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## Forebay use and entrainment rates of resident adult fish in a large hydropower reservoir

Eduardo G. Martins, Lee F. G. Gutowsky, Philip M. Harrison, David A. Patterson, Michael Power, David Z. Zhu, Alf Leake, Steven J. Cooke

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### Summary

The article investigates the vulnerability of resident adult fishes to entrainment – the displacement of individuals from reservoir to downstream waters by way of water diversions through hydropower turbines. Specifically, the authors investigated diel and seasonal patterns of forebay use and entrainment rates of adult bull trout (*Salvelinus confluentus*) and burbot (*Lota lota*) in a large hydropower reservoir (Kinbasket Reservoir, Mica Dam) in British Columbia. The team used an array of six acoustic telemetry receivers in the dam forebay to investigate forebay use of 187 bull trout and 85 tagged burbot. Entrainment events of tagged fish were monitored with two acoustic telemetry receivers deployed in the tailrace about 700 m downstream of the dam. After two years of monitoring, results revealed that (1) adult bull trout and burbot made little use of the forebay (on average < 1% of the time in each season, though some individual bull trout were detected > 50% of the time); (2) bull trout used the forebay more and had higher rates of entrainment (3.5% per year) than burbot (1.9% per year); and (3) both forebay use and entrainment varied among seasons. Bull trout used the forebay more intensively and were mostly entrained in fall and winter. Limited forebay use and entrainment data for burbot suggest that they are more vulnerable to entrainment in the fall. These findings should be applicable for adult bull trout and burbot in other hydropower reservoirs, particularly if water diversion is maximized in fall and winter, when bull trout are overwintering in the lake and burbot seem more active due to increases in pre-spawning feeding. Furthermore, the findings presented in this study indicate that assessments of the feasibility and efficiency of operating deterrent devices (e.g. strobe lights, sounds, screens) to reduce entrainment of adult bull trout and burbot should be conducted in the fall and winter.

This paper highlights entrainment of resident species in reservoirs (i.e. species which do not emigrate from reservoirs), which are vulnerable to entrainment when using habitats near water intake structures. Considerably less research has focussed on entrainment of resident fish. As low levels of adult mortality potentially impact the demography of late maturing resident species, such as bull trout and burbot, understanding the factors associated with entrainment and estimating entrainment rates are vital for the development of models to predict population-level consequences and explore ways of reducing such impacts. Crucially, the effects of additional entrainment-related mortality on the long-term viability of reservoir populations should be examined more closely in order to facilitate decision-making as to how to mitigate or offset the effects of entrainment.