Ecological Interactions between Hatchery Summer Steelhead and Wild *Oncorhynchus mykiss* in the Willamette River Basin, 2014

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Background

Wild winter steelhead populations have declined in the upper Willamette River basin and are consequently listed as "threatened" under the Endangered Species Act. The U.S. Army Corps of Engineers funded the Pacific Northwest National Laboratory (PNNL) to determine whether releases of non-native hatchery summer steelhead into the South Santiam River (a tributary of the upper Willamette River) have the potential to negatively affect the river's wild winter steelhead population. The objectives of this study were to 1) estimate the proportion of hatchery summer steelhead that residualized in the South Santiam River in 2014, 2) determine the extent to which hatchery and naturally produced *Oncorhynchus mykiss* overlapped in space and time in the South Santiam River, and 3) characterize the behavioral interactions between hatchery-origin juvenile summer steelhead and naturally produced *O. mykiss*.

Methods/Results

We used a combination of radio telemetry and direct observations (i.e., snorkeling) to determine the potential for negative interactions between hatchery summer and wild winter steelhead juveniles in the South Santiam River. Data collected from these two independent methods indicated that a significant portion of the hatchery summer steelhead released as smolts did not rapidly emigrate from the South Santiam River in 2014. The last known location of the majority of radio-tagged hatchery summer steelhead (99 of 164 = 60.4%) was in the South Santiam River. Thirty-three of the tagged hatchery steelhead were detected in the South Santiam River during mobile tracking surveys. Of those, 21 were found to be alive over three months after release. Because we did not survey the entire South Santiam River during mobile tracking surveys, the final fate (alive or dead) remained unknown for many of the tagged fish. Therefore, the proportion we detected alive (12.8%; 21 of 164) represents the absolute minimum residualization rate for the population of radio-tagged hatchery steelhead juveniles. Applying this percentage to the number of hatchery steelhead released from the South Santiam Hatchery would result in an estimated 23,616 residual hatchery summer steelhead in the South Santiam River. Snorkeling revealed considerable overlap of habitat use (in space and time) by residual hatchery steelhead and naturally produced *O. mykiss* in the South Santiam River. Results from

our study (and others) also indicated that hatchery steelhead juveniles typically dominate interactions with naturally produced *O. mykiss* juveniles.

The relatively high residualization rate, combined with the overlap in space and time and the competitive advantage that residual hatchery steelhead appear to have over naturally produced *O. mykiss*, increases the potential for negative ecological interactions that could have population-level effects on the wild winter steelhead population of the South Santiam River.