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**Presentation Title:** **Declining Pacific Northwest Steelhead Trout Adult Survival in the Ocean and Associated Ecosystem Indicators**

Abstract for the 2018 Pacific Coast Steelhead Management Meeting

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Marine survival of Puget Sound steelhead, documented from 1977-2014, declined since its peak in the early 1980s and has been consistently low since the early 1990s. We conducted a retrospective analysis aimed at evaluating how changing conditions in Puget Sound and the Pacific Ocean have related these steelhead marine survival rates, which are represented by time series data for 12 (2 wild and 10 hatchery) populations. We first developed hypotheses about steelhead marine survival based upon our mechanistic understanding of steelhead passage from their spawning streams to the Pacific Ocean and back. These hypotheses are related to steelhead predation, forage fish in Puget Sound, primary production in Puget Sound, estuary and early ocean conditions (specifically related to river flow and oceanography), and hatchery salmonid releases into Puget Sound. We then developed a suite of potential indicators that reflect changes to the environment of steelhead and are themselves changing over time and that are available or could be derived for the period of time of interest. These indicators include Puget Sound harbor seal abundance, resident orca abundance, herring spawning stock biomass, sea surface temperature, salinity, river flow rates and dates, and pink salmon abundance; Pacific Ocean SST, salinity, NPGO, PDO, MEI, PNI, NPI, upwelling index, and date of spring transition; Salish Sea human population abundance; and abundance and release dates of Puget Sound hatchery salmonids. To relate steelhead marine survival rates to the indicators we used generalized additive models (GAMs). Using model selection (based on AICc), we evaluated indicators individually and in combination, thereby addressing possible interactions and cumulative effects. The best-fitting model showed that seal abundance was strongly negatively related to steelhead survival rates, while SST and NPI values also had negative effects. PDO and the CV of hatchery subyearling Chinook release date had more moderate relationships with survival, with variable influence. Finally, there was a positive correlation between abundance of outmigrating hatchery fish and steelhead marine survival. We will continue to refine the models and assess the strength of the covariates in driving the model output.