The RMP Mercury Strategy

Goal: Collect data to support management decisions

Priority Questions

1. Where and when is mercury entering the food web?
2. What are the high leverage processes, sources, and pathways?
3. What are the best opportunities for management intervention?
4. What are the effects of management actions?
5. Will total mercury reductions result in reduced food web accumulation?

Reducing Methylmercury Accumulation in the Food Webs of San Francisco Bay and Its Local Watershed

Jay Davis, Don Yee, Letitia Grenier, Lester McKee, Ben Greenfield

San Francisco Estuary Institute

Richard Looker, Carrie Austin

San Francisco Bay Regional Water Quality Control Board

Mark Marvin-DiPasquale

U.S. Geological Survey

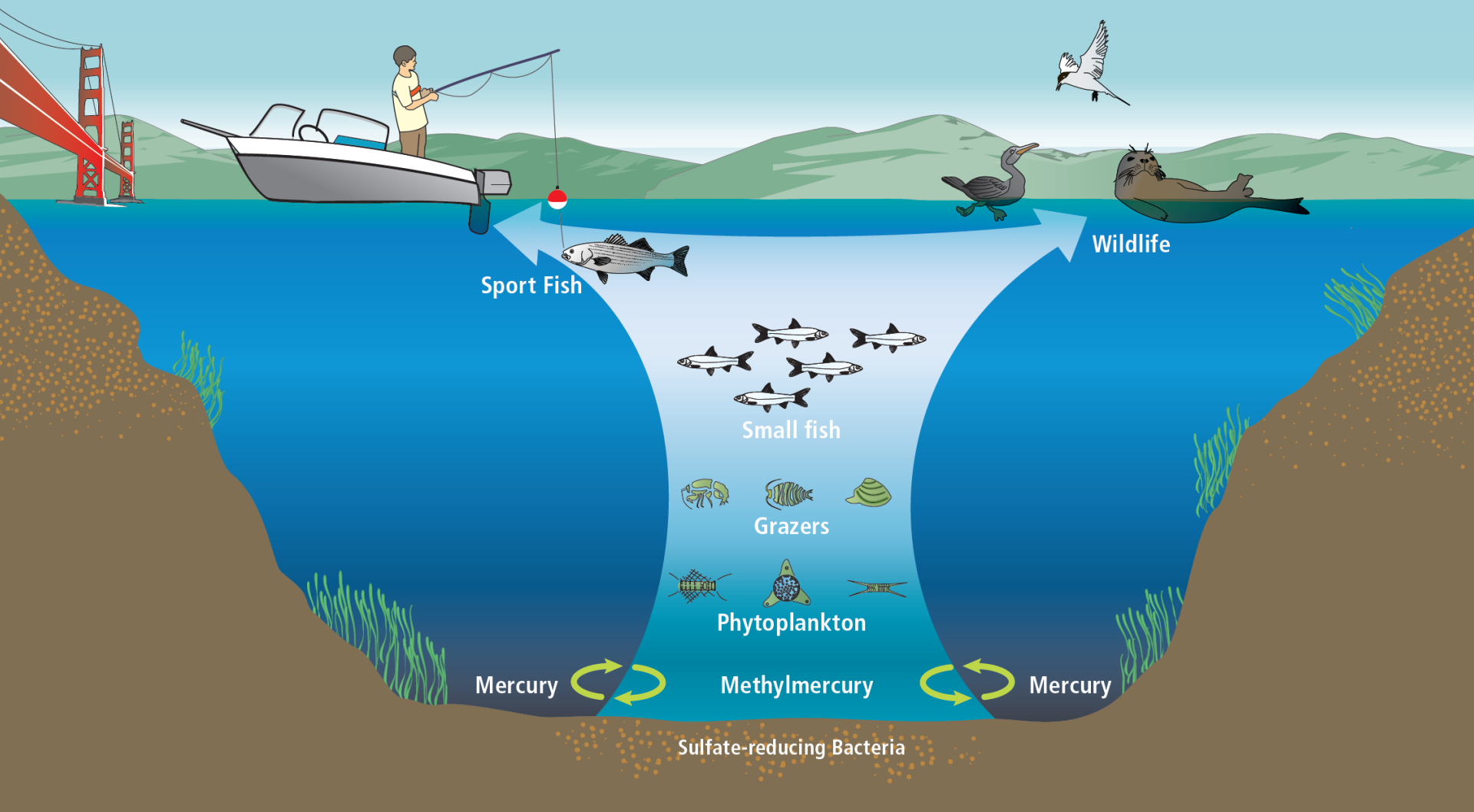
Robert Brodberg

California Office of Environmental Health Hazard Assessment

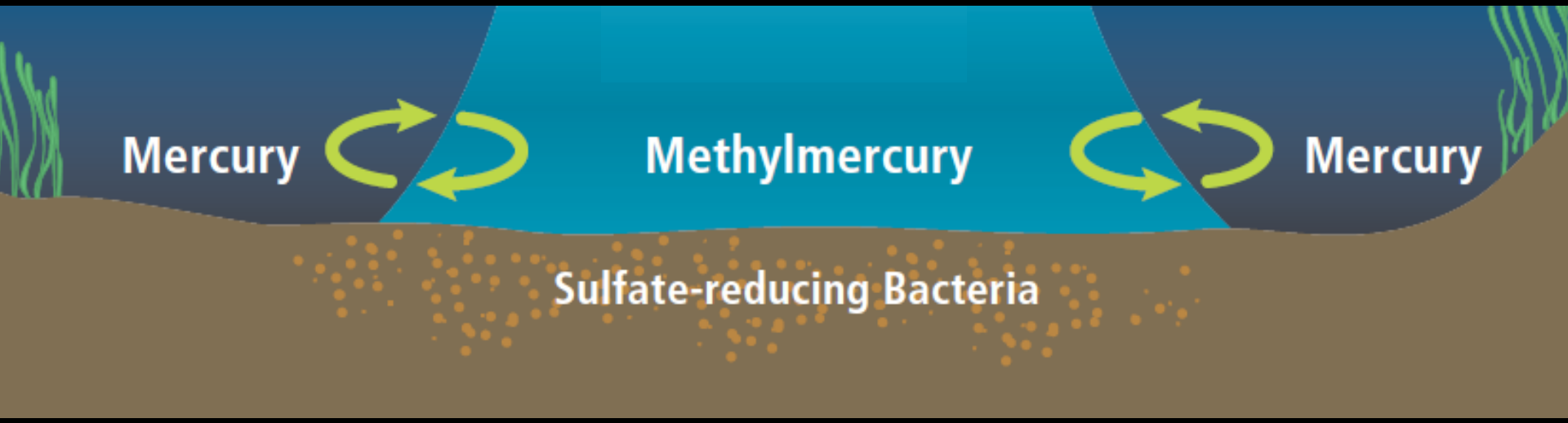
Joel Blum

University of Michigan

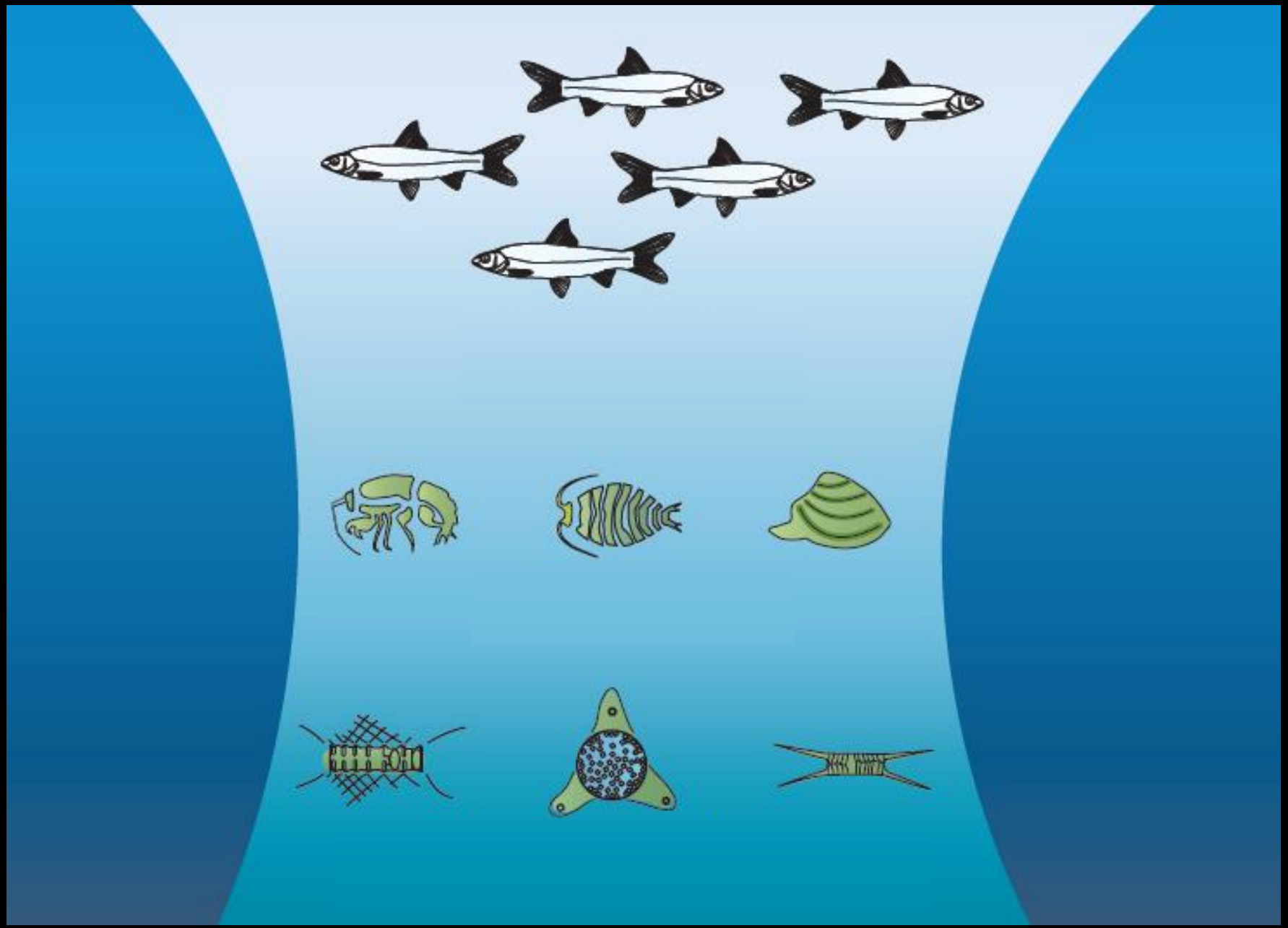
Mercury 101


Wildlife
Sport Fish
Small fish
Grazers
Phytoplankton
Mercury
Methylmercury
Mercury
Sulfate-reducing Bacteria

Potential Intervention Points: Part 1



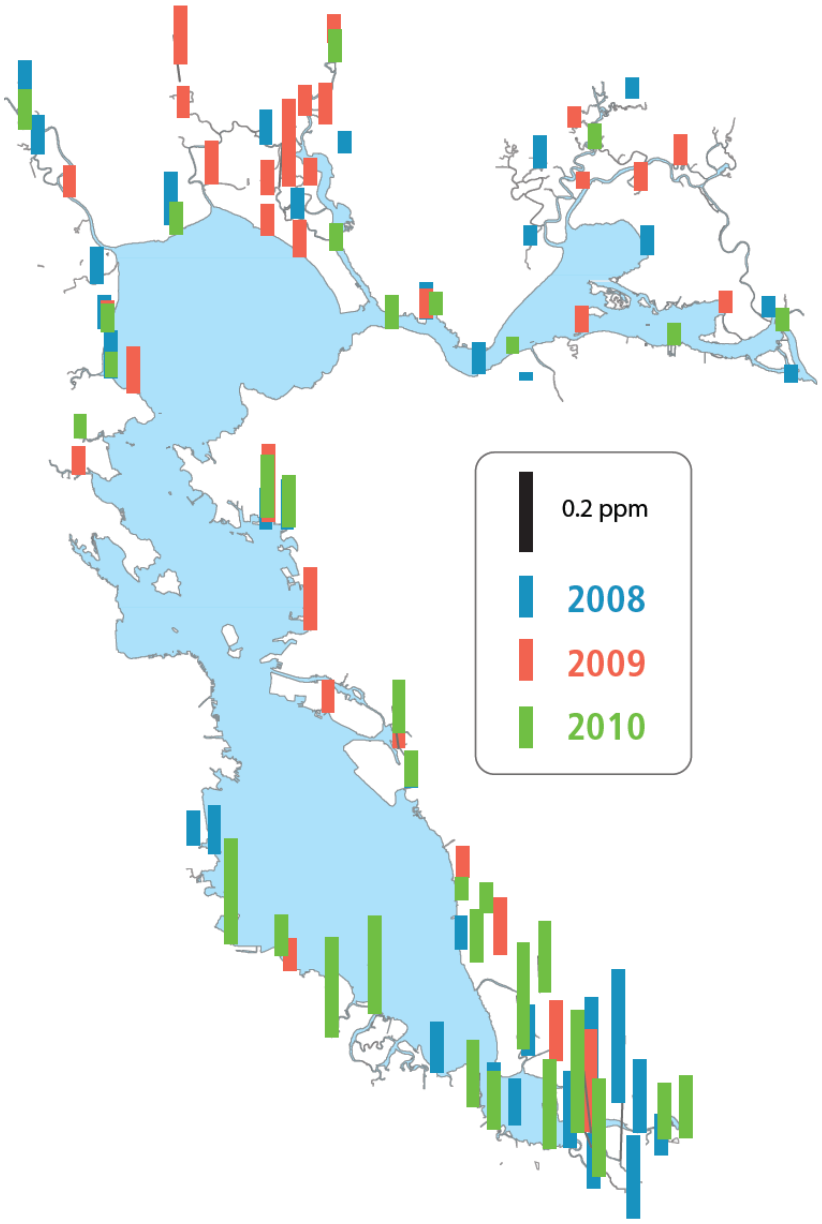
Potential Intervention Points: Part 2



What have we learned in the last few years?

Small Fish Survey

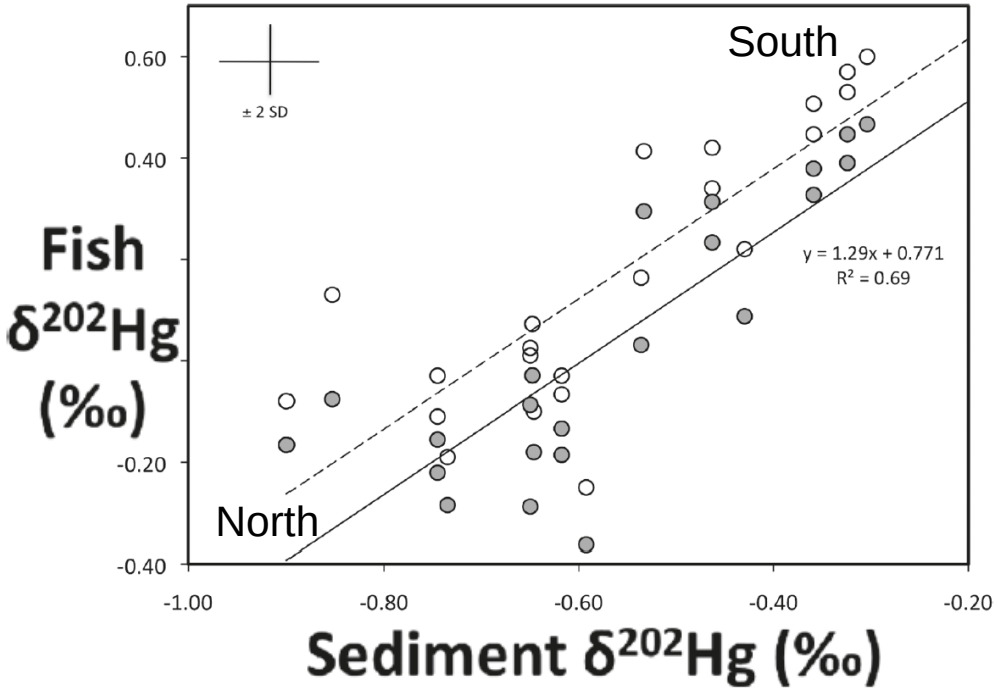
- Questions 1 and 2
- Few samples below the TMDL target
- Regional variation
- No clear high leverage pathways



Mercury concentrations (ppm) in silverside from 2008-2010.

Hg Isotope Study

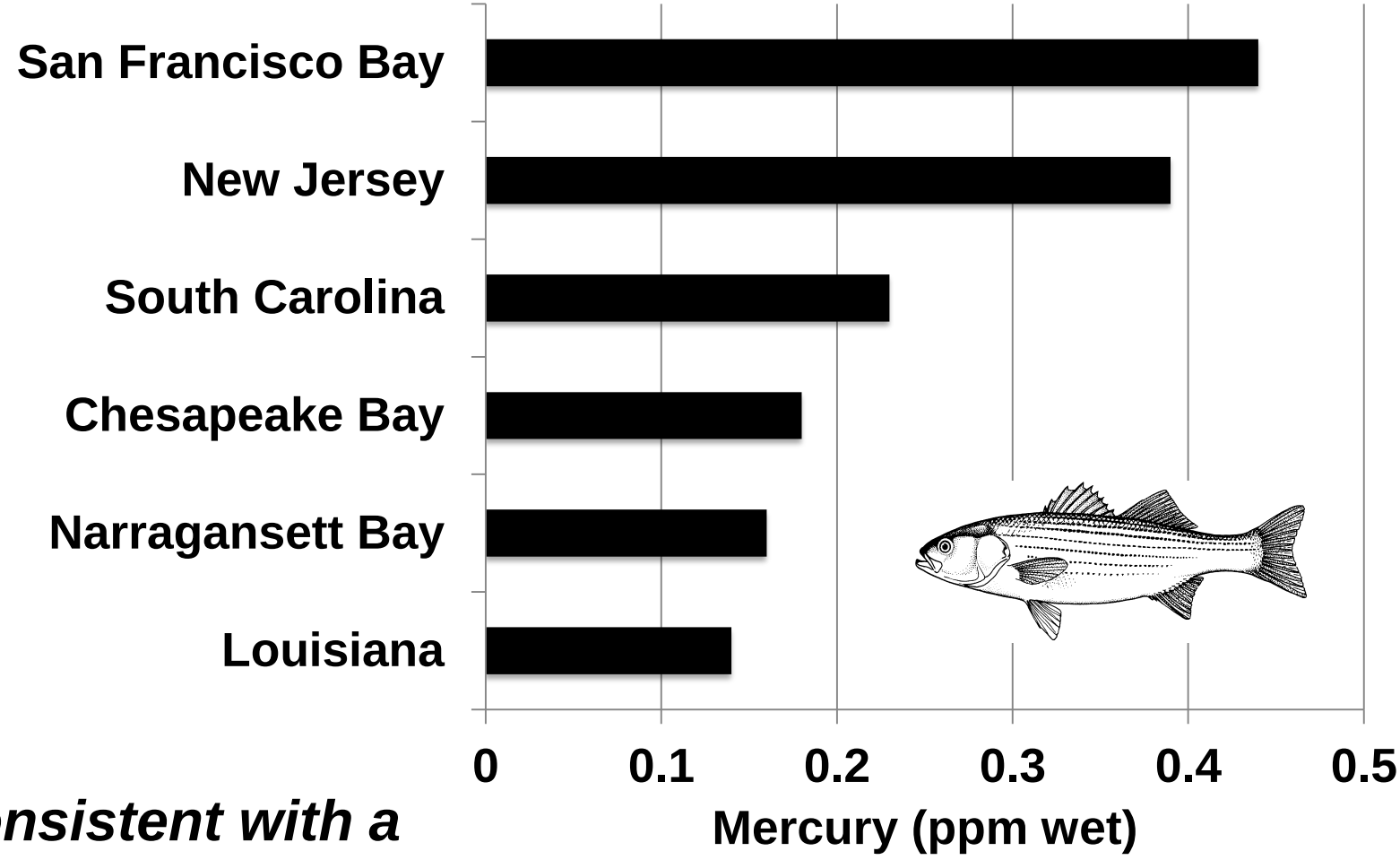
- Questions 2 and 5
- Legacy Hg matters
- Hg from historic mining regions is clearly a concern
- Elemental Hg from gold mining, urban/industrial, and atmosphere is also important



Gehrke et al. 2011. ES&T 45 (4), pp 1264–1270

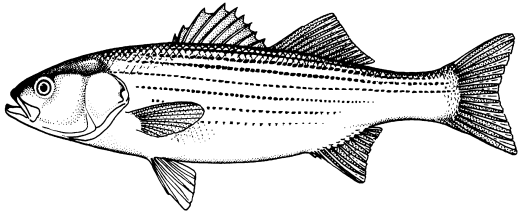
Total Hg reductions will lower food web Hg

Sport Fish: Striped Bass



Consistent with a large role of the mining legacy

Sport Fish: Striped Bass



ATL - no consumption
TMDL Target
ATL - 2 servings per week

Also consistent with legacy influence

Methylmercury Concentration (ppm)

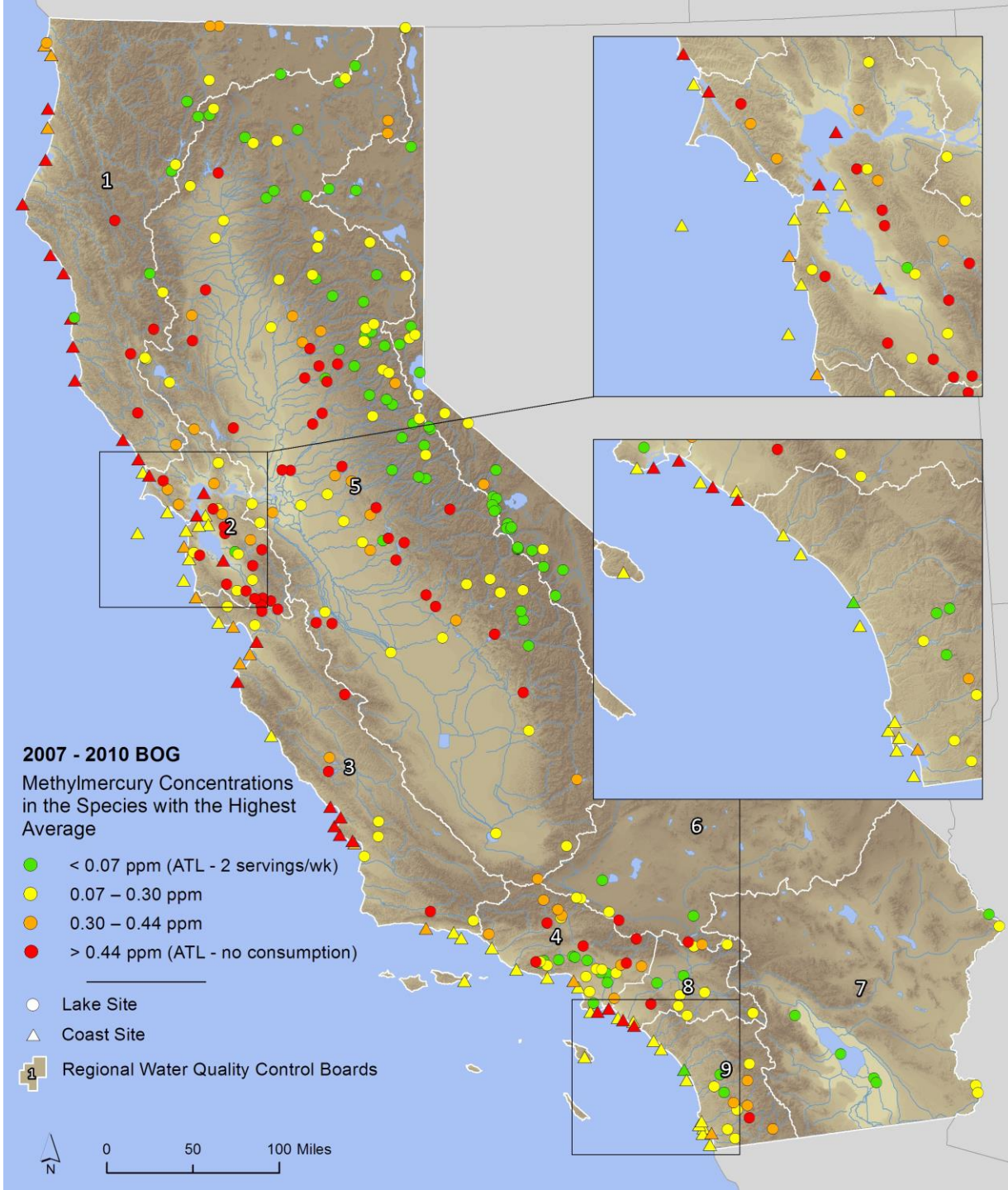
0.0
0.5
1.0
1.5
2.0

1971
1972
1994
1997
1999
2000
2003
2006
2009

Statewide Sport Fish Surveys

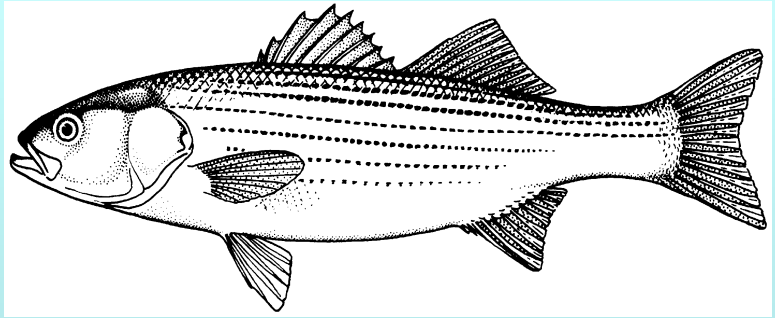
- SWAMP
- Finding accumulation in even the most remote corners of the state

Atmospheric deposition probably contributes too



Is there anything we can do to reduce food web methylmercury in the next 10-20 years?

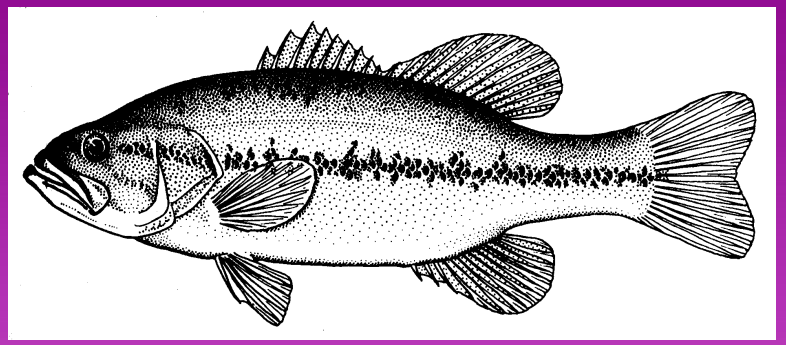
Open Bay



Tidal Marsh

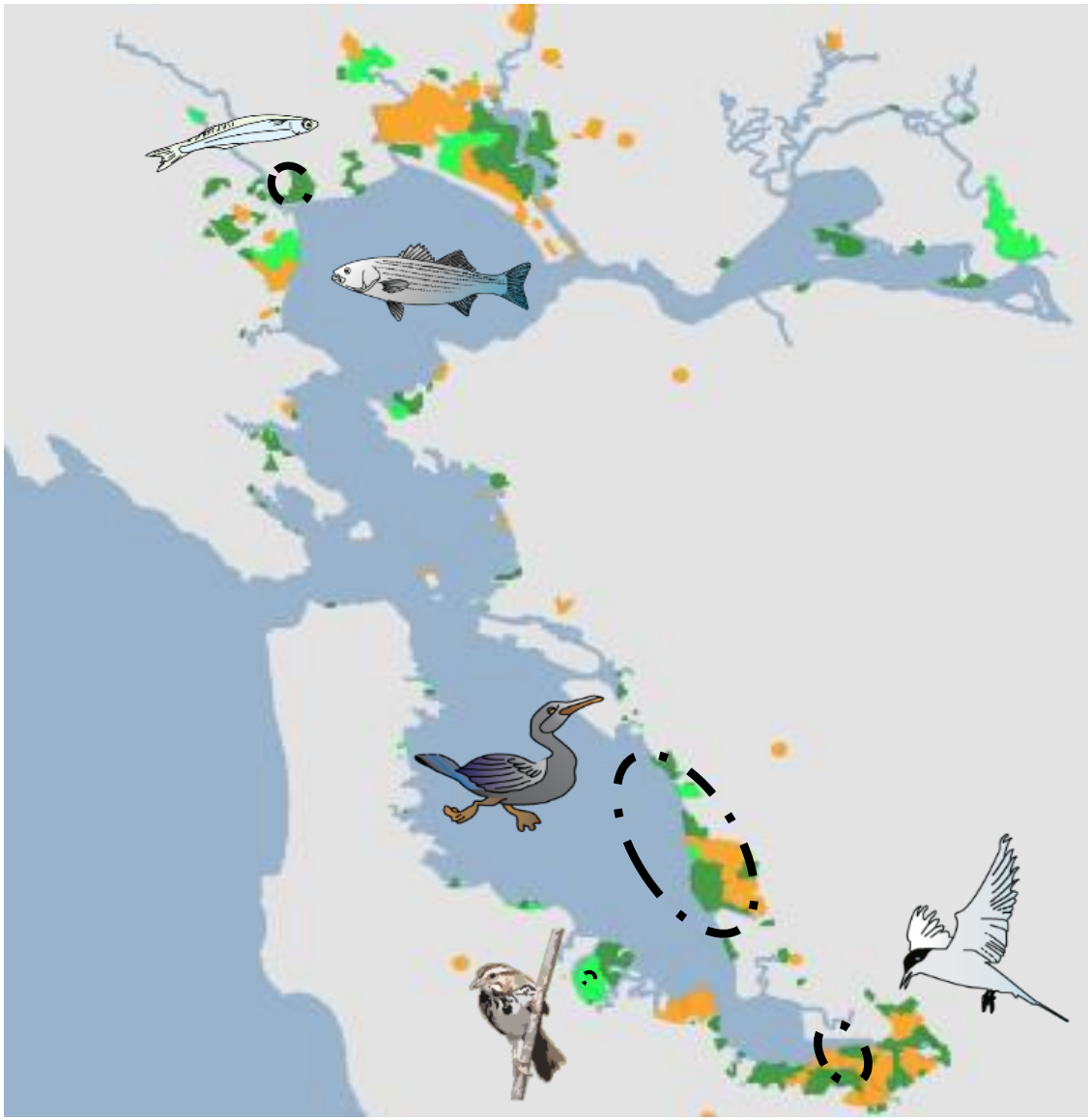
Managed Pond

Reservoir



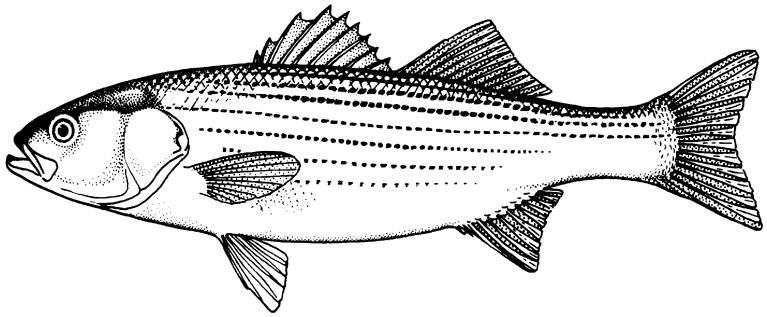
Biosentinels

- Link to beneficial uses
- Integrate over space and time
- Indicate mercury exposure in particular:
  - Habitat or habitats
  - Part of the food web
  - Spatial area
  - Period of time



Open Bay: Possible Knobs

- Elective strategies
  - Slow knobs
    - THg inputs: mining region runoff, urban runoff
  - Fast knobs
    - Nutrient control?
- Non-elective changes
  - Suspended sediment regime
  - Food web shifts
  - Temperature change
  - Sea level rise



Tidal Marsh

Knobs

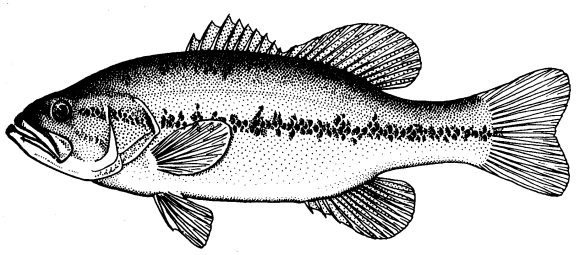
- Elective strategies
  - Slow knobs
    - THg inputs
  - Fast knobs
    - Restored marsh design and placement
- Non-elective changes
  - Suspended sediment regime
  - Temperature change
  - Food web shifts
  - Sea level rise

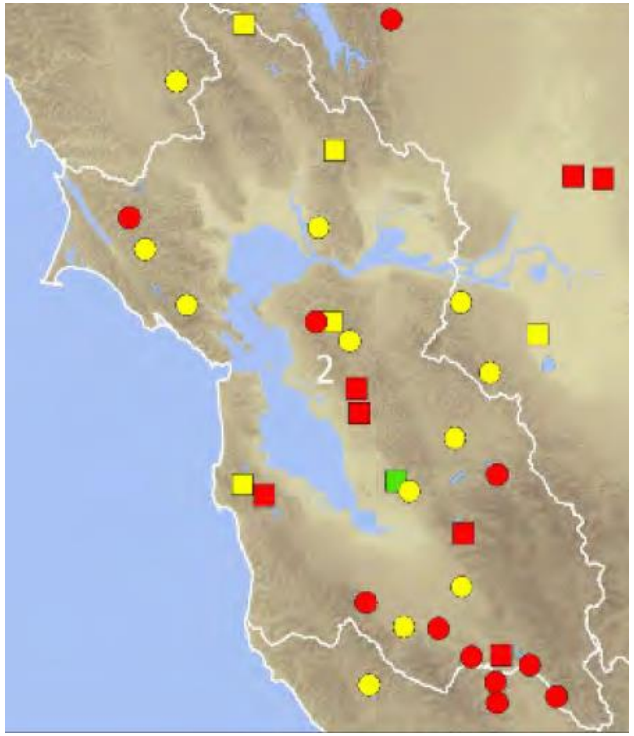
Managed Pond

Knobs

- Elective strategies
  - Slow knobs
    - THg inputs
  - Fast knobs
    - Pond design and placement
    - Pond management
- Non-elective changes
  - Temperature change
  - Food web shifts
  - Sea level rise

Reservoir

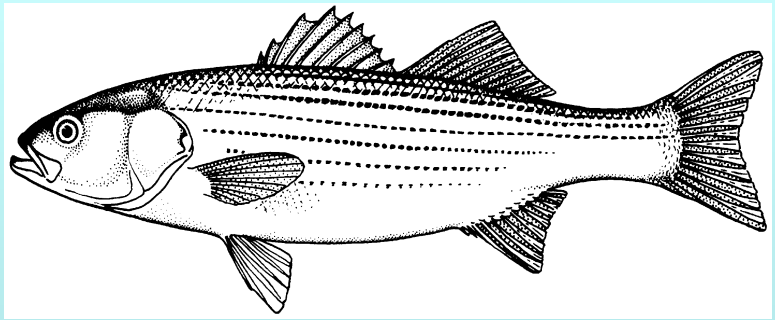




Knobs

- Elective strategies
  - Slow knobs
    - THg inputs
  - Fast knobs
    - Water management
    - Water chemistry
    - Fishery management
- Non-elective changes
  - Temperature change
  - Food web shifts

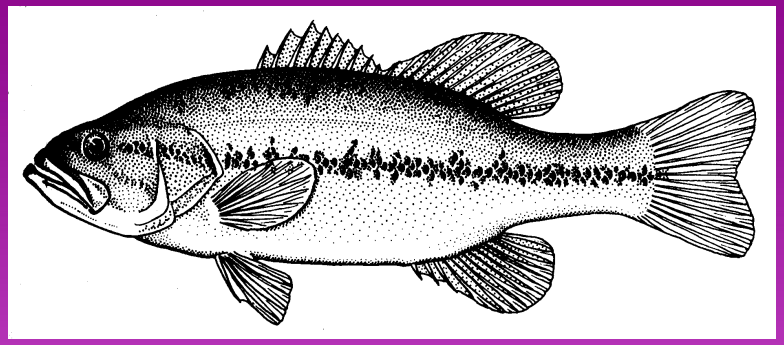
Open Bay



Tidal Marsh

Managed Pond

Reservoir



How should we monitor tidal marsh restoration projects to support decision-making and adaptive management?

Tidal Marsh

RMP – Focus on regional perspective

Monitoring also crucial at local scale


jay@sfei.org
www.sfei.org

SF Estuary Endemic Birds and Mammals

- Tidal Marsh

Clapper Rail	*Rallus longirostris obsoletus*	San Francisco Bay
Common Yellowthroat	*Geothlypis trichas sinuosa*	San Francisco Bay
Song Sparrow	*Melospiza melodia samuelis*	San Pablo Bay
	M. m. pusillula	San Francisco Bay
	M. m. maxillaris	Suisun Bay
Ornate shrew	*Sorex ornatus sinuosus*	San Pablo Bay
Wandering shrew	*Sorex vagrans halicoetes*	South San Francisco Bay
Salt marsh harvest mouse	*Reithrodontomys raviventris raviventris*	San Francisco Bay
	R. r. halicoetes	San Pablo and Suisun Bays
California vole	*Microtus californicus paludicola*	San Francisco Bay
	M. c. sanpabloensis	San Pablo Bay

- Bay