Willamette Instream Flow Project: Integrated Tools for The Evaluation of Alternative Flow Management Strategies

James T. Peterson[1], Jessica E. Pease[2], Luke Whitman[3], James White[4], Laurel Stratton Garvin[4], Stewart Rounds[4], and Rose Wallick[4]

(1) U.S. Geological Survey, Oregon Cooperative Fish and Wildlife Research Unit, Department of Fish and Wildlife, Oregon State University.
(2) Oregon Cooperative Fish and Wildlife Research Unit, Department of Fish and Wildlife, Oregon State University.
(3) Oregon Department of Fish and Wildlife, Corvallis Research Laboratory.
(4) U.S. Geological Survey, Oregon Water Science Center.

Sustaining the ecological integrity of lotic ecosystems, while providing needed water resources for human needs is a major challenge facing society. The Willamette River, Oregon has been altered by impoundments, flow regulation, and human land development, which has affected fluvial-dependent biota, such as federally threatened spring Chinook Salmon *Oncorhynchus tshawytscha* and winter Steelhead trout *O. mykiss*.

Working with an interdisciplinary team of scientists and managers, we developed a decision support tool that integrates flow, habitat, and temperature models with ecological models for predicting the response of salmonids to alternative flow regimes. To illustrate, we introduce a decision support model for Chinook salmon and Steelhead trout and use the model to estimate four responses under seven candidate flow regimes: (1) the number of Chinook salmon redds that survive to emergence; (2) the number of juvenile Chinook salmon surviving to passage at Willamette Falls; (3) the number of age 1 Steelhead trout produced; and (4) the percentage of Steelhead trout smolts successfully migrating past Willamette Falls. We also conducted sensitivity analyses to identify the most influential components.

Preliminary modeling results suggest that the flow regime varies by species and life history stage. However, model estimates under a subset of candidate flow regimes indicated relative minor losses when compared to estimated outcomes under the taxa-specific best regime. Sensitivity analyses identified key uncertainties that could be reduced within an adaptive framework where decision support model components are iteratively improved to gain better understanding of the mechanisms linking flow management actions to biotic responses.