**Factors affecting the early marine survival of Puget Sound steelhead**

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**Abstract**

Steelhead along the Pacific Coast of North America suffered steep declines in abundance from the mid 1980’s to the early 1990’s. Since then Puget Sound populations have remained at low levels or continued to decline (particularly in southern Puget Sound), while populations outside the Salish Sea have rebounded to some degree. Limited smolt-to-adult return data also suggest different marine factors drive overall marine survival of Puget Sound and coastal populations. While Pacific Ocean migratory patterns and stock distribution is extremely limited, recent studies using acoustic telemetry have provided important insights into early marine survival rates, migratory behavior, and informed hypotheses about potential predator-prey interactions. From 2006-2009, nearly 1,400 steelhead smolts from 9 watersheds within Puget Sound were implanted with acoustic telemetry transmitters and monitored by various arrays of fixed receivers. Mark-recapture-type estimates suggest approximately 20% (minimum estimate) of wild steelhead smolts survived their one to three week migration to the Pacific Ocean. Mortality rates appear to be greater in Central Puget Sound (for Puget Sound stocks) and Admiralty Inlet (for Hood Canal stocks). Overall, the data support the hypothesis that early marine mortality in Puget Sound is an important factor limiting the productivity of Puget Sound populations. Rapid migration rates suggest that predation is the predominant proximate cause of mortality. The apparent high mortality experienced by outmigrating steelhead smolts may derive from freshwater conditions (reduced diversity, pathogens, toxins, or other factors) or changes in the marine ecosystem that increase predation rates on steelhead smolts. Increases in key marine mammal species (harbor seals and harbor porpoise) and concomitant declines in other fish prey species (herring, Pacific cod, rockfish) may help to explain the low marine survival of steelhead in Puget Sound during the study period. Over the next two years, the Puget Sound Steelhead Marine Survival Project will integrate retrospective data analyses, fish health and genetic assessments, reciprocal transplant survival experiments, and predator-prey interaction studies to further understanding of the freshwater and marine factors inhibiting recovery of Puget Sound steelhead.