Influence of In-Stream Diel Concentration Cycles of Dissolved Trace Metals on Acute Toxicity to Age-1 Cutthroat Trout (*Oncorhynchus clarki lewisi)*

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Extrapolating results of laboratory bioassays to streams is difficult because conditions such as temperature and dissolved metal concentrations can change substantially on diel time scales. Field bioassays conducted for 96 hours in High Ore Creek and Dry Fork Belt Creek, two mining-affected streams, compared survival of hatchery-raised metal-naïve westslope cutthroat trout exposed to dissolved (0.1-µm filtration) metal concentrations that either exhibited the diel variation observed in streams or were controlled at a constant value.

Cadmium and Zn concentrations in these streams increased each night as much as 61 percent and 125 percent, respectively, and decreased a corresponding amount the next day. In High Ore Creek, survival (33 percent) after exposure to natural diel-fluctuating Zn concentrations (214-634 µg/L; mean = 428 µg/L) was significantly ($p = 0.008$) higher than survival (14 percent) after exposure to a controlled constant Zn concentration (422 µg/L). Similarly, in Dry Fork Belt Creek, survival (75 percent) after exposure to diel-fluctuating Zn concentrations (266-522 µg /L; mean = 399 µg/L) was significantly ($p = 0.022$) higher than survival (50 percent) in the constant-concentration treatment (392 µg/L).

Survival likely was greater in these diel treatments because the periods of lower metal concentrations provided some relief for the fish and because toxicity during periods of higher metal concentrations was lessened by the simultaneous occurrence each night of lower water temperatures, which reduce the rate of metal uptake. Based on this study, current water-quality criteria appear to be protective for streams with diel concentration cycles of Zn (and perhaps Cd) for the hydrologic conditions tested.