

Distribution of Historical Gold Mines Helps Predict Mercury in Fish Tissue, Sierra Nevada, CA, USA

ALPERS, C. N.¹, SLOTTON, D. G.², ORLANDO, J. L.¹,
YEE, J. L.³, ACKERMAN, J. T.³,
MARVIN-DIPASQUALE, M.⁴, FLECK, J. A.¹
AND STUMPNER, E.¹

¹USGS California Water Science Center, Sacramento, CA, USA

cnalpers@usgs.gov, jafleck@usgs.gov,
estumpner@usgs.gov

²Univ. of California, Davis, CA, USA dgslotton@ucdavis.edu

³USGS Western Ecological Science Center, Dixon, CA, USA
julie_yee@usgs.gov, jackerman@usgs.gov

⁴USGS National Research Program, Menlo Park, CA, USA
mmarvin@usgs.gov

Historical gold mining in the Sierra Nevada of California during the mid-to-late 1800s and early-to-mid 1900s led to losses to the environment of approximately 6 million kg of elemental mercury. The mercury was lost from stamp mills at deep mines exploiting low-sulfide gold-quartz vein deposits and from sluices and undercurrents at hydraulic mines exploiting placer gravel deposits. We compiled available data for mercury (Hg) and methylmercury (MeHg) in water, streambed sediment, and fish tissue from prior studies (pre-2011), plus we collected and analyzed samples during 2011–12 at 28 locations in the Sierra Nevada to assess whether spatial data, including information on historical mining, can be used to make robust predictions of fish tissue Hg concentration. In all, Hg data are available from more than 140 sites, including >1600 fish samples (mostly rainbow trout and brown trout), >360 water samples, and >70 sediment samples. Spatial data on historical mining was taken from various sources including the USGS MRDS database, the Significant Deposits database [1], ledgers maintained by the California Geological Survey documenting annual mine production and size of stamp mills starting in 1902, and other published sources regarding the size and location of stamp mills during 1863–1901. Estimates of Hg lost per ton of ore crushed at stamp mills [2] were combined with information on stamp mill history (years of operation and number of stamps) to quantify Hg losses at stamp mill locations. Modeling is being done using multivariate linear regression. Preliminary results indicate that fish tissue Hg, normalized for fish length and accounting for species, can be predicted using spatial data for mining history together with other landscape characteristics including land use / land cover.

[1] Long *et al* (1998) *USGS OFR 98-026A* [2] Churchill (2000) *USEPA EPA/625/R-04/102*