

Mercury concentrations and isotopes in San Francisco Bay forage fish

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RMP Annual Meeting
Sediments: Past a Tipping Point

Regional Monitoring Program
for Water Quality in the San Francisco Estuary



RMP Mercury Strategy Questions

 *Where is mercury entering the Bay food web?*

 *What processes, sources, and pathways contribute disproportionately to food web accumulation?*



RMP Mercury Strategy Questions

 *Where **and when** is mercury entering the Bay food web?*

 *What processes, sources, and pathways contribute disproportionately to food web accumulation?*

Conceptual model

Sources

Historic mining

Air deposition

WWTP

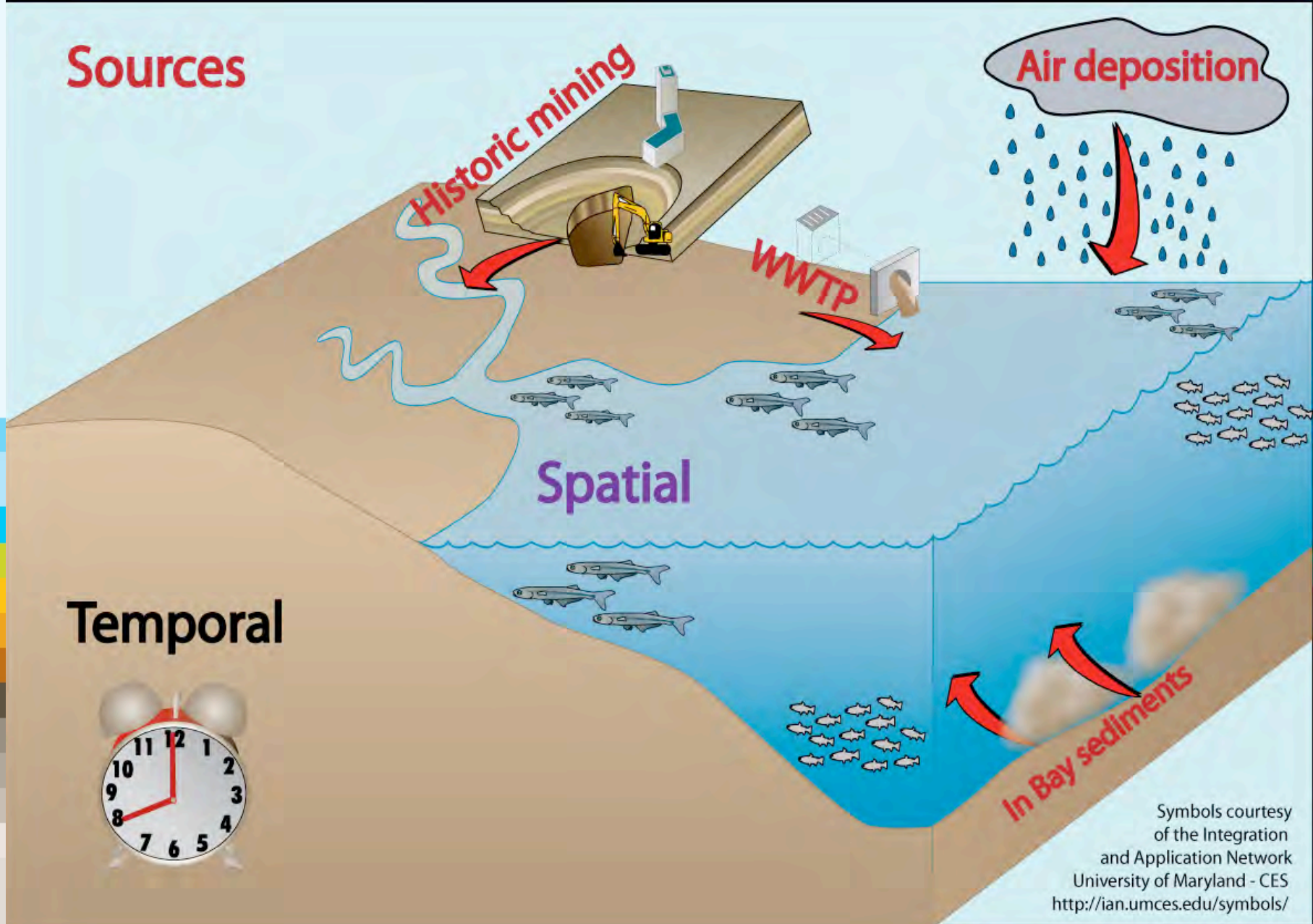
Spatial

Temporal



In Bay sediments

Symbols courtesy of the Integration and Application Network
University of Maryland - CES
<http://ian.umces.edu/symbols/>



General approach

Sources

Historic mining

Air deposition

WWTP

Spatial

Temporal



Small fish

In Bay sediments

Symbols courtesy of the Integration and Application Network University of Maryland - CES <http://ian.umces.edu/symbols/>



General approach

Sources

Historic mining

WWTP

Air deposition

Spatial • Stratified random sampling

Temporal



- Seasonal sampling
- Long term sampling

In Bay sediments

Symbols courtesy of the Integration and Application Network University of Maryland - CES <http://ian.umces.edu/symbols/>

General approach

Sources

- Targeted sampling
- Mercury isotopes
- Diffusive gradient in thinfilm

Historic mining

WWTP

Air deposition

Spatial • Stratified random sampling

Temporal



- Seasonal sampling
- Long term sampling

In Bay sediments

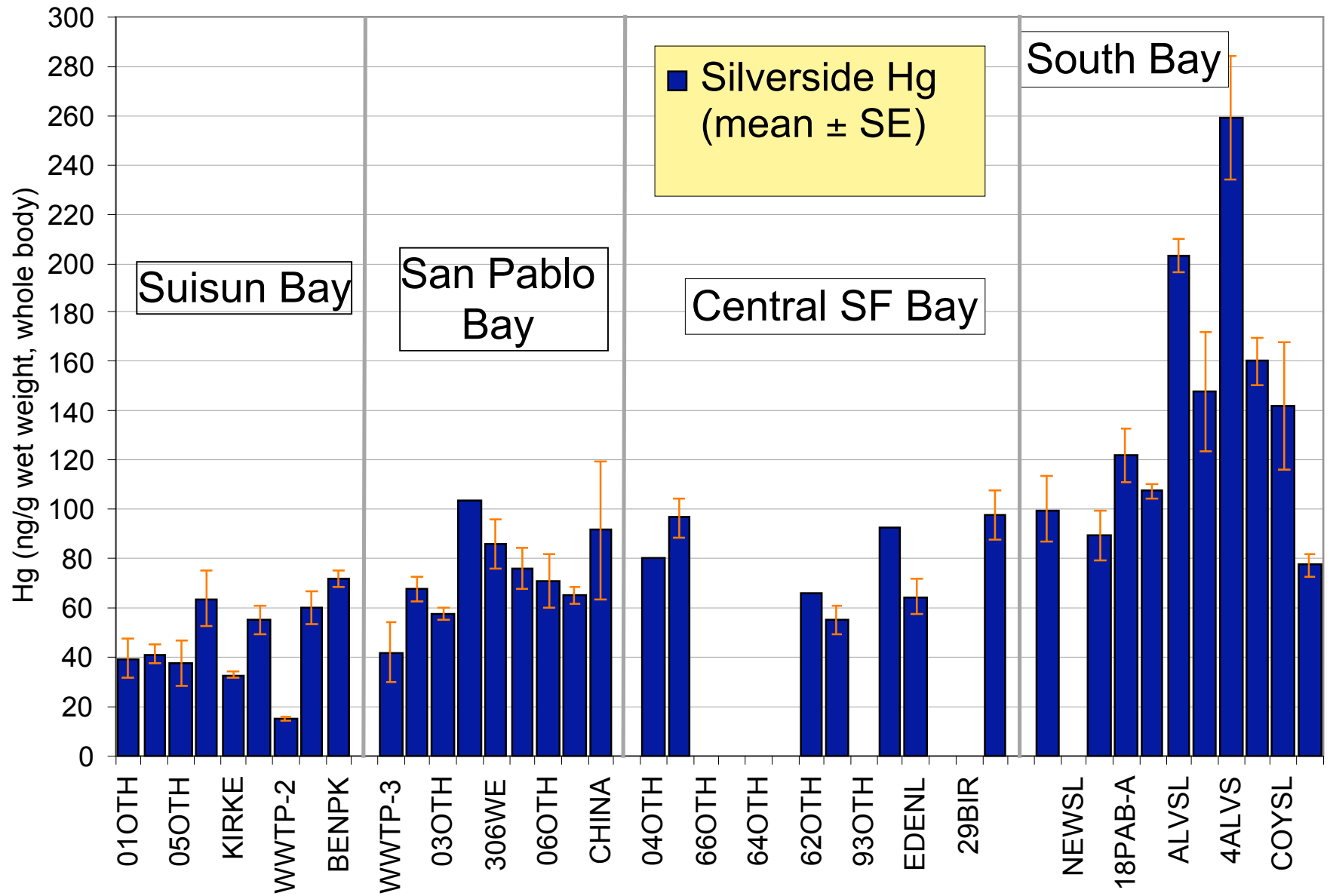
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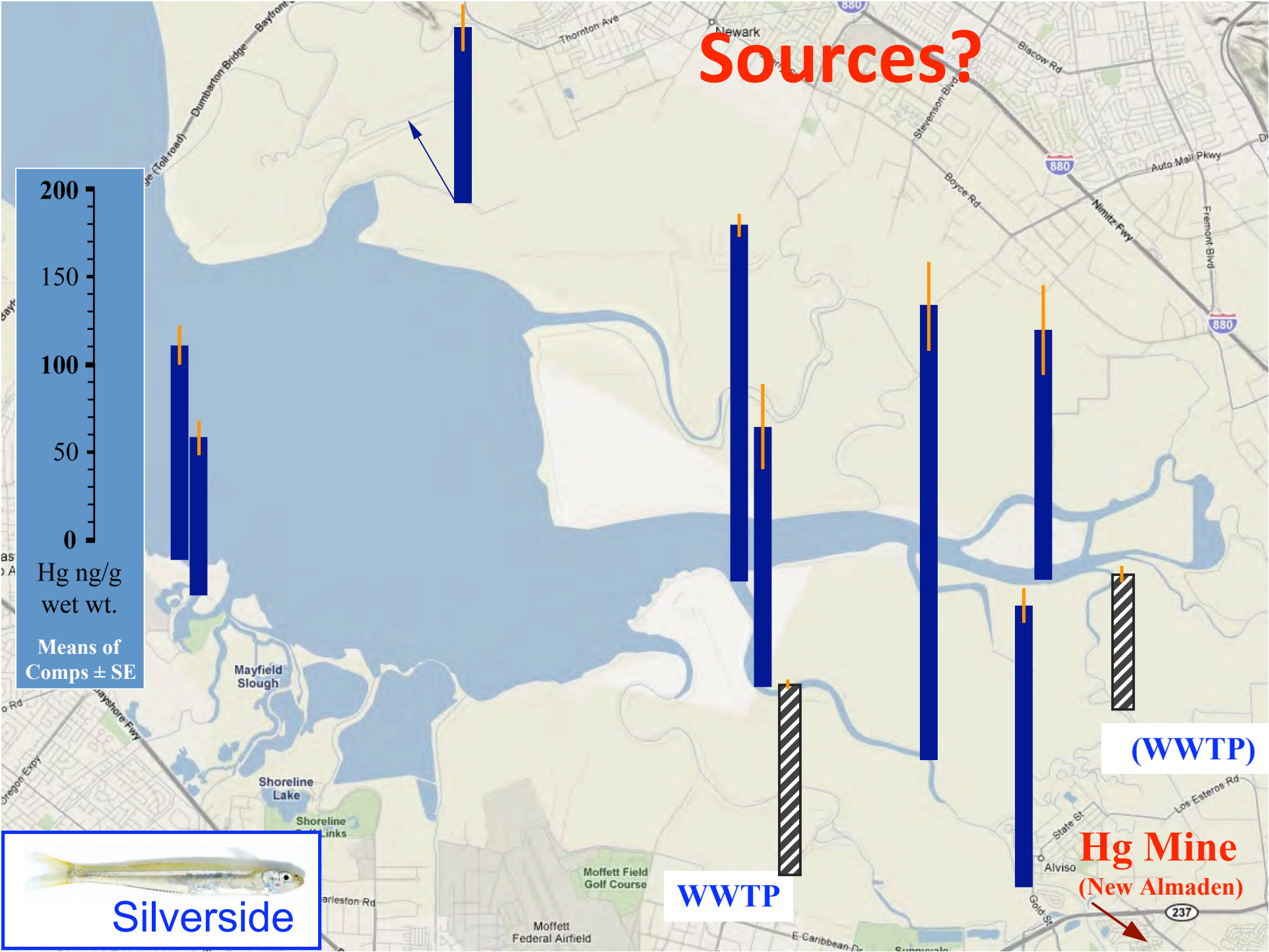
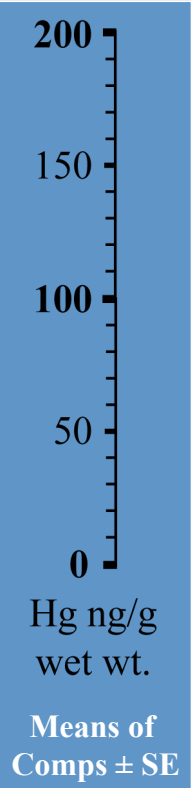
Initial results

- Spatial – Fish Hg and isotopes
- Sources – What kinds of sites have high vs. low fish Hg?
- Temporal – Seasonal trends

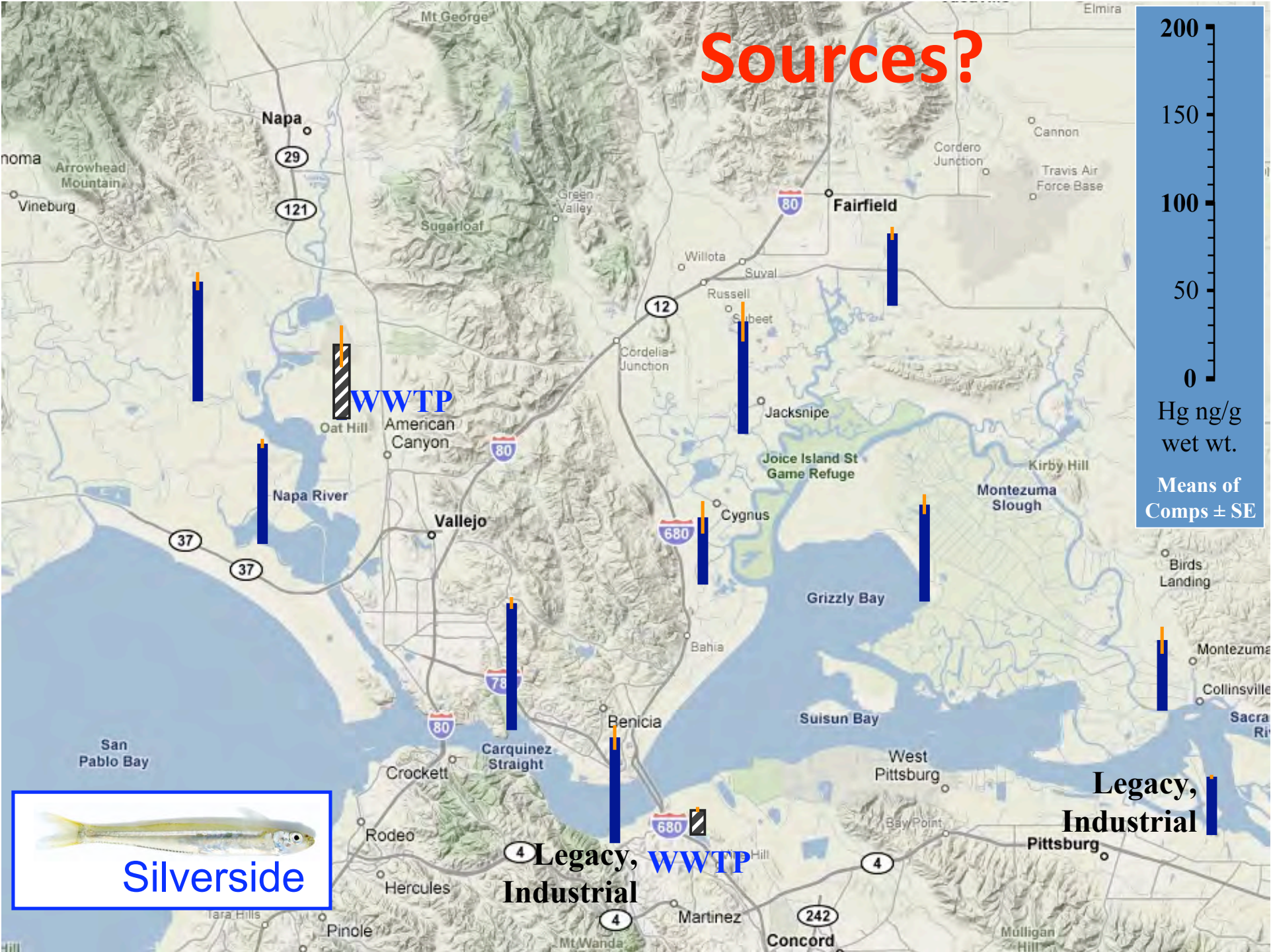
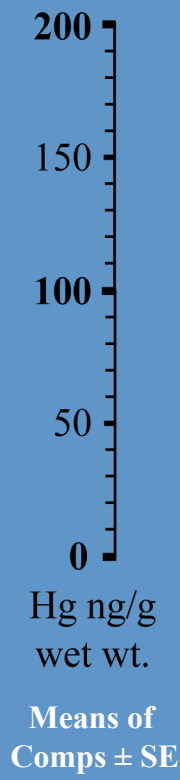
Spatial patterns



Sources?



Sources?



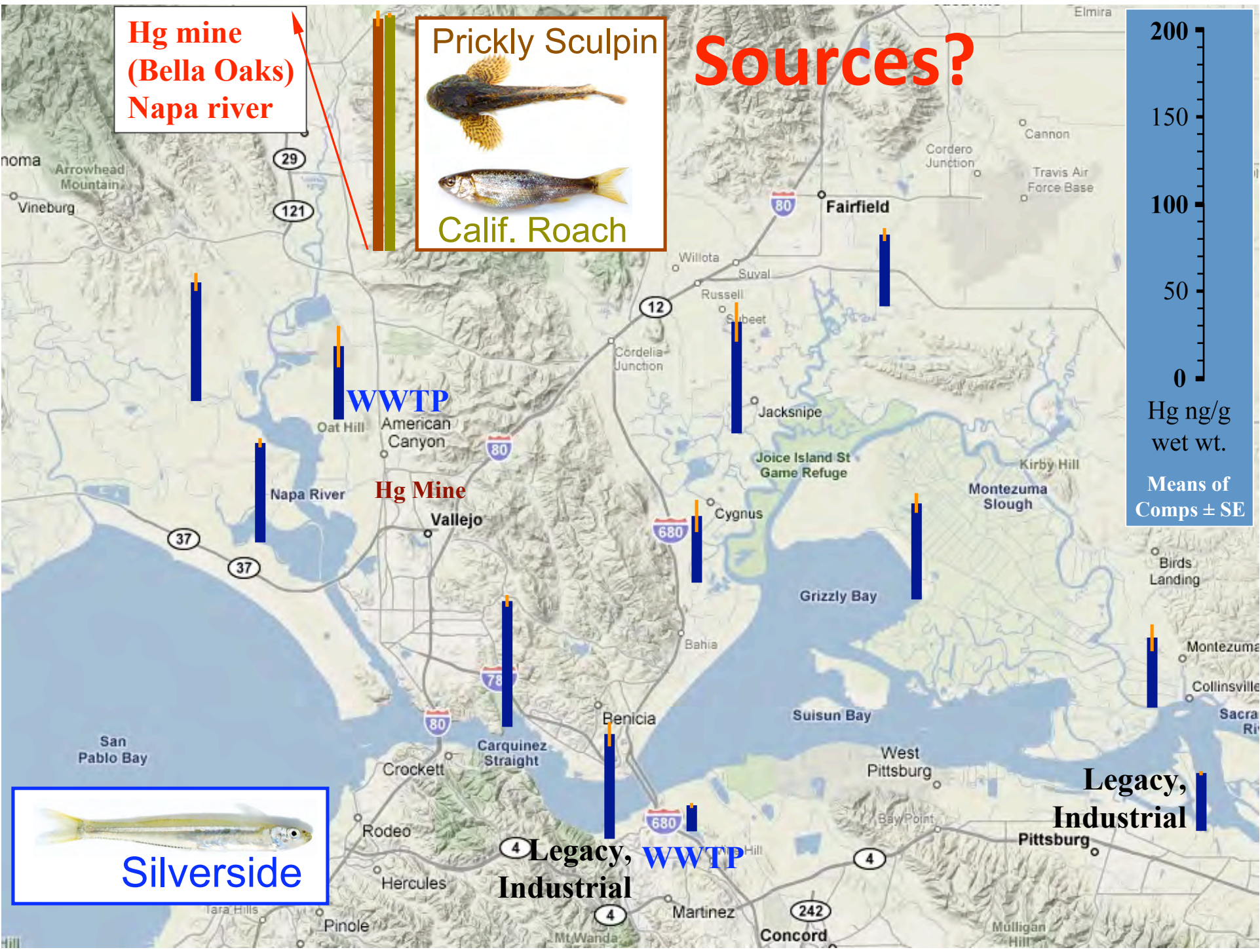
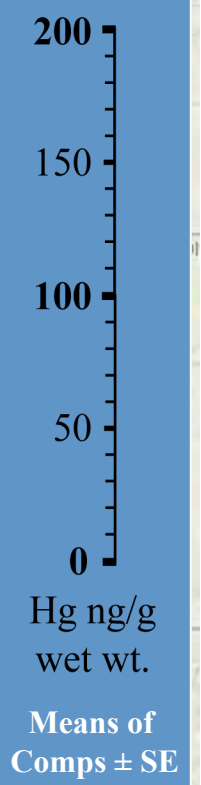
Legacy, Industrial WWTP

Legacy, Industrial

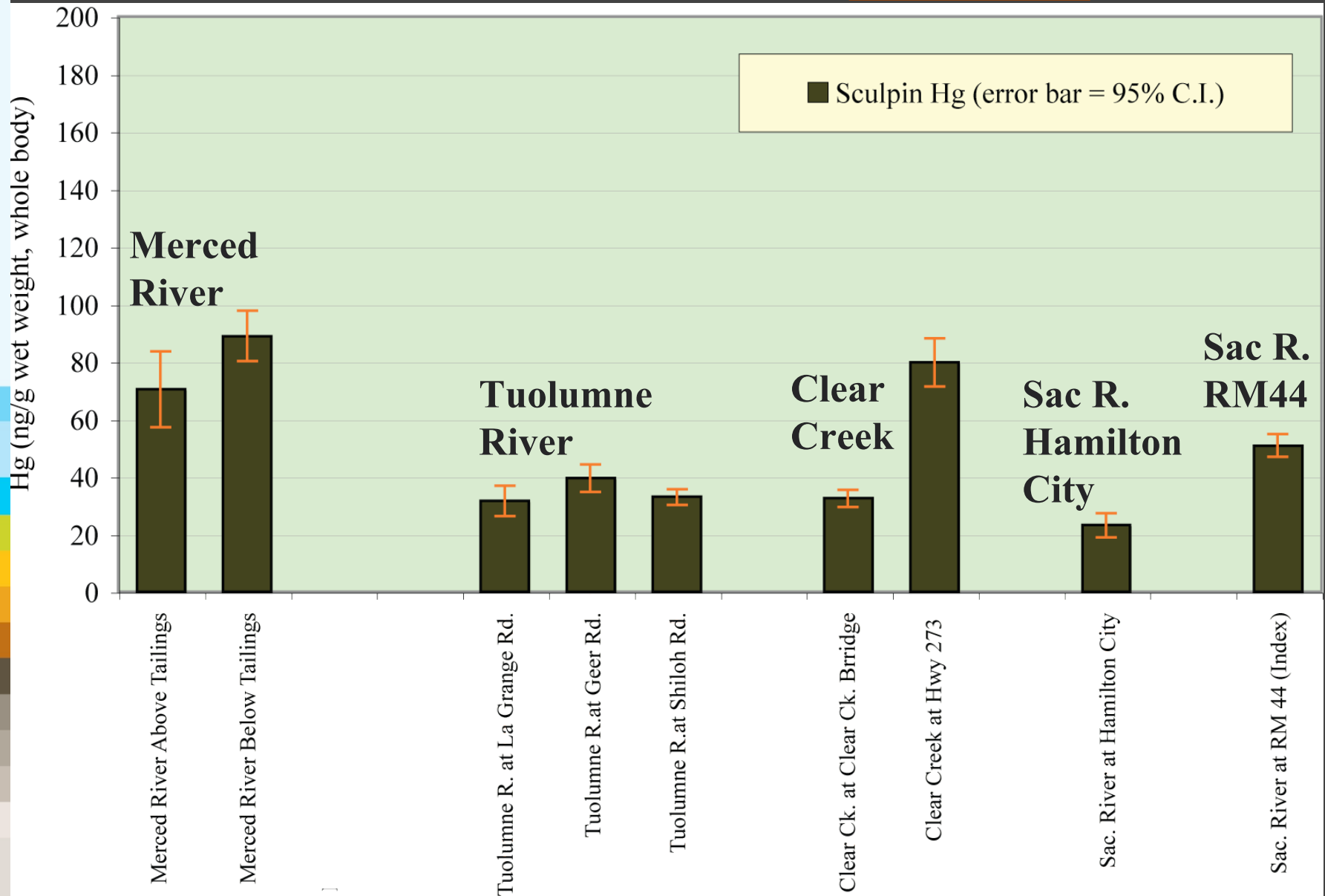
**Hg mine
(Bella Oaks)
Napa river**



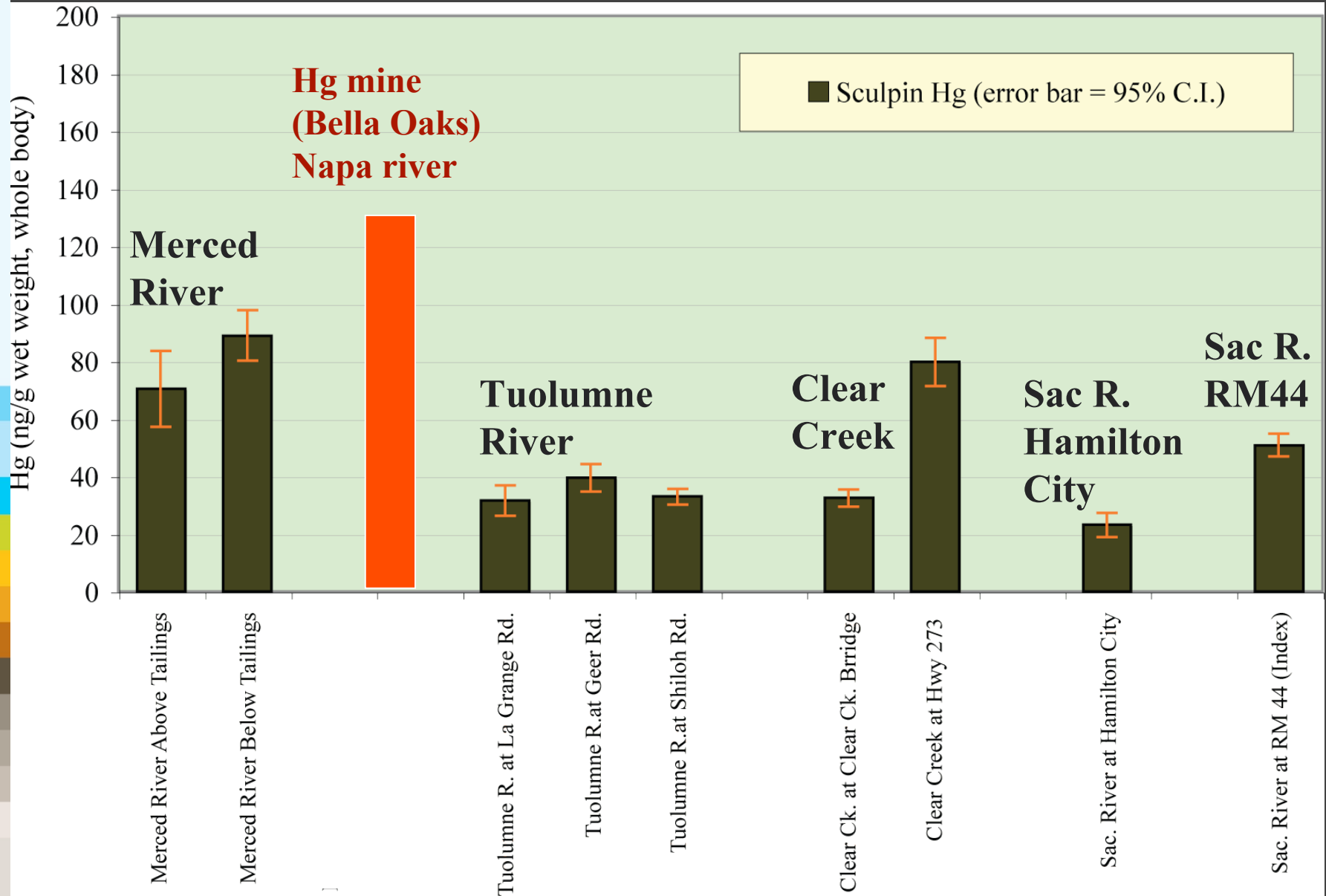
Sources?



Prickly Sculpin Regional Mercury



Prickly Sculpin Regional Mercury





Mercury isotopes - goals

- Evaluate potential use of Hg isotopes as source and process tracers
 - Similar isotope systems: N, C, S
- Determine Hg isotopic composition of multiple Hg sources in the drainage basin
 - Mine tailings
 - Municipal waste water
 - Marine (Atmospheric deposition)
- Determine spatial distribution of Hg isotopic compositions in sediments and fish
- Investigate possible sources to Bay sediments and fish



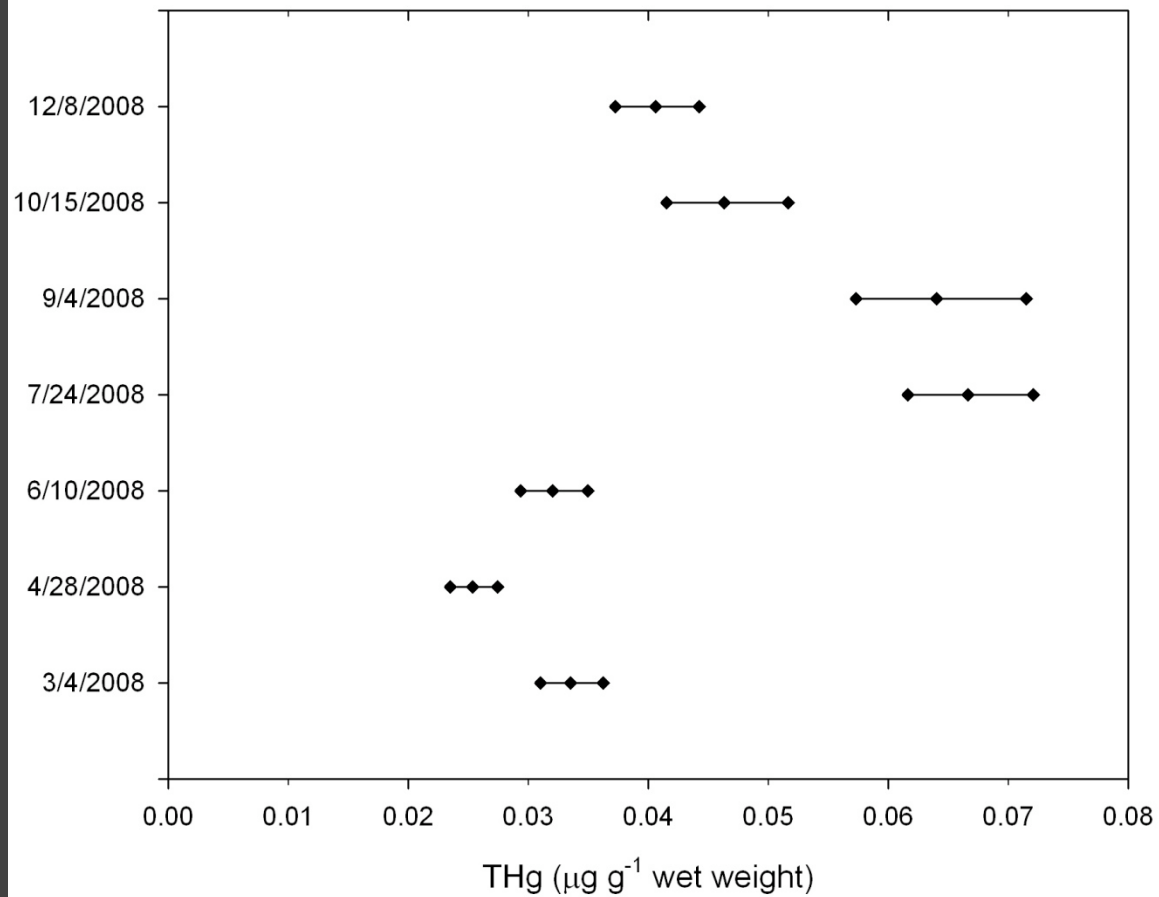
Mercury isotopes - results

- The isotope results are highly preliminary and have therefore been removed from the web-distribution of this presentation
- If you would like more information on the mercury isotope project, please contact the primary author, Gretchen Gehrke (gegehrke@umich.edu)

Seasonal trend evaluation



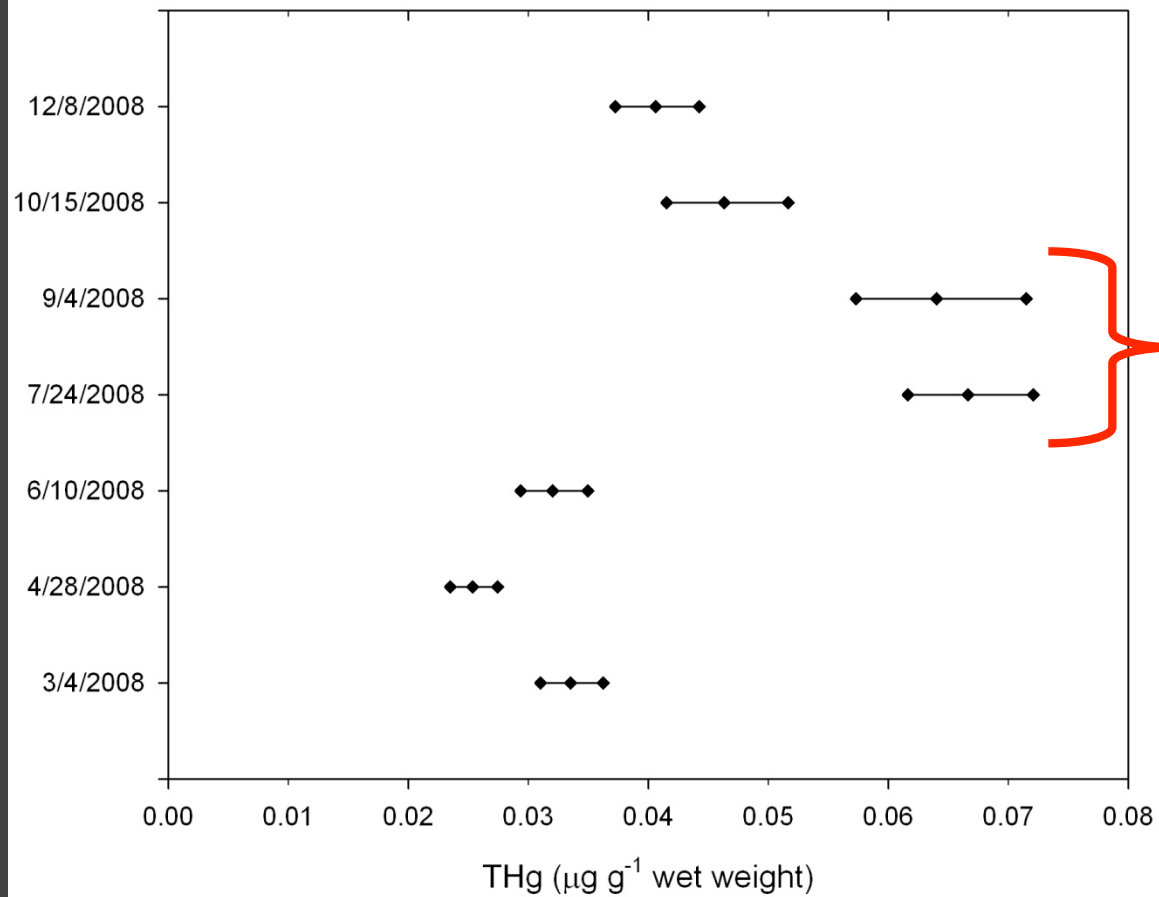
Seasonal Arrow Goby Mercury Concentrations
At Martin Luther King Regional Shoreline



Seasonal trend evaluation



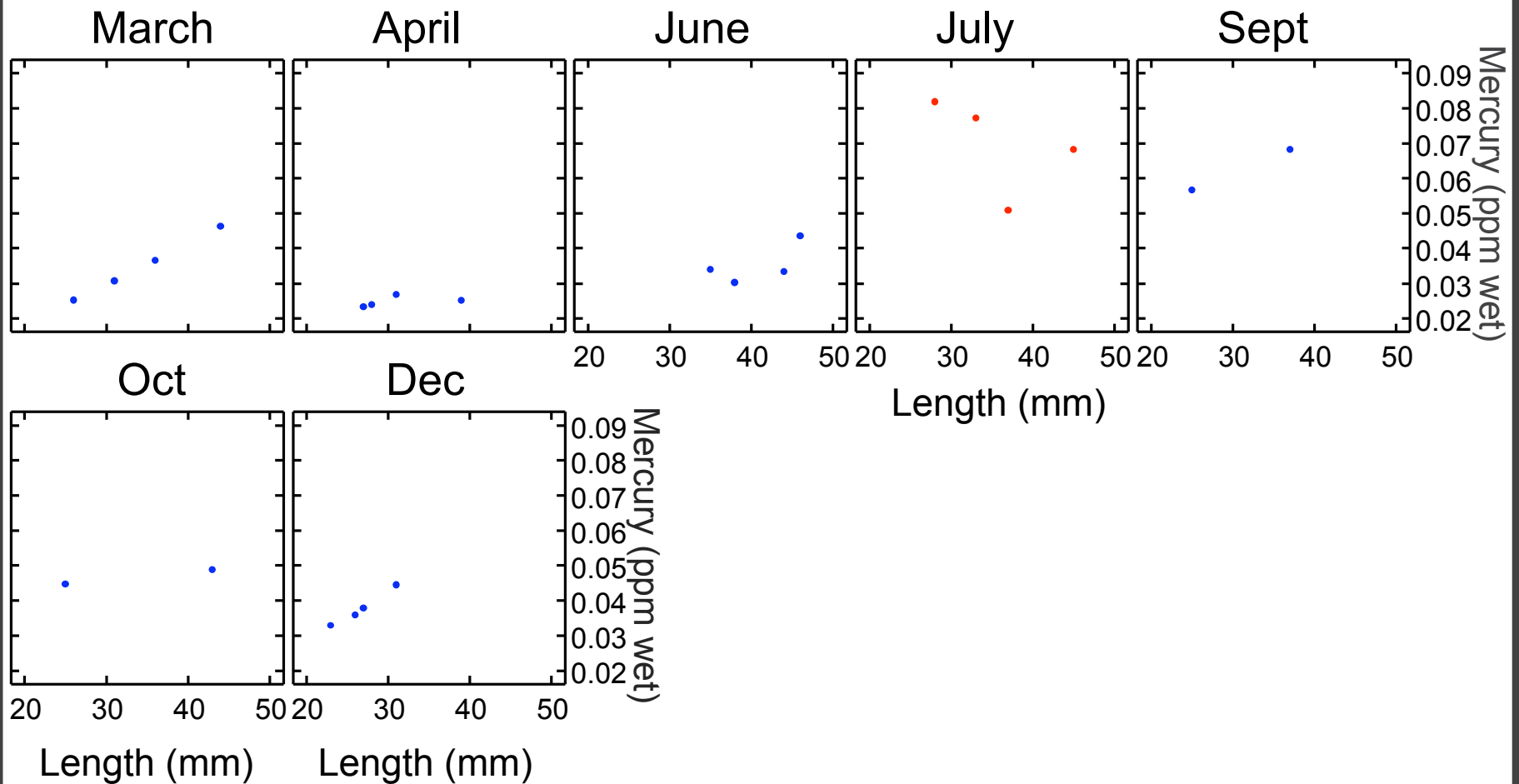
Seasonal Arrow Goby Mercury Concentrations
At Martin Luther King Regional Shoreline



Peak late summer

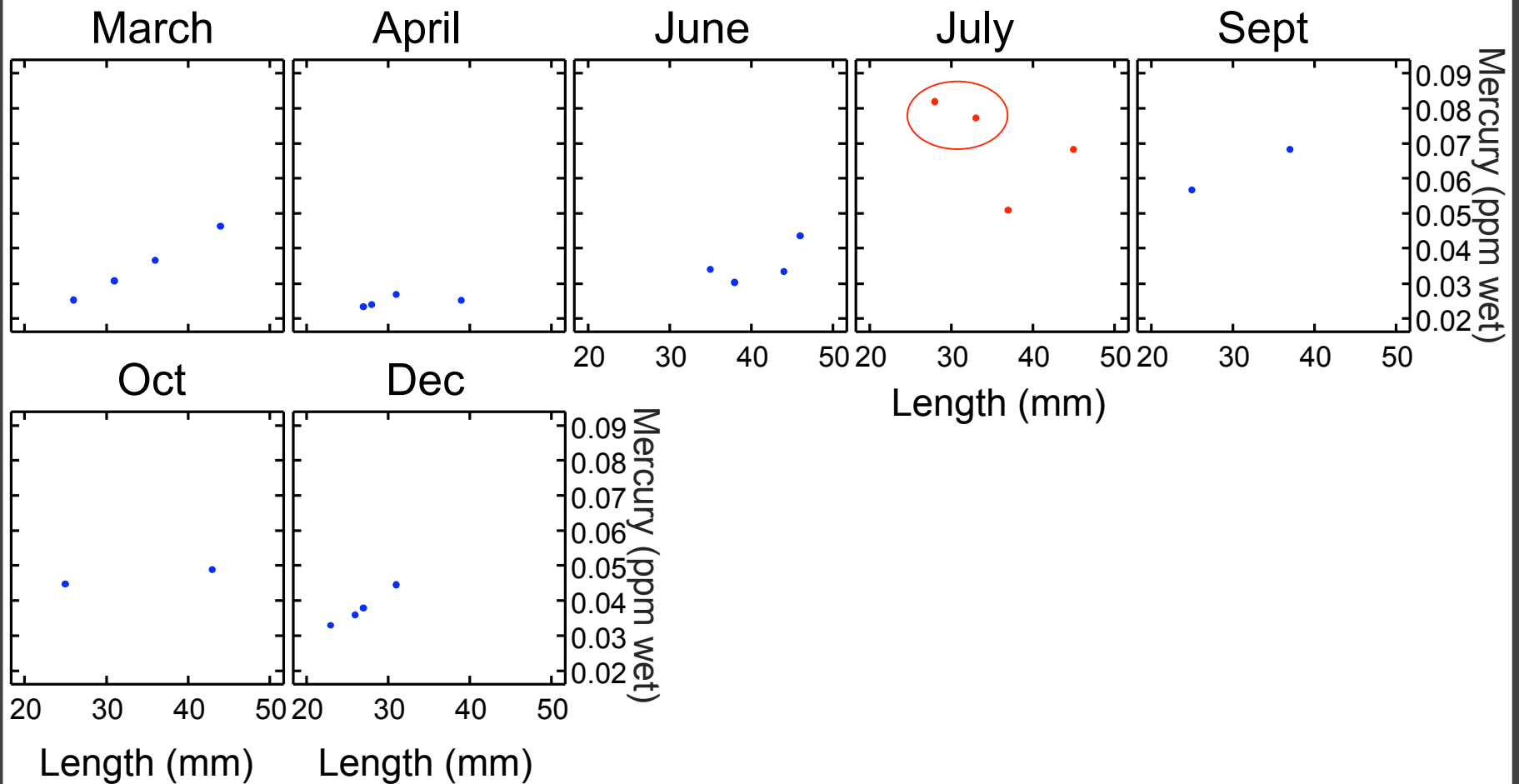


Arrow goby results – a closer look






Results suggest MeHg pulse in fish diet




Preliminary interpretations



 *Where and when is mercury entering the Bay food web?*

- A regional gradient – peak in Lower South Bay
- Late summer peak for mudflat fish?

 *What processes, sources, and pathways contribute disproportionately to food web accumulation?*

- Wastewater treatment plants dilution?
- Historic mining Hg source signal?

Potential management implications




 Greater focus on Lower South Bay warranted

- E.g., South Bay Mercury Project

 Historic mines important

- E.g., Guadalupe River Hg TMDL

 Shallow WWTP discharge potentially lower concern

- Future data will tell...