

Methylmercury Effects on Birds: A Review, Meta-Analysis, and Development of Toxicity Reference Values for Injury Assessment. J.T. Ackerman: U.S. Geological Survey, Western Ecological Research Center, Dixon Field Station, Dixon, California, S.H. Peterson: U.S. Geological Survey, Western Ecological Research Center, Dixon Field Station, Dixon, California, M.P. Herzog: U.S. Geological Survey, Western Ecological Research Center, Dixon Field Station, Dixon, California, J.L. Yee: U.S. Geological Survey, Western Ecological Research Center, Santa Cruz Field Station, Santa Cruz, California

Birds are used as bioindicators of environmental mercury (Hg) contamination and standardized toxicity reference values are needed for risk assessments. We conducted a comprehensive review, summarized data from 168 studies, performed Bayesian hierarchical meta-analyses, and developed toxicity reference values for effects of mercury on birds using a benchmark dose analysis framework. Lethal and sublethal effects of methylmercury were categorized into nine biologically relevant endpoint categories and three age classes. Effective mercury concentrations where there was a 10% reduction (EC10%) in biochemical function (0.77 and 0.57 $\mu\text{g/g}$ ww adult blood-equivalent Hg concentrations), histology endpoints (0.49 and 0.61), and output of juvenile offspring (0.55) were substantially lower than those for behavior (6.23 and 3.11) and survival (2.97 and 5.24) of juveniles and adults, respectively. Within the egg age class, survival was the most sensitive endpoint (EC10%=2.02 $\mu\text{g/g}$ ww adult blood-equivalent Hg concentrations or 1.17 $\mu\text{g/g}$ fww egg-equivalent Hg concentrations). We developed toxicity reference values using combined survival and reproduction endpoints for juveniles, because juveniles were more sensitive to mercury toxicity than eggs or adults. Adult blood-equivalent mercury concentrations ($\mu\text{g/g}$ ww) and egg-equivalent mercury concentrations ($\mu\text{g/g}$ fww) caused low injury to birds (EC1%) at 0.09 and 0.04, moderate injury (EC5%) at 0.6 and 0.3, high injury (EC10%) at 1.3 and 0.7, and severe injury (EC20%) at 3.2 and 1.8, respectively. We found few substantial differences in mercury toxicity among avian taxonomic orders. Our results can be used to quantify injury to birds caused by mercury pollution.

Platform Presentation