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To: David Clugston, USACE Portland District

From: Michael Jepson and Christopher Peery - University of Idaho

RE: *Ad hoc* summary of migration times from ladder top at Bonneville Dam to ladder top at The Dalles Dam or the tailrace of John Day Dam for radiotagged adult spring–summer Chinook salmon

Date: 22 June 2006

These data were compiled in response to concerns expressed by the U.S. Army, Corps of Engineers that the proportionately low numbers of adult Chinook salmon counted at the north-shore ladder of The Dalles Dam through early June 2006 directly or indirectly resulted in higher dam passage times. Through early June 2006, approximately 7% of the salmon counted at The Dalles Dam were counted at the north-shore ladder. Prior to 2006, the percentage of radiotagged salmon that passed The Dalles Dam via the north-shore ladder during previous study years ranged from 19.1% to 47.7% (Table 1). While we do not know the cause for this anomalous pattern, conditions at The Dalles Dam this spring are likely unique because of the combination of recent alterations to spillway structure and operations and high river flows.

There were no funded research objectives at The Dalles Dam for 2006. As such we did not deploy tailrace receivers at The Dalles Dam so dam passage times could not be calculated. In the absence of any dam passage times from the Dalles Dam during 2006, we were asked to compare annual median times for radiotagged adult Chinook salmon to migrate from a) the top of a fishway at Bonneville Dam to the last record at a ladder top at The Dalles Dam and b) the top of a fishway at Bonneville Dam to the first tailrace record at John Day Dam.

Among years, median times to migrate from a Bonneville Dam ladder top to a ladder top at The Dalles Dam ranged from 38.4 to 76.7 h (Table 1). During 2006, the median time for radiotagged salmon to migrate from a ladder top at Bonneville Dam to a ladder top at The Dalles Dam was 48.6 h ($n=134$).

The median time to migrate from a Bonneville Dam ladder top to the tailrace of John Day Dam ranged from 51.3 to 110.6 h among years for radiotagged adult spring–summer Chinook salmon. The median time for salmon to migrate through this section of the lower Columbia River during 2006 was 65.3 h ($n=104$).

Median times to migrate both distances during 2006 were the fifth highest/sixth lowest median times among the ten years for which we had radiodata. To this extent, median migration times through these river sections during 2006 were not outside the range observed in the past. Still, the time to pass The Dalles Dam was an unknown fraction of the time to migrate these distances during 2006 and many factors (e.g., temperature, fallback, temporary straying, and dam operations – none which were evaluated as part of this summary) were likely responsible for the variation in migration times among years. Therefore, we could not comment on dam passage times at The Dalles Dam during 2006 based on these surrogate metrics.

Table 1. Number of first dam passage events via the north-shore ladder, total number of first passage events, and the percentage of all first passage events via the north-shore ladder by radiotagged adult spring–summer Chinook salmon at The Dalles Dam, 1996-1998 and 2000-2005. Also included are median passage times from a ladder top at Bonneville Dam (BO) to a ladder top at The Dalles Dam (TD) and median passage times from a ladder top at Bonneville Dam to the first tailrace record at John Day Dam (JD) with sample sizes (n).

Year	Number of north ladder 1 st passage events at TD	Total number 1 st passage events at TD (all routes)	% via North ladder at TD	Median time from BO ladder top to TD ladder top (h)	n	Median time from BO ladder top to 1 st tailrace record at JD (h)	n
1996	138	495	27.9	66.1	378	86.4	305
1997	277	712	38.9	76.7	699	110.6	565
1998	364	763	47.7	56.8	743	75.8	559
2000	339	845	40.1	52.2	699	73.7	471
2001	197	1032	19.1	44.6	742	58.9	538
2002	358	925	38.7	48.5	679	64.8	561
2003	254	849	29.9	43.7	832	59.4	669
2004	139	432	32.2	38.4	413	51.3	341
2005	29	135	21.5	40.1	115	53.4	104
2006	17	234	7.3	48.6	134	65.3	104

The underlying premise associated with the expressed concerns involved the assumption that low proportionate use of the north-shore fishway was associated with high total dam passage times. We used correlation analysis to evaluate the degree of association between median dam passage time and the proportionate use of the north-shore fishway.

We observed a correlation coefficient of 0.53 which suggested the two variables were not highly interdependent (Figure 1). Moreover, the positive slope of the linear correlation model suggested that lower median dam passage times might be expected when the proportionate use of the north-shore ladder is low.

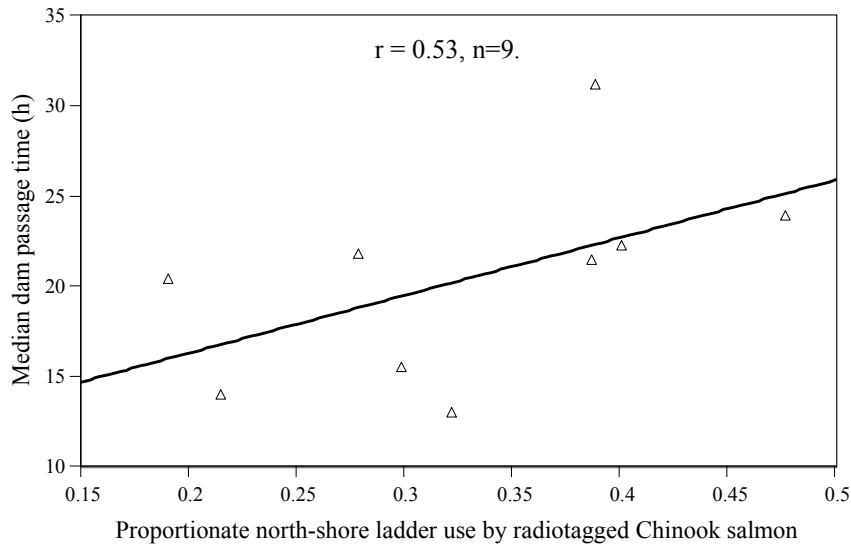


Figure 1. Linear correlation model of median dam passage times with proportionate north-shore ladder use for radiotagged spring–summer Chinook salmon at The Dalles Dam, 1996-1998 and 2000-2005.

We also compared ladder-specific dam passage times within years using a Kruskal-Wallis one-way ANOVA to test the hypothesis that there was no difference in dam passage times between north- and east-ladder migrants. We found significant differences ($p < 0.05$) in dam passage times between east- and north-ladder migrants during five of nine years (Table 2). For four of those five years, the east-ladder migrants had the significantly higher dam passage times. This suggests there's a four in nine (44%) chance that east-ladder migrants will have significantly higher dam passage times than north-ladder migrants. In contrast to the correlation analysis, these data suggested that concerns about comparatively high dam passage times may be justified when there is a disproportionately high number of spring–summer Chinook salmon counted passing the Dalles Dam via the east-ladder. Still, any justification provided by these data was diminished because significant differences were observed during years when median dam passage times were typically the lowest in absolute terms.

In summary, we concluded that median migration times from a ladder top at Bonneville Dam to a ladder top at The Dalles Dam or the tailrace of John Day Dam were poor surrogates for estimating the median dam passage time at The Dalles Dam during 2006. This conclusion was based on the inability to have much or any confidence in the proportion of those times used specifically to pass The Dalles Dam. Based on a correlation analysis, it was not clear that low proportionate use of the north-shore fishway at The Dalles Dam was highly associated with high median dam passage times. Significantly higher median dam passage times for east-ladder migrants compared to north-ladder migrants during some years provided some justification for concerns about disproportionately high east-ladder use. We believe these equivocal conclusions emphasize the relatively low utility from single location records (i.e. tops of ladders) when attempting to evaluate passage conditions for adult salmon migrants in the Lower Columbia River.

Table 2. Ladder-specific and combined median dam passage times (first tailrace record to last record at ladder top) and sample sizes for radiotagged adult spring–summer Chinook salmon recorded passing The Dalles Dam, 1996-1998 and 2000-2005.

Year	East-ladder migrants	n	North-ladder migrants	n	Kruskal-Wallis Test <i>p</i> -value	All migrants	n
1996	23.0	236	18.9	115	0.02	21.8	351
1997	27.9	333	40.9	224	0.07	31.2	557
1998	23.9	281	24.0	251	0.32	23.9	532
2000	21.6	325	22.4	234	0.21	22.3	559
2001	20.0	676	23.8	155	0.04	20.4	831
2002	22.1	430	20.0	274	0.02	21.5	704
2003	16.3	441	12.8	173	< 0.01	15.5	614
2004	13.8	228	10.1	114	0.20	13.0	342
2005	15.6	91	10.1	24	0.04	14.0	115