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Using otolith chemical and structural analysis to investigate reservoir habitat use by juvenile Chinook salmon *Oncorhynchus tshawytscha*

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Isotopic composition of ^{87}Sr:^{86}Sr and natural elemental tracers (Sr, Ba, Mg, Mn and Ca) were quantified from otoliths in juvenile and adult Chinook salmon *Oncorhynchus tshawytscha* to assess the ability of otolith microchemistry and microstructure to reconstruct juvenile *O. tshawytscha* rearing habitat and growth. Daily increments were measured to assess relative growth between natal rearing habitats. Otolith microchemistry was able to resolve juvenile habitat use between reservoir and natal tributary rearing habitats (within headwater basins), but not among catchments. Results suggest that 90% ($n = 18$) of sampled non-hatchery adults returning to the Middle Fork Willamette River were reared in a reservoir and 10% ($n = 2$) in natal tributary habitat upstream from the reservoir. Juveniles collected in reservoirs had higher growth rates than juveniles reared in natal streams. The results demonstrate the utility of otolith microchemistry and microstructure to distinguish among rearing habitats, including habitats in highly altered systems.

Key words: dams; growth; life-history variation; migration; rearing.

INTRODUCTION

For migratory species, the occurrence, timing and extent of movements can have a strong influence on the ecological and evolutionary processes of populations (Webster *et al.,* 2002). In particular, the dispersive and directed movements of individuals during early life cycle stages of complex life histories can have implications for population demographics as well as consequences for natural selection (Gross *et al.,* 1988; Gross, 1991; Drent *et al.,* 2003). It is generally accepted that variation in the expression of movement decisions is a combined genotypic and phenotypic response to heterogeneity in the environment and variation in individual responses to factors such as temperature, food availability and density (McNamara & Houston, 1996; Rochet, 2000; Hartson & Kennedy, 2014). For fishes specifically, variation in early life-history behaviours is

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