PRESPAWNING MORTALITY OF FALL CREEK WILLAMETTE CHINOOK SALMON: EVALUATION OF THE EFFECTS OF A NEW TRAP AT THE ADULT FISH COLLECTION FACILITY

K. Carey[1], L. Whitman[2], C. Sharpe[2], C. Couch[1], M.L. Kent[3], J. Sanders[4],
C.B. Schreck[1], and J.T. Peterson[5*]
[1]Department of Fisheries, Wildlife, and Conservation Sciences
[2]Oregon Department of Fisheries and Wildlife
[3]Microbiology Department
[4]Biomedical Sciences Department
[5]US Geological Survey, Oregon Cooperative Fish and Wildlife Research Unit
Oregon State University, Corvallis, Oregon 97331
jt.peterson@oregonstate.edu

Trap and transport operations have been implemented in several Upper Willamette River tributaries with the objective of establishing natural populations of spring Chinook Salmon. These efforts are complicated by high annual rates of pre-spawn mortality (PSM) in transported adult Chinook salmon. Recent improvements at the USACE trapping facilities at Fall Creek, a tributary of the Middle Fork Willamette River, have the potential to reduce PSM associated with trap and transport operations. However, previous studies suggest that adult Chinook salmon PSM is also related to other potentially manageable factors, including elevated temperature exposure, fish density, and exposure to other external stressors. Identifying these factors and developing management strategies to reduce their effect on PSM could aid in establishing natural populations. Strategy development is complicated by uncertainty associated with dynamic ecological systems that can affect strategy effectiveness. Thus, an ideal approach to PSM reduction would incorporate uncertainty and allow for the reduction of uncertainty through the incorporation of monitoring data. This approach could be transferable to reintroduction programs in other tributaries to help reduce PSM.

We evaluated PSM in Fall Creek prior to improvements of the trapping and transport facilities in summer and fall of 2010-2017 and after improvement in 2020-2021. We estimated PSM and conducted exploratory analyses to identify possible non-transport sources of stress that may contribute to the observed high prespawn mortality rates in Fall Creek. Candidate factors

included long-term temperature exposure, temperature exposure below the Fall Creek trap, total number of outplanted fish, and human disturbance of outplanted fish. We then developed and fit three linear models each representing a hypothesis of the factor influencing PSM, incorporated them into a single decision model, and conducted sensitivity analyses. The decision alternatives included flow management at Fall Creek Dam, reducing human disturbances on outplanted fish, and flow management in the Willamette Basin during upstream migration.

Preliminary analyses indicated that PSM averaged 66% over the study period and was greater for females than males. Additionally, PSM was negatively related to estimated cumulative thermal exposure of returning adults, average temperatures below Fall Creek Dam during June, and estimated human disturbance. Preliminary decision model simulations indicated that the candidate management action that reduced human disturbance during August would reduce PSM the most. Sensitivity analyses of the preliminary model indicated that the model was most sensitive to the three alternative PSM. Sensitivity analysis further suggested that reducing this source of uncertainty could lead to better management and reduce PSM by 7% per year under a high effort survey design. However, the expected reduction of PSM was lower under less intensive survey designs. We illustrate how annual monitoring data can be used to update the decision model and improve management.