

# Impact of Historical Mercury and Gold Mining on Freshwater Fisheries Habitat

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Gold, mercury, and other metals have been mined in the Salmon River Mountains of Idaho, USA, since the early 1900s. The effects of historical mining were assessed using synoptic studies of biogeochemical and fisheries metrics in Sugar Creek and Monumental Creek watersheds. The Cinnabar mine site is at the headwaters of Cinnabar Creek, a tributary to Sugar Creek. Extraction and on-site processing of cinnabar and metacinnabar bearing rock through the 1970s left groundwater-flooded workings and a footprint of tailings. Mercury (Hg) and arsenic (As) were co-contaminants to downstream food webs. Concentrations of 257 ng Hg L<sup>-1</sup> and 20.6 µg As L<sup>-1</sup> were measured in unfiltered stream water collected approximately 4 km downstream from the Cinnabar mine site. Seston and periphyton acted as reactive biofilms where Hg was methylated. Total Hg accumulated in seston, aquatic insect larvae, adult aquatic insects, riparian spiders, and fish, at much higher concentrations (1.3 to 11.3-fold) with isotopically distinct Hg in downstream sites compared with background. Methylmercury (MeHg) concentrations in bull trout and riparian spiders (732 to 918 and 347 to 1,140 ng MeHg g<sup>-1</sup> dry weight, respectively) were at levels concerning for consumption by humans and wildlife. The diversity of benthic insect communities was locally depressed by 12 to 20% immediately downstream of mining inputs with an absence of metal-sensitive sculpin. Monumental Creek, with historical gold mining and a geological Hg background, had Hg concentrations 2 to 3 orders of magnitude lower than in Cinnabar Creek, with eDNA confirming the presence of bull trout and sculpin in all sites. This further shows that the Cinnabar mine site has a magnified impact in the downstream ecosystem of Sugar Creek. Legacy mining activity can have ecologically important effects on downstream communities, including reduced biodiversity and increased mercury exposure of higher order consumers, including fish, birds, and humans.