Evaluation of the Sensitivity of Recovery Potential of Spring Chinook Salmon in the Middle Fork to Different Sources of Uncertainty

Roberto Licandeo, Eric Parkinson, Tom Porteus, Oliver Murray, and Mairin Deith & Murdoch McAllister

The University of British Columbia, Vancouver, Canada

A multi-stage life cycle model for Middle Fork (MF) spring Chinook salmon (*Oncorhynchus tshawytscha*) was developed to evaluate the efficacy of alternative dam passage measures under uncertainty. See McAllister et al. (2022 Willamette Science Review) for an overview of the model calibration methodology. Input parameters for the different groups of migrant spring Chinook salmon, when possible, were estimated from PIT tag data or the multi-stage life cycle model fitted to MF data, otherwise, from reports and literature. The parameter distributions (i.e., from data or reports) range from wide to very narrow, but overall they remain pretty uncertain. MF shows very low abundances of natural origin spawners (NORs) over the last two decades (average 94, range 14-259, n=19). Therefore, we performed a sensitivity analysis for some key model parameters to assess their effect on the predicted NOR abundance (after pre-spawn mortality (PSM)) by projecting the population model for 30 years for the base case scenario (i.e., current conditions). We used the deterministic model to vary one (or two) parameter(s) (e.g., survival rates) over a range of values (e.g., 0,…,1) while fixing the others to their mean estimated value. The sensitivity analysis included the first stage of marine survival, reservoir survivals, PSM (below and above), dam passage efficiency and survival (DPE, and DPS, respectively), and egg-to-fry survival. The results show that 1+ to-age3 and 0+ to-age3 marine survivals are the most influential parameter affecting the predicted NOR abundance, particularly the 1+ to-age3 marine survival. In addition, uncertainty over reservoir survivals (for fish remaining in spring and fall at LOP) were more influential than those over DPE, DPS and PSM. Therefore, the low abundance of NOR spawners could be explained by marine survival and reservoir survival rates lower than those for spring Chinook salmon in other Willamette sub-basins.