



FISH PASSAGE CENTER

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MEMORANDUM

TO: Ed Bowles, ODFW

FROM: Michele DeHart

DATE: February 15, 2012

RE: Acoustic tagging Studies in the Lower Columbia, performance standards, and review of "Analysis of Dam-Passage Survival of Yearling and Subyearling Chinook Salmon and Juvenile Steelhead at The Dalles Dam, Oregon, 2010"

In response to your recent request the FPC staff has reviewed the USGS/COE report "Analysis of Dam-Passage Survival of Yearling and Subyearling Chinook Salmon and Juvenile Steelhead at The Dalles Dam, Oregon, 2010", and attended the Feb 6, 2012 meeting of the Scientific Review Work Group (SRWG), during which the preliminary results from 2011 acoustic tags studies were presented. During the SRWG meeting, several concerns were raised regarding both the study design and the general limitations of acoustic tagging studies. Our overall conclusions about the USGS review of 2010 studies and comments regarding the SRWG meeting are listed below, followed by a detailed discussion of each article. Also in response to your request, we are in the process of reviewing the 2010 final reports for The Dalles Dam and Bonneville Dam acoustic tagging studies, and our comments on those studies will be provided in a later memo.

- The USGS review of 2010 acoustic tagging studies at The Dalles Dam raises concerns that inclusion of a third release group may artificially inflate dam survival estimates. This inflation may occur from random sampling effects or unequal mortality between the two control groups.
- A study design similar to 2010 was used at The Dalles Dam and Bonneville in 2011. However, high flows in the spring made 2011 an anomalous year and study results should

be used with reservations about applicability to other years. The Army Corps of Engineers has been unclear on whether or not they intend to use results from 2011 towards meeting performance standards.

- The results obtained from acoustic tagging studies are limited in their applicability to survival throughout the hydrosystem and give no information about adult returns. These limitations include the following:
 - Rejection of large percentages of fish due to fish condition and tag size limitations, so tagging studies do not adequately represent survival probabilities of the run-at-large.
 - Effects of acoustic tags on fish behavior may alter the passage routes, influencing overall survival estimates through the project.
 - Data obtained from acoustic arrays require extensive post-hoc selection after data collection, making results difficult to reproduce and introducing the possibility of subjectivity in the analysis.
 - The short tag life of acoustic tags limits the survival analysis to the immediate vicinity of the project, and cannot assess the effects of delayed mortality associated with project operations or route of passage.
- Due to the limitations of acoustic tagging, a decision making framework incorporating all available data should be adopted. Survival through the hydrosystem is a product of the cumulative effects of passage through each project, not the isolated survival probability through a single dam. Acoustic tagging can provide only a small portion of the data required to improve adult returns.

Inflated Survival Estimates due to Experimental Design

The experimental design used to test survival through the project involves two control groups—one released immediately downriver of the project (R_2) and, to control for any handling effects experienced by the R_2 group, a second control group (R_3) is released further downriver. Survival probabilities from these two groups are used as a ratio (S_2/S_3) as the control for the treatment group passing through the project. The use of R_3 is intended to decrease estimates of dam survival that would otherwise be too high due to handling effects on the R_2 group.

However, the use of a third release group in this design has introduced an additional source of variation. Random variation associated with S_2 and S_3 can artificially increase S_2/S_3 , rather than the expected decrease. This inflation will increase estimates of dam survival due strictly to random sampling effects. Although the resulting survival estimates may change only slightly, it was shown in the USGS report that this slight change could be the difference between meeting and not meeting the performance standards.

Although the R_3 release was introduced to control for handling mortality experienced by the R_2 release, the two groups may not experience the same mortality rates due to different environmental conditions in different stretches of river. If predation is consistently higher in the

location of the R₂ release (the tailrace of the dam), S₂/S₃ will be depressed and dam survival estimates will be artificially inflated. This is in addition to the random effects discussed above. Particular concern was expressed at the February 6 SWRG meeting for the R₂ release below The Dalles Dam, where releases occur near islands downstream of the dam. For a more detailed description of this issue, please see the March 24, 2011 FPC Memo.

High Flows in 2011 Make Results Inapplicable to Meeting Performance Standards

2011 was an anomalous year in terms of flow and spill percentages. Using spring flow totals for the last 50 years at The Dalles Dam, 2011 flows are the 6th highest (90th percentile). Due in part to these high flows, the study design objectives were only met during the first part of the spring season (29 April to 17 May). Although relative survival through the project surpassed the requirements of the Biological Opinion for some species at some projects, the fact that testing was carried out for only a portion of the spring migration precludes using the results for estimating seasonal survival through the projects.

Limitations of Acoustic Tagging

Even with the best experimental design, the data from acoustic tagging cannot fully represent the passage of fish through the hydrosystem. Tagging protocols require rejection of fish based on multiple criteria, including size and condition. Tagged fish must be between 95 and 300 mm. The total number of fish rejected for tagging due to size in 2011 is currently unavailable, but will be included in the preliminary results. Fish condition includes disease, descaling, and other maladies. Fish were divided into 4 groups; hatchery Chinook, wild Chinook, hatchery Steelhead, and wild Steelhead. Rejection rates due to condition for the four groups were 7 – 15% of the sampled population. In 2010, overall rejection rates (including those rejected for size or condition) were 16%. Consequently, if performance standards are determined to have been met in 2011, they may be met only for the healthiest 85 – 93% of the population. This is a high estimate of the percentage of the population, since it does not take into consideration the additional percentage of fish rejected in 2011 that were not within the targeted size range. Given the exclusion of a large proportion of the population that is not represented in acoustic tag studies, the studies cannot be considered representative of the survival of the run-at-large.

Survival through the project is a function of the number of fish travelling through each passage route and the survival through that route. If the behavior of acoustically tagged fish changes the probability of taking a specific passage route, the overall project survival will not represent the survival probabilities for untagged fish.

The use of detection arrays at multiple locations in the river generates data that requires extensive post-hoc selection of data. The methods of including and excluding data have been unclear in previous studies, and cast doubt on the repeatability of results obtained from these studies. In 2011, the FPC attempted to reanalyze data from acoustic tagging studies, and obtained results that were opposite the conclusions made by PNNL. Further investigation showed the discrepancy was due to the exclusion of data, without rigorous protocols, by PNNL. For a detailed description of this issue, please see the February 16, 2011 FPC memo.

Due to the short tag life of acoustic tags, projects must be studied individually. Questions of passage through the entire hydrosystem, delayed mortality after passage, the synergistic effects of passage through multiple dams, and rate of adult returns are all beyond the scope of acoustic tagging studies. Other forms of data must be utilized for a full understanding of the effects of project operations on survival.

Management Decisions Should Not Be Based On Just Single-Dam Performance Standards

Past FPC memos have reviewed acoustic tag studies throughout the hydrosystem. Repeatedly, these memos have raised concerns regarding the usage of these studies for project management decisions. The USGS review of the 2010 performance testing at The Dalles Dam is in agreement with many of these issues.

Management decisions about fish passage operations should utilize all available data and include the entire life cycle, rather than survival at projects considered in isolation. An appropriate decision making framework for the Columbia Basin should incorporate the strengths and limitations of each data type as part of a straightforward guide to the results of project operations.

The long term effects of passage routes for juvenile fish have been well documented. Increased spill can reduce travel times, decrease the probability of passage via juvenile bypass, and increase rates of adult returns (Haeseker et al 2012, Petrosky and Schaller 2010). Acoustic tag studies provide only short-term survivals for specific projects and therefore cannot fully inform policy makers about methods for improving adult returns.

References

Beeman J.W., Kock T.J., Perry, R.W., Smith, S.G. 2011. Analysis of dam-passage survival of yearling and subyearling Chinook salmon and juvenile Steelhead at The Dalles Dam, Oregon, 2010. Prepared in cooperation with U.S. Army Corps of Engineers. Open-File Report 2011-1162

Haeseker, S.L., McCann, J.A., Tuomikoski, J., Chockley, B. 2012. Assessing freshwater and marine environmental influences on life-stage-specific survival rates of Snake River spring-summer Chinook salmon and Steelhead. *Transactions of the American Fisheries Society* 141:121-138

Petrosky, C. and Schaller, H. 2010. Influence of river conditions during seaward migration and ocean conditions on survival rates of Snake River Chinook salmon and steelhead. *Ecology of Freshwater Fish* 19(4):520-536



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DATA REQUEST FORM

Request Taken By: Michele Dehart Date: Jan 27, 2012

Data Requested By:

Name: Ed Bowles Phone: _____
Address: _____ Fax: _____
GDFW Email: ed.bowles@state.or.us

Data Requested:

Review USGS comments on 2010 performance testing at the Dalles Dam; Also review effectiveness of current performance standards in assessing effects of operations on juvenile migration.

Data Format: Hardcopy Text Excel
Delivery: Mail Email Fax Phone

Comments:

Data Compiled By: EE Cooper Date: Feb 15 2012

Request # 10

-----Original Message-----

From: Ed Bowles [<mailto:ed.bowles@state.or.us>]

Sent: Friday, January 27, 2012 2:58 PM

To: Michele Dehart

Cc: Rick Kruger; tony.nigro@state.or.us

Subject: RE: USGS/NOAA report on 2010 compliance test at TDA

Michele... Thanks for the update. I am requesting FPC review this information and other relevant information to assess whether current performance measures and standards are accurately and adequately capturing the juvenile migration effects associated with their migration/transportation through the FCRPS. I would like this analysis to be framed in the context of an adaptive management decision framework for the existing BiOp as well as the pending new BiOp. Also, I would like FPC to closely track all aspects of performance measure and standard discussions related to juvenile and adult migrations through the FCRPS and update/alert the salmon managers as appropriate. Thank you... Ed

Ed Bowles

ODFW Fish Division Administrator