



SWAMP SURVEY OF MERCURY EXPOSURE AND RISK IN WILDLIFE IN CALIFORNIA LAKES AND RESERVOIRS

What is it?

The Surface Water Ambient Monitoring Program (SWAMP) is conducting a study that is a first step in developing a valuable tool for mercury total maximum daily load (TMDL) implementation and wildlife risk determination. The study involves the calculation of biomagnification factors (BMFs) for determining mercury concentrations in wildlife from concentrations measured in fish. When properly derived, BMFs provide managers and regulators with a quantitative tool to estimate mercury concentrations across environmental matrices (such as water, sediment, and tissue), thus enabling them to estimate wildlife exposure without the need for comprehensive and expensive sampling at all sites of interest.



This study is using western and Clark's grebes (*Aechmophorus* spp.) as an index of mercury exposure to wildlife in California lakes. As piscivorous (fish-eating) waterbirds, grebes are among the animals at the top of the food chains in lakes, and are widely distributed in lakes throughout California (see Figure). In addition, grebes become flightless after they arrive at their

summer breeding locations, making them susceptible to potential impaired reproduction due to local contamination. Thus, grebes are ideal representatives for wildlife risk to local, lake-specific contaminant exposure.

This study has three main objectives.

1. Sample grebes at 24 California lakes to determine mercury levels in a species at the top of the food chain, and compare these data to known effects-thresholds for birds
2. Simultaneously with grebe sampling, collect small fish (<100 mm) and sport fish at these same 24 lakes
3. Use data from Objectives 1 and 2 to calculate BMFs for small fish and sport fish, evaluate the BMFs usefulness for estimating wildlife exposure, and assess whether the BMFs differ by lake type or geographic region

By combining the BMFs we develop among lakes with known impairment thresholds, we will evaluate and develop a tool that will allow managers to determine the risk of mercury to wildlife by simply monitoring fish mercury concentrations.

Why is it important?

The beneficial uses of numerous water bodies in California under the Clean Water Act are listed as impaired by mercury contamination. As a result of those listings, the Regional Water Quality Control Boards have been developing TMDLs for affected water bodies and have included fish tissue methyl mercury objectives designed to protect humans and wildlife. Thus far, only a handful of impaired water bodies have mercury TMDLs. To meet the requirements of the Clean Water Act and to facilitate the development of TMDLs, the State Water Resources Control Board is now developing statewide methyl mercury fish tissue objectives.

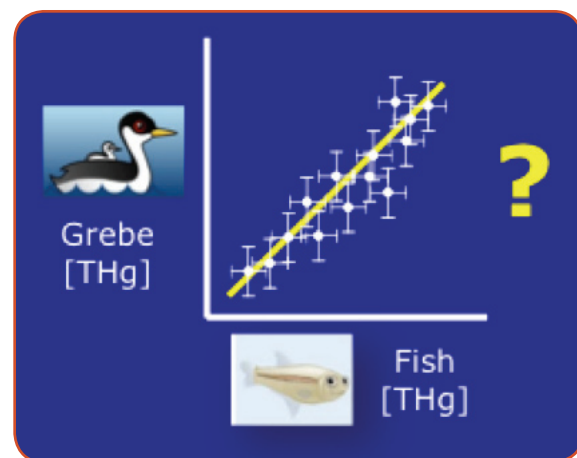
SWAMP has recently completed statewide surveys of contaminants in sport fish tissue from over 250 lakes in California and throughout coastal waters; however, this impressive effort only focused on human health issues. Because many fish-eating wildlife species such as grebes, terns, cormorants, and mergansers eat fish smaller than those sampled by the Bioaccumulation Oversight Group (BOG), and since fish mercury concentrations are not always indicative of wildlife exposure to mercury, the BOG sport fish surveys do not address whether wildlife beneficial uses may be impaired by mercury in these water bodies. Mercury has been shown to reach concentrations that pose significant risks to water birds in a few locations where this has been examined (e.g., San Francisco Bay, Clear Lake). This study will provide the first evaluation of the statewide extent of significant mercury exposure and risk in lakes and reservoirs.

The study will

- provide solid information on whether there are significant risks to the most promising statewide avian indicator species in a representative sample of lakes
- evaluate whether there is a BMF tool that can be applied on a statewide basis to estimate the risks to birds based on concentrations measured in small fish or sport fish
- establish sampling protocols for an important avian mercury indicator species

How will this information be used?

Once the BMF which best predicts mercury concentrations in birds from concentrations in fish has been determined using data from this study, regulators and managers will be able to plug in either lake-specific prey fish or sport fish mercury concentrations and any associated environmental variables (such as lake elevation or size) that this study identifies as being important. The model will then estimate the mercury concentrations in bird blood, and translate this estimated mercury concentration into the potential risk to wildlife based on published toxicity levels.



This study would provide significant support for the following management policies and actions:

- The statewide TMDL for lakes and reservoirs – by providing data to assist Regional Boards in developing TMDL monitoring requirements that address wildlife exposure, determining whether small fish must be collected or whether BMFs can be used with large fish data, establishing appropriate protocols for small fish sampling, evaluating whether and how bird tissue should be collected, and determining methods for site-specific objectives if they are warranted
- The statewide mercury objective – by providing initial data on the status of mercury concentrations in small fish as compared to the statewide objective, and providing data to confirm whether statewide wildlife objectives are protective or under/over protective

- EPA Endangered Species Act consultation with the Services on the statewide objectives – by providing data useful to EPA and the USFWS on the protectiveness of the objectives for listed wildlife

For more information:

- Visit the [Bioaccumulation Oversight Group](#) web site.
- Contact Josh Ackerman, USGS (jackerman@usgs.gov).