Exposure and Effects Pilot Study Small Fish Mercury Project

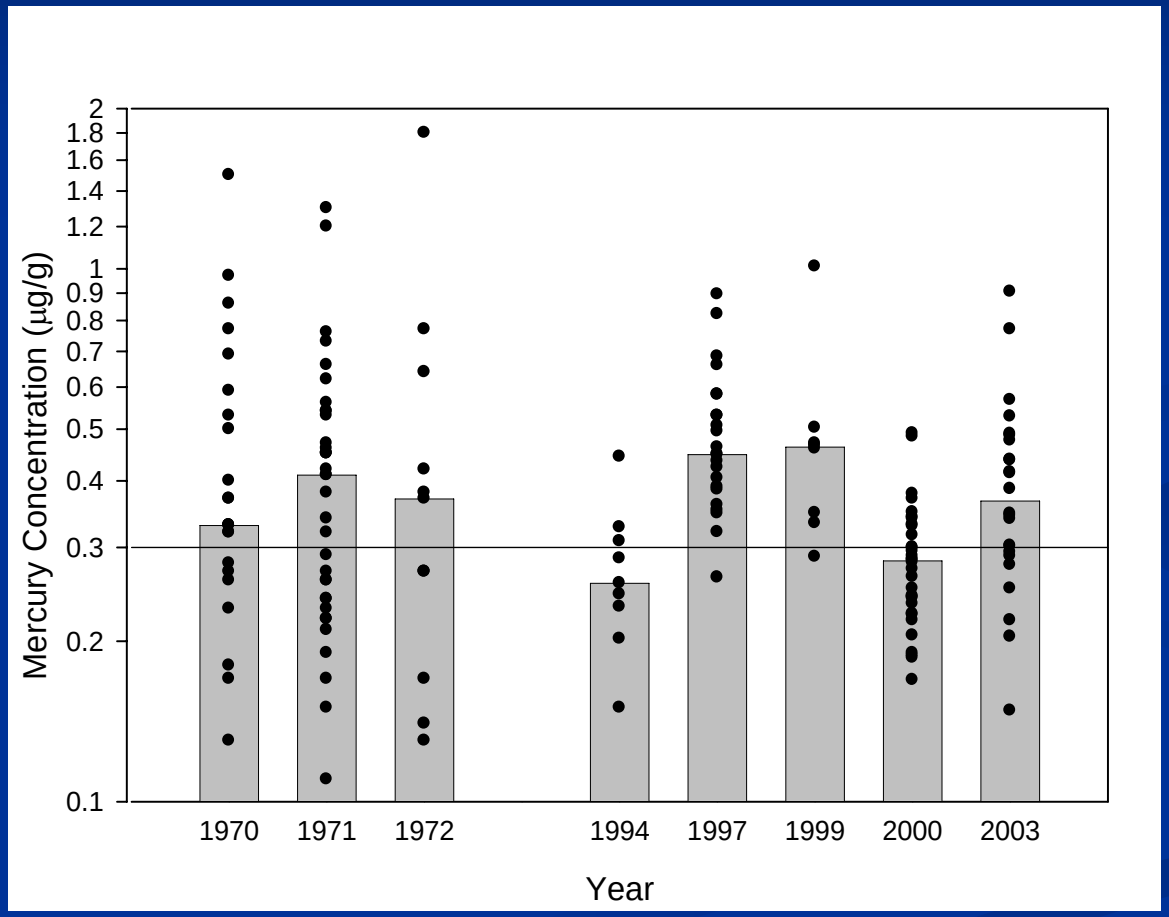
Ben Greenfield[1], Letitia Grenier[1], Andrew Jahn[2], Seth Shonkoff[1], Mark Sandheinrich[3], Jay Davis[1]

1. San Francisco Estuary Institute
2. 1000 Riverside Drive, Ukiah, CA
3. River Studies Center, University of Wisconsin – La Crosse

Small Fish Hg Project

- Background
  - Mercury (Hg) in N. California waters a longstanding management concern due to historic mining
  - Elevated concentrations in sport fish
  - San Francisco Estuary site of extensive wetland restoration activity
  - Sensitive wildlife in region

Striped bass Hg concentrations in SF Estuary over time



For more information on sport fish monitoring, see poster # 27

Small Fish Hg Project

- Goals
  - Characterize food-web mercury at fine spatial and temporal scales
  - Collect data for wildlife risk evaluations
  - Detect regional trends in bioaccumulation of Hg related to wetland restoration
  - Identify differences in pattern between benthic and pelagic food webs

- Design
  - 8 sites within San Francisco Estuary
    - 4 sites near restoration projects
    - 4 index sites near extant marshes
  - Additional samples in deep water
  - Sample benthic and pelagic species at each site
  - Use related types of species to create data sets comparable across a wide range of salinities
    - Topsmelt/Mississippi (inland) silversides (Atherinopsidae)
    - Arrow goby, cheekspot, and Shimofuri goby (*Tridentiger*)
    - Bay goby from deep water

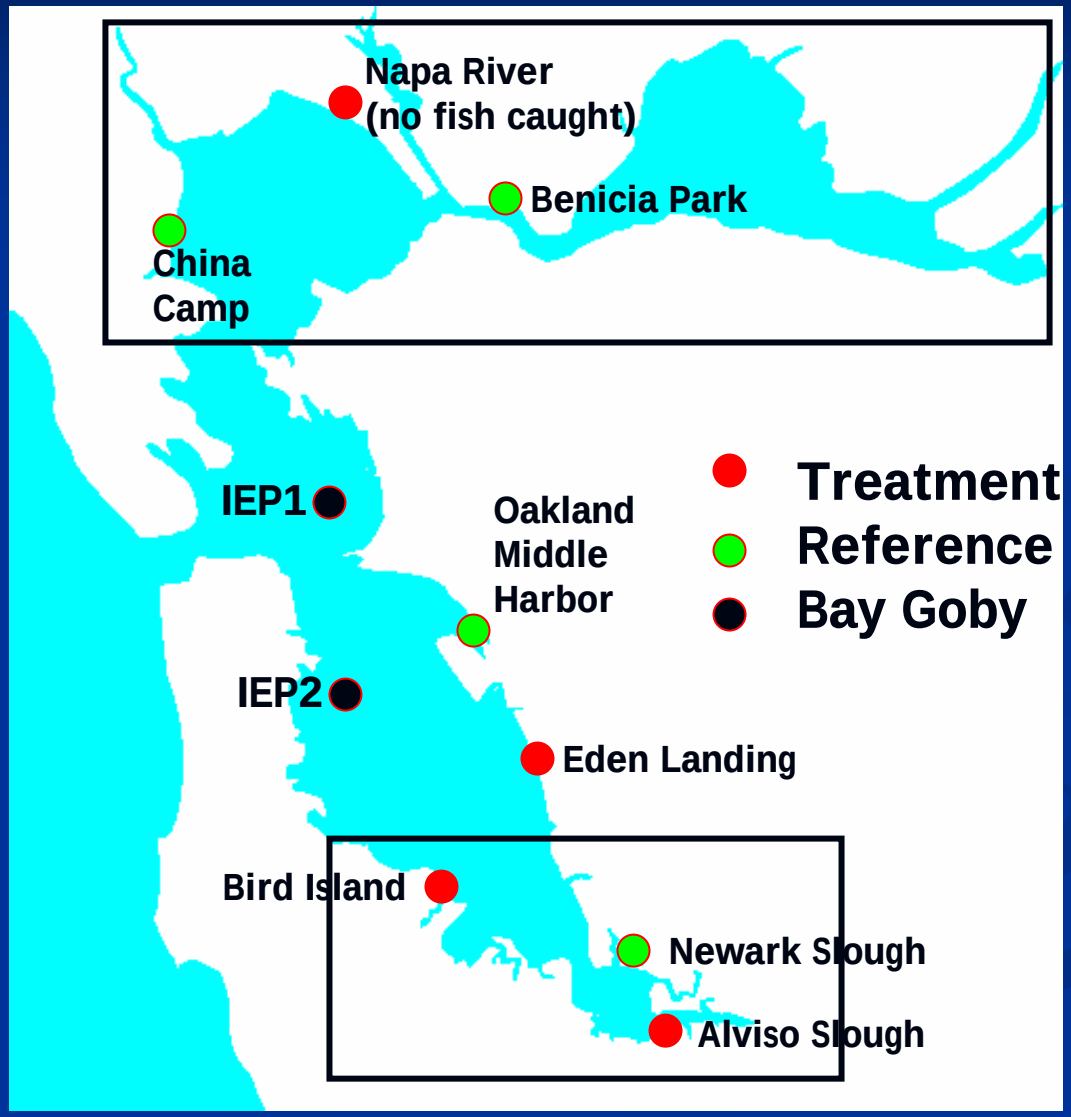
- Design
  - Four composites per species per site - allow statistical comparison
  - 5-10 individuals/composite
  - Minimize covariates by using consistent sizes

- Coordination with other monitoring
  - Geographic
    - EEPS samples bay edge - South, Central and North Bay
    - South Bay Salt Pond Hg project samples inside marshes, ponds, and sloughs
    - CBDA Fish Mercury Project - North Bay, more freshwater focus
  - Species
    - Intent to produce data set as comparable as possible across region

Small Fish Hg Project

Station	Salinity	Topsmelt	Silverside	Bay Goby	Cheekspot Goby	Arrow Goby	Shimofuri Goby
Alviso Slough	23		4		4		
China Camp	26		4			3	4
Newark Slough	27	2	4		4		
Eden Landing	29	1	4		4		
Birds Island	29	2	3		4		
Oakland Harbor	32	4				4	
IEP Treasure Island				4			
IEP Candlestick				4			

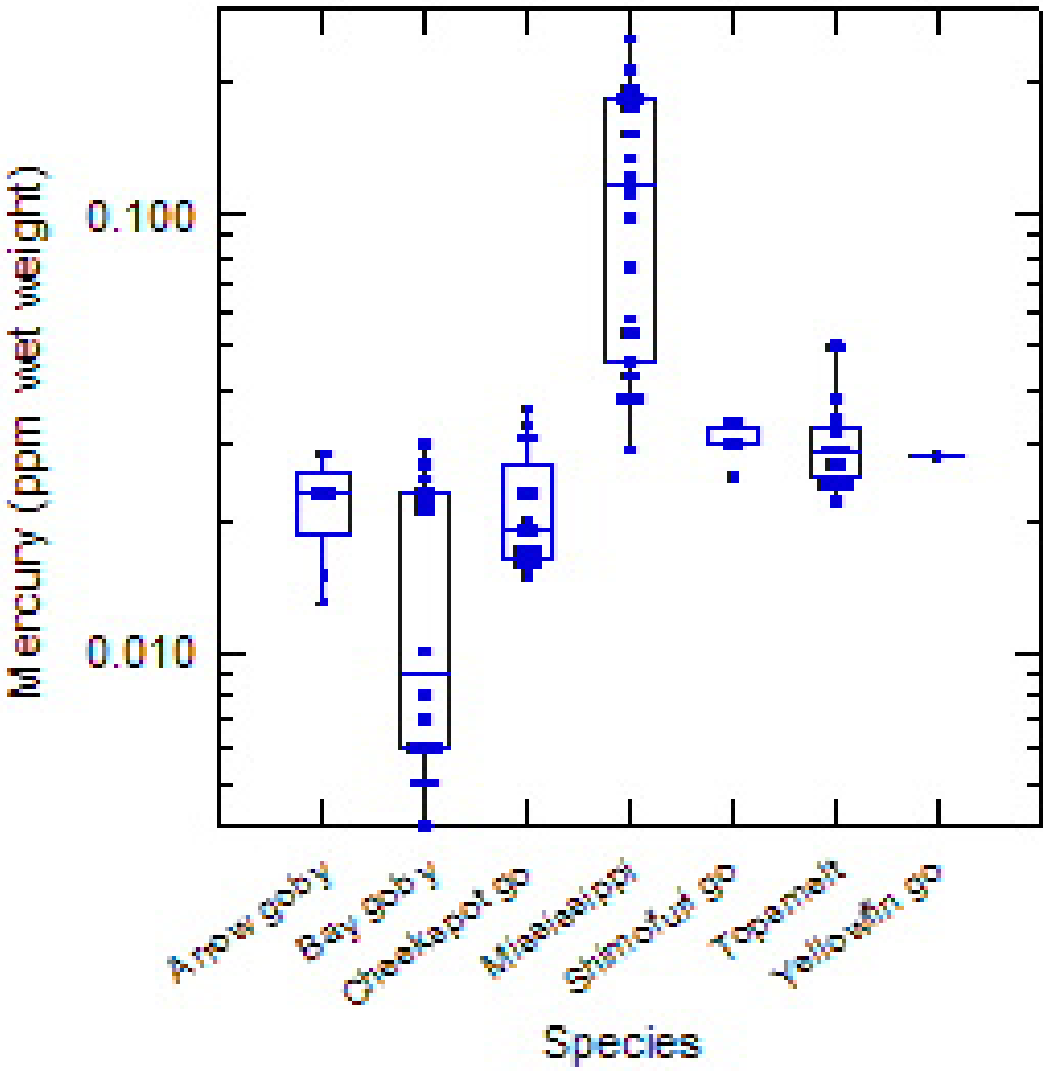
Small Fish Hg Project



Results

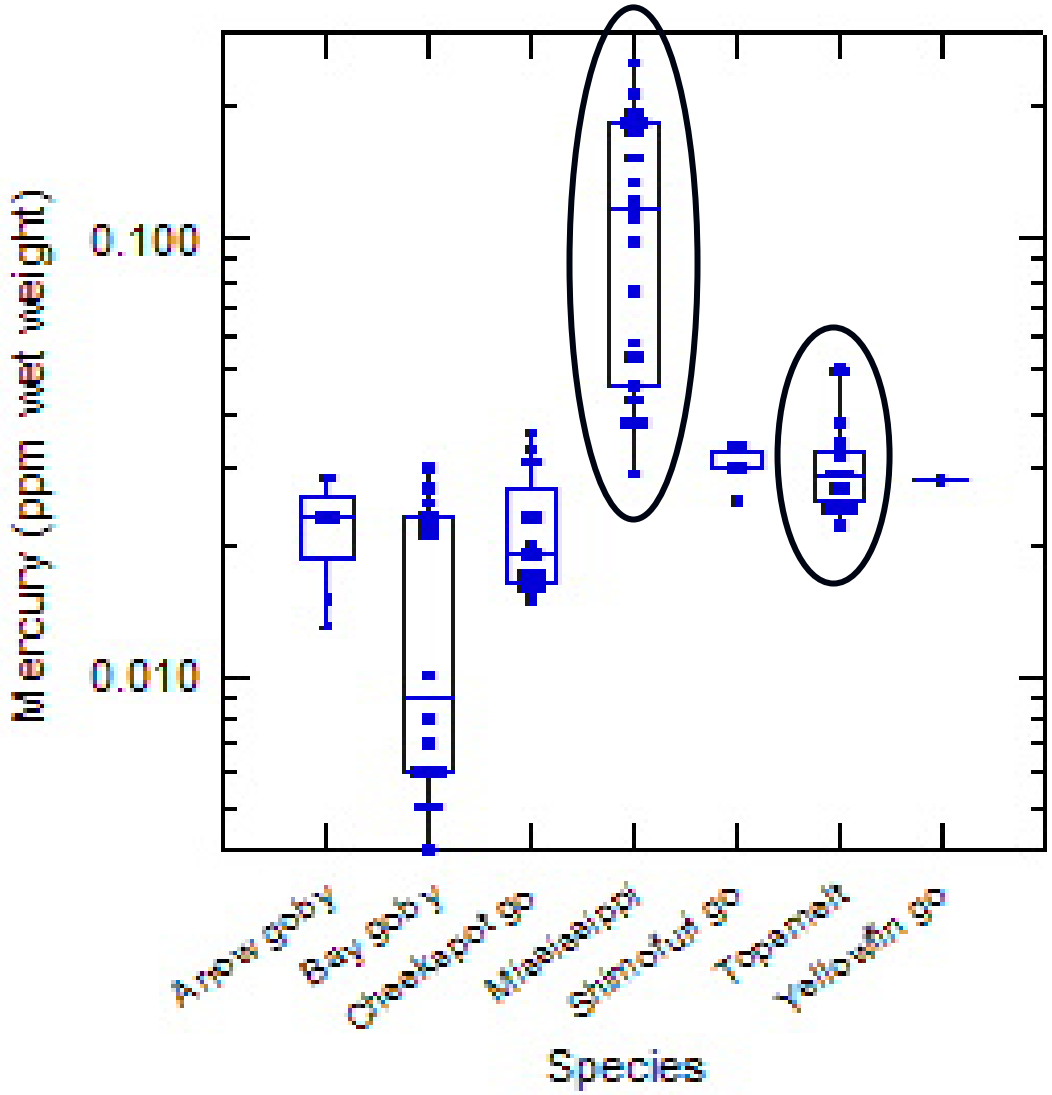
- 97 Composite samples analyzed
- QA was good
  - 94% recovery of spiked samples
  - 5% relative standard deviation of triplicate samples

Mercury By Fish Species



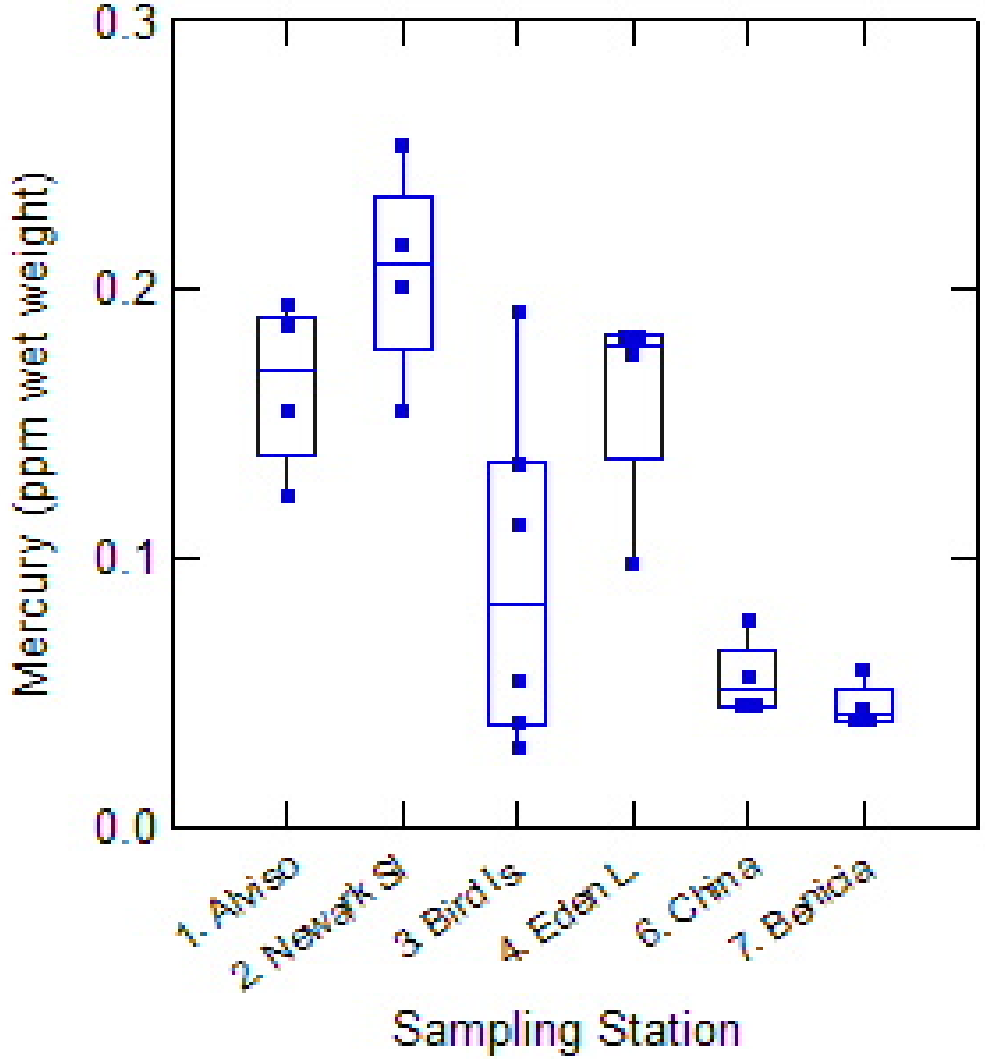
Mercury By Fish Species

Pelagic Species Higher

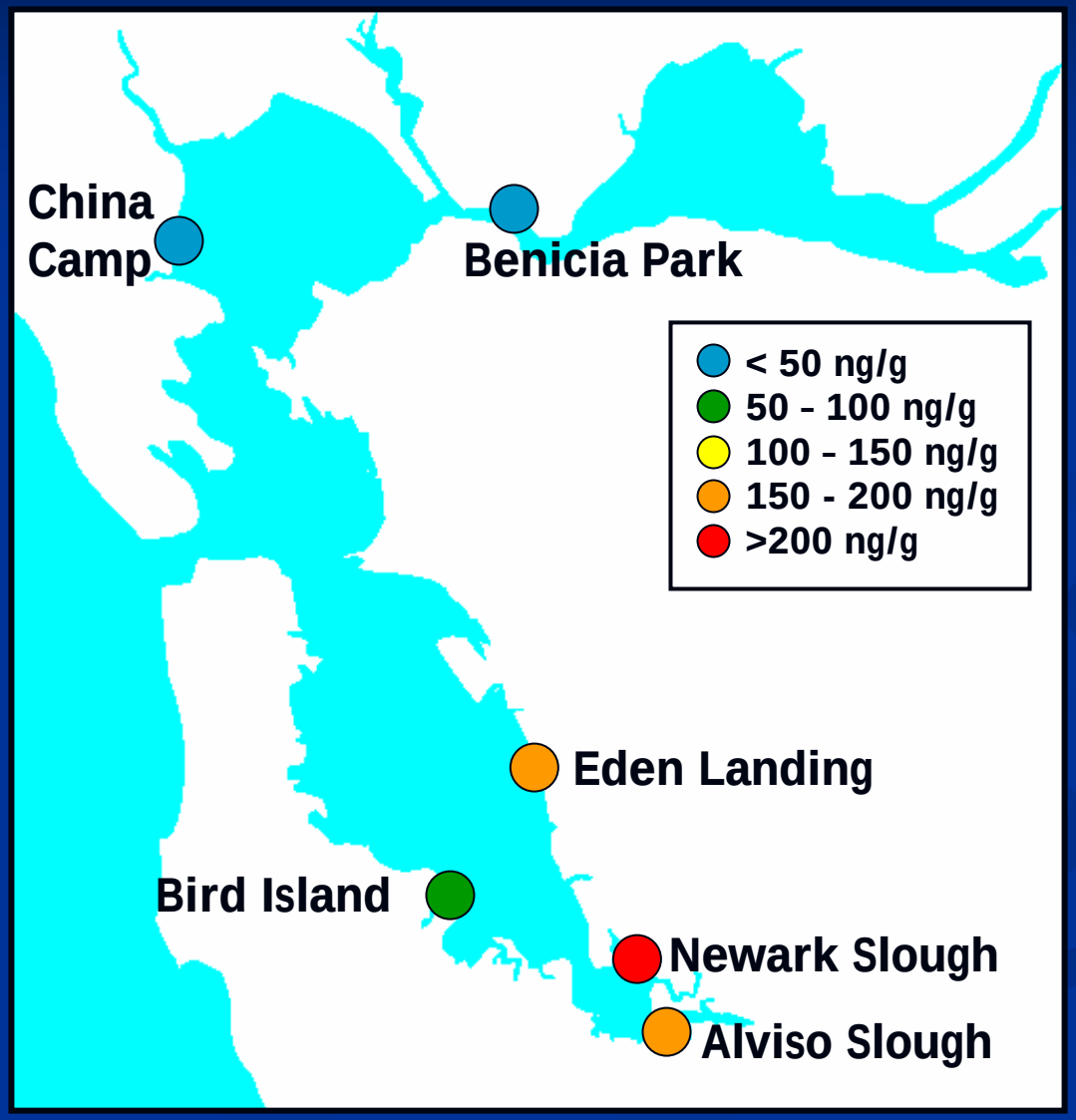


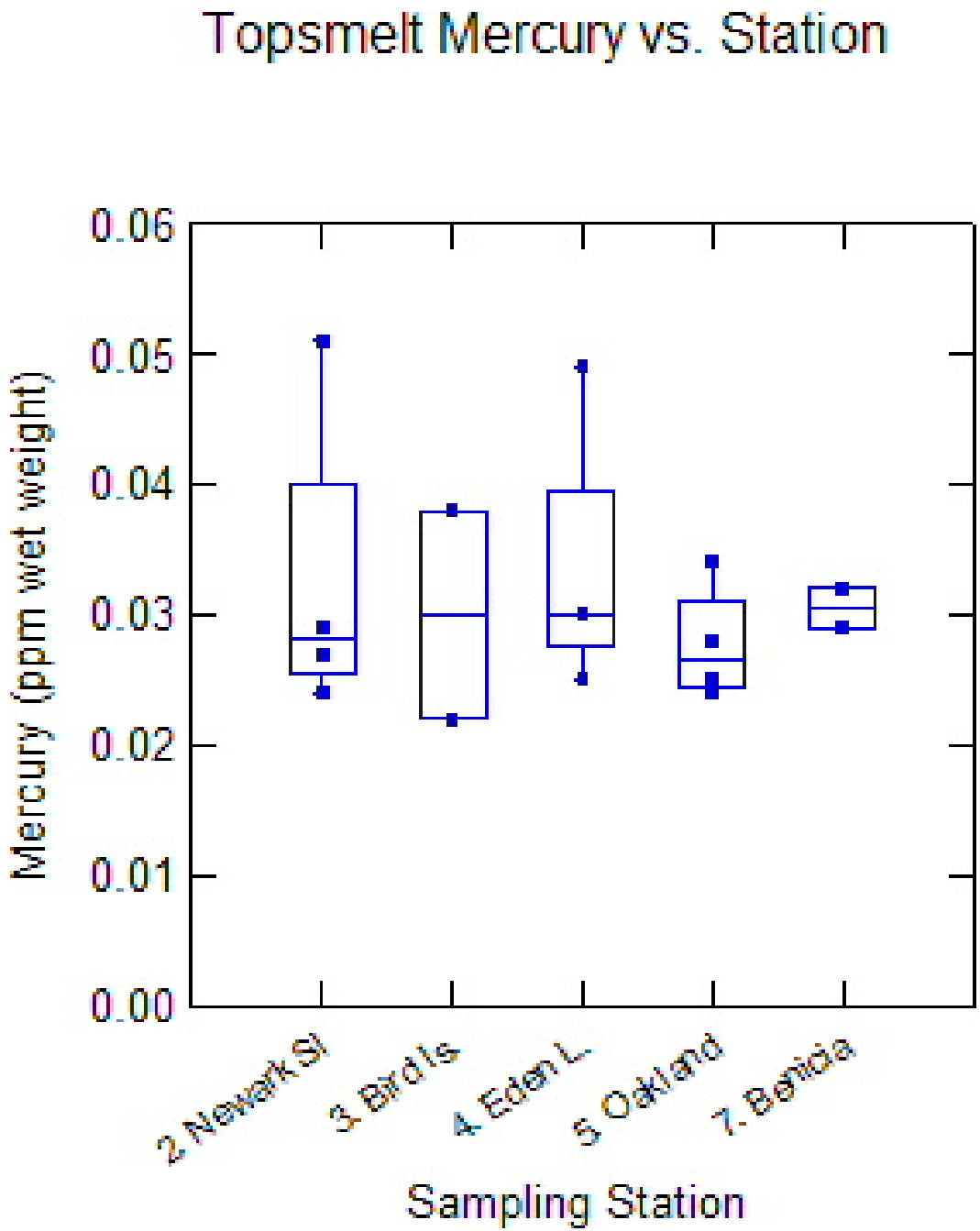
Spatial patterns

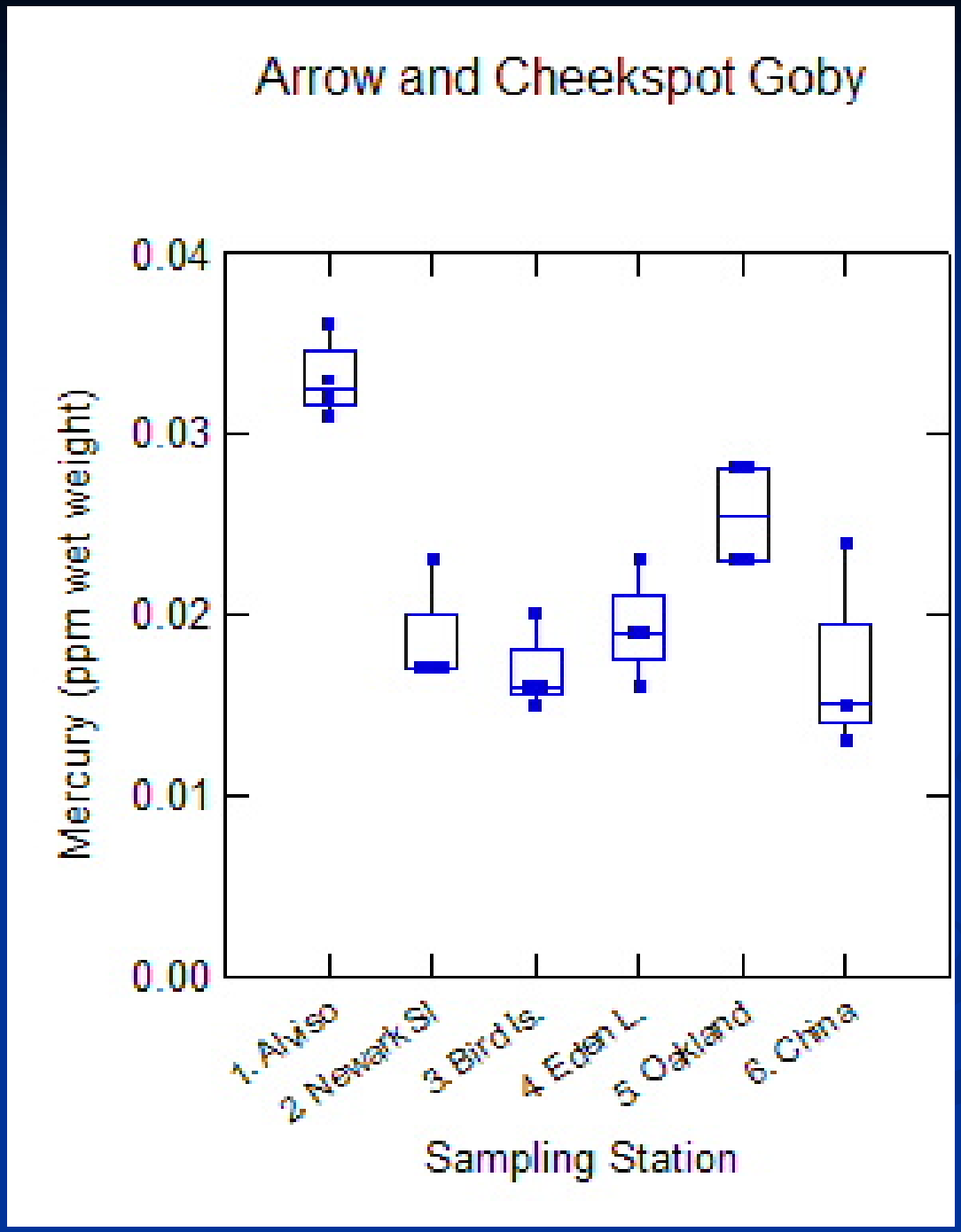
Mississippi Silverside Mercury vs. Station



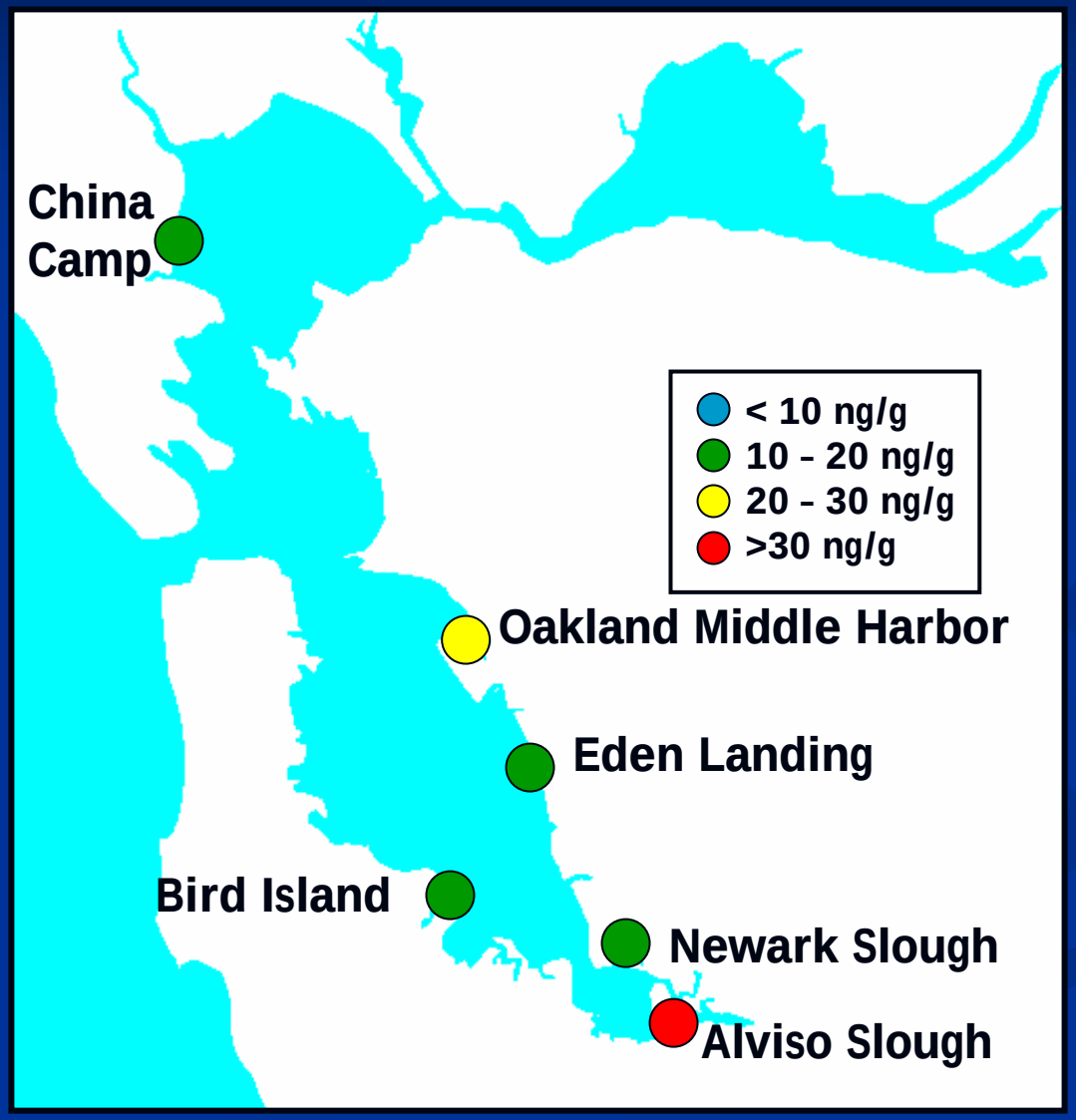
Spatial patterns - silverside




Topsmelt Mercury vs. Station
Mercury (ppm wet weight)
0.06
0.05
0.04
0.03
0.02
0.01
0.00
2. Newark Sl
3. Bird Is
4. Eden L.
5. Oakland
7. Benicia
Sampling Station


Arrow and Cheekspot Goby
Mercury (ppm wet weight)
0.04
0.03
0.02
0.01
0.00
1. Alviso
2. Newark Sl
3. Bird Is.
4. Eden L.
5. Oakland
6. China
Sampling Station

Spatial patterns - gobies



Comparison to fish/wildlife risk thresholds

Threshold	Endpoint	# Above	% Above
0.030	TMDL Target for wildlife (1)	37	41%
0.200	Fish growth, reproduction, development, behavior (2)	3	3%
0.130*	NOAEL for small sized piscivorous birds (3)	72	80%
1.440*	LOAEL for medium sized piscivorous birds (3)	1	1%

*** Tissue concentration dry weight**

Source
1. Johnson and Looker 2004
2. Beckvar et al. 2006
3. Calculated from BTAG Toxicity Reference Values

Summary

- Variation among species
  - Mississippi Silverside > Topsmelt > Arrow/Cheekspot Gobies > Bay Goby
- Variation among stations
  - Alviso Slough generally elevated
  - Southern stations elevated in silversides (Alviso, Newark, Bird Island)

Future Steps

- Evaluate species selection
  - Are we on the right track with chosen species?
- Evaluate sample sizes and study design
  - Power analysis
- Estimate wildlife risk
- Long-term trend evaluation

Thanks to...

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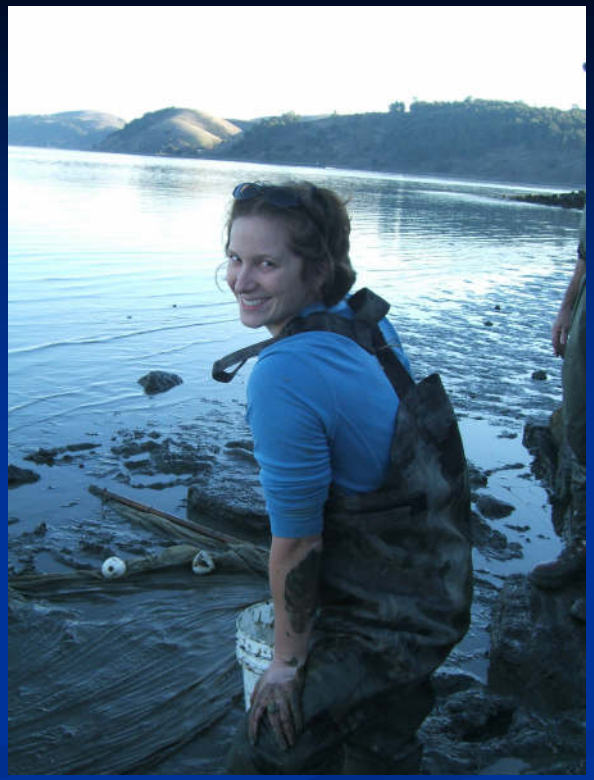

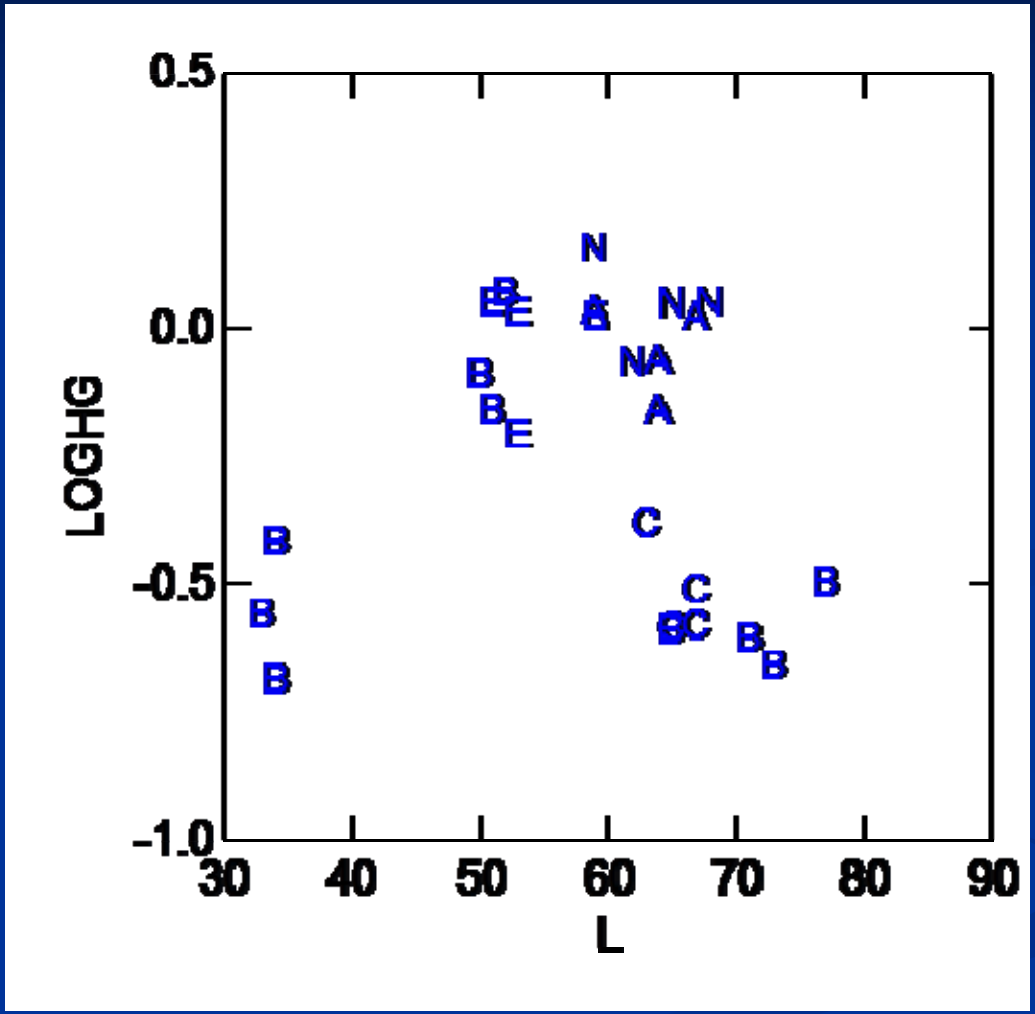
0.5
0.0
-0.5
-1.0
LOGHG
30
40
50
60
70
80
90
L