Bear River Mining Legacy

Nevada County has over 120 historic mines from the 1800s. The watersheds of the Bear River and the South Fork of the Yuba River are among the most impacted by Gold Rush mining. Much of this mining was performed using high-pressure hydraulic hoses to wash sediment from hillslopes. This contributed tons of sediment to the stream system, much of which remains, raising the original streambed by up to seventy feet in places.

Along with the sediment came mercury used to extract gold from ore. Some of this elemental mercury has been cleaned up in recent years, but a considerable amount remains—the USGS estimates that eight million pounds, one-third of all mercury used in mining the area, has never been recovered (Shilling 2002). Mercury is present in the bottom (benthos) of downstream rivers and reservoirs, as well as in the pits, sluices, and tunnels remaining in abandoned mine lands (AMLs) from which it may be mobilized.

The mercury can be converted by microbial action into "methylmercury," which can then be absorbed into the food chain by microbes, plants, and animals. As methylmercury makes its way up the food chain it is concentrated, so that in larger predatory fish such as trout and bass concentrations can exceed levels of concern for human consumption (>0.3 parts per million, ppm). These levels most severely affect top predators, such as bald eagles.

Studies by scientists at the U.C. Davis in the mid-90s and follow-up studies by U.S. Geological Survey scientists in 1998-2000 have demonstrated that there are both "hotspots" of mercury contamination in AMLs and in downstream aquatic wildlife populations that have levels approaching and exceeding 1 ppm. Although concentrations of methylmercury in fish, amphibians, aquatic insects, and water are known for certain sites, the total amount of mercury load in the watersheds and rivers is not known and can currently only be guessed.

A USGS study of mercury contamination in fish provides the most detail to date of the extent of the problem in the Yuba and Bear River water bodies (May et al 2000). Concentrations ranged from barely detectable to over 1 ppm mercury in fish tissue. Lower, warmer reservoirs stood out as having a greater problem. The Environmental Protection Agency and the Office of Environmental Health Hazard Assessment (OEHHA) standard for concentrations needing greater attention ("screening value") currently stands at 0.3 ppm. Most of the game fish tested and the waterbodies sampled fell above this threshold, suggesting that although there may be very hot spots, most of the Yuba and Bear systems should be considered worthy of attention. The Food and Drug Administration's action level for regulating mercury in commercial fish is 1.0 mg/kg (1 ppm) wet weight of fish tissue. The values found in the most recent and comprehensive survey of fish in the Yuba and Bear watershed meet and exceed the EPA/OEHHA and the FDA levels in some places. In the Bear watershed:

- At Rollins Reservoir, most channel catfish and most largemouth bass (larger than 1 foot and 400 grams) had levels >0.3 ppm.

- At Lake Combie, all adult largemouth bass (larger than 1 foot and 400 grams) had levels >0.7 ppm.

- At Camp Far West Reservoir, all spotted and largemouth bass and channel (larger than 1 foot and 300 grams) had levels >0.5 ppm, and half of the spotted bass exceeded FDA action level of 1.0 ppm

- At Dog Bar Road and Little Deer Creek at Pioneer Park, half of the brown trout sampled (larger than ten inches and 200 grams) had levels >0.3 ppm.

The USGS has measured the methylmercury concentrations in aquatic and terrestrial invertebrates, amphibians, and cliff swallow eggs (Alpers 2002). This survey was conducted in order to see how well the measured concentrations correlated with the fish data. It was also intended that this approach might lead to a rapid and broad assessment technique for prioritizing mine sites and streams for cleanup and monitoring action based on non-fish data. The aquatic insects sampled (dragonflies, stoneflies, hellgrammites, diving beetles, and giant waterbugs) had concentrations of methylmercury ranging from 0.01 ppm to a high of 1.6 ppm. The foothill yellow-legged frogs, Pacific tree frogs, and bullfrogs had concentrations ranging from 0.23 ppm to 0.39 ppm.

Charlie Alpers, lead investigator for the Bear-Yuba Watersheds Interagency Abandoned Mine Lands Project (see http://water.wr.usgs.gov/mercury/bear-yuba/), indicates that increasing flows in the Bear could increase transport of mercury-bearing sediments, though they may be more dilute. Cooler water would slow conversion to biologically-available methylmercury and thus the bioaccumulation process. But it is difficult to say for sure what interactions would be altered by increased (or decreased) flows, since the mercury cycle is a complex mix of methylation, vaporization, redox environment, etc. It also appears that sulphate loading from human-induced runoff pollution may favor increased biological uptake. Having studied fish in Camp Far West Reservoir, the collaborative research group hopes to get additional funding to study fish in Rollins and Combie Lakes (Alpers 2002).

References

Alpers, Charles. 2002. Research Chemist. U.S. Geological Survey. (916)278-3134. Phone conversation 6/11/02.

May, Jason T. et al. 2000. Mercury Bioaccumulation in Fish in a Region Affected by Historic Gold Mining: The South Yuba River, Deer Creek, and Bear River Watersheds, California, 1999. U.S. Geological Survey, Report No. 00-367. Accessed at http://ca.water.usgs.gov/rep/ofr00367/ofr00367.pdf), 6/15/02)

Shilling, Fraser. 2002. Mercury Contamination in the Yuba and Bear River Watersheds: A Report of the South Yuba River Citizens League. Accessed at http://www.syrcl.org/issues/Merc&Ars/merc0501.htm, 6/15/02.