



## FISH PASSAGE CENTER

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### MEMORANDUM

TO: Ron Boyce, ODFW

*Michele DeHart*

FROM: Michele DeHart

DATE: August 22, 2007

RE: Proportion Transported and Spill

In response to your request we summarized the proportion transported by species from the FPC Smolt Monitoring Program Annual reports for the years you requested, 2006, 2005 and 2004. We also summarized the planned spill operation for those years. The proportion of fish transported is directly related to the amount of spill at the collector projects. We also have attached a memo which is posted on the FPC web site, which summarizes elements of the 2006 fish passage and river operations.

The following table shows the proportion of fish transported by species. In 2004 a spring spill program was in place at transportation collector projects but there was no summer spill for fish passage at collector projects. In 2004 was a below average water year, with a 77 % of average run off volume for the Columbia Basin above The Dalles. The spring spill program was limited and only occurred intermittently at collector projects. There was no summer spill in 2004. In 2005 the run off volume for the Columbia River above The Dalles was lower than 2004 at 67% of average runoff. Spring spill was limited and intermittent at collector projects. Summer spill began as a result of a federal court order in mid-June and continued throughout the summer migration period in 2005. The transportation proportion of fall Chinook is high in 2005 because fall Chinook passing the collector projects in late May and the first half of June were not afforded spill for fish passage. Biological Opinion flow and reservoir targets were not met in either 2004 or 2005. In 2006 the run off volume for the Columbia Basin above the Dalles was 113% of average. Biological Opinion flow and reservoir targets for the spring period were met. As summarized in the attached memorandum passage conditions, for spring Chinook were the best that have been seen in recent years with high spill and flow levels. During the spring court ordered spill for fish passage was actually exceeded at some projects. However, Biological Opinion flow targets were not met in the summer migration period. The Court Ordered spill levels were implemented fully in 2006, with high levels of spill occurring through the spring period. The proportion of fall Chinook transported in 2006 is lower than 2005, because spill was

continuous at the collector projects at high levels throughout the spring period and at the court ordered levels through out the summer period. Fall Chinook passing the projects in late May and early June would have the benefits of the high spill levels, and also the benefits of the summer spill, thereby reducing the proportion of fish transported to 52% and 56% for hatchery and wild fish.

**TABLE 1. Comparison of the 2006 estimate of the proportion of Snake River Basin smolt population in Lower Granite Dam forebay that are "destined for transportation" and the corresponding estimates in 2004 and 2005. For yearling Chinook and steelhead, the results exclude transport at McNary Dam.**

Species –age group	Transportation Proportion <sup>1</sup>		
	2006	2005	2004
Yearling Chinook	0.611 (H) 0.579 (W)	0.92	0.870
Steelhead	0.76 (H) 0.793 (W)	0.94	0.964
Subyearling Chinook	0.521 (H) 0.562 (W)	0.809	0.972

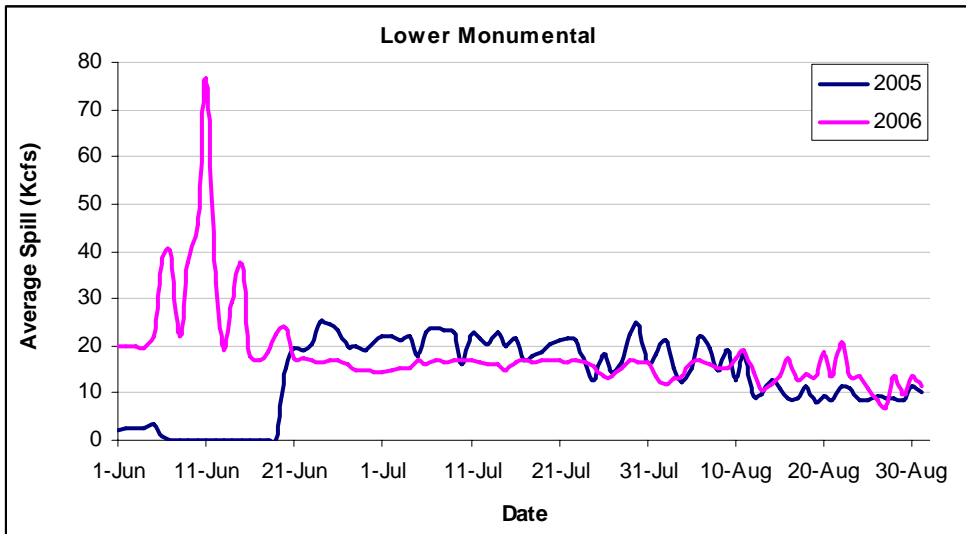
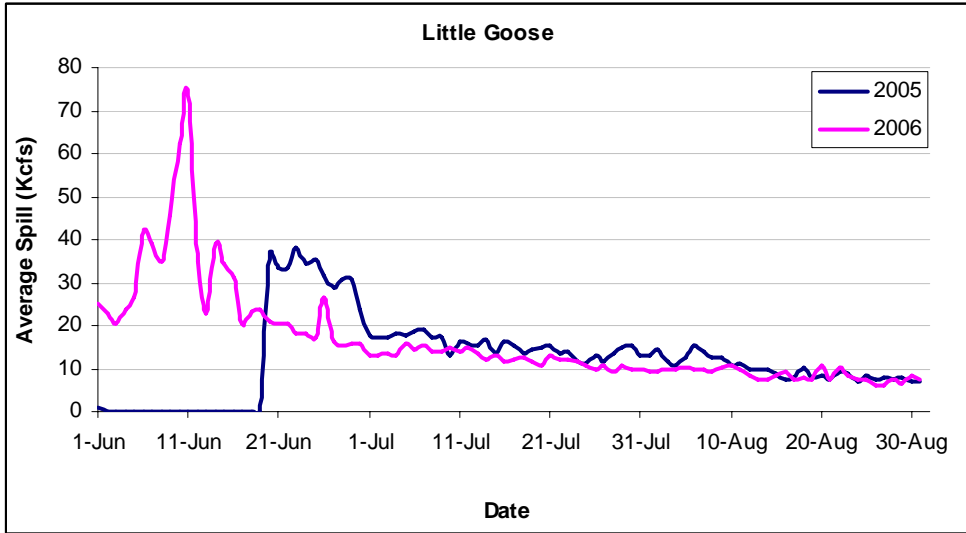
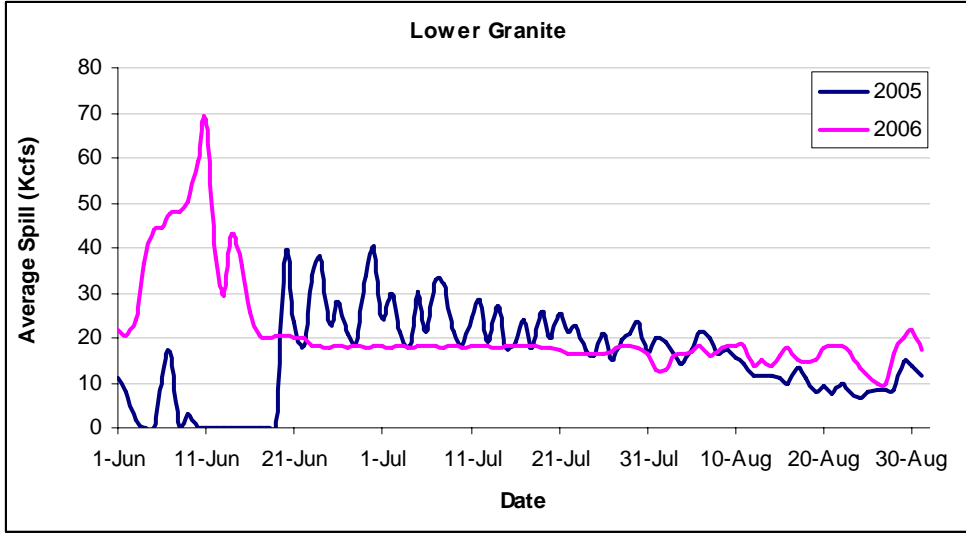
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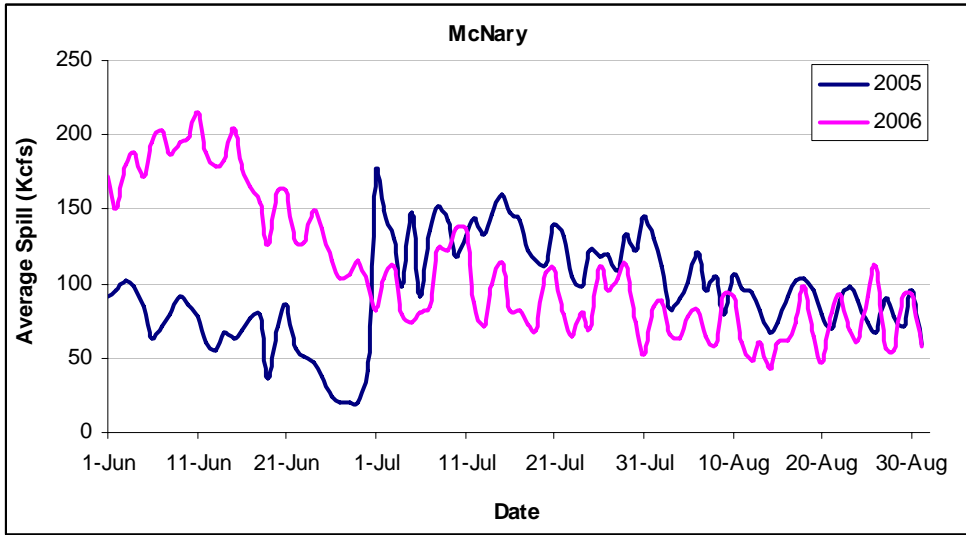
<sup>1</sup> In years 2000-2006, estimates of collection efficiency based on PIT tag data was used to generate a single annual estimate of proportion transported, while in 1999 assumed levels of high and low FGE and high and low spill effectiveness were used to generate a range for that year's estimate of proportion transported.

**TABLE 2. Comparison of spring and summer spill at Lower Snake and Lower Columbia projects over 2004, 2005, and 2006**

Site	2006	2005	2004
Lower Granite	Spring <sup>2</sup> = 20 Kcfs Summer = 18 Kcfs	Spring = Limited (Apr 30- May 2 and when flows exceeded Hydraulic Capacity)  Summer = TDG Cap	Spring = RSW plus training Spill (Apr 3-23, some spill in excess of Hydraulic capacity in late May and early June)  Summer = None
Little Goose	Spring and Summer = 30%	Spring = Limited (Only when flows exceeded Hydraulic Capacity)  Summer = 30% Day TDG Cap Night	Spring = TDG Cap Night (April 3-23)  Summer = None
Lower Monumental	Spring = 40 Kcfs Summer = 17 Kcfs	Spring = Limited (Only when flows exceeded Hydraulic Capacity)  Summer = TDG Cap	Spring = 50% when 75>Q>100 45% when 75<Q<100 (Only April 24 to Mid May)  Summer = None
Ice Harbor	TDG Cap except when RSW testing occurred	TDG Cap	April 15-July 15 = 45 Kcfs July 16-August 31 = 45 Kcfs Day TDG Cap Night
McNary	Spring = 40% vs TDG Cap Night Summer = 40% vs. 60%	Spring TDG Cap Night Summer = Spill all flow above 50 Kcfs (min PH)	Spring = TDG Cap Night Summer = None
John Day	Spring = 40% Summer = 30%	Spring = 60% Night 0% Day Summer = 30%	Spring = 60% Night 0% Day  Summer = 30% Night
The Dalles	Spring = 40% Summer = 40%	Spring = 40% (Often less due to failure of spillway gate ropes)  Summer = 40%	Spring and Summer = 40%
Bonneville	Spring = 100 Kcfs Summer = 75 Kcfs Day 120 Kcfs Night	Spring and Summer 75 Kcfs Day TDG Cap Night	Spring and Summer 75 Kcfs Day TDG Cap Night

<sup>2</sup> Spring flows in 2006 were sufficiently high that spill often exceeded hydraulic capacity of projects and the Court's Order during April, May and most of June.







**ATTACHMENT:**

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TO: Rob Lothrop, CRITFC

FROM: Michele DeHart

DATE: August 13, 2007

RE: 2006 Spring Chinook survival and outmigration conditions in relation to predicted high SAR's

In response to your request, the FPC staff summarized results from the FPC 2006 Annual Report as follows.

Spring migrating Chinook experienced improved passage conditions when compared to recent years. Higher flows and twenty four hour spill resulted in relatively high survivals when compared to previous years. Improved spill and delay of the start of smolt transportation resulted in a reduction of the proportion of smolts transported.

Runoff volume was 107% of average for the Columbia River above The Dalles and 113% of average for the Snake River above Lower Granite. 2006 was the highest run off volume and flow year in the Snake River since 1999 and 2002 in the Columbia River. Biological Opinion reservoir elevations targets were met on April 10 at Hungry Horse, Libby, Dworshak, Brownlee and Grand Coulee projects. Biological Opinion flow objectives were met and exceeded for the spring migration period benefiting spring Chinook (Table 1).

**Table 1. Spring and summer Biological Opinion flow objectives and average seasonal flows in 2006 at Lower Granite, McNary and Priest Rapids.**

	2006			
	Spring Flow Objective	Spring Average	Summer Flow Objective	Summer Average
Lower Granite	100	125.3	54.5	37.6
McNary	260	325.4	200	166.5
Priest Rapids	135	191.3	Na	Na

Spill for fish passage was affected by the interaction of several factors. Spill for fish passage was improved in 2006 over past years as a result of a 2005 federal court order that increased spring spill at Little Goose and Bonneville Dam to 24 hours per day and continued summer spill at the same levels that occurred in 2005. At the same time hydropower project equipment problems at The Dalles caused reductions in spill while unit outages and other problems at John Day and Lower Granite limited the hydraulic capacity of the projects which resulted in increased spill as river flows increased.

Survivals in 2006 for Yearling Chinook through the hydrosystem were relatively high compared to other recent years. The FPC analyzed Snake River basin yearling Chinook released from trap sites and emigrating to Lower Monumental Dam; 2006 survival estimates for these spring Chinook were the highest documented in recent years at 61.0% (Table 2). The estimated proportion of yearling Chinook that were “destined for transportation” during 2006 (61.1% and 57.9% for hatchery and wild fish respectively) was similar to 2002 and 2003 (Table 3). In addition, the court ordered spill for summer months contributed to higher survival rates for summer migrants.

**Table 2. Combined PIT-tagged hatchery and wild yearling Chinook survival in the reach Lower Granite Dam tailrace to Bonneville Dam tailrace (FPC).**

	Reach Survival by year					
<b>Migr Year</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>
<b>Survival</b>	0.262	0.568	0.546	0.374	0.477	0.610
<b>Std error</b>	0.032	0.115	0.106	0.088	0.080	0.087

**Table 3. Estimated probability of yearling Chinook being transported for out-migrants originating above Lower Granite Dam (from FPC 2006 Annual Report).**

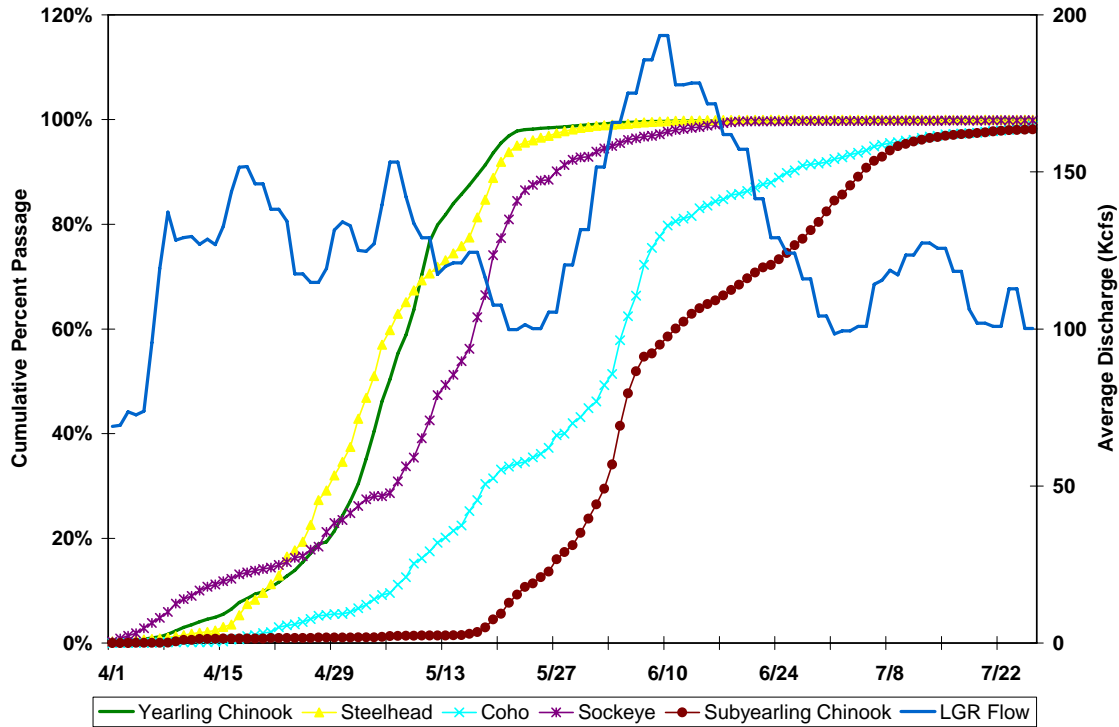
	Estimated Proportion Transported by year					
<b>Migr Year</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>
<b>Transport Proportion</b>	0.980	0.683	0.629	0.870	0.92	0.611 (H) 0.579(W)

NOAA found similar high survival estimates for 2006 stating, “Mean estimated survival for yearling Chinook salmon from Lower Granite Dam tailrace to Bonneville Dam tailrace was 61.1% in 2006, the highest since survival estimates to Bonneville Dam tailrace became possible from PIT-tag data in 1999.” (August 30, 2006 NOAA technical Memorandum, Table 4).

**Table 4. Combined PIT-tagged hatchery and wild yearling Chinook survival in the reach Lower Granite Dam tailrace to Bonneville Dam tailrace (from August 30, 2006 NOAA technical Memorandum).**

	Reach Survival by year					
<b>Migr Year</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>
<b>Survival</b>	0.279	0.578	0.532	0.395	0.577	0.611
<b>Std error</b>	0.016	0.06	0.023	0.05	0.069	0.018

Given the high reach survivals in 2006, it may be that increased spill volumes coupled with high flows could result in higher SAR's for in-river migrants. Figure 1 shows flow and the cumulative passage for each species in 2006. The month of May was significant for all species. Nearly 25% of subyearling Chinook passed Lower Granite during May. Coho, yearling Chinook, steelhead and sockeye were also present in large numbers during May.



**Figure 1. Cumulative passage timing at Lower Granite Dam in 2006 for all species of migrant juvenile salmonids using passage indices.**