



FISH PASSAGE CENTER

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MEMORANDUM

TO: Derek Fryer, US Army Corps of Engineers

FROM: Michele DeHart

DATE: August 10, 2018

RE: Comments on Crozier et al. (2018) "Passage and Survival of Adult Snake River Sockeye Salmon within and upstream from the Federal Columbia River Power System from 2008 – 2017"

At your request, we have reviewed the draft report "Passage and Survival of Adult Snake River Sockeye Salmon within and upstream from the Federal Columbia River Power System from 2008 – 2017" (Crozier et al. 2018). Several components of this report have limited or no management applications and the results should be interpreted with caution. Our comments are listed below.

- Re-ascension rates in this study are calculated using same-site detections after a six hour lag, as outlined in Burke et al. (2004). This method has been shown to overestimate re-ascension rates in other species. The Fish Passage Center ([July 6, 2017](#)) and DART (http://www.cbr.washington.edu/dart/query/pitadult_fallback) use directional movement through the ladder to avoid overestimates of fallback and might provide a more accurate methodology for this study.
- Ladder temperature differentials may not be an appropriate covariate to use in the survival analysis of Snake River adult sockeye in this analysis. As currently applied, the temperature differential experienced by an individual, as defined, would represent a very small percentage of their overall cumulative temperature exposure, and as such, it is unsurprising that adding this variable to the univariate modeling effort did not

significantly improve fit. Instead, the effect of ladder temperature differentials may be better characterized as an impedance mechanism that may increase cumulative temperature exposure by delaying fish. By equating temperature differentials to overall survival, this analysis may not accurately characterize potential impacts of ladder temperature differentials on survival dynamics of migrating adult sockeye in the following ways:

- Survival estimates are created only for individuals that pass a project. Mortality of individuals that do not pass a project due to high ladder temperature differentials would not be included in these modeling efforts and subsequent survival estimates therefore representing a potential bias.
 - Increased cumulative temperature exposure (and associated mortality) caused by delay would not be accurately characterized if fish wait until minimal ladder temperature differentials are present before passing a specific project. In other words, fish that wait for favorable ladder conditions before passing may have increased immediate or delayed mortality, caused by high ladder temperature differentials impeding dam passage. This would not be captured by the temperature differential present at the specific time individuals enter/pass each project.
 - Based on the previous two comments, it is unsurprising that adding ladder temperature differentials did not improve model fit, or prove a significant factor in adult sockeye upstream survival. Stating that “the relationship between temperature differentials and survival was variable and not significant” may describe the technical results of the specific modeling effort correctly, but might not be an accurate characterization of how ladder temperature differentials impact adult sockeye upriver migration and survival.
- The modeling of adult transportation operations of Snake River sockeye from Bonneville is not informative from a scientific or management perspective, and detracts from the robust analyses within the report.
 - There is no method of separating Upper Columbia and Snake River sockeye at Bonneville Dam, so adult transportation could only have significant negative effects.
 - Upper Columbia sockeye populations, which make up an overwhelming majority of the total adult sockeye return at Bonneville, would be removed from the system and not allowed to return to natal spawning grounds.
 - The genetic identity of Snake River sockeye would be diluted with broodstock locally adapted to the Upper Columbia.
 - The survival estimate of 80% for transported adult sockeye from Bonneville does not seem to be supported by experimental or observational data. It should be clear in the report how the success of adult transportation operations would be sensitive to projected survival estimates.
 - The median travel times reported from Bonneville to Sawtooth for Snake River sockeye are 48 – 63 days. This analysis does not address pre-spawning mortality,

or spawning success associated with transported fish holding while awaiting the rest of their cohort arriving at the spawning ground.

- It is clear from this report and Crozier et al. (2015) that the transportation of juveniles increases adult travel times, fallback, straying, and mortality. It would be useful to fisheries managers to model the potential gains in adult returns to the basin with the elimination of juvenile transportation.
- Authors can be more explicit in the discussion that fish travel time was based on river conditions in the previous reach. It is an important point because travel time in the previous reach does not reflect the environmental conditions of the current reach. The travel time variable in this analysis is most accurately used as an indication of how past conditions might affect the current survival of fish. This point should be clearly explained, and highlighted throughout the discussion to avoid misinterpretation or incorrect application of results.