**Title:** The Impacts of Dam Construction and Removal on the Genetics of Recovering Steelhead (*Oncorhynchus mykiss*) Populations across the Elwha River Watershed


## Authors

**Alexandra K. Fraik**[1], John R. McMillan[2], Martin Liermann[3], Todd Bennett[3], Michael L. McHenry[4], Garrett J. McKinney[3], Abigail H. Wells[5], Gary Winans[3], Joanna L. Kelley[1], George R. Pess[3] and Krista M. Nichols[3]

## Affiliations

[1.] School of Biological Sciences, Washington State University, Pullman, WA 99164, USA; joanna.l.kelley@wsu.edu (J.L.K.)
[2.] Trout Unlimited, 1777 N. Kent Street, Suite 100, Arlington, VA 22209, USA; jmcmillan71@gmail.com (J.R.M.)
[3.] Northwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, 2725 Montlake Boulevard East, Seattle, WA 98112, USA; martin.liermann@noaa.gov (M.L.); todd.bennett@noaa.gov (T.B.); garrett.mckinney@noaa.gov (G.J.M.); gary.winans@noaa.gov (G.W.); george.pess@noaa.gov (G.R.P.)
[4.] Lower Elwha Klallam Tribe Natural Resources, 760 Stratton Road, Port Angeles, WA 98363, USA; mike.mchenry@elwha.org (M.L.M.)
[5.] Lynker Technologies, in support of the Conservation Biology Division, Northwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, 2725 Montlake Boulevard East, Seattle, WA 98112, USA; abigail.wells@noaa.gov (A.H.W.)



## Abstract

Dam construction and longitudinal river habitat fragmentation disrupt important life histories and movement of aquatic species. This is especially true for *Oncorhynchus mykiss* that exhibits both migratory (steelhead) and non-migratory (resident rainbow) forms. While the negative effects of dams on salmonids have been extensively documented, few studies have had the opportunity to compare population genetic diversity and structure prior to and following dam removal. Here we examine the impacts of the removal of two dams on the Elwha River on the population genetics of *O. mykiss*. Genetic data were produced from >1200 samples collected prior to dam removal from both life history forms, and post-dam removal from steelhead. We identified three genetic clusters prior to dam removal primarily explained by isolation due to dams and natural barriers. Following dam removal, genetic structure decreased and admixture in-creased. Despite large *O. mykiss* population declines after dam construction, we did not detect shifts in population genetic diversity or allele frequencies of loci putatively involved in migratory phenotypic variation. Steelhead descendants from formerly below and above dammed populations recolonized the river rapidly after dam removal, suggesting that dam construction did not significantly reduce genetic diversity underlying *O. mykiss* life history strategies. These results have significant evolutionary implications for the conservation of migratory adaptive potential in *O. mykiss* populations above current anthropogenic barriers.