FISH PASSAGE CENTER

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Dr. James Anderson
University of Washington
Professor, School of Aquatic and Fishery Sciences
1325 -4th Ave., Suite 1820
Seattle, WA 98101

Dear Dr. Anderson:

Thank you for your review of the Draft, Ten Year Retrospective Summary Report. The following response was developed by the Comparative Survival Study Oversight Committee, (Committee) comprised of, the Columbia River Inter-tribal Fish Commission, the Washington Department of Fish and Wildlife, the Oregon Department of Fish and Wildlife, the Idaho Department of Fish and Game, and the US Fish and Wildlife Service. As you are aware the Comparative Survival Study is a joint project of the agencies and tribes. The study design, the implementation of the study and the analysis are carried out collaboratively among the sponsoring fish and wildlife management agencies. The Committee has developed the attached response (attachment 1) to your comments.

Sincerely

Michele Dehart
Project leader, Comparative survival Study

Attachment 1

Reviewer Comment: Result using S were not presented.

Response: Results on the model fits (AIC values) using S as dependent variables were presented in Table 2.2 and the variables that were selected were reported on page 23 of the draft report. The revised version contains a table describing the models that were fit with S as the dependent variable, the parameter estimates for the best-fit model, and an expanded comparison of the approach of modeling S versus modeling instantaneous mortality rates for all reaches as species groups evaluated.

Reviewer Comment: Mathematically the analysis based on Z is not valid.

Response: We believe that we are on firm ground mathematically with the use of Z. The mathematics of instantaneous mortality (*Z*) go back to Malthus (1798). The exponential law of mortality, which is based on *Z*, has been called the "first principle" or "first law" of population dynamics (Turchin 2003). The formula we used for estimating *Z* is the maximum-likelihood estimator for *Z* (Seber 1982, p. 216). The exponential law of mortality forms the basis for nearly all fisheries population dynamics models (Quinn and Deriso 1999).

Reviewer Comment: The analysis and conclusions based on Z should be deleted from the report and replaced with the analysis based on S.

Response: We provide a comparison of three approaches for predicting survival rates, including one that uses *S* as the dependent variable. By nearly all performance measures, the approach based on *Z* outperformed the analyses that used *S* as the dependent variable.

Reviewer Comment: The mathematical error in their analysis can be demonstrated as follows. Z contains information on fish travel time fft since it is defined

$$Z = -\frac{\log S}{ftt} \quad (1)$$

Response: We do not disagree that *Z* reflects changes in FTT (the denominator). However, *Z* also reflects changes in survival (the numerator). We found that most of the variation in *Z* was associated with variation in *S* (49-58%), whereas only a small amount of the variation in *Z* was associated with variation in FTT (2-13%).

Reviewer Comment: *However, fish travel time decreases with increasing Julian day and water travel time. This has been established in earlier studies (Zabel et al. 1997, 1998, in press). The CSS study found a similar result*

$$\log ftt = a_0 - a_1(ju) + a_3(ju)^2 + a_4(wt) - a_5(wt)^2 \quad (2)$$

Response: We find it peculiar that you have chosen to omit the spill variables that we reported from your mischaracterization of our work. Recall, if you will, that spill was found to reduce fish travel time for all species and all reaches analyzed. We do not disagree that Julian day and water transit time also affect fish travel time. However, we clearly demonstrated that the average percent spill was a primary determinant of fish travel time, with higher levels of spill associated with reductions in fish travel time.

Reviewer Comment: *Therefore, Z is a function of ju and wt independent of any effect of these variables on S.*

Response: As noted above, most of the variation in *Z* is associated with variation in survival (49-58%), whereas only a small amount of the variation in *Z* was associated with variation in *FTT* (2-13%). Given these results, and the fact that *Z* is calculated as a function of survival and fish travel time (essentially averaging total mortality over a period of time), it is unclear what your basis is for arguing that *Z* is independent of *S*.

Reviewer Comment: *In fact, Zabel et al. in press analyzed the effects of similar covariates on survival (S) and found temperature was a dominant factor in the upper reach and the only factor in the lower reach. These results stand in variance to the claims in the CSS report (lines 3-9 page 24)*

Response: The quote you refer to has nothing to do with modeling the effects of covariates on *S*, temperature or otherwise. The quote summarizes the instantaneous mortality rates that were observed in the upper and lower reaches and what the relative magnitude of those values mean.

Reviewer Comment: *The claim is not supportable. In the lower reach, mortality is independent of time in reach (Zabel et al in press). Mortality depends on temperature so the results in the CSS study reflect the effect of wt and ju on fish travel time, not on survival.*

Response: Again, the quote you refer to has nothing to do with modeling the effects of covariates on *S*, temperature or otherwise. Rather, it simply summarizes the data. See above response.

Reviewer Comment: *Relating river conditions to Z, and not S, does not reveal the effect of temperature on survival, contrary to the claims in the CSS report. The report states (line 17-19 page 24)*

Response: We did not find that temperature was an important factor for explaining patterns of variation in instantaneous mortality rates, survival rates, or fish travel times. Only in the lower reach for steelhead (the data set with the greatest level of imprecision) was temperature identified as being associated with instantaneous mortality rates. Because temperature did not explain variation in the data in the upper reach where the data were more precise, we suggested that the identification of temperature as a primary determinant of instantaneous mortality rates for steelhead *may* be a spurious correlation. However, if you had continued to read the draft report, you would have read that we offered the alternative explanation that the factors influencing mortality rates in the lower reach (i.e., temperature) may be different than those operating in the upper reach.

Zabel et al. (in press) found temperature was important in the upper reach. Furthermore, the 2001 data reveals a strong temperature effect not a flow effect (Anderson 2003). In 2001, flow increased and decreased over the migration season while survival dropped steadily (Figure 1). However, survival dropped as temperature increased showing (Figure 2). The CSS model is incapable of capturing this pattern.

A visual inspection of the predicted survival rates in Figure 2.9 of the draft report clearly demonstrates that the model developed by the CSS is quite capable of capturing the pattern of survival in 2001, as well as the other years analyzed, for both Chinook and steelhead.