

Bioaccumulation Monitoring in Changing Landscapes: A 50 Year Vision



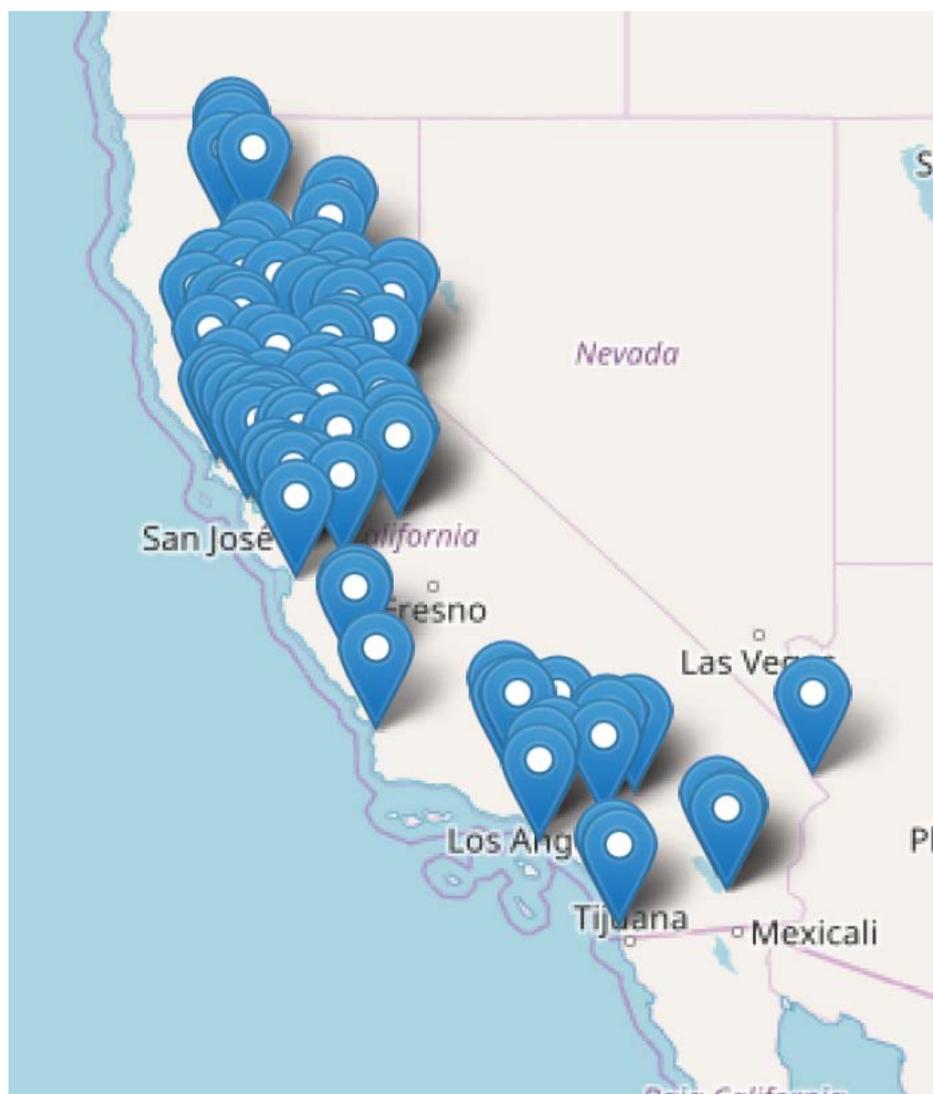
Jay Davis, SFEI
June 21, 2018

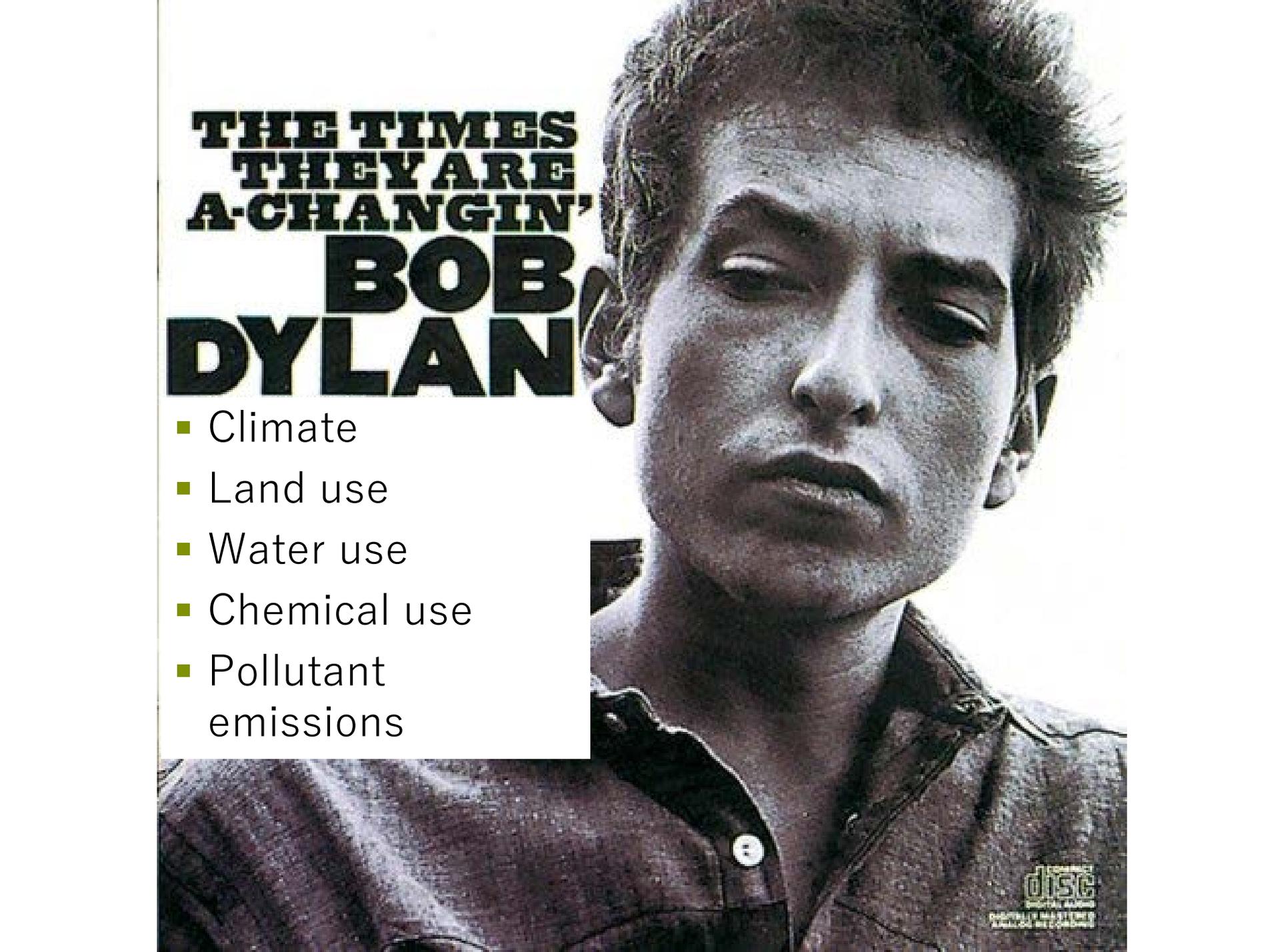


California has a bioaccumulation problem

- Fish advisories in California
- Statewide advisories for the coast and lakes and reservoirs
- What does the future hold?

Locations of Fish Advisories





**THE TIMES
THEY ARE
A-CHANGIN'
BOB
DYLAN**

- Climate
- Land use
- Water use
- Chemical use
- Pollutant emissions

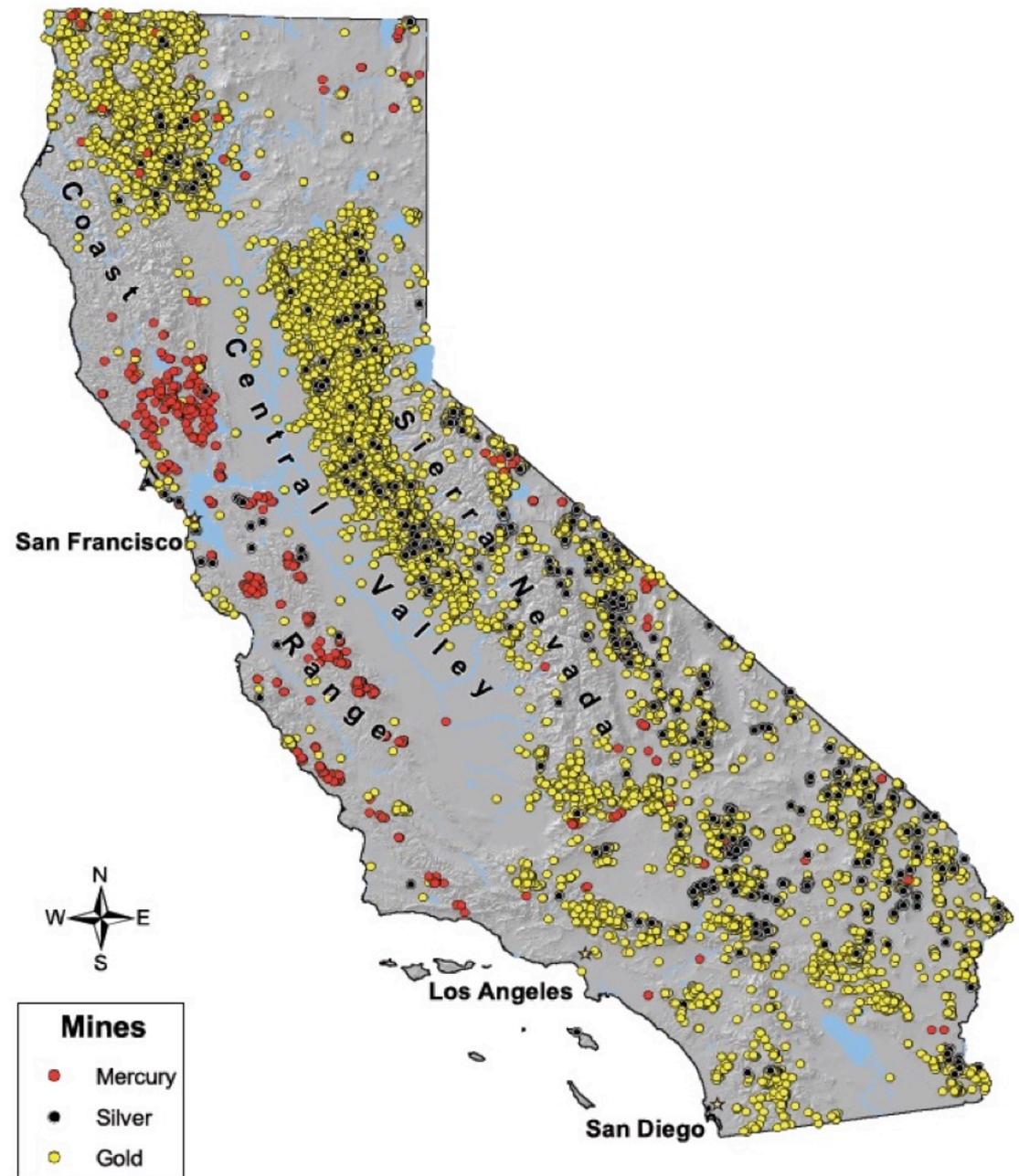
Long-term Forecast for Bioaccumulative Contaminants

- Different stories for different contaminants
 - **Mercury**
 - PCBs
 - **Algal toxins**
 - Selenium
 - **Dioxins**
 - **Emerging contaminants**
 - Microplastic



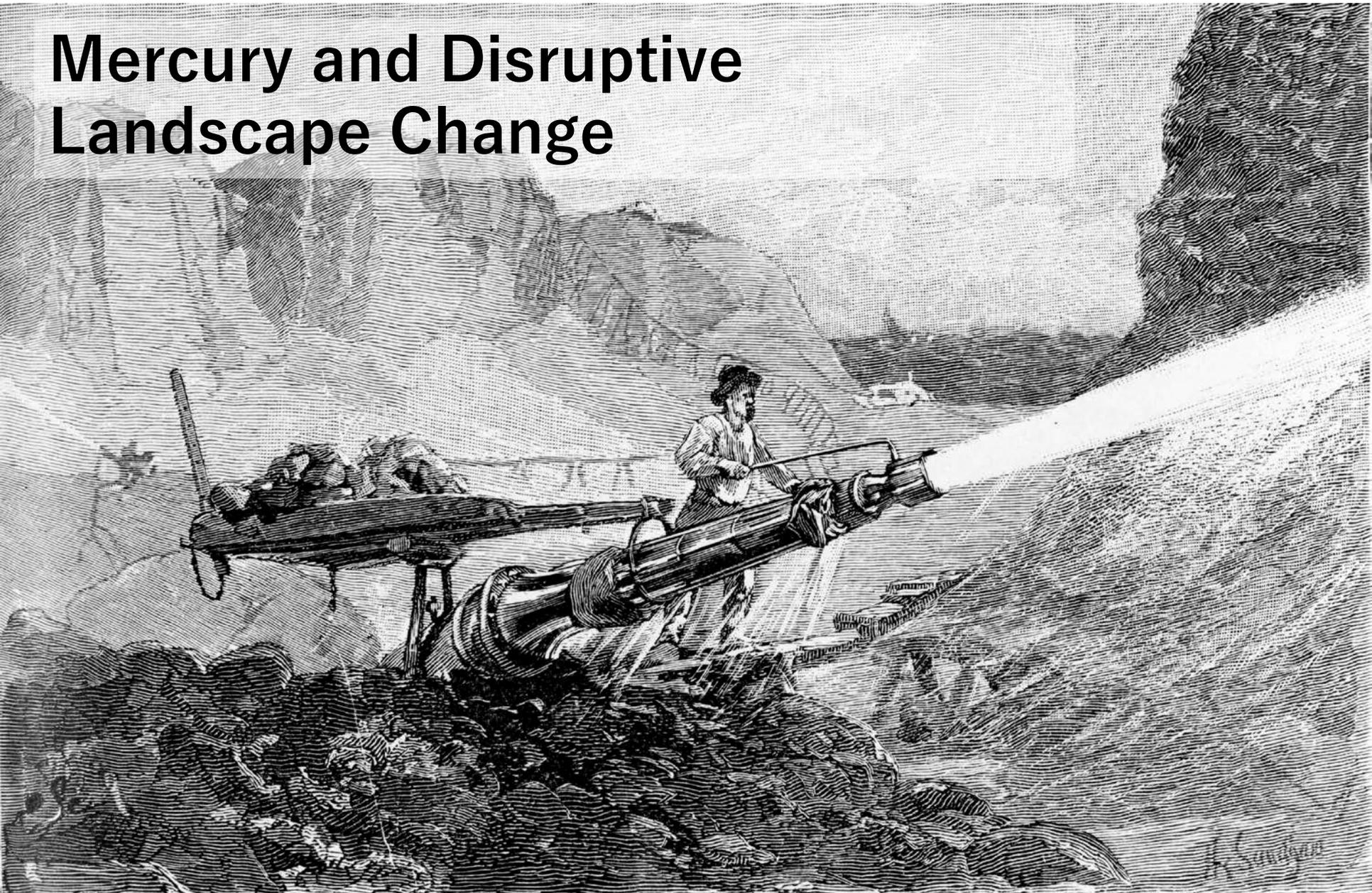
Mercury and Disruptive Landscape Change

- Gold
- Silver
- Mercury



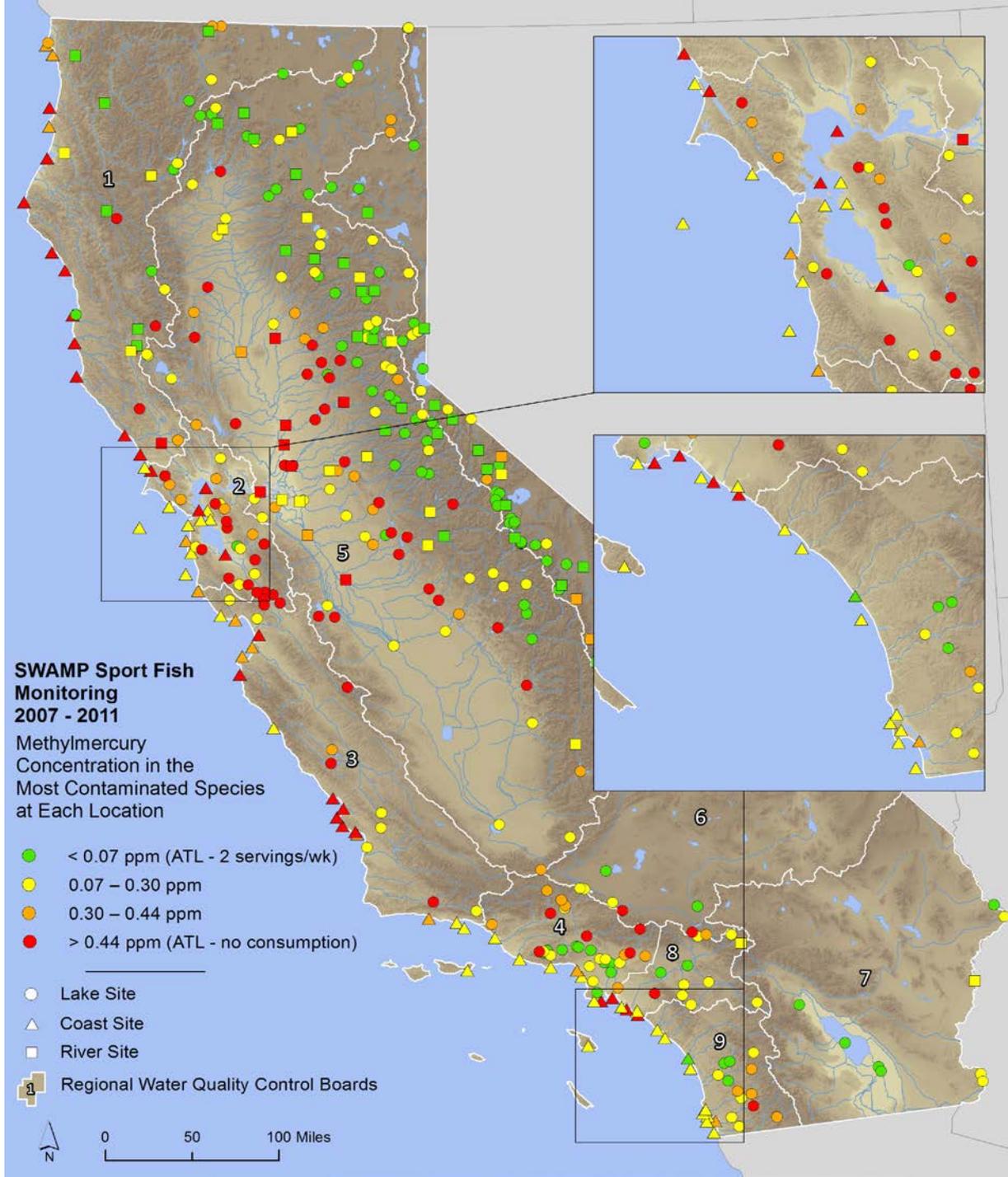
From Wiener and Suchanek (2008). Ecological Applications 18(8) Supplement: A3-A11.

Mercury and Disruptive Landscape Change

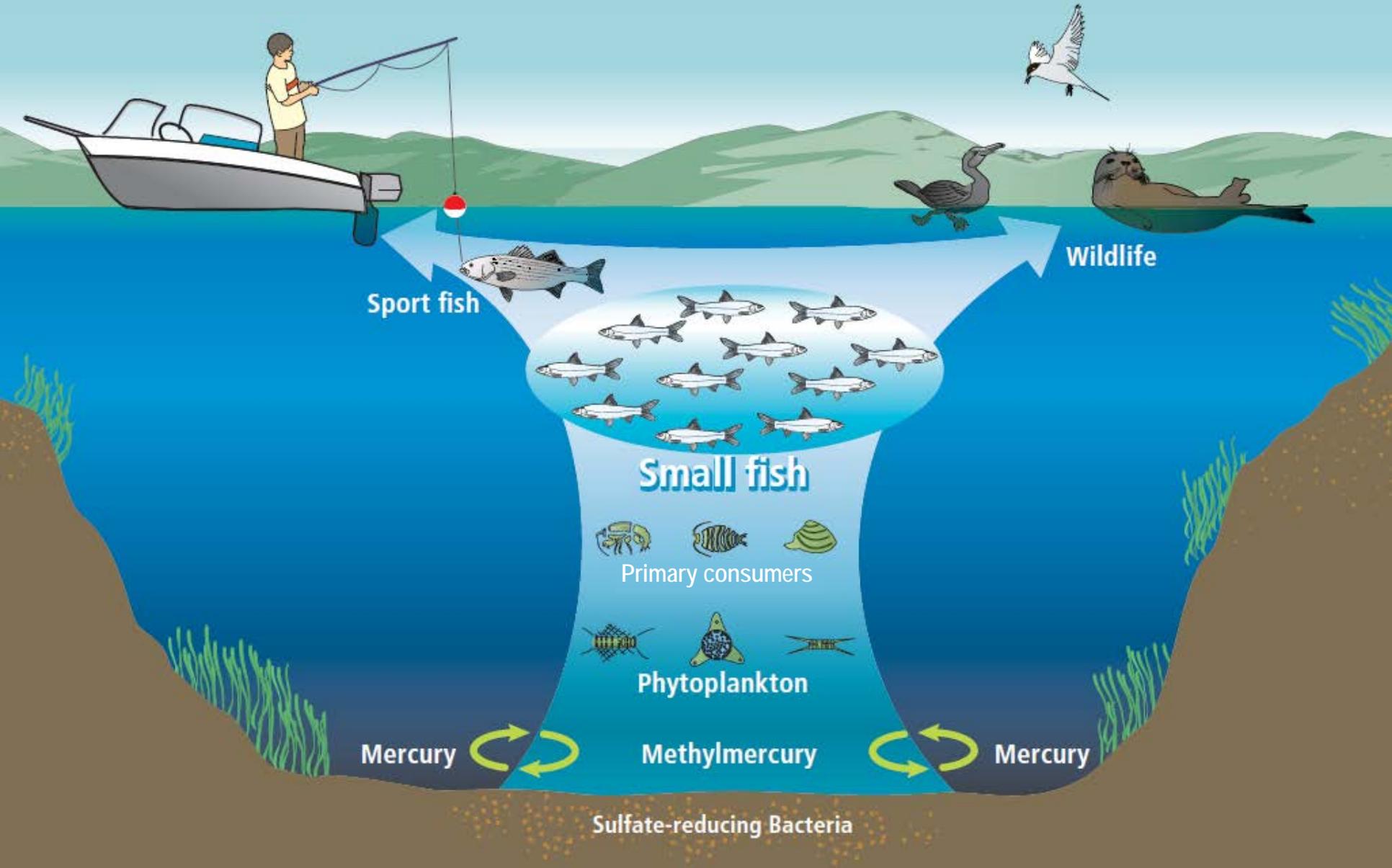


Mercury is now a problem throughout California

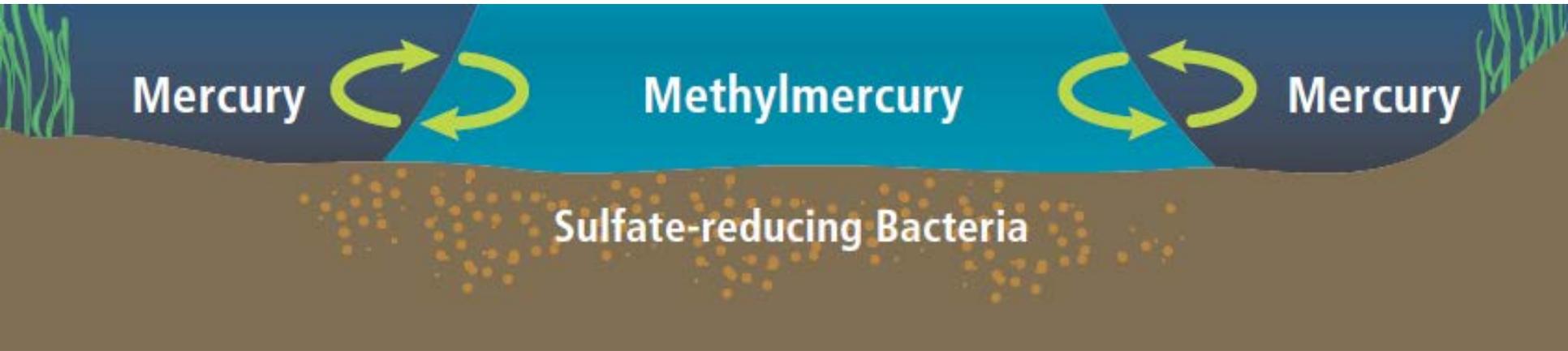
- SWAMP Sport Fish Surveys, 2007-2011
- Red = high concentration
- Mining areas, non-mining areas
- Importance of mercury cycling



Mercury Cycling



1) Methylmercury Production



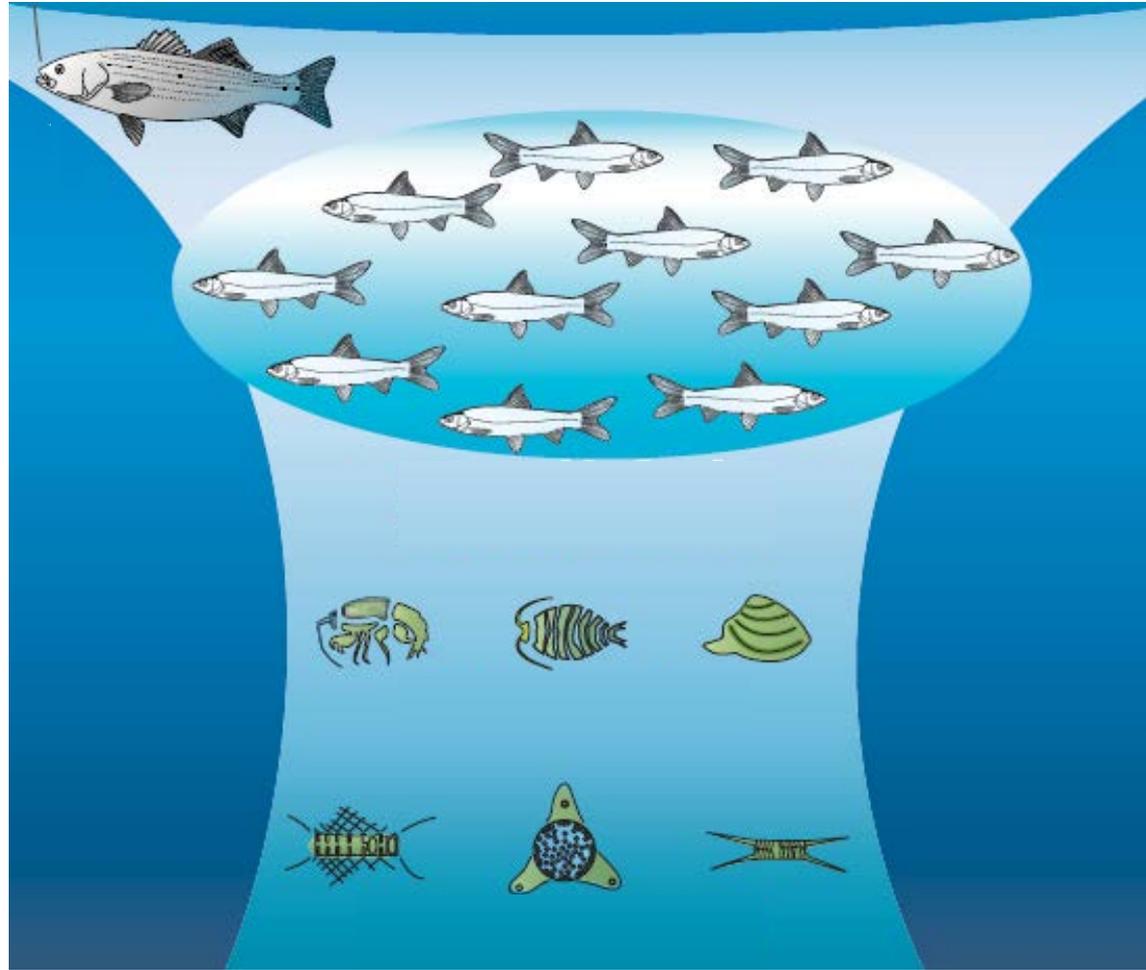
Important Processes

- Methylation
- Demethylation
- Algae growth

2) Food Chain Transfer

Important Processes

- Primary productivity
- Food web structure (food chain length, prey species)
- Bioenergetics
- Growth rate
- Habitat use



Linking Landscape Drivers and Mercury Processes

Landscape Drivers

Emissions

Climate change

 Flooding

 Drought

 Fire

 Temperature

Land use change

Nutrient loads

Habitat restoration

Green infrastructure

Reservoir management

 Water level

 Oxygen status

 Stratification

MeHg Production

Food Chain Transfer

Linking Landscape Drivers and Mercury Processes

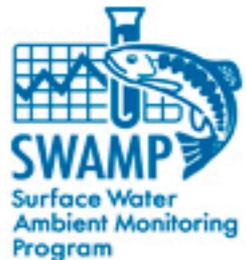
Landscape Drivers	MeHg Production	Food Chain Transfer
Emissions	X	
Climate change	X	
Flooding	X	
Drought	X	
Fire	X	
Temperature	X	
Land use change	X	
Nutrient loads	X	
Habitat restoration	X	
Green infrastructure	X	
Reservoir management	X	
Water level	X	
Oxygen status	X	
Stratification	X	

Linking Landscape Drivers and Mercury Processes

Landscape Drivers	MeHg Production	Food Chain Transfer
Emissions	X	
Climate change	X	X
Flooding	X	X
Drought	X	X
Fire	X	X
Temperature	X	X
Land use change	X	
Nutrient loads	X	
Habitat restoration	X	
Green infrastructure	X	
Reservoir management	X	X
Water level	X	X
Oxygen status	X	X
Stratification	X	X

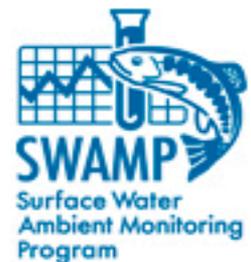
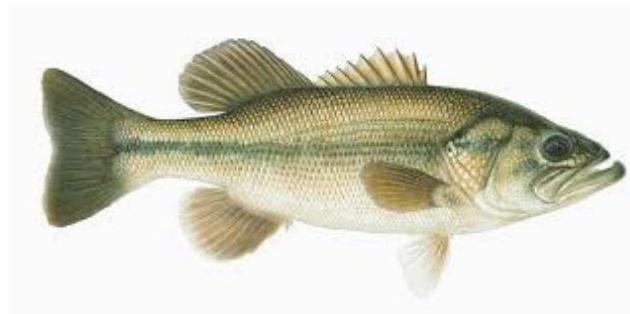
Mercury Forecast

- ? – it's complicated
- Downward and upward trends observed elsewhere
- Probably reduced impacts in 50 years
 - TMDLs
 - Reduced global emissions



Mercury Forecast

- ? – it's complicated
- Downward and upward trends observed elsewhere
- Probably reduced impacts in 50 years
 - TMDLs
 - Reduced global emissions
- Ask the fish!



Algal Toxins

- Problematic concentrations
 - Coastal bivalves
 - Coastal wildlife
 - Freshwater bivalves
 - San Francisco Bay bivalves
- Concern is rising
- Climate and landscape change will be important



Fire Contaminants

- Mercury
- Dioxins
- Emerging contaminants



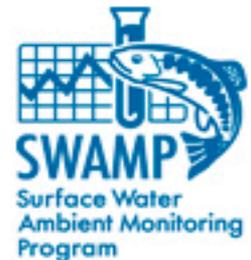
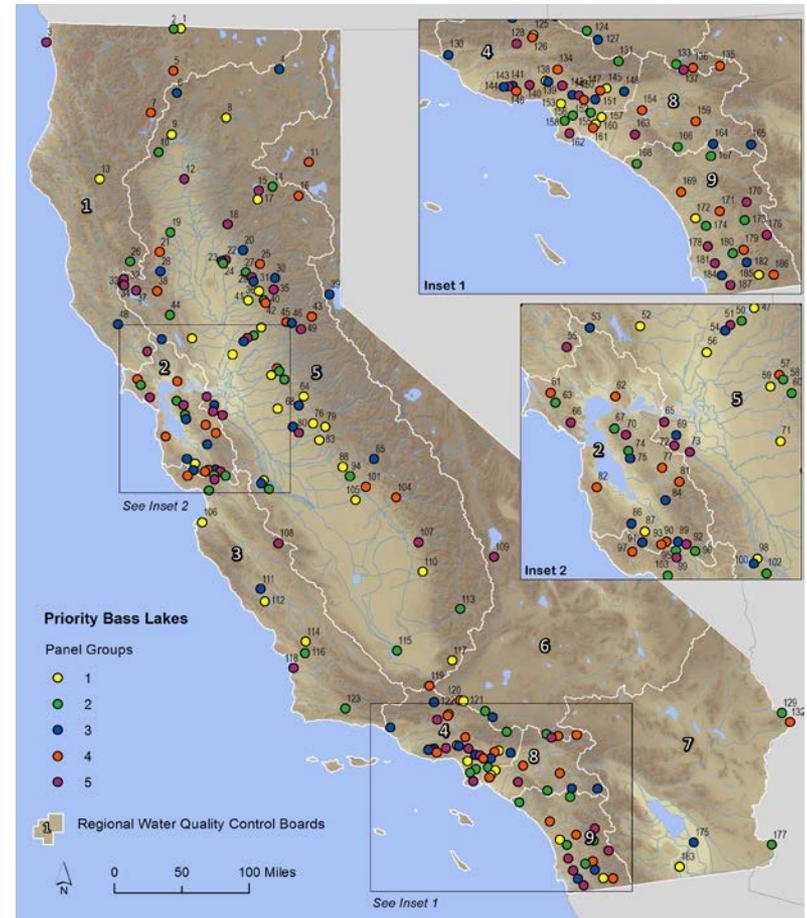
Water Use

- Green infrastructure
- Habitat creation from “waste” water
- Filters get dirty
- Wastewater contaminants
- Stormwater contaminants
- As we revamp hydrology, we need to anticipate where contaminants will accumulate, monitor, and manage accordingly



Monitoring Needs Over the Next 50 Years

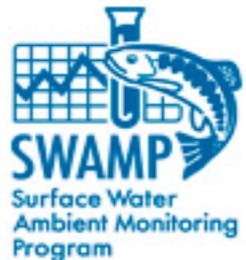
- Statewide monitoring
 - Mercury – status updates, statewide trend
 - Algal toxins
- Targeted monitoring of selected water bodies
 - Status updates, tracking local trends
 - Addressing information gaps: algal toxins, fire, CECs



Monitoring Needs Over the Next 50 Years

- Sustain existing monitoring
- Expand to address information gaps
- Coordinated effort led by SWAMP can meet these needs

- If we stay the course on monitoring and management, and implementing the visions presented yesterday...





More Information

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- www.mywaterquality.ca.gov



Vision of a Bay Area City in 2065

