

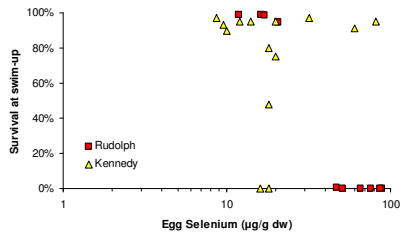


Effect of Selenium on Early Lifestage Development of Westslope Cutthroat Trout

¹Elphick, J., ¹Bailey, H., ¹Lo, B., ²Berdusco, J., ³Sword, G.
¹ Nautilus Environmental, ² Interior Reforestation, ³ Teck Coal Ltd

Background

- Selenium is a contaminant of concern, and targets are needed in order to make management decisions
- It is an unusual toxicant- risk of adverse effects is generally associated with a specific body burden in the adult female, resulting in accumulation of selenium in eggs and deformities and/or mortality in the developing offspring, due to mobilization of selenium during development
- Previous studies have produced inconsistent results using westslope cutthroat trout collected from the Elk Valley river system
 - Fish from lotic (i.e., flowing water) environments resulted in no relationship between selenium tissue concentrations from fish and deformities or survival of offspring (Kennedy et al. 2000)
 - Fish from lentic (i.e., still water) environments contradicted those results where fish with higher body burdens resulted in mass mortality of developing embryos (Rudolph et al. 2008)



Remaining Questions

- What is the threshold for toxicity of selenium to westslope cutthroat trout?
- Do fish from lentic and lotic habitats respond differently to selenium uptake?

Sampling Sites

- Lentic exposure site: Clode Pond
- Lotic exposure sites: Fording River tributaries and mainstem
- "Control" site: Connor Lake

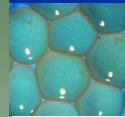
Methods



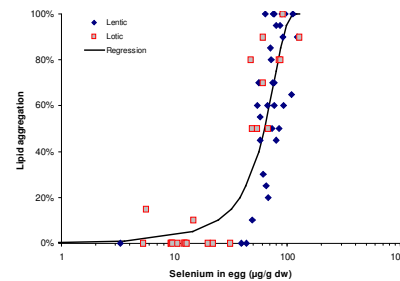
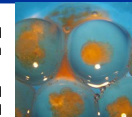
- Adults primarily captured in traps (v-weir and fyke) or by angling
- Small number of fish captured by electrofishing and by dip-net
- Fish were held in two holding areas established between Primary and East Clode Ponds
- Spawning was conducted on five occasions over three weeks in June/July 2008
- Reared in 4-L plastic containers in the dark in a consistent environment room; four replicates per fish (where possible)
- At swim-up, half of the fish were sacrificed for deformity assessment, and half were reared for an additional 28 days
- Concentration of Se was measured in eggs using ICP-MS (collision cell)
- Speciation of Se was measured in the eggs to establish the type of selenium present

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 Kennedy, E.J., McDonald, L.E., Loveridge, R., and M.M. Strosher, 2000. The effect of bioaccumulated selenium on mortalities and deformities in the eggs, larvae and fry of a wild population of rainbow trout (*Oncorhynchus clarki lewisi*). Archives of Environmental Contamination and Toxicology, 39:46-52
 Rudolph, B., Andrieller, I., and C.J. Kennedy, 2008. Reproductive success, early life stage development, and survival of westslope cutthroat trout (*Oncorhynchus clarki lewisi*) exposed to elevated selenium in an area of active coal mining. Environmental Science and Technology, 42:3109-3114

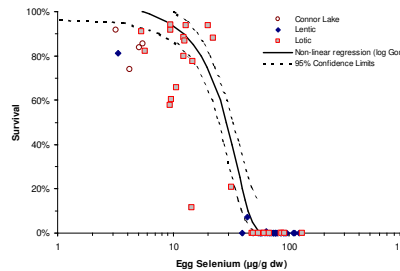
Results and Conclusions



- Some of the eggs exhibited mortalities (breakage) upon water hardening
- The eggs were associated with aggregated lipid vesicles and elevated Se

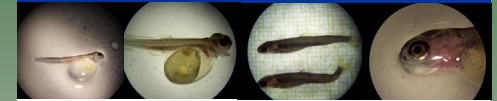


Lipid aggregation rate was related to egg Se



Survival to swim-up as a function of egg Se concentration

Results and Conclusions



- A high rate of deformity was observed in two fish that had a low rate of survival
- Rates of deformity were low in fish that had high rates of survival
- There was no evidence of elevated deformities at concentrations lower than those associated with significant mortality**
- Survival of fish was high (>90%) in the 28 days following swim-up
- There was very low incidence of deformity (<2%) at this point in time
- There was no evidence of delayed effects associated with fish that had a high rate of survival at swim-up**
- The speciation of selenium did not appear to differ in eggs from lentic or lotic environments
- Measurements of Se were systematically different in the two laboratories used in the study
- The data from the study are largely consistent with data from Rudolph et al. (2006)

