FISH PASSAGE CENTER

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MEMORANDUM

TO: Jay Hesse, Nez Perce Tribe

FROM: Jerry McCann

DATE: April 23, 2008

RE: Average Spill Proportion variable used in analysis of importance of spill in SAR's of Snake River yearling Chinook and steelhead

As per your request, I've put together some information on the Average Spill Proportion variable we used to analyze the importance of spill on SAR's of salmon

How is Average Spill Proportion Measured?

Juvenile in-river migration indices were used to characterize the river environment and timing of out-migration of each of the five cohorts during each year. The in-river indices were assigned based on timing of entry and passage through the hydro-system. Based on past studies that have identified the most important variables for determining juvenile in-river survival, three indices were calculated for each cohort based on timing and fish travel time through the hydro-system. Each reservoir water transit time (WTT) was calculated using the reservoir replacement method, which divides the reservoir volume by the river flow. An overall WTT was calculated by summing the WTT's for each reservoir in the Lower Granite to Bonneville Dam reach. Average spill proportion (AvgSpillProp) was the average of the proportion of total river flow spilled at all seven dams in the reach as each cohort passed through. Finally, date group (Date_grp) was a number (1 to 5) assigned based on the two-week time period the cohort passed Lower Granite Dam during the time period April 8 to June 16 of each year. An interaction term was also modeled WTT*Date_grp to evaluate seasonal effects (in updated analyses).

Average spill proportions were assigned to a cohort based on when that group of marked fish were detected migrating through a reach. Fish travel times from Lower Granite Dam to each downstream dam were estimated for each group. Conditions at downstream dams were averaged over two weeks and the travel time from Lower Granite Dam was used to adjust the start date of these calculations. For example, travel time from Lower Granite to Little Goose Dam, for the earliest steelhead cohort in 1999 (passed LGR from 4/8 to 4/21), was estimated to be 4.2 days based on 3,070 detections at both Lower Granite and Little Goose Dam during that two week period. Average spill proportion, average total discharge, and average forebay elevation at Little Goose Dam over the time period April 12 to April 25 were then calculated and assigned for that reach. At each downstream site similar variables were calculated based on estimated travel time from Lower Granite Dam to that downstream dam. Since no PIT-tag detection data were available until 2005 at Ice Harbor Dam, the travel time to Ice Harbor Dam was estimated as 43% of the total travel time from Lower Monumental Dam to McNary Dam. The average spill proportion for each group was an average of the calculated values for each project.

Without a direct estimate of proportion of fish passing in spill at each dam (such as PIT-tag detections in the spillway, bypass and turbines), average spill proportion was used. While others have modeled proportion passing in spill (e.g. compass model approach which has both average operations and fish travel time related components--but also relies on functional models supported by numerous research studies using radio telemetry marked fish etc...) in this analysis we sought to use a variable that was to the extent possible *not* derived from other models and therefore built upon additional underlying assumptions. It may be necessary to incorporate some spill efficiency function to the spill variable as more surface passage routes (RSW's) come on line and change the spill efficiency at dams. Those changes would affect analyses from 2005 and more recent as Ice Harbor was the second dam to receive an RSW (operational in 2005). Lower Granite Dam had an RSW operational in 2002, however, our analyses do not include operations at Lower Granite since the tailwater of that site is the starting point for the reach.

What does average spill proportion measure?

As stated before it is a surrogate for spill passage proportion. It measures a broad hydro-system effect that may be thought of as correlated to the probability of fish passing via spill and may measure both the benefits of decreased stress relative to that (associated with bypass or turbine passage) as well as direct survival effects as measured by radio-telemetry studies. Further, it may incorporate indirect effects of the probability of passing in spill, which are expressed in longer reach survival estimates and SAR's (such as "extra mortality" of bypassed fish, identified by Budy et al 2002 and NOAA unpublished.