California's Surface Water Ambient Monitoring Program

Mercury in Fish from California Lakes and Reservoirs

Val Connor

CA State Water Resources Control Board

California Water Boards

SWAMP Surface Water Ambient Monitoring Program

SWAMP "Lake Survey"

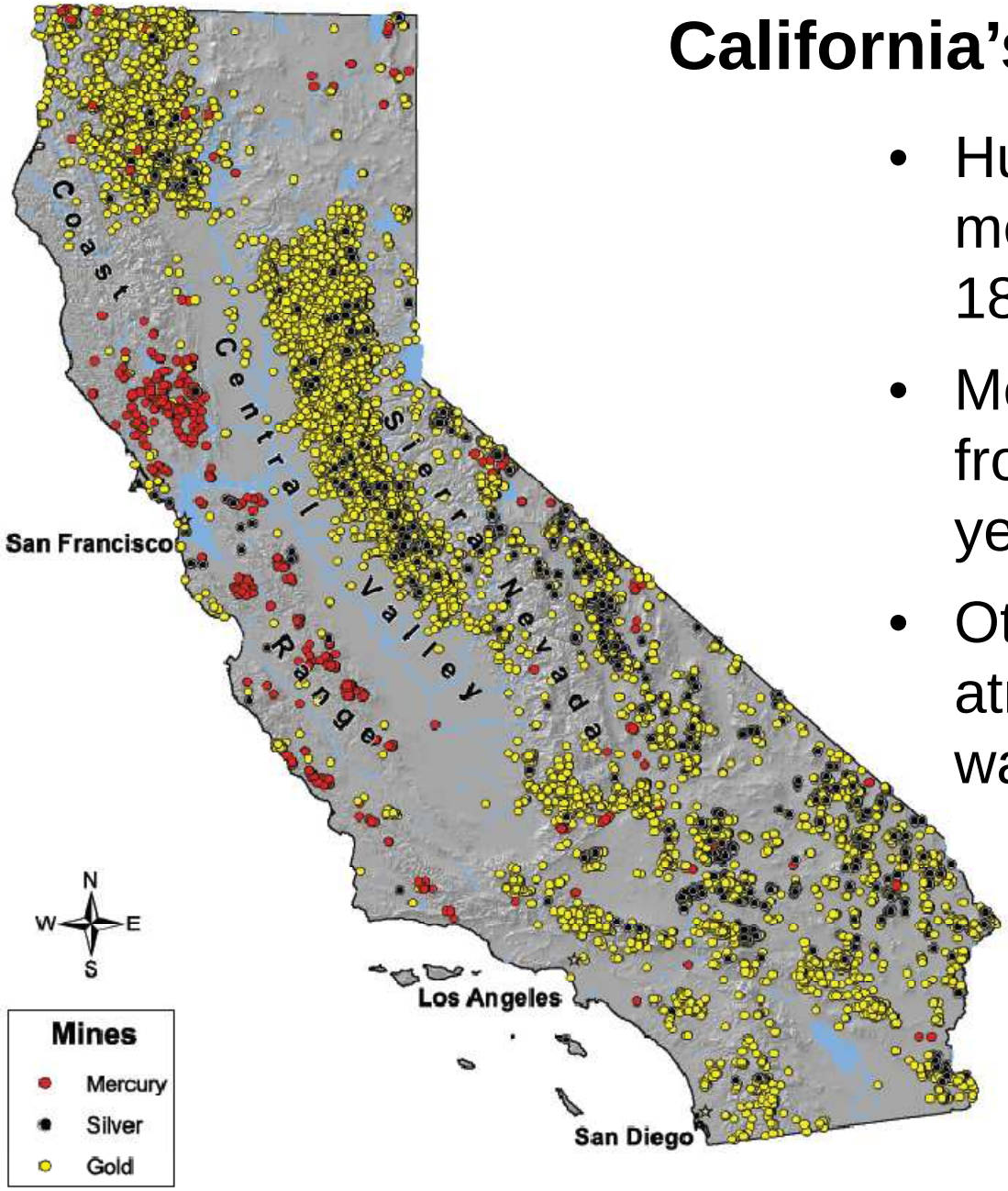
Mercury and Other Contaminants in Sport Fish of California Lakes and Reservoirs

J.A. Davis, A.R. Melwani, S.N. Bezalel, G. Ichikawa, A. Bonnema, C. Lamerdin, W.A. Heim, D. Crane, M. Stephenson

(SWAMP BOG)

Image NASA
© 2008 Europa Technologies

California's Mining Legacy



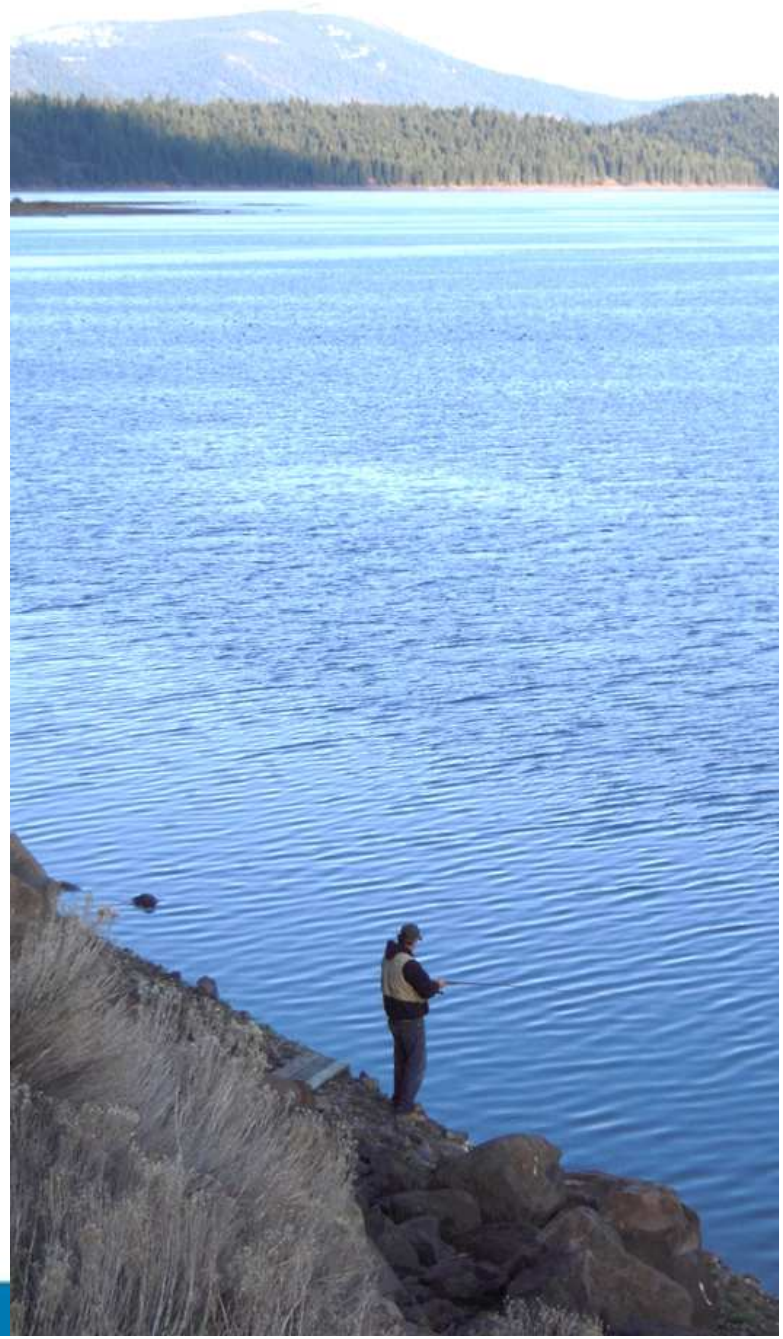
- Hundreds of gold and mercury mines from mid-1800s
- Mercury contamination from mining persists 150 years later
- Other sources: atmospheric deposition, wastewater, urban runoff

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

Background

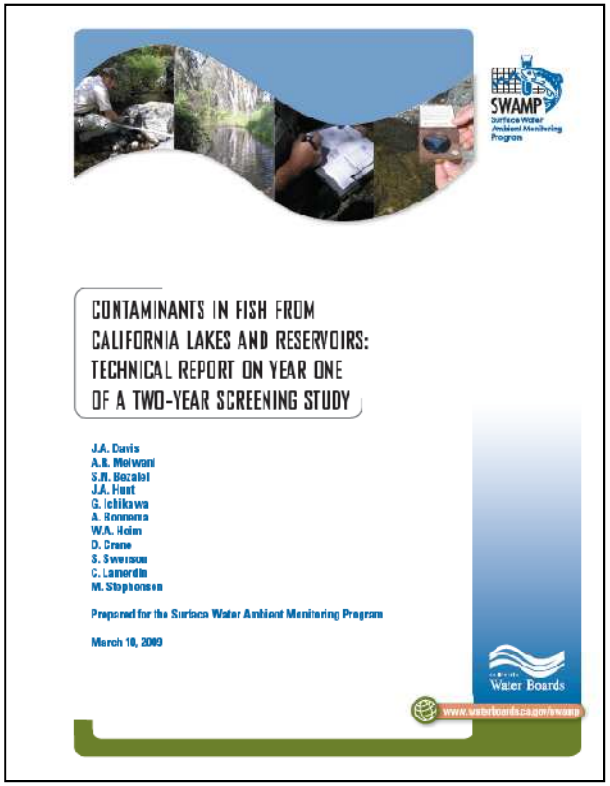
- Problem
  - Lack of information on contaminants in fish
  - Lack of safe eating guidelines,

- New SWAMP monitoring began in 2007
- $750,000 to $1 million per year
- Significant partnerships and matching funds
- Five-year cycle to cover all water body types, beginning with lakes
- Initial focus on sport fish



Lakes Survey

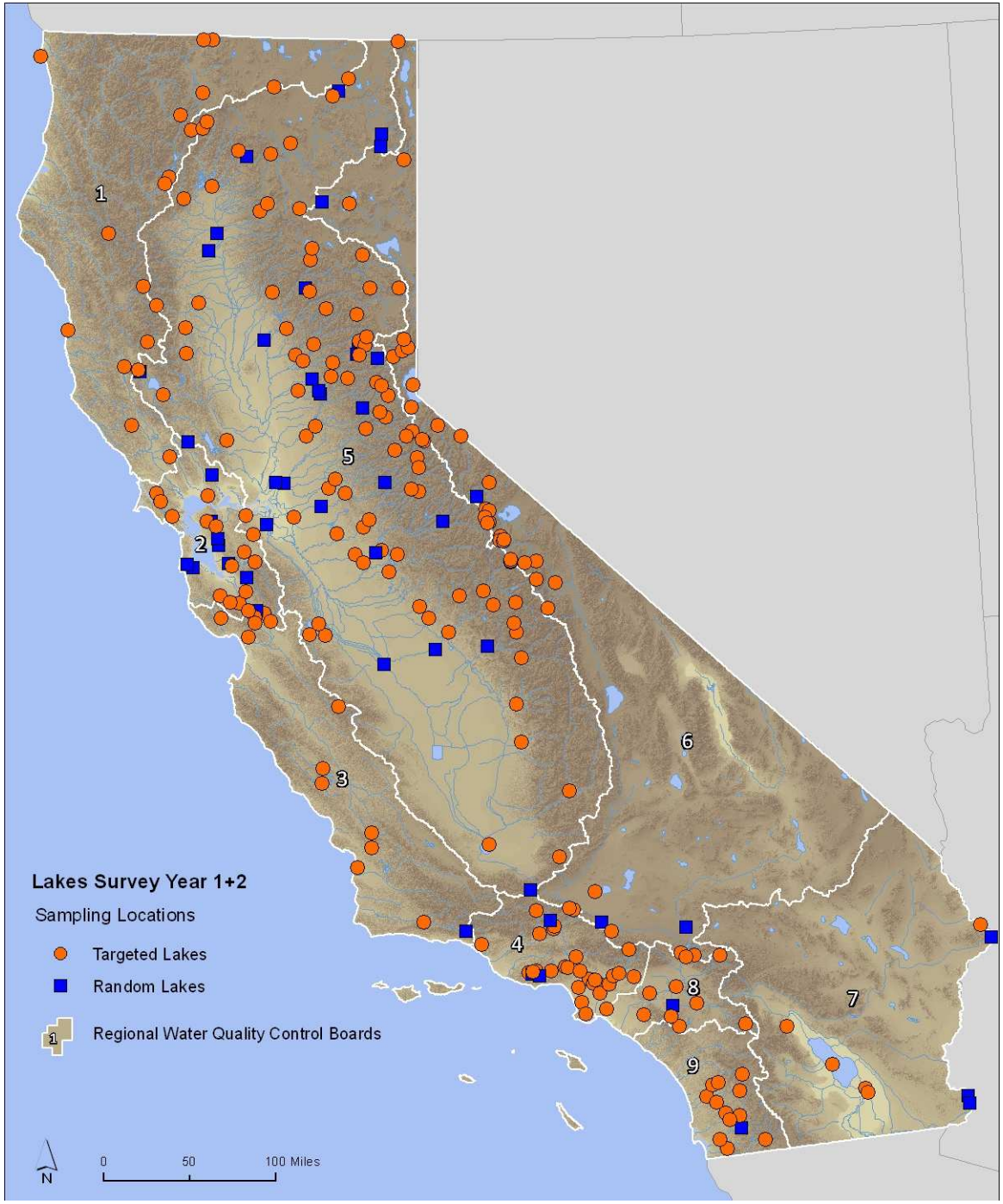
- Questions
  1. Condition of California lakes?
  2. Candidates for 303(d) listing?
  3. Candidates for additional sampling? (Consumption advisories)
- Focus on screening of indicator species
- 2007 – 2008



SWAMP
Surface Water Ambient Monitoring Program

Sampling Locations

- 272 lakes sampled
- 50 random
- 222 popular
  - 22 extra in Los Angeles area



Example:

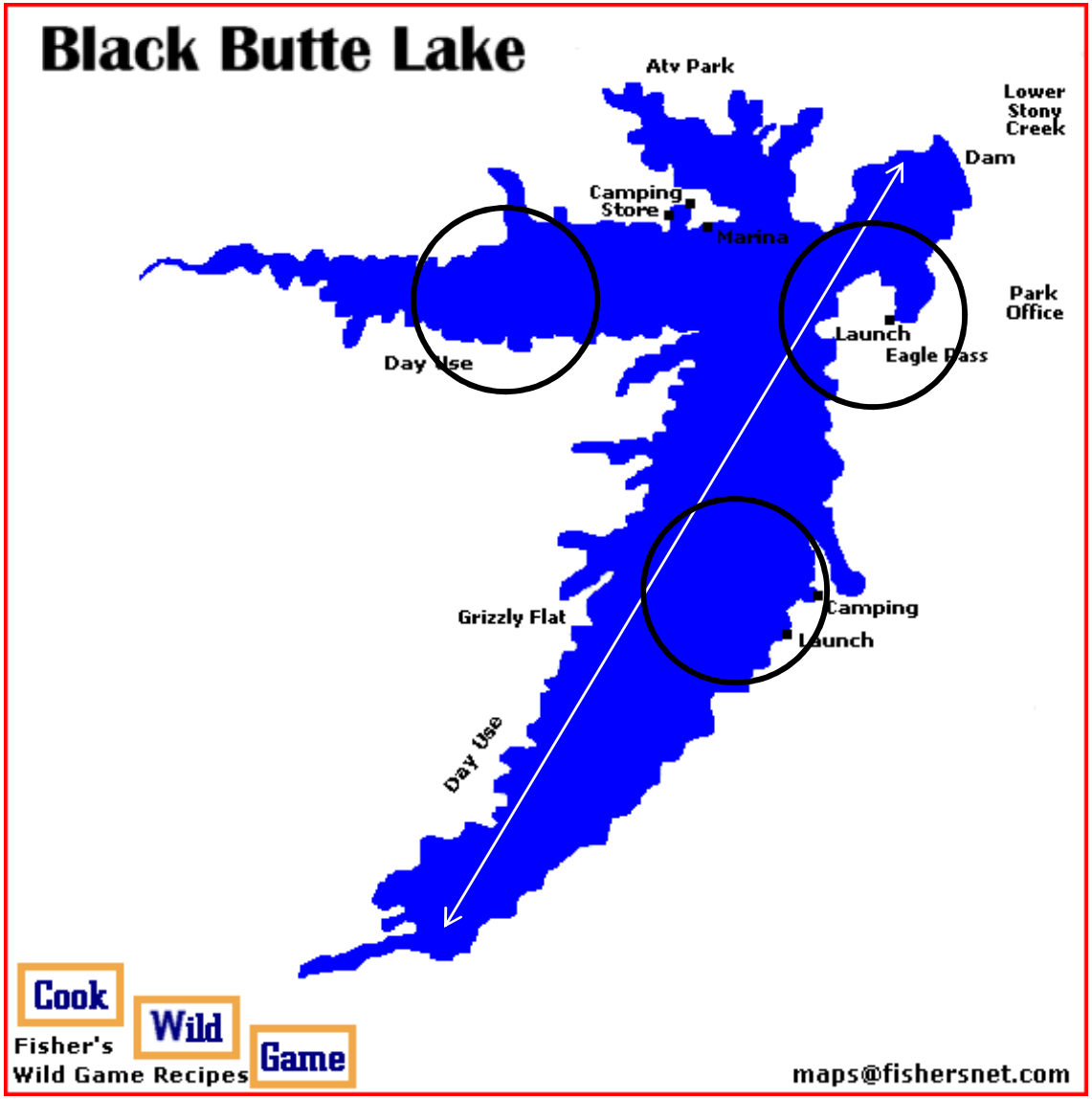
Black Butte Lake

Tehama County

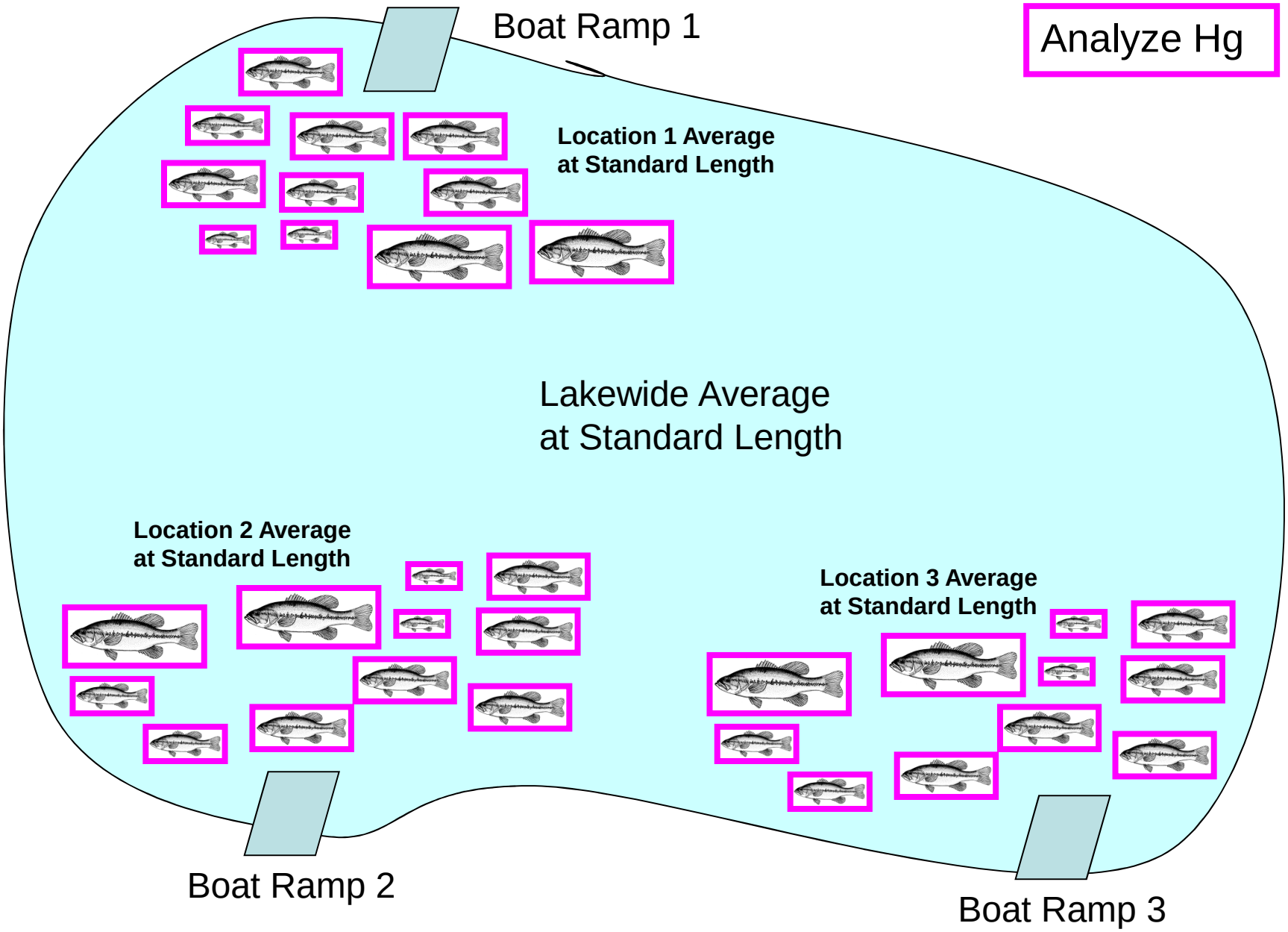
Lake is 5 miles wide

1824 ha (a large lake)

3 locations adequate

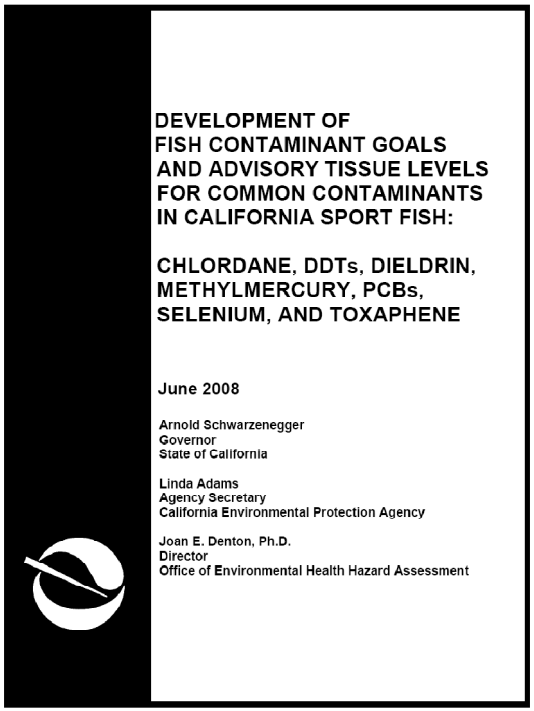


Large Lake: Predator



Assessment Thresholds

- Fish Contaminant Goals (FCGs)
  - Purely risk-based
  - 1 serving/wk
  - 1 in 1,000,000 additional cancer risks
  - Useful goals for risk minimization or elimination
- Advisory Tissue Levels (ATLs)
  - Take benefits into account
  - 1 in 10,000 additional cancer risks
  - 0, 1, 2, 3 servings per week categories
  - For OEHHA use in advisories/safe eating guidelines



DEVELOPMENT OF
FISH CONTAMINANT GOALS
AND ADVISORY TISSUE LEVELS
FOR COMMON CONTAMINANTS
IN CALIFORNIA SPORT FISH:

CHLORDANE, DDTs, DIELDRIN,
METHYLMERCURY, PCBs,
SELENIUM, AND TOXAPHENE

June 2008

Arnold Schwarzenegger
Governor
State of California

Linda Adams
Agency Secretary
California Environmental Protection Agency

Joan E. Denton, Ph.D.
Director
Office of Environmental Health Hazard Assessment

Klasing and Brodberg, 2008

http://www.oehha.ca.gov/fish/gtlsv/index.html

Surface Water Ambient Monitoring Program

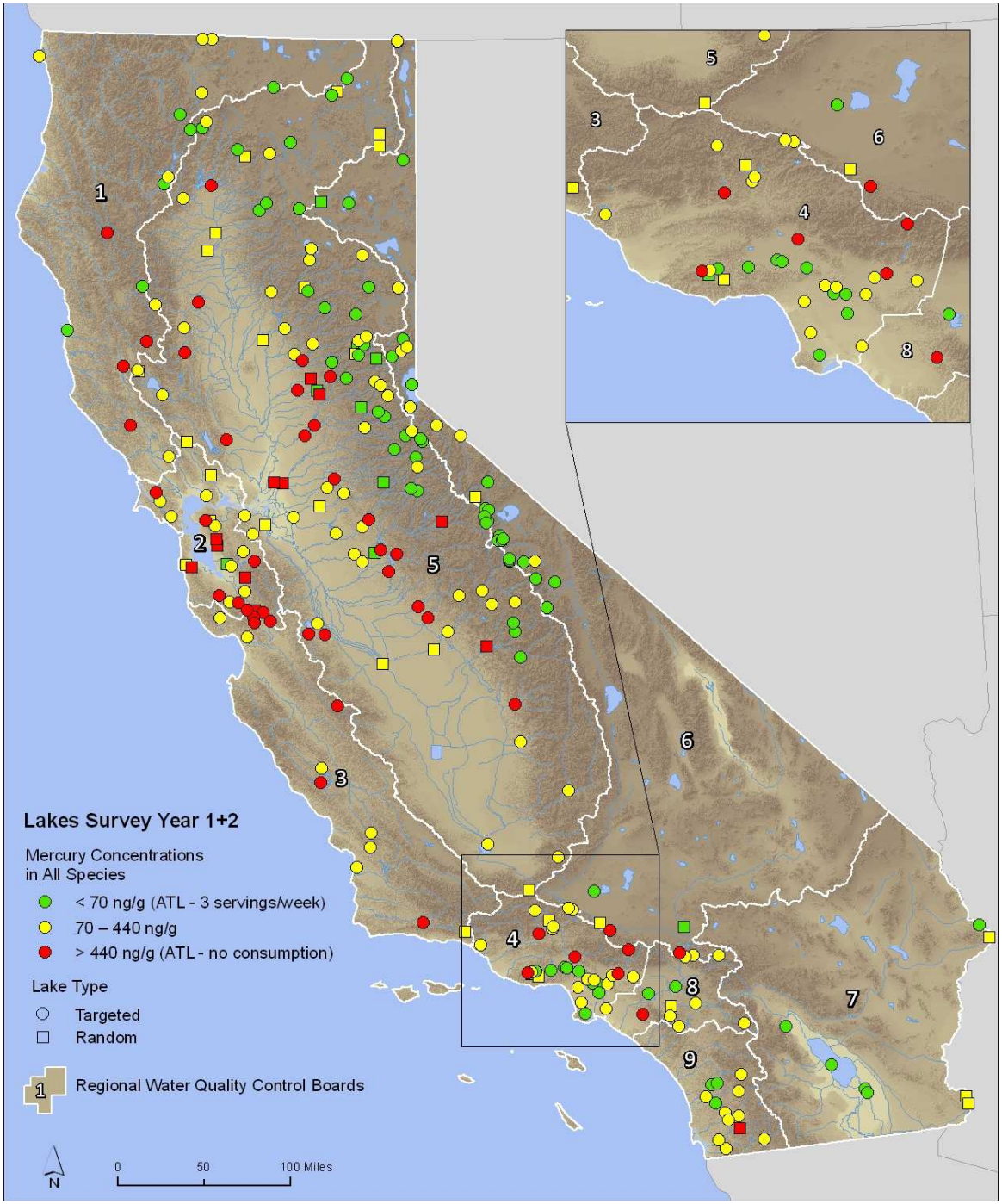
Assessment Thresholds (ppb)

Pollutant	Fish Contaminant Goal	Advisory Tissue Level (3 servings/ week)	Advisory Tissue Level (2 servings/ week)	Advisory Tissue Level (No Consumption)
Chlordanes	**5.6**	190	280	560
DDTs	**21**	520	1000	2100
Dieldrin	**0.46**	15	23	46
Mercury	220	**70**	150	440
PCBs	**3.6**	21	42	120
Selenium	7400	**2500**	4900	15000

Klasing and Brodberg, 2008 http://www.oehha.ca.gov/fish/gtlsv/index.html

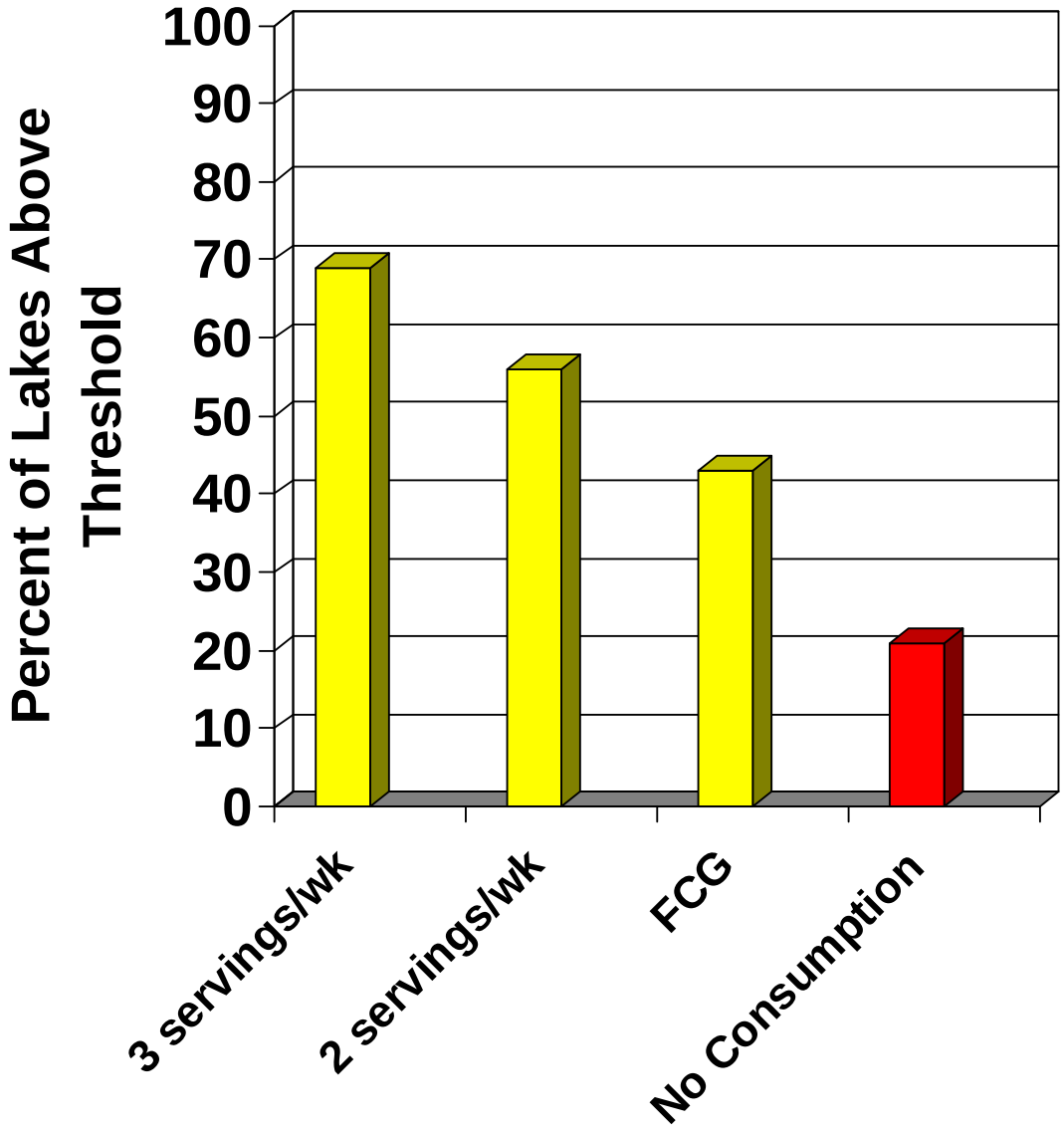
Methylmercury: Spatial Distribution

- Based on highest species average at each lake
- Low concentrations in many Sierra Nevada and southern CA lakes
- Not just a northern CA problem
- Species distribution has a big influence
- Red lakes a high priority for followup



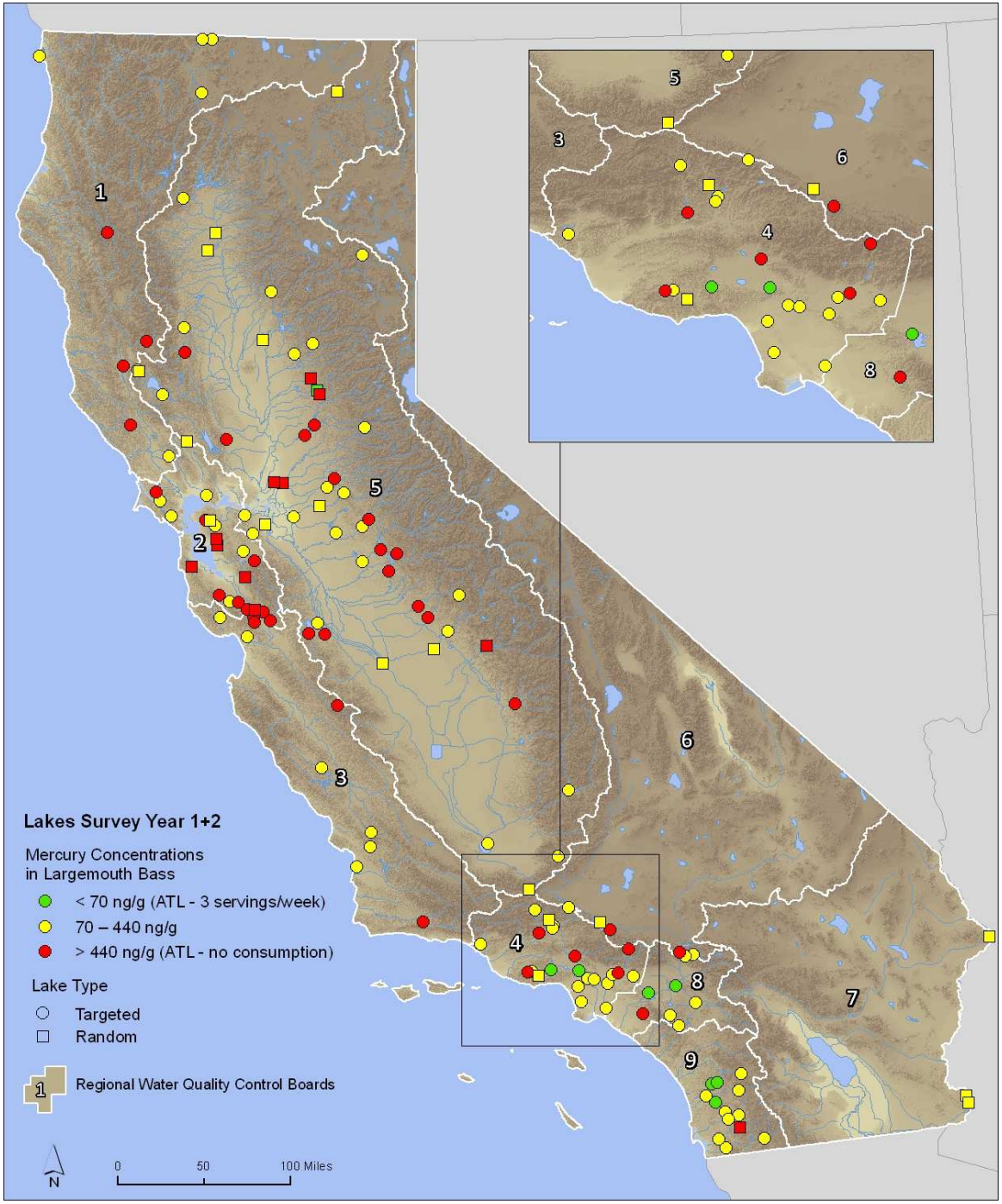
Methylmercury: Severity of the Problem

- Based on highest species average at each lake
- 21% in <u>no consumption</u> range (> 440 ppb)
- 43% above Fish Contaminant Goal (220 ppb)
- 56% above 2 serving/wk ATL (150 ppb)
- 69% above 3 serving/wk ATL (70 ppb)

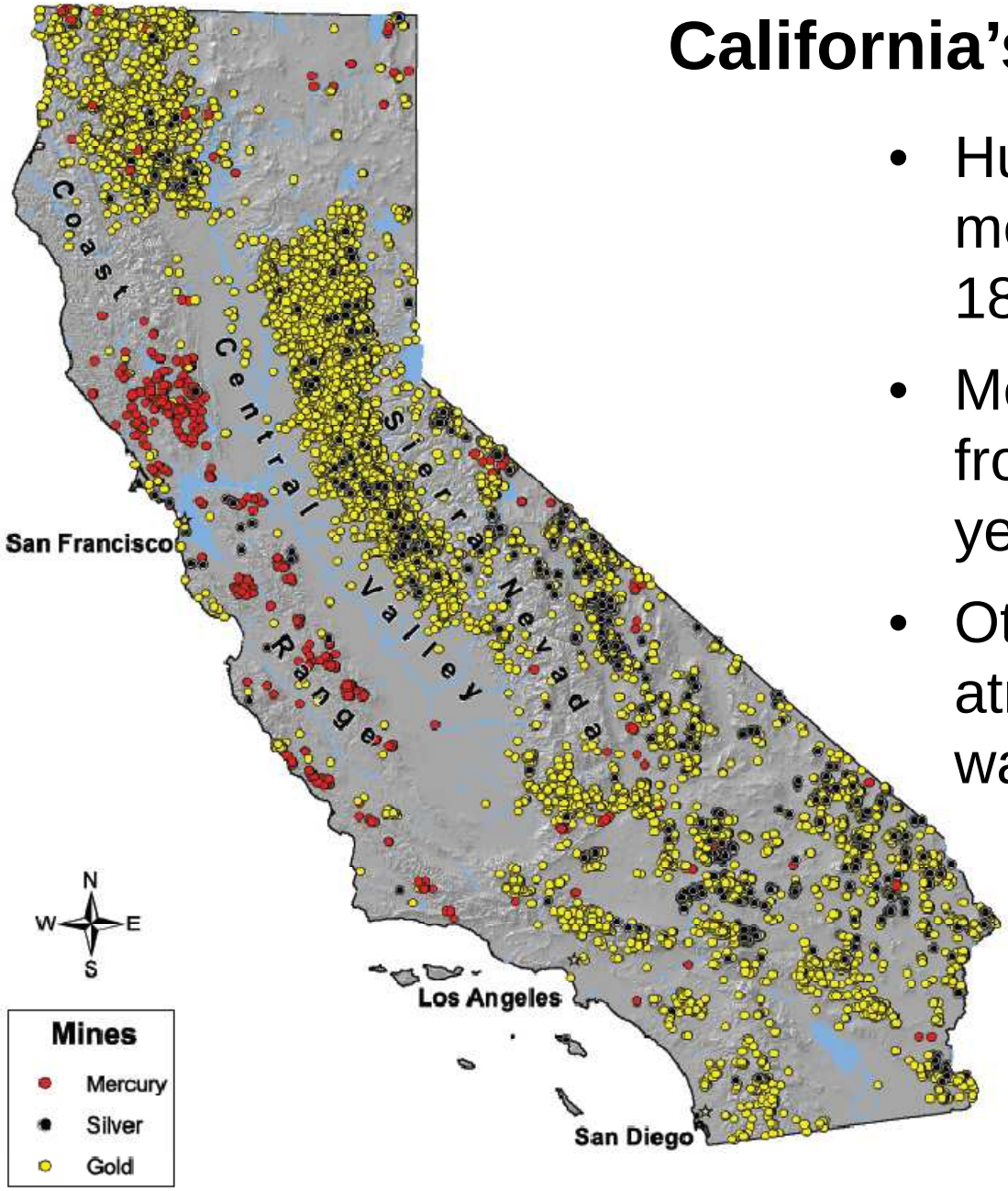


Methylmercury: Spatial Distribution

- Standard size largemouth bass: apples vs. apples
- One “clean” lake in northern California
- Seven clean lakes in southern California
- Sources: mining, what else?



California's Mining Legacy

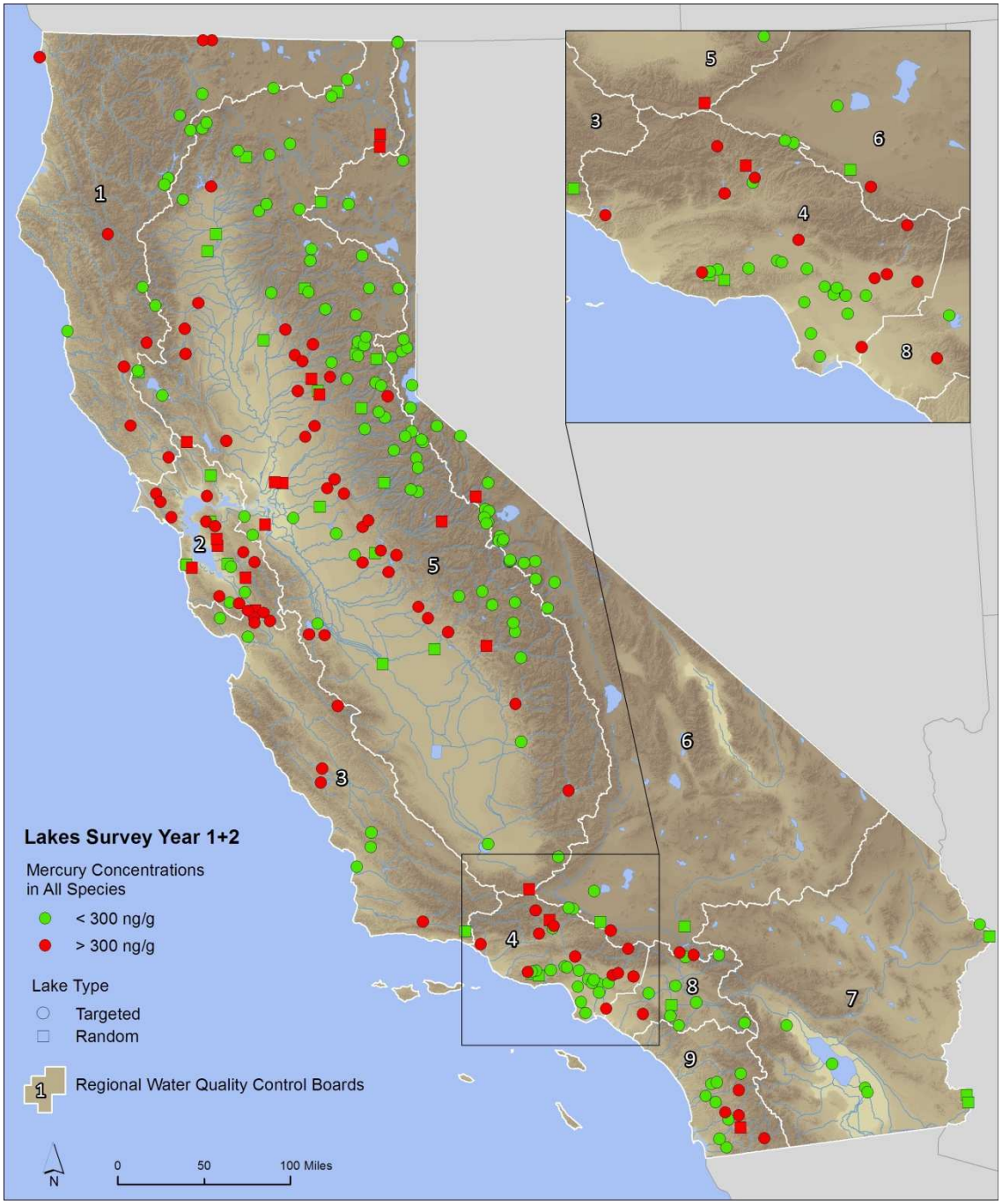


- Hundreds of gold and mercury mines from mid-1800s
- Mercury contamination from mining persists 150 years later
- Other sources: atmospheric deposition, wastewater, urban runoff

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

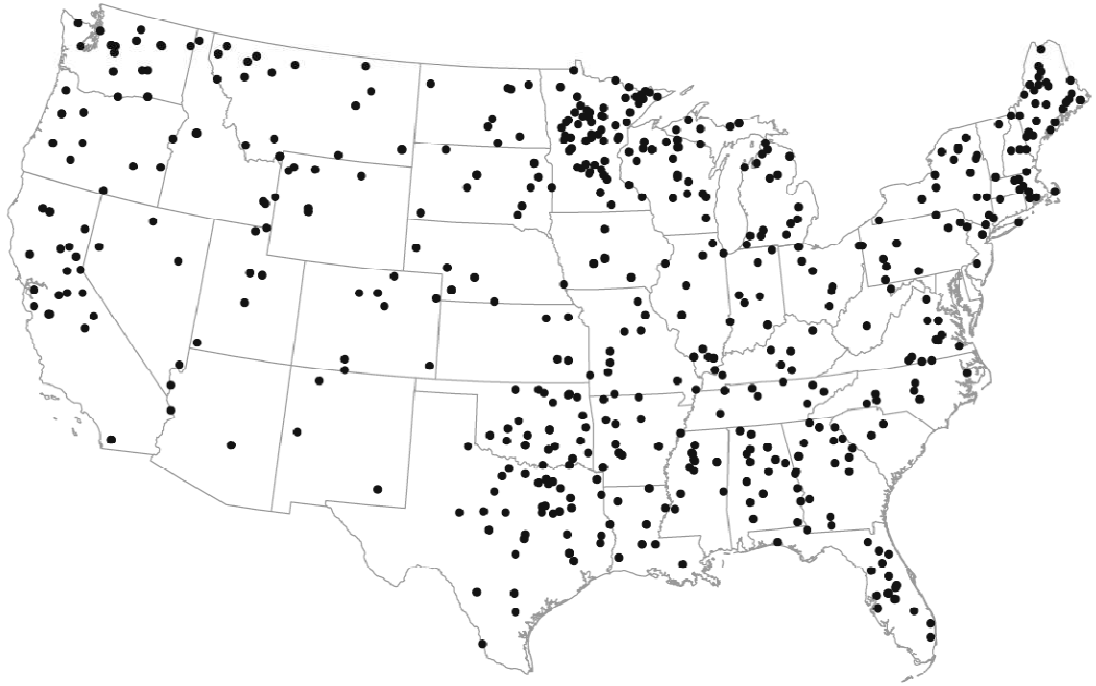
Methylmercury: Comparison to 0.3 ppm Threshold

- Based on species with highest average at each lake
- 35% (95 of 272) over 0.3 ppm



Comparison to National Survey by USEPA (2009)

- 500 lakes
- 2000-2003
- MeHg: 49% of lakes had a predator above 0.3 ppm (35% of lakes in SWAMP* above 0.3 ppm)
- PCBs: 16.8% of lakes had a *predator* above 12 ppb (17% of lakes in SWAMP* above 12 ppb)



Stahl et al. 2009. Contaminants in fish tissue from US lakes and reservoirs: a national probabilistic study. Environmental Monitoring and Assessment 150: 3-19.

* Data shown for SWAMP are for highest species average in each lake, including predators and bottom-feeders.

Bottom Line: MeHg contamination is moderate, PCB contamination is average

CALIFORNIA WATER QUALITY MONITORING COUNCIL

Using Web Portals to Present Meaningful Information

Jon Marshack, Karen Larsen, Valerie Connor, Jeff Kapellas

SWAMP
Surface Water Ambient Monitoring Program

State of California
ENVIRONMENTAL PROTECTION AGENCY
RESOURCES AGENCY

CALIFORNIA WATER QUALITY MONITORING COUNCIL

Skip to: Content | Footer | Accessibility

Search GO
California This Site

Home | Safe to Drink | Safe to Swim | Safe to Eat Fish | Ecologic Health | Stressors & Processes | Contact Us

My Water Quality - hosted by the Surface Water Ambient Monitoring Program (SWAMP) |

GOVERNOR SCHWARZENEGGER
Visit his Website

- Cal/EPA
- The Resources Agency
- About the California Water Quality Monitoring Council
- State & Regional Water Boards
- Web Portal Partners
- Monitoring Programs, Data Sources & Reports
- Water Quality Standards, Plans and Policies
- Regulatory Activities
- Enforcement Actions
- Research

- About SWAMP
- SWAMP Tools

SWAMP
Surface Water Ambient Monitoring Program

Welcome to My Water Quality

This web portal, supported by a wide variety of public and private oraganizations, presents California water quality monitoring data and assessment information from a variety of perspectives that may be viewed across space and time.

IS OUR WATER SAFE TO DRINK?

Safe drinking water depends on a variety of chemical and biological factors regulated by a number of local, state, and federal agencies. More >>

IS IT SAFE TO SWIM IN OUR WATERS?

Swimming safety of our waters is linked to the levels of pathogens that have the potential to cause disease. More >>

IS IT SAFE TO EAT FISH AND SHELLFISH FROM OUR WATERS?

Aquatic organisms are able to accumulate certain pollutants from the water in which they live, sometimes reaching levels that could harm consumers. More>>

ARE OUR AQUATIC ECOSYSTEMS HEALTHY?

The health of fish and other aquatic organisms and communities depends on the chemical, physical, and biological quality of the waters in which they live. More>>

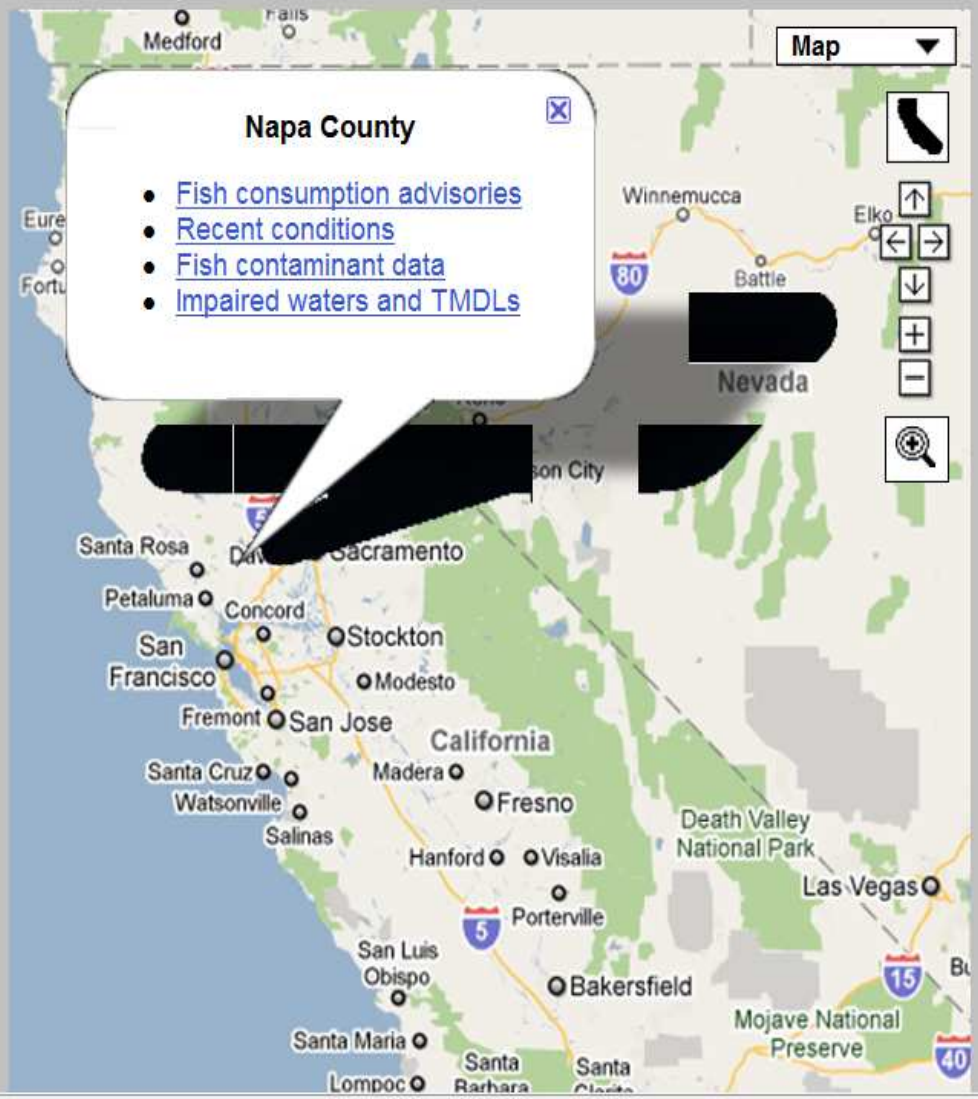
WHAT STRESSORS AND PROCESSES AFFECT OUR WATER QUALITY?

Benefical uses of our waters are affected by emerging contaminants, invasive species, trash, global warming, acidification, pollutant loads, and flow. More>>

Is It Safe to Eat Fish and Shellfish From Our Waters?

Show County Info: Napa

Show counties



Fish and shellfish are nutritious and good for you to eat. But some fish and shellfish may take in toxic chemicals from the water they live in and the food they eat. Some of these chemicals build up in the fish and shellfish - and in the humans that eat fish and shellfish - over time. Although the chemical levels are usually low, it is a good idea to learn about advisories and monitoring in water bodies where you fish, and for fish or shellfish you eat.

QUESTIONS ANSWERED

- Can I eat fish or shellfish caught in my lake, stream, or ocean?
- Does my lake, stream, or ocean location have fish or shellfish with contaminants at levels of concern?
- What are the levels and long-term trends in my lake, stream, or ocean location?
- Which lakes, streams, or ocean locations are listed by the State as impaired?
- What is being done to reduce these problems?

Water Quality information addressing these questions is currently available for the counties that are shaded on this map. This portal is a work in progress, initially showing readily available data and assessment information. More will be added as it becomes available.

- Click on a question to view water quality information specific to that topic.
- Click on a county or select the county from the drop-down menu to view information on these questions from a county perspective.
- Links in the green bar below the tabs at the top of the page

GOVERNOR
SCHWARZENEGGER

Visit his Website

- State & Regional Water Boards

SAFE TO EAT FISH LINKS

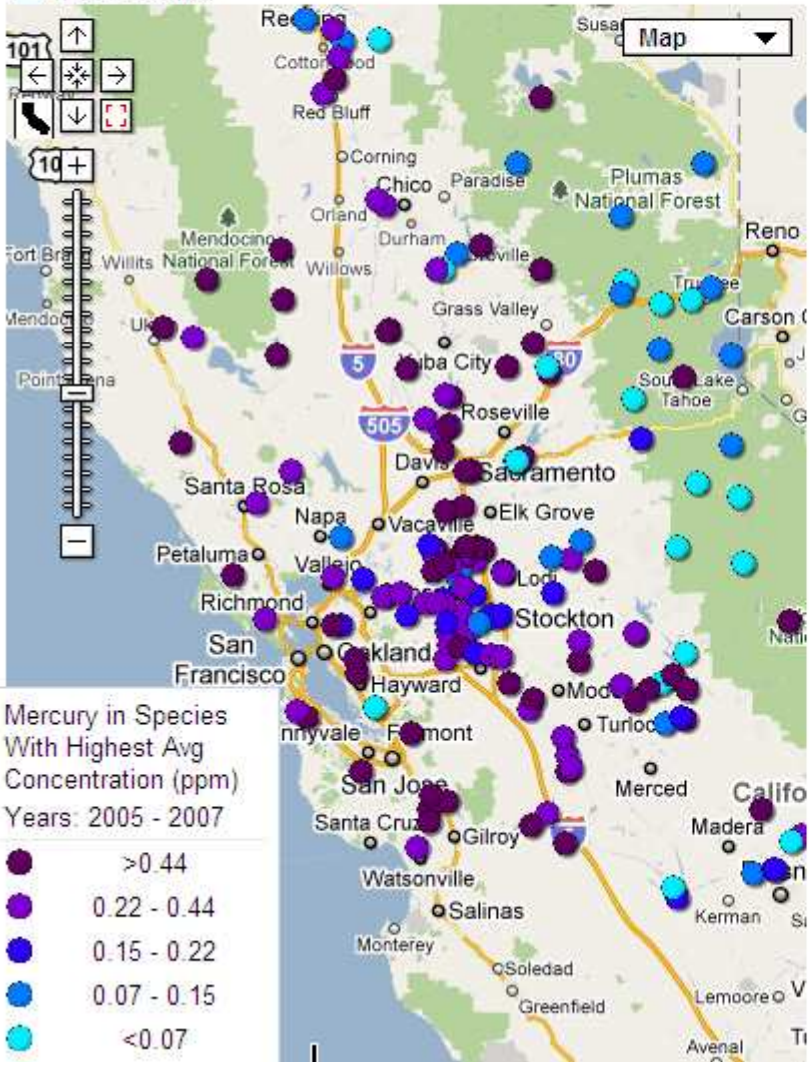
- Pollution Sources & Health Risks
- Laws, Regulations, Standards & Guidelines
- Assessment Thresholds
- Regulatory Activities
- Enforcement Actions
- Research
- Monitoring Programs, Data Sources & Reports
- Statewide Perspective
- National Perspective

What are the Levels and Long-Term Trends in My Lake, Stream, or Ocean Location?

Select location from list.

Zoom to county:

☐ Show counties



Contaminant Data

This interactive map allows you to explore fish contaminant data for your fishing locations.

- Select parameters of interest from the menus below and click on the "Go" button. The map will display average concentrations for the selected water bodies.
- To view data for all species at your water body, trends, or comparisons with nearby water bodies, click on a map location or select a water body from the menu above the map.
- Thresholds displayed on the map can be modified by clicking the Change Thresholds link in the map legend.

Select Species:

Species With Highest Avg Concentration

Select Contaminant:

Mercury

Select Start Date:

2005

Select End Date:

2007

Go Reset

GOVERNOR
SCHWARZENEGGER

Visit his Website

- State & Regional Water Boards

SAFE TO EAT FISH LINKS

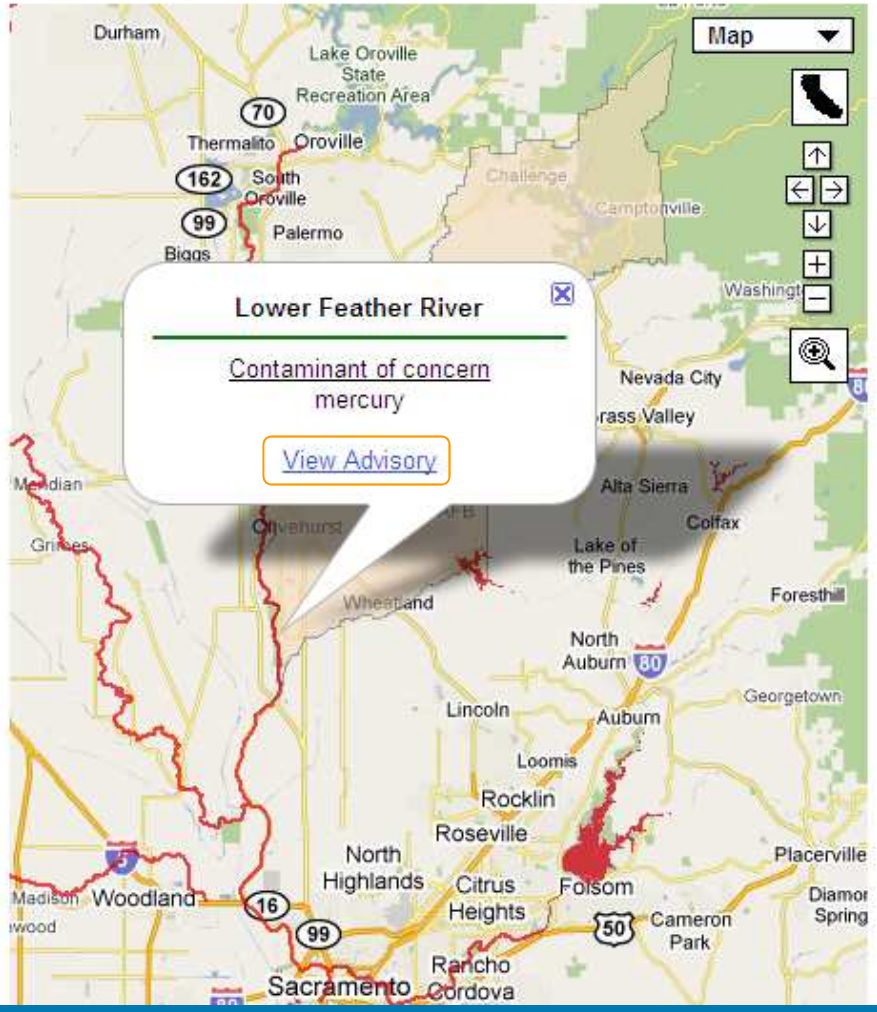
- Pollution Sources & Health Risks
- Laws, Regulations, Standards & Guidelines
- Assessment Thresholds
- Regulatory Activities
- Enforcement Actions
- Research
- Monitoring Programs, Data Sources & Reports
- Statewide Perspective
- National Perspective

Can I Eat Fish or Shellfish Caught in My Lake, Stream, or Ocean Location?

County: Yuba

Water Body:

☑ Show county



Fish and Shellfish Consumption Advisories by Location

There are health benefits from eating fish and shellfish. But, some fish and shellfish may contain chemical or biotoxin contaminants that could pose health risks. When contaminant levels are unsafe, consumption advisories may recommend that people limit or avoid eating certain species of fish caught in certain places and at certain times.

- California Sport Fish Consumption Advisories
  For a number of California water bodies, the Cal/EPA office of Environmental Health Hazard Assessment (OEHHA) publishes consumption advisories for chemicals in noncommercial fish which you and your family or friends catch.
  These advisories are shown on the map to the left.
  - Click on a water body (shown in **red**), or
  - Select (or type) the county in the County box, then select the water body from the Water Body menu, or
  - Select (or type) the water body name directly in the Water Body box
  - Use the magnifier tool to zoom into an area of interest (more highlighted water bodies will appear).
  - How does OEHHA develop fish consumption advisories and safe eating guidelines?
  - Why do so few water bodies have fish consumption advisories and safe eating guidelines?

Safe Eating Guidelines
for the Lower Feather River

Women 18 – 45 and Children 1 – 17 Years

American Shad	Carp Suckerfish Redear or other sunfish	Black Bass Catfish Pikeminnow Striped Bass
4 Servings a week	1 Serving a week	Do not eat

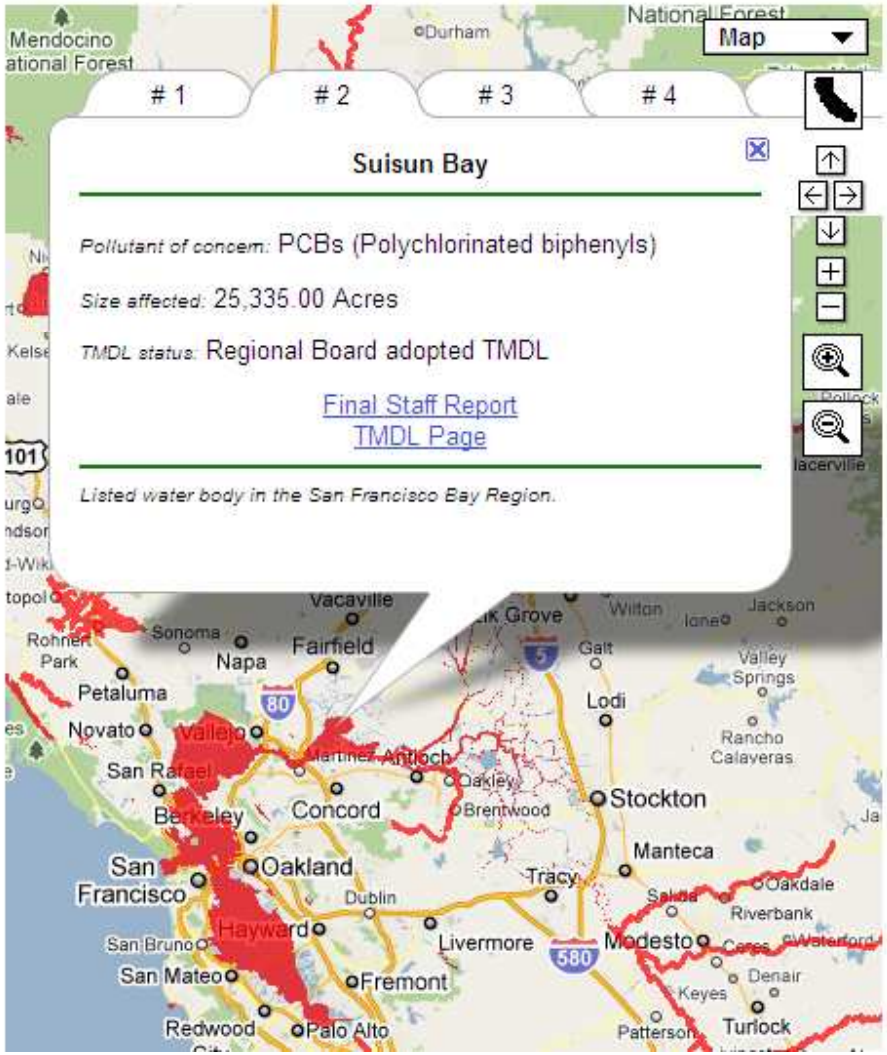
SWAMP
Surface Water Ambient Monitoring Program

Which Lakes, Streams, or Ocean Locations Are Listed By The State As Impaired?

County: All

Water Body:

☐ Show county



This interactive map shows which of California's waters are listed as impaired for uses related to fish or shellfish consumption by humans and which pollutants are involved. Also shown are the Total Maximum Daily Load (TMDL) projects to reduce pollutants to acceptable levels.

View 2006 303(d) Listing and current TMDL Information:

- Click on a water body (shown in **red**), or
- Select (or type) the county in the County box, then select the water body from the Water Body menu, or
- Select (or type) the water body name directly in the Water Body box
- Use the magnifier tool to zoom into an area of interest (more highlighted water bodies will appear)
- Click on the state outline tool to return to a statewide view

Impaired Water Bodies

Listing a water body as impaired in California is governed by the State Water Board's 303(d) Listing Policy.

Water Boards

The State and Regional Water Boards assess water quality data for California's waters every two years to determine if they contain pollutants at levels that exceed protective water quality criteria and standards. This biennial assessment is required under Section 303(d) of the federal Clean Water Act.

The map shows California waters that were placed on the State's most current (2006) 303(d) list and which pollutants they contain that adversely impact

Summary of Results

- California now has made substantial progress in defining the problem
- As in many other states, the problem is widespread
- Mercury poses the greatest concern
- There is significant variation among lakes and among species
- Data from this screening will be valuable in setting priorities for developing TMDLs and safe eating guidelines

SWAMP
Surface Water Ambient Monitoring Program

Summary (continued)

- Distinct regional variation in MeHg
- Statewide average MeHg in largemouth and smallmouth bass is near no consumption ATL
- California MeHg concentrations are moderate compared to the rest of the US
- Mining legacy and atmospheric deposition both have a role in methylmercury contamination, lake and watershed factors that control MeHg cycling have a strong influence
- Information conveyed via “My Water Quality” web portal.

SWAMP
Surface Water Ambient Monitoring Program

Questions?