Life-cycle models for the diverse and plastic *Oncorhynchus mykiss*: challenges and opportunities

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*Oncorhynchus mykiss* support numerous fisheries in North America, have tremendous social and cultural value, and are an integral part of river and stream ecosystems. However, many populations have declined. The species displays a wide variety of life history strategies, which can be influenced by environmental and anthropogenic factors. Life-cycle models can be used to better understand these strategies of *O. mykiss* and evaluate their population dynamics both spatially and temporally. I will talk about recent efforts to develop life-cycle models for interior Columbia River basin *O. mykiss* populations. I will discuss existing life-cycle models upon which we are building and available data from eight steelhead populations in two ESUs including Rapid River, Big Bear Creek of the Potlatch River, and Catherine Creek (Snake River Steelhead ESU) along with Umatilla River and Satus Creek, Toppenish Creek, Naches River, and upper Yakima River of the Yakima River basin (all Middle Columbia River Steelhead ESU). Overall, we have found that resident *O. mykiss* (rainbow trout) data are not available for most populations, which may limit the power of some models. However, we can successfully evaluate a number of scenarios, including juvenile survival; downriver survival associated with hydropower corridor passage; estuary and early marine survival; later marine survival; and upriver survival. We found that population abundance and extinction probability trends varied a great deal among the populations and were sensitive to the various scenarios. These flexible models demonstrate great potential to increase our understanding of how changes in survival rates at different stages of the life cycle of *O. mykiss* affect population abundance trends and viability.

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