

DEVELOPMENT OF TREATED MINE WATERS FOR AQUACULTURE: OVERVIEW OF WATER QUALITY FROM DOGWOOD LAKES, 2002- 2003¹

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Abstract: In October 2002, a production-scale experiment was initiated to assess the feasibility of using treated acid mine waters to rear rainbow trout (*Oncorhynchus mykiss*). The following were identified as major ionic constituents of the treated water: iron (Fe^{3+}), aluminum (Al^{3+}), manganese (Mn^{2+}), calcium (Ca^{2+}), magnesium (Mg^{2+}), and sulfate (SO_4^{2-}). On average, dissolved ion concentrations exceeded levels recommended for freshwater aquaculture. Further, alkalinity, acidity, water temperature, turbidity, dissolved oxygen, nutrients (NO_2^- , NO_3^- , total ammonia nitrogen, and total phosphorus), BOD_5 , and TSS were monitored. Of these parameters, un-ionized ammonia concentrations were in excess of recommended limits. However, the fish exhibited no signs of stress and grew well. A low mortality of ~1.4% was observed. The lack of impact by metals and ammonia loading was explained as a combination of high ionic strength impacts on “active” ion concentrations and on the formation of less bioavailable metal-ligand species such as $\text{MgSO}_4(\text{aq})$ as opposed to the free magnesium ion.

In contrast, temperature was identified as a primary productivity-limiting water characteristic, based on the period of time water temperatures at the site were outside the optimum growth range for rainbow trout (~13 – 21°C). In general, fish growth changed in direct proportion to water temperature, where maximum growth was observed at temperatures within the optimum range for trout. However, growth rates were slower at the beginning of the study due to stress from handling and acclimation. Feeding was halted in the winter due to sustained low water temperatures (<4 °C), and operation was discontinued when the fish were harvested in the summer (June and July 2003) as temperatures approached lethal levels.

The total net production was 3,657 kg, with a calculated feed conversion rate of 1.4, and an average absolute growth rate of 1.55 g/day. Further, a condition factor of 0.0005 was determined, where a typical value for trout is ~0.0004. Thus, the trout grown in mine water exhibited normal growth.

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