**Hatchery, wild, or out-of-town visitor? Evaluating steelhead spawning interactions in the Klickitat River — Updated results from genetic and radio telemetry monitoring**

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**ABSTRACT:**

Steelhead in the Klickitat River subbasin are listed as threatened under the Endangered Species Act (ESA), and key monitoring objectives for this population include tracking adult returns, genetic characteristics, spawner locations, and interactions between hatchery- and natural-origin fish. Evaluations of interbreeding between hatchery- and natural-origin fish (through genetic analysis and radio telemetry from 2009-2014) indicated there was some degree of overlap in spawn locations and timing; but the majority of natural-origin steelhead spawned upstream of and after hatchery-origin spawners, most Skamania Hatchery steelhead adults did not spawn in the wild (and those that did exhibited an early spawn timing), and generally a strong distinction between hatchery- and natural-origin steelhead was maintained. Monitoring also documented stray adult steelhead (fish that originated in other subbasins) in the Klickitat River and on spawning grounds, but actual spawning interactions and gene flow between out-of-subbasin fish and native Klickitat steelhead had not been thoroughly evaluated.

More recent genetic analysis of adult steelhead returning to the lower Klickitat from 2012-2021 indicate that Klickitat natural-origin steelhead still show strong genetic distinction from Skamania Hatchery fish, and natural-origin steelhead still display relatively high genetic diversity, including distinctions between different geographic areas within the Klickitat subbasin, and in run timing (with summer, winter, and intermediate genotypes).  Adult steelhead from sources outside the Klickitat enter the Klickitat River regularly (some likely for thermal refuge), with >20% of both hatchery- and natural-origin steelhead sampled at Lyle Falls being from outside stocks (most of them from Snake River populations).  These out-of-subbasin stocks (and both hatchery- and natural-origin spawners) may contribute as much or more in terms of genetic introgression with native Klickitat fish (especially in the lower Klickitat subbasin) than Skamania Hatchery fish do.

Commonly-used hatchery evaluation metrics such as percent of hatchery-origin spawners (pHOS) on the spawning grounds, which was estimated at 12% for steelhead in the 5-year radiotelemetry study in the Klickitat, do not provide a full picture of actual spawning interactions and gene flow. Interpretation of effects of introgression between stocks (with hatchery stocks or with natural-origin strays) is complex and nuanced; trade-offs between beneficial dispersal among populations and adverse fitness effects from interbreeding should carefully be considered, especially in naturally genetically diverse populations such as Klickitat steelhead.