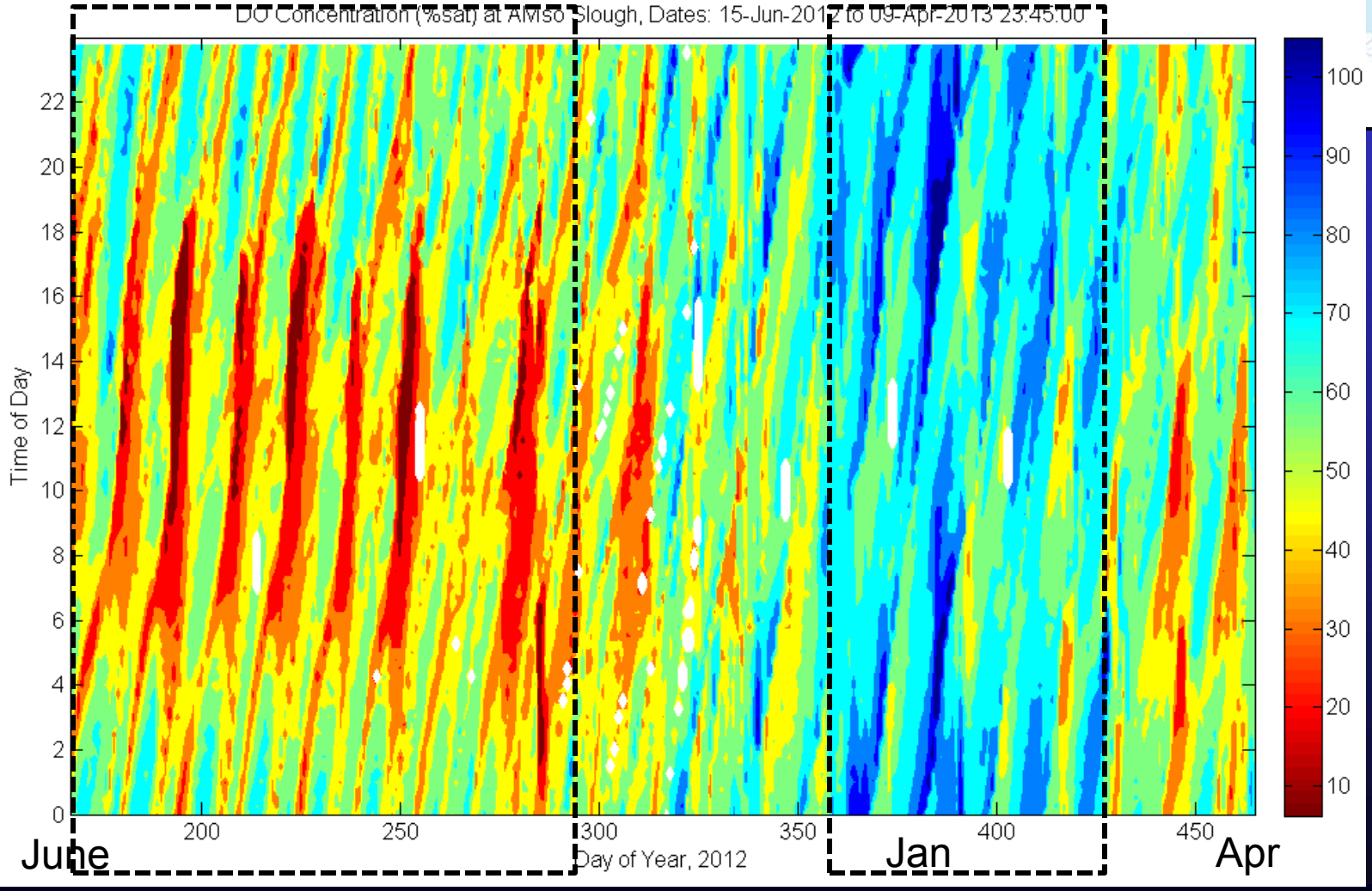
Alviso Slough DO patterns

Summer—periodic low DO

Winter—DO increases





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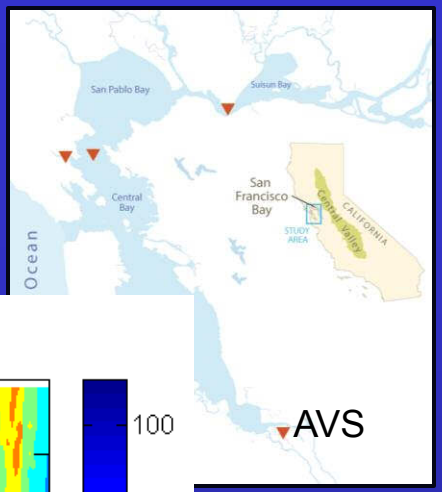
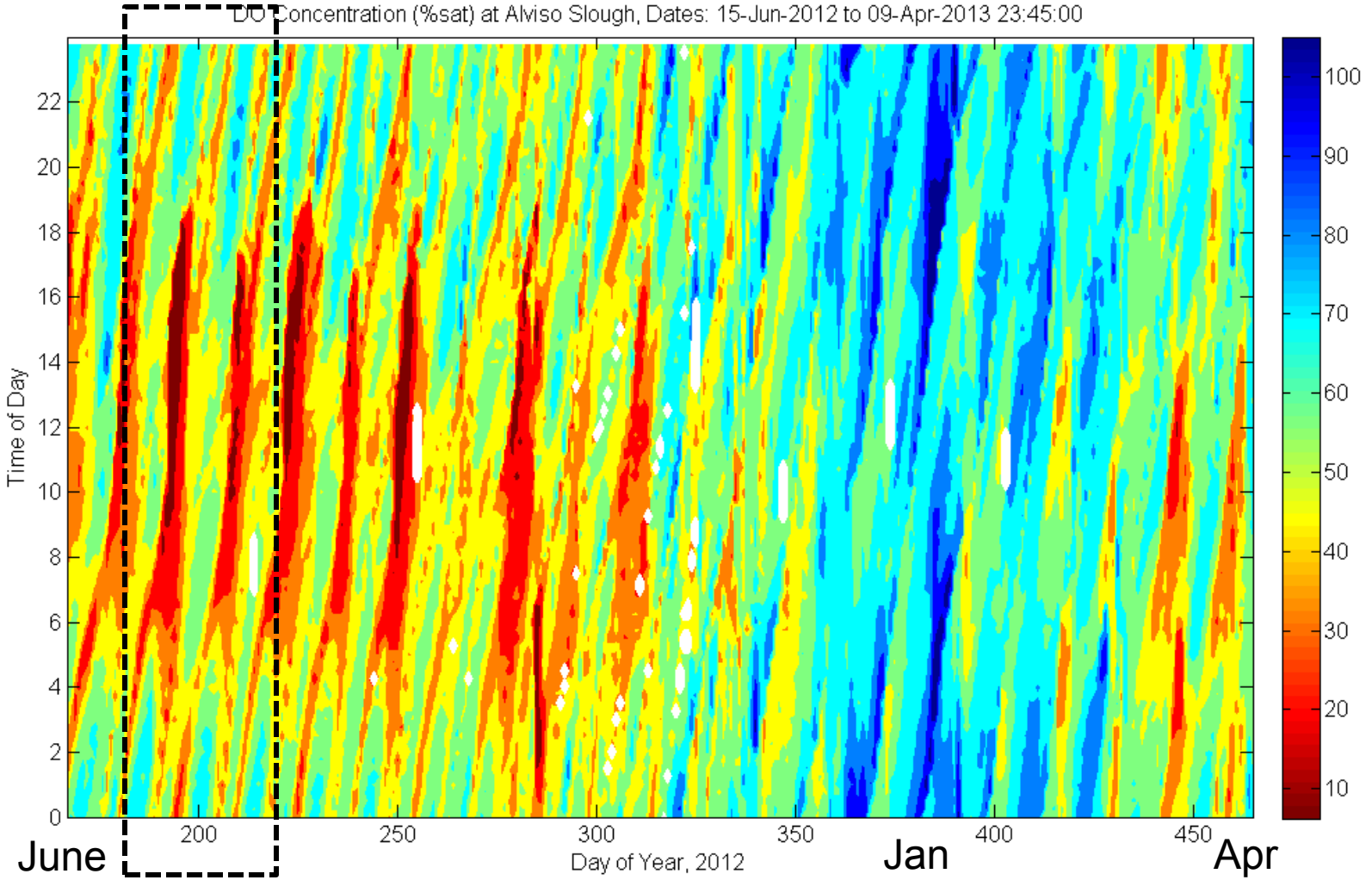
Alviso Slough DO patterns





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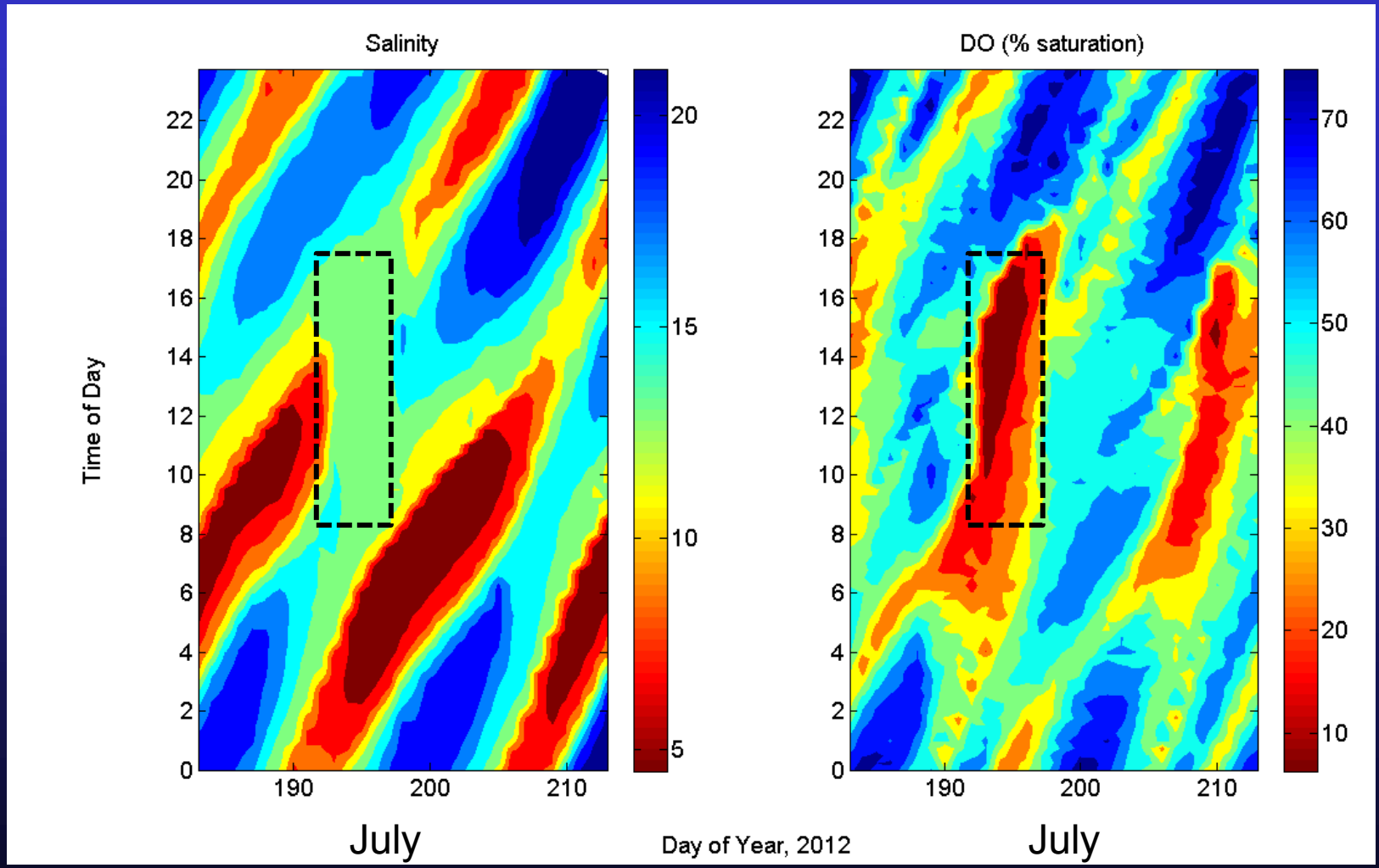
Alviso Slough becomes hypoxic in summer during neap tides



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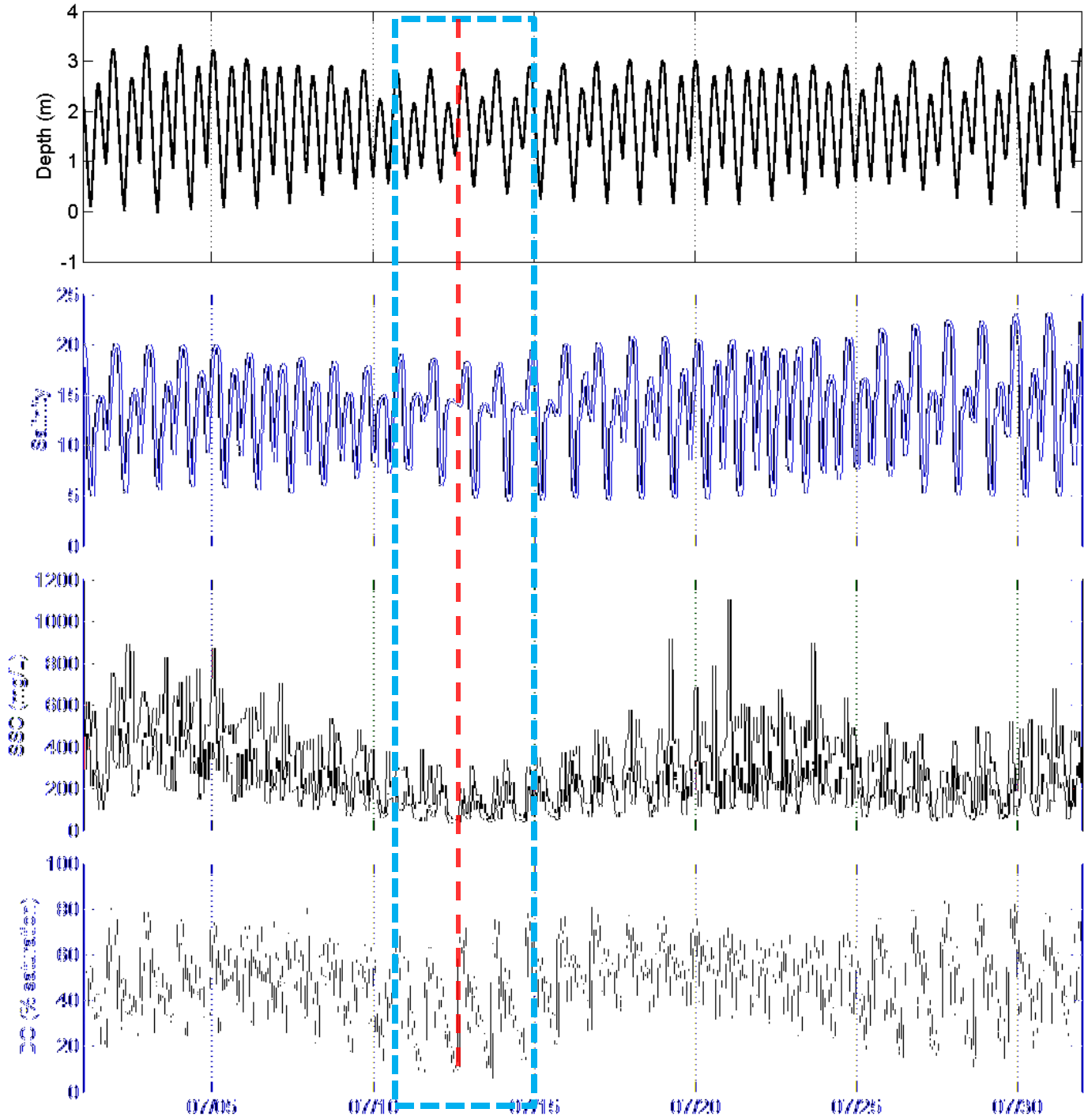

Lowest DO during summer neap tides

Reduced SSC=> decreased turbulent mixing from density stratification

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FY2015 outlook

- We lost $225,000/yr RSM funding for Corte Madera Creek and Alviso Slough stations and interpretation in FY2013
- We lost $50,000/yr funding for Dumbarton sediment flux
- Level RMP funding $250,000/yr since late 1990s
- DWR & USGS salinity funding ($261,291 in 2014) for data collection only
- Added DO measurements in 2012
- Our present level of Bay work not sustainable with present funding
- Reduction in data collection and/or interpretation may be needed in FY2015

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Further Work Ideas

- Reference Slough study in South Bay
- Golden Gate flood sampling contingency
- Alviso Slough sediment & mercury transport
- Alviso Slough DO dynamics
- Data to support modeling
- Others?

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Bonus Material

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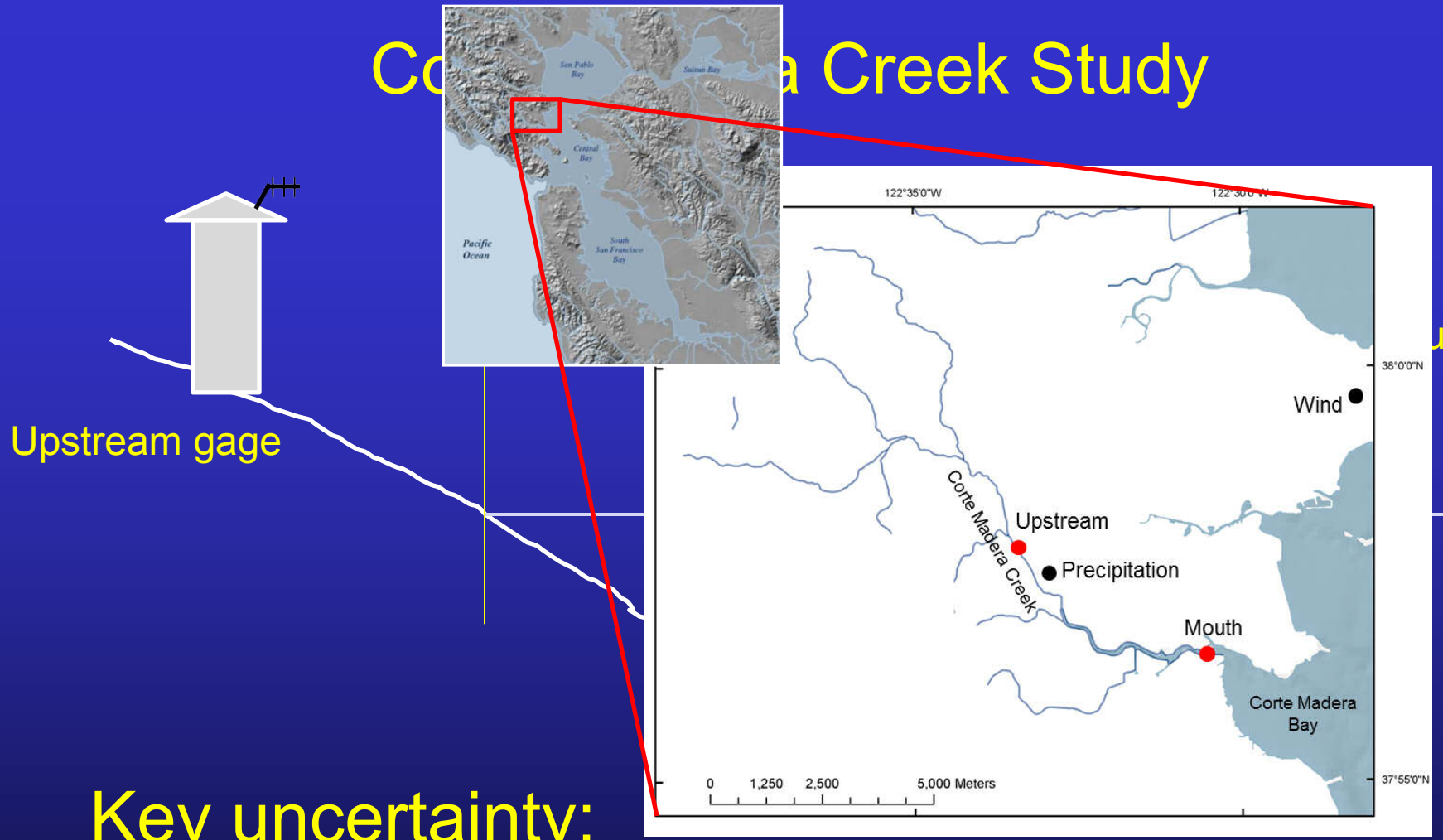
Co a Creek Study



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Key uncertainty:

Do these upstream gages accurately estimate sediment supply to the estuary?

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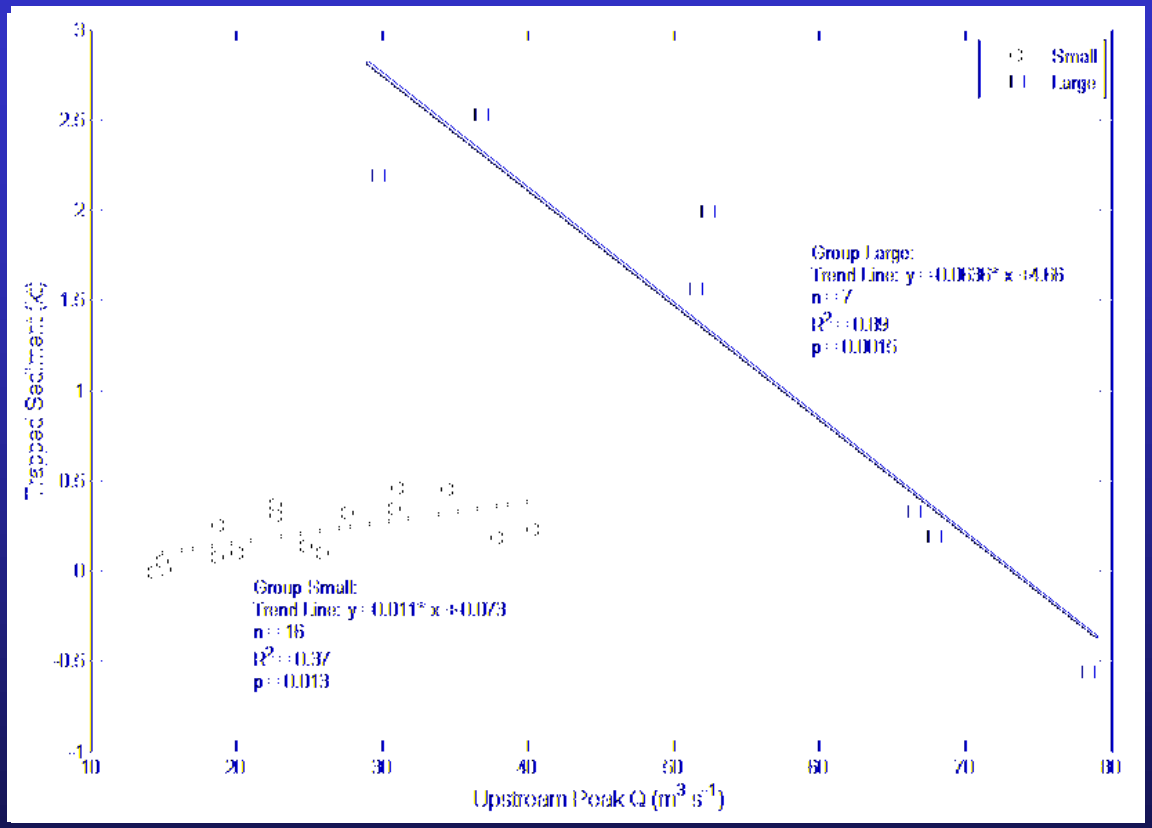
Corte Madera Creek Study Results

- Over 3 years, 50% of suspended sediment was trapped in tidal reach
- Trapping caused by 2 factors:
  - Storm pulse attenuation by flood tides
  - Dry season import from Bay
- Storm trapping varied by storm size
  - Trapped sediment related to upstream peak discharge



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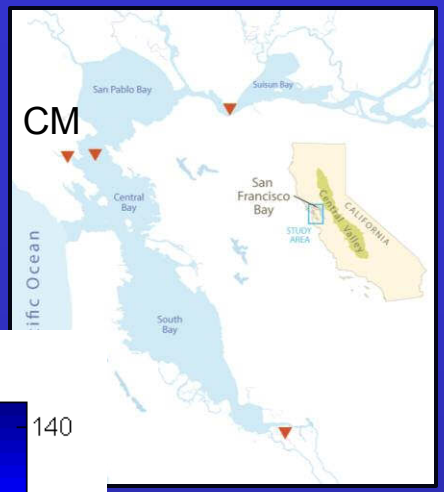
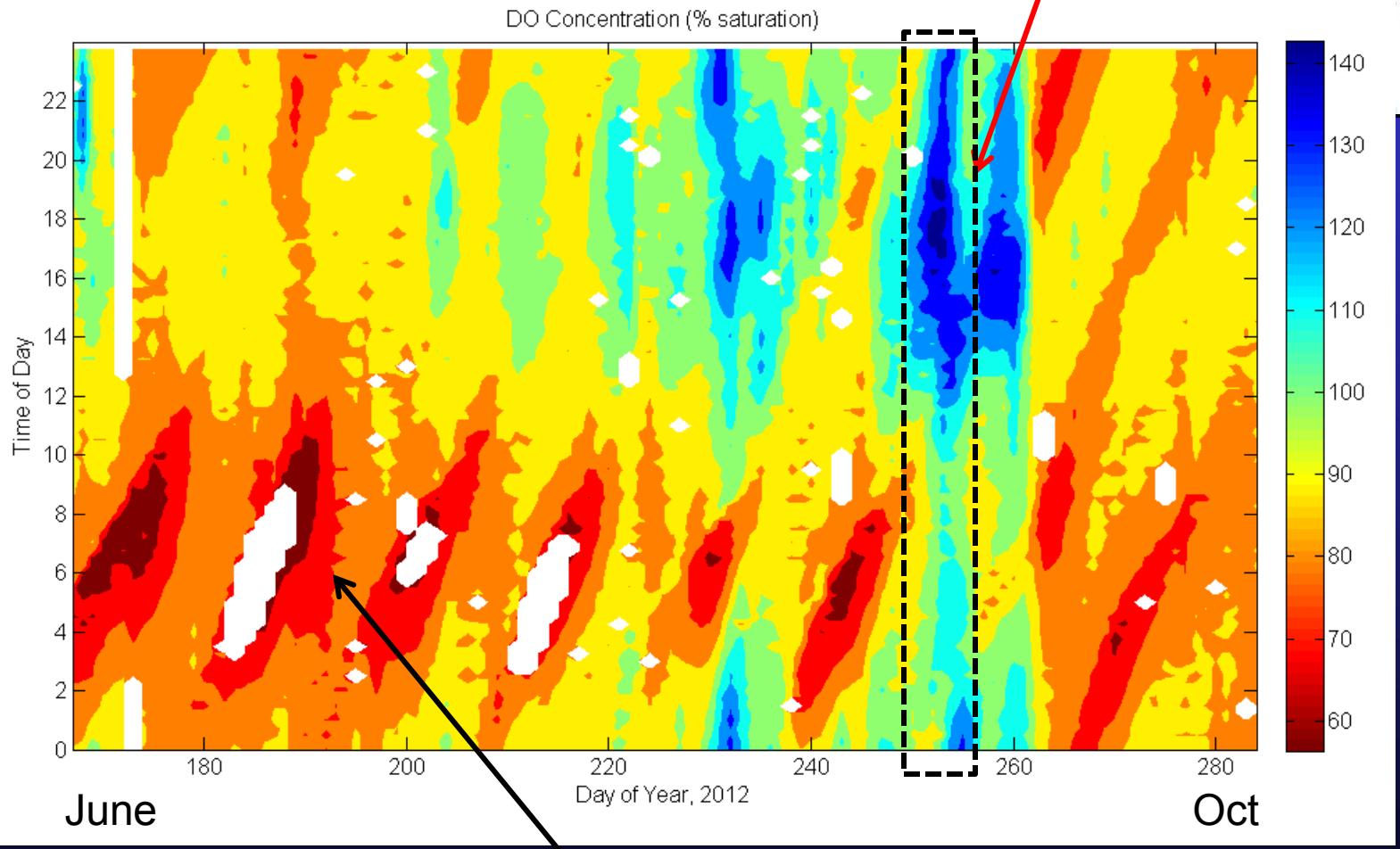
Comparing perimeter sites

Corte Madera DO patterns



Fall bloom?



Lowest DO on spring-tide ebbs during summer

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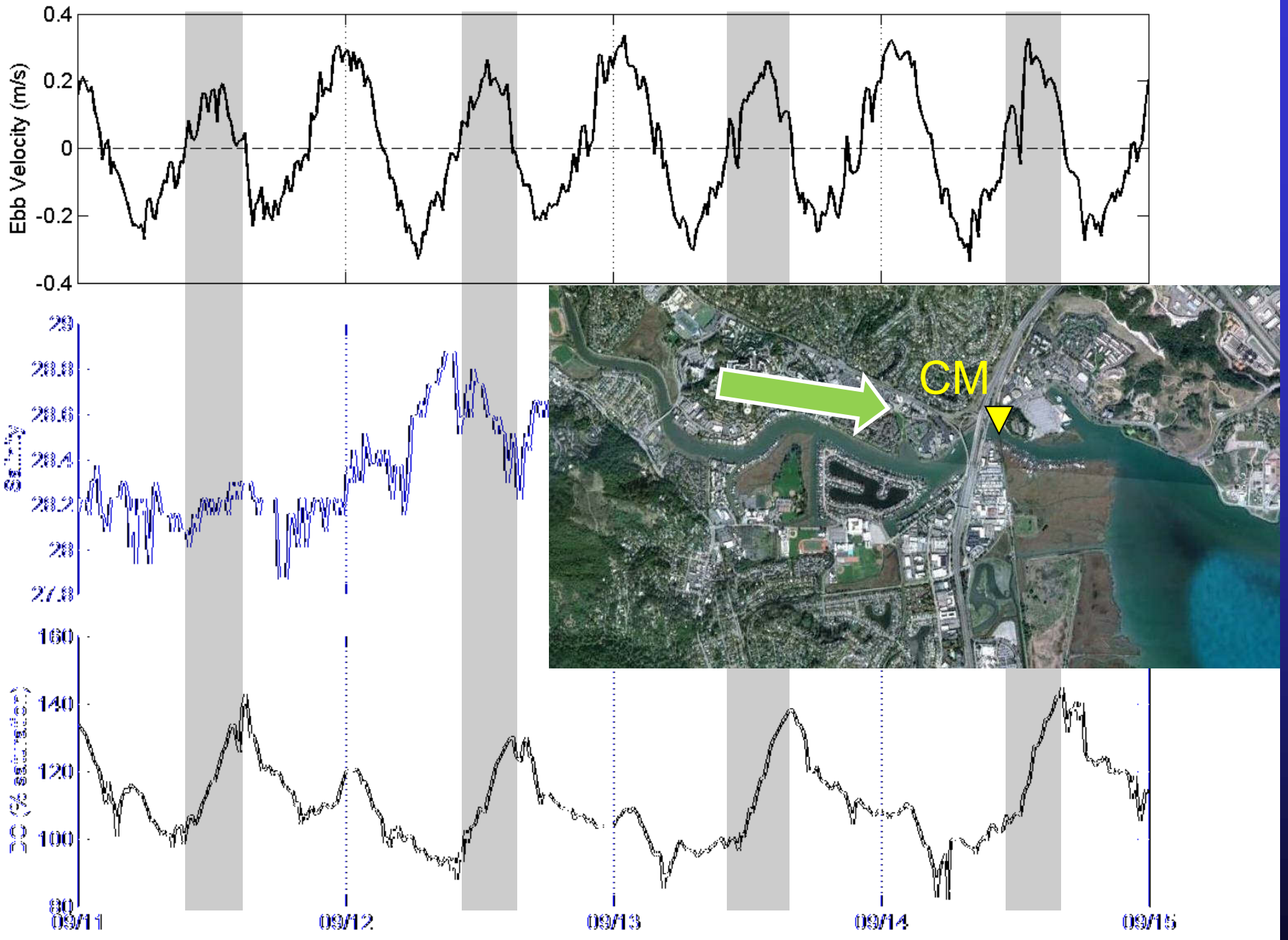


Peak DO at end of ebb during daylight hours—advection of bloom from upstream

Sources, Pathways, and Loadings

Lester McKee

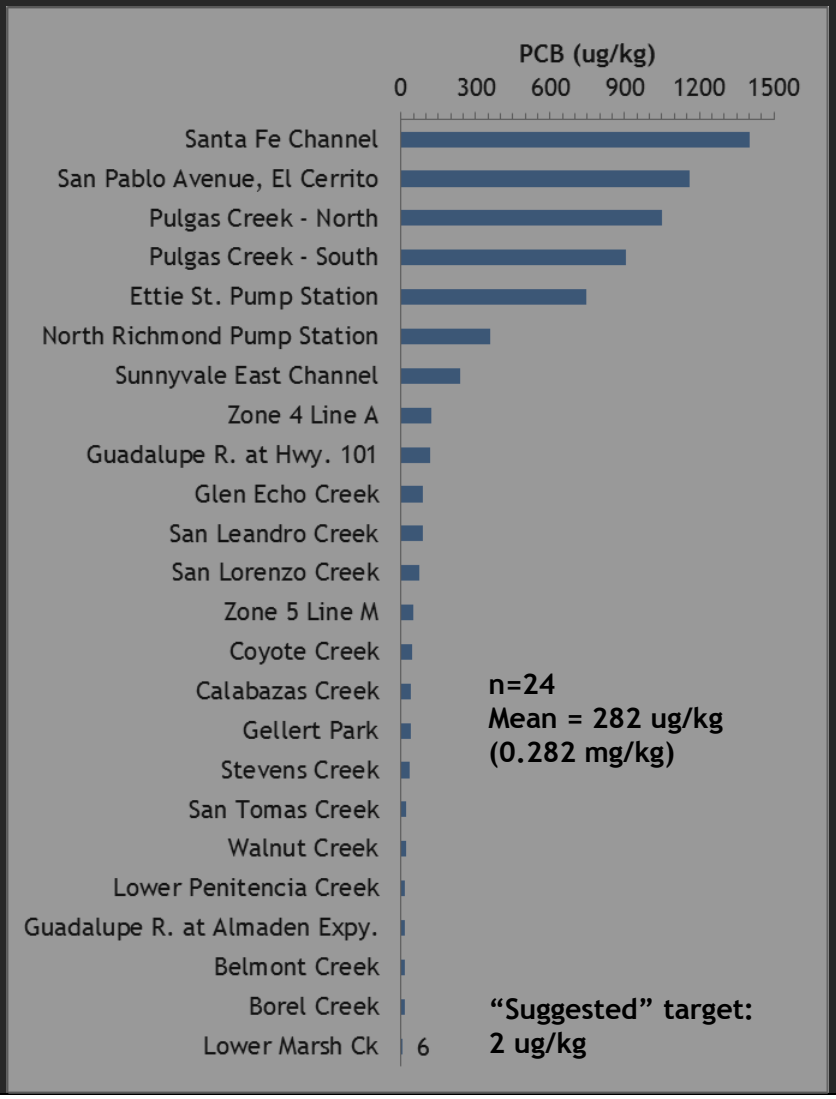
Clean Water Program
San Francisco Estuary Institute
Richmond California

SAN FRANCISCO ESTUARY INSTITUTE
4911 Central Avenue, Richmond, CA 94804
p: 510-746-7334 (SFEI), f: 510-746-7300, www.sfei.org

Overview of the Small Tributaries Loadings Strategy

Management questions	Strategy components			
	POC loads monitoring	Model input "EMC" data development	Regional modeling (RWSM)	Management and coordination
1. Impairment	Reconnaissance		Proposed output to include: "top 25", "urban"	Regular STLS phone calls, face-to-face meetings, and other strategic meetings
2. Loads	Long term, select Recon	GIS layers and “back calculation methods"	Estimates at sub-regional/ regional scales	
3. Trends	Long term, select Recon	Site specific EMC data could be developed		
4. Management Support	Reconnaissance	GIS layers; site specific EMC data could be developed	Potential further development	

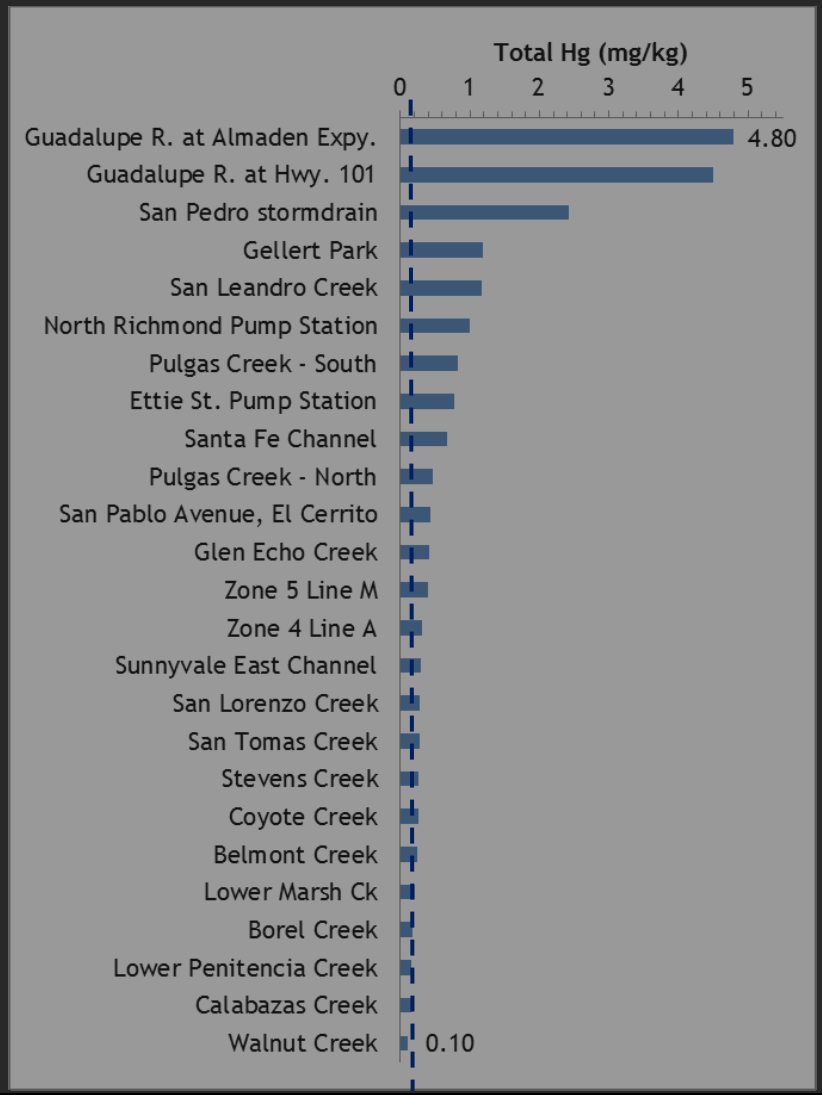
Impairment: Identifying high leverage watersheds – PCBs (Studies: POC loads monitoring WYs2002-13)



- 24 quantified to-date
  - Santa Fe channel in Richmond highest measured to-date
  - Management actions in Pulgas on going
  - Mean = 282 ug/kg (0.282 mg/kg or ppm)
  - Suggested target 2 ug/kg
    - Marsh Creek exceed this

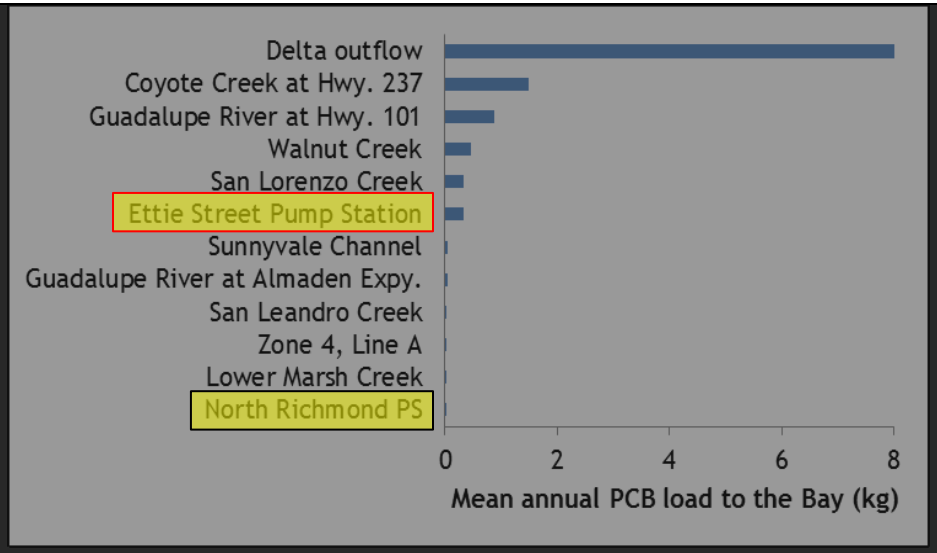
Impairment: Identifying high leverage watersheds – Mercury (Studies: POC loads monitoring WYs2002-13)

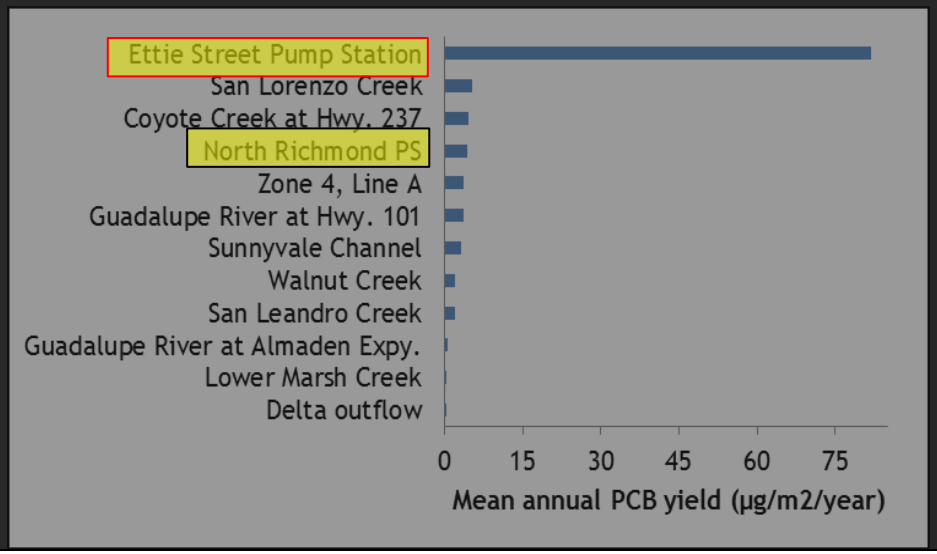
- **25 quantified to-date**
  - **Upper Guadalupe River highest measured to-date**
    - Management actions dealing with mining debris ongoing
  - **Mean = 0.9 mg/kg (or ppm)**
  - **Suggested target 0.2 mg/kg**
    - 7 tributaries at or below 0.25 mg/kg



Watershed specific loads - PCBs

(Studies: POC loads monitoring WYs2002-13)



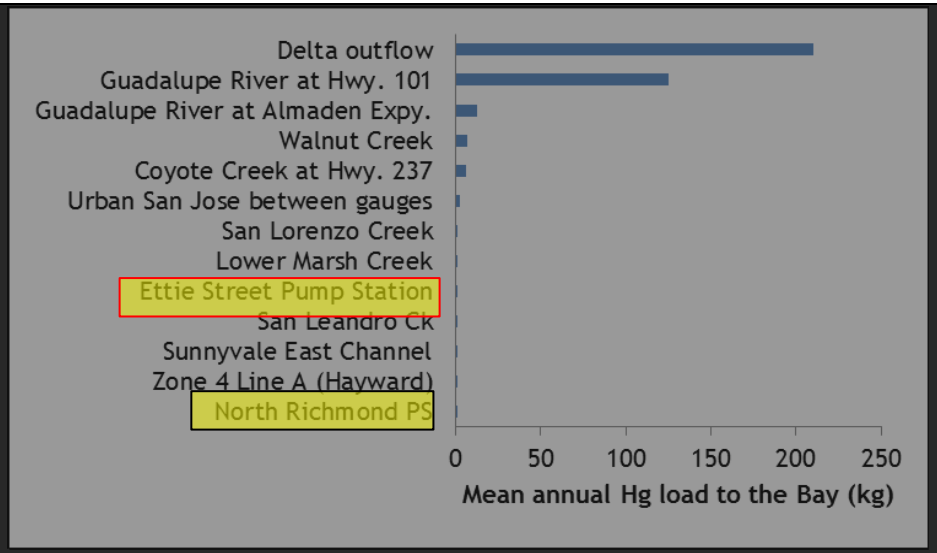


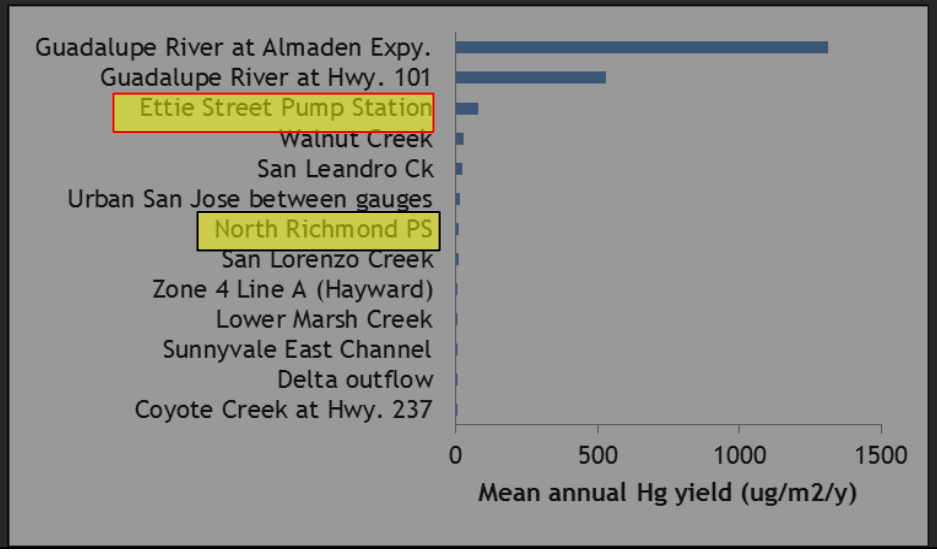
- 12 locations quantified
  - Delta outflow is the largest single loading input
  - Sum of the 11 small tributaries quantified = 45% delta outflow
  - Small tributaries may be locally impactful
    - acute (event) toxicity
    - chronic (dry season) toxicity
  - Smaller tributaries tend to have high yields (mass / area)

Watershed specific loads - Mercury

(Studies: POC loads monitoring WYs2002-13)

- **13 locations quantified**
  - **Delta outflow is the largest single input**
  - **Sum of small tributaries quantified (except Guadalupe mining) = 8% delta outflow**
  - **Small tributaries may be locally impactful**
    - acute (event) toxicity
    - chronic (dry season) toxicity
    - Dry season loads in dissolved, methylated, and reactive phases
  - **Smaller tributaries tend to have high yields (mass / area)**





Regional loads - simple interpolation techniques

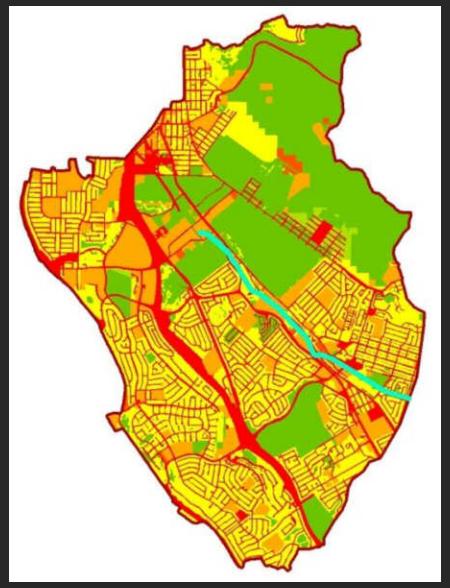
- **PCB TMDL = 20 kg/year**
  - Equivalent to = 0.016 mg/kg
  - 11 tributaries measured to-date add to 4.6 kg
- **Mercury TMDL = 160 (urban) and 25 (non-urban) kg/yr**
  - Equivalent to 0.15 mg/kg
  - 10 tributary areas measured to-date (other than Guadalupe mining sources) add to 17 kg.
- **Are these TMDL published estimates still reasonable?**

Regional loads – Regional Watershed Spreadsheet model (RWSM) – sediment (BASMAA and RMP funding)

For each watershed, generate average annual:

- Discharge volume
- Sediment load (Geology/slope/land use loading coefficients)
- POC loads

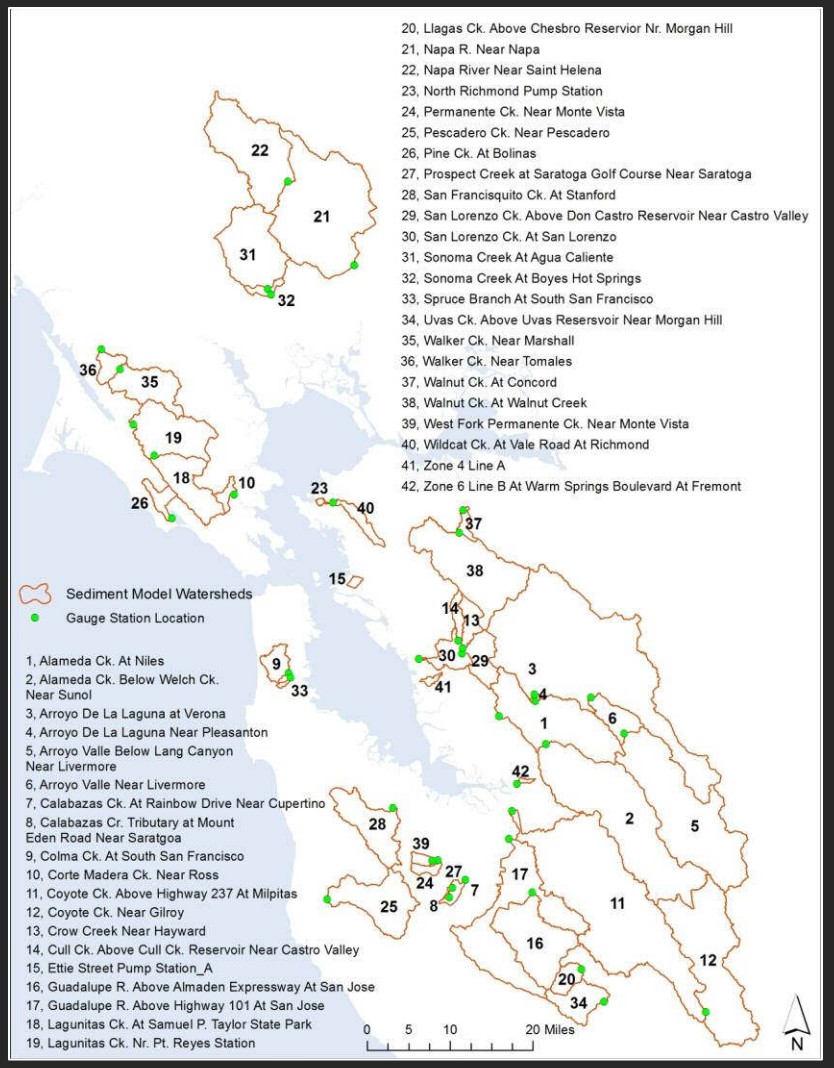
Runoff volume* x Concentration = Load



*or sediment load

Loads: Sediment RWSM model basis

- 46 sediment discharge locations
- Five geological classes
- Based on field experience/ natural breaks, 3 slope classes
- Areas upstream from reservoirs removed

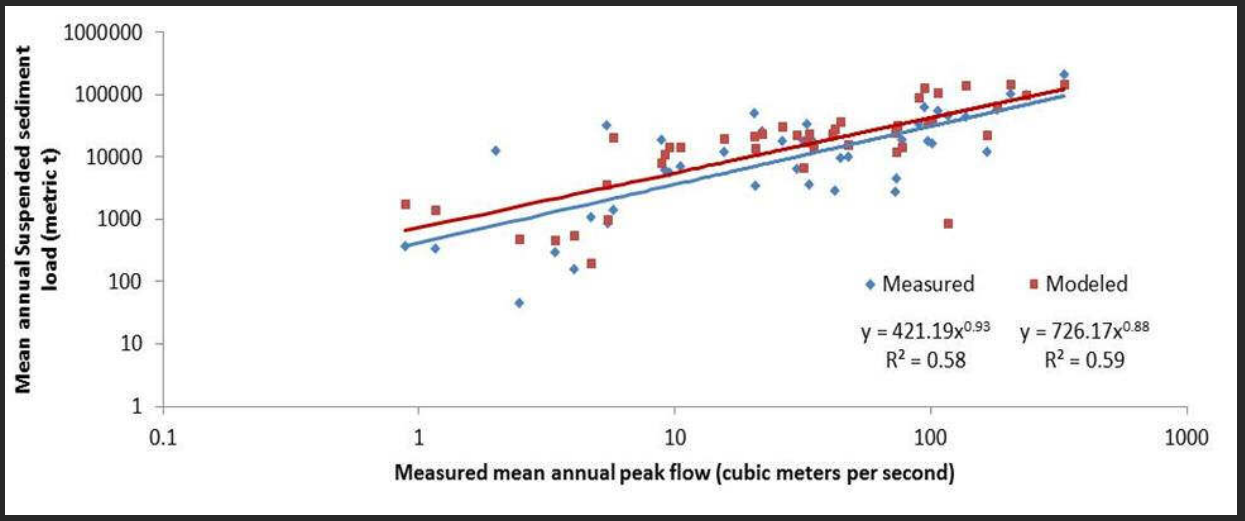


Loads: “Local sediment experts” workshop

- Barry Hecht, Jeff Haltiner, Leonard Sklar
- Outcomes
  - General agreement on model architecture, order/magnitude of coefficients
  - Cautioned against use of the model at less than watershed scale without field calibration-verification
  - Recommended adding a climatic factor if model does not calibrate initially

Loads: Sediment calibration results

- Scatter suggests
  - Additional parameterization needed? Climate?
  - Report submitted to BASMAA without a new regional load estimate!



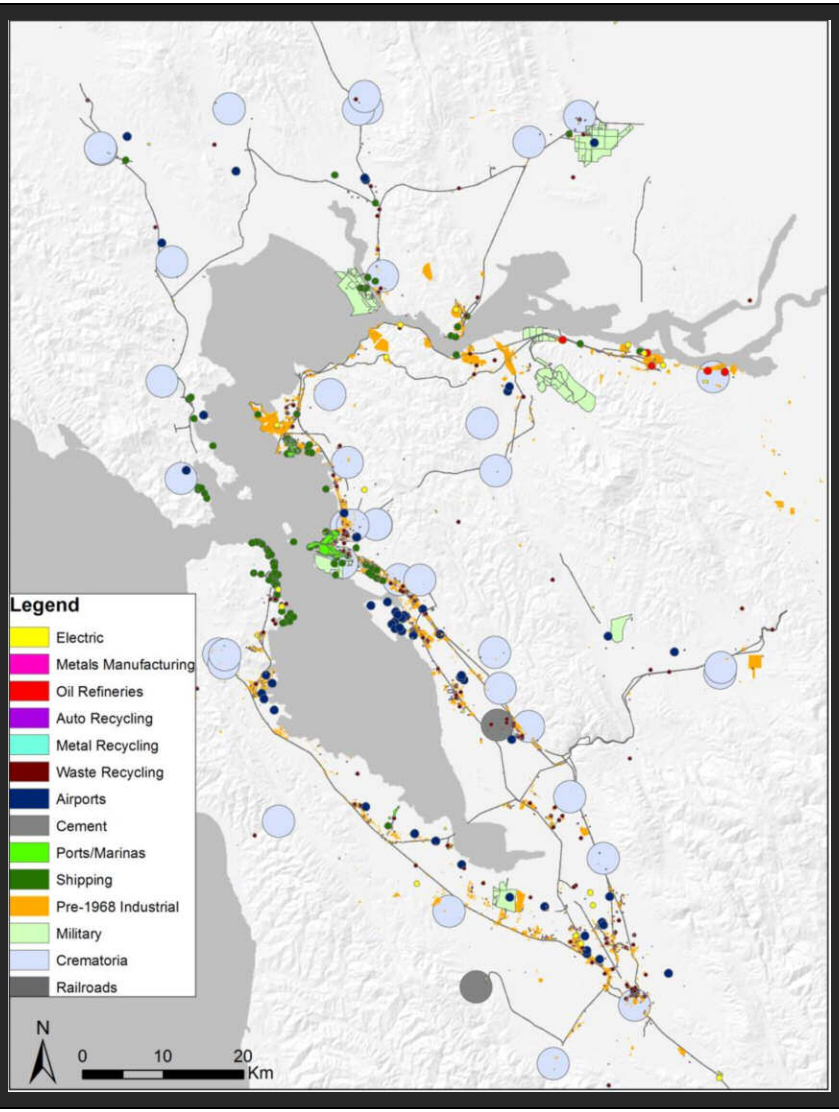
Loads: PCB and Hg RWSM models basis
(RMP RWSM and EMC funding)

- Model architecture
  - Reviewed literature to derive land use and source area parameters (Lent and McKee 2011)
- Parameter coefficients
  - Amassed estimates of water and particle concentration ("EMC") data
- Calibration data
  - Locally collected particle ratio "EMC" for 21+ watersheds
- Auto calibration – constrained optimization approach
  - Initial model run on a reduced set of parameters

Loads: Source area mapping
(EMC and BASMAA funding)

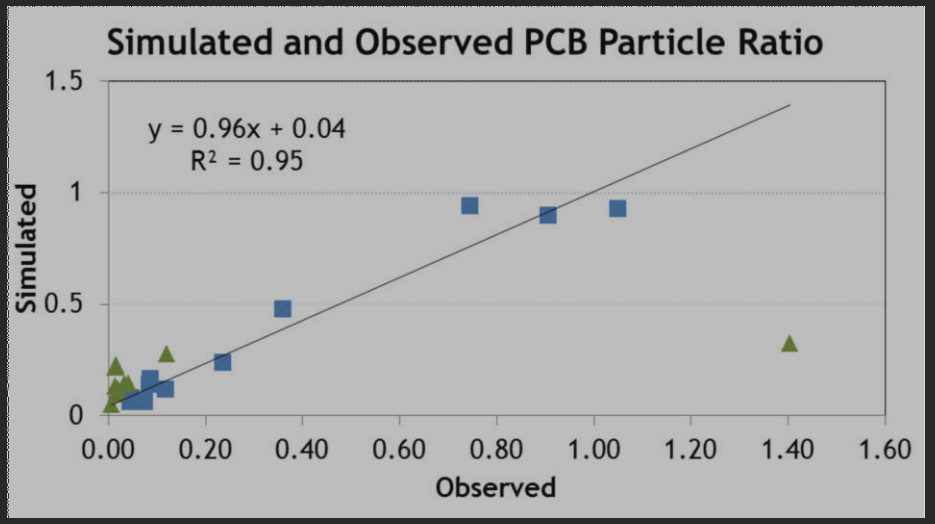
Categories within calibration watersheds

	PCB	Hg
Land uses		
Old.Industrial	✓	✓
Old.Urban	✓	✓
Other.Urban	✓	✓
Ag.Open	✓	✓
Source areas		
electricTransf	✓	✓
manufMetals	✓	✓
recycAuto	✓	✓
recycWaste	✓	✓
transpRail	✓	✓
crematoria		✓

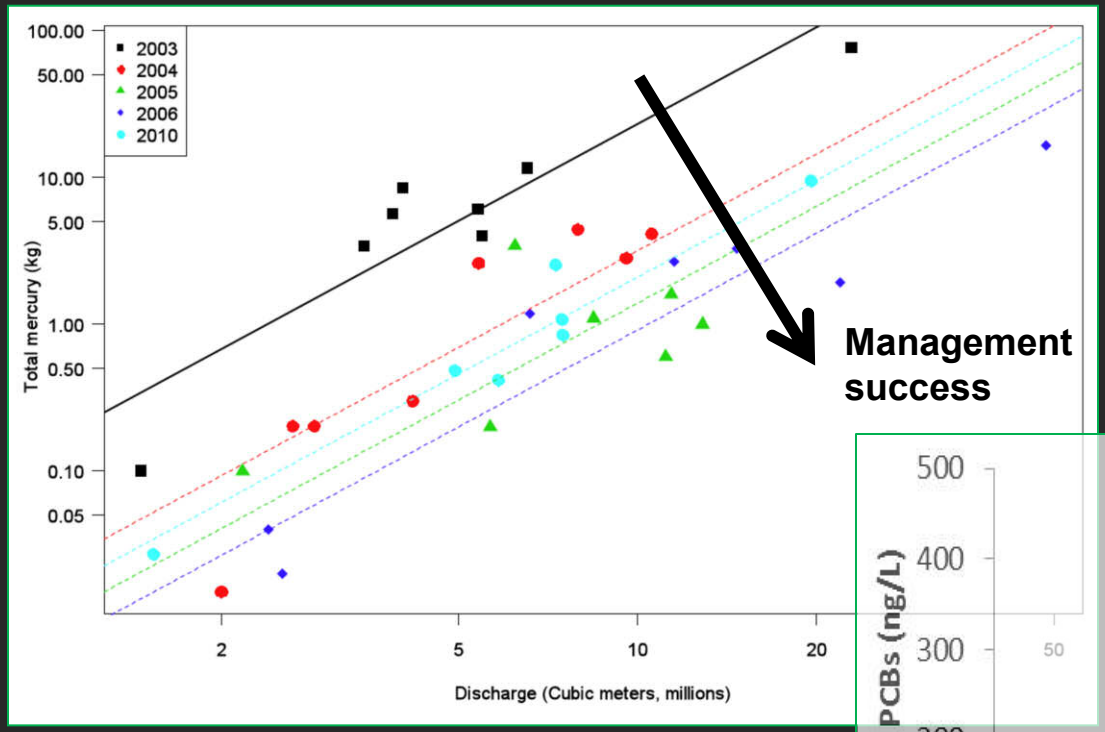


Loads: Preliminary PCB RWSM calibration results

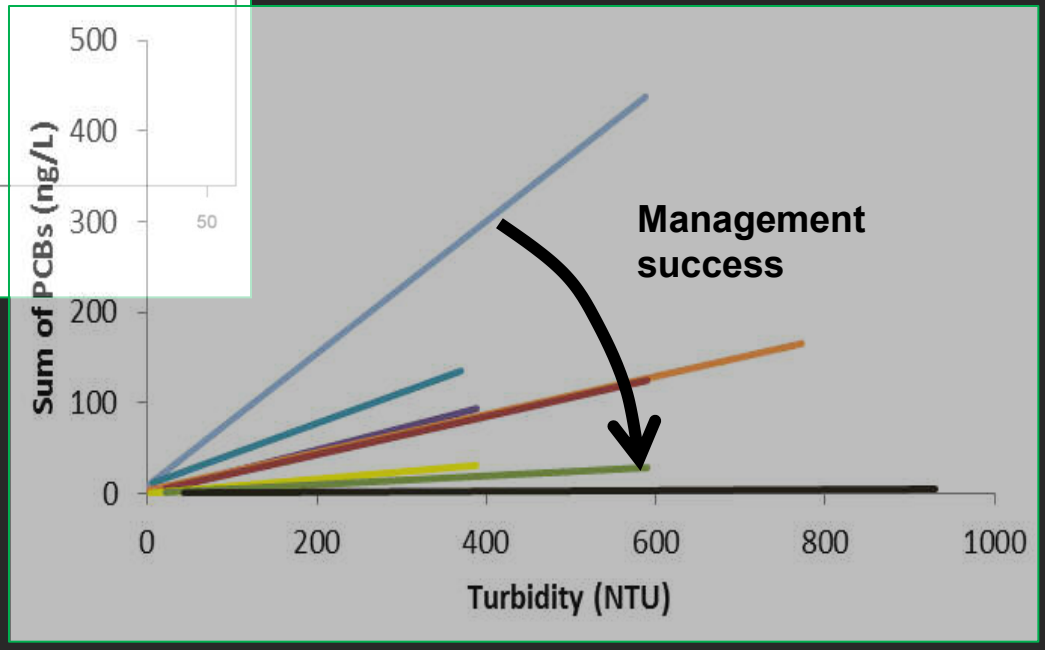
- Encouraging initial draft results
  - Note these results are changing each day presently
- 11 watersheds calibrate well (within 50-200%)
- Extreme outliers
  - Santa Fe channel in Richmond
  - Cleaner watersheds tend to be over predicted
- Adding more parameterization has not improved the model



Trends: Baseline data sets for 20+ locations (Studies: POC loads monitoring WYs2002-13)



- Loading trends over time



- Particle concentration trends over time

Support for management decisions:
increased information from monitoring at lower costs

Option	Outcome
1. Status quo	Costly and not adaptive to evolving information needs
2. Targeted monitoring at fewer POC loads stations	Provides improved base line and more efficiently addresses information gaps
3. Change frequency of loads station monitoring (rotating)	Allows for monitoring focus each year to be based on climate and information gaps
4. Change frequency of sample collection for low priority pollutants	Focus on priority pollutants
5. Reconnaissance monitoring – watershed and source area characterization	Identifies high leverage watersheds/ source areas for management focus
6. BMP effectiveness monitoring	Supports management decisions on which BMPs to apply where
7. Sediment/soil monitoring	Not recommended at a watershed scale due to false negatives and lower quality information

*Combination approach best with a fixed but lower annual budget, a portion applied to loads, and the balance applied to other monitoring styles with annual decisions about how to apply resources

2014 STLS budget approved

- **Total 2014 Budget - $487k**
  - **Pollutants of Concern (POC) Monitoring - $352k**
    - 2 tributaries (BASMAA funding a further 4)
  - **Regional watershed spreadsheet model (RWSM) - $30k**
    - Add climatic parameterization to the sediment model
    - Explore improved estimates for PCBs and Hg as finer resolutions
  - **Event Mean Concentration (EMC) Development - $80k**
    - Further EMC development using back-calculations?
    - Field monitoring?
  - **Management support to help ensure full coordination - $25k**

Data Technical Services Update

Cristina Grosso, Adam Wong, Amy Franz, Don Yee, John Ross, Michael Weaver, Marcus Klatt, Patty Frontiera, Rebecca Sutton,
Shira Bezalel, Todd Featherston

December 12th, 2013

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2013 Highlights

→ Developed new capacity/redundancy

→ Uploaded 2012 sediment & bivalve data

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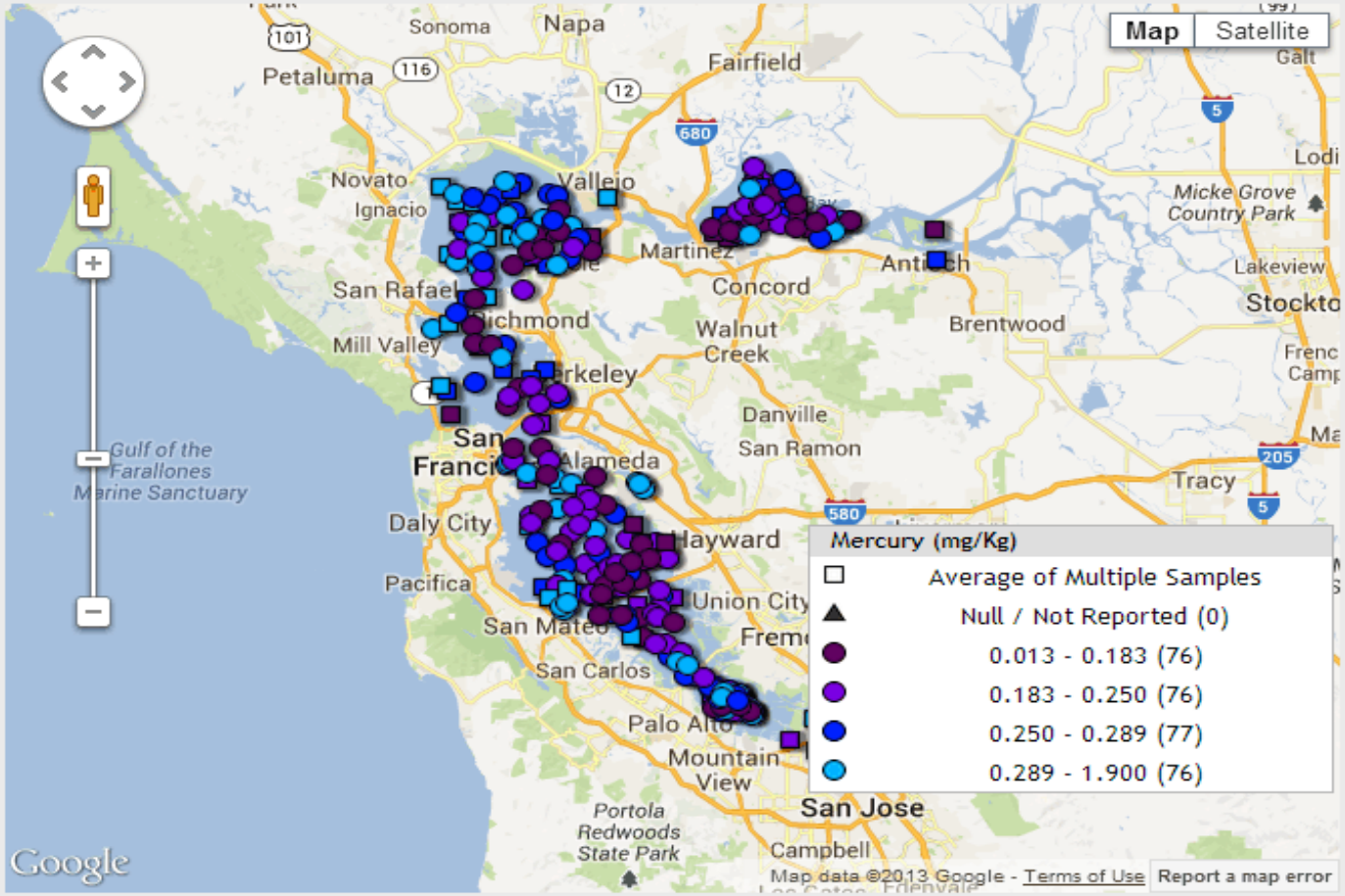
CD3 Contaminant Data Display & Download

water sediment bivalves sport fish

CD3 enables users to perform spatial queries of water quality data from the San Francisco Estuary and Delta. Data can be dynamically mapped and downloaded as an Excel file. New datasets are regularly added.



SEARCH

MORE INFO

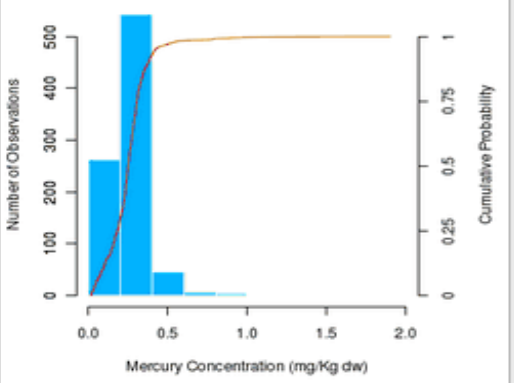
- Data Available
- Data Handling Details
- Tips for Using CD3
- Static Maps of Sampling Stations

CD3 USER INTERFACE

Search Parameters:

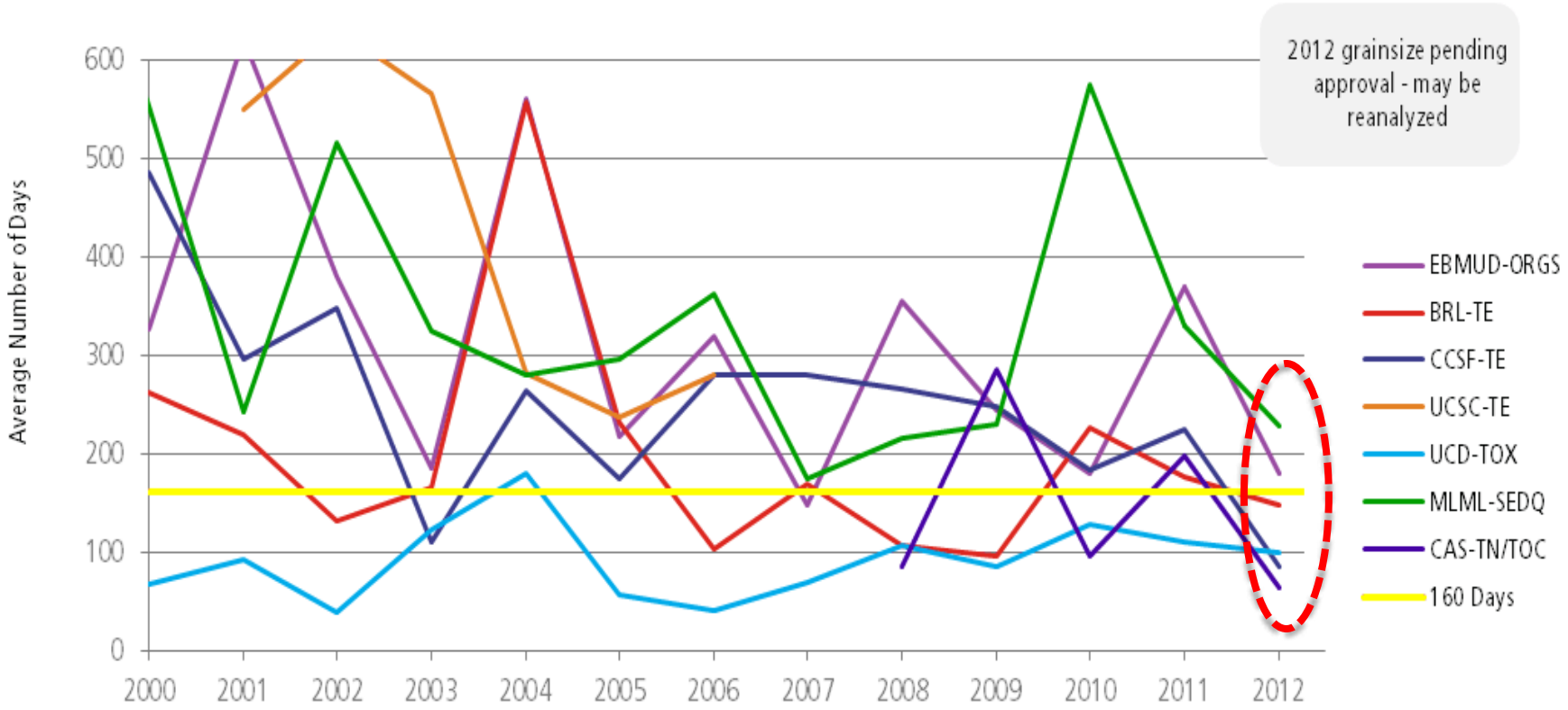
Test Material:
Sediment
Program/Project:
Regional Monitoring Program
Start Year:
1993
End Year:
2012
Parameter Type:
Trace Elements
Parameter:
Mercury

Distribution of Results



Timeliness: Sediment

Avg. Days After Collection

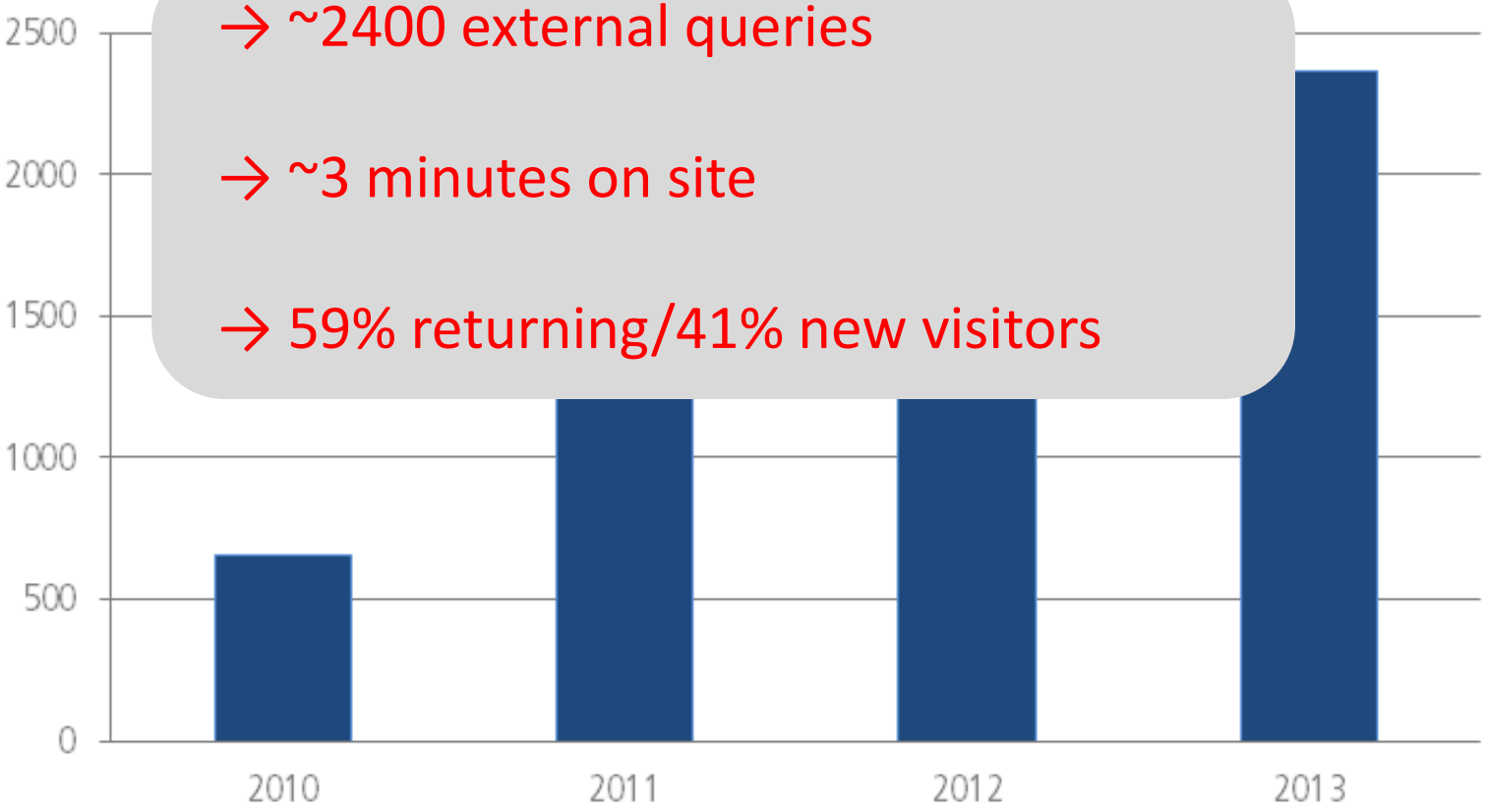


CD3: External Queries

→ ~2400 external queries

→ ~3 minutes on site

→ 59% returning/41% new visitors



2013 Highlights

→ Adopted new tracking system for datasets and SOPs

Pending Formatting:

Summary	Assignee	Status
2012 CW4CB T3P2 Sediment PAHS - ALS	Michael Weaver	Awaiting Formatting
2012 CW4CB T3P2 Sediment Dx - ALS	Unassigned	Awaiting Formatting
2012 CW4CB T3P2 Sediment OC Pests - ALS	Unassigned	Awaiting Formatting
2012 CW4CB T3P2 Sediment PBDE - ALS	Unassigned	Awaiting Formatting
2012 CW4CB T3P2 Sediment GS - SCL	Unassigned	Awaiting Formatting
2012 CW4CB T3P2 Sediment Hg - SCL	Unassigned	Awaiting Formatting
2012 CW4CB T3P2 Sediment Hg - ALS	Unassigned	Awaiting Formatting
2012 CW4CB T3P2 Sediment Bulk Density - ALS	Unassigned	Awaiting Formatting
2012 CW4CB T3P2 Sediment PCB - ALS	Unassigned	Awaiting Formatting
2012 CW4CB T3P2 Sediment GS - ALS	Unassigned	Awaiting Formatting
2012 CW4CB T3P2 Sediment TOC - ALS	Unassigned	Awaiting Formatting
2012 CW4CB T3P2 Sediment Habitat	Adam Wong	Awaiting Formatting

12 issues Refresh

Pending QA Review:

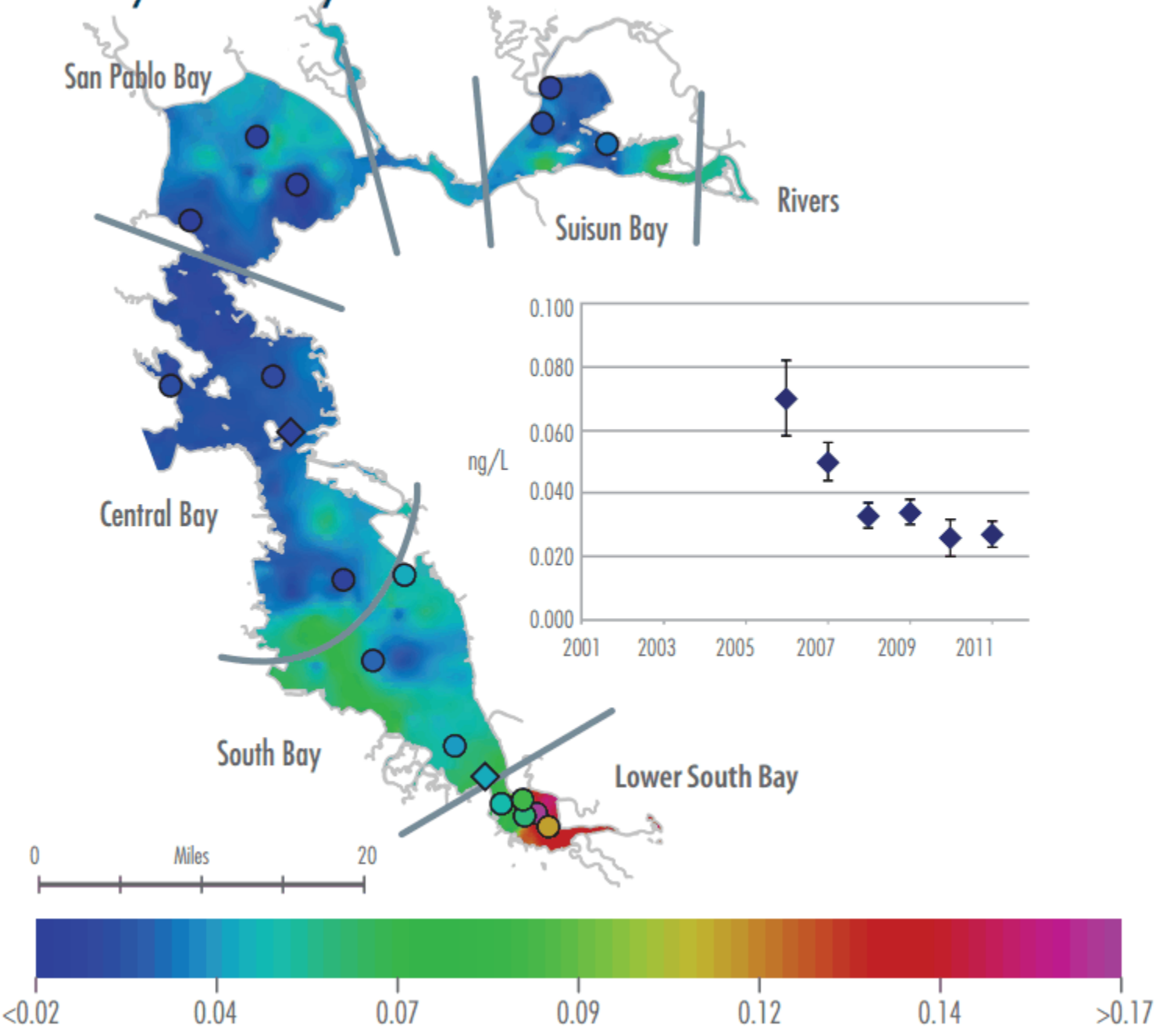
Summary	Assignee	Status
CW4CB T5P1 Water - PCB	Adam Wong	QA Review in Progress
2013 RMP S&T Water Fipronil	Adam Wong	QA Review in Progress
CW4CB T5P1 Water - Mercury	Don Yee	Awaiting QA Review
CW4CB T5P1 Sediment - Mercury	Don Yee	Awaiting QA Review
2013 RMP S&T Water Cu,Ni	Don Yee	Awaiting QA Review

5 issues Refresh

2013 Highlights

→ Automated generation of kriging maps for Pulse

Methylmercury in Water



CD3 Improvements

→ More options for querying data
(by contaminant, station, region)

→ Update mapping and user interface

→ Refine download

→ More meaningful statistics

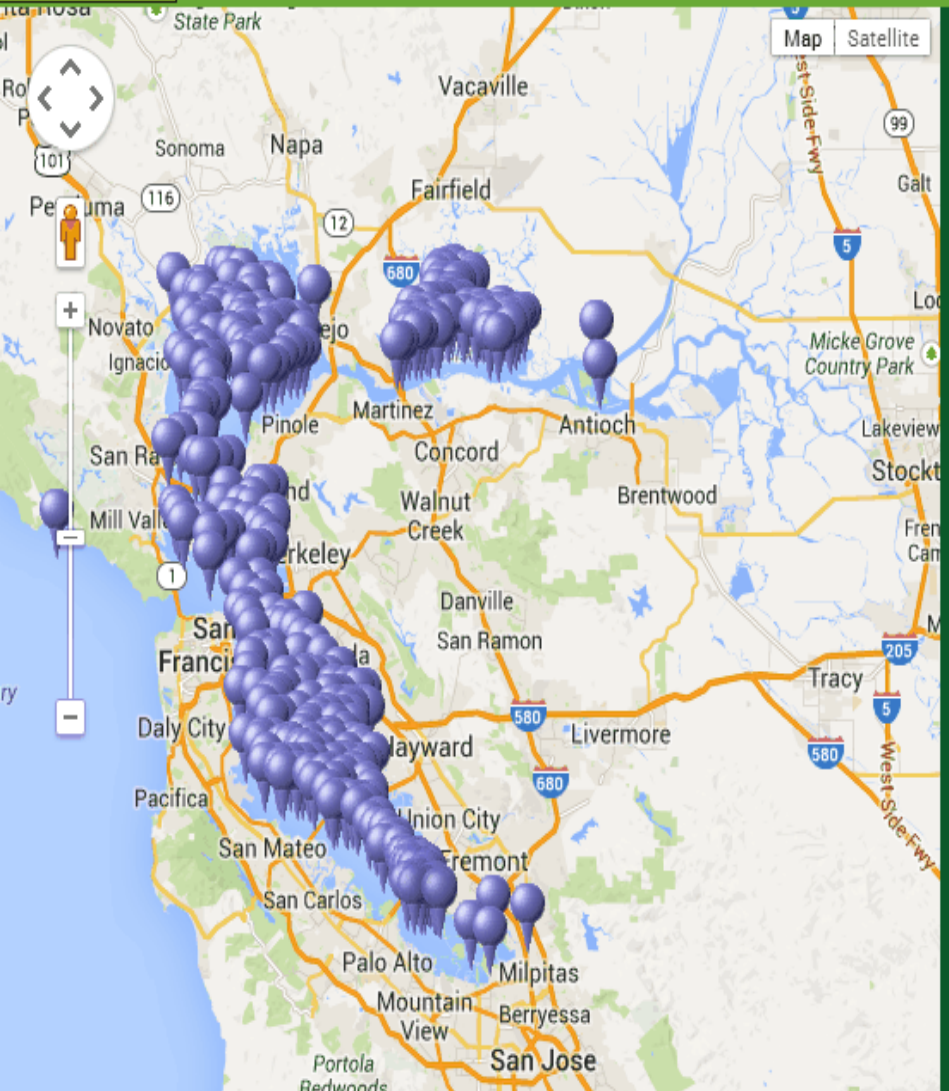
Demo

RDC and CEDEN

- → San Francisco Bay-Delta RDC: ~2M records
- → Automated uploading/checking scripts
- → Added time series tables to database
- → Improved accessibility of RMP data

CEDEN

CALIFORNIA ENVIRONMENTAL DATA EXCHANGE NETWORK



RESULT CATEGORY: ◉ Water Quality ○ Toxicity ○ Tissue ○ Benthic ○ Habitat

☐ Turn on automatic station mapping.

Click **Map Stations** at any time to show currently selected stations on the map

START OVER | MAP STATIONS | HELP

Missing Georeferences Info

Region Type Selection: County

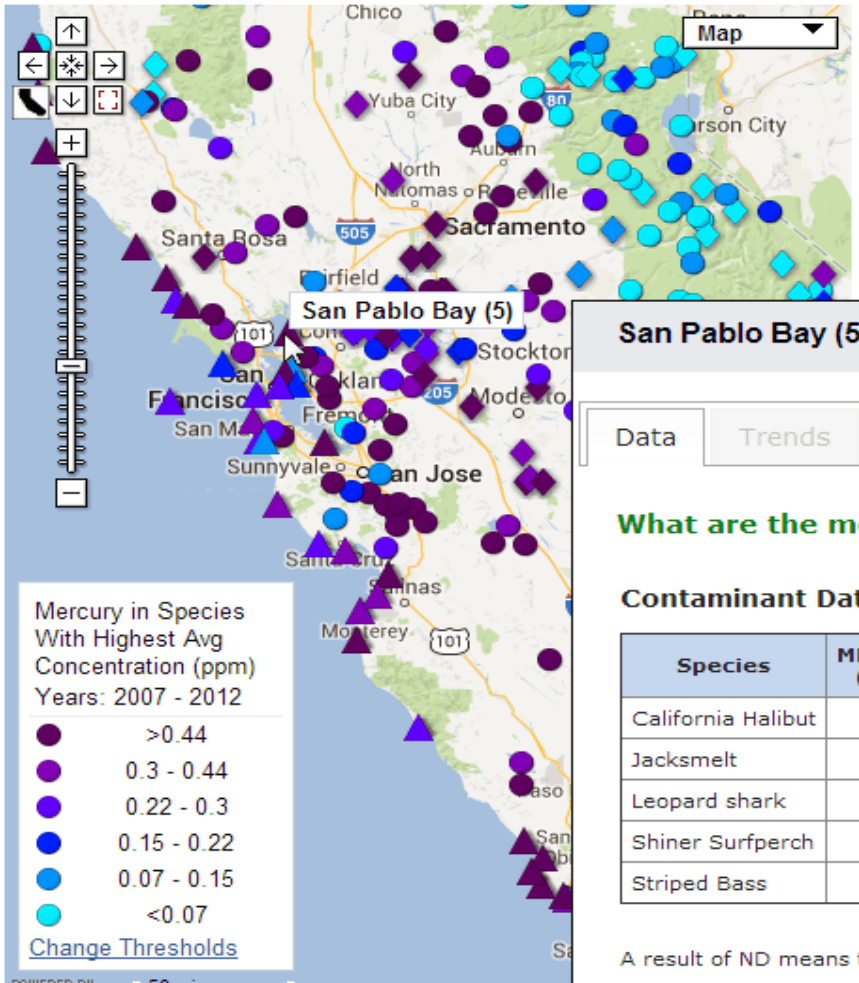
SELECT COUNTIES	Do not limit search by Counties
SELECT PROGRAMS	Regional Monitoring Program for Water Quality
SELECT PROJECTS	Do not limit search by Projects
SELECT PARAMETER GROUPS	Do not limit search by Parameter Group
SELECT PARAMETERS	Do not limit search by Parameters
SELECT STATIONS	Alameda (BB70) Central Bay (CB001S) Central Bay (CB001W) Central Bay (CB002S) Central Bay (CB002W) Central Bay (CB003S) Central Bay (CB003W) Central Bay (CB004S)

Missing Georeferences Info

What are the Levels and Long-Term Trends in My Lake, Stream, or Ocean Location?

Select location | Zoom to county:

Show counties



Contaminant Data

This interactive map allows you to explore fish contaminant data for your fishing extensive monitoring by SWAMP of lakes and reservoirs in 2007 and 2008, of th streams in 2011, and from other studies. Data from 2007-2011 are shown by defa

Select Species:

Species With Highest Avg Concentration

Select Contaminant:

Mercury

San Pablo Bay (5)

View Safe Eating Guidelines for this water body.

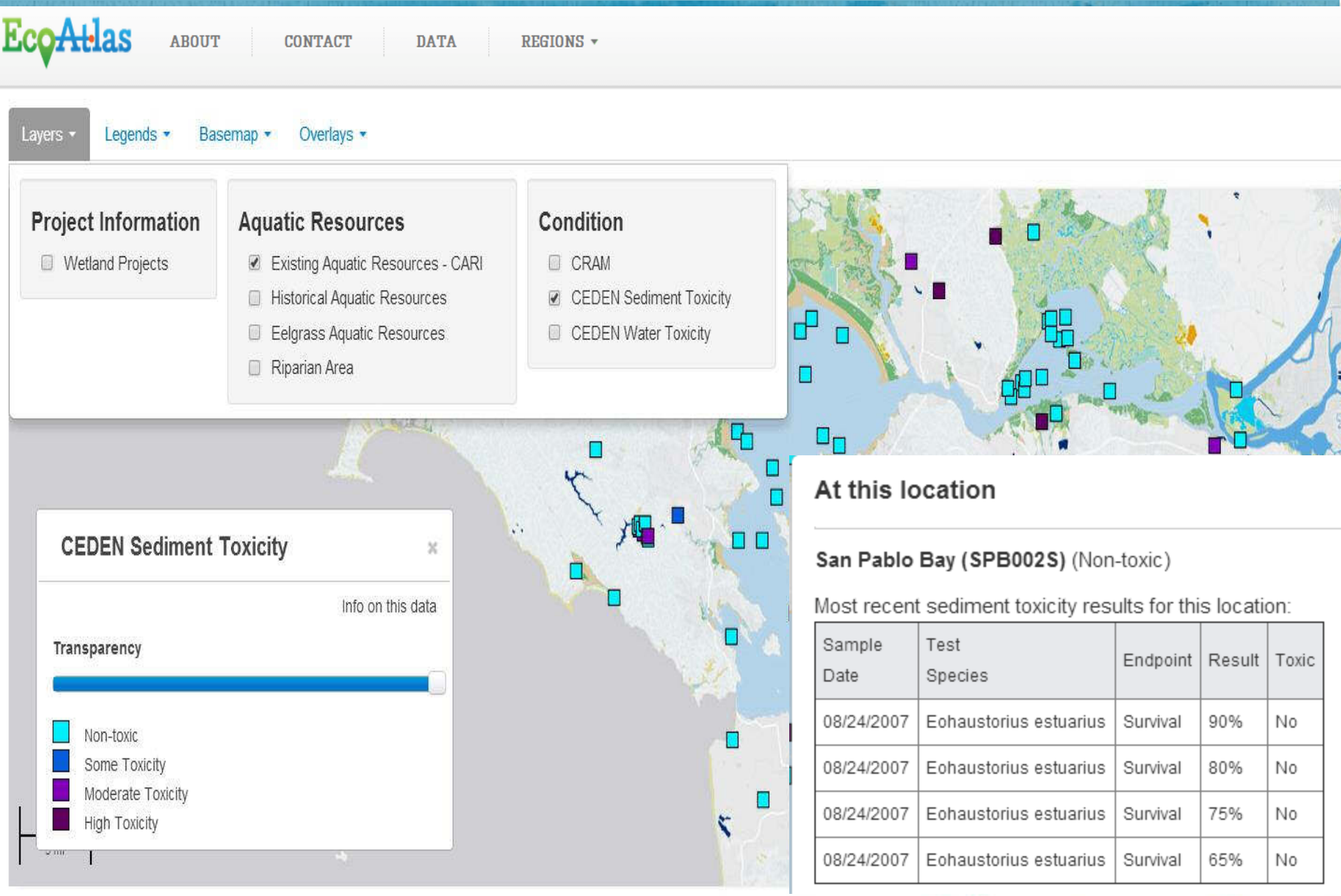
Data | Trends | Nearby Locations

What are the most recent data for my location?

Contaminant Data For 2007 - 2012

Species	MERCURY (ppm)	Sample Year	Prep Code	Sample Type
California Halibut	0.18	2009	Skin off	Average of Composites
Jacksmelt	0.1	2009	Skin off	Average of Composites
Leopard shark	1.49	2009	Skin off	Average of Individuals
Shiner Surfperch	0.08	2009	Skin On, Scales Off	Average of Composites
Striped Bass	0.47	2009	Skin off	Average of Individuals

A result of ND means the concentration was below detection limits.


EcoAtlas
ABOUT
CONTACT
DATA
REGIONS
Layers
Legends
Basemap
Overlays
Project Information
Wetland Projects
Aquatic Resources
Existing Aquatic Resources - CARI
Historical Aquatic Resources
Eelgrass Aquatic Resources
Riparian Area
Condition
CRAM
CEDEN Sediment Toxicity
CEDEN Water Toxicity
CEDEN Sediment Toxicity
Info on this data
Transparency
Non-toxic
Some Toxicity
Moderate Toxicity
High Toxicity
At this location
San Pablo Bay (SPB002S) (Non-toxic)
Most recent sediment toxicity results for this location:
Sample Date
Test Species
Endpoint
Result
Toxic
08/24/2007
Eohaustorius estuarius
Survival
90%
No
08/24/2007
Eohaustorius estuarius
Survival
80%
No
08/24/2007
Eohaustorius estuarius
Survival
75%
No
08/24/2007
Eohaustorius estuarius
Survival
65%
No

2014 Goals

→ Timely review and upload of 2013 data

→ Add statistics & Pulse graphics to CD3

→ Time series visualizations

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Other Activities in EDIT

→ Collaborative tools
(JIRA/Confluence, Google docs & sites)

→ Web services for exchanging data

→ New visualizations and reporting
(interactive reports & dynamic PDF summaries)

→ New SFEI website design

Other Activities in EDIT

→ Social media at RMP Annual Meeting

- Twitter fountain: 394,000 impressions
  — 473 posts by 83 users

- Save the Bay, Open Space Council, California/NOAA Sea Grant, EPA Region 9, KQED, SFPUC

Annual Meeting Tweets

We, as scientists, live to answer this question: why?

Safer consumer product regulations require manufacturers to ask: is it necessary? Often the answer is no.

Sewer facilities are not designed to remove pharmaceutical compounds.

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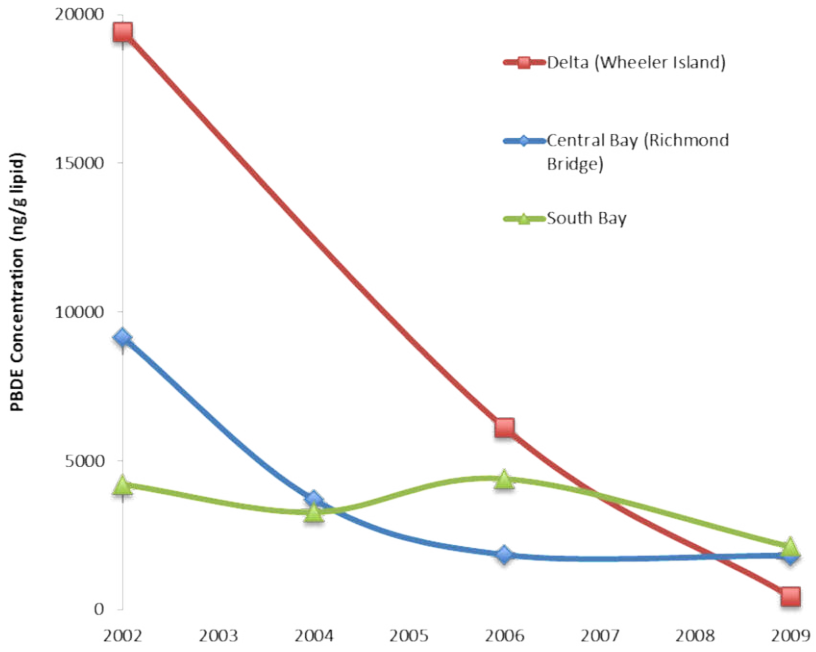
CONTAMINANTS OF EMERGING CONCERN

Update on 2013 Activities and Plans for 2014

Update on 2013 Activities

- ✔ Completion of CEC Synthesis
- ✔ Completion of CEC Strategy
- ☐ Completion of PBDE Summary…



…Well almost

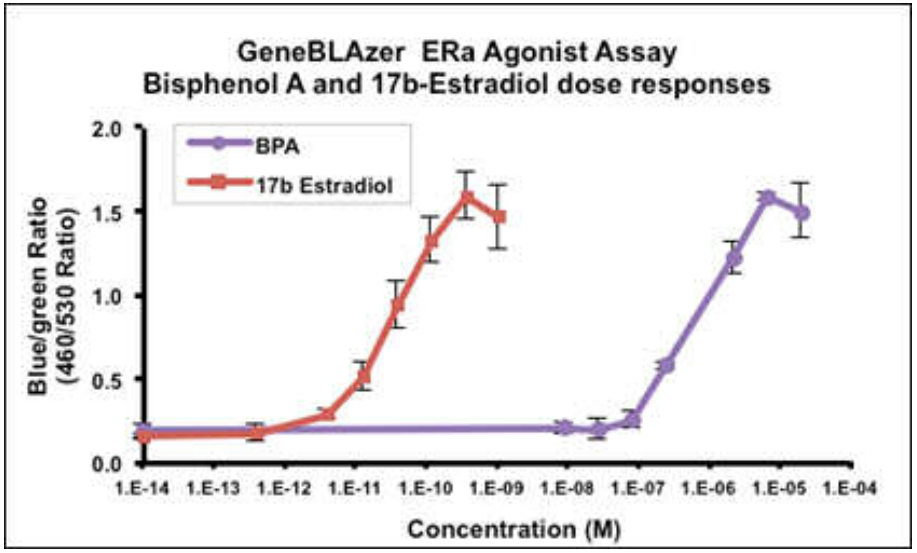
Plans for 2014: Alt. Flame Retardants

- ✓ 10 Bay Water
  - 3 in LSB; 3 in SB; 2 in CB and 1 each in SP and Suisun
- Stormwater – 2 sites Sunnyvale/Richmond (8 samples)
- Effluent (3 facilities)
- Sediment (10 sites)
- Bivalves (6 sites)
- Seals (10)
- Collaboration with Southern Illinois University

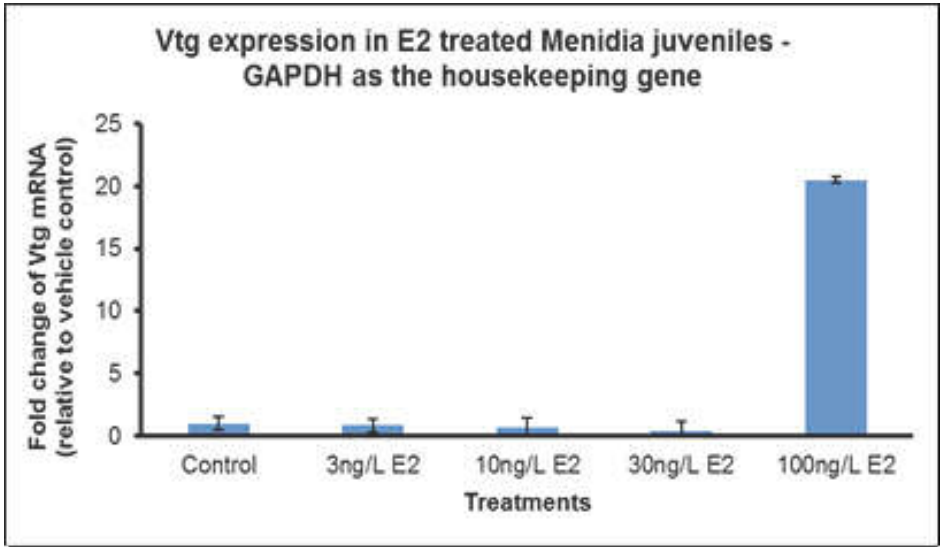
Update 2013: Bioanalytical Tools

- Goal: link *in vitro* assays to *in vivo* adverse effects in the Silverside fish (e.g. growth and survival)
- ✔ Have developed assays for a variety of biomarkers associated with growth, brain development, and reproduction (e.g., vitellogenin, choriogenin)
- UF/SCCWRP collaborating with UC-Davis
  - Evaluating estrone, BPA, nonylphenol, galaxolide
  - Ethinylestradiol and bifenthrin (UC-Davis)

Update 2013: Bioanalytical Tools



Bioassay



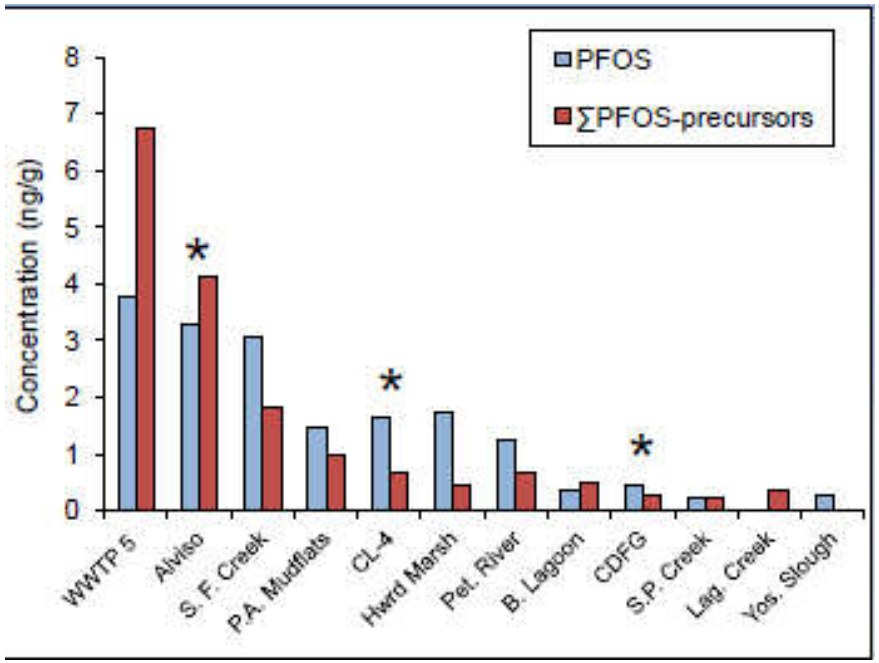
Whole fish

Plans for 2014

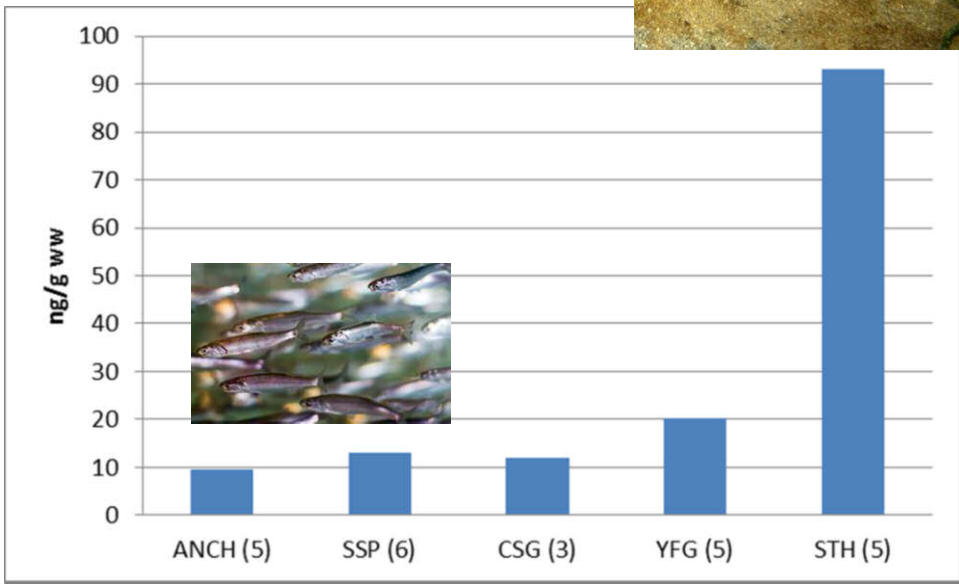
- Obtaining wastewater effluent from 2 facilities
  - NorCal and SoCal
  - Measuring Estrone, Galaxolide, BPA and 4-NP
- Applying bioassays to effluent
- Characterizing effects to whole fish
  - Early life stages (hatched embryos – 10 day larvae)
  - Juvenile fish (50-day old fry)

Perfluorinated Studies

- ✔ Completed field sampling/analysis and pro bono precursor work (AXYS Analytical)
- Writing article complete Feb 1



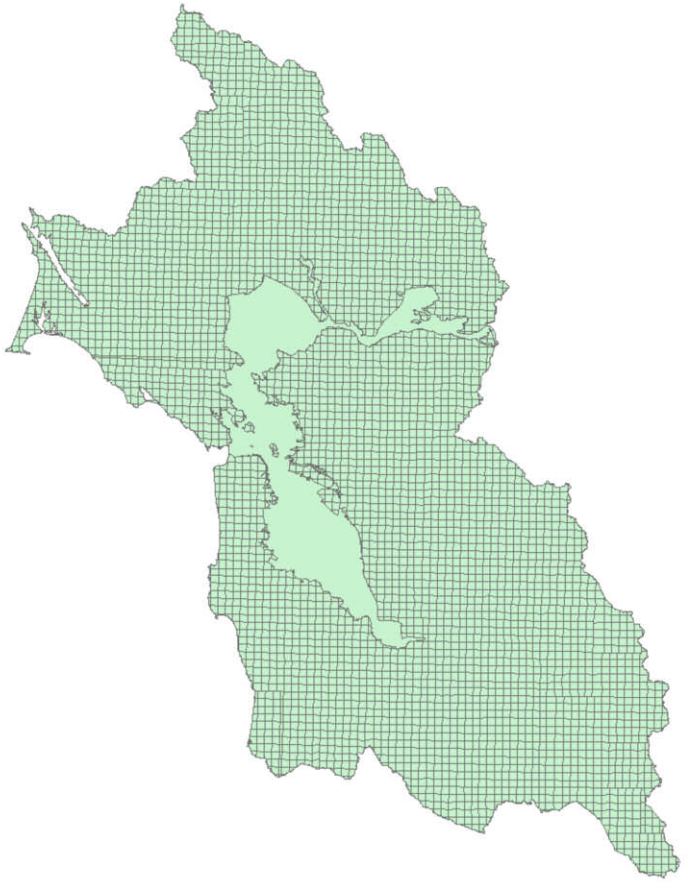
Sediment



Small Fish

Update on 2013 Activities - CUPs

- Current Use Pesticide Meeting → Prioritization/Mapping Exercise
- ✔ Data from DPR (CalPIP)
  - 9 Bay Area Counties (at Township level)
  - Focus on Ag
    - Issues with urban
  - 425 pesticides identified



Initial Screening List (48)

1,3-dichloropropene	Cyprodinil	Iprodione	Oryzalin	Sodium Tetrathiocarbonate
2,4-Dichlorophenoxyacetic acid	Dimethoate	Kresoxim-Methyl	Oxyfluorfen	Tebuconazole
Acephate	Ethalfluralin	Mancozeb	Paraquat Dichloride	Thiophanate-Methyl
Azoxystrobin	Ethephon	Maneb	PCNB	Trifloxystrobin
Bensulide	Fenhexamid	MCPA	Pendimethalin	Triflumizole
Bifenazate	Flumioxazin	Metam-Sodium	Potassium N-Methyldithiocarbamate	Trifluralin
Boscalid	Fosetyl-Al	Methomyl	Propargite	Ziram
Buprofezin	Glufosinate-Ammonium	Methoxyfenozide	Pyraclostrobin	
Chloropicrin	Glyphosate	Myclobutanil	Quinoxyfen	
Chlorthal-dimethyl	Imidacloprid	Naled	S-metolachlor	

Simple Prioritization Method

- Pounds used/ lowest effects threshold to develop relative risk ratios

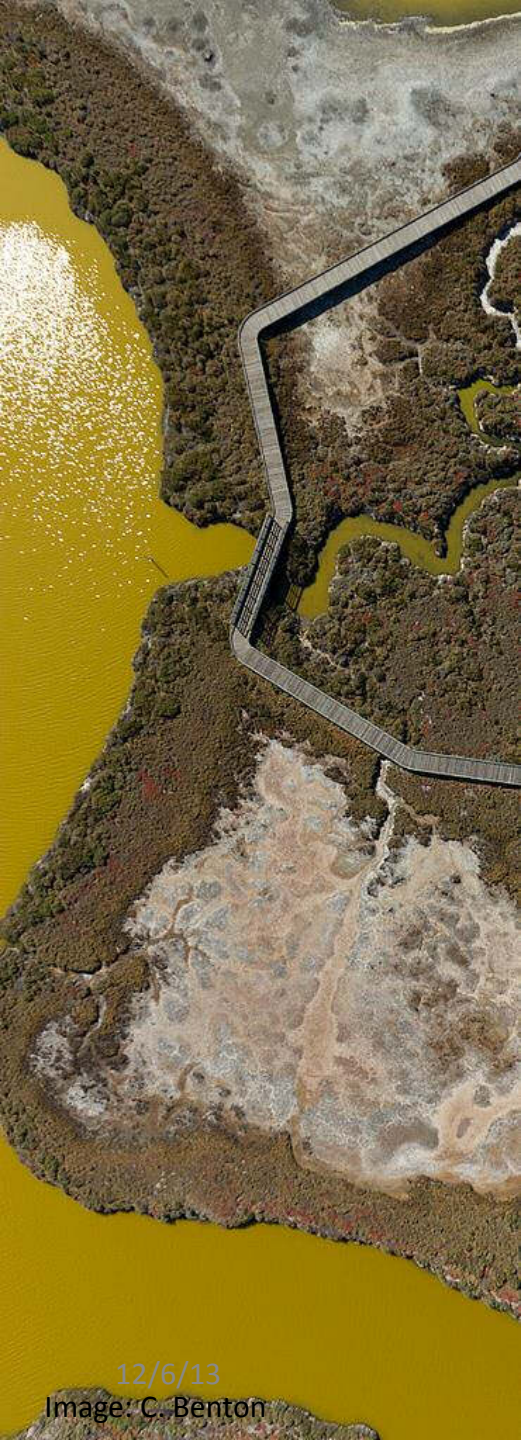
Pesticide	Sum of Active Ingredient (AI) Used (lbs)	Lowest Aquatic Life Benchmark (ug/L)	Type of Benchmark	Risk Ratio (sum of AI used/aquatic life benchmark)
Naled	9,804	0.045	Chronic-Invertebrates	217,877
Ziram	17,598	9.7	Acute-Fish	1,814
Pyraclostrobin	56,807	1.5	Acute-Nonvascular Plants	37,871

Current Top 20 Rankings

Pesticide	Priority Ranking
Oxyfluorfen	1
Naled	2
Paraquat Dichloride	3
Ethalfluralin	4
Mancozeb	5
Dimethoate	6
Trifluralin	7
Flumioxazin	8
Pyraclostrobin	9
Metam-Sodium	10
Methomyl	11
Pendimethalin	12
1,3-dichloropropene	13
Imidacloprid	14
Maneb	15
Chloropicrin	16
2,4-Dichlorophenoxyacetic acid	17
S-metolachlor	18
Thiophanate-Methyl	19
Cyprodinil	20

Next Steps

- Evaluate fate and transport properties
- Generate GIS Maps
- Present to ECWG
  - Next meeting June 3rd



Nutrient Program Update

David Senn and Emily Novick

davids@sfei.org

Image: C. Benton

RMP-funded Projects and Work Products (2013)

	Draft	Final
Conceptual Model	Apr 2013	Dec 2013
Loading Study	Apr 2013	Dec 2013
Modeling Program Development Plan	Aug 2013	Dec 2013
Modeling Workplan	Jan 2014	Feb 2014
Stormwater load estimate: summary, next steps	Oct 2013	Oct 2013
Moored sensor: maintenance manual	Feb 2014	Apr 2014
Algal toxins (with UC Santa Cruz)	Feb 2014	May 2014
Stormwater monitoring: WY2012, WY2013	?	?

Overall Nutrient Work Products

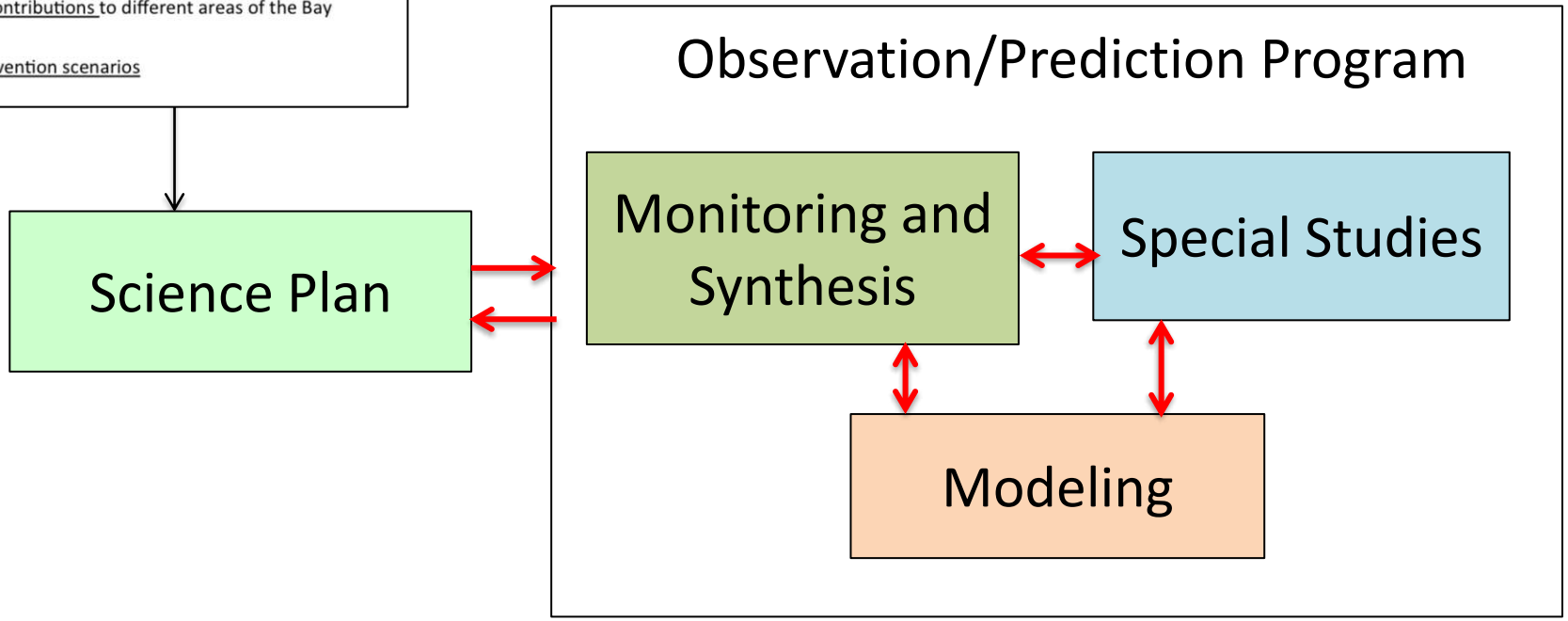
	Draft	Final
NNE Literature Review	Spring 2011	Sep 2011
Nutrient Strategy	Mar 2012	Nov 2012
Conceptual Model	Apr 2013	Dec 2013
Suisun Synthesis I	Nov 2012	Dec 2013
Loading Study	Apr 2013	Dec 2013
Yr.1 Effluent Characterization	Oct 2013	Oct 2013
GG exchange conceptual model	Dec 2013	Jan 2013
Lower South Bay Synthesis	Jan 2014	Mar 2014
Suisun Synthesis II	Jul 2014	Sep 2014
Science Plan – v.1, v.2	May 2014	July 2014
Modeling Program Development Plan	Aug 2013	Dec 2013
Modeling Workplan	Jan 2014	Feb 2014
DO in South Bay and LSB margins	Oct 2013	Q1 2014
Assessment Framework report #1	May 2013	
Assessment Framework report #2	Q2/Q3 2014	
Monitoring Program Development Plan	Mar 2013	

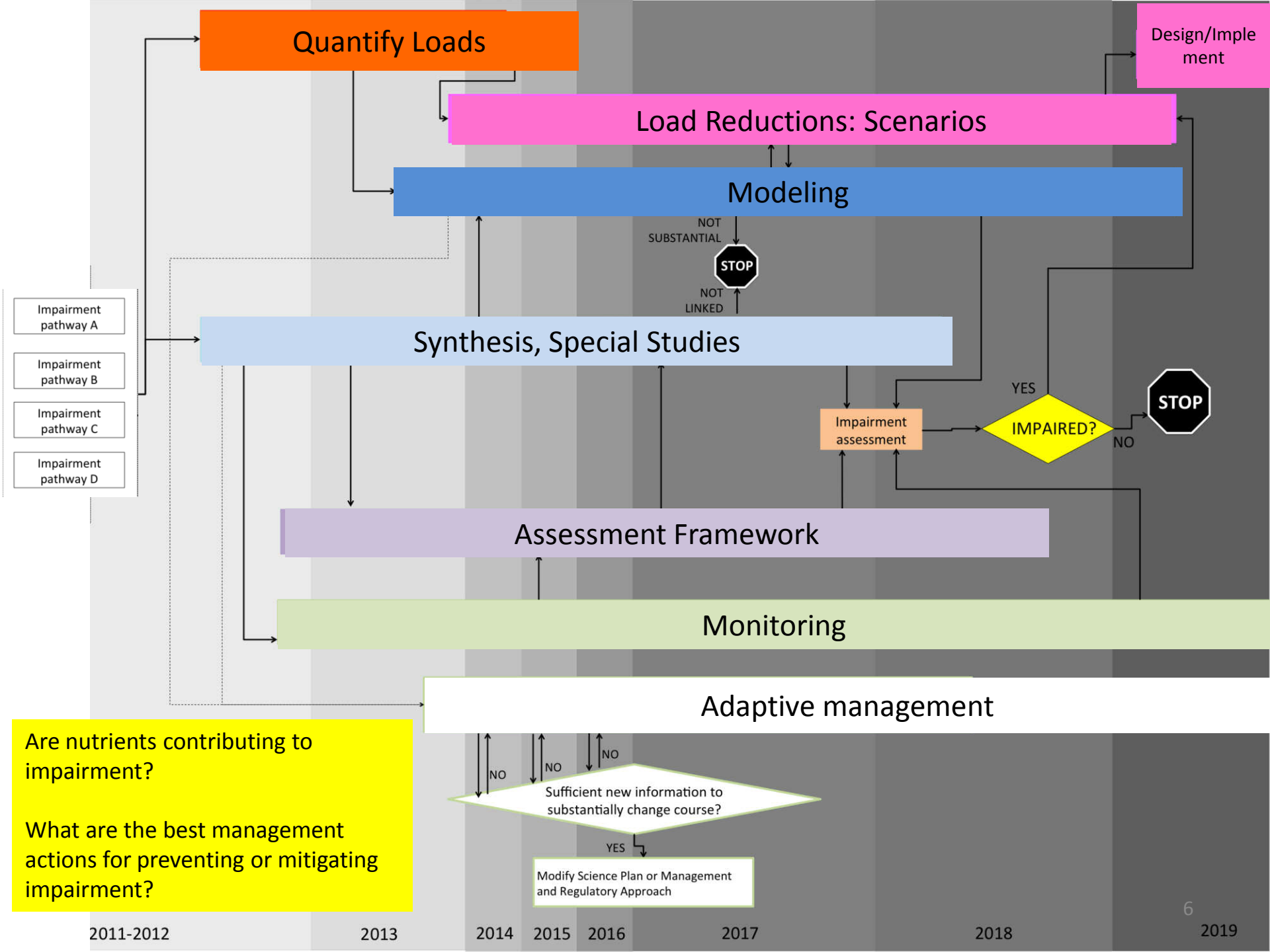
Highest Priority Issues – CM report

- Determine whether increasing biomass signals future impairment
- Characterize/quantify factors that adversely affect phytoplankton composition, including harmful algal blooms
- Determine if low DO in shallow habitats causes adverse impacts
  - Quantify role of nutrients
- Test future scenarios that may lead to worsening conditions
- Quantify nutrient contributions to different areas of the Bay
- Test mitigation/prevention scenarios

Highest Priority Issues and Goals

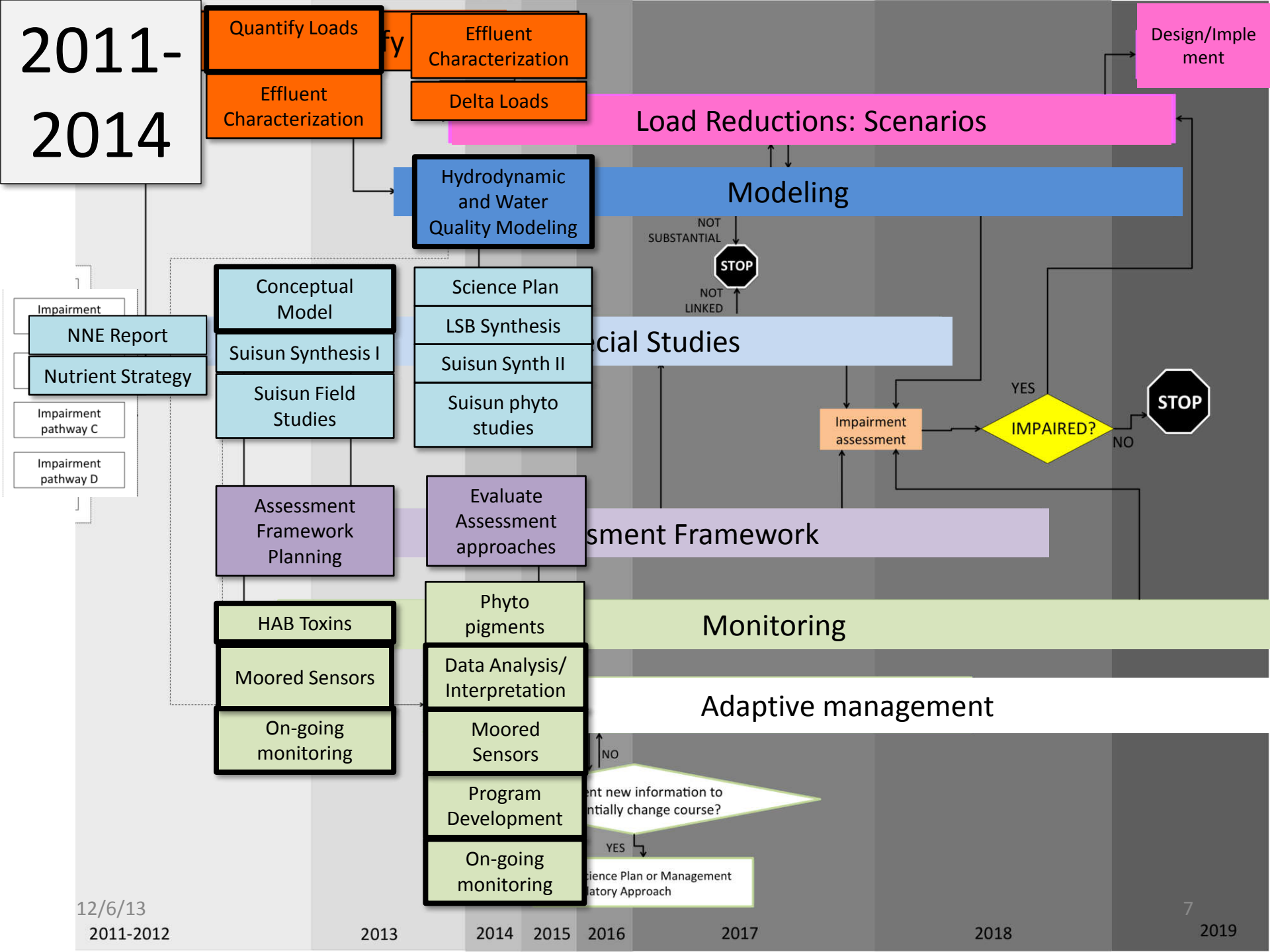
- Determine whether increasing biomass signals future impairment
- Quantify factors that adversely affect phytoplankton composition
- Determine if low DO in shallow habitats causes impairment
  - Quantify role of nutrients
- Test future scenarios that may lead to worsening conditions
- Quantify nutrient contributions to different areas of the Bay
- Test mitigation/prevention scenarios





Are nutrients contributing to impairment?

What are the best management actions for preventing or mitigating impairment?


2011-2014
Quantify Loads
Effluent Characterization
Effluent Characterization
Delta Loads
Design/Implement
Load Reductions: Scenarios
Modeling
Hydrodynamic and Water Quality Modeling
NOT SUBSTANTIAL
STOP
NOT LINKED
Conceptual Model
Science Plan
LSB Synthesis
Suisun Synthesis I
Suisun Synth II
Suisun Field Studies
Suisun phyto studies
NNE Report
Nutrient Strategy
Impairment pathway C
Impairment pathway D
YES
Impairment assessment
IMPAIRED?
NO
STOP
Assessment Framework Planning
Evaluate Assessment approaches
HAB Toxins
Phyto pigments
Monitoring
Moored Sensors
Data Analysis/ Interpretation
Adaptive management
On-going monitoring
Moored Sensors
Program Development
On-going monitoring
NO
YES
2011-2012
2013
2014
2015
2016
2017
2018
2019

Moored Sensor Update

<u>Current (all sites)</u>
DO
Salinity
Turbidity
pH
Temp
Depth
Chl-a
Blue-green algae
fDOM

<u>Future (select sites)</u>
NO3

SFEI station

Real-time
SFEI station

Moored Sensor Pilot Program Goals

1. Develop capacity to deploy and maintain moored sensors

2. Develop procedures for data management, processing and presentation

3. Improve understanding of sensor performance/accuracy (data analysis, experiments, field studies)

4. Identify optimal spatial distributions of sensors

Moored Sensor Pilot Program Goals

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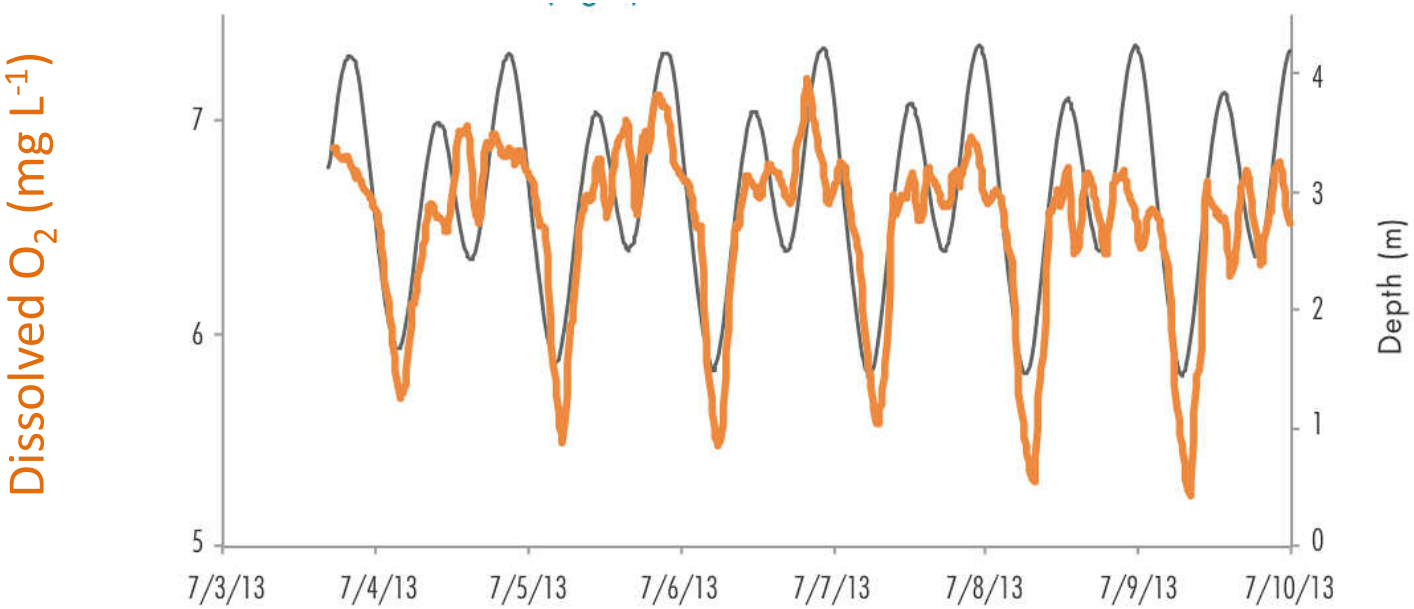
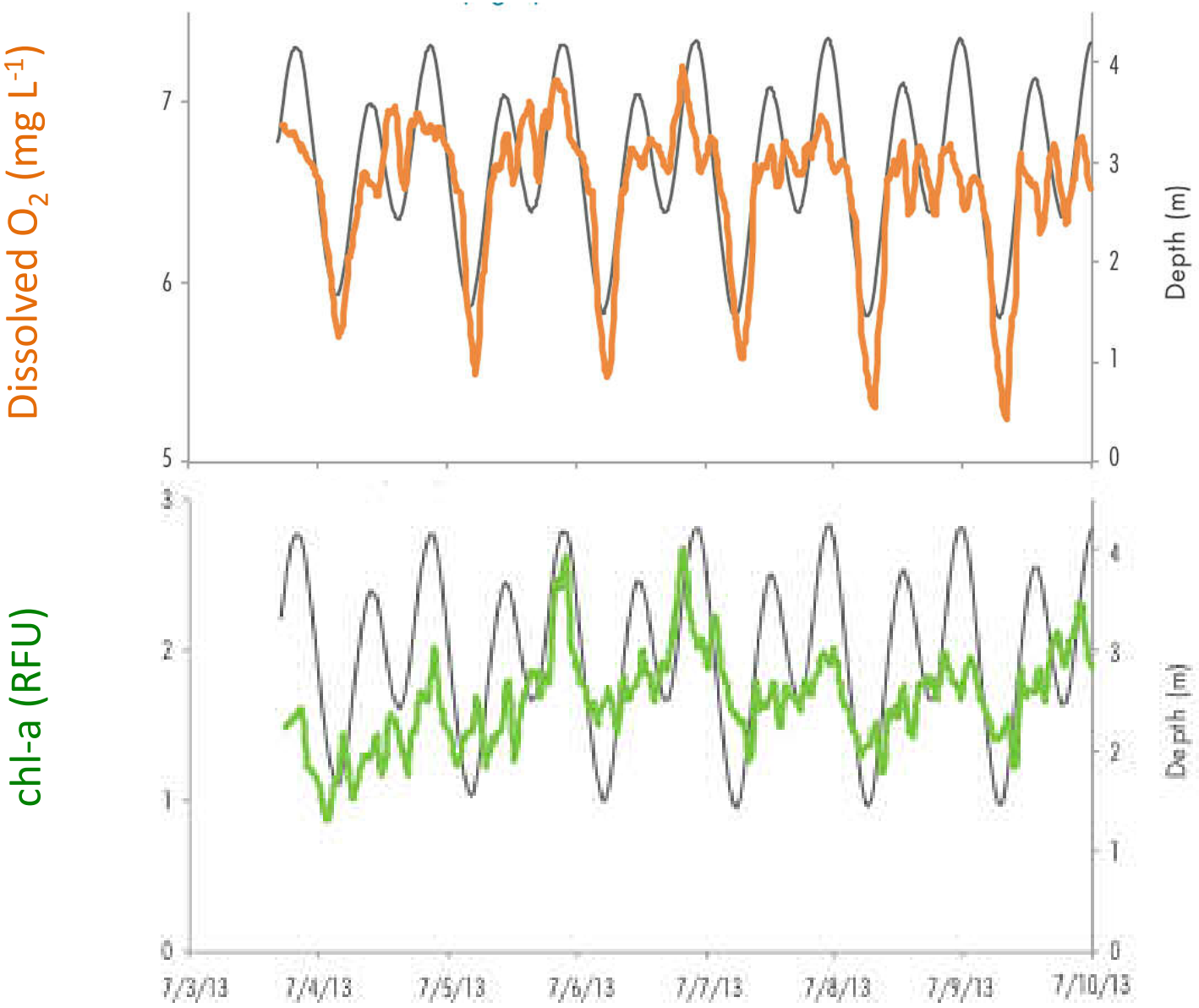
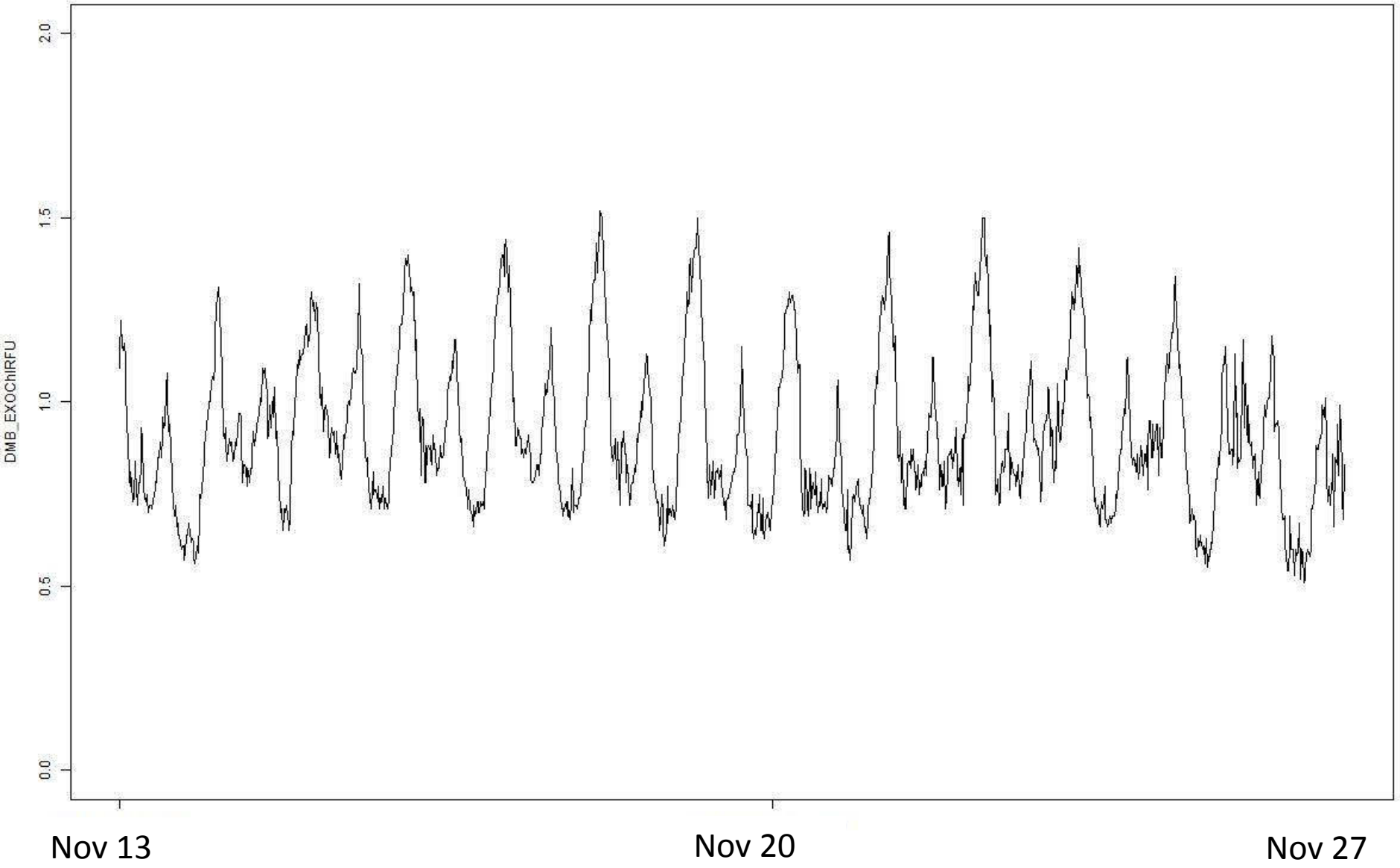
1 week in July 2013



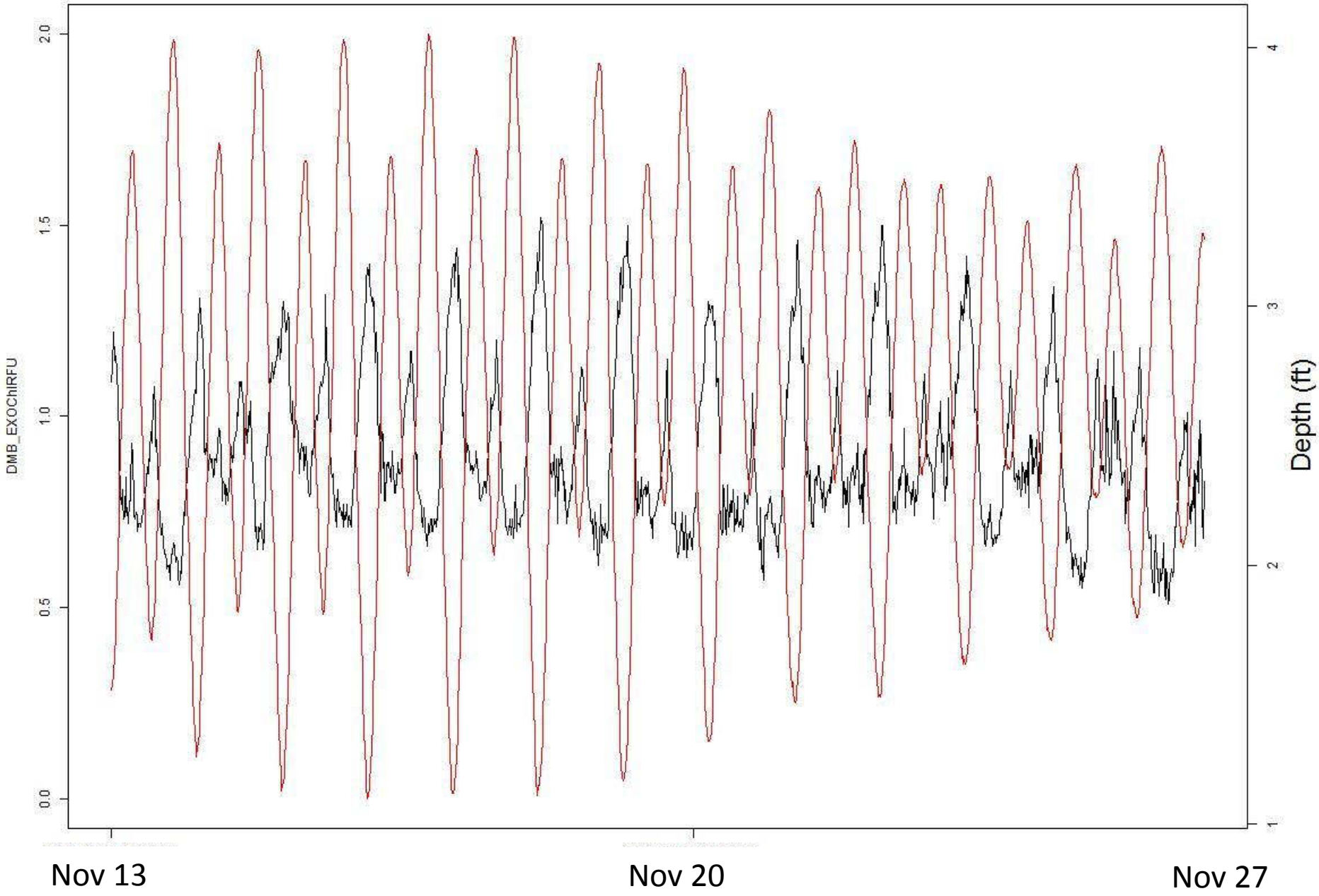
1 week in July 2013

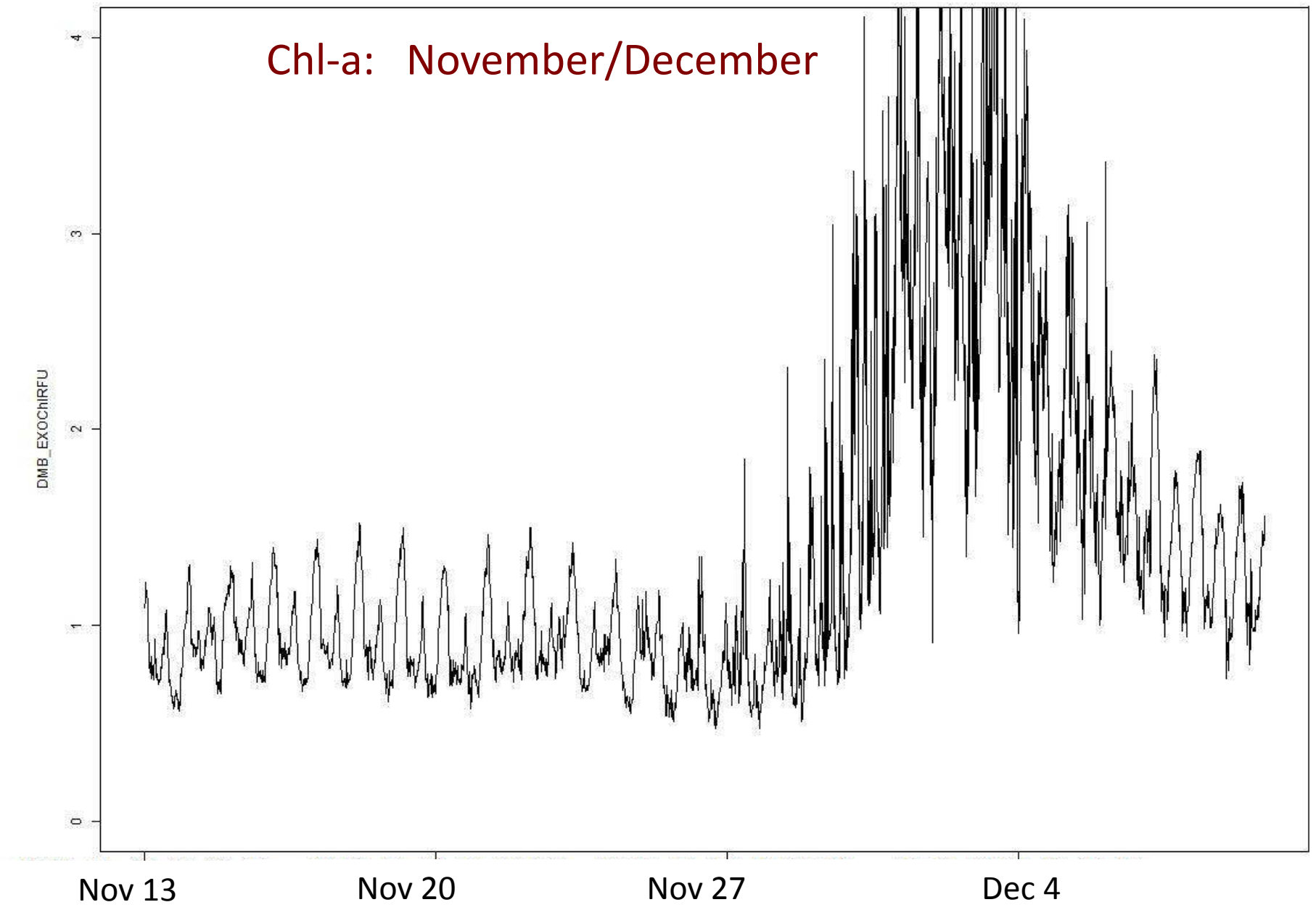


Chl-a: November

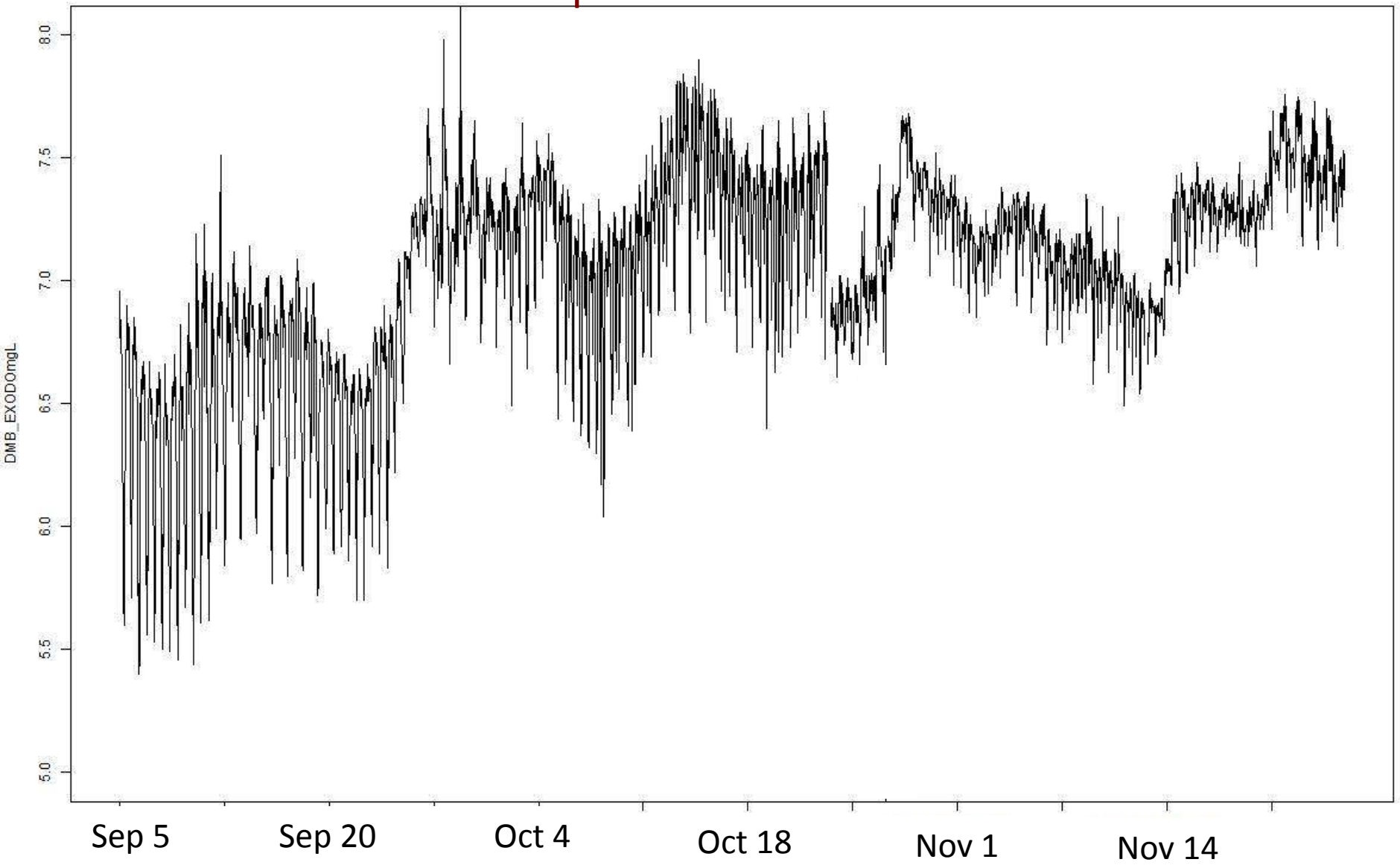


Chl-a: November




Chl-a: November/December
DMB_EXOChlRFU
0
1
2
3
4
Nov 13
Nov 20
Nov 27
Dec 4

O2: Sep-Nov

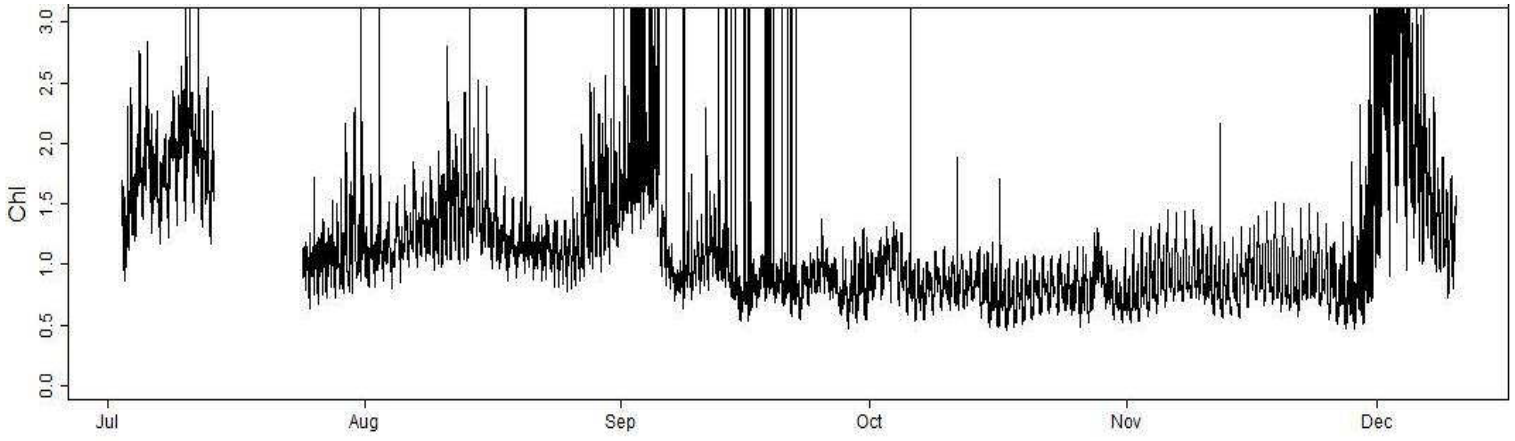

DMB_EXODOmgL
8.0
7.5
7.0
6.5
6.0
5.5
5.0
Sep 5
Sep 20
Oct 4
Oct 18
Nov 1
Nov 14

Sensor Performance: Priority Questions

- What is typical biofouling drift for individual sensors? What biofouling prevention tools are most effective?
- How are fluorometer results influenced by potential interferences (turbidity, dissolved organics, temp)?
- How do fluorometer results vary due to differences in fluorescence per unit chlorophyll – e.g., caused by temperature, light intensity, diurnal variations in response, species?
- How variable are chl vs. fl relationships in space and time?
- How well do EXO sensors agree with other manufacturers/models?
- What amount of ancillary data collection is necessary in order for in-situ chl-a and lab-analyzed chl-a to agree within acceptable limits?

Sensor Performance: In-situ drift

Chl
(relative units)

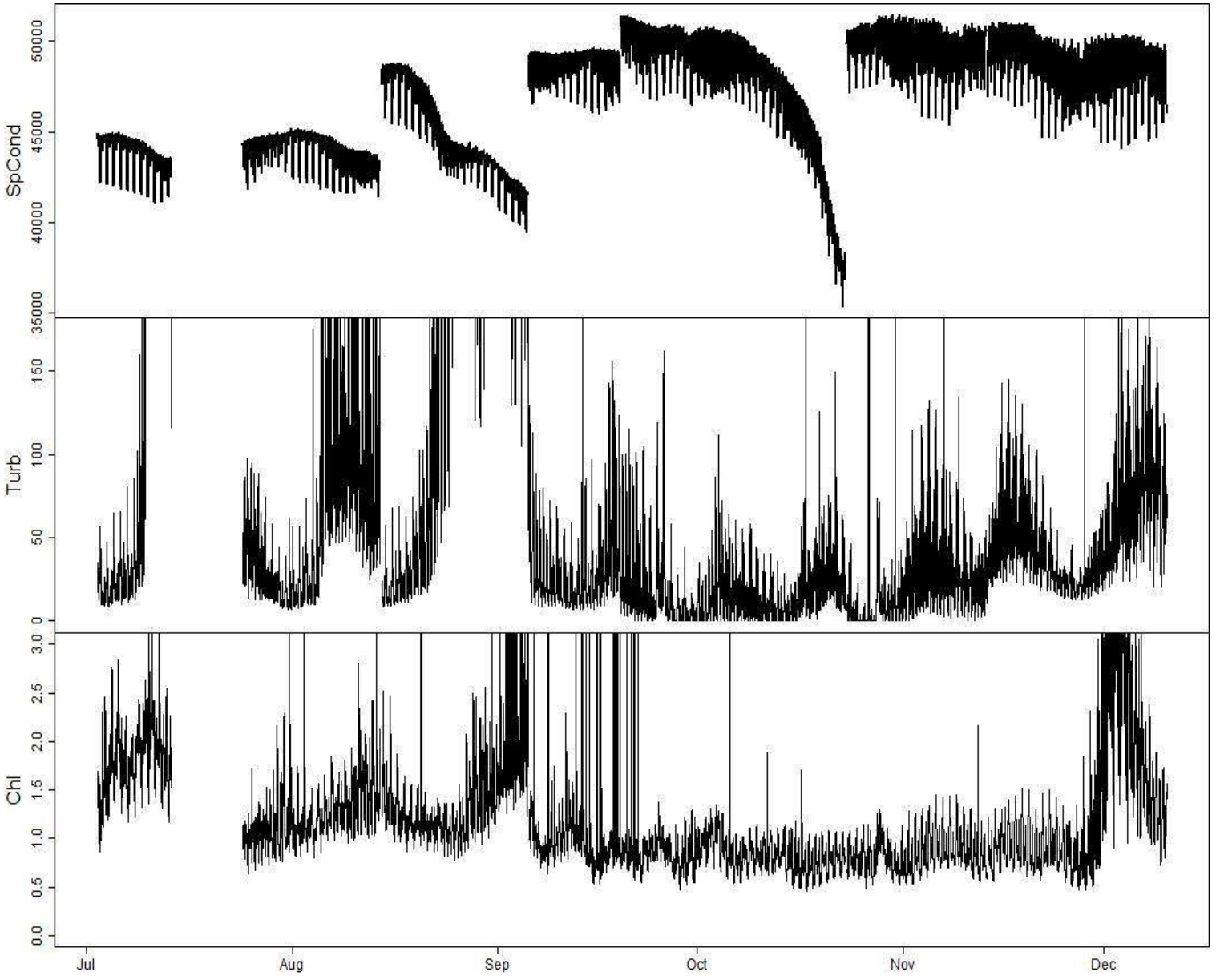


Sensor Performance: In-situ drift

SpCond
(µS cm^{-1})

Turb
(relative units)

Chl
(relative units)

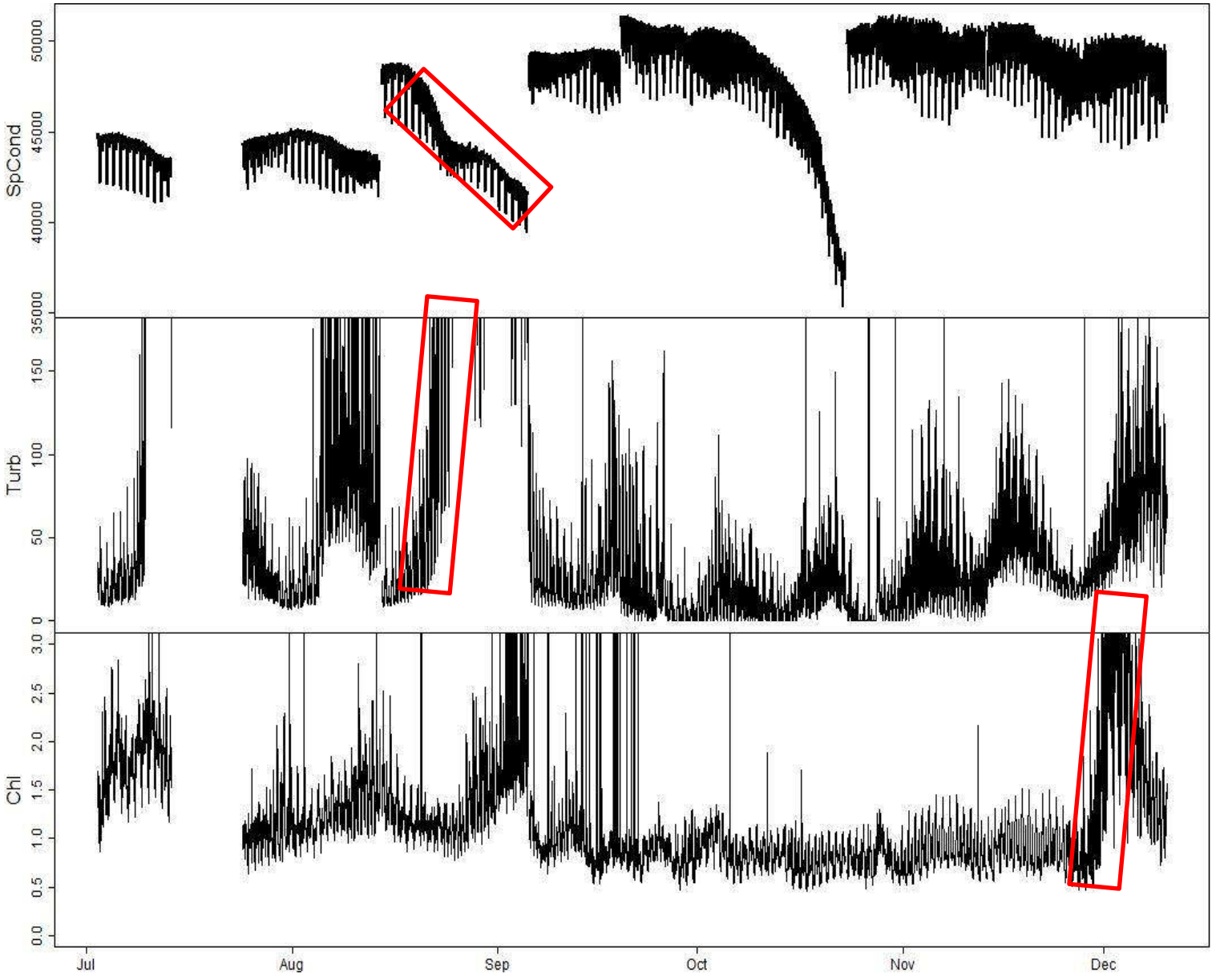


Sensor Performance: In-situ drift

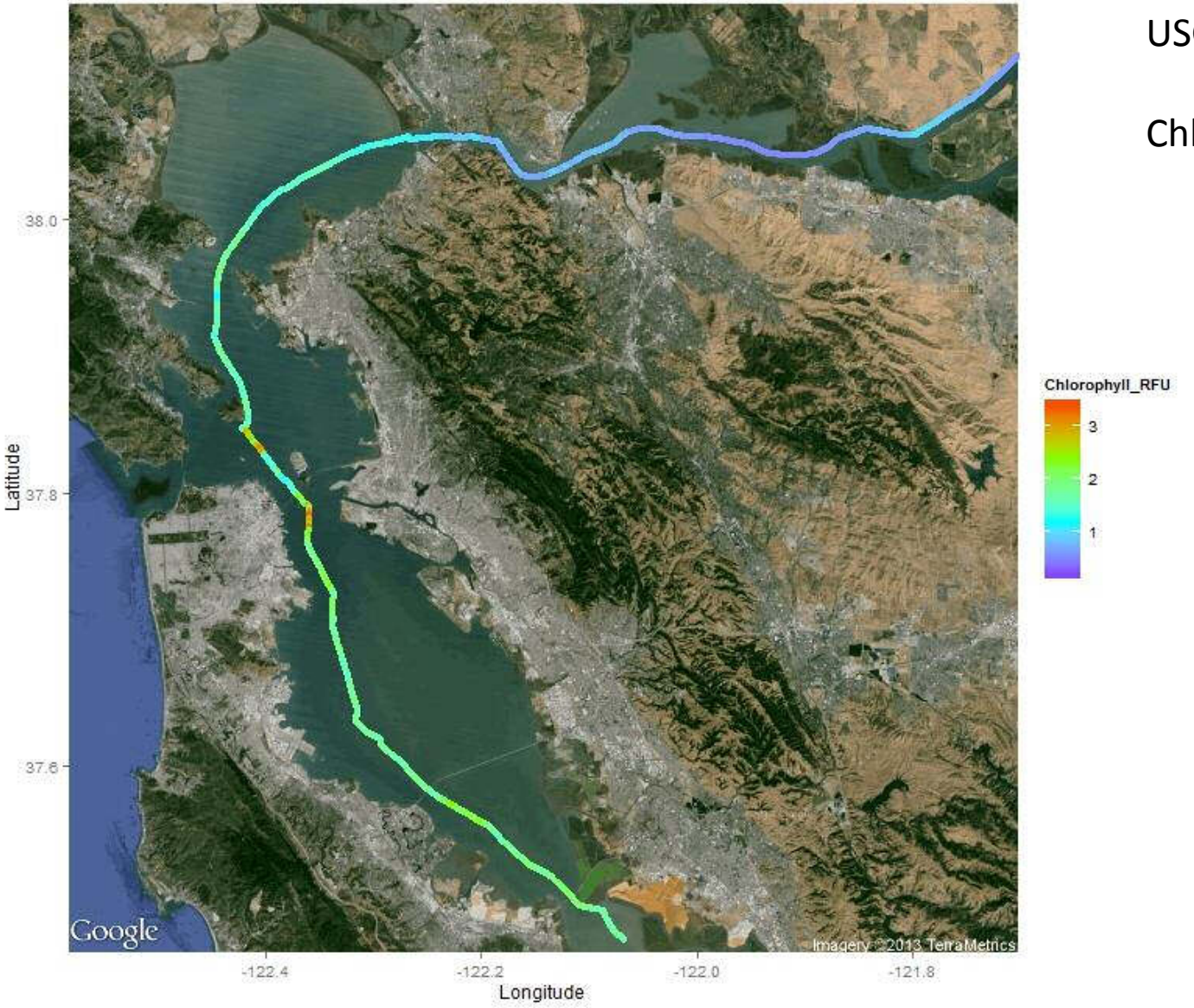
Real?

Due to fouling?

Due to sensor drift?



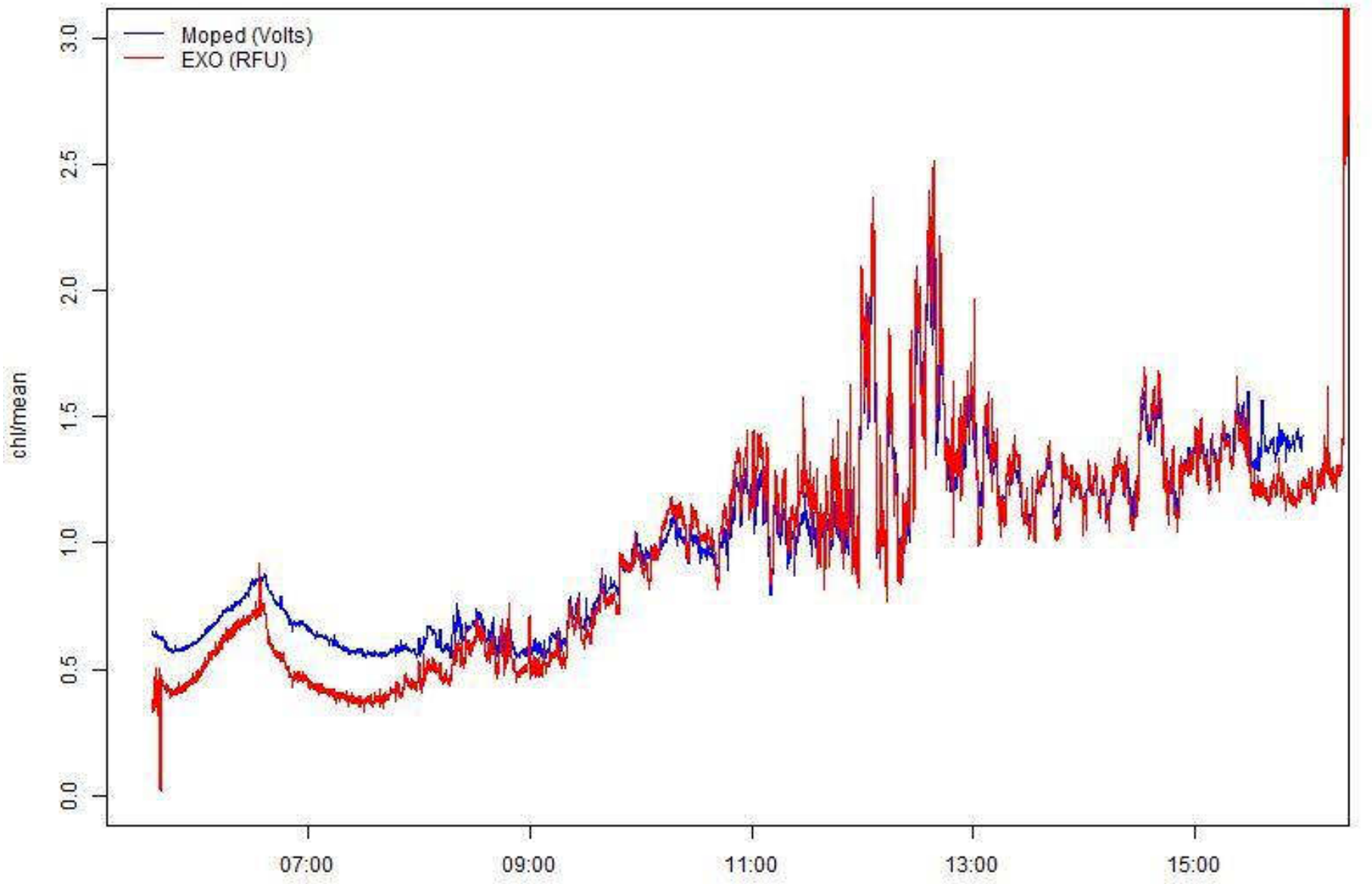
Sensor Performance: Calibration, Spatial Variability



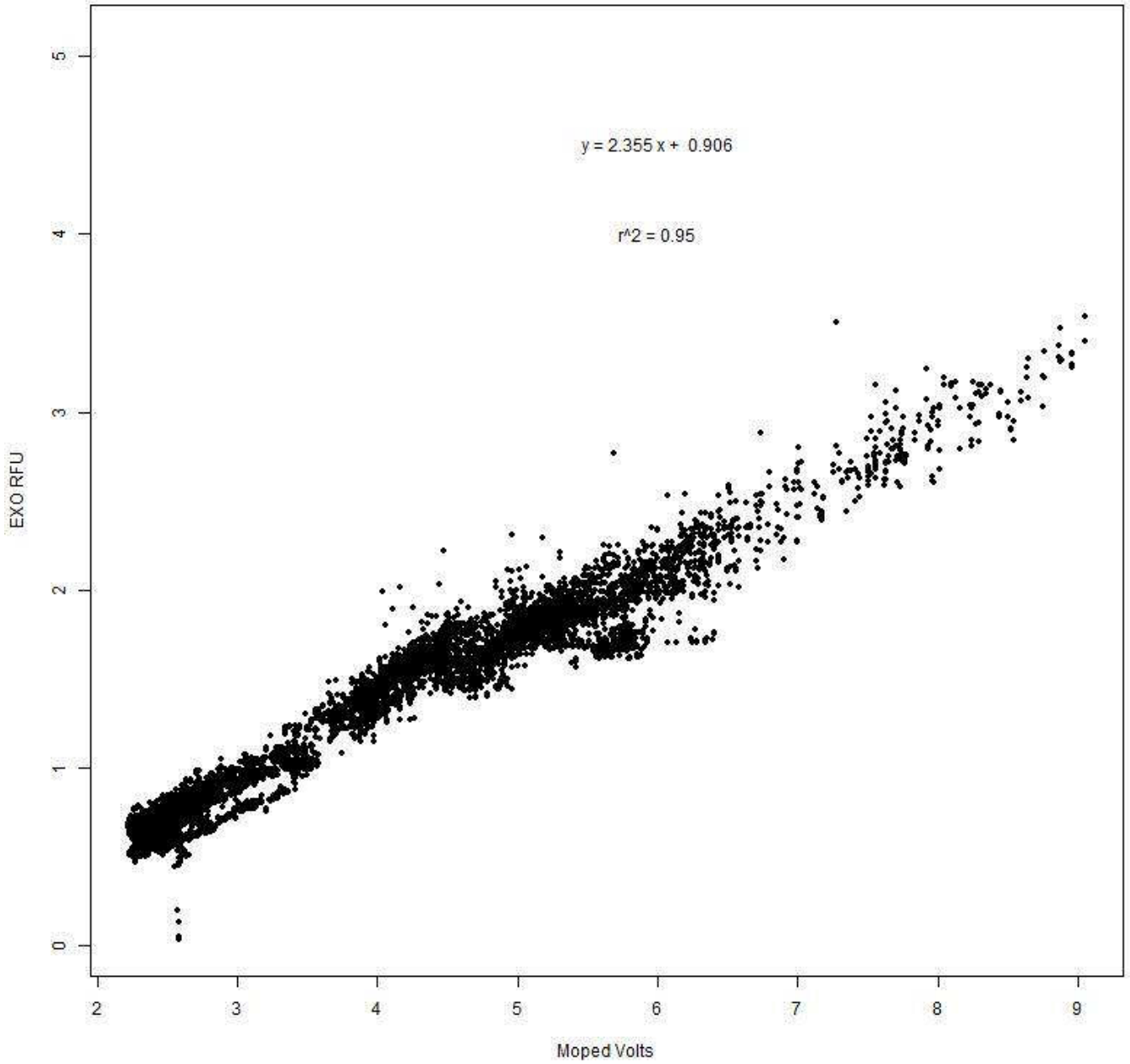
USGS flow-through system

Chl-a (RFU)

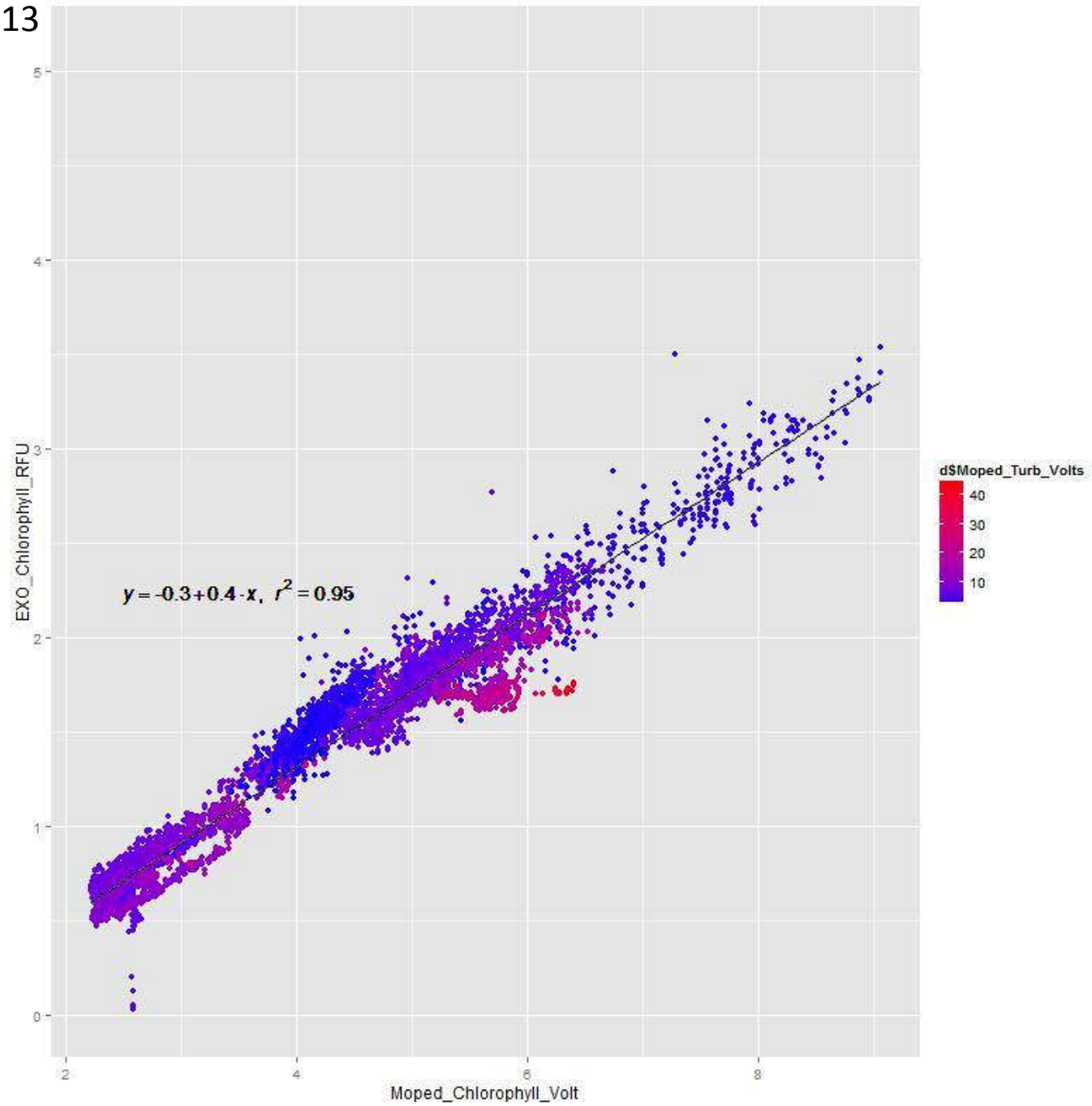
9/26/2013


Moped (Volts)
EXO (RFU)
chl/mean
0.0
0.5
1.0
1.5
2.0
2.5
3.0
07:00
09:00
11:00
13:00
15:00

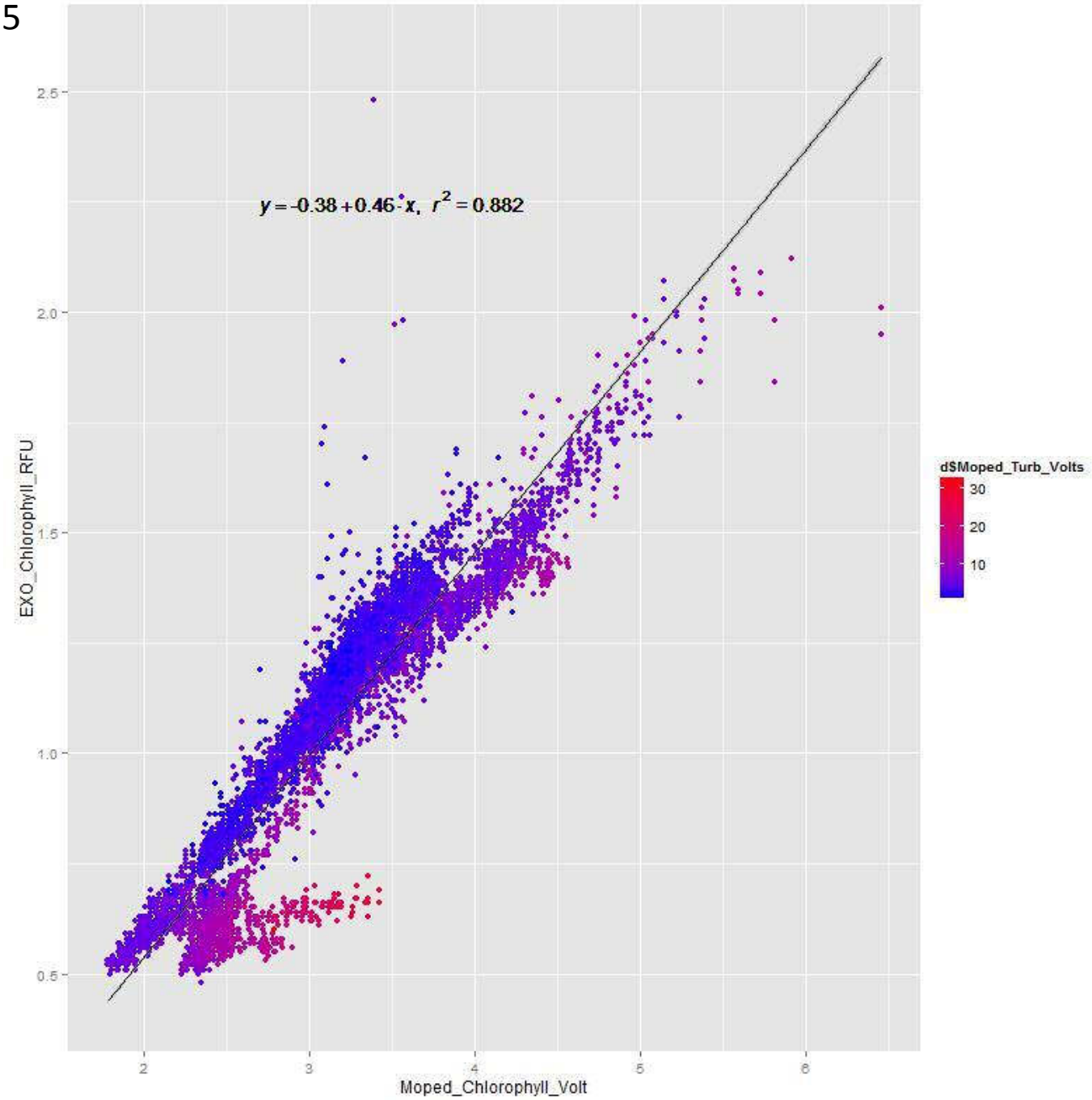
9/26/2013



9/26/2013

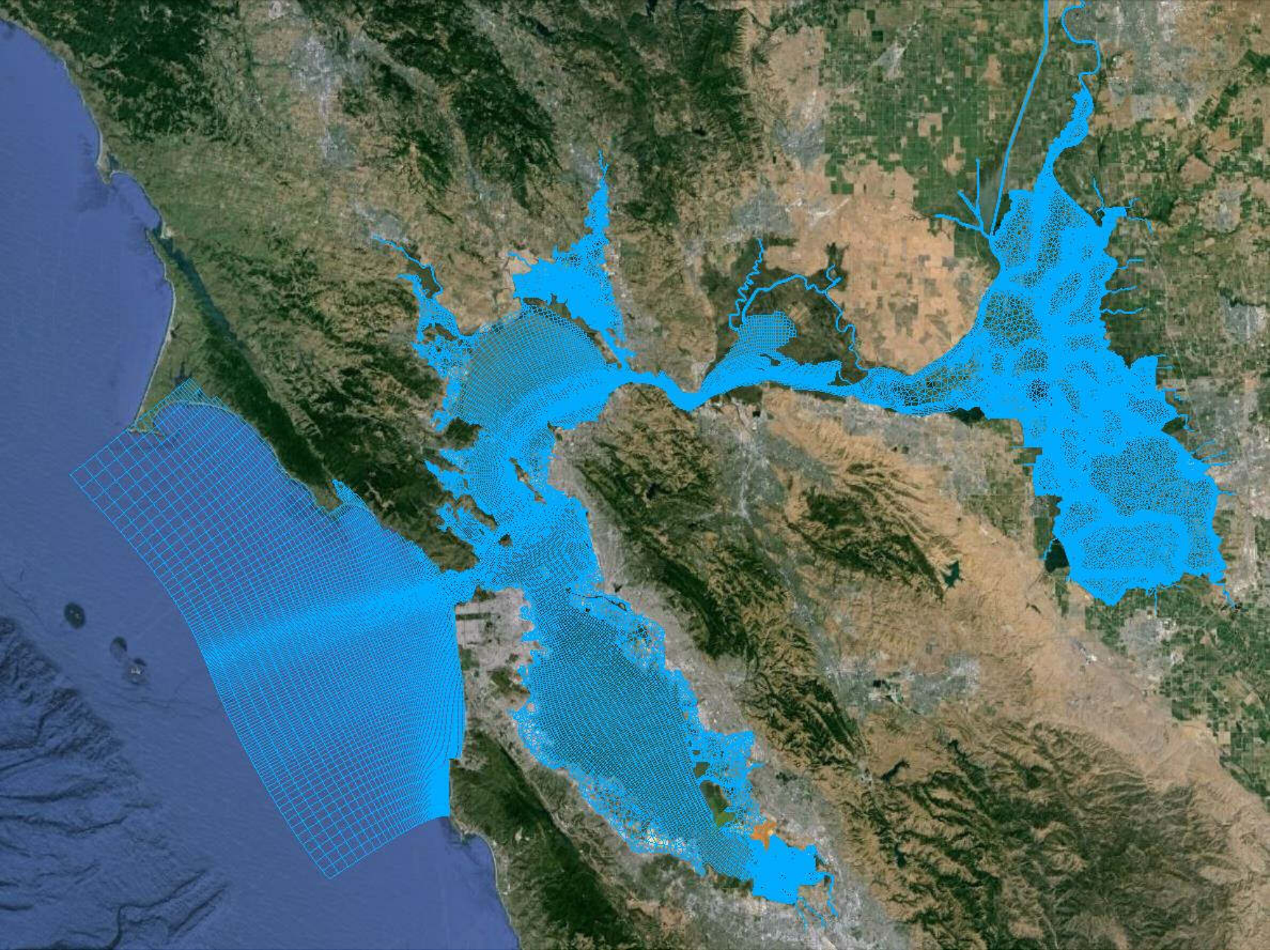

EXO_Chlorophyll_RFU
Moped_Chlorophyll_Volt
y = -0.3+0.4 ·x, r² = 0.95
dS$Moped_Turb_Volts
40
30
20
10
0
1
2
3
4
5
2
4
6
8

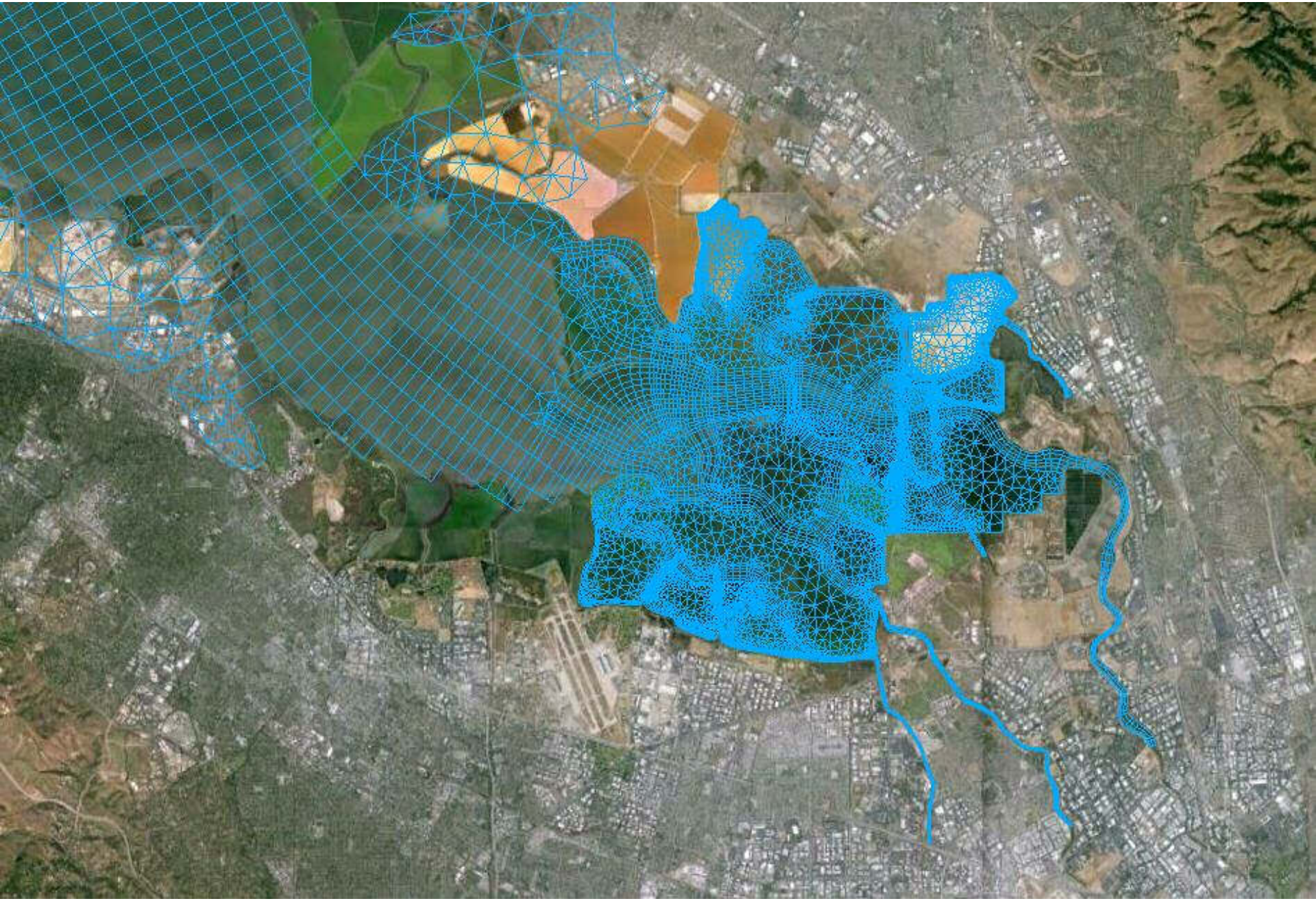
10/24-25


y = -0.38 + 0.46 x, r² = 0.882
EXO_Chlorophyll_RFU
Moped_Chlorophyll_Volt
d$Moped_Turb_Volts
30
20
10
0.5
1.0
1.5
2.0
2.5
2
3
4
5
6

Modeling update

- 2 meetings with technical advisors — Apr/Sep 2013
- Draft modeling plan — Sep 2013
  - Broad agreement among advisors: Delft3D and DELWAQ
- Meetings with Deltares and potential partners — Dec 2013
- Revised modeling plan — Dec 2013





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Next steps

- Develop draft detailed work plan — Jan/Feb 2013
- Nutrient Technical Work Group meeting — Jan/Feb 2013
- Begin modeling work — Mar 2013

Nutrient Modeling Related Questions:

(potential questions to target with "basic models" in year 1-2 indicated with *)

1. *What are the relative magnitudes/contributions of factors controlling ecosystem response to nutrients?
   - *Response*: phytoplankton biomass, DO, phyto comm compos. (?), HABs (?)
   - *Regulating factors*: light attenuation, clam grazing, NH4-inhibition, nutrient abundance

2. To what extent can observed changes in ecosystem response over the past ~25 years be explained by actual or hypothesized changes in regulating factors?
   a. * Decrease in phytoplankton biomass/blooms in Suisun Bay post-1987 (Corbula, NH4)
   b. Change in phytoplankton composition in Suisun Bay post-1987 (Corbula, NH4)
   c. * Gradual increase in biomass in Suisun post-1990 (light attenuation)
   d. *3x increase in chl-a in South Bay during Summer/Fall months since 1998 (clam loss, light)
   e. *Emergence of a fall bloom in South Bay/LSB after 1998 (clam loss, light)
   f. Unprecedented red tide bloom in South Bay Fall 2004 (warm/calm spell)

1. What is the contribution of anthropogenic nutrient loads to low DO in shallow poorly-exchanging margin habitats?
   - E.g., Low DO in LSB sloughs

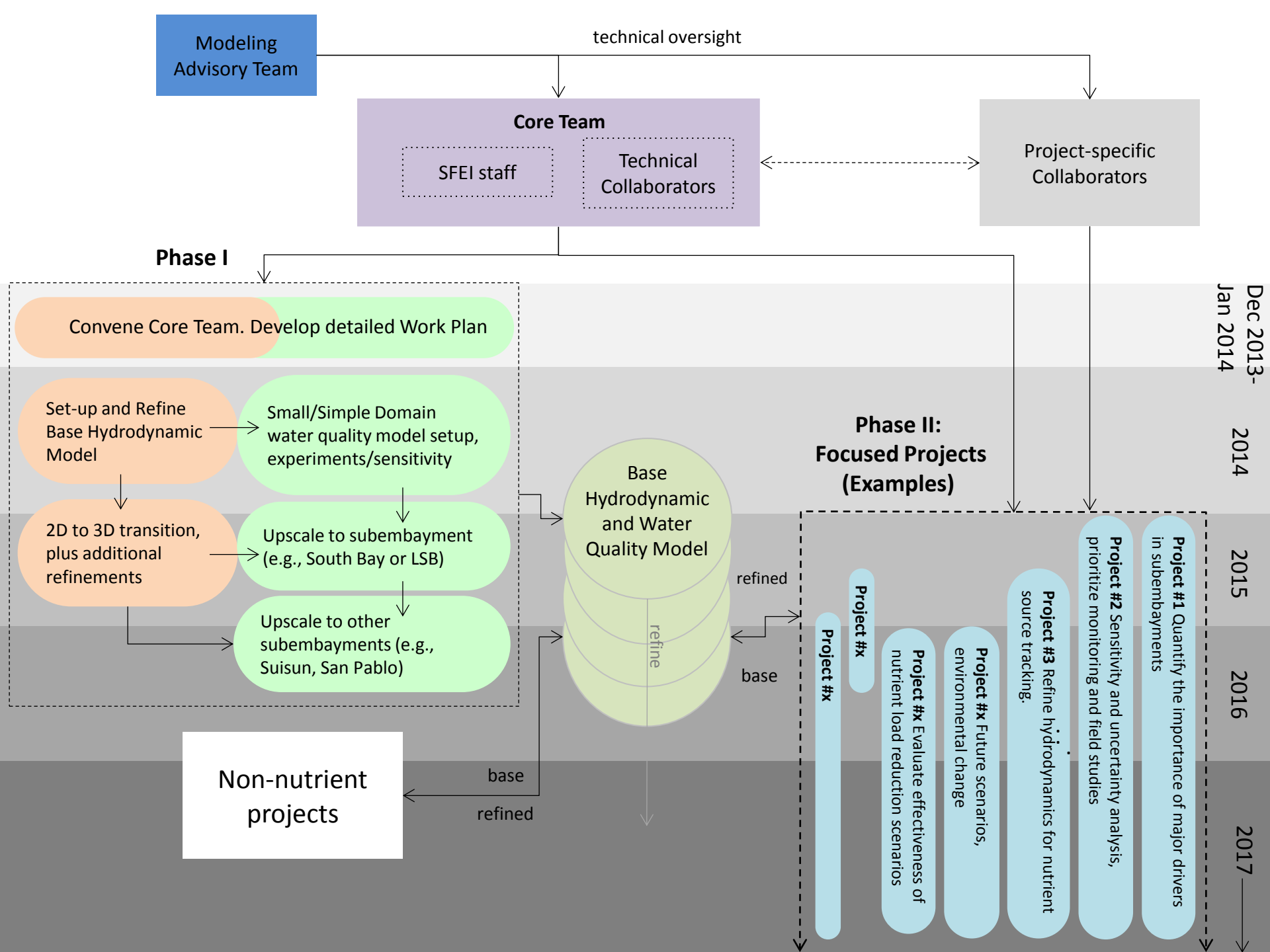
1. *What is the natural capacity to assimilate/process nutrients, at the subembayment (or finer) scale?
   - Nutrient transformations and losses (benthic and pelagic nitrification, denitrification, OM burial), losses, flushing

Nutrient Modeling Related Questions

5. *Under what future conditions would impairment be expected? What magnitude(s) of changes in drivers could lead to a tipping point, and are those changes plausible/probable?
   - *Causes:*
     - *prolonged stratification, *loss of clams, * increased water clarity, stochastic introduction(s) of opportunistic harmful phytoplankton species
   - *Effect:*
     - *Large blooms, *Low dissolved O_2, acute nuisance blooms, HABs, shifts in species composition

6. How do nutrient loads from known sources contribute to concentrations (and impairment) as a function of space and time?
   - Source types: POTWs, Delta, stormwater
   - Once hydrodynamics and mixing/dilution/reaction are taken into account, what spatial scales are relevant in terms of
     - Regulating and, for example, nutrient "trading"

7. *What potential effects would various control measures have on mitigating current or future problems at the subembayment (or finer) scale?
   - E.g., *load reductions, *wetlands, *shellfish beds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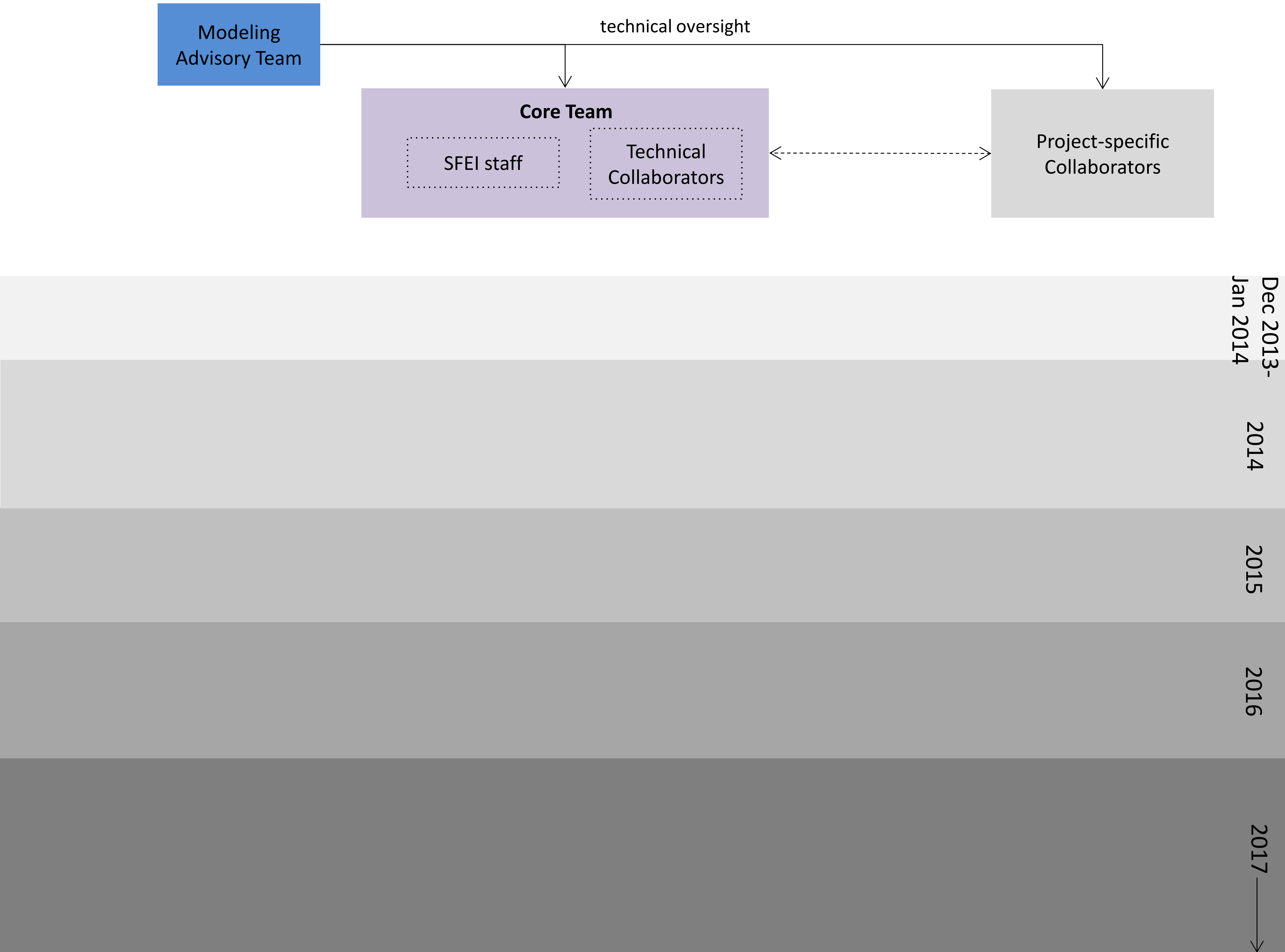
technical oversight
Core Team
SFEI staff
Technical Collaborators
Project-specific Collaborators
Phase I
Convene Core Team. Develop detailed Work Plan
Set-up and Refine Base Hydrodynamic Model
Small/Simple Domain water quality model setup, experiments/sensitivity
2D to 3D transition, plus additional refinements
Upscale to subembayment (e.g., South Bay or LSB)
Upscale to other subembayments (e.g., Suisun, San Pablo)
Base Hydrodynamic and Water Quality Model
refine
refined
base
Non-nutrient projects
base
refined
Phase II: Focused Projects (Examples)
Project #x
Project #x
Project #x Evaluate effectiveness of nutrient load reduction scenarios
Project #x Future scenarios, environmental change
Project #3 Refine hydrodynamics for nutrient source tracking.
Project #2 Sensitivity and uncertainty analysis, prioritize monitoring and field studies
Project #1 Quantify the importance of major drivers in subembayments
Dec 2013-Jan 2014
2014
2015
2016
2017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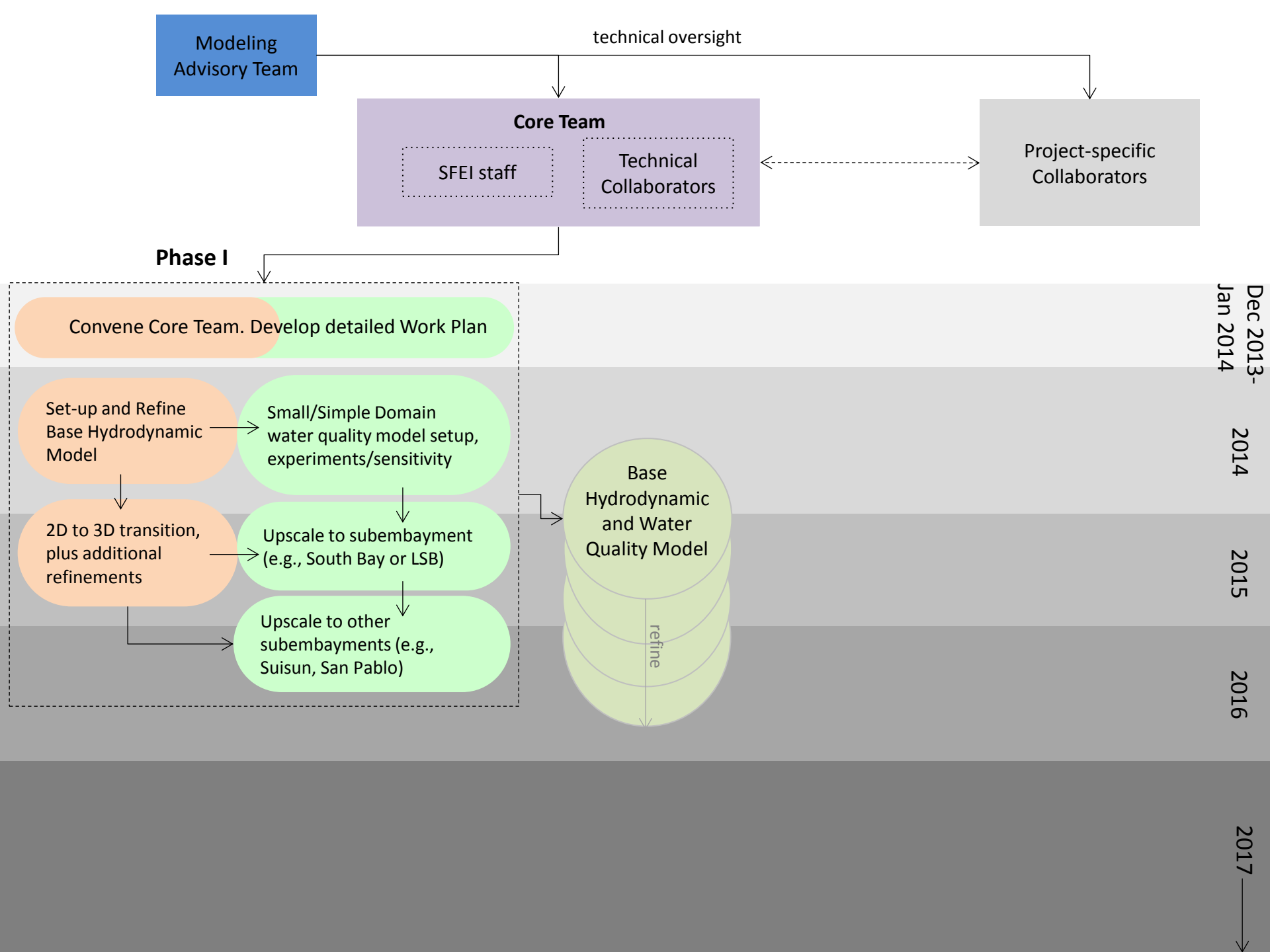
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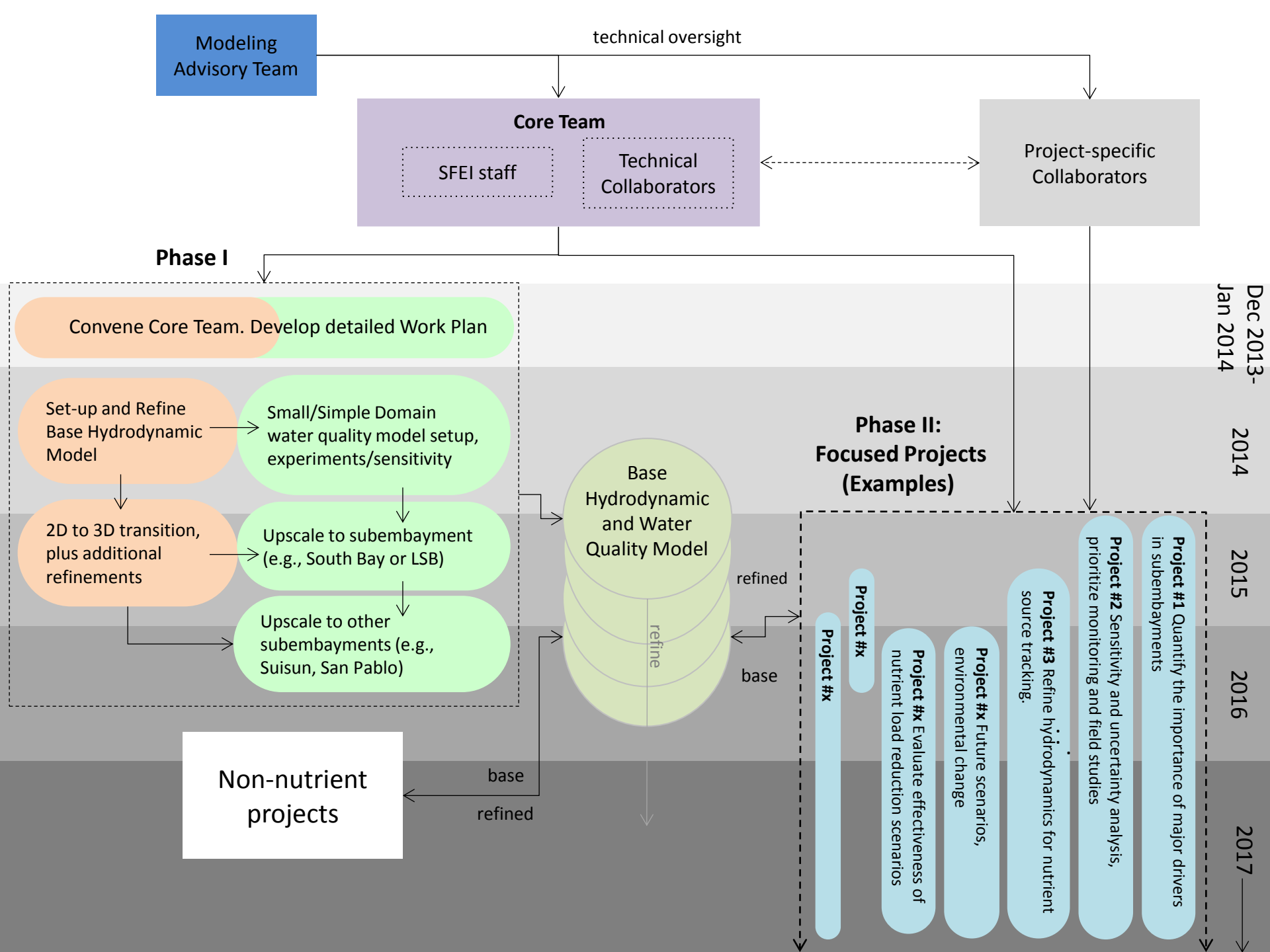
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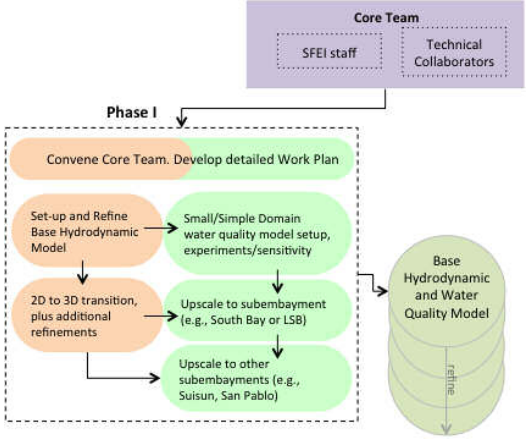

Phase I Primary Goals:

- Set-up base model that can support specific studies in Phase II
  - Model testing and evaluation

- Lay groundwork for a robust modeling program
  - Develop program structure: collaborations, institutional support, technical oversight
  - Build regional capacity for use in management applications
  - Engage research community and model developers/users

Approach:

- Assemble Core Team of SFEI staff + researchers/consultants
- Develop detailed work plan (December2013/January2014)
- Hydrodynamics:Water Quality…30%:70% split of resources

Timing:

- 1 year (starting Feb 2014)

Focus in 2014

- Moored sensors…
  - Decide on ‘permanent’ locations
  - Real-time
  - Data viz
- Modeling
  - Develop base biogeochemical model
- Monitoring Program
  - Begin detailed planning and data analysis to inform future monitoring program