**Population, habitat, and marine location effects on early marine survival and migration behavior of Puget Sound steelhead smolts**

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**Abstract**

Steelhead trout (*Onchorhynchus mykiss*) smolts suffer high mortality rates during their rapid migration through the Salish Sea. Among-population variability in mortality rates may reflect i) genetic fitness variation among populations, ii) freshwater environmental effects on fish condition, or iii) differences in local marine conditions upon seawater entry. A reciprocal transplant experiment was conducted to investigate the importance of freshwater effects (combined effects of population and freshwater environment) from local marine conditions on survival of two Puget Sound steelhead populations. Steelhead smolts from the Green River in Central Puget Sound (urbanized and hatchery-influenced) were tagged with acoustic telemetry transmitters and released back into the Green River or transported and released into the Nisqually River (less urbanized; no hatchery influence), and vice versa. Population-of-origin had little influence on probability of surviving the migration through Puget Sound. However, smolts released into the Green River had higher survival through Puget Sound (17%) than smolts released into the Nisqually River (5%); the extra 60-km migration segment for the Nisqually-released fish accounted for most of the difference between the two release locations. Neither fork length nor translocation influenced survival, though release date did affect the odds of survival for the Nisqually population regardless of their release location. Residence time and behavior in the two estuaries were similar, and no effects of population-of-origin or release date were evident. Marine travel rates also did not differ between populations, release dates, or release locations. This study indicates that mortality occurring in the Salish Sea is likely not influenced by freshwater processes, but rather by processes occurring during inland marine migration.