California’s Surface Water Ambient Monitoring Program

Mercury in Fish from California Lakes and Reservoirs

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CA State Water Resources Control Board
Mercury and Other Contaminants in Sport Fish of California Lakes and Reservoirs


(SWAMP BOG)
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

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
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

Analyze Hg

Boat Ramp 1

Location 1 Average at Standard Length

Lakewide Average at Standard Length

Location 2 Average at Standard Length

Location 3 Average at Standard Length

Boat Ramp 2

Boat Ramp 3
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

Klasing and Brodberg, 2008

http://www.oehha.ca.gov/fish/gtlsv/index.html
## Assessment Thresholds (ppb)

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

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 no consumption 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

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)


* 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
Using Web Portals to Present Meaningful Information

Jon Marshack, Karen Larsen, Valerie Connor, Jeff Kapellas
Welcome to My Water Quality

This web portal, supported by a wide variety of public and private organizations, 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?**

Beneficial 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?

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 a tab to view information on these questions from a county perspective.
- Links in the green bar below...
What are the Levels and Long-Term Trends in My Lake, Stream, or Ocean Location?

Select location from list.

Zoom to county:

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:

- 2006

Select End Date:

- 2007

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

County: Yuba

Water Body: [Dropdown]

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

California Water Quality Monitoring Council
Which Lakes, Streams, or Ocean Locations Are Listed By The State As Impaired?

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

Listed water body in the San Francisco Bay Region.
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.
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.
Questions?