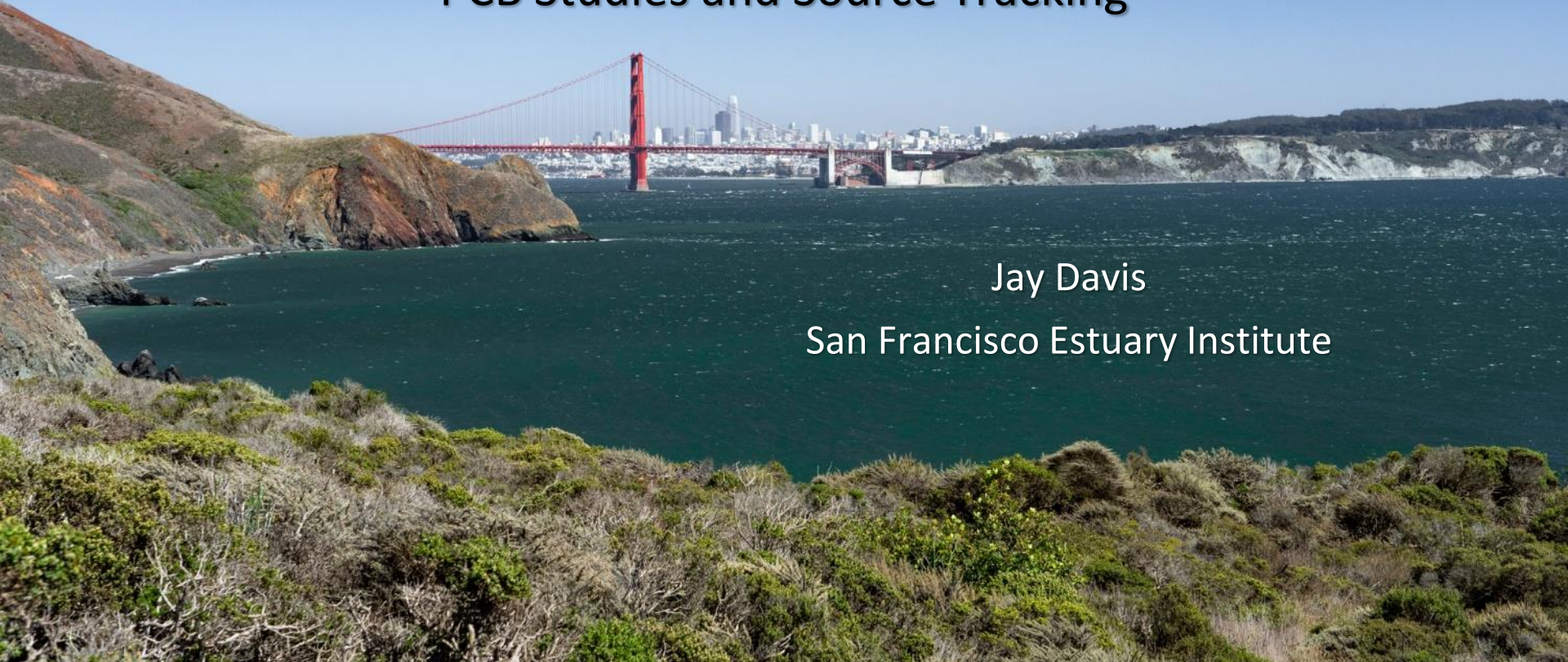


Regional Monitoring Program for Water Quality in San Francisco Bay

PCB Studies and Source Tracking

Jay Davis

San Francisco Estuary Institute



Regional Monitoring Program for Water Quality in San Francisco Bay

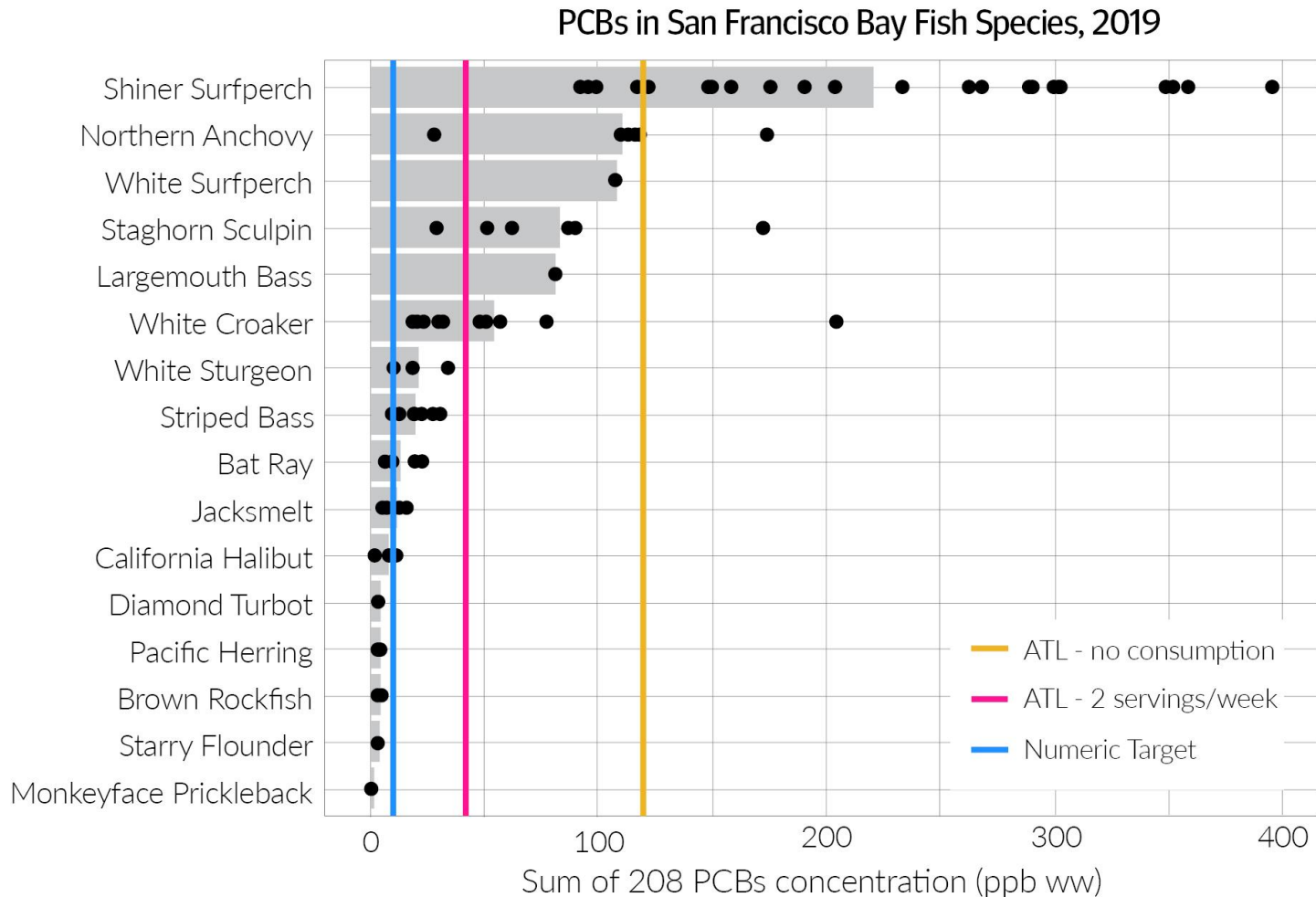


- Began in 1993
- \$4 million/year of stable funding
- Multi-faceted
- Continually adapting

A Persistent Challenge: PCBs

This is the dataset that defines the problem

Many species have average concentrations well above thresholds

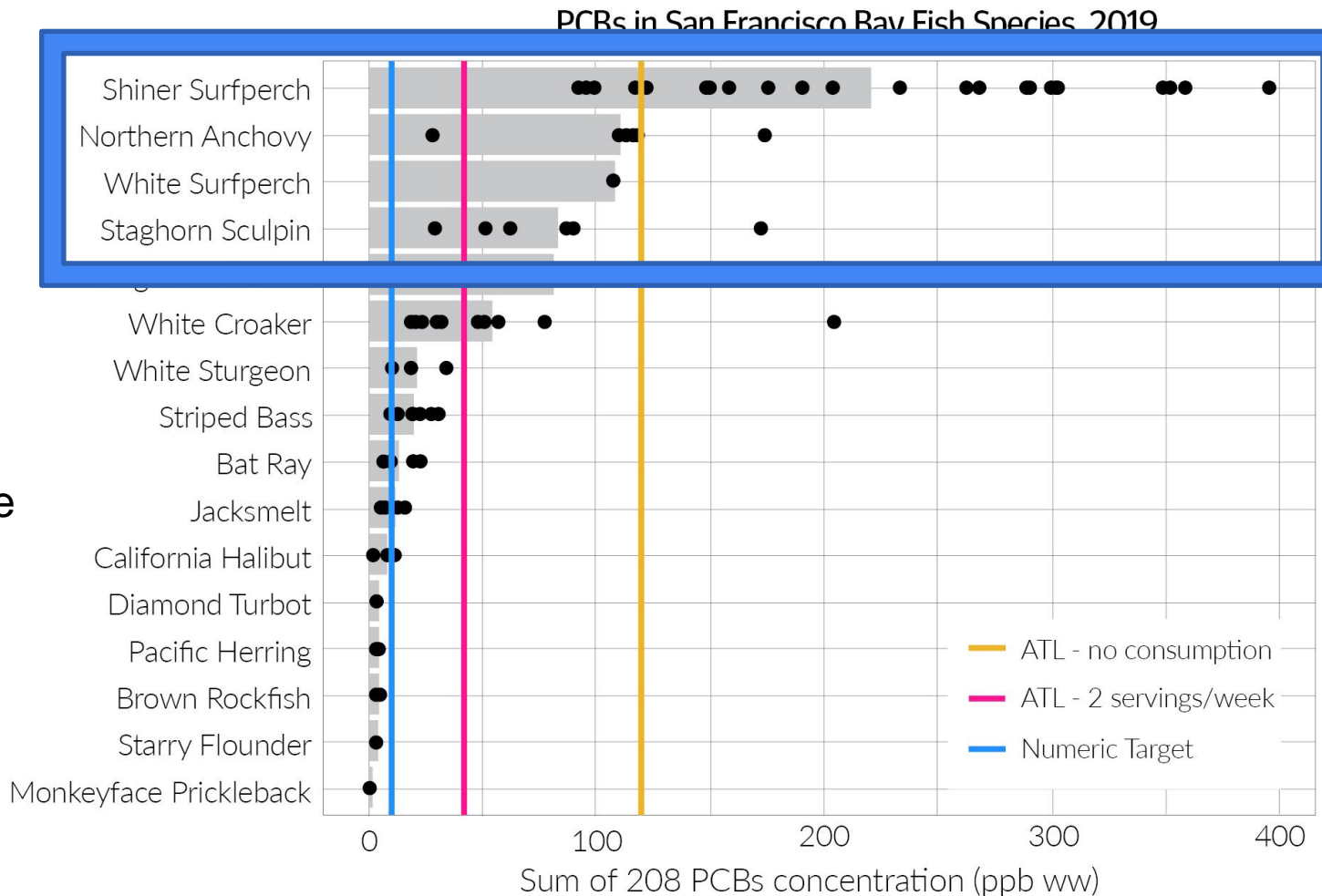


Understanding the Problem

Part A:

Localized margin contamination

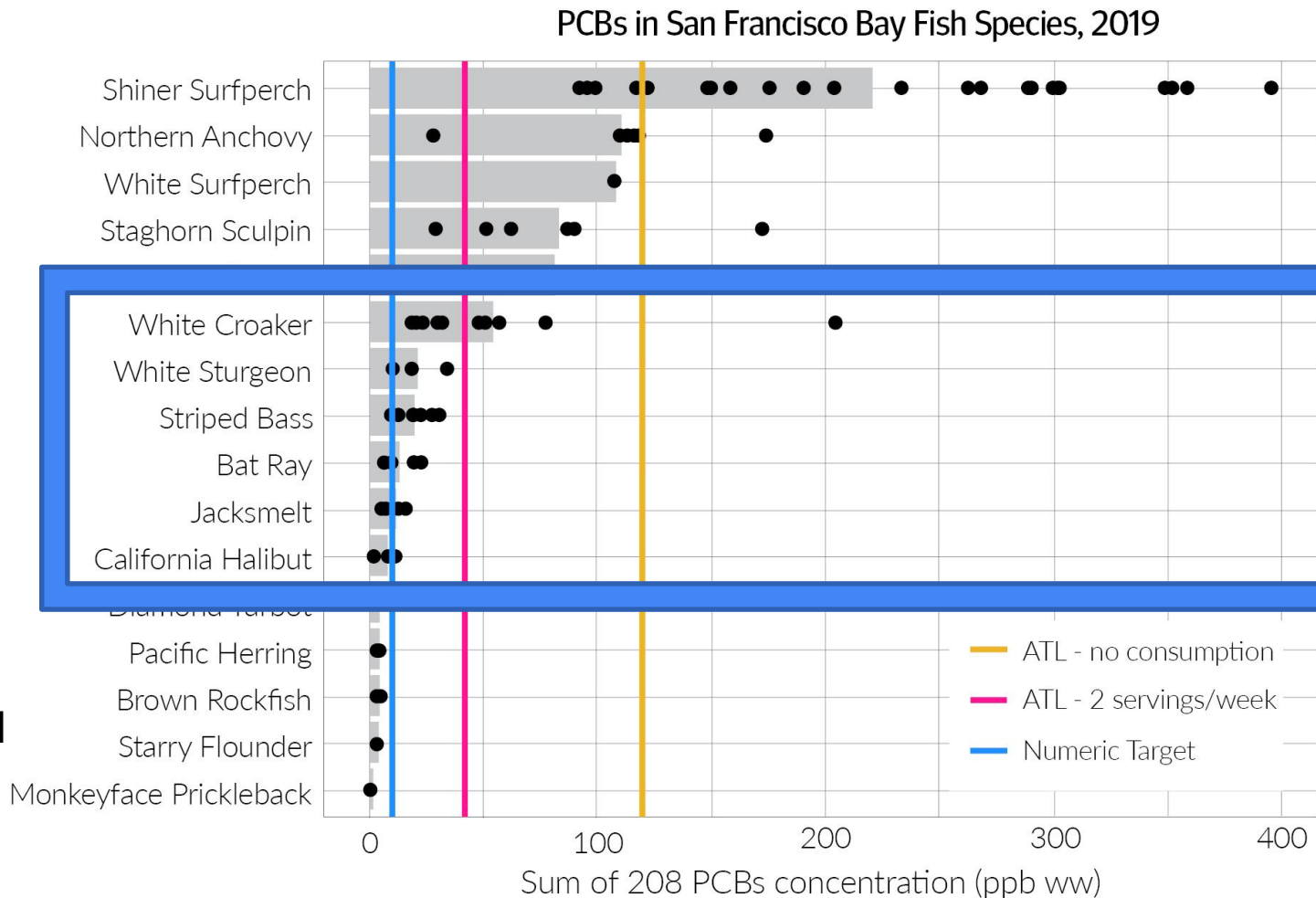
- Very high levels
- More controllable



Understanding the Problem

Part B: Regional Bay contamination

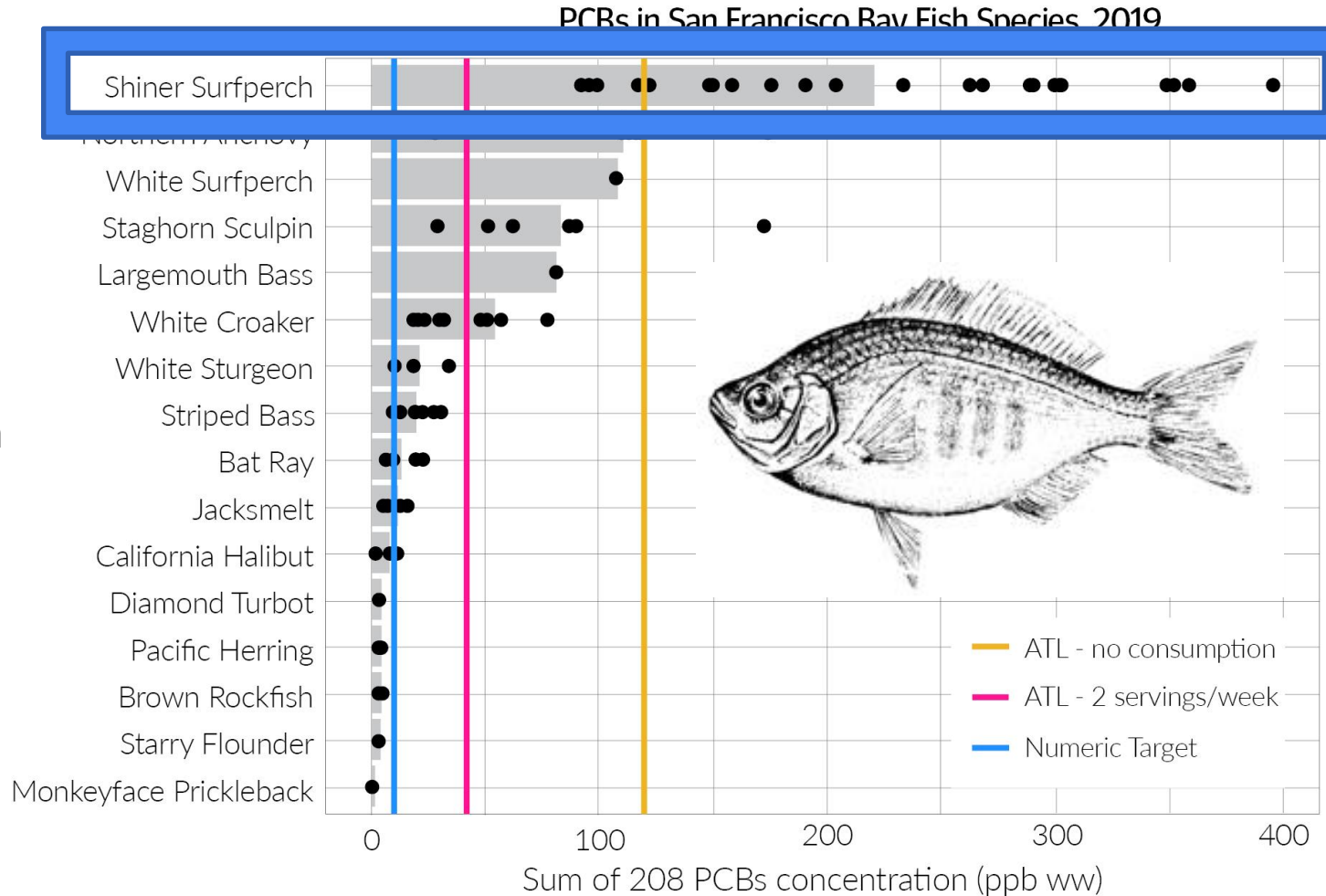
- Moderate levels
- Harder to control



Understanding the Problem

Part A: Localized margin contamination

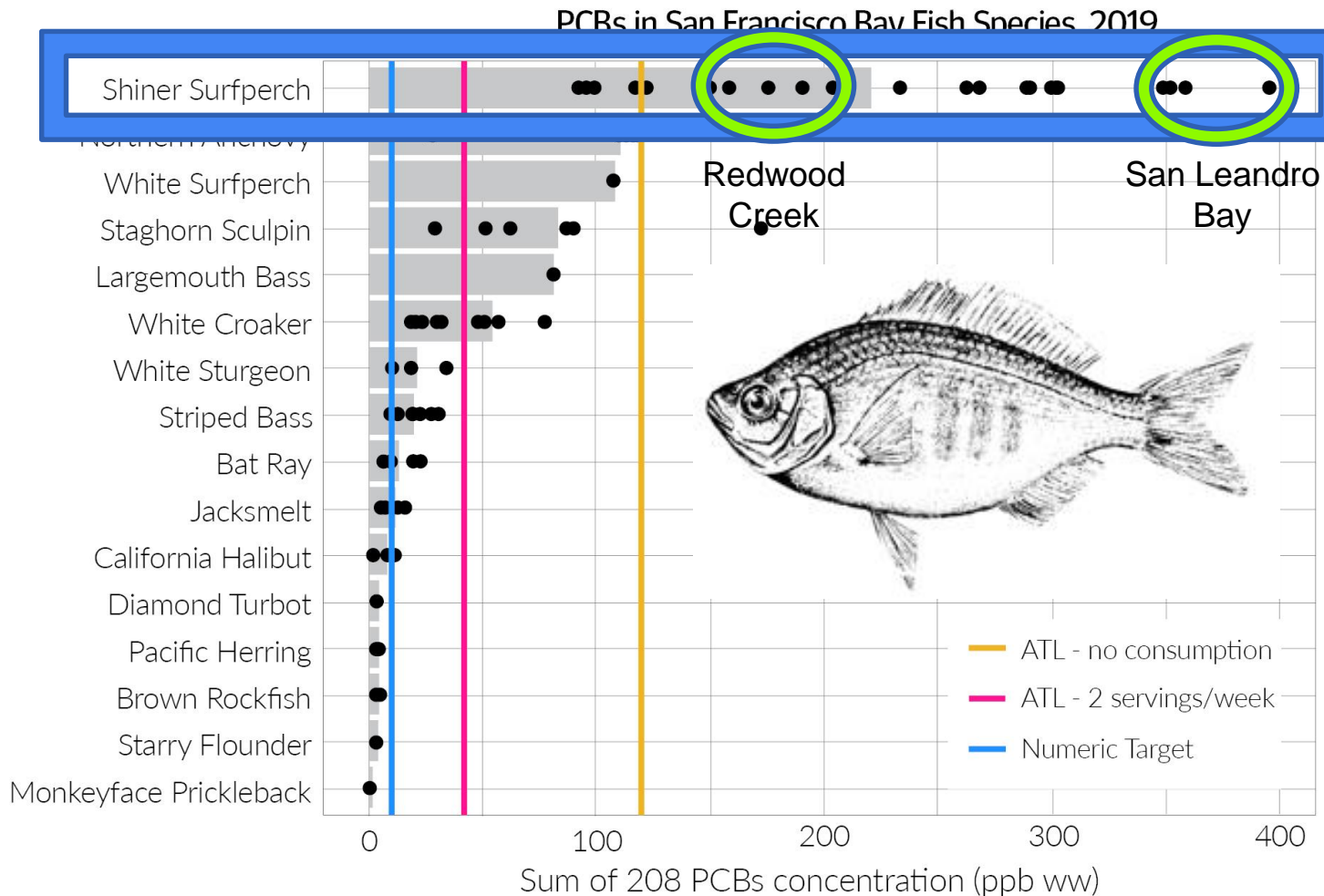
- Shiner surfperch



Understanding the Problem

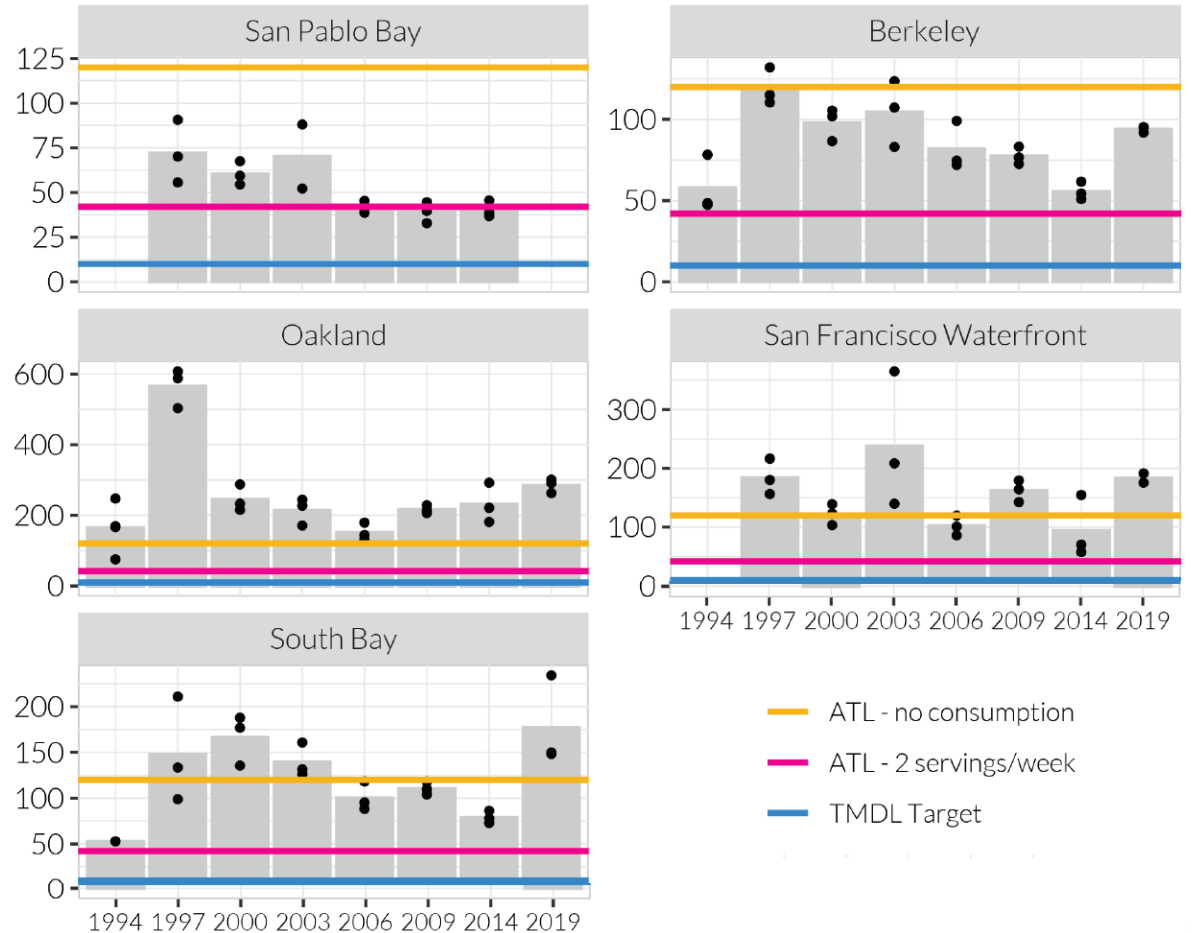
Part A: Localized margin contamination

- Shiner surfperch



Negligible improvement in the last 25 years

PCBs in Shiner Surfperch by Location, 1994-2019



Buzby, N., Davis, J., Sutton, R., Yee, D., Miller, E., Wong, A., Sigala, M., Bonnema, A., Heim, W., Grace, R. 2021. Contaminant Concentrations in Sport Fish from San Francisco Bay: 2019. SFEI Contribution No. 1036. San Francisco Estuary Institute, Richmond, CA.

PCBs in Prey Fish, 2010

- Higher concentrations than sport fish!
- Focused attention on contaminated margin areas

Greenfield, B.K. and Allen, R.M., 2013.
Polychlorinated biphenyl spatial patterns
in San Francisco Bay forage fish.
Chemosphere, 90(5), pp.1693-1703.

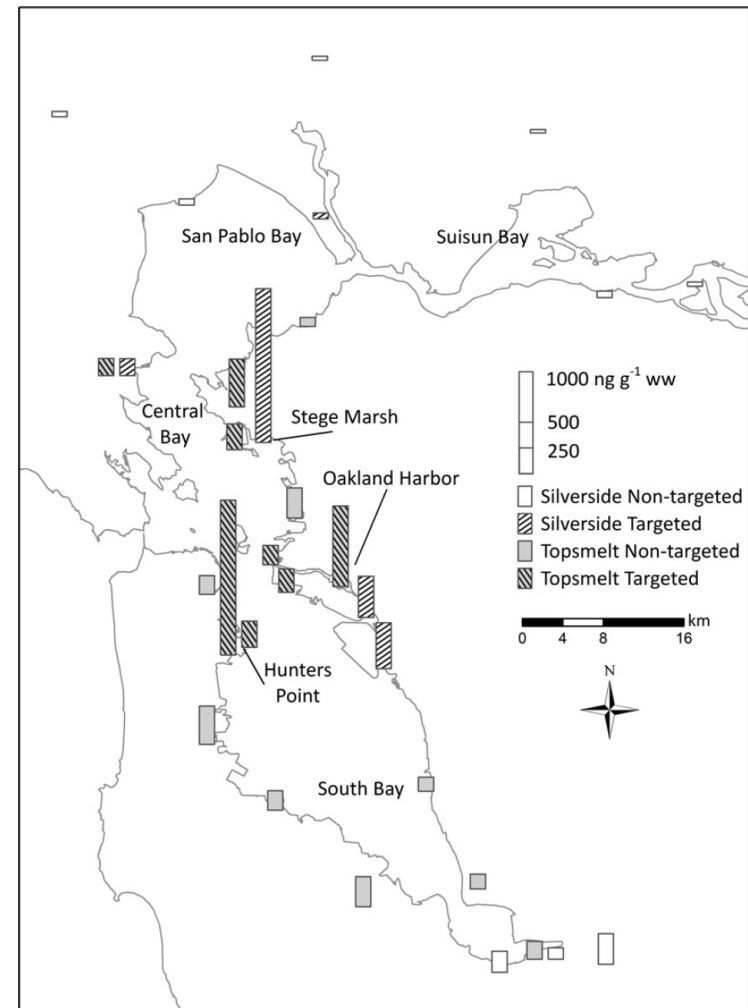


Fig. 1. Sum of 209 PCB wet weight concentrations at each location.

Stormwater Reconnaissance

- 2015-2020
- Single grab samples
- Estimated particle concentrations

Gilbreath, A.N. and McKee, L.J. 2021.
Pollutants of Concern Reconnaissance
Monitoring Progress Report, Water Years
2015-2020. SFEI Contribution No. 1061.
San Francisco Estuary Institute, Richmond,
California.

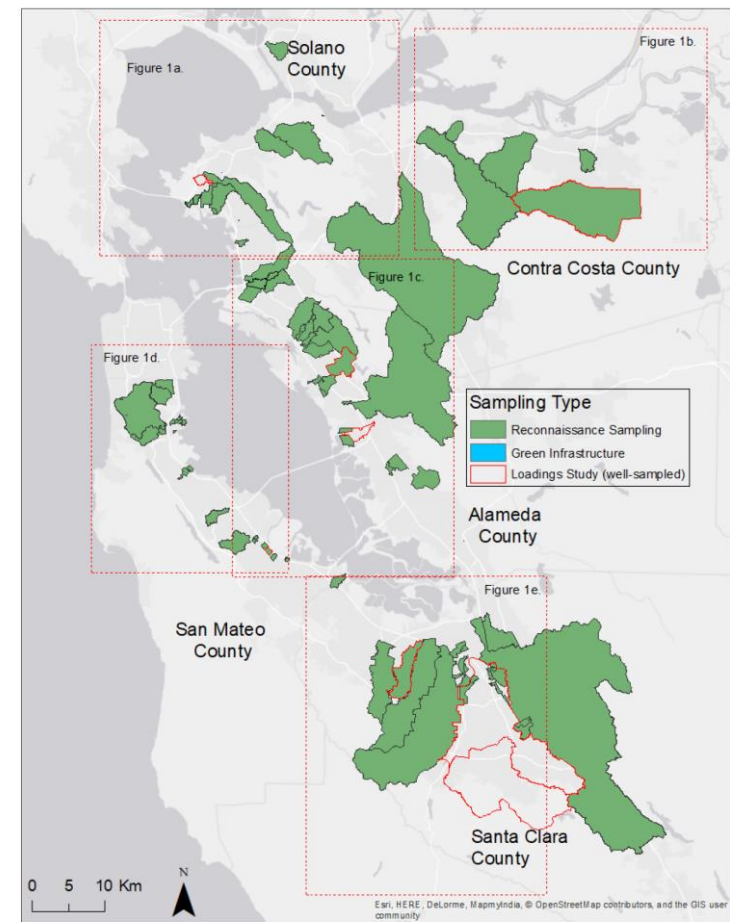
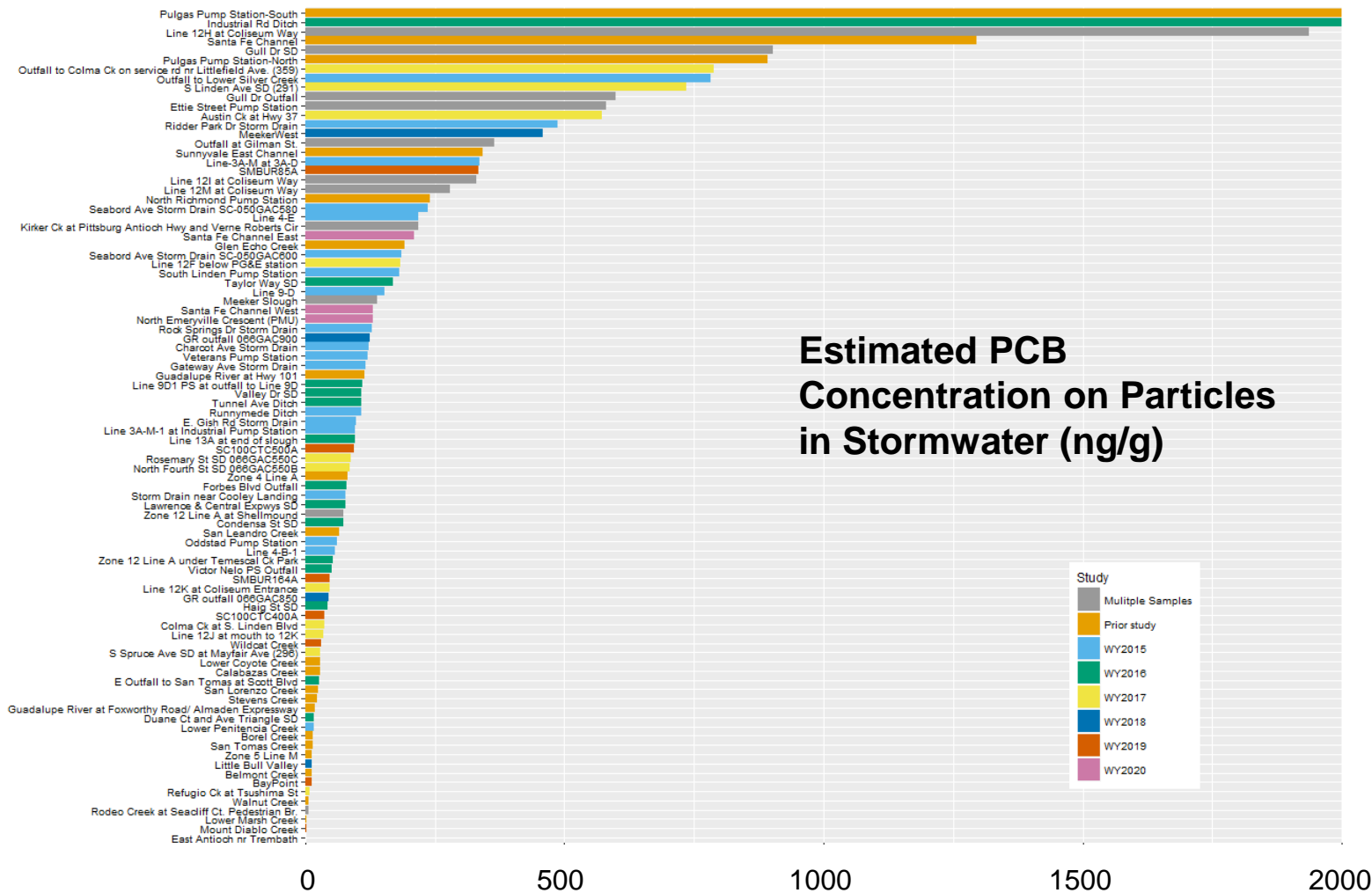
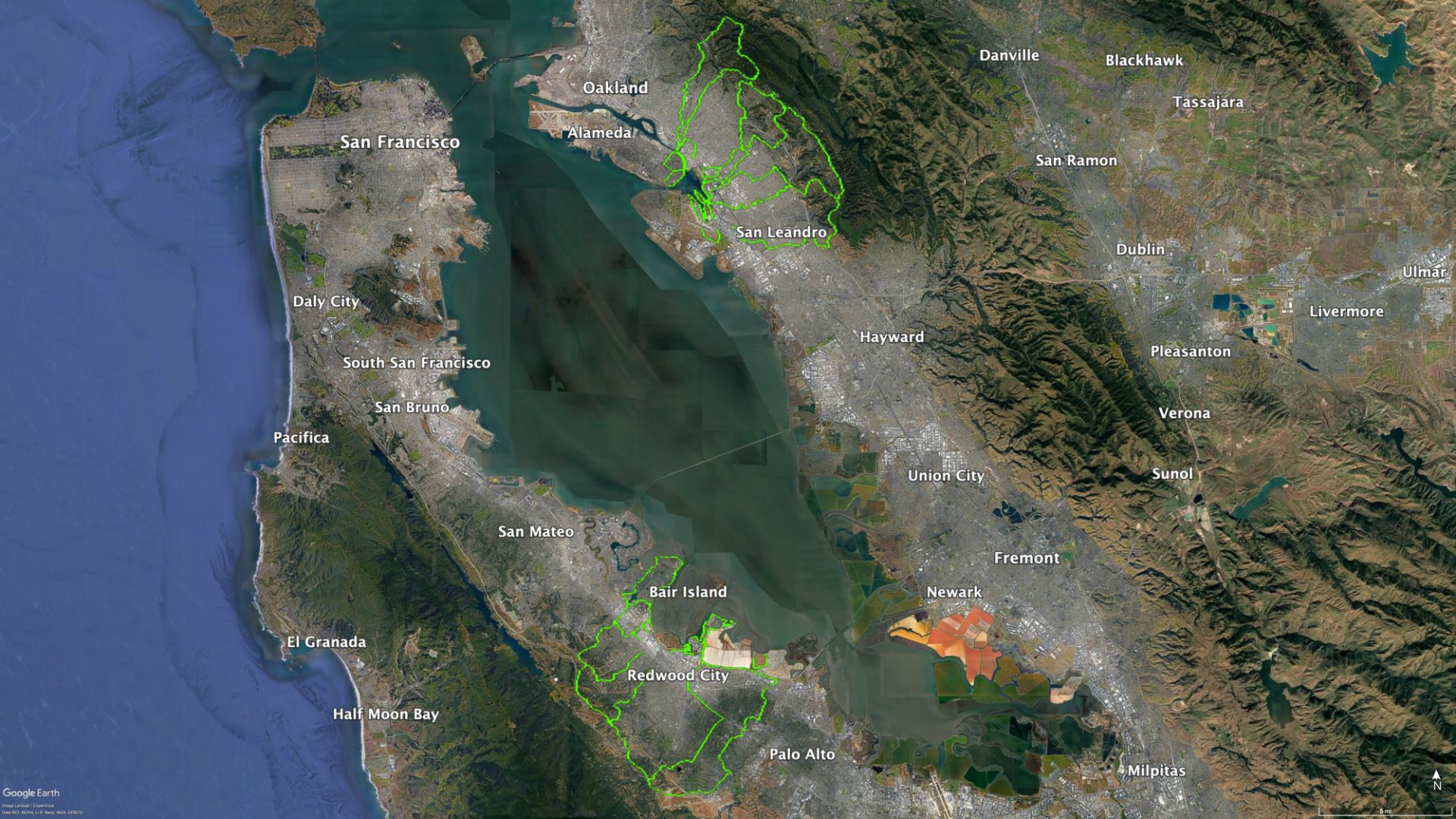
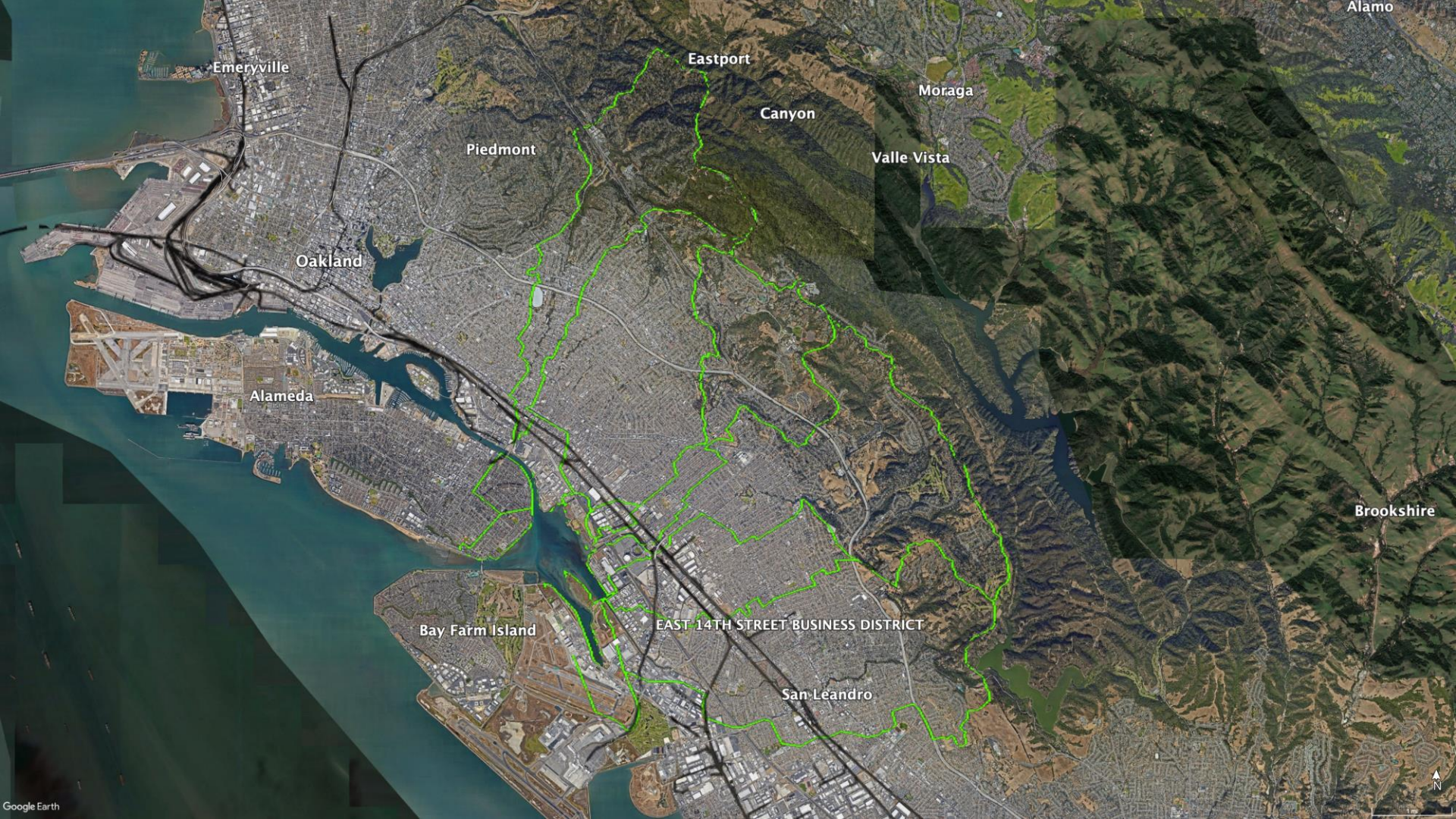


Figure 1. Watersheds/catchments sampled to date. Note: The drainage management areas (DMAs) of the green stormwater infrastructure sampling sites are so small they are not visible, though they are given a numeric map key identifier.

Gilbreath, A.N. and
 McKee, L.J. 2021.
 Pollutants of Concern
 Reconnaissance
 Monitoring Progress
 Report, Water Years 2015-
 2020. SFEI Contribution
 No. 1061. San Francisco
 Estuary Institute,
 Richmond, California.







Emeryville

Eastport

Moraga

Piedmont

Canyon

Valle Vista

Oakland

Alameda

Alamo

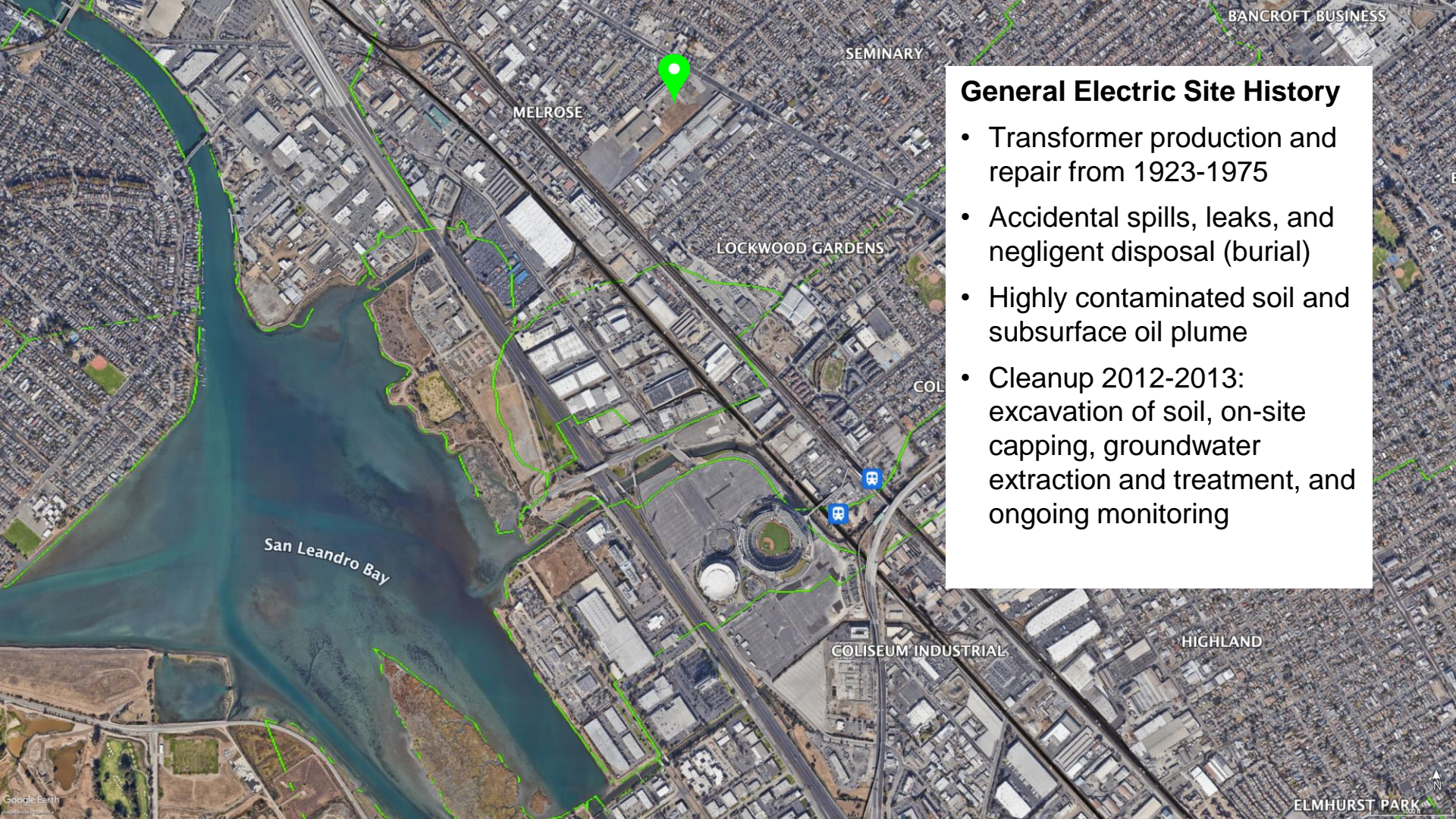
Brookshire

Bay Farm Island

EAST 14TH STREET BUSINESS DISTRICT

San Leandro





General Electric Site History

- Transformer production and repair from 1923-1975
- Accidental spills, leaks, and negligent disposal (burial)
- Highly contaminated soil and subsurface oil plume
- Cleanup 2012-2013: excavation of soil, on-site capping, groundwater extraction and treatment, and ongoing monitoring

Stormwater (RMP)

Zone 12, Line H

2017: 2,601 ng/g

2020: 1,271 ng/g





Stormwater (RMP)
Zone 12, Line I
2017: 398 ng/g
2020: 263 ng/g

MELROSE

SEMINARY

BANCROFT BUSINESS

HAVENSCOURT

HEGENBERGER

ARROYO VIEJO

COLISEUM

FITCHBURG

WOODLAND

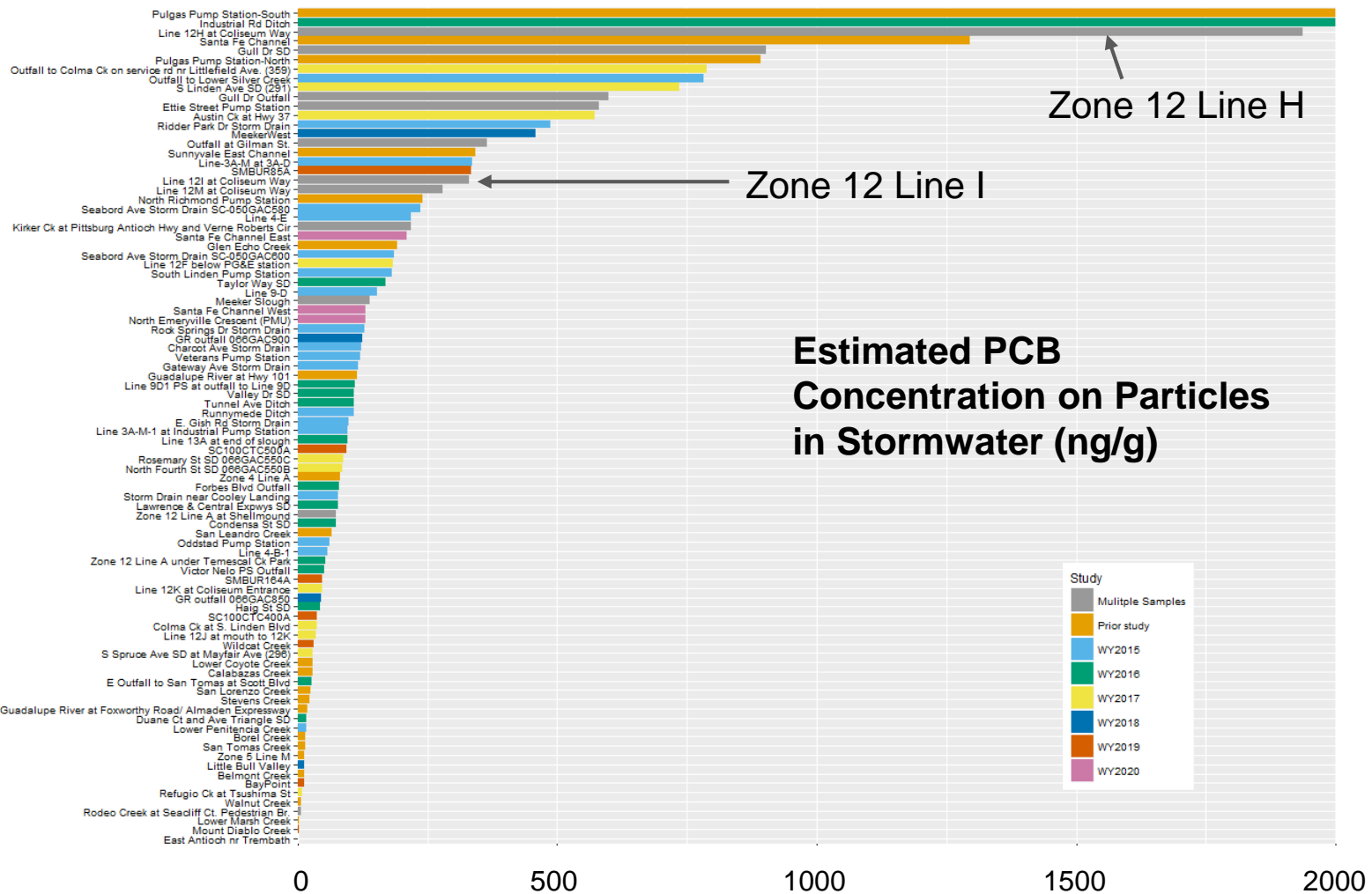
San Leandro Bay

COLISEUM INDUSTRIAL

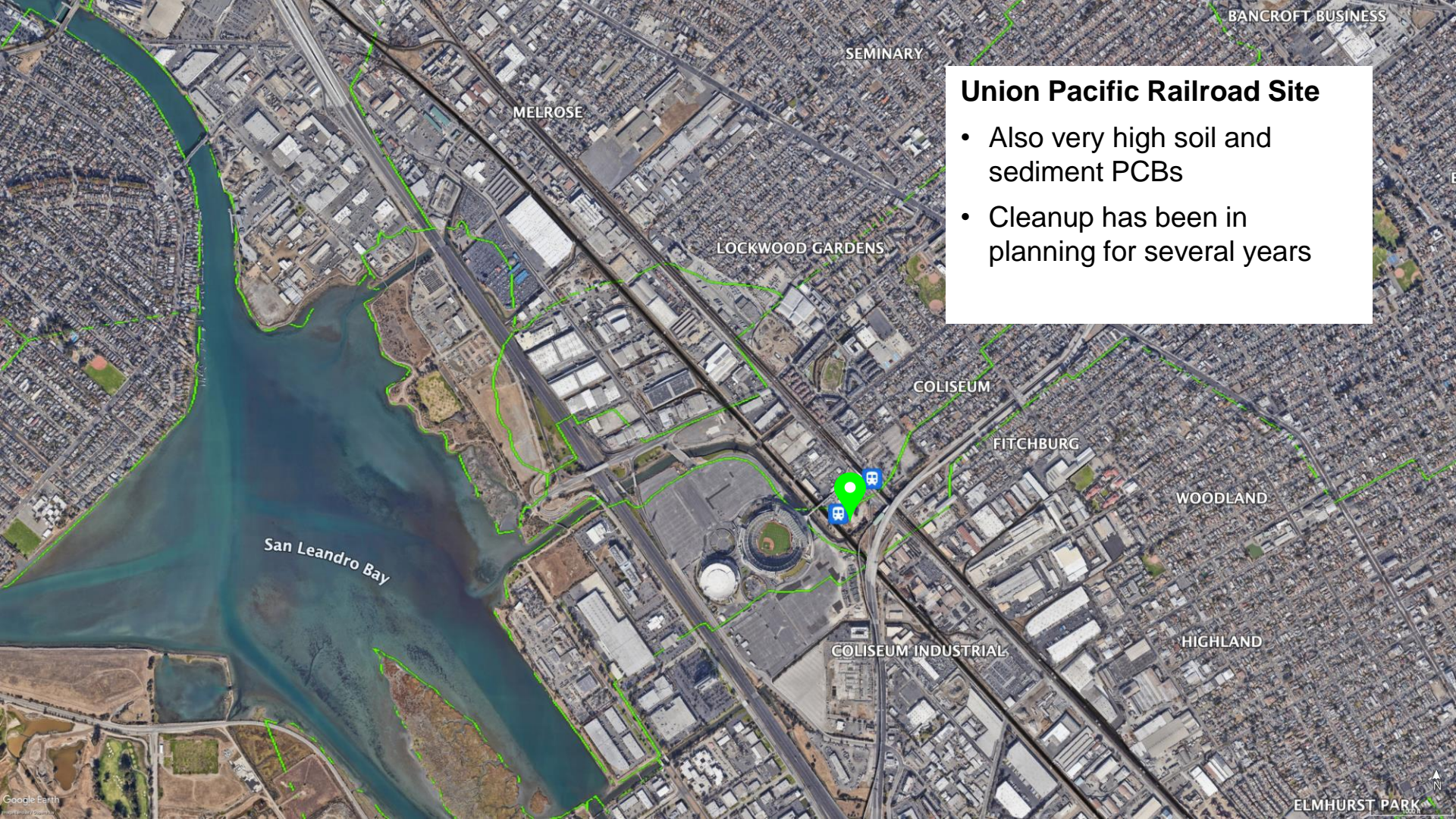
HIGHLAND

ELMHURST PARK





Gilbreath, A.N. and
 McKee, L.J. 2021.
 Pollutants of Concern
 Reconnaissance
 Monitoring Progress
 Report, Water Years 2015-
 2020. SFEI Contribution
 No. 1061. San Francisco
 Estuary Institute,
 Richmond, California.



Union Pacific Railroad Site

- Also very high soil and sediment PCBs
- Cleanup has been in planning for several years

SEMINARY

MELROSE

BANCROFT BUSINESS

LOCKWOOD GARDENS

COLISEUM

FITCHBURG

WOODLAND

San Leandro Bay

COLISEUM INDUSTRIAL

HIGHLAND

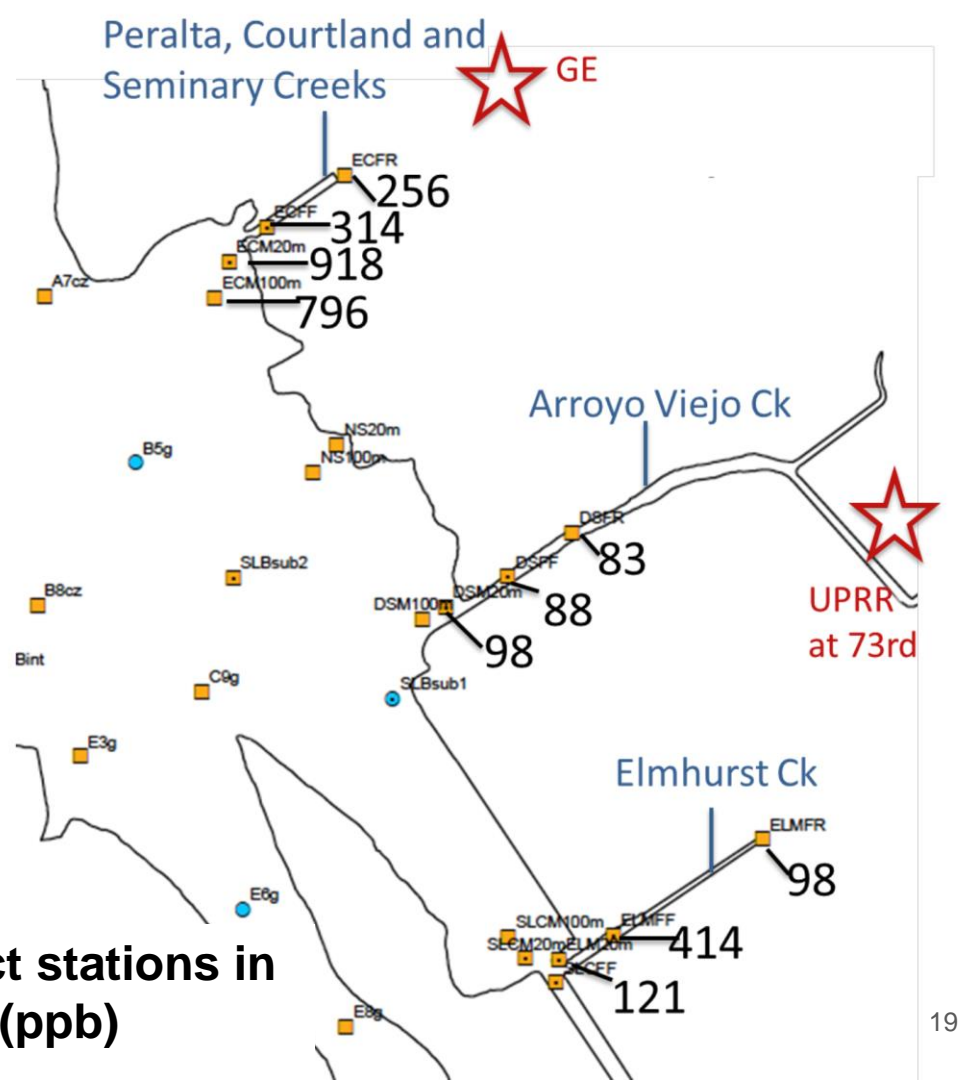
ELMHURST PARK

Google Earth

Real-world complexities demand a data-driven approach

- Straightforward expectations may be wrong
- Cleanup actions may not work as expected

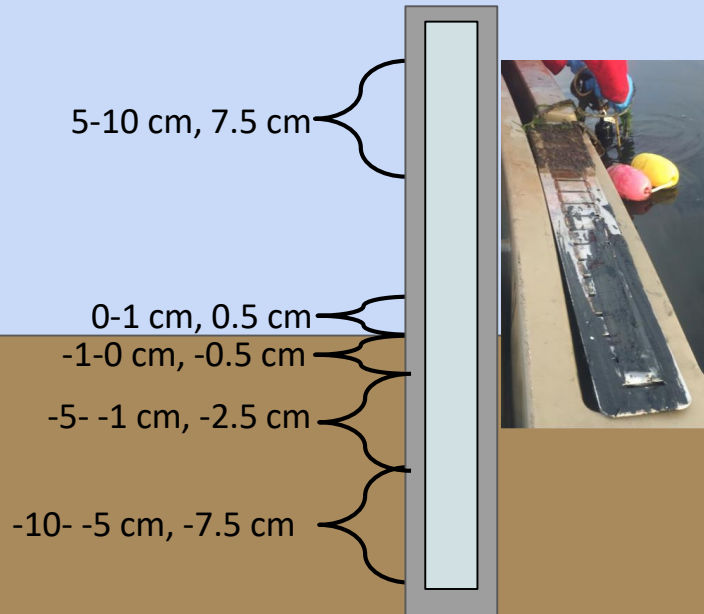
Sediment PCBs at select stations in San Leandro Bay, 2016 (ppb)



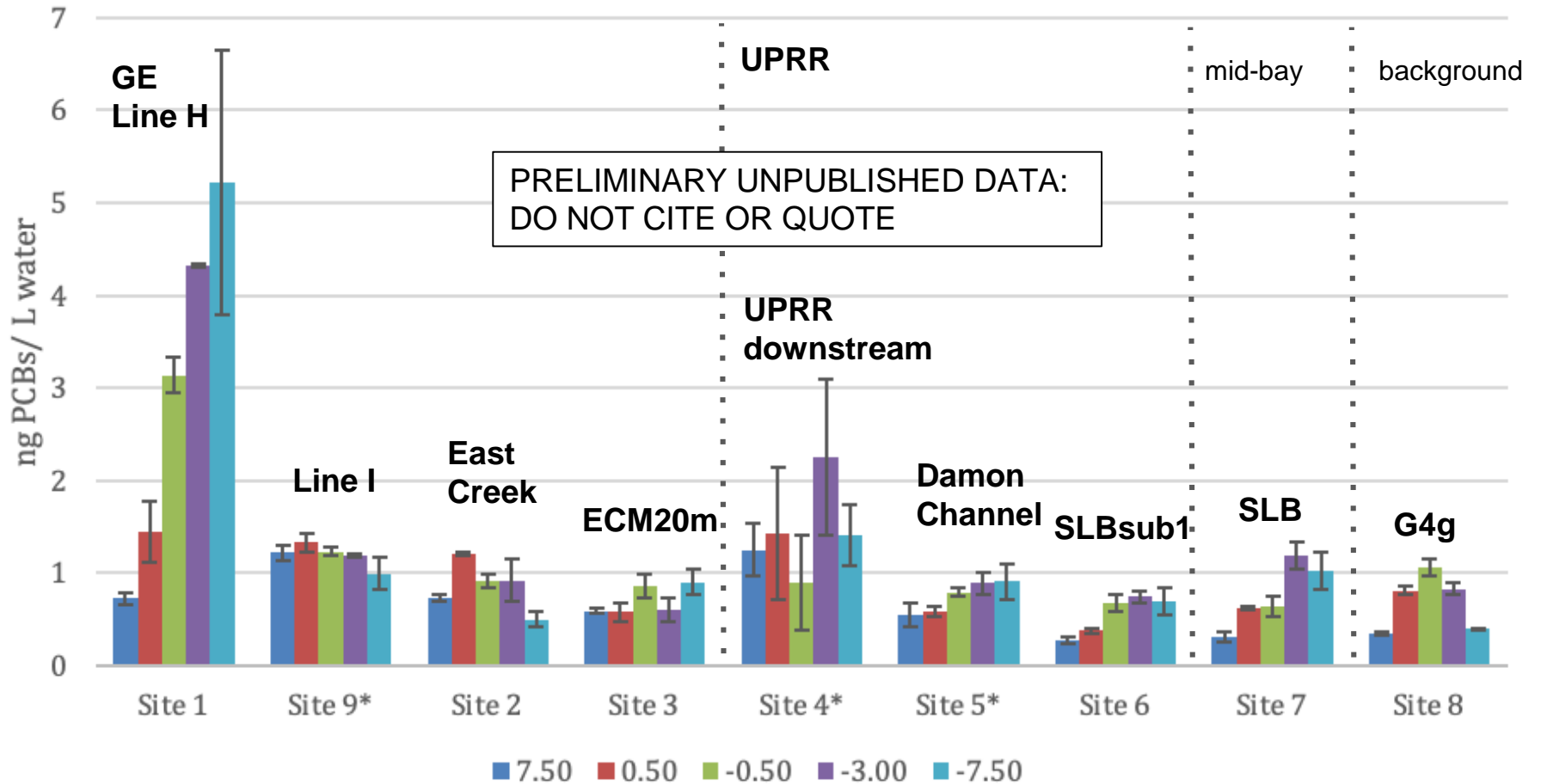
Passive Sampler Monitoring

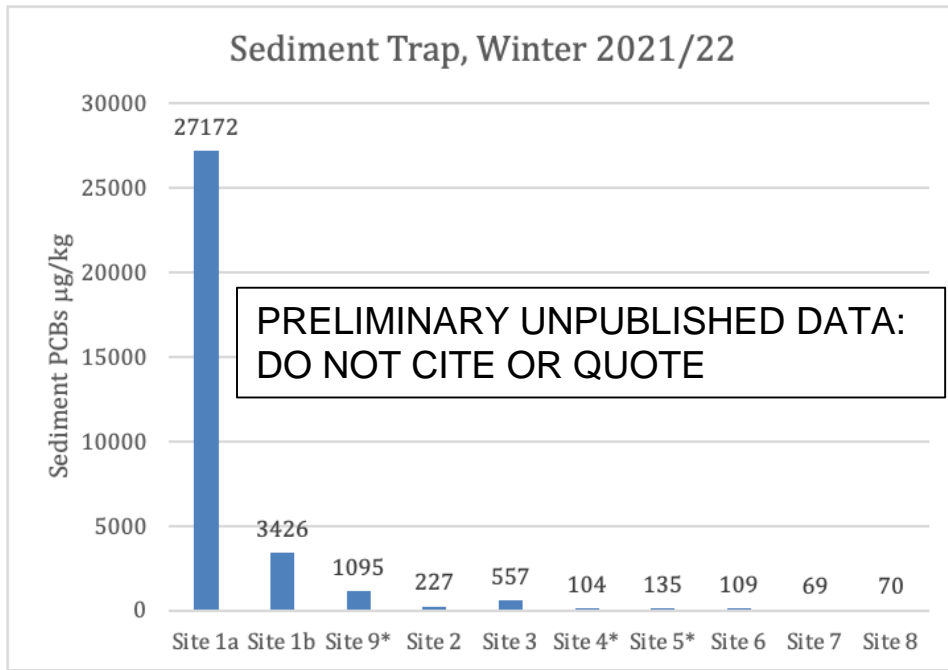
Passive sampler
(PCB analysis, C_{PE} and C_{free})

Collaboration of Stanford University
(Richard Luthy, Yeo-Myoung Cho) and
SFEI



(a) C_{free} , Winter 2021/22



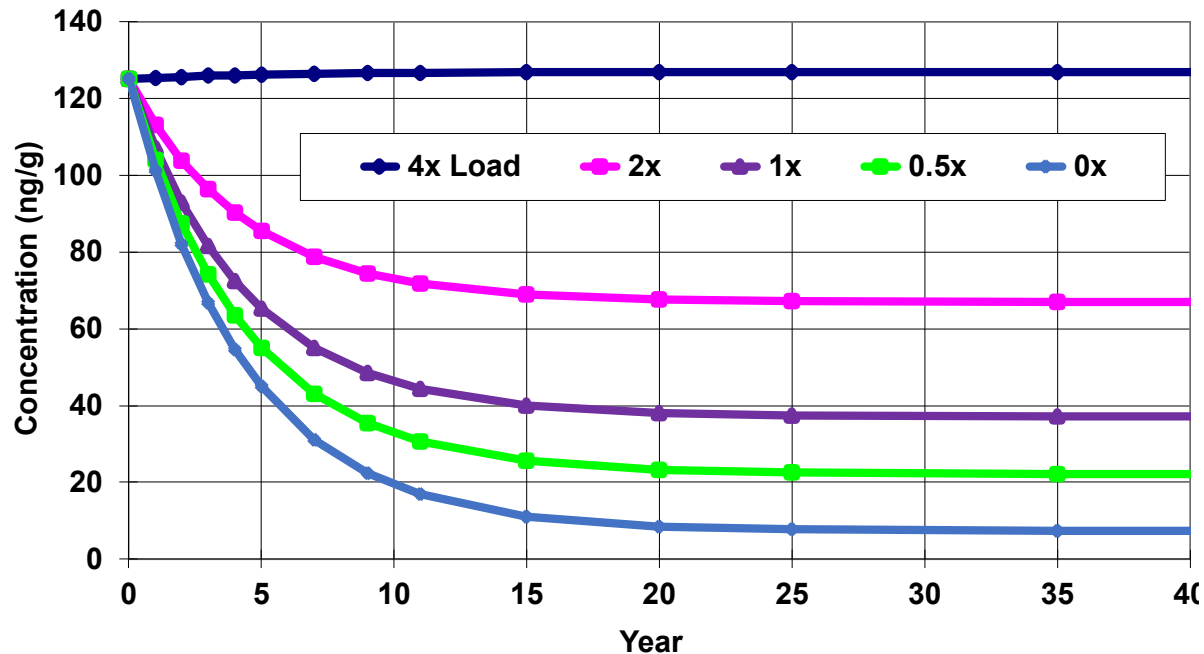


- **Very high** concentration observed near GE site (1-27 ppm)
- Re-confirmed heavier contamination in GE downstream than in UPRR downstream

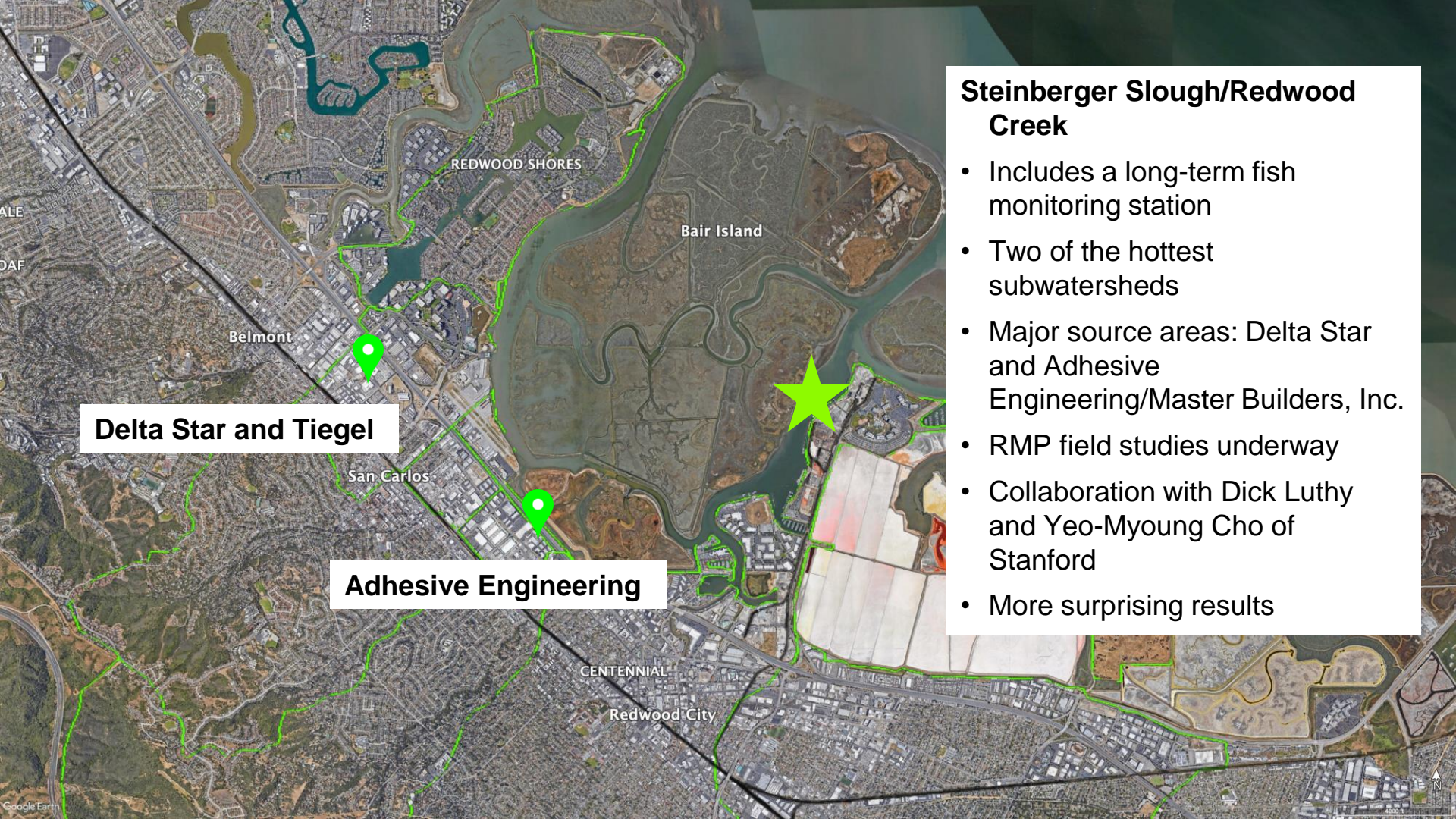
Simple Mass Budget Model for San Leandro Bay

- PMUs will vary
- Fish will follow sediment
- Suggests inputs are continuing
- Reducing watershed inputs would greatly accelerate recovery
- High uncertainty

Predicted Change in Sediment Concentration with Changing Loads



Loads shown as multiples of estimated current stormwater load

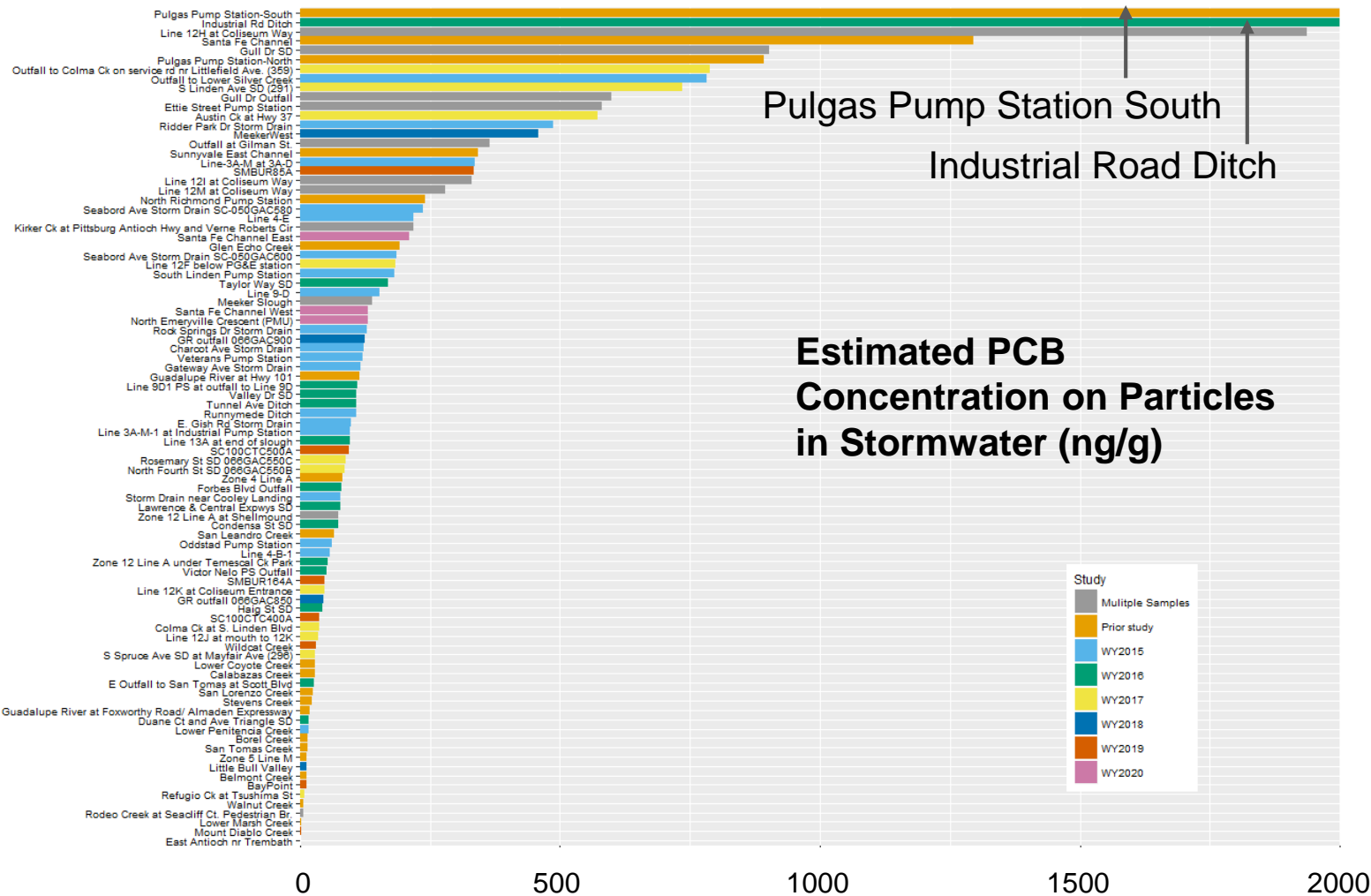


Steinberger Slough/Redwood Creek

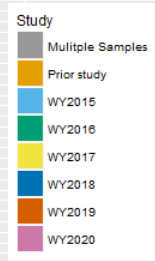
- Includes a long-term fish monitoring station
- Two of the hottest subwatersheds
- Major source areas: Delta Star and Adhesive Engineering/Master Builders, Inc.
- RMP field studies underway
- Collaboration with Dick Luthy and Yeo-Myoung Cho of Stanford
- More surprising results

Delta Star and Tiegel

Adhesive Engineering



Gilbreath, A.N. and
 McKee, L.J. 2021.
 Pollutants of Concern
 Reconnaissance
 Monitoring Progress
 Report, Water Years 2015-
 2020. SFEI Contribution
 No. 1061. San Francisco
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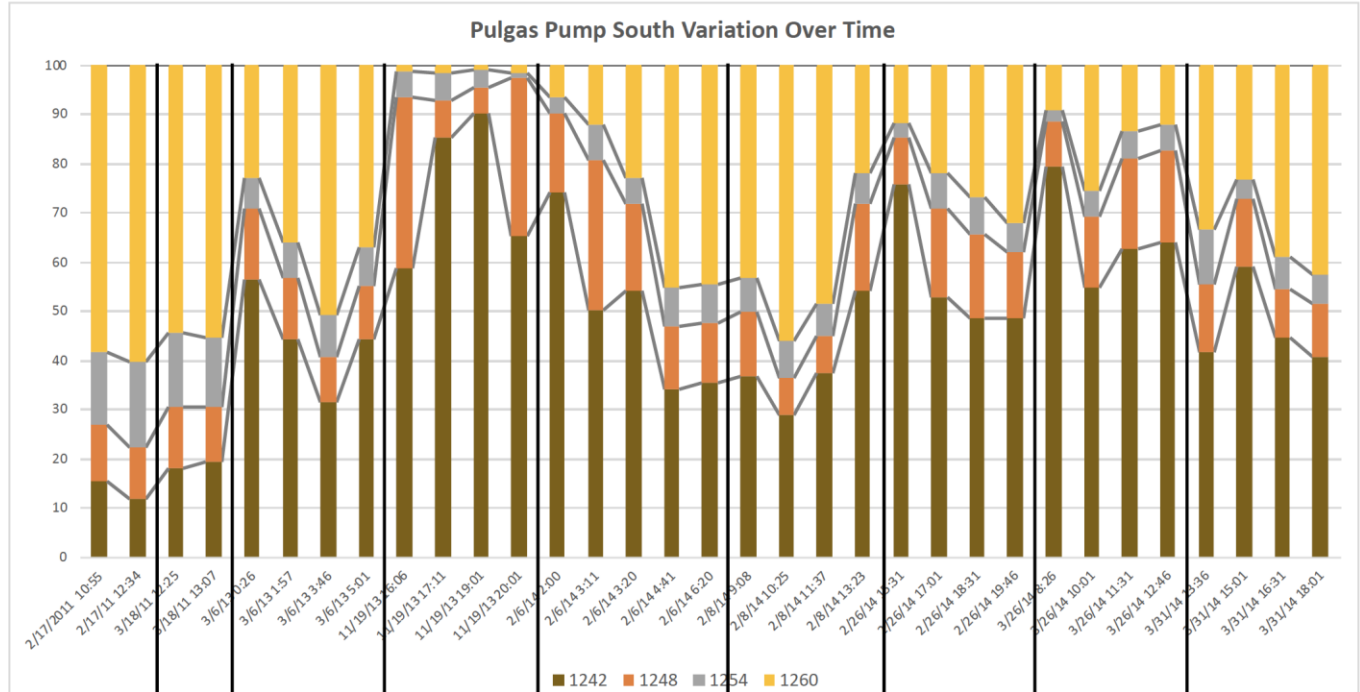


Stormwater

- 2011-2014

Davis, J.A. and Gilbreath, A.N., 2019. Small Tributaries Pollutants of Concern Reconnaissance Monitoring: Pilot Evaluation of Source Areas Using PCB Congener Data. SFEI Contribution No. 956. San Francisco Estuary Institute, Richmond, California.

Figure 3. Aroclor indices in stormwater at the outlet of Pulgas Pump Station South over time.



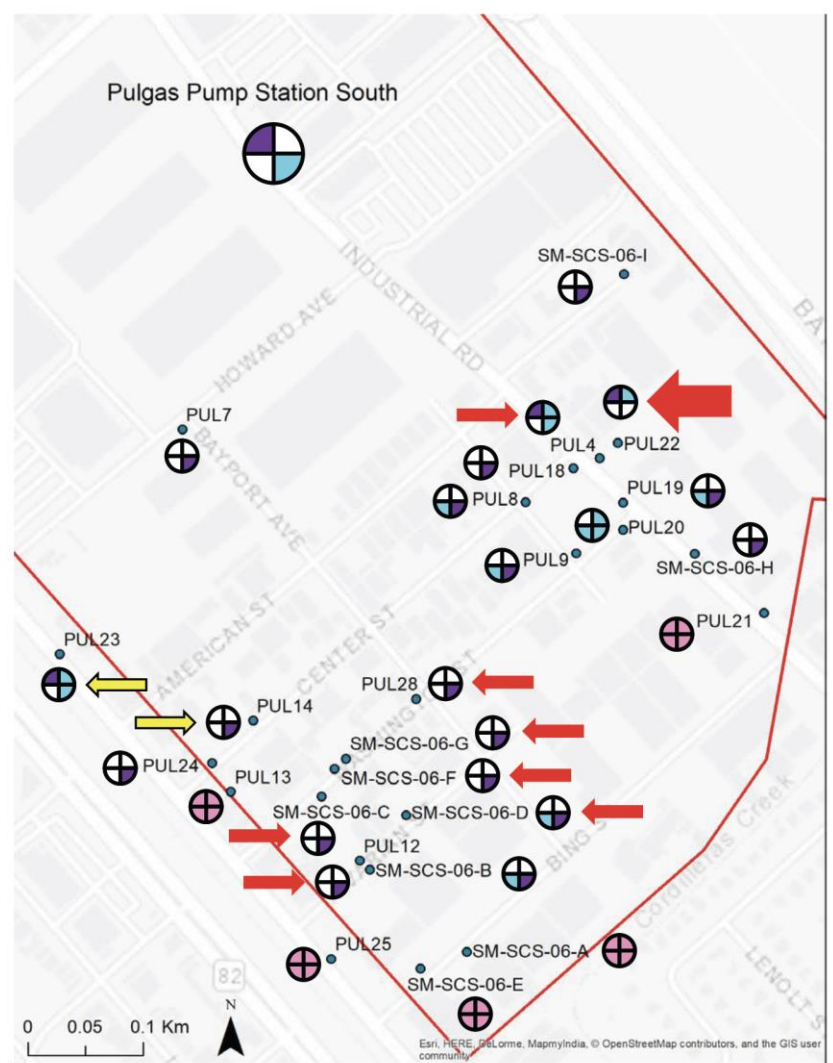
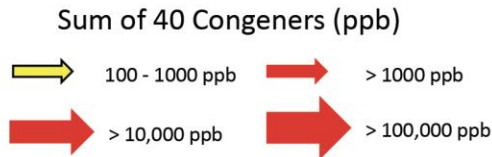
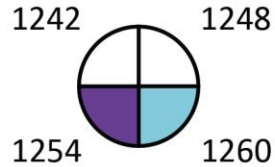
Sediment in Source Areas

- One very hot source area with unique profile

Davis, J.A. and Gilbreath, A.N., 2019. Small Tributaries Pollutants of Concern Reconnaissance Monitoring: Pilot Evaluation of Source Areas Using PCB Congener Data. SFEI Contribution No. 956. San Francisco Estuary Institute, Richmond, California.

Figure 4. Aroclor indices in sediment in the Pulgas Pump Station South watershed.

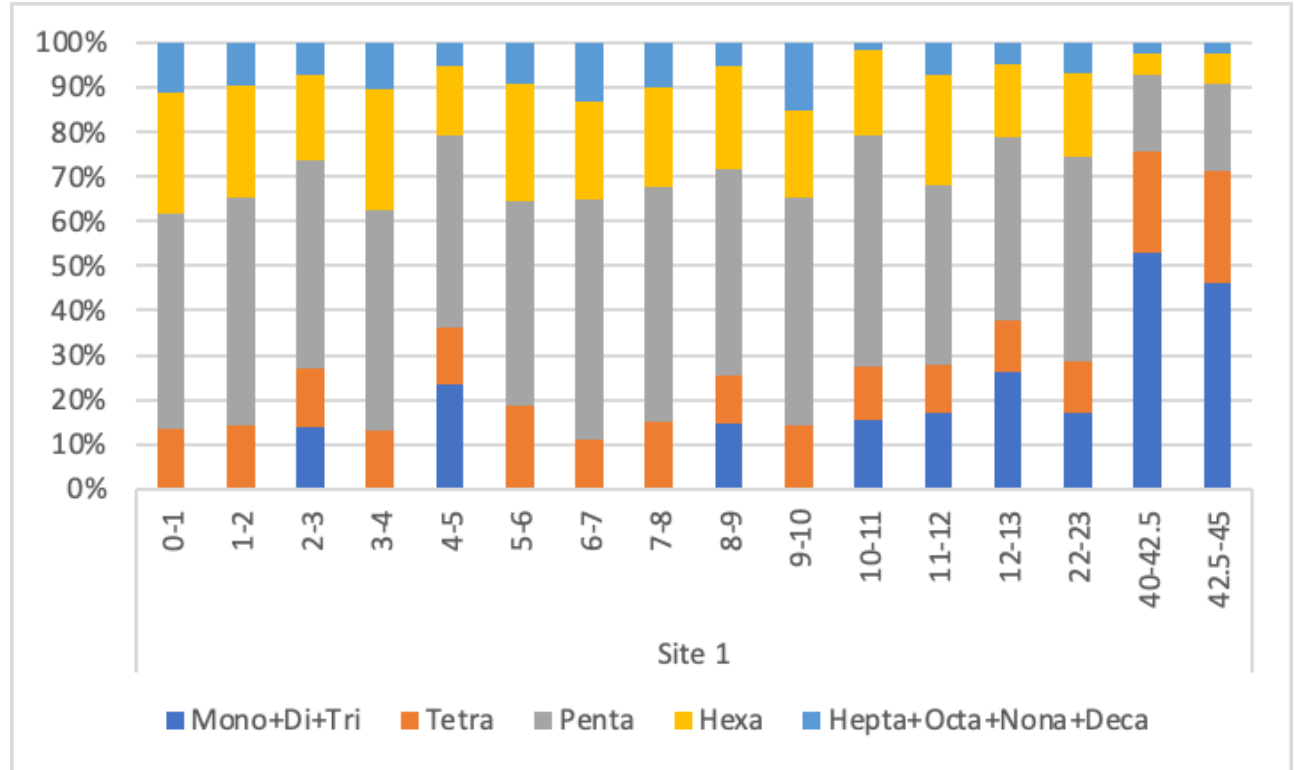
Purple: Primary contributor (>40% of sum of indices)
 Blue: Secondary (20-40%)
 White: Low contributor (<20%)
 Pink: Unreliable profiles due to low concentrations



Passive Sampler at Pour Point

- 2020

PRELIMINARY UNPUBLISHED DATA: DO NOT CITE OR QUOTE



Bay Science Needs and Plans

- Adequate **monitoring**
 - Establish baselines
 - Identify most important sources
 - Support modeling
 - Track improvement
- More robust fate **modeling** for SLB, SS/RC, other margin areas, and the whole Bay
- The RMP (PCB Workgroup) has been laying the groundwork to meet these needs

Model Grid for San Leandro Bay



Other Ideas

- PCB-sniffing dog

Acknowledgements

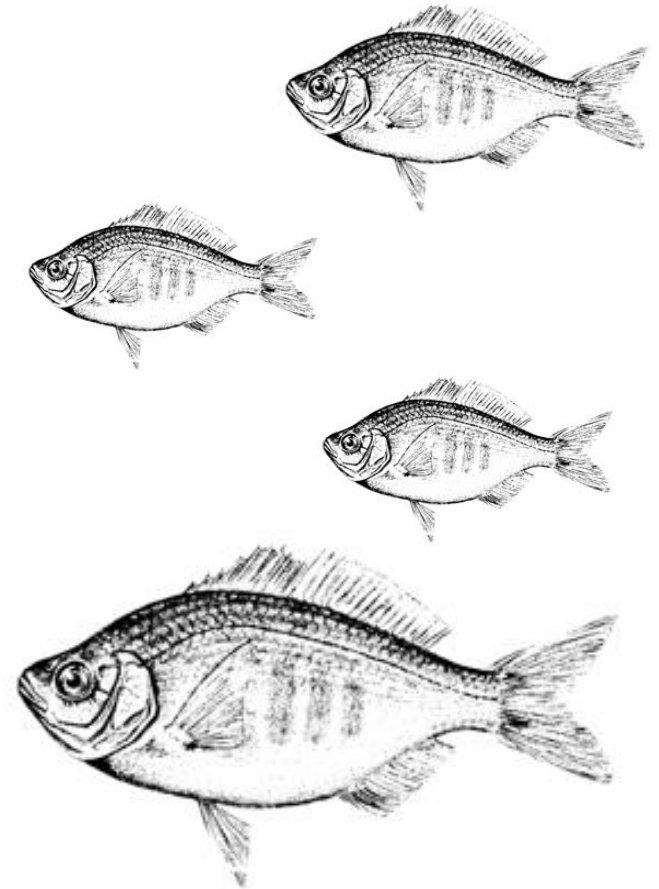
Co-Investigators

- Don Yee
- Alicia Gilbreath
- Lester McKee
- Diana Lin
- Yeo-Myoung Cho
- Dick Luthy
- Craig Jones
- Marco Sigala

RMP PCB

Workgroup

- Setenay Frucht
- Frank Gobas
- Jon Konnan
- Ned Black
- Luisa Valiela
- Bridgette DeShields
- Bryan Frueh
- + the investigators



More Information

San Leandro Bay Conceptual Model Report

- <https://www.sfei.org/documents/conceptual-model-support-pcb-management-and-monitoring-san-leandro-bay-priority-margin-1>

Steinberger Slough/Redwood Creek Conceptual Model Report

- <https://www.sfei.org/documents/conceptual-model-support-pcb-management-and-monitoring-steinberger-sloughredwood-creek>

Emeryville Crescent Conceptual Model Report

- <https://www.sfei.org/documents/conceptual-model-support-pcb-management-and-monitoring-emeryville-crscent-priority-margin>

PCBs in Shiner Surfperch in Priority Margin Areas

- <https://www.sfei.org/documents/pcbs-shiner-surfperch-priority-margin-areas-san-francisco-bay>

Me

- jay@sfei.org

RMP

- [sfei.org/rmp](https://www.sfei.org/rmp)

My son's band: Hot Flash Heat Wave

- Spotify, Apple Music, etc.

