

## Management Question 1:

What is the effect of increased tidal action on methylmercury bioaccumulation in wildlife, within the project and downstream, over timescales of about one year and longer than one year?

## Hypothesis 1:

The effect of tidal action on restored sites may result in a local short-term, transitory spike or increase in net methylmercury production and biotic exposure, within the project and downstream, but we are unlikely to see levels of concern in biota that warrant management action.

# Tidal Restorations: Findings from small fish monitoring



**Darell Slotton (et al.)**

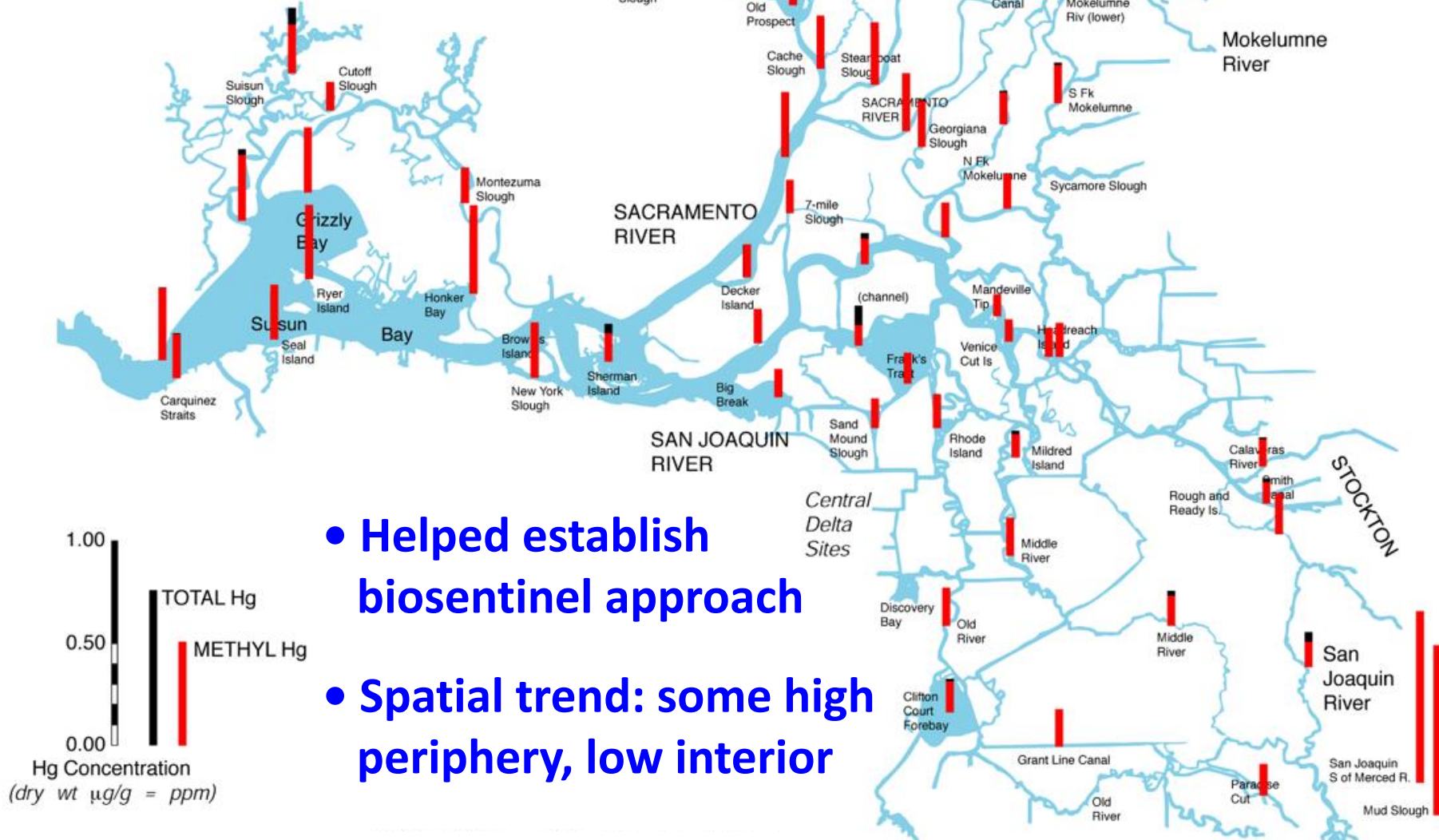
*Department of Environmental Science and Policy  
University of California, Davis*



**UCDAVIS**



# Mercury Trend in Mississippi Silversides, UC Davis data, 1998

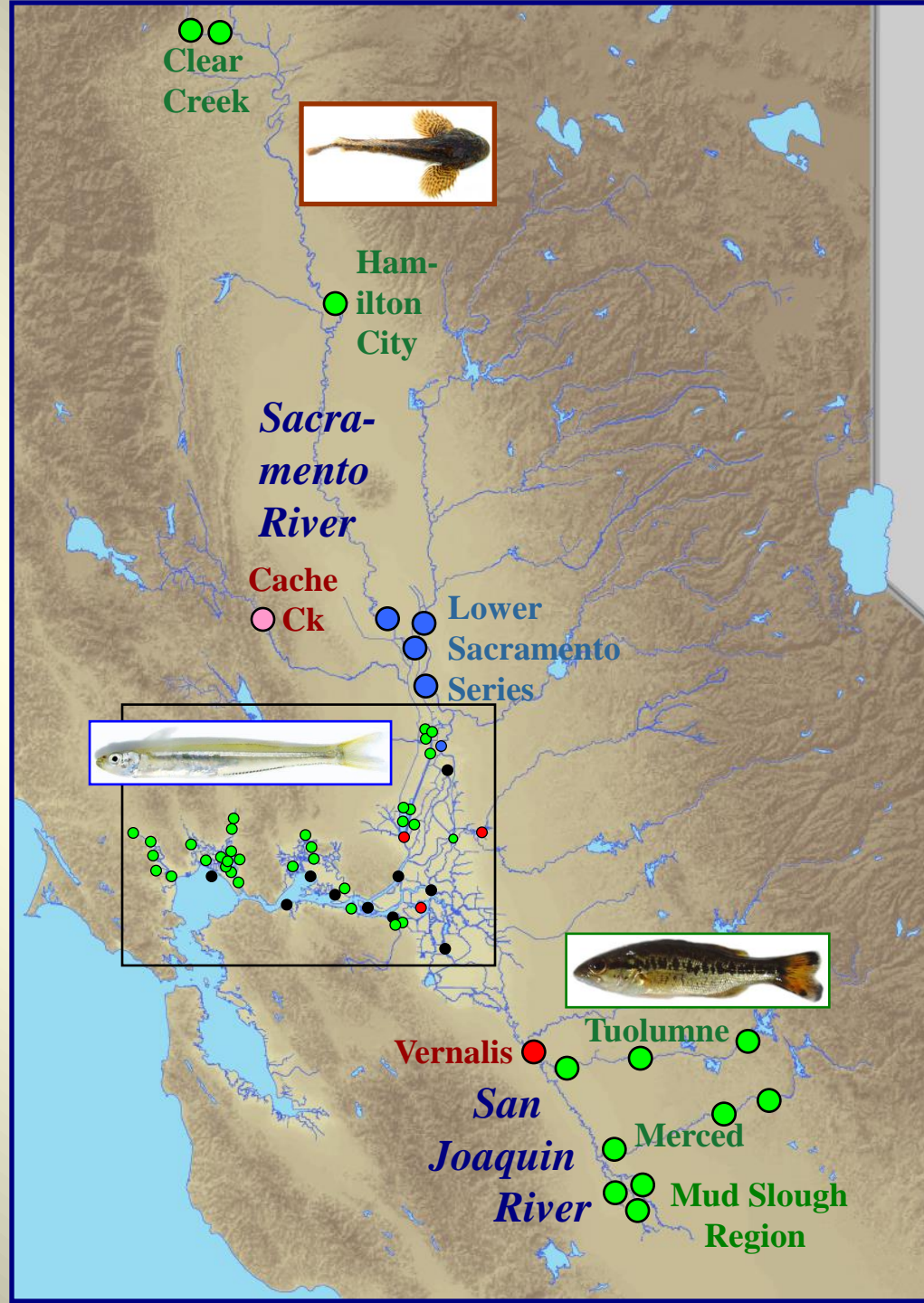


- Helped establish biosentinel approach
- Spatial trend: some high periphery, low interior



# CalFed Biosentinel Small Fish Mercury Project 2005-2008

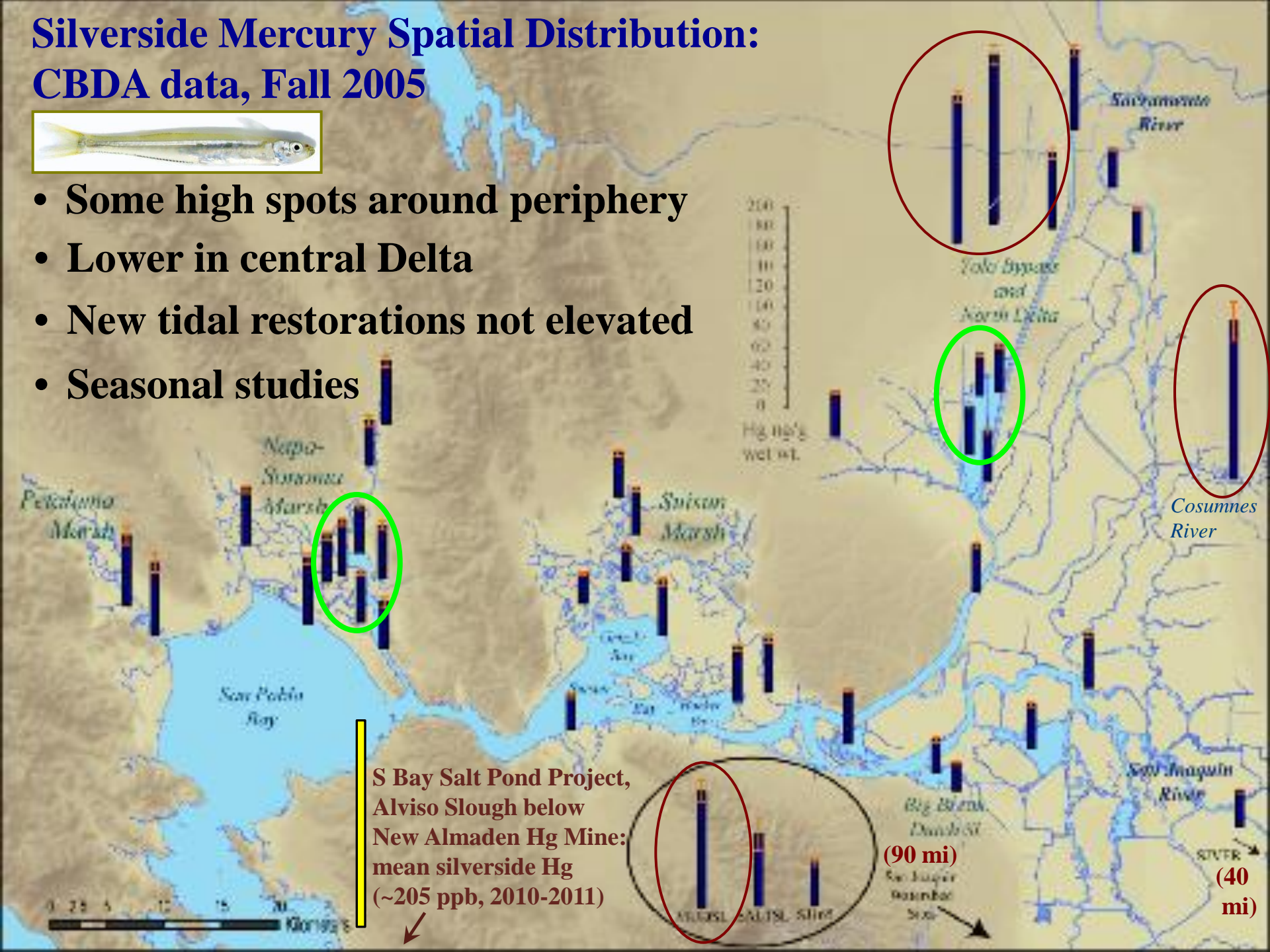
- Thousands of analyses from across watershed
- Several primary target species



# Silverside Mercury Spatial Distribution: CBDA data, Fall 2005



- Some high spots around periphery
- Lower in central Delta
- New tidal restorations not elevated
- Seasonal studies



S Bay Salt Pond Project,  
Alviso Slough below  
New Almaden Hg Mine:  
mean silverside Hg  
(~205 ppb, 2010-2011)

(90 mi)

(40 mi)

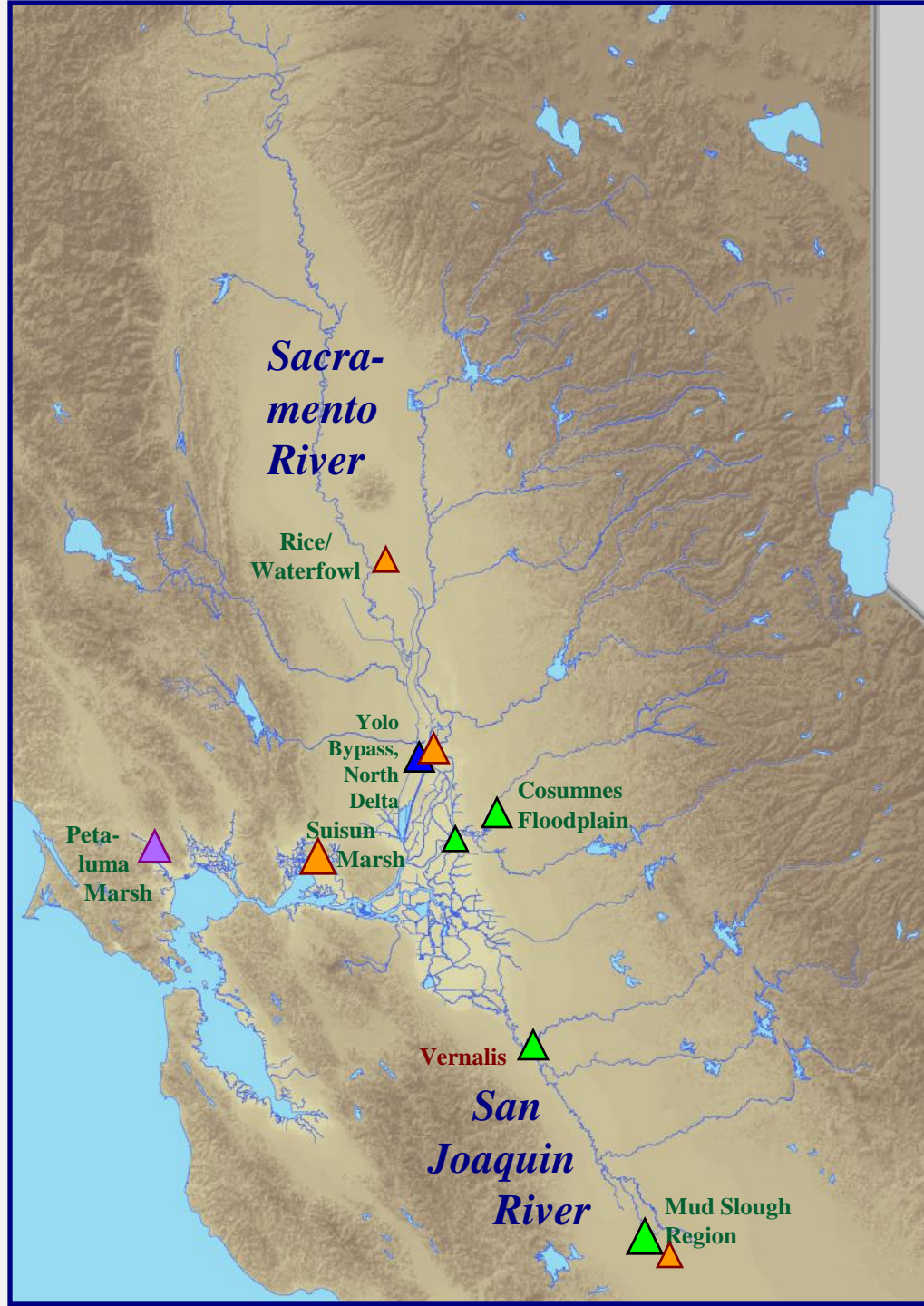


# Overall Conclusions

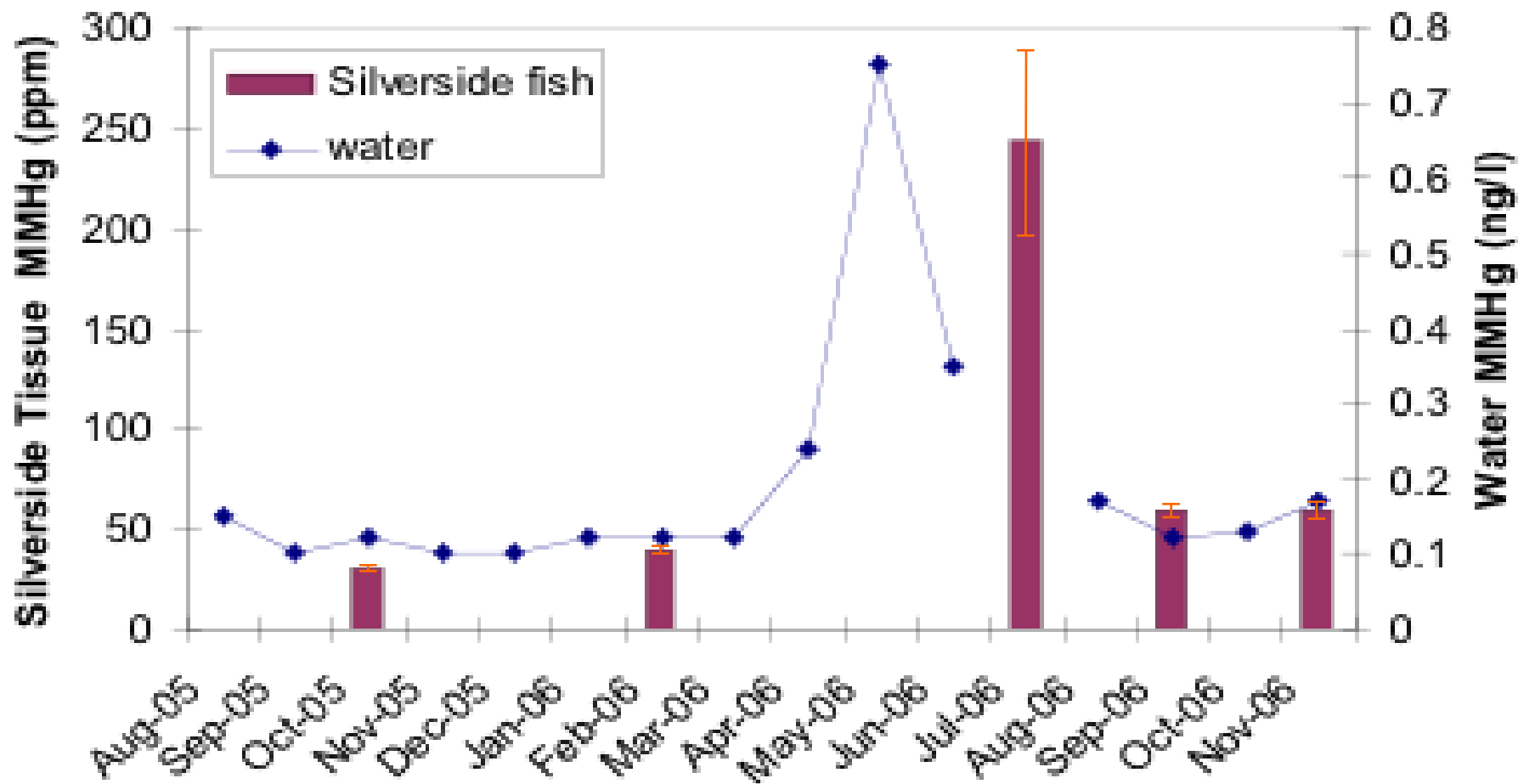
Main cases of highly elevated exposure – outside of major mining inputs – were associated with some form of occasional flooding:

- ▲ Winter, rain-runoff flooding
- ▲ Spring, snow-melt flooding
- ▲ Managed flooding (summer/fall)
- ▲ Episodic tidal flooding

\* **Conversely: tidal sites that remained wet were generally not elevated**

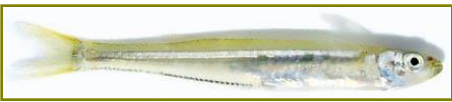


# Methyl Hg concentrations in water vs small fish. San Joaquin River at Vernalis.

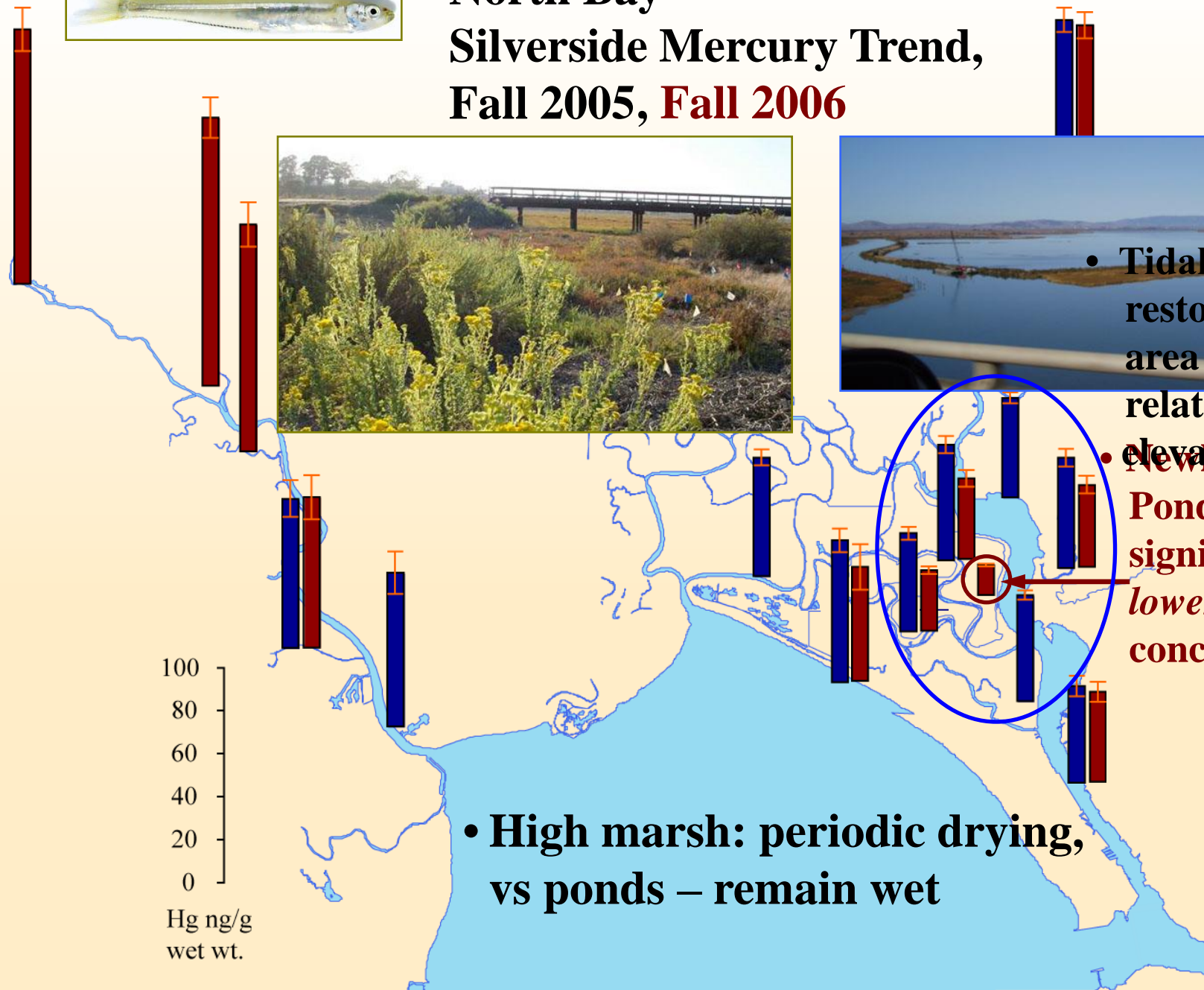


(Water data from Foe et al., Central Valley RWQCB, 2008)





# North Bay Silverside Mercury Trend, Fall 2005, **Fall 2006**



- Tidal restoration area not relatively elevated
- Newly breached Pond 4/5 had significantly *lower* mercury concentrations

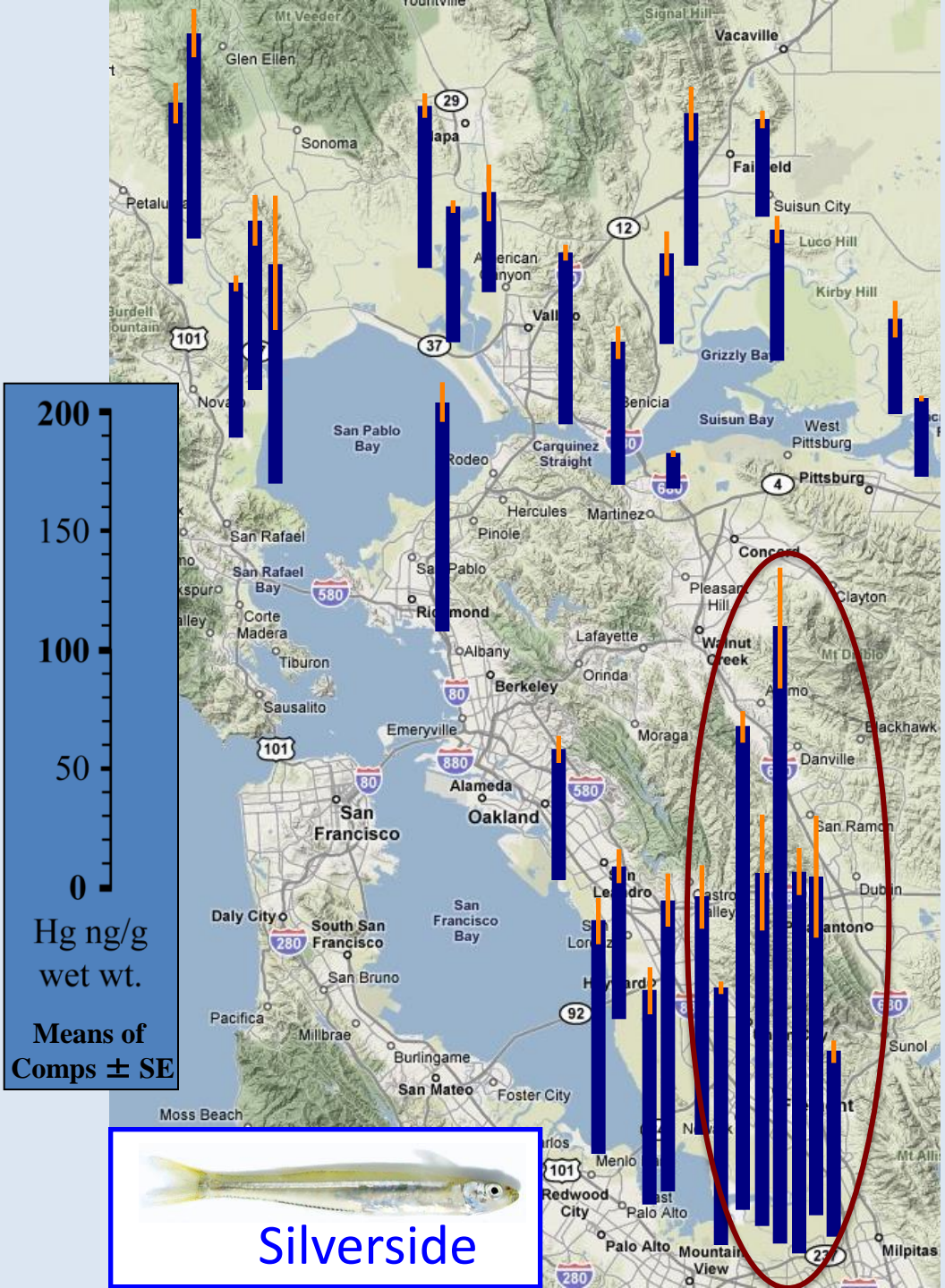
• High marsh: periodic drying, vs ponds – remain wet



# Tidal restoration evidence from the South Bay

Regional Monitoring Program (RMP/UC Davis) 2008 data

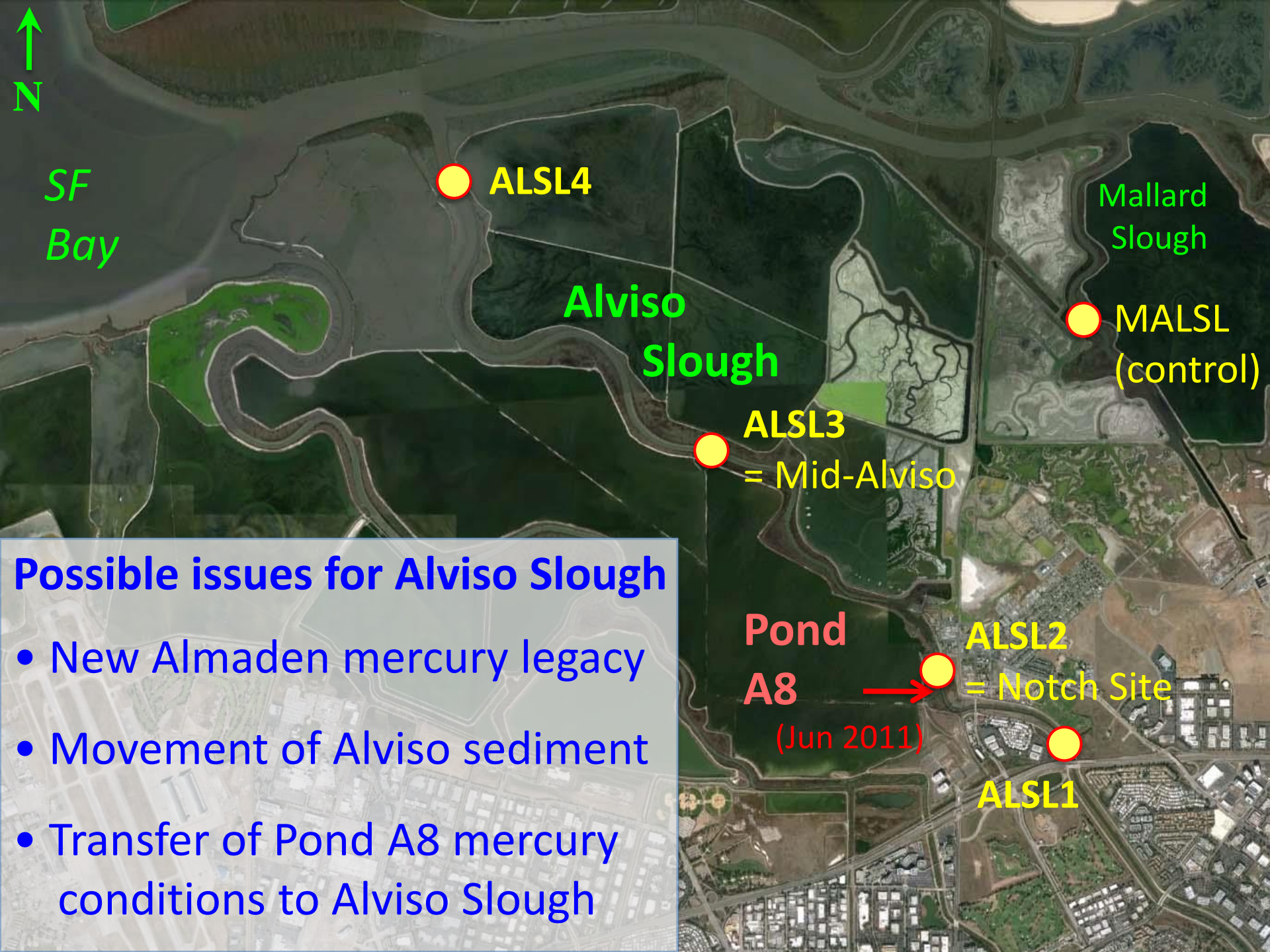
- Alviso region a long-time 'hot spot'



Hg ng/g wet wt.  
Means of Comps ± SE







SF  
Bay

● ALSL4

Alviso  
Slough

Mallard  
Slough

● MALSL  
(control)

● ALSL3  
= Mid-Alviso

Pond  
A8 →  
(Jun 2011)

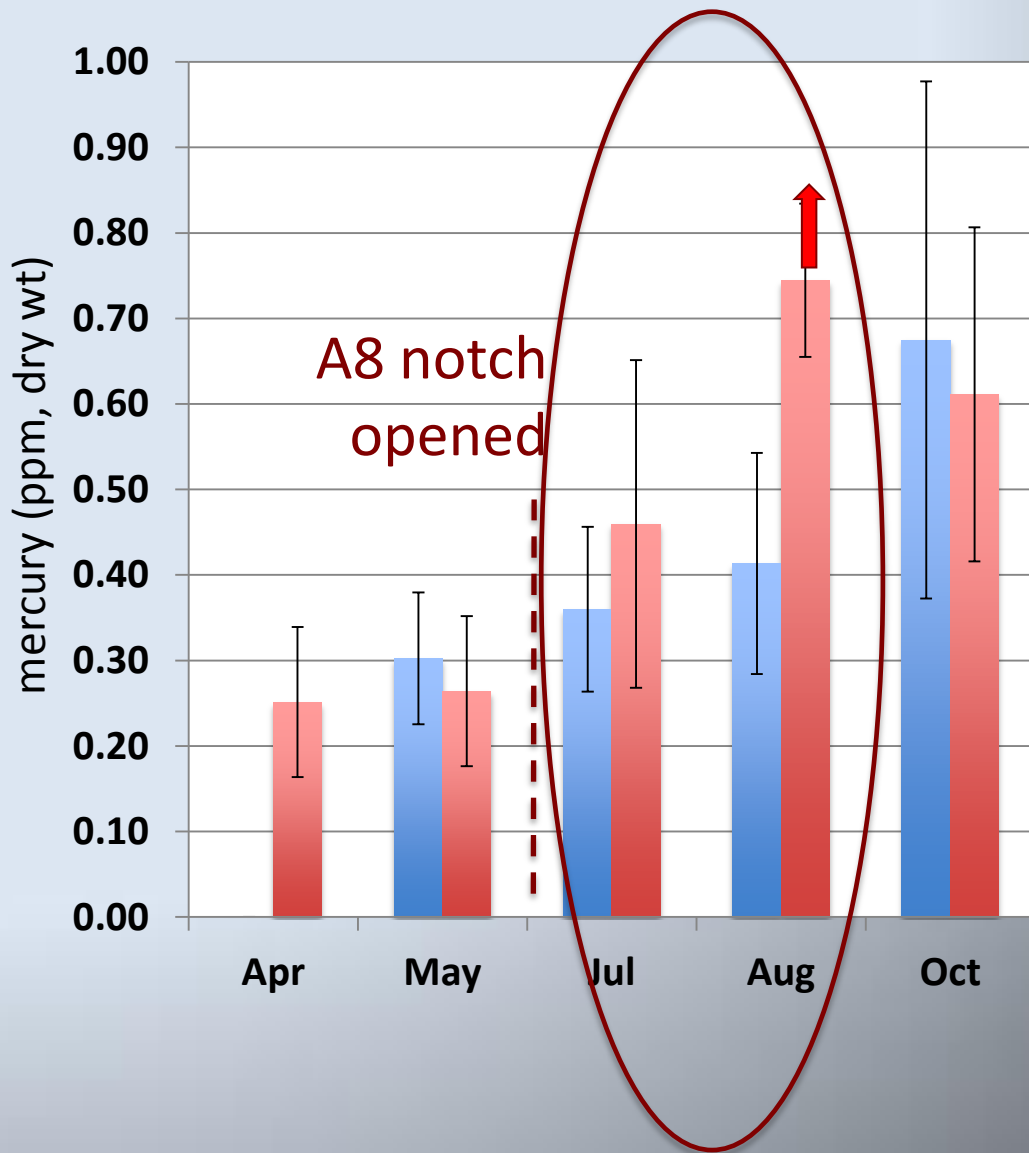
● ALSL2  
= Notch Site

● ALSL1

**Possible issues for Alviso Slough**

- New Almaden mercury legacy
- Movement of Alviso sediment
- Transfer of Pond A8 mercury conditions to Alviso Slough





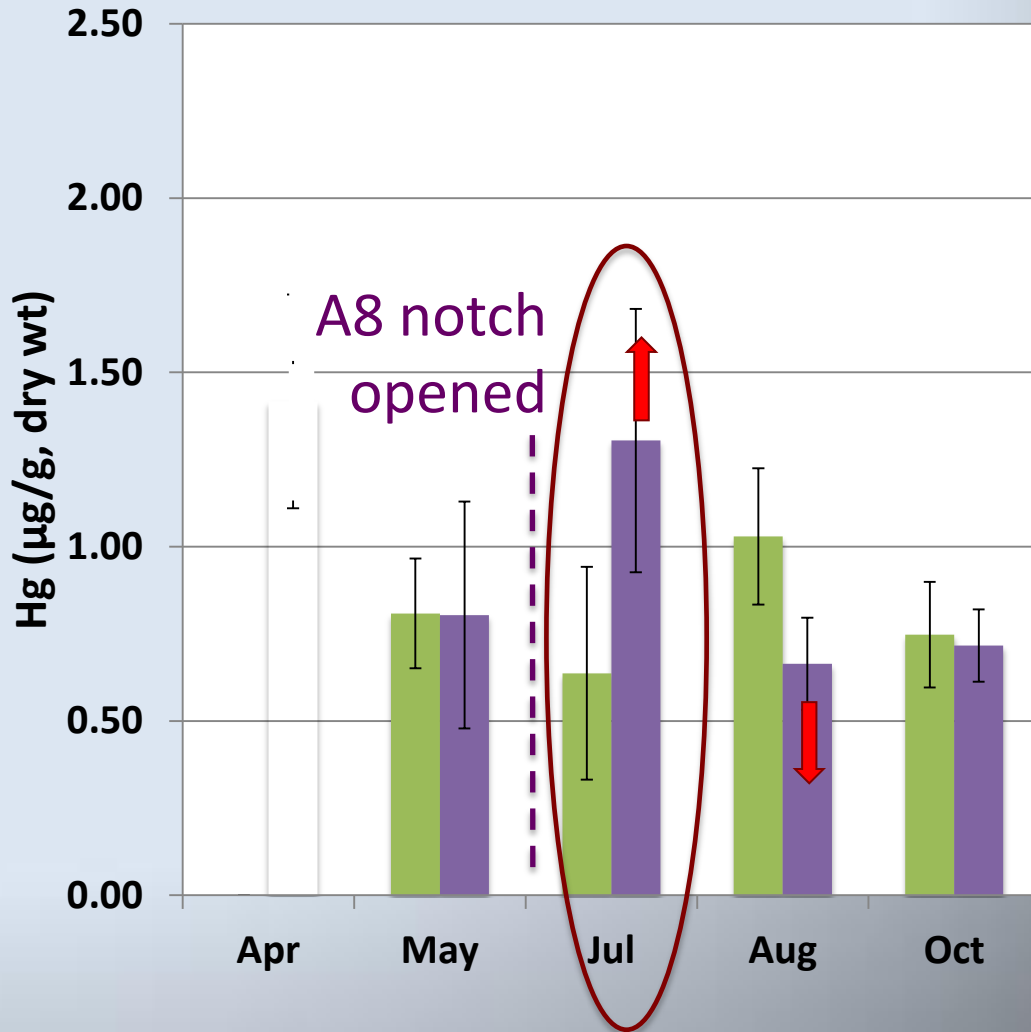
2010  
2011

**ALSL2**  
Alviso Slough  
at the Pond A8  
notch



**Threespine  
Stickleback**

- Higher in Jul-Aug, vs 2010
- By Oct, within 'normal' range



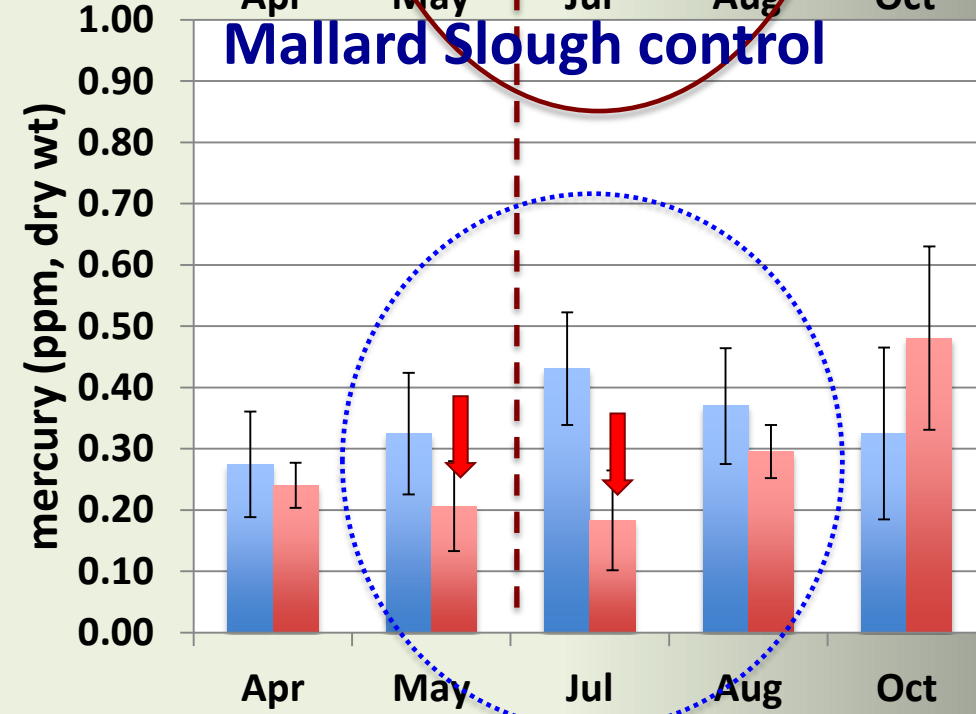
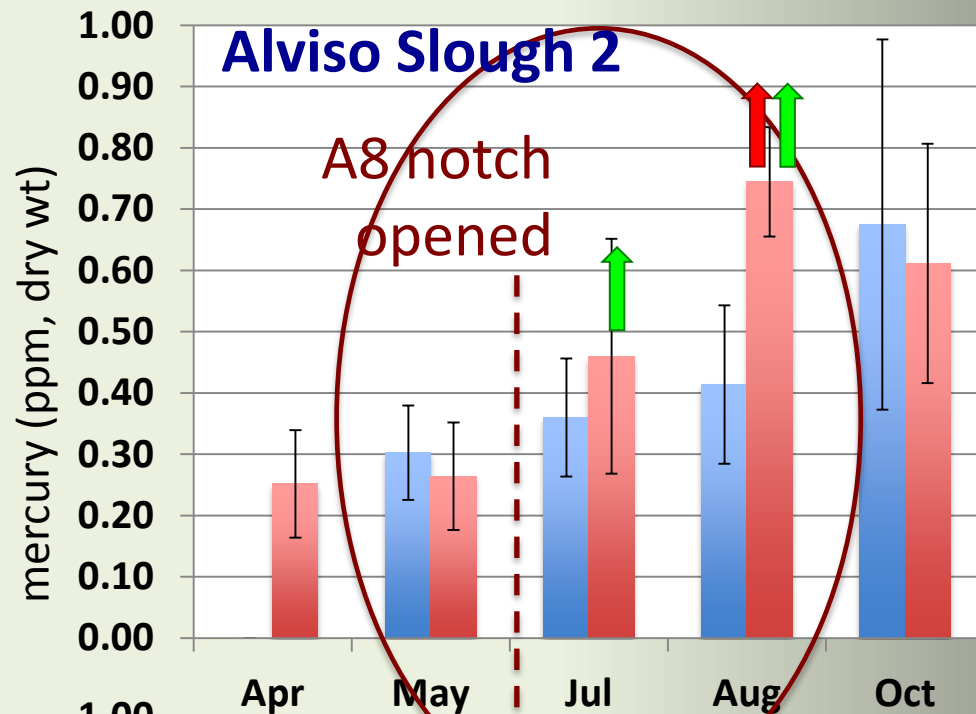
■ 2010  
■ 2011

**ALSL2**  
Alviso Slough  
at the Pond A8  
notch



Mississippi  
Silverside

- Higher in July, vs 2010
- Lower in August, Oct



## Alviso Slough 2 (at Notch) vs Control Site



### Stickleback

- 2011 rises during opposite trend at control site.
- Statistically significant vs control.





- Slough fish increase was apparently short-term
- Monitoring continues
- Opposite trend in Pond A8 (decline in fish Hg--USGS)

- ### Possible sources of Alviso rises
- Scour of Alviso sediment
  - Transfer of pond high mercury conditions to Alviso Slough
  - Migration of fish from pond



## Hypothesis 1:

The effect of tidal action on restored sites may result in a local short-term, transitory spike or increase in net methylmercury production and biotic exposure, within the project and downstream, but we are unlikely to see levels of concern in biota that warrant management action.

- **Generally supported by local data**
- **Caveat: -- if restorations can remain wet**

