

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

Jay Davis, Letitia Grenier, Don Yee, 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

ICMGP

July 2011



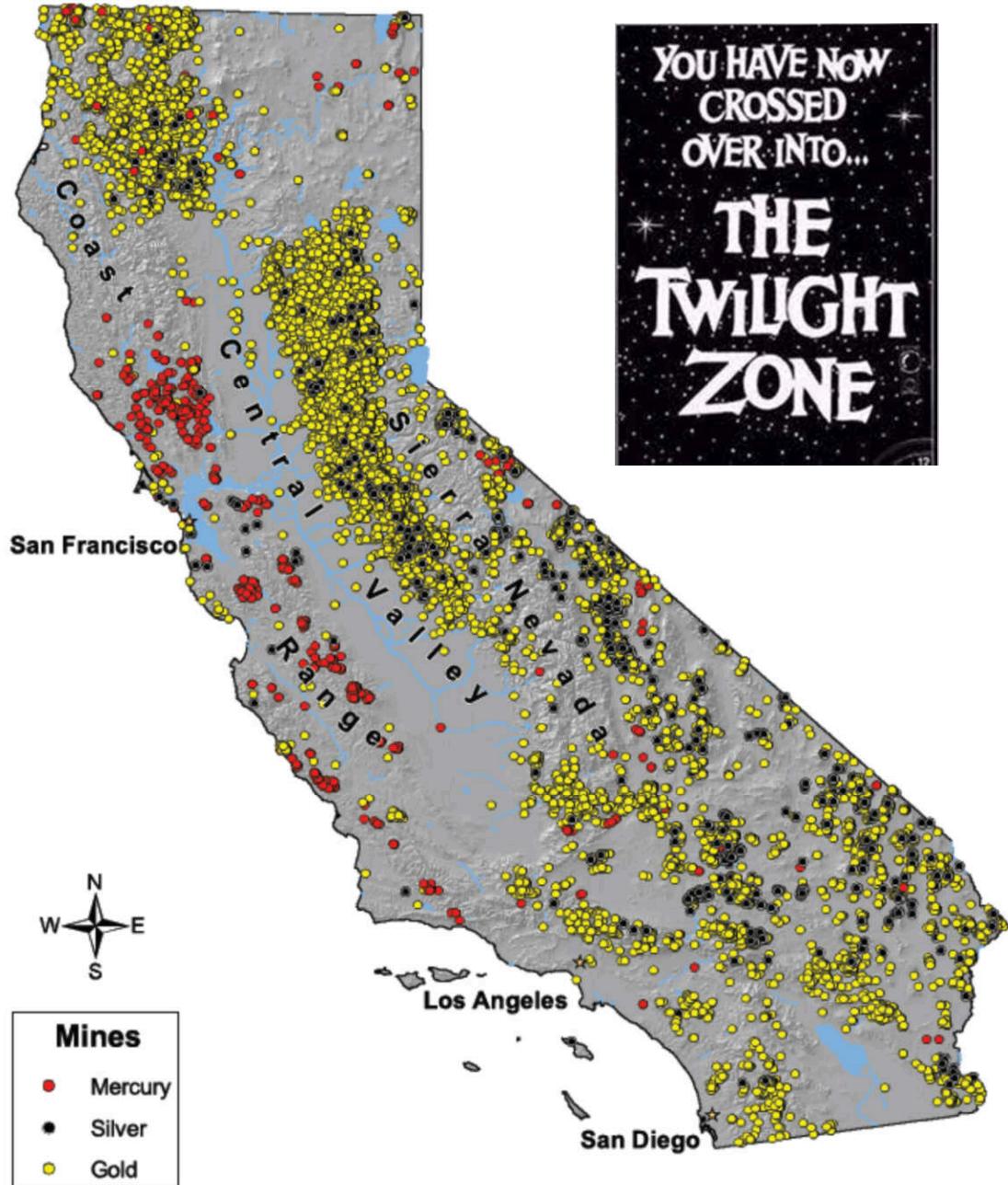
Interesting Case Study: Features Typical of Estuaries

- Sediment retention
- Dense population
- Urban and industrial
- High productivity
- Food web contamination



Interesting Case Study: Atypical Features

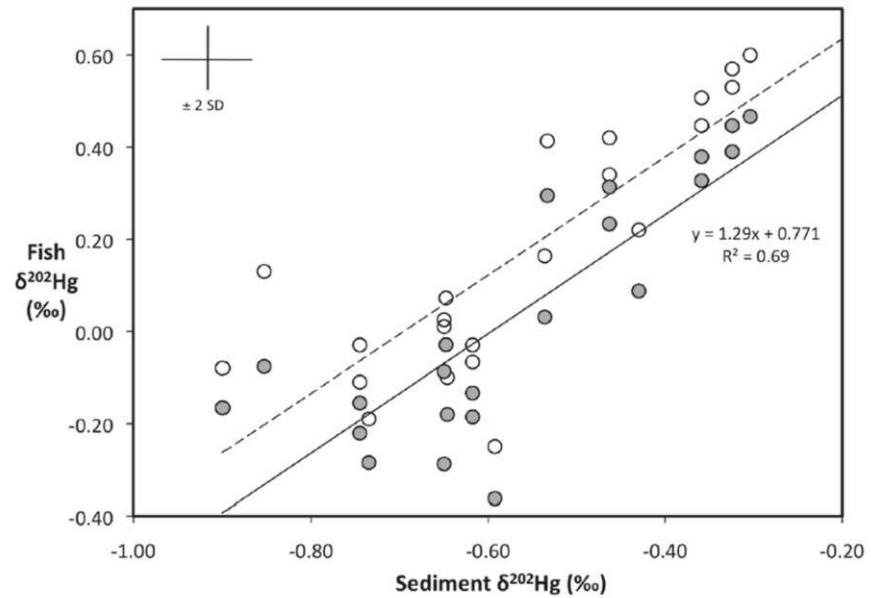
- Mining legacy
- Lack of local atmospheric sources
- Unusual speciation
- Erosional sediment regime
- Extensive wetland restoration
- Not eutrophic
- Thorough monitoring



From Wiener and Suchanek (2009). Ecological Applications 18(8) Supplement: A3-A11.

Mining legacy Hg matters

- Isotopes
- Spatial patterns
- Even Hg in cinnabar and related forms makes it into the food web
- Sediment from historic mining regions is clearly a concern
- Elemental Hg from gold mining, urban/industrial, and atmosphere is also important



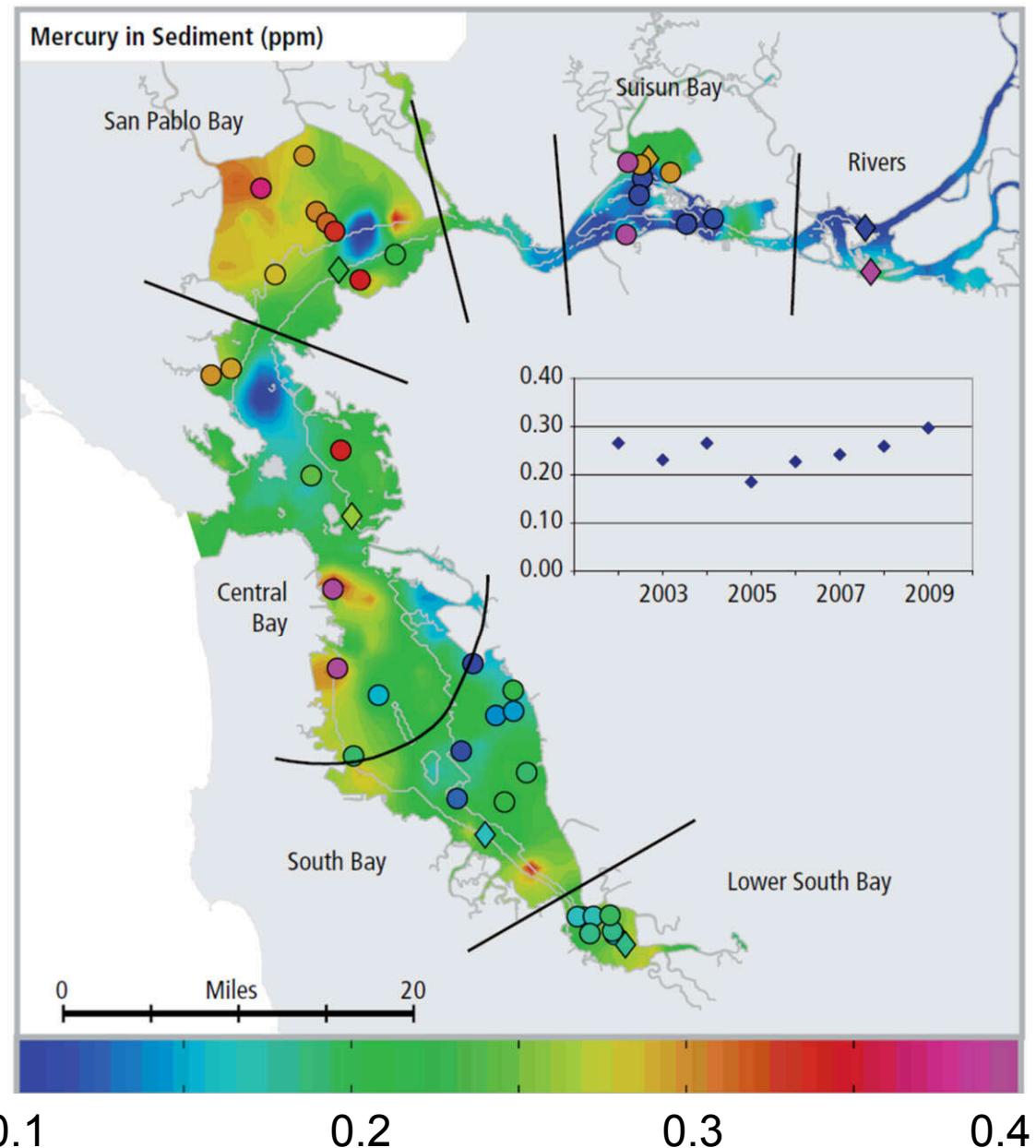
Gehrke et al. 2011. ES&T 45 (4), pp 1264–1270

***Fluvial inputs of THg
should be controlled***
***Atmospheric deposition
is a secondary concern***

THg in Sediment

- 2002-2009
- 378 data points
- Average 0.25 ppm
- Regional variation

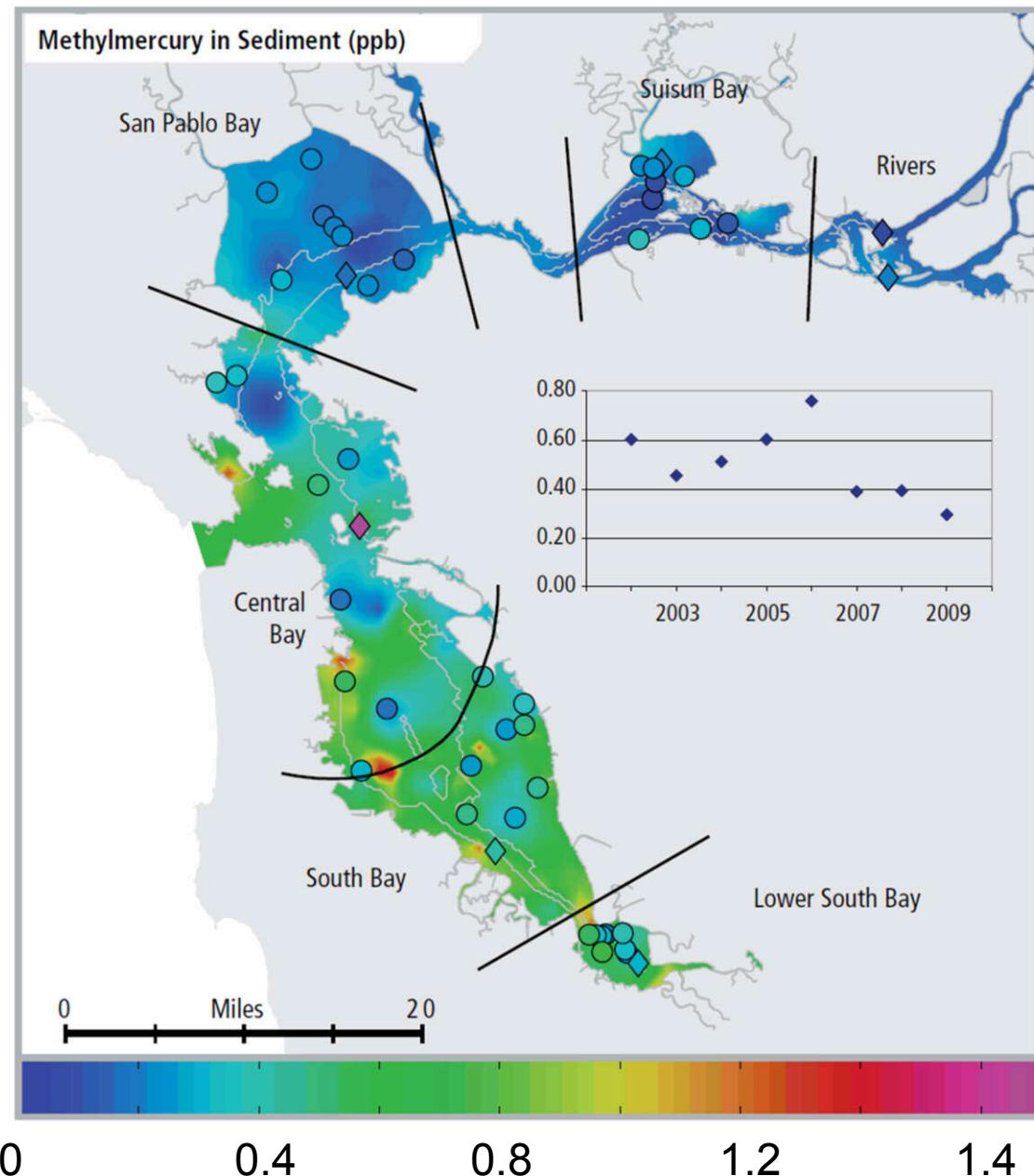
There is a lot of THg in circulation and it is thoroughly mixed



MeHg in Sediment

- 2002-2009
- Average 0.5 ppb
- Contrasting regional pattern to THg

Internal net MeHg production dominates the mass budget and is another possible intervention point



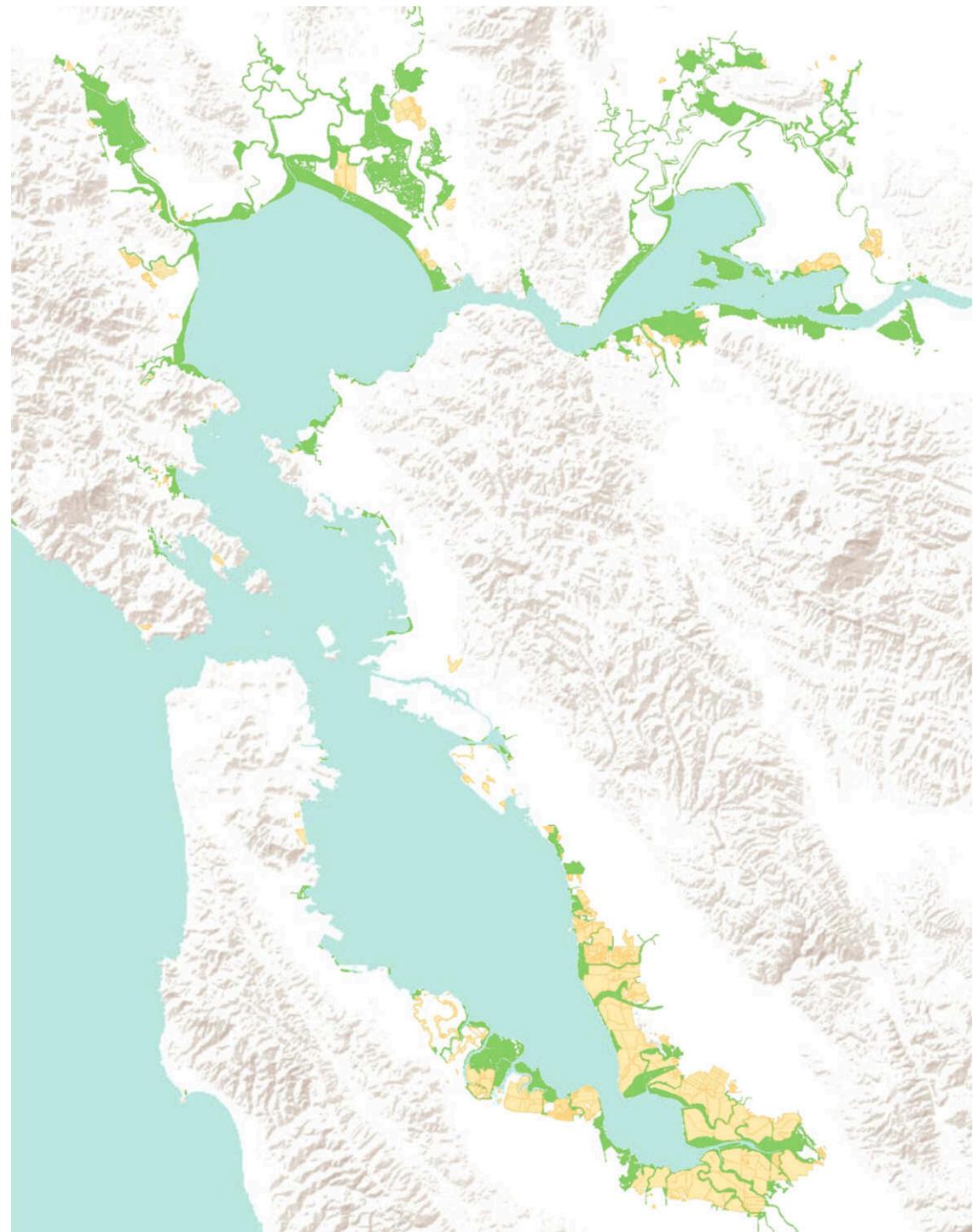
Habitats

Open Bay

Tidal Marsh

Managed Pond

Reservoir



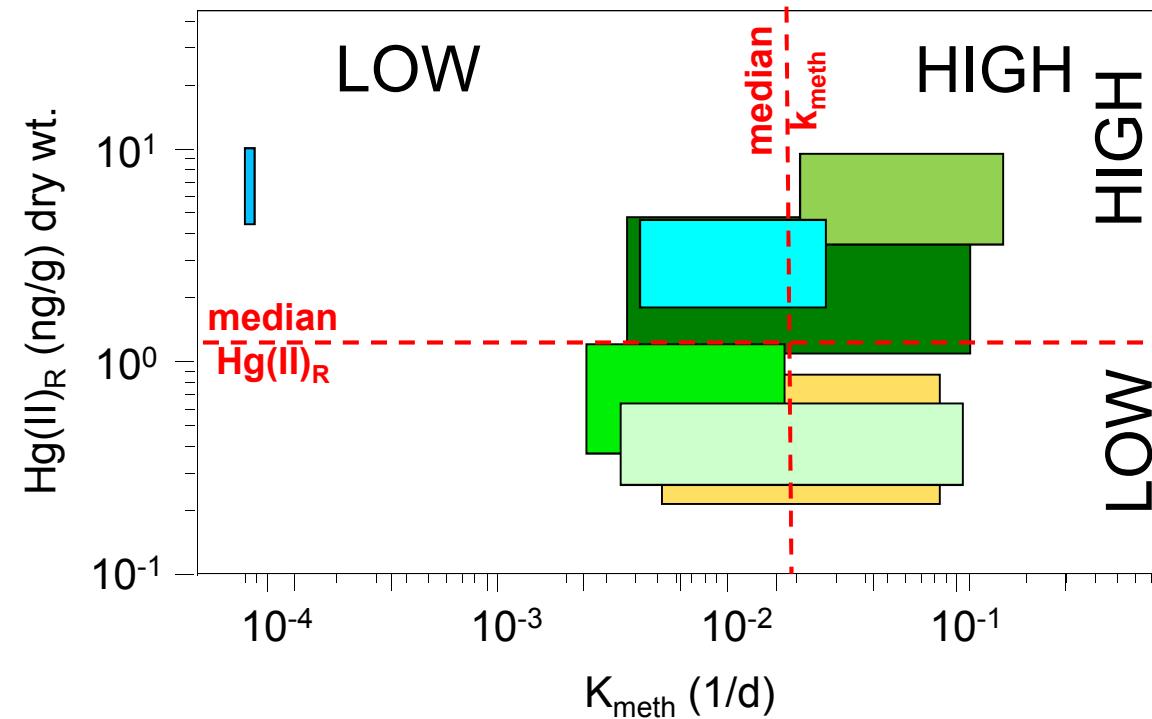
MeHg production varies by habitat

North & Central SFB

- Bay subtidal
- marsh plain
- marsh slough

South SFB

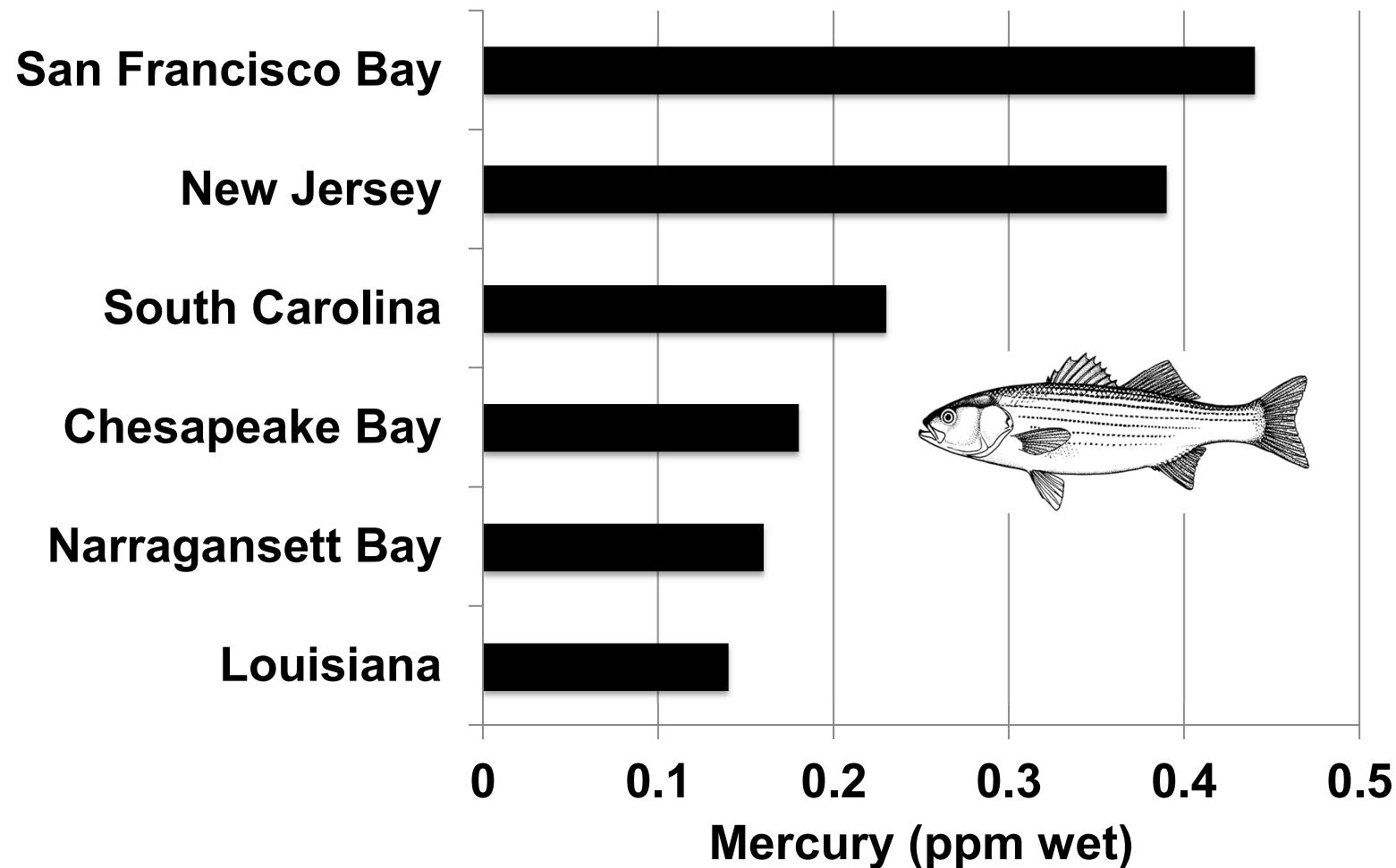
- Bay subtidal
- marsh plain
- marsh slough
- salt pond



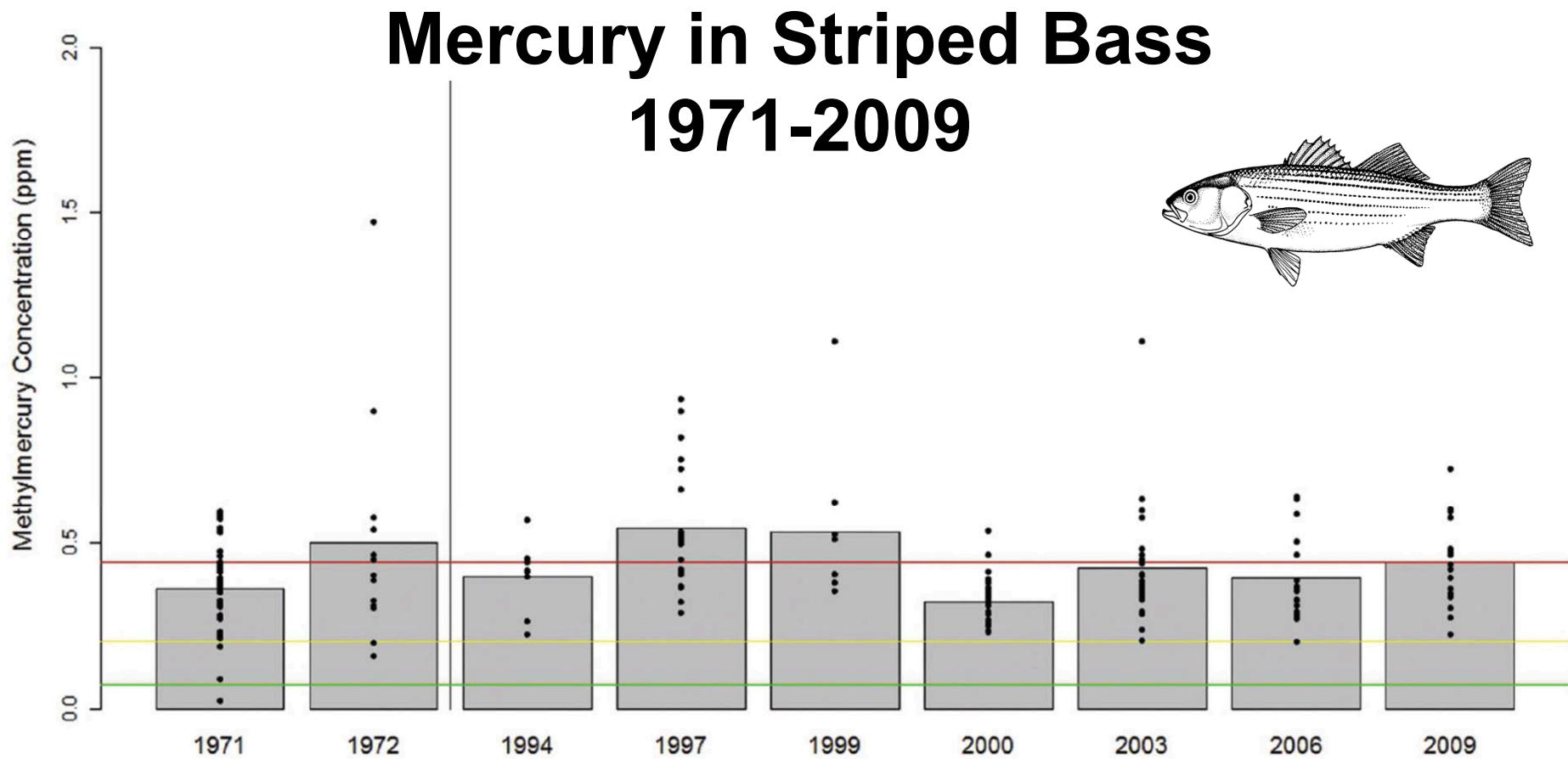
And so does degradation

Open Bay: Risk Indicator

Mercury in Striped Bass



Open Bay: Risk Indicator

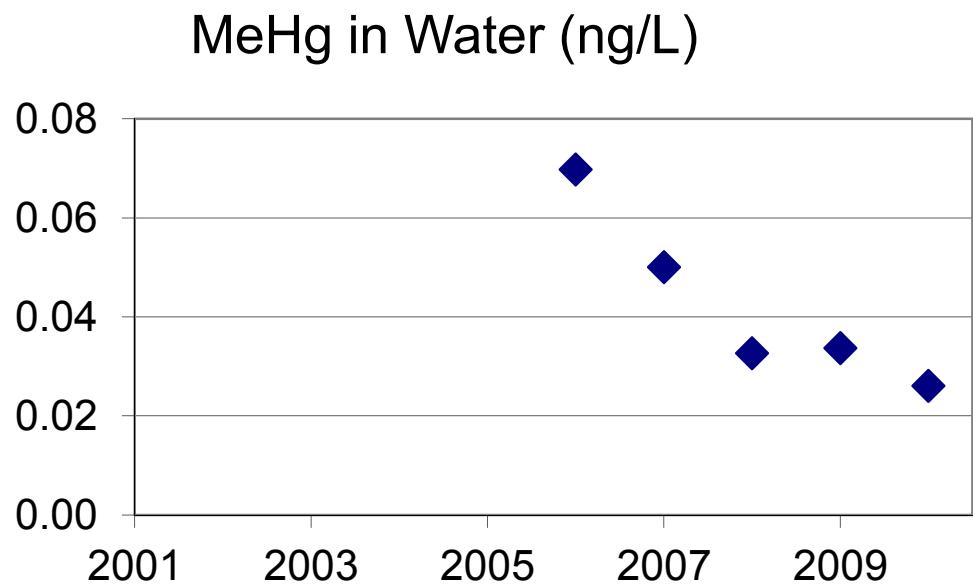
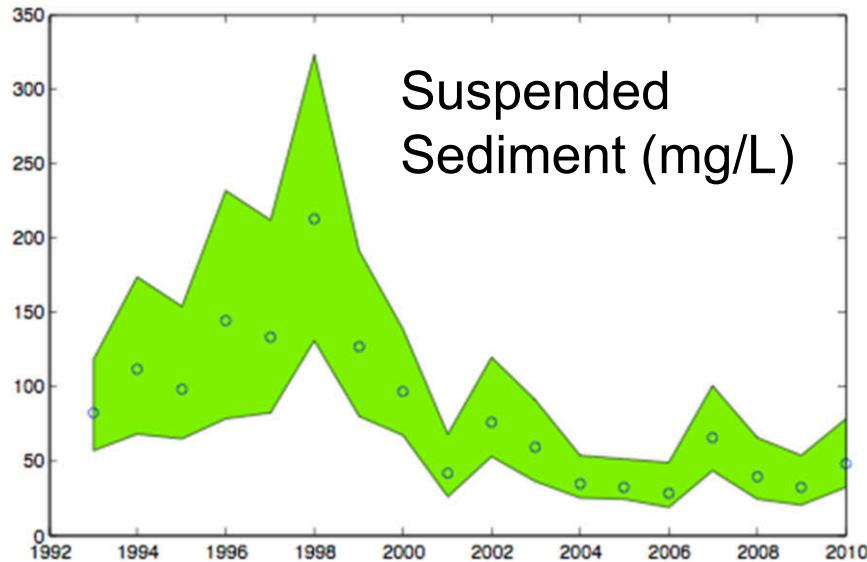


Open Bay: Possible Knobs

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

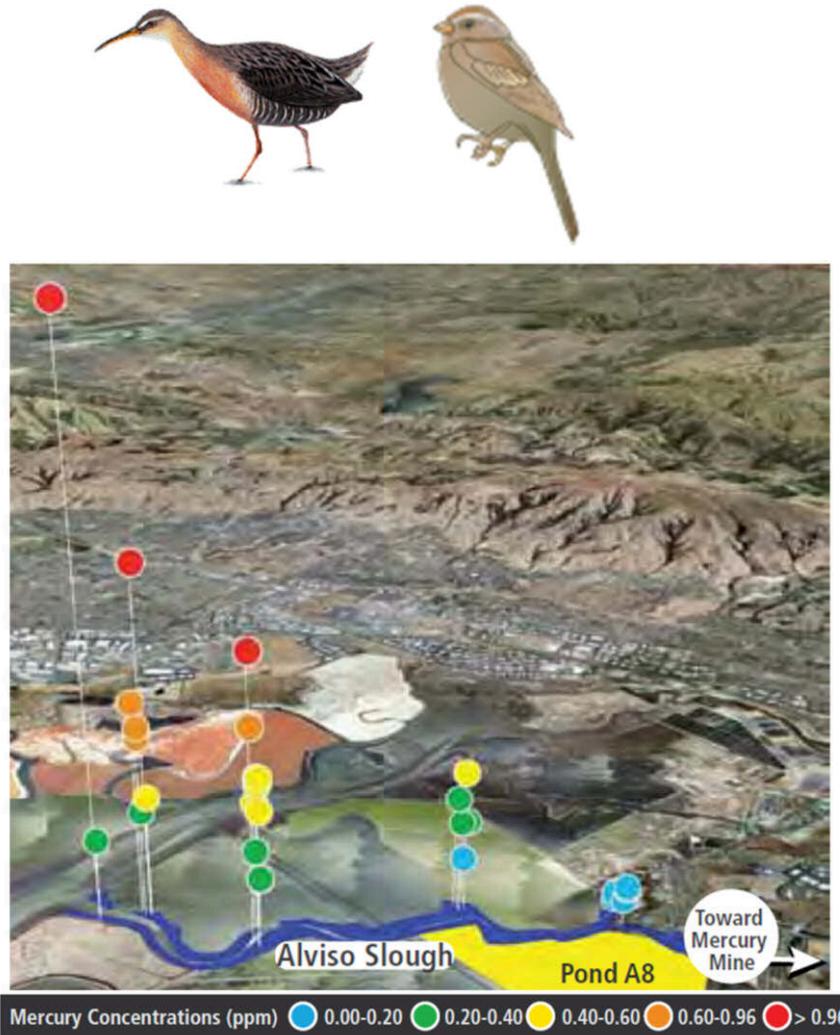


Open Bay: Non-elective Change



Tidal Marsh

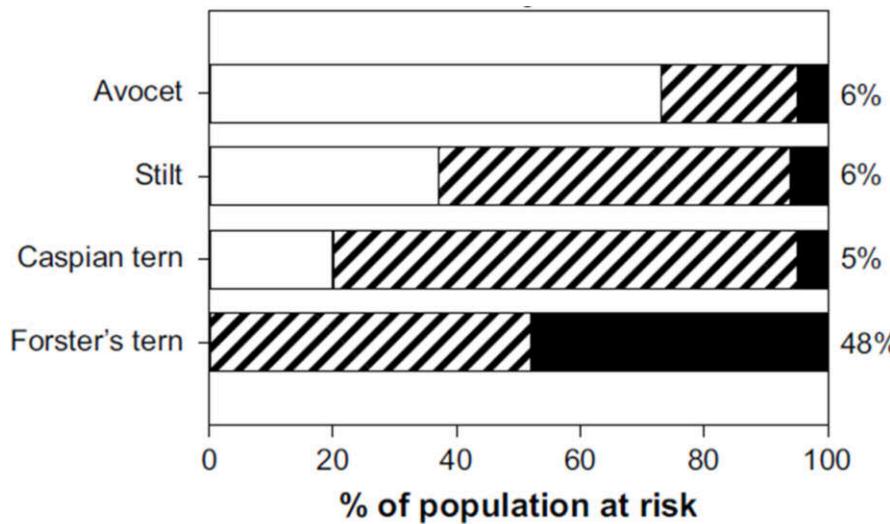
Risk Indicators



Knobs

- Elective strategies
 - Slow knobs
 - THg inputs: mining region runoff, urban runoff
 - Faster knobs
 - Design of restored marshes
- Non-elective changes
 - Temperature change
 - Food web shifts

Managed Pond

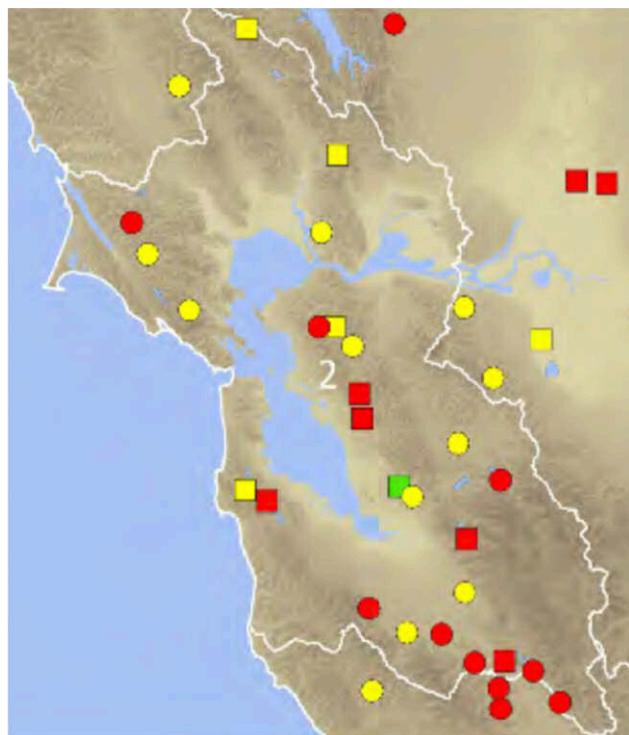
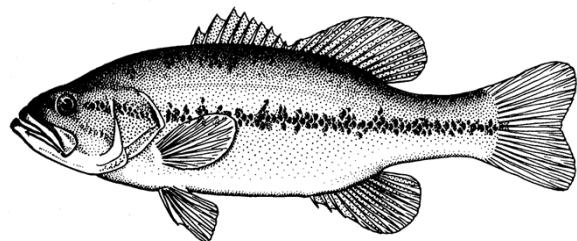


Knobs

- Elective strategies
 - Slow knobs
 - THg inputs: mining region runoff, urban runoff
 - Faster knobs
 - Pond management
 - Pond placement
- Non-elective changes
 - Temperature change
 - Food web shifts

Eagles-Smith et al. 2009. Environ Pollut 157: 1993-2002.

Reservoir



Knobs

- Elective strategies
 - Slow knobs
 - THg inputs: mining region runoff, urban runoff
 - Faster knobs
 - Water management
 - Water chemistry
 - Fishery management
- Non-elective changes
 - Temperature change
 - Food web shifts

To be submitted to
Environmental Research

jay@sfei.org

www.sfei.org

