

To: David A. Clugston, USACE Portland District
From: Mike Jepson
RE: Behavior of radio-tagged adult spring Chinook salmon at The Dalles Dam - 2007
Date: 31 May 2007

This summary addresses concerns regarding how a spill pattern with a range of spill volumes thought to be beneficial to smolt survival at The Dalles Dam (through spillbays 1-6 only) might affect adult Chinook salmon behaviors and passage times there. It is based on radio data downloaded from receivers at The Dalles Dam on and before approximately noon of 29 May 2007. Two hundred eighty-six adult Chinook salmon were radio-tagged at Bonneville Dam through 29 May 2007 as a part of this study and of those, 186 were recorded at The Dalles Dam by the time of the last downloads (Table 1). Of the 186 radio-tagged salmon recorded at The Dalles Dam, 169 passed the dam; 16 via the north ladder, and 153 via the east ladder. Fourteen radio-tagged salmon had tailrace or spillway monitoring area (SMA) records only by the time of the last download (Figure 1). Eleven fallback events were recorded by ten unique radio-tagged salmon. All fallback events were preceded by dam passage events via the east ladder. No post-fallback data were evaluated as part of this summary.

Table 1. Number and percent of adult radio-tagged Chinook salmon recorded at The Dalles Dam through noon of 29 May 2007, that were recorded on their first passage of the tailrace, first passage of the spillway monitoring area (SMA) prior to their first approach, first approach at a fishway opening, first fishway entry, and exit from the top of a ladder.

<i>2007</i>	<i>Freq.</i>	<i>Percent</i>
Recorded at dam	<i>186</i>	<i>100</i>
Known to pass dam	<i>169</i>	<i>91</i>
Recorded first tailrace passage	<i>100</i>	<i>54</i>
Recorded in SMA before 1 st approach	<i>149</i>	<i>80</i>
Recorded first (known) fishway approach	<i>105</i>	<i>56</i>
Recorded first (known) fishway entrance	<i>99</i>	<i>53</i>
Recorded ladder exit	<i>169</i>	<i>91</i>

Passage Times

Overall, median passage times from first tailrace record to first fishway approach, first fishway entry, and last record at a ladder top were less than or on the low end of the range of median times observed during April and May of previous years (Table 2). The median time from first fishway approach to first fishway entry was less than the range of values observed during previous years

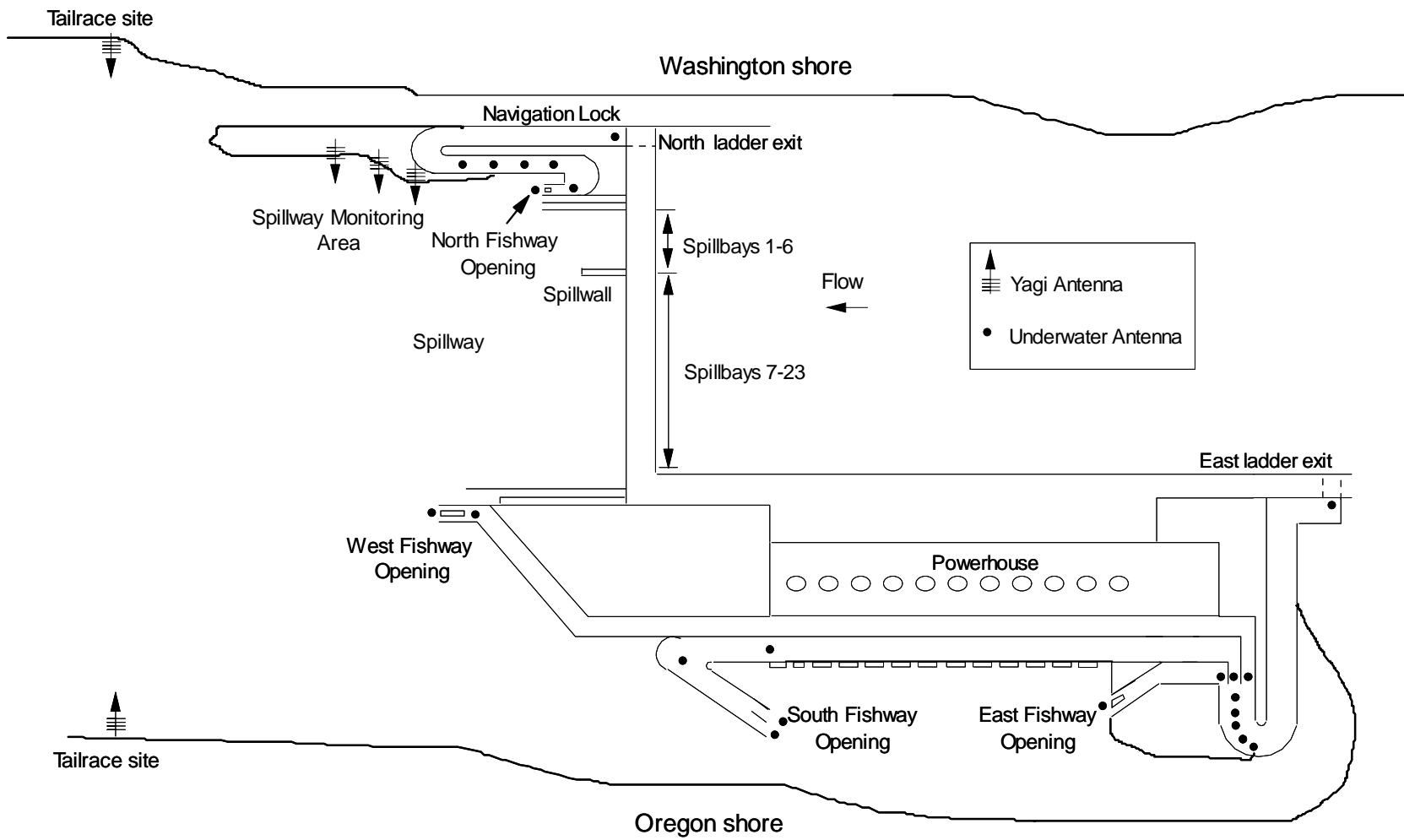


Figure 1. Aerial view of radio antenna deployments at The Dalles Dam during 2007.

Table 2. Number of adult radio-tagged spring–summer Chinook salmon and median times to pass (h) from first tailrace record to first fishway approach, to first fishway entrance, and to pass The Dalles Dam, and from first fishway approach to first fishway entry based on month fish were first detected in the tailrace.

		Chinook salmon															
		1997		1998		2000		2001		2002		2003		2004		2007	
		N	Med	N	Med	N	Med	N	Med	N	Med	N	Med	N	Med	N	Med.
<u>First tailrace to first approach</u>																	
April		125	11.6	147	5.2	199	7.1	295	4.2	147	9.0	179	4.7	56	3.0	2	8.2
May		242	6.2	229	3.1	210	4.3	238	3.7	311	4.1	158	3.4	121	3.1	57	5.1
June		87	3.6	100	3.7	96	3.4	136	2.8	155	3.6	135	3.4	92	3.3		
July		118	2.6	67	2.5	54	3.2	114	2.7	94	3.5	136	3.1	53	2.8		
<u>First tailrace to first entry</u>																	
April		101	71.1	132	20.0	172	22.8	271	13.8	140	27.0	165	11.2	48	4.1	2	11.6
May		186	33.8	203	10.1	200	12.1	186	6.8	300	12.0	156	5.3	112	4.0	53	5.6
June		68	5.5	72	8.8	94	5.2	136	4.1	149	5.8	132	4.3	88	5.7		
July		100	3.1	58	4.1	53	5.3	114	3.6	92	6.0	135	4.2	52	3.1		
<u>First tailrace to pass dam</u>																	
April		118	98.2	141	47.1	198	34.1	290	24.7	144	41.1	182	17.4	56	9.4	9	8.8
May		221	53.1	222	22.0	205	22.3	238	19.7	304	19.8	160	13.5	121	13.0	88	14.3
June		83	18.1	98	20.3	96	12.8	138	15.1	154	20.6	136	18.1	92	20.5		
July		133	12.7	69	14.3	55	15.2	111	14.6	95	17.6	139	13.4	53	11.6		
<u>First approach to first entry</u>																	
April		101	41.2	133	8.6	172	11.4	271	4.1	140	14.8	218	3.0	60	0.2	4	5.6
May		186	21.0	203	3.6	200	5.6	186	1.6	300	3.7	224	0.9	127	0.5	73	0.1
June		68	0.5	72	0.2	94	0.5	136	0.2	149	0.6	192	0.3	99	0.7		
July		99	0.2	58	0.0	53	0.4	114	0.3	92	1.2	170	0.2	54	0.2		

Behavior of Tagged Salmon Recorded in the Spillway Monitoring Area

On median, tagged salmon were recorded in the SMA 1.1 h ($n=134$) before approaching a fishway opening. Of the 149 tagged salmon recorded in the SMA and subsequently recorded in a fishway, nine (6%) made their first approach at the north fishway opening. All of the tagged salmon that made their first approach at the north fishway opening made their first fishway entry there. The median time from first fishway approach to first entry for these nine fish was 0.2 h. In comparison, the median time from first fishway approach to first entry for tagged salmon making their first approach at any fishway opening other than the north fishway opening was 0.1 h ($n=68$).

Based on linear regression modeling (Figure 2), the mean daily spill on dates tagged salmon were first recorded in the SMA had no effect on the time tagged salmon spent in the SMA before making a fishway approach ($p=0.40$). Moreover, the negative slope suggested that SMA residence times could be expected to decrease slightly in response to increasing spillway discharge over the range of spill volumes encountered by tagged salmon.

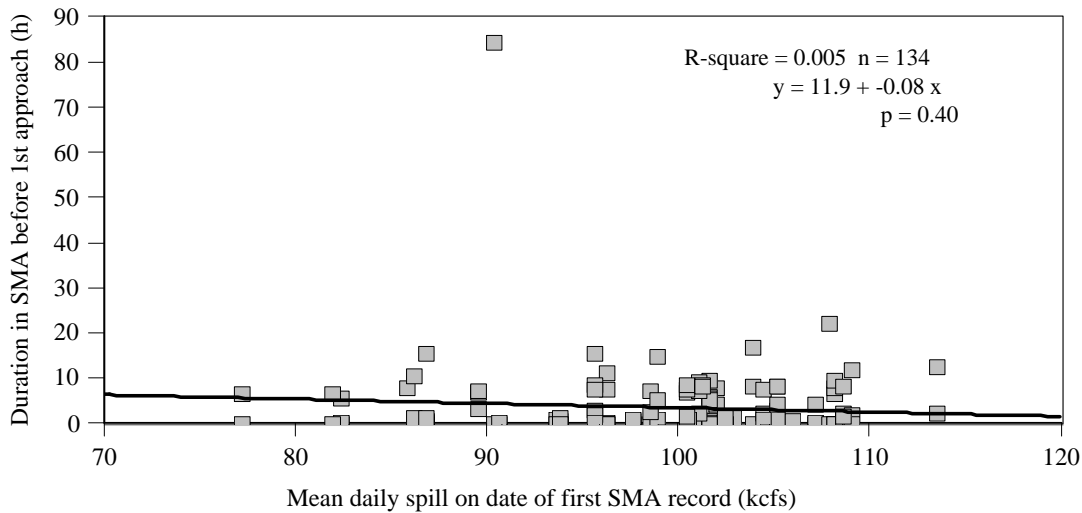


Figure 2. Linear regression model of mean daily spill on the date of first SMA record with the interval between first and last records in the SMA prior to first fishway approach for radio-tagged spring Chinook salmon at The Dalles Dam, 2007.

North Fishway Use in Relation to Spill Volume

Generally, the use of the north fishway by tagged salmon was low. Only 18 of the 189 tagged salmon recorded at the dam were detected approaching or being inside the north fishway. Based on dam counts, mean daily spillway discharge had no effect on the proportionate use of the north fishway (Figure 3). The negative slope of the linear regression model suggested that the proportionate use of the north fishway could be expected to decrease with increasing spillway discharge volumes over the range of mean daily spill volumes observed.

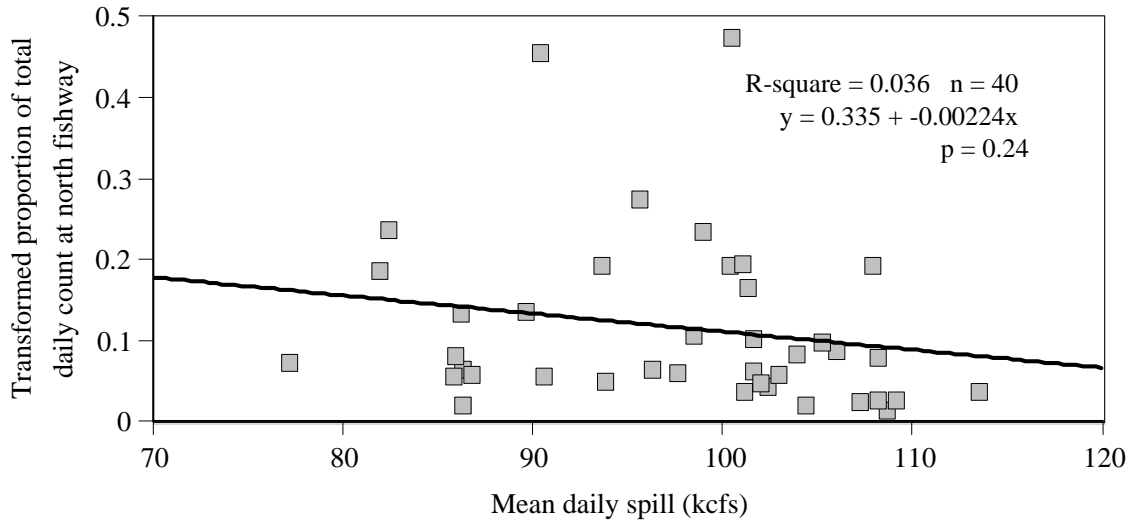


Figure 3. Linear regression model of mean daily spill with arcsine-transformed proportions of total daily Chinook salmon counts at The Dalles Dam counted at the north fishway through 29 May 2007.

Fishway-specific Dam Passage Times

During 2007, the median dam passage time for tagged salmon that passed via the north fishway was approximately 4 h higher than the median value for east fishway migrants (Table 3). North fishway migrants have typically had lower median dam passage times than east fishway migrants but north fishway migrants having higher median dam passage times is not without precedent. As mentioned earlier, however, overall median dam passage times were on the low end of the range of median dam passage times observed during previous years.

Table 3. Fishway-specific and combined median dam passage times (first tailrace record to last record at ladder top) and sample sizes for radio-tagged adult spring–summer Chinook salmon recorded passing The Dalles Dam, 1996-1998, 2000-2005, and through 29 May 2007.

Year	East fishway migrants	n	North fishway migrants	n	All migrants	n
1996	23.0	236	18.9	115	21.8	351
1997	27.9	333	40.9	224	31.2	557
1998	23.9	281	24.0	251	23.9	532
2000	21.6	325	22.4	234	22.3	559
2001	20.0	676	23.8	155	20.4	831
2002	22.1	430	20.0	274	21.5	704
2003	16.3	441	12.8	173	15.5	614
2004	13.8	228	10.1	114	13.0	342
2005	15.6	91	10.1	24	14.0	115
2007	14.3	87	18.9	10	14.3	97

Dam Passage Times in Relation to Spill Volume

The mean daily spill on dates tagged salmon were first recorded in the tailrace had no effect on the time tagged salmon used to pass the dam ($p=0.56$). However, the positive slope suggested that dam passage times could be expected to generally increase in response to increasing spillway discharge over the range of spill volumes encountered by tagged salmon.

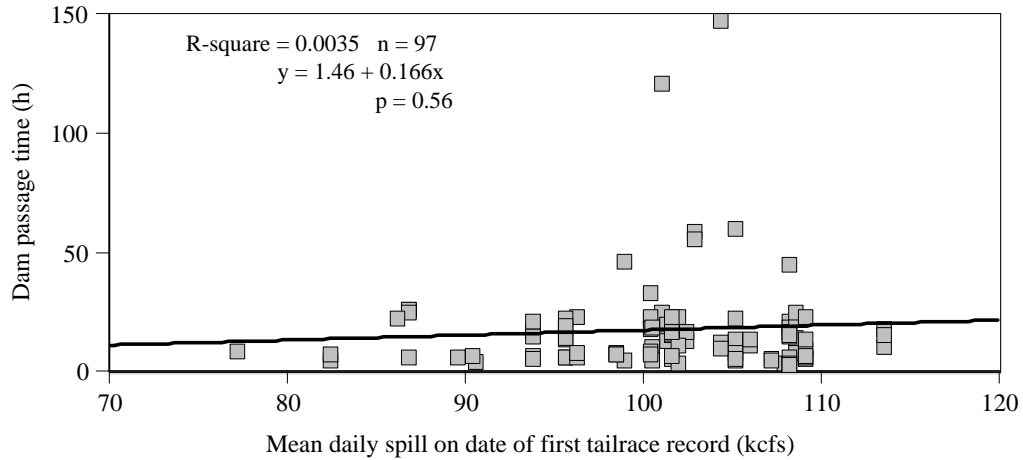


Figure 4. Linear regression model of mean daily spill on date of first tailrace record with dam passage times by radio-tagged adult spring Chinook salmon at The Dalles Dam during 2007.

In summary, the proportionate use of the north fishway by spring Chinook salmon to pass The Dalles Dam was low over the range of mean daily spill volumes observed based on both dam counts and radiotelemetry. Median dam passage times for tagged salmon were within or below the range of medians observed during previous years. It is unclear if the time tagged salmon spent in the SMA before making a first fishway approach was extraordinarily high or low because this was the first year of monitoring this area of the tailrace successfully. On balance, it does not appear that the passage of tagged salmon past The Dalles Dam is unduly impeded by the current spill pattern over the range of spill volumes observed to date.