



FISH PASSAGE CENTER

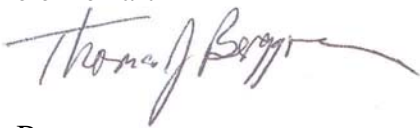
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MEMORANDUM

TO: Michele DeHart


FROM: Tom Berggren

DATE: July 7, 2006

RE: Adult passage, spring summer Chinook

In response to your request I reviewed adult passage of Comparative Survival Study mark groups through the Columbia and Snake rivers. Returning adult hatchery and wild spring/summer Chinook salmon PIT tagged as juvenile fish in the Snake River basin for the 2001 to 2003 migration years were evaluated in the 2005 CSS Annual Report (Berggren et al. 2005) for “dropout” rates between Bonneville (BON), McNary (MCN), Ice Harbor (IHR), and Lower Granite (LGR) dams on their upstream migration through the hydrosystem. The inter-dam “dropout” rate is simply the proportion of the returning PIT-tagged adults first encountered at BON that are subsequently detected at (or known to have passed) each of the upstream dams equipped with adult PIT-tag detectors (see Table 1). Adult fish traverse about 286 river miles and encounter eight dams from BON to LGR inclusive. Once adult fish negotiate BON, they pass through a tribal fishery between BON and MCN and a sport fishery in both the Columbia and Snake Rivers. A combination of harvest, straying, and mortality of returning adults is incorporated in the “dropout” rates.

Table 1. Dropout rate of jack and adult wild and hatchery Chinook between dams with adult PIT-tag monitors (percentage relative to fish first detected at BON) – returns from smolts that outmigrated in 2001 to 2003.

Migr. Year	Age (salt) =>	Dropout Rate (%) BON -to- MCN			Dropout Rate (%) MCN -to- ICH			Dropout Rate (%) ICH -to- LGR		
		1	2	3	1	2	3	1	2	3
2001	RAPH	5.0	19.2	23.5	NA ¹	0.8	0	NA ¹	3.0	0
	DWOR	7.1	12.8	28.6	NA	1.1	0	NA	2.1	0
	CATH	33.3	22.7	--	NA	0	--	NA	18.2	--
	MCCA	7.7	17.3	23.3	NA	0.8*	0	NA	0	6.7
	IMNA	6.9*	18.8	20.2	NA	1.6	0	NA	3.1	0
	HAT.	7.6	17.7	24.2	NA	0.9	0	NA	2.3	3.0
	WILD	0	13.3	12.5	NA	0	0	NA	0	6.3
2002	RAPH	11.9	13.0	16.7*	0	0.9	0*	3.0	3.0	0
	DWOR	6.1	14.4	33.3	2.0	0	0	0	3.8	0
	CATH	9.1	15.4	0	0	5.8	0	0	0	50.0
	MCCA	3.1*	20.5	0	0	0.9	0*	2.1	0	0
	IMNA	5.1	18.8	33.3	2.6	1.0	0*	0	0	0
	HAT.	6.5	16.6	14.6	0.8	0.9	0	1.5	1.7	2.4
	WILD	4.3*	13.1	15.6	0	0	0	4.3	0.9	4.4
2003	RAPH	0	24.2	NA ²	0	1.1*	NA ²	0	0	NA ²
	DWOR	20.0*	17.2	NA	0	5.7	NA	0	0	NA
	CATH	0	13.0	NA	0	0	NA	0	0	NA
	MCCA	4.3	9.1	NA	0	0.8	NA	0	3.7	NA
	IMNA	3.0*	12.5	NA	0	4.5	NA	0	4.5	NA
	HAT.	4.3	13.7	NA	0	2.3	NA	0	2.4	NA
	WILD	0	5.1	NA	0	1.7	NA	0	0	NA

¹ Detections at Ice Harbor Dam began with return year 2003, so information on jacks returning from migration year 2001 is not available.

* denotes dropout rate was computed using the return count from next dam upstream due to missing fish detections.

² Incomplete since Age 3-salt adult returns are not available until return year 2006.

The dropout rate tended to be higher for hatchery Chinook than wild Chinook and in BON-to-MCN reach where an active Zone 6 tribal harvest occurs on spring/summer Chinook. Other factors besides harvest can reduce numbers of returning adults passing upstream through the hydrosystem including debilitating injuries, hydrosystem passage mortality, and straying into watersheds other than where the fish originated. Fish that are removed from the river and transported downstream may have greater susceptibility to straying upon return. As shown in Table 2, transported PIT-tagged Chinook smolts (Group T) returned with a higher “dropout” rate in the BON-to-MCN reach than did the inriver migrating PIT-tagged Chinook (Group C). This evaluation is conducted on the combined 2- and 3-salt adult returns (no jacks), since they make up the vast majority of the overall PIT-tagged returns and are the only returning age groups used in the SAR determinations. Although not always higher at the individual hatchery level (*e.g.*, Rapid River Hatchery Chinook from migration years 2002 and 2003), the aggregate hatchery group’s dropout rate for returning adults of transported smolts was approximately 20 to 46% higher than observed for returning adults of inriver migrants. For PIT-tagged wild Chinook the

adult dropout rate of returning transported fish was 55-56% higher than that of inriver migrants from migration years 2001 and 2002. This was not the case for returns from migration year 2003, when the BON-to-MCN adult dropout rates of transported and inriver fish was more similar. Since the dropout rates above MCN were relatively small, we did not see any strong pattern in dropout rates between returning adults that were transported or migrated inriver as smolts for either the wild or hatchery Chinook stocks.

Table 2. Dropout rate of adult (2-and 3-salt) wild and hatchery Chinook between dams with adult PIT-tag monitors (percentage relative to fish first detected at BON) grouped by whether the fish outmigrated in 2001 to 2003 as a transported or inriver migrant.

Migr. Year	Class=>	Dropout Rate (%) BON -to- MCN		Dropout Rate (%) MCN -to- ICH		Dropout Rate (%) ICH -to- LGR	
		T	C	T	C	T	C
2001	RAPH	19.2	25.0*	1.1	0	2.6	8.3
	DWOR	15.5	11.1	1.0	0	2.1	0
	CATH	26.3	0	0	0	15.8	33.3
	MCCA	17.7	14.3	1.2	0	0.8	0
	IMNA	19.7	0	0	0	1.6	0
	HAT.	18.4	14.3	1.0	0	2.2	5.7
	WILD	21.4	9.4	0	0	0	3.1
2002	RAPH	12.8	13.7	1.5	0.5	2.3	2.8
	DWOR	23.5	10.9*	1.2	0	4.9	3.1
	CATH	24.2	0	9.1	0	0	4.8
	MCCA	19.5	19.5	2.4	0*	0	0
	IMNA	21.4	18.3	2.4	0*	0	0
	HAT.	18.8	15.1	2.4	0.1	1.5	1.7
	WILD	25.0	11.2	0	0	0	1.8
2003	RAPH	36.2	11.4	0	0*	2.1	0
	DWOR	20.5	14.6	10.3	2.1	0	0
	CATH	20.0	7.7	0	0	0	0
	MCCA	9.9	8.4	0	1.5	3.6	3.8
	IMNA	17.9	8.3	5.1	4.2	0	6.3
	HAT.	18.3	9.9	2.4	1.8	2.0	2.8
	WILD	4.8	5.3	0	2.6	0	0

* denotes dropout rate (%) was computed using the return count from the next dam upstream due to missing fish detection.

The estimated total returns of the PIT-tagged Chinook adults to the hatchery racks (with harvest adjustment) are presented in Table 3, along with an estimate of adult survival rate from LGR to the hatchery. Returning adults from smolts that outmigrated inriver and via transportation were combined for making these survival estimates since results in the 2002 CSS Annual Report (Berggren et al. 2003) showed no significant difference in proportion of PIT-tagged adult Chinook (originating from Rapid River, McCall, Imnaha, and Dworshak hatcheries) detected at Lower Granite Dam that were subsequently detected at their natal hatchery rack. The estimates of adult survival from LGR to the hatchery were quite variable, ranging between 29 and 88%, across the hatcheries and migration years. The average adult survival from LGR to the hatchery rack (adjusted for harvest) for the available years of data was 58% for Dworshak Hatchery, 55% for Rapid River Hatchery, 67% for Catherine Creek AP, and 61% for McCall

Hatchery. Across all the available years of PIT-tag return, about half the estimates were below 60%. There are multiple factors that could result in low numbers of PIT-tagged adults detected at the hatchery rack: (1) unaccounted adults spawning below weirs and trapping sites; (2) adults overshooting the trapping sites during periods when weirs are not installed; (3) straying into other streams; (4) missed detections of PIT-tagged adults or shed tags at the hatchery; (5) under-reporting of harvest; (6) delayed mortality from hooking and handling these fish in fisheries; and (7) high natural mortality of adults after passing upstream through the hydrosystem.

Table 3. Estimated harvest-adjusted survival of PIT-tagged adults from Lower Granite Dam to hatchery rack (LGR to HAT) for hatchery spring/summer Chinook that outmigrated in 1997 to 2002.

Hatchery	Migration Year	Return Year	PIT-tag count at LGR	PIT-tags at hatchery rack (including harvest)	Estimated survival LGR to HAT
Dworshak	1997	'99-'00	42	37	0.884
	1998	'00-'01	395	249	0.631
	1999	'01-'02	437	278	0.636
	2000	'02-'03	377	183	0.485
	2001	'03-'04	89	35	0.393
	2002 ^A	'04	222	98	0.441
Rapid River	1997	'99-'00	93	68	0.726
	1998	'00-'01	413	121	0.292
	1999	'01-'02	818	240	0.294
	2000	'02-'03	627	349	0.557
	2001	'03-'04	219	185	0.845
	2002 ^A	'04	298	172	0.577
Catherine Ck	2001	'03-'04	13	9	0.692
	2002 ^A	'04	45	29	0.644
McCall	1997	'99-'00	274	156	0.569
	1998	'00-'01	431	344	0.798
	1999	'01-'02	835	433	0.519
	2000	'02-'03	875	502	0.574
	2001	'03-'04	223	126	0.565
	2002 ^A	'04	347	225	0.648

^A Return year 2005 harvest information is not available until next year; PIT-tagged adults at LGR and hatchery rack include 2-salt fish from Table 46.

From the above findings presented in CSS annual reports, there are indications that a yearling Chinook's prior experience when outmigrating as a smolt may affect their success in navigating the hydrosystem on their upstream migration to their natal streams for spawning. We observed a higher "dropout" rate in the BON-to-MCN reach for returning adults that as smolts were transported. An overall lower escapement was estimated in the BON-to-MCN was also observed in the radio-tag studies by Keefer et al. (2005) using returning adults of known origin based on PIT-tags (as well as fish of unknown origin) that were then fitted with radio tags at BON and monitored on their upstream migration. In that study both mainstem and tributary harvest was taken into account, and they found "reach (dam-to-dam) escapement estimates were lowest in the lower Columbia River and were highest in the lower Snake River." They also reported that "non-fallback fish escaped at higher rates than fallback fish." Whether these

returning adults were transported or remained inriver as smolts was not addressed in that study, although the authors recommend further research to “describe what proportion of the [fallback-related] loss can be attributed to initial fish condition, fish origin, juvenile rearing and transportation history, and/or other factors.”

References Cited:

Berggren, T., H. Franzoni, L. Basham, P. Wilson, H. Schaller, C. Petrosky, E. Weber, R. Boyce, and N. Bouwes. 2003. Comparative Survival Study (CSS) of PIT-tagged Spring/Summer Chinook. 2002 Annual Report, Migration Years 1997-2000 Mark/Recapture Activities and Bootstrap Analysis. BPA Contract # 8712702.

Berggren, T., H. Franzoni, L. Basham, P. Wilson, H. Schaller, C. Petrosky, E. Weber, and R. Boyce. 2005. Comparative Survival Study (CSS) of PIT-tagged Spring/Summer Chinook and PIT-tagged Summer Steelhead. 2005 Annual Report, Mark/Recapture Activities and Bootstrap Analysis. BPA Contract #19960200.

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