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To: Bioaccumulation Oversight Group

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Re: 2013 Project Summary

Incorporating Wildlife Mercury Exposure and Risk Estimates using Biomagnification Factors into BOG California Lake Monitoring

Background
USGS, Moss Landing, and BOG are conducting a study to develop a biomagnification factor model for estimating mercury exposure and risk in wildlife using mercury concentrations in lower trophic level prey animals. Specifically, this study aims to calculate biomagnification factors for modeling mercury concentrations in piscivorous western and Clark's grebes (*Aechmophorus spp.*) from forage fish and sport fish throughout California lakes and reservoirs. When properly derived, biomagnification factors are valuable because they provide managers and regulators with a quantitative tool to estimate mercury concentrations across environmental matrices, thus enabling them to adequately estimate wildlife exposure and risk without the need for comprehensive sampling at all sites of interest.

Project Update
During the 2012 project update meeting, the BOG team and technical review panel recommended continuing the second year of the study as originally designed, into 2013. However, administrative contracting delays halted the funding amendment, potentially jeopardizing our ability to complete the study. Funding for the 2013 field portion of the project has not been received to this date. Nonetheless, USGS and Moss Landing made extraordinary efforts to proceed with field sampling in 2013 as originally planned in order to ensure this project's success. To do so, some 2012 funds scheduled for data analysis and reporting were used as a stop-gap measure until 2013 funding has been received.

We now have successfully completed two field seasons (2012 and 2013) for this project and have successfully obtained 354 grebe blood samples from 25 California lakes and reservoirs (**Table 1, Figure 1**). In addition, we have collected 226 grebe eggs from 7 California lakes and reservoirs (**Table 2**) for a total of 580 grebe tissue samples. The deliverables for this project were to collect and analyze 480 grebe tissues from 24 lakes over two years; thus not all eggs will be analyzed for mercury. Based upon input from the BOG, we selected lakes in 2013 that both contained black bass as forage fish, and provided a broad range of mercury concentrations, to ensure that our model would be representative to a broad range of lake and reservoir types in California.

Grebe blood sampling was conducted in close coordination with prey and sport fish sampling carried out by the California Department of Fish and Wildlife, Moss Landing Marine Lab such that fish were collected within two weeks of grebe blood sampling at each lake. We have selected the 2013 prey fish that will be analyzed for mercury concentrations and mercury analysis is currently underway at Moss Landing.

All 2012 and 2013 grebe capture and measurement data entry has been completed. All 2012 grebe blood and egg samples have been analyzed for total mercury. All 2013 grebe eggs have been dissected and are awaiting analysis for total mercury. All 2013 grebe blood samples have been transferred to USGS in Corvallis and are awaiting analysis for total mercury. Once funding for the 2013 work has been received, we will be ready to proceed on analyzing all 2013 samples for total mercury. Once completed, we will combine these results with the 2012 data and develop our final biomagnification factor model for predicting grebe blood mercury concentrations based upon prey fish mercury concentrations in California lakes and reservoirs. We will also test the performance of this model using sportfish data where available in order to evaluate utilizing the rich monitoring data across California for evaluating wildlife risk to mercury.

Table 1. Number of grebe blood samples collected in 2012 and 2013 by lake.

Lake	Grebe blood samples
2012	
Black Butte Lake	17
Bridgeport Reservoir	10
Clear Lake	38
Crowley Lake	12
Eagle Lake	14
East Park Reservoir	20
Lake Almanor	15
Lake Berryessa	17
Lake Cachuma	16
Lake Davis	12
Lake San Antonio	17
O'Neill Forebay	2
Thermalito Afterbay	15
2013	
Antelope Lake	11
Big Lake	12
Lake Casitas	17
Lake Hennessey	9
Lake Hodges	15
Lake Mendocino	10
Lake Success	16
Lower Otay Reservoir	11
Perris Reservoir	9
Stony Gorge Reservoir	10
Topaz Lake	8
Tule Lake	21
TOTAL	**354**

Table 2. Number of grebe egg samples collected in 2012 and 2013 by lake.

Lake	Grebe egg samples
2012	
Clear Lake	15
East Park Reservoir	15
Lake Almanor	22
Thermalito Afterbay	36
Tule Lake	10
2013	
Antelope Lake	8
Big Lake	16
Clear Lake	15
Lake Almanor	45
Thermalito Afterbay	29
Tule Lake	15
TOTAL	**226**

Figure 1. California lakes and reservoirs where grebe blood samples and prey fish samples were collected in 2012 (circles) and 2013 (squares).