Fish Passage Center

Columbia Basin Fish and Wildlife Authority

Annual Report 2005

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FISH PASSAGE CENTER

2005 ANNUAL REPORT

***Fish Passage Center
of the
Columbia Basin Fish &
Wildlife Authority***

July 2006

Final

FISH PASSAGE CENTER ANNUAL REPORT

2005

This report responds to the Fish Passage Center annual reporting requirements to the Northwest Power and Conservation Council under its Columbia River Basin Fish and Wildlife Program, and the annual reporting requirements to the Bonneville Power Administration under its funding contracts which supported this work.

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July, 2006

FINAL

Fish Passage Center 2005 Annual Report

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We appreciate the efforts of the field crews at each of the monitoring sites. Sampling and reporting were carried out by WDFW at Ice Harbor, McNary, Lower Monumental, and Lower Granite dams; by ODFW at Little Goose Dam and Grande Ronde River trap; by Pacific States Marine Fisheries Commission (PSMFC) at John Day and Bonneville dams; by WDFW (subcontractor for Chelan County Public Utility District (PUD) at Rock Island Dam); by NPT at Imnaha River trap; and by IDFG at the traps on the Salmon and Snake rivers.

In addition to the aforementioned monitoring supported under the SMP, related activities by others, such as the fish transportation program supported by the U.S. Army Corps of Engineers (COE), provided valuable information at various monitoring sites. The COE also provided facilities and accommodations for smolt monitoring activities at their projects. This report was prepared by the Fish Passage Center (FPC) staff: Michele DeHart, Tom Berggren, Margaret Filardo, David Benner, Sergei Rassk, Jerry McCann, Chris McCarty, Brandon Chockley, Peter McHugh and Dona Watson.

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2005 Executive Summary

Although seasonal precipitation was near average, runoff volumes for 2005 were below average for the January to July period for all sites measured throughout the Columbia River Basin. The average runoff volume among the six measured sites was approximately 67% of the average run off volume between 1971 and 2000. The April 10th Biological Opinion elevations were not met for any of the measured sites. Furthermore, hydrosystem operations and runoff conditions resulted in flows that did not meet the spring or summer seasonal Biological Opinion flow objectives at Lower Granite Dam, McNary Dam, and Priest Rapids Dam for 2005.

Spring spill was provided as described by the 2004 Biological Opinion program for fish passage at Ice Harbor, McNary, John Day, and Bonneville Dams, within the constraints of the State waivers for total dissolved gas supersaturation levels. Conditions with the spillway gates at the Dalles Dam were deemed unsafe. Thus, this project was operated with fixed gate settings to get close to a 40% spill, although actual spill was often less than this 40% target. To enhance fish passage, the action agencies operated John Day Dam to spill 40% during the day and 60% at night from May 20-May 30. The salmon managers requested that this operation be continued as long as The Dalles Dam was not fully operative but action agencies denied this request. Planned spring spill under the 2004 Biological Opinion measures did not occur at Lower Granite, Little Goose, and Lower Monumental due to low average spring flow. On June 10, 2005, the 9th Circuit Court issued an order that mandated spill during the summer months at the Snake River and McNary transportation dams. Lower Granite, Little Goose, and Lower Monumental began their mandated summer spill on June 20, while McNary Dam began its spill on July 1. Ice Harbor, John Day, The Dalles and Bonneville dams spilled as called for in the 2004 Biological Opinion.

Gas bubble trauma (GBT) sampling was successful for the 2005 season. As in past years, the number of fish showing fin signs appeared to be proportional to the levels of TDGS experienced by fish. The 2005 sample year was unique due to a mandated summer relief spill program for the Snake River and McNary transportation dams. This summer spill program resulted in detectable GBT signs from only one dam, Little Goose, where 0.9% of fish had signs of GBT, which were all of the lowest level.

The population estimate for yearling hatchery Chinook at Lower Granite Dam for 2005 was lower than the previous years and equal to 2003 at 5.9 million. This could, in part, be due to an 18% decrease in hatchery releases from the previous year. Estimates of population size for wild yearling Chinook were 1.7 million, which is similar to previous years. Even with the lowest level of hatchery release in the past 7 years, steelhead population estimates for 2005 showed a 13.6% increase from that estimated for 2004. Survival likely did not play a significant role in this increase, as survival estimates for 2005 were close to the average of other years. However, it is possible that the later steelhead migration, which coincided with higher flows, may have contributed to higher population estimates for steelhead. When compared to estimates from previous years, Chinook travel times in 2005 to Lower Granite Dam from Dworshak, Imnaha, and McCall Hatcheries were around the average. However, travel time increased for Rapid River Hatchery Chinook and Dworshak Hatchery steelhead.

Returning numbers of adult spring Chinook, summer Chinook, fall Chinook, coho, and sockeye for 2005 were all lower than those observed in 2004. However, the number of returning adult steelhead increased from 2004. Returning numbers for spring Chinook were lower than their ten-year-average for the Lower-Columbia and Snake River Dams, while the Mid-Columbia River dams continued to experience higher than average levels of returning adults. The numbers of adult summer and fall Chinook returning to the Lower-Columbia, Snake, and Mid-Columbia rivers were all above their respective ten-year-averages. Sockeye returns were higher than their ten-year average for the Lower- and Mid-Columbia Rivers, but well below that for the Snake River. Coho returns for 2005 were also above their ten-year average for the Lower-Columbia, Snake, and Mid-Columbia Rivers. Finally, 2005 adult steelhead counts were higher than their ten-year average for the Lower-Columbia and Snake Rivers and almost identical to that for the Mid-Columbia River.

In all, about 83.1 million juvenile salmonids were released from Federal, State, Tribal, or private hatcheries into the Columbia River Basin, above Bonneville Dam. This total release was about 287,000 less than the previous year. An additional 50.9 million juvenile salmonids were released into the Columbia River Basin below the Bonneville Dam.

I. 2005 WATER SUPPLY

A. Water Supply

Water Year (WY) 2005 was well below average in terms of runoff volumes throughout the Columbia Basin. At The Dalles Dam, the observed runoff volume recorded between January and July of 2005 was 81.4 Maf, which was 76% of the average runoff volume between 1971 and 2000 (Table 1). Runoff volumes at other Columbia Basin locations varied somewhat, ranging between 62% and 94% of average. In terms of the 77-year historic runoff record between 1929 and 2005, the 2005 January-July runoff at Lower Granite and The Dalles ranked 68th and 63rd, respectively (Table 2).

TABLE 1. January and April Final Water Supply Forecasts and observed runoff at Libby, Hungry Horse, Grand Coulee, Dworshak, Lower Granite, and The Dalles over various time periods in WY 2005. Data taken from the River Forecast centers website at http://www.nwrfc.noaa.gov/water_supply/ws_verif.cgi.

Site	January Final Water Supply Forecast (Kaf)	April Final Water Supply Forecast (Kaf)	Observed Runoff (Kaf)	Percent of 1971-2000 Average (%)
The Dalles (Jan-July)	85600	73800	81349	76
Grand Coulee (Jan-July)	57200	52200	54393	86
Libby Res. Inflow, MT (Jan-July)	5830	4990	5919	94
Hungry Horse Res. Inflow, MT (Jan-July)	1760	1580	1785	80
Lower Granite Res. Inflow (Apr- July)	15800	11800	14378	63
Dworshak Res. Inflow (Apr-July)	1960	1530	1643	62

TABLE 2. Observed Runoff at Lower Granite and The Dalles from January-July from 1990 to 2005 along with each years rank in terms of the 77-year record between 1929 and 2005 (lower rank = higher water year).

Year	Lower Granite (Jan-July)		The Dalles (Jan-July)	
	Runoff (Maf)	Rank	Runoff (Maf)	Rank
1990	20.2	60	99.7	43
1991	18.9	64	107.1	32
1992	14.1	76	70.4	69
1993	26.7	36	88.1	57
1994	15.9	73	75.0	67
1995	29.4	32	104.0	39
1996	42.4	8	139.3	5
1997	49.5	1	159.0	1
1998	31.3	26	104.1	38
1999	36.1	17	124.1	12
2000	24.6	46	98.0	44
2001	14.4	75	58.2	76
2002	24.0	49	103.8	40
2003	23.8	51	87.7	58
2005	20.7	58	83.0	60
2005	18.1	68	81.4	63

Precipitation was near average over WY 2005. Seasonal (October through September) precipitation was: 98 percent of average (1971-2000) at Columbia above Coulee, 93 percent of average at the Snake River above Ice Harbor, and 93 percent of average at Columbia above the Dalles (Figure 1).

FIGURE 1. Seasonal precipitation from October 1, 2005 to September 30th, 2005 at select locations within the Columbia Basin.

By March, 1 2005, snowpack was only 44% of average in the Columbia River Snow pack throughout Columbia Basins above the Snake River confluence, 63% of average in Snake River basins, and 31% of average in basins between Bonneville and McNary Dam (Table 3). As the season progressed snowpack remained at very low levels.

TABLE 3. Seasonal snow water equivalents at select basins during various points of WY 2005. Data from <ftp://ftp.wcc.nrcs.usda.gov/data/snow/update/columbia/>

Basin	3-1-05 Snow Water Equivalent (% Avg.)	3-31-05 Snow Water Equivalent (% Avg.)	4-28-05 Snow Water Equivalent (% Avg.)
<i>Columbia Above the Snake River Confluence</i>			
Kootenai River in Montana	56	62	52
Flathead River	53	61	64
Upper Clark Fork River	50	57	72
Bitterroot	51	54	50
Lower Clark Fork River	42	52	53
Idaho Panhandle Region	43	51	46
Columbia Above Methow	43	53	36
Chelan, Entiat, Wenatchee	36	36	15
Yakima, Ahtanum	24	32	20
<i>Average*</i>	44	51	45
<i>Snake River</i>			
Snake Above Palisades	74	76	68
Henry Fork, Teton, Willow, Blackfoot, Portneuf	77	79	72
Big and Little Wood	66	71	63
Big and Little Lost	66	66	64
Raft, Goose, Salmon Falls, Bruneau	74	83	100
Weiser, Payette, Boise	52	59	54
Owyhee Malheur	59	65	75
Grande Ronde, Powder, Burnt, Imnaha	48	45	41
Clearwater and Salmon	52	58	55
<i>Average*</i>	63	67	66
<i>Lower Columbia Between Bonneville and McNary</i>			
Umatilla, Walla Walla, Willow	30	28	11
Deschutes, Crooked, John Day	48	36	22
Lower Columbia, Hood River	16	17	9
<i>Average*</i>	31	27	14

* The averages presented in the table above are straight averages; they are not weighted by area.

According to the River Forecast Center (RFC), precipitation gauges are typically at elevations or locations that receive rainfall, whereas snow gauges are located at higher elevations that accumulate snow. This can lead to a situation like 2005, where precipitation was near normal while snowpack was well below normal. Because the Columbia Basin water supply is driven heavily by accumulated snow, the 2005 water supply was well below average.

B. Water Supply/Management Impacts to Biological Opinion Measures

Grand Coulee

Figure 2 shows how GCL was operated throughout the winter with respect to flood control. Grand Coulee was operated below its flood control elevations for the entire winter period. Grand Coulee ended April 10th at an elevation of 1255.3 feet; 28 feet (2011.2 Kaf) below its standard BIOP required April 10th elevation (1283.3 feet) (Figure 2, Table 4). Reaching the April 10 flood control elevations ensures a high probability of both meeting spring flow objectives and refill by June 30. The draft of Grand Coulee significantly below flood control was requested by the Bureau of Reclamation for drum gate maintenance.

In 2005, the end of August summer draft limit at Grand Coulee was 1278 feet. On August 31st, 2005 at midnight, Grand Coulee was at an elevation of 1278.0 feet, exactly at the draft limit.

FIGURE 2. Operations at Grand Coulee over WY 2005.

Dworshak

In January of 2005, the COE utilized the extended stream flow prediction model (ESP) and concluded that 50 Ksf (or 100 Kaf) of flexibility was available at Dworshak. In response, the fishery managers wrote a Joint Technical Staff letter to the COE dated February 8, 2005 (attached as part of Appendix J of this report) that explained that all available data indicated that the water supply forecast (WSF) was decreasing through the winter. In particular, the RFC January Final (Apr.-Jul.) WSF at Dworshak was 1960 Kaf (74% of average) and the February Early-Bird (Apr.-July) forecast was down 140 Kaf to 1820 Kaf (69% of average). Also, the fishery managers pointed out in the same letter that a study¹ pointed out there was likelihood that ESP would over predict the inflows to Dworshak in lower water years and therefore increase risk for juvenile migrants and exacerbate failure to meet flow targets at Lower Granite dam by needing to refill more in late March and early April. Despite the letter, the COE used 50.5 Kaf of flexibility at Dworshak between 1/26/05 and 2/1/05.

Dworshak remained below flood control throughout much of the winter and spring (Figure 3). On April 10th Dworshak was at an elevation of 1584.6 feet, 9.5 feet (169.5 Kaf) below its BIOP system Flood Control elevation (Table 4). Had operators not used flexibility earlier in the season, Dworshak would have been closer to the April 10th flood control elevation and would have had less to refill ultimately allowing spring flows to be closer to the Biological Opinion Objective in the Snake River.

On June 30th, Dworshak was full (1600 feet). Over the summer months Dworshak was operated in accordance with System Operational Requests (SORs) 2005-17 and 2005-18 and was drafted to elevation 1535.1 feet on August 31st, 2005 for temperature regulation in the lower Snake River. Dworshak reached elevation 1520 feet on September 20, 2005.

1. "Review of Extended Stream Flow Prediction of the National Weather Service River Forecast System" by Joseph A Pica of Portland State Universities Civil Engineering Department at http://www.nwrhc.noaa.gov/nwrhc/papers/esp_review/esp_review.html.

FIGURE 3. Operations at Dworshak over WY 2005.

Libby

Early season water supply forecasts were near average (Table 1) at Libby, leading to relatively high flood control elevations (Figure 4). On December 31, 2004, Libby was at an elevation of 2410.7 feet (Figure 4). Libby was already 9.2 feet below its flood control elevation by January 31st, 2005 (Figure 4). As the winter/early spring months progressed Libby inflows were approximately equal to the 4.0 Kcfs minimum outflow and therefore Libby could not refill significantly to get closer to its flood control elevations (Figure 4). By April 10th, Libby was 29 feet below the April 10th Biological Opinion flood control elevation (Table 4). On June 30th, 2005 Libby was at an elevation of 2456.9 feet and reached a maximum elevation of 2458.3 feet on July 9, 2005.

On May 13, 2005 the USFWS submitted SOR 2005-FWS1 which asked for flows to be ramped up on May 19 to 15 Kcfs, then ramped to 20 Kcfs on May 21st, then ramped again on May 23rd to 25 Kcfs. Outflows were ramped down to 14 Kcfs June 3rd, 2006.

On June 29, 2005, the State of Montana submitted SOR 2005 MT-1 to the Action Agencies, which asked for a flat flow from Libby Dam (approximately 13.6 Kcfs) from July through August while drafting to elevation 3540 feet by September 30th, 2005.

After being raised to the Implementation Team (IT) level, a decision was made to gradually ramp down Libby outflow through the month of August and draft to 2439 by the end of August. Libby outflows were held near 24 Kcfs from 7/11 to 7/21, reduced to 19 Kcfs through 8/17, reduced to 16.5 Kcfs through 8/24, reduced to 12 Kcfs through 9/5, reduced to 10 Kcfs through 9/11, reduced to 8 Kcfs through 9/26, and finally reduced to 7 Kcfs for the rest of September. On August 31st at midnight, Libby was at an elevation of 2439.5 feet (Figure 4).

FIGURE 4. Operations at Libby over WY 2005.

Hungry Horse

Hungry Horse began Water Year 2005 at an elevation of 3539.9 feet. Throughout much of the water year, Hungry Horse was operating to meet the Columbia Falls minimum flow. By April 10th, Hungry Horse was six feet below Flood Control (Table 4). Hungry Horse did end up refilling by June 30th, 2005 (elevation 3560 feet).

As previously mentioned, On June 29, 2005, the State of Montana submitted SOR 2005 MT-1 to the Action Agencies, which recommended drafting Horse to an elevation that is 20 feet

from full by the end of September, rather than implementing the Biological Opinion operation. After being raised to the IT level, a decision was made to draft to 3540 feet by the end of August consistent with the Biological Opinion. On August 31st at midnight, Hungry Horse was at an elevation of 3539.8 feet (Figure 5).

FIGURE 5. Operations at Hungry Horse over WY 2005.

Brownlee

Brownlee began the Water Year at an elevation of 2050.4 feet. Early season water supply forecasts for inflow to Brownlee were significantly lower than average (January Final 50% of normal), and early flood control elevations at Brownlee were set at a high level. The January 31st, 2005 flood control elevation was set at full pool (2077 feet), at this time Brownlee was only 7.5 feet below its flood control point. On April 10th, Brownlee was 5.0 feet below its Flood Control elevation, which was also at full pool (Table 4). Brownlee was within two feet of full for most of June 2005 (Figure 6).

FIGURE 6. Operations at Brownlee over WY 2005.

TABLE 4. April 10th Biological Opinion elevations at Grand Coulee, Libby, Dworshak, Hungry Horse, and Brownlee along with actual elevations on April 10th, 2005.

Site	April 10 th BiOp Elevation	Actual April 10 th Elevation
Grand Coulee	1283.3	1255.3
Libby	2442.0	2413.0
Dworshak	1594.1	1584.6
Hungry Horse	3556.3	3550.6
Brownlee	2077.0	2072.0

** April 10th BIOP Elevations were linearly interpolated between the April 1st and April 15th flood control elevations issued in March of 2005.

1. Spring/Summer Flow Objectives

Table 5 summarizes the spring and summer Biological Opinion flow objectives and actual flows for 2005 at Lower Granite, Priest Rapids, and McNary.

TABLE 5. Spring and summer flow averages at Lower Granite, McNary, and Priest Rapids during their respective spring and summer Biological Opinion periods.

	2005			
	Spring Flow Objective	Spring Average	Summer Flow Objective	Summer Average
Lower Granite	85	66.3	50	33.4
McNary	220	195.7	200	165.1
Priest Rapids	135	122.7	Na	Na

Overall, taking into account all of the projects with BIOP flow objectives (all blocks in the above Table 5), Biological Opinion flow objectives were never met in 2005. Figure 7 and Figure 8 display similar information regarding flow objectives as Table 5. Figure 7 displays the shape of the runoff over the spring and summer at McNary Dam along with the spring and summer flow objectives; Figure 8 displays the same information for Lower Granite.

FIGURE 7. Spring and summer Biological Opinion flow objectives and actual flows at McNary Dam over the BIOP period.

FIGURE 8. Spring and summer Biological Opinion flow objectives and actual flows at Lower Granite Dam over the BIOP period.

2. Dworshak Operations for Temperature Regulation at Lower Granite

Water temperatures in the Lower Granite Tailwater did not exceed the 20° C temperature standard between July 1st and September 30th, 2005. Figure 9 displays tailwater temperatures at Lower Granite as well as the temperature and magnitude of discharges from Dworshak Reservoir.

Two SORs were submitted to the Action Agencies in 2005 concerning the release of summertime water from Dworshak reservoir. The first, SOR 2005-17, asked for Dworshak releases of 7 Kcfs through July 10th, 2005 and then be ramped up to 10 Kcfs on July 11th. The second SOR, 2005-18, asked to ramp up outflows between July 12th and 19th to 12 Kcfs. Both SORs were implemented by the Action Agencies. Dworshak outflows were maintained near 12 Kcfs from July 14 to August 10, 2005 and outflows were ramped down to approximately 10 Kcfs on August 11th to August 17th. Outflows were further decreased to 7 Kcfs on August 18th and held

until September 14th. On August 31st, 2005 Dworshak was at an elevation of 1535.2 feet, leaving approximately 200 Kaf of flow augmentation for the first portion of September.

FIGURE 9. Tailwater temperatures at Lower Granite Dam as well as the temperature and magnitude of discharges from Dworshak Reservoir from July 1st to September 30th, 2005.

3. Canadian Operations

Coordination of the Pacific Northwest and BC Hydro systems was initiated in 1964 with the ratification of the Columbia River Treaty (Treaty). Under the Treaty, Canada was required to construct 15.5 Maf of storage at the Mica, Arrow and Duncan projects for optimum power generation and flood control downstream in Canada and the United States. The Treaty also allowed the US to construct the Libby project on the Kootenai River in Montana for flood control and other benefits. BC Hydro also built storage on the Columbia River system beyond what was required by the Treaty, termed Non-Treaty Storage (NTS). The Canadian storage projects are Mica, with 7 Maf of usable Treaty Storage and 5 Maf of Non-Treaty Storage, Arrow Lakes, with 7.1 Maf of Treaty Storage and 0.26 Maf of Non-Treaty Storage, and Duncan, with 1.4 Maf of Treaty Storage.

Non-Treaty Storage Operations

The NTS agreement between BC Hydro and BPA expired in 2004 and therefore no Non-Treaty water was stored in 2005.

Treaty Storage Operations

The Treaty requires Canada to operate at least 8.45 Maf of storage for flood control in Canada and the United States. The U.S. downstream power benefits from Canadian Treaty storage are to be shared equally between the two countries. Each year the U.S. and Canadian Entities (BC Hydro, BPA and the COE) prepare an Assured Operating Plan with agreed Determinations of Downstream Power Benefits for the sixth succeeding year. Beginning with the 1997 through 1998 Assured Operating Plans, additional loads were included in June to assist meeting U.S. flow augmentation objectives. Each year a Detailed Operating Plan is prepared for the upcoming operating year that implements the Assured Operating Plan. Since 1993, the Entities have agreed only to mutual beneficial deviations from the Detailed Operating Plan, generally to meet U.S. salmon flow augmentation and Vernita Bar needs, in return for meeting Canadian trout and white fish spawning and for blowing dust.

In 2005, storage was 439 Ksfd (870 Kaf) above of the Treaty Storage Regulation (TSR) by mid April

4. Snake River

The Bureau of Reclamation (BOR) released approximately 427 Kaf of water for summer flow augmentation by the end of August 2005. The National Oceanic and Atmospheric Administration (NOAA Fisheries) Biological Opinion and the NPCC Fish and Wildlife program call for the BOR to provide up to 427 Kaf of volume from Upper Snake River Reservoirs for summer flow augmentation.

C. Conclusions

- Water Year 2005 was below average in terms of runoff volumes throughout the Columbia Basin. At The Dalles Dam, the observed runoff volume recorded between January and July of 2005 was 81.4 Maf, which was 76% of the average runoff volume between 1971 and 2000 and the 4th lowest in the last 16 years (Table 2).
- Precipitation was near average over WY 2005. Seasonal (October through September) precipitation was: 98 percent of average (1971-2000) at Columbia above Coulee, 93 percent of average at the Snake River above Ice Harbor, and 93 percent of average at Columbia above the Dalles.
- Snowpack was well below average at all sites in 2005.
- Grand Coulee ended April 10th at an elevation of 1255.3 feet; 28 feet (2011.2 Kaf) below its standard BIOP required April 10th elevation (1283.3 feet). The draft of Grand Coulee significantly below flood control was requested by the Bureau of Reclamation for drum gate maintenance.
- Libby was 29 feet below the April 10th Biological Opinion flood control elevation. On June 30th, 2005 Libby was at an elevation of 2456.9 feet and reached a maximum elevation of 2458.3 feet on July 9, 2005. On August 31st at midnight, Libby was at an elevation of 2439.5 feet, 0.5 feet above its BIOP draft elevation of 2439 feet.
- Hungry Horse was six feet below its April 10th Flood Control, however did end up refilling by June 30th, 2005. On August 31st at midnight, Hungry Horse was at an elevation of 3539.8 feet, slightly below its BIOP draft elevation of 3540 feet.
- Biological Opinion flow objectives were not met over a seasonal average at any project in 2005.
- Water temperatures in the Lower Granite Tailwater did not exceed the 20° C temperature standard between July 1st and September 30th, 2005.
- The BOR released approximately 427 Kaf of water for summer flow augmentation by the end of August 2005.

II. 2005 SPILL MANAGEMENT

A. *Spill*

1. Overview

In March of 1995, an ESA Section 7 Biological Opinion on the operation of the Federal Columbia River Power System was issued. The BIOP established a set of reasonable and prudent alternatives with the objective of improving the operation and configuration of the federal power system to meet a no jeopardy requirement of the Endangered Species Act (ESA), and to fulfill the United States commitment to uphold tribal treaty fishing rights. One of the RPA established a Biological Opinion spill program for fish passage. A Supplemental Biological Opinion was signed on March 2, 1995 in part to address the needs of the newly listed as threatened Snake River steelhead and the Lower Columbia River steelhead, as well as the endangered Upper Columbia River steelhead. The Supplemental Biological Opinion called for additional spill to the gas caps on a system-wide basis and modified the planning dates for the initiation and duration of the spill program. To the extent that the fish passage efficiency (FPE) at some projects exceeded 80%, the additional spill supplemented 1995 RPA Measure 2 for an interim period pending decisions regarding biologically based performance standards for project passage.

The NOAA Fisheries (then National Marine Fisheries Service) again modified spill in the 2000 Biological Opinion (BIOP) issued in December of 2000. In the 2000 BIOP spill at Lower Monumental Dam was increased from a 12-hour period to a 24-hour period. At The Dalles Dam the instantaneous spill level was decreased from 64% of instantaneous flow to 40% of instantaneous flow. Spill at John Day and Bonneville dams remained unchanged from the 1998 Supplemental Opinion, but called for the initiation of daytime spill test at John Day Dam and a test of increasing daytime spill volume at Bonneville Dam.

In June 2003, Judge James A Redden remanded the 2000 BIOP to NOAA Fisheries to resolve several deficiencies including: reliance on federal mitigation actions that have not undergone section 7 consultation under the ESA; and reliance on range-wide off-site non-federal mitigation actions that are not reasonably certain to occur. In a subsequent "minute order," the Judge denied plaintiffs' motion to vacate the Biological Opinion and the BIOP will remain in place as deficiencies are addressed. Consequently, the system in 2004 was operated as called for by the

2000 BiOp.

In December of 2004 a new Biological Opinion was released. In a May 2005 opinion, it was found that the 2004 BiOp violated the ESA and it was remanded. The provisions contained in the 2004 BiOp remained in place for the 2005 migration, with the exception of the requirements for summer spill. Judge Redden's June 10, 2005 opinion in NWF v. NMFS granted the spill portion of the National Wildlife Federation's requested injunctive relief.

The purpose of the spill program is to improve the downstream passage of ESA listed stocks by providing a route with less associated mortality than turbine passage. It is recognized that spilling water generates atmospheric gas supersaturation of the river that can have detrimental effects on fish. In providing spill as an alternate passage route the associated potential for mortality due to dissolved gas supersaturation needs to be balanced against mortality of turbine passage. However, monitoring migrating populations for signs of gas bubble trauma since 1994 has shown that problematic dissolved gas levels have not occurred with the provision of voluntary levels of spill for fish passage. Problematic total dissolved gas levels usually are observed when spill exceeds voluntary spill levels due to flows in excess of hydraulic capacity or generation needs.

2. Spill Planning and Operations

There were a number of specific issues relative to the Spill Program that were addressed in the hydrosystem over the past year. These included:

- a)The provision of spill for the Spring Creek Hatchery release;
- b)The termination of spring spill at Snake River transportation collector sites.
- c)Restricted gate openings for spillbays at The Dalles Dam.
- d)The court ordered summer spill program

a) *The provision of spill for the Spring Creek Hatchery release.*

The USFWS has been releasing tule fall chinook in March for several years. Spill has been provided annually since the early 1980's to facilitate the passage of the fish past Bonneville Dam. In recent years, providing spill for these fish has proven to be contentious because they migrate

outside of the BiOp spring spill program and because they are not ESA listed fish. The Action Agencies in 2004 proposed to operate the new Bonneville Second Powerhouse Corner Collector in lieu of providing spill for fish passage. This proposal was not regarded as sufficient by the agencies and tribes since the corner collector had not been tested and, therefore, any benefits at the time were speculative. The USFWS coordinated with the Action Agencies and agreed to a three-year operation: spill and study this year and no spill for the next two years (2005 - 2006) for Spring Creek hatchery releases, dependent on the outcome of the research.

The corner collector at Bonneville Dam operated at 5 Kcfs for approximately 48 hours beginning on 1545 hours on March 3, 2005 and continued through 1530 hours on March 5, 2005 to facilitate the passage of Spring Creek fish. Tailrace elevation was raised from 11.5 feet to 12.5 feet during the first day, and then to 13.5 feet during the remainder of this operation to address dissolved gas concerns at the ESA listed chum redds located below the project. Total dissolved gas levels reached 107% over the chum redds located on the Oregon side of the river, near Multnomah Falls, prior to the operation of the corner collector, and after the first day of the operation. On March 4 the tailwater was raised to a minimum of 13.5 feet to address concerns of gas levels above 105% over the redds with insufficient depth compensation when the tailwater was at 12.5 feet. After the operation the tailwater returned to 11.5 feet. Total dissolved gas levels exceeded 105% over several days at the Warrendale site.

b) The termination of spring spill at Snake River transportation collector sites

The early volume forecast for the Snake River projected that flows would average less than 85 Kcfs during the spring spill season. Due to projected low flows no spill was planned at the Snake River transportation collector projects in accordance with the Biological Opinion measures.

c) Restricted gate openings for spillbays at The Dalles Dam

Spill at The Dalles Dam was restricted in 2005 due to the inability to operate spill gates at all but two spillbays because of gate hoist problems. All except two spillbays were operated with a fixed opening and, consequently, the project only had the ability to pass a fixed volume of spill. During the month of May the flows increased sufficiently that the fixed gate openings, with the two flexible gate openings, resulted in spill percentages less than the 40% specified in the Biolog-

ical Opinion. System Operational Request 2005-12 requested that spill be provided during daytime hours at John Day Dam to increase spillway passage at this project to offset the decrease in spillway passage due to the fixed gate operations at The Dalles Dam. The Action Agencies agreed to implement daytime spill at John Day for a seven-day period but would not agree that it was compensation for the shortage at The Dalles Dam. The salmon managers were encouraged by the operation, and requested that this continue as long as there was an impact at The Dalles (i.e. a volume for volume spill operation). The Action Agencies responded that they have completed the request to try to enhance migration during the short period when significant numbers of fish were passing. The Action Agencies stated that they had not agreed to a volume for volume operation, and so did not continue daytime spill at John Day.

d) *The court ordered summer spill program*

Judge Redden's June 10, 2005 opinion in NWF v. NMFS granted the spill portion of the National Wildlife Federation's requested injunctive relief. Spill in excess of the flow necessary for station service (one unit at each Snake River Project at the low end of the 1% efficiency range) and 50 Kcfs at McNary Dam was to occur on a 24-hour basis. Spill started at Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams on June 20. Spill began at McNary Dam on July 1.

The COE worked with the Salmon Managers to develop a plan for spill implementation so that spill could be provided in such a way as to meet the court order and at the same time accommodate planned research projects. Spill was also limited to not exceed the state water quality waiver standards. At Lower Monumental Dam spill was originally limited because of concerns regarding total dissolved gas production at this project. Consequently, spill began at 11.5 Kcfs instantaneous flow and was gradually increased to 24.9 Kcfs. Other modifications were made based on real time data and information relative to total dissolved gas levels.

3. Project Specific Operations

Dworshak Dam

Spill did not occur at this project except during periods of increased outflow for flow augmentation (Figure 10). Two periods of flow augmentation occurred when flows exceeded project capacity, one during the spring migration in May and another during the summer augmentation period from mid July to mid August. At this project, spill occurred during these periods.

FIGURE 10. Dworshak Dam flow and spill for spring and summer of 2005.

Lower Granite Dam

Planned spring spill under the 2004 Biological Opinion was not provided at this project because of the low (less than 85 Kcfs) average spring flow. However, some spill did occur during the spring migration (April 30 to May 2) (Figure 11) to facilitate the passage of large numbers of juvenile migrants arriving at the project. Some additional spring spill occurred when flows were above powerhouse capacity. Summer spill occurred according to the court order from June 20 to August 31. Spill at Lower Granite Dam was provided to the gas cap, except for days when the removable spillway weir (RSW) was being tested.

FIGURE 11. Lower Granite Dam flow and spill for spring and summer 2005.

Little Goose Dam

Planned spring spill under the 2004 Biological Opinion was not provided at this project because of the low average spring flow, except for a short period of time when flows exceeded powerhouse capacity. Summer spill at Little Goose Dam was implemented to the gas cap as per the court order. Spill at Little Goose Dam was changed from gas cap spill for 24 hours per day to gas cap spill during nighttime hours and 50% of instantaneous flow during daytime hours and was further reduced to 30% of instantaneous flow during daytime hours (Figure 12). These changes were made to address concerns regarding adult passage at this project. Shortly after spill began on June 20th, the adult passage numbers declined. The spill changes were designed to allow adult fish to pass more easily.

FIGURE 12. Little Goose Dam flow and spill for spring and summer 2005.

Lower Monumental Dam

Planned spring spill under the 2004 Biological Opinion was not provided at this project because of the low average spring flow. Increases in fish numbers around May 10 prompted the fishery managers to request spill to pass large numbers of migrants passing through the system. The increase in fish numbers was likely due to the low flow year causing slower migration, followed by the rain events that pushed the fish downstream quickly. Other spring spill occurred when flows exceeded powerhouse capacity.

At Lower Monumental Dam summer spill was originally limited because of concerns regarding total dissolved gas production at this project. Consequently, spill began at 11.5 Kcfs instantaneous flow and gradually increased to 24.9 Kcfs. However, spill was subsequently reduced due to dissolved gas concerns in Ice Harbor forebay. Spill was managed to the TDG caps in the Lower Monumental tailrace as well as the Ice Harbor Dam forebay (Figure 13).

FIGURE 13. Lower Monumental Dam flow and spill for spring and summer of 2005.

Ice Harbor Dam

Spring and summer flow occurred according to the 2004 Biological Opinion. RSW testing was implemented in 2005 and consequently the spill program was modified for this research. Spill at Ice Harbor Dam was provided to the gas cap, except for days when the RSW was being tested. Spill occurred from April 3 through August 31, 2005 (Figure 14).

FIGURE 14. Ice Harbor Dam flow and spill for spring and summer of 2005

McNary Dam

Spring spill according to the Biological Opinion was initiated on April 10 and continued through June 20. Spill at McNary Dam was terminated on June 20, rather than on June 30, since temperatures were at or above 62° F and flows were less than the spring flow target. The 2004 BIOP and COE Fish Passage Plan prescribe eliminating voluntary spill and maximizing transportation at McNary Dam under these conditions. Although spring spill at McNary Dam ended on June 20th, some spill did occur since river flows were above powerhouse capacity and water was intentionally being spilled as part of a juvenile fish survival study, which includes a minimum spill level. Summer spill began on July 1 and was set at spilling any flow in excess of 50 Kcfs. (Figure 15). Summer spill ended on August 31, 2005.

FIGURE 15. McNary Dam flow and spill for spring and summer of 2005.

John Day Dam

Spill was provided from April 10 through August 31 for spring and summer migrants as required in the NOAA NMFS Biological Opinion. Spring spill occurred as 60% of instantaneous flow during nighttime hours and changed to 30% of instantaneous flow for 24-hours during the summer spill period. (Figure 16).

FIGURE 16. John Day Dam flow and spill for spring and summer of 2005.

The Dalles Dam

Spring spill began on April 10 and summer spill continued until August 31, 2005 (Figure 17). The condition of wire ropes on the spillway gates was deemed unsafe. The project was operated with fixed gate settings. Bays 1-6 were operated open using two openings and three settings through spring to get close to 40% spill. Two spillbays had variable gate openings. The Dalles often spilled less than the 40% target due to this mechanical failure of the spillway gate hoist ropes. As discussed above, to enhance overall fish passage, the Action Agencies operated John Day to spill 40% during the day and 60% nighttime beginning on 5/20 as requested by the salmon managers, which with minor adjustments continued through 5/30.

The salmon managers were encouraged by the operation, and requested that this continue as long as there is an impact at The Dalles (i.e. a volume for volume spill operation) based on the fact that the tail end of migration is important, and the fish would benefit from continued daytime spill at John Day. The Action Agencies did not agree to continue the spill.

FIGURE 17. The Dalles Dam flow and spill for spring and summer of 2005.

Bonneville Dam

Spill was provided from April 10 through August 31 at 75 Kcfs during daytime hours and up to gas cap spill during nighttime hours. However, spill was routinely moderated to meet the gas cap below the project (Figure 18).

FIGURE 18. Bonneville Dam flow and spill for spring and summer of 2005

4. Summary and Conclusions

- Spring Creek Hatchery Spill did not occur as per the three-year agreement. Gas generated from the corner collector was a concern due to the low tailwater elevations.
- Spring spill did not occur at the Snake River transportation collector dams.
- Spill was restricted at The Dalles Dam because of mechanical difficulties at the spill bays.
- The 9th Circuit Court provided an order to spill at the Snake River and McNary transportation dams during the summer months.

B. Gas Bubble Trauma Monitoring and Data Reporting for 2005

1. Overview

Monitoring of juvenile salmonids in 2005 for gas bubble trauma (GBT) was conducted at Mid Columbia, Lower Columbia and Snake River sites where fish were examined for signs of GBT. Fish were collected at Bonneville Dam and McNary Dam on the Lower-Columbia River, and at Rock Island Dam on the Mid-Columbia River. The Snake River monitoring sites were Lower Monumental Dam, Little Goose Dam, and Lower Granite Dam. The alteration of the spill program in the Snake River, because of low river flow, resulted in termination of the GBT sampling at the Snake River monitoring sites during the spring spill season. However, summer monitoring at the Snake River sites did occur this year as a result of the Court ordered summer spill program injunctive relief. Summer spill in the Snake River occurred from June 20, 2005 until August 31, 2005.

Sampling of yearling Chinook and steelhead occurred through the spring at the Columbia River sites. Once subyearling Chinook predominated smolt collections the sampling of subyearling Chinook occurred at Columbia River sites to the end of August. Subyearling smolts were monitored in the Snake River during the summer spill period.

Sampling occurred two days per week at the Columbia River sites and at Lower Granite, Little Goose and Lower Monumental in the Snake River during the time period that spill was implemented. In previous years fish were sampled every other day (3 to 4 days per week) at most facilities. The number of sampling days was reduced in 1999, in order to decrease the number of fish handled. It was determined that the reduced sampling effort would not significantly diminish the capability to detect the presence of GBT in the migrating population.

The goal was to sample 100 salmonids of the most prevalent species (limited to Chinook and steelhead) during each day of sampling at each site, the proportion of each species dependent upon their prevalence at the time of sampling. Examinations of fish were done using variable magnification (6x to 40x) dissecting scopes. The eyes and unpaired fins were examined for the presence of bubbles. The bubbles present in the fins were quantified using a ranking system based on the percent area of the fins covered with bubbles. A rank of 0 was recorded when no

bubbles were present; rank 1 was recorded when up to 5% of a fin area was covered with bubbles; rank 2 was for 6% to 25%; rank 3 indicated 26% to 50% fin area was bubbled; and rank 4 indicated greater than 50% of a fin was covered with bubbles. The eyes of the fish were also examined and the eye with the highest amount of bubbles in it was ranked using the same criteria as was used for the fins. Additional information was recorded for each fish including, species, age, race, rearing disposition, fork length, fin clips, and tags. The examination procedures were similar to those used in past years of the program (see the GBT Monitoring Protocol for details of exam procedures).

Sampling techniques varied somewhat based on the location. This year all sampling sites were at dams, where fish could be collected from the juvenile fish bypass system. At those dams where fish crossed separators the fish were collected as they entered the separator. Rock Island Dam is the only site where fish were held in a tank (up to 24 hours) prior to examination.

2. Results

A total of 11,428 juvenile salmonids were examined for GBT between April and August (Table 6). A total of 55 or 0.48 % showed some signs of GBT in fins or eyes, while fin signs were found in 52 or 0.46% of the fish sampled at all sites (Table 7). Only 1 fish was found with severe fin signs (rank 3 or higher) while 1 fish had fin rank 2, with the remainder having rank 1 signs. The prevalence of GBT signs at Rock Island Dam was higher than any other Columbia River site during the 2005 monitoring season as is typically the case each season. Because the Rock Island data may obscure other inter-annual trends in the occurrence of GBT signs among sites, it will be treated separately in the remainder of this report.

TABLE 6. Number of juvenile salmonids examined for signs of GBT at dams on the Lower Snake River and on the Columbia River from April to August 2005 as part of the GBT Monitoring Program.

Species	Site					
	BON	MCN	LMN ¹	LGS ¹	RIS	Total
Chinook Subyearlings	2,095	2,147	298	866	1,117	6,523
Chinook Yearlings	1,603	1,279			930	3,812
Steelhead	250	274	38	11	520	1,093
Total	3,948	3,700	336	877	2,567	11,428

¹ Modified sample dates.**TABLE 7. Number of juvenile salmonids found with fin GBT at dams on the Lower Snake River and on the Columbia River from April to August 2005 as part of the GBT Monitoring Program.**

Species	Site					
	BON	MCN	LMN ¹	LGS ¹	RIS	Total
Chinook Subyearlings	0	0	0	8	16	24
Chinook Yearlings	0	1	0	0	19	20
Steelhead	0	1	0	0	7	8
Total	0	2	0	8	42	52

¹ Modified sample dates.

At the Lower Columbia River and Snake River sites (i.e. excluding Rock Island) a total of 8,861 fish were examined with (0.11%) exhibiting any signs of GBT, compared to past years (1995 to 2004), which ranged between a low of 0.1% in 2001 to a high of 4.3% in 1997. Ten fish were found with fin signs in 2005 (0.11%), comparable to the last three of the past four years, when less than 1% of fish have shown signs of fin GBT. The percent signs over the past several years are shown in the following table (Figure 19).

FIGURE 19. Comparison among years of the annual percent of GBT observed in unpaired fins.

One fish was found with severe fin GBT in Lower Snake and Lower Columbia sampling. This low level of occurrence is similar to 2004, 2003, 2002, 2001, 2000, 1999, and 1995 when no severe fin GBT was found. Other years showed higher incidence of severe fin GBT; in 1998 four (0.01%) fish displayed severe fin signs, 1997 when 117 fish (0.27%) had severe fin signs (again excluding Rock Island) and 47 fish (0.12%) in 1996.

The Biological Opinion Spill Program was managed using the data collected for total dissolved gas levels. However, signs of GBT in fins of juvenile fish, examined as part of the biological monitoring, are used to complement the physical monitoring program. NOAA Fisheries originally established the action criteria for the biological monitoring program at 15% prevalence of fish having fin signs or 5% with severe signs (rank 3 or greater) in fins. The action criteria were not exceeded in 2005. This is similar to all past years since 1995, with the exception of the high flow years (1996 and 1997) when uncontrolled spill occurred. In contrast there were 23 dates when GBT levels surpassed the action criteria in 1997 and 20 in 1996.

The prevalence and severity of fin signs in juvenile salmonids sampled in the Lower Snake and Lower Columbia rivers reflects changes in TDGS conditions in the river from year to year. The occurrence of severe signs in 1996 and 1997, and the increase in exceedences of the

NMFS action criteria, reflected a significant increase in the number of days when TDGS rose above 125% in the forebays of these dams (Table 8 and Table 9). In other years few fish were observed with severe signs of GBT, reflecting the more moderate conditions found in the river.

TABLE 8. The number of days when TDGS levels were above 120% and 125% at representative forebay monitors in the Lower Snake and Lower Columbia Rivers from April 1 to August 31.

	2005		2004		2003		2002		2001	
TDGS Monitor	days >120	days >125	days >120	days >125	days >120	days >125	days >120	days >125	days >120	days >125
Lower Granite	0	0	0	0	0	0	0	0	0	0
Little Goose	0	0	0	0	7	2	1	0	0	0
Lower Monumental	0	0	0	0	7	2	5	0	0	0
Ice Harbor	0	0	0	0	4	0	0	0	0	0
McNary (Oregon) ^a	0	0	1	0	1	1	0	0	0	0
Bonneville	0	0	0	0	0	0	0	0	0	0
Total	0	0	1	0	20	6	6	0	0	0

^a 2002 data used Washington monitor at McNary due to missing data from Oregon monitor during July and August.

TABLE 9. The number of days when NMFS GBT criteria of 15% prevalence or 5% severe signs were exceeded at sites in the Lower Snake and Lower Columbia rivers from April 1 to August 31.^{ab}

Site	2005	2004	2003	2002	2001	2000	1999
Lower Granite	0	0	0	0	0	0	0
Little Goose	0	0	0	0	0	0	0
Lower Monumental	0	0	0	2	0	0	0
Ice Harbor	0	0	0	0	0	0	0
McNary	0	0	0	0	0	0	0
Bonneville	0	0	0	0	0	0	0
Total	0	0	0	2	0	0	0

^a Based on dates when at least 30 fish of the species exhibiting signs were captured.

^b More than 5% of fish showed severe signs on only 1 date in each year 1996 & 1997 and on those same dates the prevalence of fin signs was greater than 15%.

3. Summary and Conclusions

GBT sampling was successfully accomplished for the 2005 migration season. In general, the low river flows this year resulted in a very controlled spill program. Consequently, few fish were observed with any signs of GBT. This year, as in previous years, the number of fish showing fin signs appears to be proportional to the levels of TDGS experienced by fish.

The 2005 sample year was uniquely different than other years because of the sampling that was conducted for the implementation of the court ordered injunctive relief spill program. The only signs of GBT detected during the implementation of the summer spill were at Little Goose Dam. A total of eight juvenile migrants (out of 877 sampled) were detected spread over several days during the summer time period (June 20 to August 31). The signs detected were of Rank 1, meaning that less than 5% of an unpaired fin was affected with bubbles. It can be concluded that the spill experienced by the subyearling migrants in the Snake River during the summer of 2005 did not result in concern for GBT in subyearling migrants.

III. 2005 SMOLT MONITORING

A. Summary

The 2005 out-migration from the Snake River reflected the water year and subsequent operational decisions. Based on low water supply forecasts, NOAA Fisheries and the other Action Agencies decided to maximize transportation of spring migrants as called for in the 2000 Biological Opinion. The decision resulted in approximately 94% of steelhead and 92% of yearling Chinook being transported.

Summer migrant subyearling Chinook salmon continued to migrate past Lower Granite earlier than historically, based on analysis of PIT-tagged wild fish timing. It is unclear what has caused this shift in timing. One possible explanation is genetic alteration of the population with supplementation fish. Our analysis shows that supplementation fish exhibit much earlier migration patterns than wild fish. There are two possible mechanisms for this change, either through interbreeding of adult returns of hatchery origin and wild fish, resulting in a genetically altered population, or through inadvertently tagging smaller unmarked supplementation migrants as part of wild fish marking.

Migrant fall Chinook posted some of the highest survivals we have measured from Lower Granite Dam to McNary Dam during late June this year. Winter migration and fish over-wintering in the reservoirs of the Snake River would not be included in those survival comparisons. In addition to high survivals, travel time estimates showed that summer migrants traveled much more rapidly than other years with similar flows, during the spill period, and that difference was likely due to the provision of summer spill.

Mid-Columbia Chinook spring and summer migrants, marked at Rock Island Dam, showed average survival in 2005.

B. *Special Operations at Sites in the Lower Snake and Lower Columbia in 2005*

There were notable changes in operations at several dams in 2005. During Spring operations spill was curtailed in the Lower Snake River as a result of the low water supply forecasts. In

the Lower Columbia River operations were altered due to research operations at McNary Dam, while at Ice Harbor Dam installation of the RSW resulted in changes in operations at that project.

1. Lower Granite Dam

Due to low flows, the Action Agencies did not provide spill in April this year. Typically spill begins the first week of April and continues until June 20. But in 2005 spill was limited in the Spring, to periods of high flows, when hydraulic capacity was exceeded. Due to flows in excess of hydraulic capacity (turbine unit 1 was not available so hydraulic capacity was limited), spill began May 16, and small volumes of spill were recorded throughout the remainder of May and into June. Several days of no spill occurred during late May and June as well. There were radio tag (RT) and hydroacoustic studies at Lower Granite during the spring and summer. During spring, spill included Removable Spillway Weir operation. Operations changed greatly on June 20 when summer spill began. In the summer spill, an RT study was conducted comparing RSW spill passage with conventional spillway passage. Based on PIT-tag recapture data, after spill began June 20, collection efficiency for subyearling migrants was decreased to very low levels.

2. Little Goose Dam

The most significant changes in operations at Little Goose Dam were related to spill during the spring and summer of 2005. In spring, there were only 6 days of involuntary spill at the project, while in the summer period spill was carried out due to Court order. Spill patterns were changed on the weekend following the initiation of spill on June 20th, due to decreased passage of adult salmon after the initiation of spill. When the adult passage did not improve, efforts were undertaken to reduce the spill volume relative to the amount of water passing through the powerhouse in order to draw more adults to the fishway entrances. Spill was reduced to 50% of total river flow during daytime hours on June 28, and then when adult passage numbers did not increase, spill was further reduced to 30% of river flow during daytime hours on June 30. Adult fish counts at Little Goose Dam responded and exceeded 1500 fish for the day.

3. Lower Monumental Dam

Survival studies were carried out at Lower Monumental Dam in 2005 with an abbreviated spill period available. The spill began May 3 in conjunction with a spill bay survival study comparing survival between fish released into bays 7 and 8. Spill continued through June 6 about 10 days beyond the end of the study due to flows above hydraulic capacity. During the peak of the migration due to large numbers of juvenile salmon being collected at Lower Granite and Little Goose dams and filling transportation barges, fish were bypassed back to the river at Lower Monumental Dam for several days beginning May 9. In summer, court ordered spill occurred beginning June 20 and lasting through the end of August.

4. Ice Harbor Dam

This year the RSW was installed at Ice Harbor Dam. As a result, the COE conducted survival tests under two different spill scenarios at the site during spring migration. The operations alternated between bulk spill operations, and an RSW operation, where spill was reduced to just over 20 kcfs. During summer spill operations two spill patterns were also compared, with spill percentage staying relatively similar between treatments, at about 45%. In both spring and summer tests, it appeared that RSW operations resulted in significantly higher proportions of fish passing through the bypass and turbine routes, although relative dam survival was not significantly different for any comparison.

5. McNary Dam

There were spring and summer spill studies at the project in 2005. In spring 12h and 24h spill operations were compared, while in the summer RT was used to estimate survival under the existing conditions. The turbines at McNary Dam were operated outside the 1% criteria to allow testing of new high volume vertical barrier screens.

McNary Dam was operated every other day in the spring for transportation collection of PIT-tagged fish from the COE Mid-Columbia transportation study. Fish were bypassed via the full flow bypass channel on alternate days. During summer all fish were collected for transporta-

tion beginning June 24. Primary bypass operations were used sporadically beginning August 29 in order to pass large numbers of juvenile shad. Collection for transportation ended early this year, on September 16, as American shad numbers predominated to such an extent that sampling was terminated and transportation operations ended.

6. The Dalles Dam

A second year of spill studies were conducted at The Dalles Dam measuring passage proportions and dam survival under 40% average spill operations.

7. Bonneville Dam

At Bonneville Dam the newly installed corner collector at Powerhouse 2 was operational in 2004, and again this year, though no PIT-tag detection was available via this route of passage. The Corner Collector operated at 5 kcfs discharge. The apparatus is designed to attract migrant fish to the south corner of powerhouse II via a surface outlet down a long channel to a discharge downstream of the powerhouse. While the volume of discharge is low, preliminary results in 2004 indicate that the collector was very effective in passing some fish. There are some indications that fish previously destined for bypass passage were diverted to the corner collector resulting in very low collection efficiency at the project. Because no PIT-detections were available in the collector channel, low PIT-tag detection efficiency was observed in this year in the monitored channel.

C. Smolt Monitoring Sites and 2005 Schedules

Information on the juvenile salmon out-migration is collected each year to aid the Fisheries Agencies and Tribes in making management decisions beneficial to smolt survival as they move down-river from natal streams, through the hydro-system and on toward the ocean. The Smolt Monitoring Program (SMP) provides data on the initiation of the juvenile out-migration, estimates of relative fish abundance at the dams, migration timing at traps and dams, fish travel time through key river reaches both prior to and within the hydrosystem, and estimates of survival for key groups of fish through index reaches. Portions of the data are gathered on the run-at-large

migrating population, such as the passage indices, while other data such as travel time and survival estimates target specific mark-groups of fish. All of the data are collected for the purpose of providing information for management of flows and spills, and post-season evaluation of the effects of the year's management actions on migrating juvenile salmonids. Because the SMP has been carried out over the course of 20 years or more at some locations, the program also provides historic perspective for comparing both in-season data with past years and for combining recent data with historic data for retrospective analyses.

Data were gathered at eleven monitoring sites in the Columbia River Basin (See Table 10 for sites and dates of operation for 2005). Monitoring was conducted at four traps in the Snake River Basin above Lower Granite Dam, three dams in the Lower Snake River, Rock Island Dam in the mid-Columbia River, and three dams in the Lower Columbia River. Data from all sites were transmitted to FPC daily during the sampling season, where they were archived as well as compiled for reporting. The information was made available to all interested parties via the Fish Passage Center web page at www.fpc.org. Data were also available through the Fish Passage Center's weekly reports or by data requests from Fish Passage Center Staff.

In addition to the activities described above, fish are also collected and PIT-tagged at SMP traps, Rock Island Dam and at selected hatcheries for more specific evaluations.

TABLE 10. Smolt monitoring sites and schedules for 2005.

Site	Sampling Method	Dates of Operation	Primary Fish Data
Bonneville Dam	PH2: Timed subsample from bypass	March 1 to October 31	C, FQ, GBT(2)
John Day Dam	Timed subsample from bypass	April 1 to September 15	C, FQ
McNary Dam	Timed subsample from bypass	April 3 to September 16	C, FQ, GBT(2)
Lower Monumental Dam	Timed subsample from bypass	April 2 to October 1	C, FQ, GBT(1)
Little Goose Dam	Timed subsample from bypass	April 1 to October 31	C, FQ, GBT(1)
Lower Granite Dam	Timed subsample from bypass	March 26 to October 31	C, FQ, GBT(1)
Rock Island Dam	PH2: Census of fish captured in volitional bypass	April 1 to August 31	C, FQ, GBT(2), PIT
Snake River Trap (rkm 225)	Rotating Drum Dipper Trap	March 6 to June 22	C, FQ, PIT
Salmon River Trap (rkm 123)	Inclined Plane Trap	March 6 to May 18	C, FQ, PIT
Grande Ronde Trap	Inclined Plane Trap	March 7 to May 25	C, FQ, PIT
Imnaha Trap	1-2 Screw Traps	March 2 to June 15	C, FQ, PIT

C = fish counts recorded

FQ = fish quality including descaling and injury data obtained

PIT = PIT tagging and release from site

GBT(k) = gas bubble trauma measurements taken "k" days per week

D. Collection Counts and Relative Abundance

The daily passage index is computed by dividing the daily collection by the proportion of water passing through the powerhouse where the sampling takes place (Table 11). The daily passage indices adjust for daily changes in spill proportion under the conservative assumption that the proportion of fish passing through spill will be close to the proportion of water being spilled. Estimates of fish guidance efficiency of the screens or of spill effectiveness (proportion of fish passing through spill) are not necessary using this method. As long as the daily index remains

highly correlated to daily population abundance at each site the index remains useful for gauging passage timing and magnitude of passage. For these reasons, the daily passage index was chosen over attempts to estimate daily absolute abundance. Post-season, the daily passage indices are summed for the season at each site to provide an annual passage index for each species and rearing type available. The passage index is not applicable to trap sites because collection efficiencies of the traps are not calculated; therefore only collection counts are reported for the four SMP traps in Table 12.

Since 1984 the passage index has been used for calculation of within season relative abundance. In the past several years, changes in the methods of sampling at Bonneville and John Day dams have evolved to a point where collection methods are very similar to other COE dams. Since 1998, sampling at John Day Dam has been carried out using a timed sample from the entire powerhouse bypass system instead of samples from a single gatewell slot as in prior years. At Bonneville Dam, the index sampling is a timed sample at Powerhouse II bypass since 2000 (previously, the timed trap samples were taken in Powerhouse I).

The index is based on an estimate of total daily collection at each monitoring site where a sample timer is used to systematically divert collected fish into a sample tank for processing. The resulting enumeration is divided by the sample rate to arrive at estimated collection.

TABLE 11. Formulas to compute passage indices (collection/flow expansion factor) at dams.

Sampling Site	Years	Collection	Flow expansion factor
Rock Island Dam (PH 2)	1985-2005	Catch / 1	PH2/(PH1+PH2+SP)
Lower Granite Dam	1984-2005	Catch / sample rate	PH/(PH+SP)
Little Goose Dam	1984-2005		
Lower Monumental Dam	1993-2005		
McNary Dam	1984-2005		
John Day Dam (bypass)	1998-2005	Catch / sample rate	PH/(PH+SP)
John Day Dam Unit 3	1984-97	Catch / 1	Unit3/(PH+SP)
Bonneville Dam (PH 1)	1986-92	8 hr catch / sample rate	PH1/(PH1+PH2+SP)
	1993-95	24 hr catch / sample rate	
	1996-99	8 hr catch / sample rate	
		24 hr catch / sample rate	
Bonneville Dam (PH 2)	2000-2005	24 hr catch / sample rate	PH2/(PH1+PH2+SP)

Legend: PH=powerhouse flow; PH1=first powerhouse flow; PH2=second powerhouse flow; SP=spill flow; and Unit3=turbine unit 3 flow (note: all flows are 24-hr averages over the sample interval).

1. Snake River

The cumulative counts of salmonids at the four traps above Lower Granite Dam were summarized over the scheduled operation dates in 2005 (Table 12). For SMP these traps operated primarily on a five day per week schedule (Sunday afternoon to Friday morning). Sampling on the Imnaha River often involved two traps to increase collection of fish for PIT-tag marking. Trap counts reflect total fish collected and handled for either timing, fish condition or PIT-tagging purposes. Trap efficiencies were not estimated in 2005.

TABLE 12. Sampled numbers of composite wild/hatchery Chinook, steelhead, coho, and sockeye at the four traps used in the Smolt Monitoring Program in 2005.

Species	No. of Fish Sampled	Species	No. of Fish Sampled
Salmon River Trap (above Whitebird)		Snake River Trap (at Lewiston)	
Chinook 1's	43,641	Chinook 1's	1,810
Steelhead	3,754	Steelhead	7,263
Sockeye	115	Sockeye	263
		Coho	110
		Chinook 0's	1,152
Imnaha River Trap		Grande Ronde River Trap	
Chinook 1's	42,756	Chinook 1's	5,793
Steelhead	36,509	Steelhead	2,453
Chinook 0's	86	Chinook 0's	1,224

At all monitoring sites, SMP crews reported smolt sample counts at the level of clipped and unclipped fish. Because not all hatchery fish were fin clipped in the Snake and Columbia River basins, the FPC has, since 2000, reported all sample collection and passage index data for each species at the level of combined hatchery and wild fish in our weekly reports and annual report tables (Table 13). However, since all hatchery Chinook released in tributaries above Lower Granite Dam were either fin clipped or implanted with a wire tag, we did attempt to collect supplemental data at several sites to help differentiate between hatchery and wild stocks for yearling Chinook and in some cases for steelhead (see Table 14 through Table 16). The data for the Salmon River trap and Snake River (Lewiston trap) included counts of unclipped yearling Chinook with a coded wire tag (CWT) and counts of unclipped yearling Chinook. In addition, for the first year, information was recorded in the SMP data system on holdover fall Chinook collected at Snake and Lower Columbia River sites. Holdover fall Chinook were differentiated based on mor-

phology and timing; yearling fish seen at most sites in April, exhibiting a deeply forked tail, very little descaling, and eye orientation consistent with fall Chinook were considered holdover yearling fall Chinook. Within the database, the code "HC" was used in the special species category to indicate these fish. Steelhead with fin erosion typical of a hatchery fish were also used to distinguish additional hatchery fish at the Salmon and Snake River traps. These data were necessary at the traps in order to provide valid PIT-tag codes for PTAGIS and could be used to differentiate wild and hatchery yearling Chinook and steelhead smolts for travel time and survival estimates. The use of fin erosion was extended to Lower Snake River dams (Lower Granite and Lower Monumental) beginning in 2004, however steelhead rearing types were combined for this report.

TABLE 13. Sample, collection, and passage indices of salmonids at Snake River dams in 2005 and comparison with recent annual passage indices.

Dam	Species	2005			2004	2003	2002
		Sample	Collected	Passage Index	Passage Index	Passage Index	Passage Index
Lower Granite	Chinook Age 0	41,017	1,581,984	1,755,890	1,034,532	1,413,192	753,573
	Chinook Age 1	43,456	5,540,519	5,676,994	5,176,632	3,599,259	2,460,813
	Coho	1,912	286,020	305,073	259,509	132,928	124,067
	Steelhead	43,049	5,590,787	5,935,708	5,828,675	3,355,830	2,603,071
	Sockeye/kokanee	484	31,656	38,484	8,053	16,399	77,820
Little Goose	Chinook Age 0	56,500	1,197,776	1,287,921	493,436	685,932	335,795
	Chinook Age 1	22,304	2,451,059	2,475,848	2,658,622	3,644,755	2,847,393
	Coho	1,515	185,963	191,698	127,985	116,669	104,590
	Steelhead	23,074	2,857,097	2,921,864	1,917,941	2,583,409	2,274,786
	Sockeye/kokanee	805	38,769	41,369	4,846	8,126	66,825
Lower Monumental	Chinook Age 0	28,833	177,812	207,821	191,594	341,254	306,204
	Chinook Age 1	13,065	670,864	706,774	913,852	785,329	2,220,450
	Coho	323	21,563	24,370	15,934	37,604	66,185
	Steelhead	9,307	614,133	675,547	343,355	1,865,478	1,793,280
	Sockeye/kokanee	292	7,346	8,217	962	4,543	38,999

The FPC makes annual estimates of the hatchery and wild yearling Chinook migrating past Lower Granite Dam each year as well as total numbers of steelhead (Table 14, Table 15 and Table 16). Sockeye data are also presented in this report at the combined hatchery and wild level, even though hatchery sockeye were 100% fin clipped, because the numbers of hatchery sockeye collected at SMP sites are very small.

TABLE 14. Hatchery yearling Chinook population estimates at Lower Granite Dam in 2005 with comparison to prior years and hatchery production.

Year	Collection efficiency	Collection	Passage index	Population estimate	Hatchery release ^a
1999	0.26	1,762,700	2,768,100	6,800,000	9,676,126
2000	0.38	2,035,000	2,725,400	5,400,000	7,317,023
2001	0.75	1,547,700	1,547,700	2,100,000	4,076,080
2002	0.22	1,288,102	2,075,234	5,900,000	10,822,876
2003	0.32	2,014,435	2,813,499	6,300,000	12,111,740
2004	0.55	4,846,456	5,175,978	8,700,000	12,268,500
2005	0.72	4,257,329	4,349,634	5,900,000	10,005,428

^a We did not include releases before September 1 of year prior to migration year in either the total hatchery release or the % fall release data.

At Lower Granite Dam the RSW was again in operation in 2005 but only for short periods of time, during the spring, while during summer spill RSW and conventional spill were utilized under the Court-ordered spill program. The high collection efficiency in the spring, at the site was due to limited spill.

Year to year changes in the hatchery yearling Chinook population index at Lower Granite would be an effect of both hatchery production and survival upstream of Lower Granite Dam. Hatchery releases of yearling Chinook dropped to 10 million in 2005, and that lower level release was reflected in the lower estimated population size in 2005 (Table 14). The estimated wild yearling Chinook population size at Lower Granite Dam in 2005 was 1.7 million smolts. This estimate is similar to those from other recent years (Table 15).

TABLE 15. Wild yearling Chinook population estimates at Lower Granite Dam in 2005 with comparison to prior years.

Year	Collection efficiency	Collection	Passage index	Population estimate
1999	0.26	410,800	636,600	1,600,000
2000	0.38	415,100	565,100	1,100,000
2001	0.82	410,600	410,600	500,000
2002	0.22	249,200	385,579	1,100,000
2003	0.42	562,595	785,759	1,300,000
2004	0.61	1,042,762	948,424	1,700,000
2005	0.76	1,283,153	1,327,323	1,700,000

Steelhead collection efficiency at Lower Granite Dam was the closest to 2004 at 68% this year. Such high collection was likely affected by similar factors as yearling Chinook; mainly low amount of spill during peak passage. Despite later steelhead passage, with the 90% passage date on May 24, less than ten percent of the steelhead passage occurred during the highest flows (between May 27 and June 8 when flows were above 100 kcfs) so that only those late steelhead likely benefited from the higher spill volumes associated with the late spike in flows (Table 16).

TABLE 16. Steelhead population estimates at Lower Granite Dam in 2005 with comparison to prior years and hatchery production.

Year	Collection efficiency	Collection	Passage index	Population estimate ¹	Hatchery release
1999	0.36	3,355,187	5,234,736	9,400,000	9,573,500
2000	0.59	5,039,620	6,782,359	8,500,000	9,568,500
2001	0.89	5,580,471	5,580,776	6,300,000	9,442,600
2002	0.24	1,698,933	2,342,800	7,100,000	9,225,257
2003	0.32	2,337,143	3,355,823	7,300,000	9,627,940
2004	0.73	5,677,412	5,828,611	7,800,000	9,068,327
2005	0.68	5,590,788	5,935,714	8,300,000	8,661,461

¹ Steelhead have not been distinguishable by clip status as hatchery or wild since 2000 with the relative average split of about 10% wild and 90% hatchery.

2. Columbia River

The cumulative number of fish sampled at each dam in 2005, along with expanded annual collection and passage indices, were summarized for the Columbia River dams (Table 17). Caution should be used in comparing the magnitude of passage indices between years at a given site, however patterns that are consistent at multiple sites likely suggest changes in population passing through a segment of the river. Passage indices at Rock Island Dam in 2005 were lower than in other recent years especially for spring migrants. This is also reflected in the lower passage indices seen at McNary Dam and indicates potentially lower populations emigrating from the Mid-Columbia in 2005.

At McNary Dam, sampling occurred every other day from April 3 to June 28. During the spring, on alternate days fish were either sampled and run through the full facility, or fish were routed back to the river through the primary bypass. There were some exceptions to this pattern

early in the season, when fish were collected for research purposes on non-sampling days. The passage indices at McNary were adjusted to account for every other day full sample by using the average of the previous day's total and following days total for those days when the facility was either in primary bypass or only sampled for a portion of the day.

Overall spring migrant indices were down at McNary Dam in 2005. The yearling Chinook index was lower than most other recent years. The coho passage index was lower than 2003 and slightly below the recent average. The steelhead index was much lower than 2002 and 2003 but higher than 2004. Sockeye indices again showed a marked decrease compared to other recent years. The 2005 subyearling index at McNary was lower than other recent years. To some extent the lower indices for summer migrants at McNary Dam could be a function of summer spill operations, which may result in lower collection efficiency at the project. When spill passage efficiency is greater than one to one, the between year comparison of the magnitude of passage indices becomes very difficult.

At John Day Dam and Bonneville Dam all indices were generally down compared to 2002 and 2003, but higher than 2004. However, the sockeye index was much lower than that seen in other recent years (including 2004).

TABLE 17. Sample, collection, and passage indices of salmonids at Columbia River dams in 2005 and comparison with 2002-2005 annual passage indices.

Dam	Species	2005			2004	2003	2002
		Sample	Collected	Passage Index	Passage Index	Passage Index	Passage Index
Rock Island Dam	Chinook Age 0	15,311	15,311	22,360	25,928	28,113	25,466
	Chinook Age 1	10,610	10,610	14,586	12,571	15,355	28,982
	Coho	25,533	25,533	35,640	28,673	41,690	86,227
	Steelhead	11,293	11,293	15,656	10,733	15,507	28,714
	Sockeye/kokanee	1,396	1,396	1,963	7,101	10,306	20,632
McNary Dam ^a	Chinook Age 0	77,214	4,169,021	6,841,553	8,414,556	10,678,975	8,405,200
	Chinook Age 1	25,249	718,260	2,415,949 ^a	1,920,075 ^a	3,242,581 ^a	3,336,001
	Coho	2,042	60,522	203,820 ^a	171,063 ^a	218,467 ^a	200,556
	Steelhead	5,827	119,228	386,518 ^a	209,203 ^a	490,024 ^a	771,115
	Sockeye/kokanee	1,217	60,174	206,076 ^a	578,916 ^a	1,645,224 ^a	1,362,086
John Day Dam	Chinook Age 0	75,545	1,624,903	2,300,846	1,720,827	2,713,873	3,465,726
	Chinook Age 1	77,605	1,052,463	1,409,477	1,005,402	2,074,671	2,104,938
	Coho	13,062	141,772	192,566	175,315	258,282	315,280
	Steelhead	25,174	384,788	526,642	257,198	553,522	545,814
	Sockeye/kokanee	3,907	60,632	84,481	235,900	726,177	934,108
Bonn. Power-house 2	Chinook Age 0	134,837	2,142,693	3,821,741	2,846,510 ^b	6,265,644 ^b	6,993,964 ^b
	Chinook Age 1	69,022	760,522	1,527,240	1,466,448	4,043,776	5,269,226
	Coho	43,043	393,288	771,275	938,113	2,116,570	3,328,201
	Steelhead	10,549	92,824	186,563	92,894	1,635,181	2,331,599
	Sockeye/kokanee	3,291	19,026	41,901	189,695	1,261,375	1,455,004

^a McNary sampled every other day from April 3 to June 28, in 2003, April 3 to June 23, in 2004 and 2005 so these years' passage indices were adjusted for comparison to historic data by interpolating values for dates not sampled or only partially sampled (project operated primary bypass) between two sample dates. As an example, for yearling Chinook the unadjusted passage index for 2003 was 1,624,087 compared to adjusted value of 3.2 million which is more comparable to recent historic indices.

^b Upper brights annual values were summed commencing May 13, 2004, May 15 in 2003, May 10 in 2002, May 1 in 2001 due to tule Chinook releases from Spring Creek Hatchery a week prior to that date in each year.

E. Migration Timing

The distribution of daily passage indices provides a measure of migration timing at a given site. From the passage distributions at Lower Granite, Rock Island, McNary and Bonneville dams, the dates of passage of key cumulative percentiles of 10%, 50%, and 90% were summarized for each species in Table 18. These timing data were also plotted for the run-at-large for these sites in Appendix D.

In the Snake River at Lower Granite Dam, the yearling Chinook timing was temporally compressed compared to the ten-year-average. The 10% date was only 3 days earlier than the 10 year average, but the 90% date of May 11 was 8 days earlier than the historic average. Due to a very early run, 90% passage date was reached prior to peak flows, which occurred between May 13 and June 6. Timing in 2005 was similar to 2004, but much earlier than 2003, when the 90% date was passed on May 22. Similar to yearling Chinook, steelhead timing was compressed; the 10% passage date of April 27, was one day later than the ten-year-average, while the 90% date of May 19 was seven days earlier than average. Similar to last year there was a substantial spike in numbers of yearling Chinook and steelhead coinciding with increasing flow above 70 kcfs in early May. Coho and Sockeye timing both were earlier than 2003 and 2004, with both showing peak migrant numbers prior to the late freshet. Similar to last year, run-at-large subyearling Chinook, which is now predominantly hatchery released fish, showed a much earlier migration than other recent years as well as much earlier than historic average, with the 90% date occurring on June 19. This early timing is due in part to earlier hatchery releases in response to low flows as well as the change in operations (summer spill) on June 20 that resulted in substantially lower collection efficiency from that time onward.

Timing at McNary Dam for yearling Chinook was similar to Lower Granite Dam, in that the passage was compressed, with the 10% date occurring on May 4, eight days later than the ten-year-average, but the 50% and 90% dates were similar to 2003 and 2004 as well as the average. For steelhead, the 2005 run began near ten-year-average and reached 50% passage similar to average, but the 90% date was 5 days earlier than the average. Coho 10%, 50% and 90% passage was earlier than 2003 and 2004. Sockeye timing was condensed compared to other recent years with the middle 80% passage taking just 20 days in 2005 compared to 24-27 days the previous two years.

At Bonneville Dam the yearling Chinook run was similar to 2003 and 2004, while steelhead showed a compressed timing distribution compared to other recent years.

TABLE 18. Migration timing of salmonids at Lower Granite, Rock Island, McNary, and John Day dams in 2005 compared to 2004 and 2003.

Dam	Species	2005			2004			2003		
		10%	50%	90%	10%	50%	90%	10%	50%	90%
Lower Granite	Chinook Age 0	5/29	6/3	6/19	6/8	6/21	7/14	6/1	6/18	7/12
	Chinook Age 1	4/24	5/5	5/11	4/19	5/4	5/12	4/21	5/6	5/22
	Coho	4/30	5/10	5/19	5/8	5/20	5/29	5/14	5/27	6/19
	Steelhead	4/27	5/9	5/19	4/27	5/9	5/24	4/25	5/16	5/29
	Sockeye and kokanee	5/10	5/20	6/1	5/12	5/22	6/19	5/22	5/31	6/5
Rock Island	Chinook Age 0	5/27	6/29	7/25	6/1	7/3	7/28	6/6	7/8	7/31
	Chinook Age 1	4/19	5/10	5/27	4/17	5/7	5/25	4/24	5/8	5/31
	Coho	5/10	5/15	5/26	5/11	5/23	6/5	5/24	6/3	6/11
	Steelhead	5/2	5/12	5/26	5/3	5/12	5/30	5/6	5/26	6/3
	Sockeye	4/28	5/12	7/8	4/17	5/2	5/23	4/20	5/11	5/28
McNary ^a	Chinook Age 0	6/14 (6/16)	6/24 (6/27)	7/5 (7/9)	6/19 (6/20)	6/28 (6/29)	7/14 (7/16)	6/13 (6/18)	6/27 (7/10)	7/25 (7/29)
	Chinook Age 1	5/4	5/15	5/29	4/27	5/12	5/30	4/30	5/14	5/29
	Coho	5/5	5/21	6/6	5/15	5/30	6/12	5/26	6/3	6/15
	Steelhead	4/23	5/17	5/27	4/24	5/12	6/1	4/29	5/26	6/3
	Sockeye	5/11	5/19	5/31	5/15	5/29	6/11	5/3	5/15	5/27
Bonneville PH 2	Chinook Age 0 "upriver brights"	6/14 ^c	6/28 ^c	7/16 ^c	6/7 ^d	6/29 ^d	7/14 ^d	6/14 ^e	7/1 ^e	7/19 ^e
	Chinook Age 1	4/19	5/7	5/25	4/17	5/4	5/30	4/22	5/14	5/31
	Coho	4/22	5/9	5/27	4/18	5/5	5/17	4/29	5/17	6/9
	Steelhead	4/25	5/13	5/30	4/19	5/17	5/31	5/6	5/29	6/10
	Sockeye	5/15	5/23	6/1	5/21	6/1	6/14	5/12	5/20	6/5

^a Because there was every other day sampling from April 1 to June 26 passage indices were adjusted by interpolating the non-sampled days total with the average of preceding and following days' total. This adjustment made a relatively little difference for subyearling Chinook in 2004 and 2005, but a large difference in 2003. The 50% passage date (the dates in parentheses are the unadjusted values).

^c Upper brights annual values are summed commencing May 20 in 2005, since tule Chinook releases from Spring Creek Hatchery occurred on March 2, April 15 and May 4).

^d Upper brights annual values are summed commencing May 13 in 2004, since tule Chinook releases from Spring Creek Hatchery occurred on March 1, March 10, April 14 and May 6).

^e Upper brights annual values are summed commencing May 15 in 2003, since tule Chinook releases from Spring Creek Hatchery occurred on March 8, April 14, May 8).

F. Travel Time Analyses

1. Results for Hatchery and Trap Release Travel Time Estimates

Snake River

Travel time of yearling Chinook and steelhead from hatcheries in the Snake River basin to Lower Granite are presented in Table 19. Median travel times were longer in 2005 at Rapid River Hatchery releases and for Dworshak steelhead releases than other recent years. Other releases appeared to have intermediate travel times to Lower Granite in 2005.

TABLE 19. Median travel time from release to Lower Granite Dam for Snake River basin hatchery yearling Chinook and steelhead in 2005 compared to the past several years.

Hatchery	Species	Median travel time release site to Lower Granite Dam						
		2005	2004	2003	2002	2001	2000	1999
Dworshak Hatchery	Chinook	30.2	32.2	49.4	38.1	30.4	27.3	27.7
Imnaha Acclimation Pond	Chinook	36.1 ^a	38.5 ^a	34.6 ^a	31.7 ^a	29.1 ^a	29.3 ^a	23.7 ^a
McCall Hatchery	Chinook	49.4	43.4	42.0	51.4	48.5	34.1	39.9
Rapid River Hatchery	Chinook	50.9 ^c	46.7 ^c	49.4 ^c	47.4 ^c	32.3 ^c	29.0 ^c	37.1 ^b
Dworshak Hatchery	Steelhead	11.2	8.8	7.2	7.8	6.8	3.5	6.2

^a Midpoint of volitional release period used in calculation.

^b Projected median date of volitional release period used in calculation.

^c Monitored median date of volitional release period used in calculation.

Travel times for yearling Chinook and steelhead were generally intermediate for PIT-tagged fish marked at Smolt Monitoring Traps in 2005, reflecting the average flows fish experienced (as measured over the 30-day time period April 20 to May 20) as shown in Table 20. A notable exception to the intermediate travel times were seen at the Grande Ronde Trap, where hatchery yearling Chinook median travel time was only 4.6 days, which was much lower than what had been measured in past years. In contrast wild steelhead marked at the Grande Ronde Trap showed a relatively long median travel time of 4.4 days. For steelhead releases, flow is usu-

ally the most important factor, and for these groups it is apparent that the longest travel times generally occurred during 2001, while 2005 travel times were, average in most cases. This pattern fits the flow data since 2005 had average flows for the time period measured.

The 2005 seasonal survival estimate for PIT tagged wild and hatchery Chinook released from the four traps to Lower Monumental Dam tailrace ranged between 59.0% and 73.3% (Table 21), and that of wild and hatchery steelhead was between 52.7% and 58.8% (Table 22). Generally the highest survivals are seen in releases from the Snake Trap (nearest Lower Granite Dam) followed by the Grande Ronde Trap which is next upstream. The estimates for Chinook were intermediate from basin to basin when compared to those seen in recent years. Steelhead tended to have survival estimates higher than 2001, but similar to the average of other recent years. Steelhead fared better than yearling Chinook in relation to 2001 estimates. This may be due to the later steelhead migration which coincided with the short period of higher flows seen in 2005.

TABLE 20. Average travel time and flow for yearling Chinook and steelhead released from traps on the Salmon, Imnaha, Grande Ronde, and Snake rivers to Lower Granite Dam in 2005 compared to other recent years.

Year	Average ¹ Flow (kcfs)	Average Travel time (days) ²							
		Salmon River Trap		Imnaha River Trap		Grande Ronde River Trap		Snake River Trap	
Yearling. Chinook		H	W	H	W	H	W	H	W
1999	100.4	20.2	9.4	24.3	12.1	23.7	7.2	6.3	4.9
2000	88.5	15.9	11.4	20.7	10.6	11.4	6.8	6.7	5.3
2001	55.4	14.4	11.6	12.4	11.1	13.3	10.4	7.8	5.5
2002	67.8	13.6	17.7	19.6	12.1	25.3	9.1	10.0	7.3
2003	73.4	17.5	21.5	NA	18.9	23.7	8.9	6.4	6.0
2004	60.2	13.6	13.6	NA	9.3	15.3	8.1	5.2	4.4
2005	71.1	13.4	12.2	NA	10.5	4.6	6.9	6.9	6.5
Steelhead		H	W	H	W	H	W	H	W
1999	100.4	6.0	4.7	15.2	4.6	3.0	2.9	1.9	2.0
2000	88.5	4.7	N/A	9.6	4.7	3.5	3.0	2.1	2.1
2001	55.4	9.1	6.5	10.1	8.0	6.5	4.2	5.2	3.9
2002	67.8	5.8	6.1	8.6	7.2	4.2	4.4	2.3	2.7
2003	73.4	5.7	5.2	8.5	7.9	3.0	3.5	2.6	2.8
2004	60.2	8.7	5.7	10.0	5.3	5.9	3.7	4.7	3.4
2005	71.1	6.4	5.4	8.1	5.1	4.3	4.4	3.7	2.4

¹ Flow averaged from April 20 to May 20 at Lower Granite Dam.

² Average (weighted by released number) of median travel time estimates from daily releases between April 10 and May 10.

TABLE 21. Annual average reach survival estimates of Snake River basin PIT tagged yearling Chinook from trap release sites to Lower Monumental Dam tailrace for years 2000 - 2005.

Tag Site	Species	Rearing type	Year	Date Range	No. of Blocks	Average Survival	Lower Limit	Upper Limit
Salmon River trap								
	Chinook	Wild	2001	3/19-5/4	4	0.583	0.547	0.619
		Wild	2002	3/30-4/22	6	0.808	0.772	0.844
		Wild	2003	3/14-5/07	7	0.645	0.587	0.702
		Wild	2004	3/14-5/26	1	0.556	0.594	0.518
		Wild	2005	3/12-5/17	1	0.610	0.583	0.638
		Hatchery	2001	3/19-5/17	8	0.629	0.605	0.653
		Hatchery	2002	3/14-5/7	8	0.740	0.706	0.774
		Hatchery	2003	3/18-5/1	4	0.554	0.458	0.650
		Hatchery	2004	3/17-5/8	1	0.629	0.706	0.551
		Hatchery	2005	3/12-5/18	1	0.652	0.609	0.694
Snake River trap								
	Chinook	Hatchery	2001	4/27-5/4	1	0.745	0.666	0.825
		Hatchery	2002	4/12-4/18	1	0.894	0.808	0.979
		Hatchery	2003	4/15-5/27	2	0.786	0.620	0.952
		Hatchery	2004	3/25-5/20	1	0.724	0.823	0.625
		Hatchery	2005	3/30-5/16	1	0.606	0.703	0.800
Imnaha River trap								
	Chinook	Wild	2001*	3/14-4/27	14	0.683	0.669	0.697
		Wild	2001*	4/29-5/12	1	0.529	0.475	0.583
		Wild	2002	3/25-4/29	3	0.800	0.751	0.849
		Wild	2003	3/15-4/26	5	0.660	0.583	0.737
		Wild	2004	2/26-5/31	1	0.556	0.587	0.525
		Wild	2005	3/4-5/18	1	0.645	0.592	0.697
Grande Ronde River trap								
	Chinook	Wild	2001	3/28-5/3	2	0.764	0.694	0.835
		Wild	2002	4/17-4/24	1	0.839	0.713	0.966
		Wild	2004	3/9-5/29	1	0.744	0.808	0.681
		Wild	2005	3/8-5/24	1	0.737	0.669	0.810
		Hatchery	2001	4/2-4/26	3	0.624	0.578	0.670
		Hatchery	2002	4/8-4/23	2	0.724	0.658	0.790
		Hatchery	2003	3/17-4/1	2	0.695	0.504	0.885
		Hatchery	2004	3/18-4/17	1	0.533	0.625	0.441
		Hatchery	2005	3/15-5/22	1	0.590	0.516	0.664

* Identifies a year with a significant "between blocks (temporal releases)" variance component. For those years, survival estimates are presented separately for each set of blocks that differ significantly.

TABLE 22. Annual average reach survival estimate of Snake River basin PIT tagged steelhead from trap release sites to Lower Monumental Dam tailrace in the years 2000 to 2005.

Tag Site	Species	Rearing Type	Year	Date Range	No. of Blocks	Average Survival	Lower Limit	Upper Limit
Salmon River trap								
	Steelhead	Wild	2001	4/23-5/4	1	0.476	0.367	0.585
		Wild	2005	3/31-5/16	1	0.711	0.526	0.897
		Hatchery	2001	4/9-5/18	3	0.413	0.329	0.496
		Hatchery	2002	4/13-5/19	4	0.556	0.483	0.629
		Hatchery	2003	4/28-5/12	2	0.725	0.618	0.832
		Hatchery	2004	4/10-5/21	1	0.609	0.699	0.519
		Hatchery	2005	3/21-5/17	1	0.646	0.600	0.691
Snake River trap								
	Steelhead	Wild	2001	4/27-5/21	2	0.452	0.392	0.513
		Wild	2002	5/20-5/26	1	0.787	0.661	0.913
		Wild	2003	4/18-5/27	3	0.795	0.597	0.992
		Wild	2004	3/25-6/2	1	0.646	0.741	0.551
		Wild	2005	3/29-6/1	1	0.765	0.684	0.847
		Hatchery	2001	4/27-5/21	3	0.465	0.365	0.565
		Hatchery	2002	4/12-6/6	6	0.764	0.685	0.844
		Hatchery	2003	4/12-5/20	5	0.898	0.796	1.000
		Hatchery	2004	3/26-6/3	1	0.767	0.834	0.700
		Hatchery	2005	3/29-6/2	1	0.799	0.755	0.842
Imnaha River trap								
	Steelhead	Wild	2001*	3/20-4/1 & 5/1-5/15	5	0.445	0.405	0.484
		Wild	2001*	4/15-4/30	2	0.637	0.555	0.719
		Wild	2002	4/17-5/29	6	0.701	0.656	0.746
		Wild	2003	4/21-5/23	5	0.710	0.644	0.775
		Wild	2004	2/21-5/31	1	0.670	0.767	0.572
		Wild	2005	3/20-5/18	1	0.588	0.548	0.627
		Hatchery	2001	4/15-5/15	6	0.450	0.376	0.525
		Hatchery	2002	4/12-5/29	3	0.755	0.668	0.843
		Hatchery	2003	4/12-5/22	5	0.834	0.770	0.899
		Hatchery	2004	4/14-5/12	1	0.685	0.758	0.612
		Hatchery	2005	4/12-5/31	1	0.604	0.572	0.637
Grande Ronde River trap								
	Steelhead	Wild	2001*	4/23-5/1	1	0.547	0.401	0.692
		Wild	2001*	5/7-5/21	1	0.298	0.199	0.397
		Wild	2003	5/24-6/02	1	0.655	0.493	0.817
		Wild	2005	3/29-5/24	1	0.735	0.631	0.838
		Hatchery	2001	4/23-5/17	3	0.511	0.408	0.614
		Hatchery	2002	4/8-5/7	2	0.827	0.688	0.966
		Hatchery	2003	4/14-6/04	4	0.788	0.693	0.883
		Hatchery	2004	3/20-5/21	1	0.527	0.594	0.460
		Hatchery	2005	3/30-5/24	1	0.666	0.591	0.740

* Identifies a year with a significant "between blocks (temporal releases)" variance component. For those years, survival estimates are presented separately for each set of blocks that differ significantly.

Mid-Columbia

Travel time of yearling and subyearling Chinook from hatcheries in the Mid-Columbia River basin to McNary Dam is presented in Table 23. Median travel times to McNary Dam were 29.8 and 25.9 days in 2005 for yearling spring Chinook from Leavenworth, and Winthrop hatcheries respectively. Those estimates were similar to most recent years for Leavenworth and Winthrop released fish. The median travel time of subyearling Chinook released from Priest Rapids hatchery has ranged within 10 to 14 days in 2001 to 2003, but 2004 and 2005 travel times were much lower than those earlier years.

TABLE 23. Median travel time for Mid-Columbia River hatchery Chinook from hatchery site to McNary Dam in 2005 compared to 2001 to 2004.

Hatchery	Age	Migration Year									
		2005		2004		2003		2002		2001	
		TT	Flow	TT	Flow	TT	Flow	TT	Flow	TT	Flow
Leavenworth	1	29.8	110.5	25.2	104	27.6	73	28.2	151	37.0	64
Winthrop	1	25.9	108.0	32.5	102	22.9	73	27.8	163	36.9	64
Priest Rapids ¹	0	6.7	130.6	6.3	151	10.5	69.7	12.2	227	13.7	95

¹ Priest Rapids Hatchery's median travel time and flow is computed as average of three releases separated 3-5 days apart starting mid-June (individual release data shown in appendix of each annual report).

Survivals for yearling Chinook released from all three Mid-Columbia hatcheries were intermediate compared to other recent years, reflecting the poor to average flow conditions predominating the last five years (Table 24). These overall average survivals reflect the average travel times also measured for release groups passing through this reach.

TABLE 24. Annual average reach survival estimates of Mid-Columbia River basin PIT tagged yearling and subyearling hatchery Chinook from release site to McNary Dam tailrace in the years 2001 to 2005.

Tag Site	Species	Age	Year	Release Date Range	Survival	Lower Limit	Upper Limit
Leavenworth NFH ^a	Chinook	1	2001	4/17	0.501	0.484	0.517
			2002	4/22	0.518	0.505	0.531
			2003	4/21	0.662	0.655	0.669
			2004	4/19	0.483	0.473	0.494
			2005	4/15	0.526	0.500	0.553
Wells SFH	Chinook	0	2001	6/20	0.211	0.166	0.257
			2002	6/17	0.449	0.395	0.503
			2003	6/17	0.456	0.406	0.506
			2004	5/12	0.251	0.205	0.296
			2004	6/15	0.160	0.106	0.215
			2005	5/18	0.323	0.230	0.416
Priest Rapids SFH	Chinook	0	2001	6/11-6/19	0.746	0.670	0.794
			2002	6/11-6/19	0.697	0.627	0.767
			2003	6/12-6/20	0.633	0.590	0.677
			2004	6/14-6/22	0.775	0.689	0.861
			2005	6/9-6/18	0.655	0.573	0.729

^a Includes releases of SMP and NMFS research PIT-tagged fish.

Subyearling Chinook

Median estimates of travel time were generated for subyearling Chinook using Lower Granite Dam passage periods of 17 to 20 days in duration (Table 25). These temporal blocks were wider than the weekly blocks used with yearling Chinook and steelhead because of fewer PIT tagged subyearling Chinook available for analysis. PIT tagged Lyons Ferry Hatchery subyearling Chinook released in the three acclimation ponds (Captain John Rapids, Pittsburg Landing, and Big Canyon acclimation ponds) and in the weekly direct stream releases near those acclimation ponds were used in the analysis along with other fish marked above Lower Granite Dam. The trend toward, not only faster travel times, but also earlier migration timing, with few

fish available for later season blocks in the past two years, is an artifact both of release timing and the emphasis on supplementation released PIT-tagged fish. But the late season 2005 travel time is by far the shortest for any group measured during that time period of the season. Compared to other years with similar flows, such as 1996, 2000, 2002 and 2004, when travel time ranged from 16 to 23 days, the 2005 travel time during the late June-early July period was highly reduced. In 2005 spill began at Lower Granite Dam on June 20 and so it is likely that spill reduced travel time for these fish. So, supplementation releases tend to migrate much faster than wild marked fish captured by Fish and Wildlife Service in the Lower Snake River and by the Nez Perce Tribe in the lower Clearwater River. The wild marked fish also tend to remain above Lower Granite Dam later, with the 95% passage date occurring well into August for those groups. However, even the wild marked fish have begun to show earlier migration timing. The longer travel times generally observed in the second block, are likely due to both the decreasing flows and the transition from supplementation fish to wild marked fish in the groups being measured.

TABLE 25. Median travel time for subyearling Chinook from Lower Granite Dam to McNary Dam within temporal blocks across ten years, 1995 to 2005, and corresponding average flow.

Year	Date of passage at Lower Granite Dam							
	6/5-6/24		6/25-7/11		7/12-7/31		8/1-8/20	
	Travel time	Flow	Travel time	Flow	Travel time	Flow	Travel time	Flow
1995			19.7	63.9	14.1	46.3	14.2	38.1
1996			22.7	49.4	15.2	39.9	14.0	38.3
1997	28.5	98.7	25.4	74.2	17.6	64.1	12.8	54.4
1998	20.1	87.8	12.3	66.9	10.8	58.6	10.9	40.5
1999	21.3	105.1	23.1	63.9	15.6	51.2	13.5	42.9
2000	15.6	52.1	20.3	43.6	16.5	37.7	15.8	30.3
2001	39.5	29.2	27.9	27.4	35.5	26.2	18.1	23.7
2002	17.2	67.4	15.9	47.1				
2003	12.4	68.3	24.7	33.2				
2004	11.4	96.1	21.9	42.6				
2005	16.4	57.3	8.9	46.5				

G. Multi-Year Snake River Fall Chinook Survival Analysis

1. Introduction

The June 10, 2005 Opinion of the 9th Circuit Court ordered spill for fish passage to occur at the Snake River and McNary transportation dams during the summer of 2005 producing in-river migration conditions for Snake River subyearling Chinook migrants that were unique when compared to past years. Normally, some early subyearling migrants pass through the Snake River during the spring spill period (which ends June 20), and the remainder of the subyearling migrants pass under a no spill condition at the three Snake River transportation collection sites. The 2005 migration year was significantly different, since spring spill was terminated due to low flows. In 2005 the early subyearling migrants passed through the Snake River under a no spill condition, whereas the remainder of the migration passed under spill conditions at the three transportation sites.

The FPC, responding to requests for analyses of the effects of summer spill on fish survival, specifically addressed the primary migration characteristic data (juvenile survival and travel time) to determine if an effect of the court ordered summer spill operations could be documented. In order to address this question the travel time and survival of juvenile subyearling Chinook that migrated prior to the initiation of the summer spill program in 2005 were compared to the subyearling Chinook survival and travel time for fish migrating after summer spill had been initiated. The survival analyses do not attempt to predict the impact of hydrosystem operations on adult return rates. In addition to analyzing the 2005 migration data, past years (1998 to 2004) were reviewed to determine if the pattern of survivals estimated in 2005, with highest survival for migrants passing Lower Granite in late June, was due to the unique spill operations, or were typical seasonal patterns repeated annually. Again, the unusual spill operations in 2005 provided a contrast to other recent years, for determining the effects of spill on subyearling Chinook survival.

The analysis was conducted in-season and reviewed as additional PIT tag information became available (see attached memos for in-season preliminary analyses). The analysis was presented to the Technical Management Team during its post-season annual review meeting, and subsequently to the NPCC's Independent Scientific Advisory Board (ISAB) upon their request. In response to comments received from the ISAB at the December 7, 2005 meeting and subsequent written comments, the analysis has been updated. For the analysis presented here, log and arcsine-

transformation of survival estimates was considered for analyzing the multi-year dataset. Also, the analysis addresses concerns expressed about the effects of holdover fish on survival estimation using Cormack-Jolly-Seber (CJS) method, as well as the importance of holdovers in interpreting reach survival estimates. Further, the implications of temporal overlap among the detection groups were considered, with regard to the ability to detect effects of differing conditions upon survival. All things considered, the analysis has not changed substantially from the presentation given to the ISAB, nor have the conclusions changed as a result of further analysis.

The analysis is divided into two distinct but complementary parts. First, survival and travel time in 2005 for "pre-spill" PIT-tagged fish and PIT-tagged fish that passed "in-spill" through the reach Lower Granite Dam to McNary Dam reach based on date of detection at Lower Granite Dam were compared. In this first analysis a time window of detections was used at Lower Granite Dam to achieve the largest sample sizes possible in the two time periods. Separately, a multi-year analysis was conducted using two-week blocks to analyze the effects of flow, spill, and temperature on survival and travel time. Both analyses consider survival from Lower Granite Dam to McNary Dam using fish detected at Lower Granite Dam so that the timing of fish migrating through the reach could be used to assess the effects of dam operations and other river conditions of fish survival and travel time.

2. Methods

2005 pre-spill and in-spill survival comparison

Survival and travel time from Lower Granite Dam to McNary Dam were estimated using PIT-tagged subyearling Chinook of hatchery or wild origin that originated above Lower Granite Dam in 2005. Fish released in the Snake River and early releases from the Clearwater River, such as May or June releases from the Big Canyon Creek acclimation facility, were included in the analysis. Late releases of wild Clearwater tagged fish or late season surrogate wild tagged fish from Big Canyon Creek were not included, since these fish exhibit a much later and, therefore, different migration than the Snake River fish.

To estimate travel time and survival, fish detected and returned to the river at Lower Granite Dam were used in the analysis. Survival and travel time for the subyearling Chinook migrants

were estimated and analyzed for two distinct time periods in 2005. Separating the migrants into two groups was done to assess survival prior to and after implementation of the court ordered summer spill program. Spill began June 20 at the Lower Snake River projects and July 1 at McNary Dam. For the pre-spill group (group 1) the date range May 20 to June 12 was chosen. Looking at PIT-tag timing at Lower Granite Dam it appeared that May 20 encompassed the beginning of the run, while June 12 was chosen to assure that many of the migrants would pass through at least part of the hydrosystem prior to spill beginning.

For the post-spill group (group 2) June 17 was chosen as the start date for grouping at Lower Granite Dam, since the PIT-tagged fish would not experience spill until reaching Little Goose Dam. Based on PIT-tag travel time, nearly all fish passing Lower Granite Dam on June 17 would reach Little Goose Dam by June 20. Minimum travel time was nearly 3 days for the tag groups, while median travel time was 6 days. July 15 was chosen as the end date for the release groups to minimize the effects of holdovers in both the CJS survival estimation and subsequent interpretation of the survival results.

Multi-year analysis of survival and travel time

Survival and travel time were estimated using PIT-tagged subyearling Chinook of hatchery or wild origin that originated above Lower Granite Dam for the years 1998 to 2005. Fish detected at the dam between May 20 and July 14 were included in four two-week detection groups for subsequent analysis. Fish released in the Snake River and early releases from the Clearwater River, such as May or June releases from the Big Canyon Creek acclimation facility, were included in the analysis. Late releases of wild Clearwater tagged fish or late season surrogate wild tagged fish from Big Canyon Creek (particularly from 2005 releases) were not included, since these fish exhibit a much later and, therefore, different, migration pattern than the Snake River fish. To estimate travel time and survival, fish detected and returned to the river at Lower Granite Dam were used in the analysis.

PIT-tag fish detected at Lower Granite Dam were separated into distinct groups based on the dates of detection at Lower Granite Dam. In contrast to the 2005 analysis described above, survival groups were limited to two week time periods in an effort to limit the range of environmental variables any single group might experience during their passage through the reach.

Table 26 summarizes the survival estimates, and groups for each year. Four distinct detection groups were created for each year and survival estimates generated for each when sample sizes were adequate within the time periods to estimate survival through the reach.

TABLE 26. Detection groups at Lower Granite Dam used in survival estimation for multi-year analysis.

Migration Year	Numbers of fish in each PIT survival Group			
	5/20 to 6/2	6/3 to 6/16	6/17 to 6/30	7/1 to 7/14
1998	165	120	561	9559
1999	NA	526	1018	421
2000	NA	117	624	1436
2001	NA	4061	888	3899
2002	NA	215	1178	1802
2003	714	4856	5860	1395
2004	NA	4512	2581	589
2005	4514	9996	2554	NA

Holdover detections, fish that were detected the following year as out-migrants, were excluded for purposes of travel time and CJS survival estimates. Although a small portion of fish were detected the following year as holdovers, those detections were not included in survival estimations since those detections would violate basic assumptions of the model due to changes in detection probability, as well as likely survival changes in the reach. However, in response to the comments received regarding the ability to estimate juvenile survival using the CJS techniques and to assess the relative number of holdover fish in the survival groups used in the analysis, the relative number of holdover fish detected as well as the location of first detection as yearling fish was analyzed.

Environmental variables were generated based on fish travel time through the reach. Travel time for each group between dams was estimated, and assigned average flow, water transit time, spill percentage and temperature (based on tailwater TDGS monitor data) values as indicators of conditions each group experienced while passing through the reach. Conditions at downstream dams were averaged over two weeks and the travel time to the next dam was used to adjust the start date of the calculations. For example, travel time from Lower Granite to Little Goose Dam, for the earliest detection group in 2005 (detected from 5/20 to 6/2), estimated to be 4.0 days based on 2,008 detections. Average environmental variables over the time period May 24 to June

6 were then calculated. At each downstream site a similar variable was calculated. 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 overall reach environmental variables were the average of these calculated values for flow, spill and temperature, while for water transit time; the values were summed for a reach water transit time.

The analysis used weighted regression because there was unequal confidence in the survival estimates based on the considerable difference in the variances of the estimates. The inverse relative variance was used to weight individual estimates (Burnham et al 1987). Finally, survival was regressed against each environmental variable individually using SYSTAT statistical software, and the resulting models are reported, including parameter coefficients, adjusted R square, and p values. Interactions between variables were not evaluated although they may be important in refining the understanding of the effects of each on reach survival. However, based upon previous analyses of yearling Chinook reach survival, the sample size of 26 in this data set is too small to adequately assess those relationships.

The proportion of fish holding-over in each detection group was determined to assess whether there was a potential bias in the survival estimates. The site of first detection of holdover fish, from each detection groups was determined and the PIT-tag detections were expanded, in essence, to PIT-tag "populations" to account for collection efficiency (CE), using estimates of CE's from Comparative Survival Study (CSS) yearling chinook reach survival estimates for each year. A holdover passage population to below John Day Dam was developed based on detections to that dam.

3. Results

2005 pre-spill and in-spill survival comparison

Reach survival estimates are shown in Table 27 for PIT-tagged subyearling Chinook detected and released at Lower Granite Dam during early summer migration period, pre-spill (or group 1) compared to later season in-spill (or group 2) in 2005.

TABLE 27. Summary of survival estimates from Lower Granite Dam to McNary Dam for 2005 pre-spill and in-spill groups.

	Group 1 Pre-Spill	Group 2 In-Spill
Dates at LGR	5/20 to 6/12	6/17 to 7/15
Survival	0.46	0.75
Variance	0.0005	0.0233
N	9514	2674
90% CI	0.411 to 0.486	0.497 to 0.999

Median travel time from Lower Granite Dam to McNary Dam for group 1 was 19.6 days compared to 11.6 days for the later group that passed during spill operations. The group 2 travel time estimate was well below travel times for similar time periods measured in other recent years as part of our multi-year analysis (Table 28). Water transit times experienced by fish in 2005 was not significantly different than past years', consequently, it is more likely that the travel times were improved by the reduced forebay delay associated with spill.

Multi-year analysis of survival and travel time

Estimates of survival, median travel time and corresponding environmental variables used in our analysis are provided in Table 28. Weighted linear regression results are summarized in Table 29 through Table 32. Figure 20 - Figure 24 also summarize the survival and regression analysis data. A total of 26 records were used in this analysis.

TABLE 28. Survival Estimates and environmental variables used in multi-year analysis.

YEAR	Date Range Of Detections at LGR	Survival LGR to MCN	Variance	Avg Spill Pct	Avg Flow	WTT	Avg TempC	Median Trav Time
1998	5/20 to 6/2	0.782	0.0775	0.36	146.0	8.5	16.0	29.2
1998	6/3 to 6/16	0.667	0.0963	0.24	127.6	9.9	16.8	24.6
1998	6/17 to 6/30	0.517	0.0077	0.23	111.7	11.3	18.3	16.0
1998	7/1 to 7/14	0.523	0.0004	0.23	96.7	13.5	20.6	11.6
1999	6/3 to 6/16	0.598	0.0236	0.30	148.8	8.7	15.5	23.7
1999	6/17 to 6/30	0.606	0.0127	0.30	126.6	10.8	16.1	15.8
1999	7/1 to 7/14	0.315	0.0059	0.28	93.5	15.2	19.5	25.9
2000	6/3 to 6/16	0.827	0.1382	0.40	97.0	13.8	16.2	12.2
2000	6/17 to 6/30	0.548	0.0129	0.22	75.0	19.3	18.3	15.9
2000	7/1 to 7/14	0.313	0.0028	0.20	66.1	22.6	20.6	25.7
2001	6/3 to 6/16	0.237	0.0008	0.00	40.7	32.3	20.0	42.4
2001	6/17 to 6/30	0.391	0.0040	0.00	40.6	32.1	20.5	34.7
2001	7/1 to 7/14	0.266	0.0009	0.00	44.5	30.9	20.9	32.5
2002	6/3 to 6/16	0.731	0.0398	0.30	122.2	11.0	15.6	31.5
2002	6/17 to 6/30	0.502	0.0021	0.32	110.8	13.2	16.7	16.9
2002	7/1 to 7/14	0.537	0.0035	0.29	78.9	20.8	19.4	15.1
2003	5/20 to 6/2	0.859	0.0080	0.35	158.7	8.0	14.3	11.2
2003	6/3 to 6/16	0.683	0.0005	0.33	122.0	10.5	15.6	10.8
2003	6/17 to 6/30	0.482	0.0004	0.11	66.4	21.1	18.2	16.0
2003	7/1 to 7/14	0.310	0.0014	0.11	55.1	26.3	20.9	25.3
2004	6/3 to 6/16	0.774	0.0018	0.24	102.2	12.9	15.3	13.6
2004	6/17 to 6/30	0.524	0.0016	0.19	71.2	19.5	18.9	15.1
2004	7/1 to 7/14	0.303	0.0042	0.19	57.9	23.8	20.9	20.7
2005	5/20 to 6/2	0.529	0.0011	0.25	108.9	11.5	14.5	14.5
2005	6/3 to 6/16	0.473	0.0006	0.34	87.7	16.3	15.9	18.1
2005	6/17 to 6/30	0.714	0.0209	0.56	81.2	18.1	18.3	11.7

Survival showed a significant relationship with each environmental variable we analyzed. Average total discharge showed the highest significance in relation to survival with the $p = 0.00000$ Adj $R^2 = 0.62$. Figure 20 summarizes the data by year and detection group for visual comparison of survival within and among years. Figure 21 to Figure 24 illustrate the linear relationship between survival and environmental variables with estimates color coded by year. As can be seen from Table 28 and Figure 20, while there were four possible detection/survival groups each year, only in 1998 and 2003 were enough PIT-tags available to estimate survivals in all time periods. In all other years 3 estimates were possible. In 2005 estimates for the first 3 detection groups could be generated, while in other years with three groups, it was the later three that were available.

FIGURE 20. Plot of LGR to McNary Reach Survival data for each group within each year and 95% confidence intervals.

TABLE 29. Summary of regression output for LGR to McNary Reach Survival and Average Spill Proportion at LGS, LMN, IHR, and MCN.

Dep Var: SURVIVAL N: 26 Multiple R: 0.61938 Squared multiple R: 0.38363					
Adjusted squared multiple R: 0.35795 Standard error of estimate: 1.35786					
Effect	Coefficient	Std Error	Std Coef	t	P(2Tail)
CONSTANT	0.35916	0.27144	0	1.32316	0.19825
SPILLPROP	0.83714	0.2166	0.61938	3.86496	0.00074

FIGURE 21. Plot of LGR to McNary Reach Survival and Average Spill Proportion at LGS, LMN, IHR, and MCN with weighted linear regression line.

TABLE 30. Summary of regression output for LGR to McNary Reach Survival and Average Total Discharge at LGS, LMN, IHR, and MCN.

Dep Var: SURVIVAL N: 26 Multiple R: 0.79859 Squared multiple R: 0.63775					
Adjusted squared multiple R: 0.62266 Standard error of estimate: 1.04097					
Effect	Coefficient	Std Error	Std Coef	t	P(2Tail)
CONSTANT	0.15931	0.21336	0	0.74668	0.46251
AVGQ	0.00421	0.00065	0.79859	6.50024	0.00000

TABLE 31. Summary of regression output for LGR to McNary Reach Survival and Average Temperature (degrees C) at LGS, LMN, IHR, and MCN as measured at tailwater TDGS monitors.

Dep Var: SURVIVAL N: 26 Multiple R: 0.64429 Squared multiple R: 0.41511					
Adjusted squared multiple R: 0.39074 Standard error of estimate: 1.32273					
Effect	Coefficient	Std Error	Std Coef	t	P(2Tail)
CONSTANT	1.23367	0.30619	0	4.02909	0.00049
AVTEMPC	-0.03856	0.00934	-0.64429	-4.12718	0.00038

TABLE 32. Summary of regression output for LGR to McNary Reach Survival and Fish Travel Time through the reach.

Dep Var: SURVIVAL N: 26 Multiple R: 0.68548 Squared multiple R: 0.46989					
Adjusted squared multiple R: 0.44780 Standard error of estimate: 1.25927					
Effect	Coefficient	Std Error	Std Coef	t	P(2Tail)
CONSTANT	0.79491	0.25206	0	3.15368	0.0043
TRAVTIME	-0.01532	0.00332	-0.68548	-4.61233	0.00011

FIGURE 22. Plot of LGR to McNary Reach Survival and Average Total Discharge at LGS, LMN, IHR, and MCN with weighted linear regression line.

FIGURE 23. Plot of LGR to McNary Reach Survival and Average Temperature (degrees C) measured at tailrace TDGS monitors at LGS, LMN, IHR, and MCN with weighted linear regression line.

FIGURE 24. Plot of LGR to McNary Reach Survival and Median Travel Time from LGR to MCN with weighted linear regression line.

The results of the multi-year analysis suggest that the pattern of survivals in 2005, with highest survival for PIT-tagged fish passing Lower Granite from June 17 to June 30, was a reversal of the typical annual trend (Figure 20). The typical trend in years prior to 2005 was for highest survival for earliest groups (detected at Lower Granite Dam between May 20 and June 2 in 1998 and 2003, or June 3 to June 16 in 2000, 2002, and 2004). In no year beside 2005 did the latest group show the highest survival. The highest early survivals were associated with high spill, high flows, and lower temperatures. However in 2005, during the period of lowest flows, and highest temperatures, we estimated the highest survival. It is concluded that the trend in survival does not typically increase in late season, and that the increase in survival estimated for late June of 2005 is very likely due to the provision of spill.

Based on this analysis it appears the rate of holdover fish surviving to migrate as yearling fish from the PIT-tag detection groups was very small. The annual estimates of yearling fall chi-

nook out-migrating at least past John Day Dam showed that they typically represented less than 1% of the starting number of PIT-tag fish in the Lower Granite detection/survival groups (Figure 6). For the year 1999, no holdover detection data was available due to a change in PIT-tag detection systems prior to potential yearling holdover out-migration detections in 2000. Only migration year 2000 showed greater than 1% holdover PIT-tags in-river the next year. The initial estimate for 2000, based on CSS survival estimate from 2001, was nearly 7% of the starting detection groups. However, the CSS detection probability estimate at John Day Dam of 0.178 was suspect, as was the estimated survival from McNary Dam to John Day Dam of 0.94. Since, nearly all of the 23 detected PIT-tags at John Day Dam upon which the PIT-tag population was based passed during no spill, a much higher detection probability was likely. Therefore, the COMPASS data group FGE estimate for John Day Dam of 0.64 was substituted as a better estimate of the detection probability for the PIT-tag group. The PIT-tags that were detected, came mostly from the latest release group, which showed the lowest survival. However, even that holdover proportion appears very low and represents a small bias in the estimation of reach survival. In terms of contribution to adult returns, of the 2000 migration year holdover fish, available information suggests they had little impact. From the PIT-tag detection groups in 2000, there were a total of 5 adult returns to Bonneville Dam (4 of which were subsequently detected at Lower Granite Dam), all of these were only detected as subyearling migrants.

The distribution of holdover fish first-time-detections, corrected for collection efficiency/detection probability at each dam, each year, is shown in Figure 26. The detection probabilities were taken from Rapid River Hatchery yearling Chinook reach survival estimates and applied to the holdover fish. The distribution shows that fish likely hold over throughout the system, but based on first downstream detection few appear to hold over below John Day Dam in most years. If the distribution in Figure 26 were skewed to the right, with most detections at John Day Dam or Bonneville Dam, it would suggest most holdover fish were passing out of the system with just a few remaining to be detected. While 2005 is not included in Figure 26 only 1 holdover detection was found from the detection groups and that first time detect was at John Day Dam in 2006.

Finally, the month of passage at John Day Dam for holdover fish suggests these fish pass out of the hydrosystem mainly throughout April and May (Figure 27). This timing data further suggests that few of the PIT-tag fish in our survival groups passed out of the hydro-system during winter months undetected.

FIGURE 25. PIT-tag HO detections expanded to estimated populations surviving to pass below John Day Dam for each year of our multi-year analysis. Note: in 1999 there were no holdover detects available due to transition in PIT-tag detection equipment between fall of 1999 and spring of 2000.

FIGURE 26. Distribution of first-time-detections of fish holding over in the hydro-system for the years of the multi-year analysis.

FIGURE 27. Month of Holdover PIT-tag detections at John Day Dam expanded for CE at the site for the years of the multi-year analysis (no detections available for my 1999 and only 1 2005 detection not included).

4. Discussion

2005 pre-spill and in-spill survival comparison

The analysis shows that the survival for fish migrating as subyearling Chinook from Lower Granite Dam to McNary Dam was significantly higher ($p = 0.1$) during court ordered summer spill than prior to the start of summer spill in 2005 (Table 26). This increase in survival for the later migrating fish is unusual based on the multi-year analysis of survival (Figure 20). Given the decreasing flows that the later group encountered, as well as increasing temperatures in the reach, the provision of spill is likely to have been extremely important in explaining the improvement in survival observed.

In order to adequately assess the impact that operational changes as well as variations in flow and temperature might have on survival estimates, survival groups must experience substantially different conditions. The before and after spill groups were separated by five days to insure some degree of temporal/spatial separation at the start of their downstream passage through the reach. The arrival timing of the distribution was examined at McNary Dam to assess how distinct the in-river groups were in their passage timing through the reach. The greater the distinction in passage timing between the groups, the better the ability to assign separate environmental parameters to each group. Also, it is likely that as groups overlap in timing distributions, survival estimates will become more similar. For the two groups used in the analysis (pre-spill and in-spill) the arrival timing at Little Goose Dam was quite distinct (Figure 28). In the box plots, the center horizontal line marks the median of the sample. The length of each box shows the range within which the central 50% of the values fall. Arrival timing at McNary Dam, while still distinct for the middle 50% of each group showed more overlap occurring as the PIT-tag groups passed downstream (Figure 29). A comparison of survival by reach (LGR to LGS, LGS to LMN, LMN to MCN) showed the greatest difference in survival in the LGR to LGS reach, with an absolute difference in survival estimates between the two groups of 37%, while in the LGS to LMN and LMN to MCN reaches the absolute difference in survival estimates were within 6% of each other. This decreasing difference in estimates, suggests greater similarity in conditions as fish moved downstream and began to overlap as they neared McNary Dam. Ideally these groups would stay separated through the entire reach, providing the best measure of the difference between spill and no spill operations. However, given that fish travel times are variable, with some showing extended travel time through the reach it is not possible to fully separate the groups for this type of analysis. However, overlap would tend to obscure differences in survival and yet, despite that overlap, the difference in the estimated survival estimates for the two groups was rather large.

FIGURE 28. Arrival timing of pre-spill and in-spill PIT-tag fish at Little Goose Dam from 2005 detection groups used in spill survival comparison. The center horizontal line of box plot marks the median of the sample. The length of each box shows the range within which the central 50% of the values fall.

FIGURE 29. Arrival timing of pre-spill and in-spill PIT-tag fish at McNary Dam from 2005 detection groups used in spill survival comparison. The center horizontal line of box plot marks the median of the sample. The length of each box shows the range within which the central 50% of the values fall.

From this analysis it is clear that conditions for the group of fish passing after spill was initiated were sufficiently improved over the pre-spill group. The improvement in survival was large for group 2 despite some overlap in timing distribution as fish moved through the reach. Again, overlap in groups is anticipated to obscure differences between groups, in essence, decreasing an ability to measure a survival benefit. In this case, the pre-spill population likely benefited to some extent from spill operations as they passed downriver, as the population spread out due to differences in travel time. This is true particularly for the slowest fish in the early group, since those fish would have passed through at least McNary Dam during spill operations. The spill group would have passed through the entire reach in spill. Therefore, the estimated improvement in survival from our analysis is likely a conservative measure the extent of the benefit that the spill (versus no the spill operation) had on survival through the reach in 2005.

Multi-year analysis of survival and travel time

After exploring natural log transformations (and arcsine transformation based on suggestions from the ISAB) weighted linear regressions were chosen to characterize the relationship between survival and environmental variables. After reviewing the data it was apparent that the estimates of survival ranged mostly between 0.3 and 0.7 and that arcsine transformation, which is most appropriate when most values lie outside this range (Snedecor and Cochran 1989), would not be useful for this data set. Natural log-transformation of the survival estimates was also explored, where the residuals resulting from regressions with environmental variables for both survival estimates that were transformed and untransformed were examined, and it was found that in every case transforming the survival estimates did not improve the patterns of residuals. In fact in all the models the untransformed data provided the best fit based on analysis of the residuals. It may be possible that the relationship between survival and some of the environmental variables (such as flow and spill) is non-linear, but in the range of data analyzed a linear relationship seemed most appropriate.

The multi-year analysis included a study of the migration timing of detection groups for each year, similar to that conducted for the 2005 data described above. In general good separation of those groups was observed when comparing the timing of the middle 50% of the group passing a dam. Where there was clear separation in timing, the estimates of survival generally were rela-

tively distinct (as an example see estimates for detection groups in 2000 in Table 28). As concluded relative to the within 2005 analysis, conditions and timing among groups were different enough to yield meaningful results. If no differences had been observed in survival through the season for the various groups, it could have been concluded that either conditions did not vary enough to result in differing survival, or that groups commingled to such an extent that all groups experienced similar conditions. However, the analysis shows that conditions varied considerably within years, and among years, so that the degree of overlap among detection groups did not hinder the ability to detect significant relationships between survival and all environmental variables analyzed.

The survival relationships reported, do not represent the full extent of hydro-system effects on fish and the analysis was not designed to determine the effects of flow, spill and temperature on adult return rates. The analysis does provide a measure of the effects of hydro-system operations on actively migrating subyearling chinook that pass through the Lower Granite Dam to McNary Dam reach until July 15 each year.

The analysis was cognizant of the propensity of subyearling chinook to hold over either above Lower Granite Dam, or lower down in the hydrosystem, and then continue migration the following year. This alternate life-history strategy has been taken into account in the analysis. By selecting fish detected at Lower Granite Dam between May 20 and July 15 the effects of holdover fish on survival estimation is minimized. Including only those fish detected at Lower Granite Dam eliminates fish that hold over prior to entering the reach. Also by limiting the tag group to fish detected at Lower Granite prior to July 15 the rates of fish holding-over are very low and have minimal, if any, impact on the analysis conducted.

The rate at which the detection groups used in the analysis held over was investigated to determine how important this behavior might be in interpreting the survival results. If fish stop migrating but do not survive to migrate the following year, then assigning that as mortality would be appropriate. However, if the fish hold-over in large numbers to migrate the following spring, and our estimates showed those fish as mortalities, the analysis would be compromised. As shown here, further analysis suggests that for the detection groups used, survival to holdover and migrate the following year was low, typically less than 1% of the PIT-tagged fish. In addition, for the PIT-tag groups analyzed where adult data were available, holdover fish did not show a particularly high rate of adult return from the initial juvenile tag group. Generally the adult return rate

of holdover fish was higher than the adult return rate of subyearling fish but only when considering their return rate from the yearling stage. Since the survival of the holdover fish from the sub-yearling to the yearling stage is not considered in this calculation, it can not be used as a good measure of their overall contribution. However, for the overall population, the full implications of summer spill in 2005 on Snake River Fall Chinook, including holdover fish, will not be known until adult return data can be analyzed.

Finally, based on the low survival to holdover rates of our detection groups, the use of the CJS methodology to estimate survival and relate those survivals to in-river conditions as done in the multi-year analysis is robust to holdover behavior, and relatively unbiased. As long as hold-over survival rate is low then the use of CJS to assess the effects of spill, flow and temperature on survival of juvenile migrants through at least the Lower Granite Dam to McNary Dam portion of the hydrosystem is applicable. Longer reach estimates might be possible in future years as greater numbers of PIT-tagged fish pass downstream as part of expanded studies on Snake River Fall Chinook.

References

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H. Conclusions

- Subyearling Chinook survival in the mid-Columbia reach from Rock Island Dam to McNary Dam was intermediate in 2005 when compared to other recent years.
- Migration timing of subyearling Chinook in the Snake River has changed dramatically over the past several years. The migration is now dominated by supplementation fish which migrate early and move down river relatively quickly after release. Also, passage timing of wild fish marked in the Snake River appears to have shifted earlier, with fewer fish passing Lower Granite Dam in August.
- Survival for subyearling chinook in 2005, was significantly higher for the later migrants that passed during court ordered summer spill, despite lower flows and higher temperatures for the late group.
- Multi-year analyses showed that spill, flow and temperature are all important in explaining survival in subyearling migrants.
- The effects of holdovers to our study groups were not significant. This is likely true because the time period of detections we used in our survival groups minimized the resulting proportion of fish surviving to holdover. In addition, limiting the groups to fish that were detected at Lower Granite as subyearlings required those fish were active migrants to be considered as part of the survival analysis groups.
- The CJS methodology is useful in estimating survival for the purpose of measuring hydro-system impacts on active migrants during periods when few fish survive to holdover.
- The survival analyses do not attempt to predict the impact of hydro-system operations on adult return rates.
- Because the analyses were conducted post hoc, not designed studies, sample sizes vary greatly between groups, and confidence intervals are wide, especially in the multi-year analysis. However, the underlying relationships in the multi-year study are likely robust to this high variability because of the use of weighted regression.
- The differences in survival were observed in spite of the overlap in timing observed for the survival groups, which was expected to make it more difficult to detect differences among groups.

IV. 2005 ADULT FISH PASSAGE

A. Overview

Adult fish passage was blocked upstream at Grand Coulee (completion by 1941) Dam in the Columbia River and blocked at Brownlee, Oxbow, and Hells Canyon dams (completion by 1958) in the Snake River (Figure 30). Bonneville Dam is the lowest dam operating on the Columbia River, located at River Mile 146.1. Eight additional mainstem Columbia River dams and four Snake River dams were built incorporating adult fish passage facilities. Criteria were developed through the years to meet hydraulic conditions that would safely and quickly pass adult fish by each dam. These standards are placed in Fish Passage Plans or Habitat Conservation Plans that are required as part of the Biological Opinion established by NOAA Fisheries.

An annual report titled Adult Fishway Inspections summarizes inspections of the adult fishways completed at the COE and PUD projects during the 2005 fish passage season. This fishway inspection program has been in place since 1984 with fishway inspections completed by State and Federal fish agencies on at least a monthly basis to assure that adult fishways are maintained at or near acceptable criteria levels throughout the fish passage season. In addition, the FPC assists with coordination of operations that would affect passage of adult salmon at the mainstem dams.

During the 2005 fish passage season, most fishway equipment such as fish turbines, fish pumps, or other water supply equipment operated satisfactorily with little disruption to supplying water for the adult passage facilities. Higher summer time spill at the Snake River projects slowed and affected adult fish passage at Little Goose Dam until spill level was reduced to a level (30% of flow) where the adult fish could find the main entrance gates and negotiate the project.

Upstream migration from the Columbia River mouth to spawning areas normally will require about a 1-2 month time frame to reach the river system where they began their juvenile migration to the ocean, depending on distance and spawning times for the different salmonids. This journey is not hazard-free with the adult salmon initially adapting to freshwater after spending from several months to 4 years in the saltwater ocean environment. Up to Bonneville Dam, salmon can still fall prey to larger marine mammals such as sea lions. The COE with approval from the fishery agencies and tribes will have exclusion gates in place in 2006 at the main

entrance gates to the fishways at Bonneville Dam that should help preclude the sea lions from entering the main fish ladders as occurred in 2005. Fishing seasons were reduced in 2005 due to lesser numbers of salmon returning to the Columbia River, especially during the spring Chinook migration (April and May). Commercial and sport fishers also captured a portion of these fish during designated seasons.

Once the adult fish reach Bonneville Dam, they must search for fishway entrances that eventually route them to a fish ladder and an exit in the forebay of the dam. Above the Bonneville Dam, they may pass through a series of reservoirs and dams for several hundred-river miles depending on the distance they are migrating upstream. In addition, they may pass through a tribal commercial fishery and, in recent years, a sport fishery. Environmental conditions affect passage of these fishes, as they must adapt to riverine conditions such as changes in river flows, wide ranges of water temperatures, and other factors in their upstream migration.

To assess passage of adult fish at the mainstem dams, the operating agencies are required to fund fish counting programs at the COE and PUD projects. These counting programs normally run from early spring through late fall to encompass most of the fish passage that occurs throughout the year. WDFW contracts to count fish at COE projects while the PUD directly contract with personnel to count adult fish at the Mid-Columbia River projects. Fish counts may be assessed by directly counting fish as they swim through the counting slot or videotaped through the slot. Fish counts from each dam are updated daily on the FPC Web site during the normal fish passage season. The FPC Weekly Report incorporates adult fish counts for that season and compares that total to the previous year as well as the 10-year average through the same block of time.

Flow levels were about 76% of normal for the Jan.-July season (measured at The Dalles Dam). Water temperatures were satisfactory through the early summer but as normal rose to 69 F by mid-July and were near 70-73 F for much of late July through late August at Bonneville Dam. The water temperature did not drop to below 69 F until mid-September. Warm/hot water temperatures remain a problem for salmon species during the mid to late summer season in the Columbia and Snake Rivers.

Dam	Year in Service	Miles to Mouth	Gross Head (Feet)	Miles of Reservoir	Operator	Adult Fish Passage
Bonneville	1938	146	65	45	COE	Yes
The Dalles	1957	192	85	24	COE	Yes
John Day	1968	216	105	76	COE	Yes
McNary	1953	292	75	61	COE	Yes
Priest Rapids	1959	397	82	18	Grant PUD	Yes
Wanapum	1963	416	84	38	Grant PUD	Yes
Rock Island	1933	453	54	21	Chelan PUD	Yes
Rocky Reach	1961	474	93	42	Chelan PUD	Yes
Wells	1967	515	72	30	Douglas PUD	Yes
Chief Joseph	1955	545	177	51	COE	No
Grand Coulee	1941	597	343	151	BOR	No
Ice Harbor	1961	334	100	32	COE	Yes
Lower Monumental	1969	366	100	29	COE	Yes
Little Goose	1970	395	100	37	COE	Yes
Lower Granite	1975	432	98	39	COE	Yes
Hells Canyon	1967	571	210	22	Idaho Power	No
Oxbow	1961	597	120	12	Idaho Power	No
Brownlee	1958	609	272	57	Idaho Power	No

FIGURE 30. Location of hydroelectric dams in the Columbia River basin.

B. Adult Fish Counts

The 2005 return of adult salmon passing Bonneville Dam was lower than in 2004 for each species except steelhead (hatchery component). It continues the downward trend from the peak years of returns observed earlier in this current decade (Figure 31). In 2005, approximately 568,500 adult Chinook salmon, 83,300 adult Coho salmon, 72,400 sockeye salmon and 315,000 steelhead were counted at Bonneville Dam. The decline in adult Chinook returns was more dramatic for spring Chinook than the summer and fall runs. The adult returns to mainstem dams are summarized in Table 33 for the various species and runs of salmon for return year 2005 along with return year 2004 and the 10-year average counts (1985 - 2004).

1. Spring Chinook Salmon

Prior to the 2005 migration of spring Chinook, the Technical Advisory Committee (TAC) had projected a return of more than 200,000 spring Chinook to Bonneville Dam. It was becoming apparent by mid-April that the spring Chinook run size would be much lower, so on April 19 the Columbia River Compact voted to halt sport fishing (and commercial fishing on selective stocks of hatchery fish) on salmon, steelhead trout, and shad to avoid losing too many upriver spring Chinook (AP news article by Jeff Barnard, 4/22/2005). A spring Chinook fishery was resumed late in the season between June 4 and June 15. For the 2005 return season, Bonneville Dam fish counter recorded only 170,152 adult spring Chinook salmon, far below the projected total and 56% lower than last year and 49% lower than the 10-year average. The 2005 spring Chinook jack count was also about half of last year and the 10-year average.

Nearly all the reduction in the upriver spring Chinook return occurred on stocks headed to the Snake River basin. Compared to last year, the 2005 adult spring Chinook count at Ice Harbor Dam in the Snake River was 63% lower while the count at Priest Rapids Dam in the Mid-Columbia River was nearly 5% higher. Compared to the 10-year average, the Ice Harbor Dam count was 46% lower and Priest Rapids Dam count was 8% lower. The fish count at Lower Granite Dam was 26,028, which was 60% lower than last year and 45% lower than the 10-year average. The similarity in percent reduction in passage counts compared to last year and the 10-year average at both Ice Harbor and Lower Granite Dam implies that most of the reduction in the upriver

spring Chinook run in 2005 occurred on stocks originating in tributaries above Lower Granite Dam.

In the Mid-Columbia River, the 2005 spring Chinook counts at Priest Rapids, Rock Island, Rocky Reach, and Wells dams were between 4.6% and 9.1% higher than last years count. As one goes upstream from Priest Rapids Dam to Wells Dam, there has been increasingly more returning spring Chinook adults at each higher dam in both return years 2004 and 2005 compared to the 10-year average, signifying increased numbers of returning adult spring Chinook to tributaries above Wells Dam in recent years.

2. Summer Chinook Salmon

In past years, the summer Chinook count at Bonneville Dam has been initiated on June 1st and this will continue; however, the TAC will now be using June 15 as the date to estimate and forecast spring Chinook in the Columbia River. A key factor influencing this change was the shift in composition of the summer Chinook run from mainly Snake River stocks before mid-June to Mid-Columbia River stocks that dominate during mid-June through July.

This year's return of summer Chinook was 78,373 counted at Bonneville Dam, which is 15% lower than 2004, but still 43% higher than the 10-year average. Both sport and commercial fisheries occurred between June 16 and July 31 in 2005.

A total of 6,736 summer Chinook were counted at Lower Granite Dam, which was 22-23% of last year and the 10-year average. The Snake River summer Chinook returned mostly to the South Fork of the Salmon River and its tributaries, plus some to the Pahsimeroi River. This year's count of summer Chinook jacks was only 1,078 at Lower Granite Dam, which is 57% lower than 2004 and 43% lower than the 10-year average.

The Mid-Columbia count of adult summer Chinook at Priest Rapids Dam was 61,227 in 2005, which is 8.7% lower than last year, but still 56% higher than the 10-year average. Adult summer Chinook counts at Rocky Reach and Wells dams were very similar in 2005 to their respective 2004 levels, but still between 53 and 61% higher than the 10-year averages. Summer Chinook can be either trapped at Wells Dam or volitionally enter Wells Hatchery for their hatchery program. The return of summer Chinook jacks at Priest Rapids Dam was only one-third the 2004 return, but still very similar to the 10-year average. The overall summer Chinook run into

the Mid-Columbia River reach was approximately 62,400 adult summer Chinook, which is very close to actual count at Priest Rapids Dam in 2005.

3. Fall Chinook Salmon

The number of adult fall Chinook counted at Bonneville Dam was 416,091 with 21,219 fall Chinook jacks also counted. The 2005 adult count was 28% lower than last year, but still 28% higher than the 10-year average. In the lower Columbia River, the estimated number of adult "tule" fall Chinook at Bonneville Dam was near 99,400 (Figure 32, bottom graph) with 33,188 "tules" arriving at Spring Creek NFH, located in the Bonneville Dam pool. This component of the fall Chinook run was again at high levels when compared to most years and bolstered the overall fall Chinook count at Bonneville Dam. Tule fall Chinook do not make the lengthy migration journeys of the upriver bright stocks with most spawning in the Bonneville pool area and below Bonneville Dam. The bright fall Chinook component of the fall Chinook run are bound for Little White Salmon, Klickitat, Deschutes, John Day, and Umatilla river in the lower Columbia River reach, as well as mainstem and tributaries of the Mid-Columbia and Snake River reaches. Sport and commercial harvests in the lower Columbia River occurred between August 1 and September 17, with the season opening again between October 20 and the end of the year. At Buoy 10, the first fishing season extended through September 30.

The number of adult fall Chinook (Bright component) that arrived at McNary Dam was 134,881 (Figure 32, top graph), which is 19% less than 2004, but still 34% higher than the 10-year average. Many fall Chinook passing McNary Dam are of "wild" origin and are destined for the Hanford Reach to spawn. In addition, the Yakima River supports a run of upriver bright fall Chinook both natural and hatchery in origin. The number of adult fall Chinook at Priest Rapids Dam counted in 2005 was 31,289, which was 20% less than last year and 30% higher than the 10-year average.

The Snake River component of the fall Chinook run remained above 10,000 adults in 2005 with 14,716 counted at Ice Harbor Dam and 11,182 counted at Lower Granite Dam. The Ice Harbor Dam count was 29% lower than last year, but 54% higher than the 10-year average. Some fall Chinook return to Lyons Ferry Hatchery and the lower Tucannon River located above Lower Monumental Dam. But most continue above Lower Granite Dam. The Lower Granite Dam

count was 21% lower than last year, but 94% higher than the 10-year average. The increased hatchery and supplementation releases of fall Chinook in the Snake and Clearwater River basins appear to be contributing to the larger returns of adult fall Chinook above Lower Granite Dam in recent years. However, the fall Chinook jack counts are not following this pattern. At Lower Granite Dam, the count of jacks in 2005 dropped 54% from last year's count and was 11% lower than the 10-year average.

4. Sockeye Salmon

The 2005 return of sockeye salmon to Bonneville Dam was 72,448, which is down 41% from last year, but still 35% higher than the 10-year average. Columbia River sockeye are primarily destined for two Lakes in the upper Mid-Columbia River. The count at Rock Island Dam was 71,226 with 55,570 continuing above Rocky Reach Dam. Based on the differential of 15,656 sockeye salmon between these two dams, approximately 22% of the sockeye run was destined for Lake Wenatchee and the remaining 78% was destined for Lake Osoyoos. Similar to the past few years, a large portion of the sockeye returned to the Okanogan River basin with Lake Osoyoos as the final destination for these fish.

The 2005 return of sockeye salmon to the Snake River was only 19 counted at Ice Harbor Dam and 17 counted at Lower Granite Dam. This was approximately an 80 and 85% drop from last year and 21 and 47% drop from the 10-year average for Ice Harbor and Lower Granite dams, respectively. These returning adults are part of the recovery efforts taking place in the upper Salmon basin from captive brood stock, habitat and other enhancement efforts in Red Fish, Alturas, and Pettit Lakes.

5. Coho Salmon

The combined return of adult and jack count of Coho salmon in 2005 was 88,809 at Bonneville Dam. This total was 26% below the 2004 return but was about 8.9% higher than the 10-year average. The majority of Coho passing Bonneville Dam still "home" into rivers and hatcheries located in the Bonneville pool. A total of 36,404 Coho adults and jacks were counted at The Dalles Dam. This was close to last year's count (only 3.2% lower) and 77% higher than the 10-

year average. Juvenile Coho released from hatchery plants in the upper Mid-Columbia and Snake Rivers in recent years along with supplementation and natural spawning of adult fish from the Umatilla and Yakama rivers have increased numbers of Coho salmon returning to river basins above the Bonneville Pool the past few years. In the Snake River, a total of 2,184 Coho adults and jacks were counted at Lower Granite Dam, which is 29% lower than last year, but 4.4 times greater than the 10-year average. In the Mid-Columbia, 6,581 adult Coho (no jacks) were counted at Rock Island Dam and 1,225 counted at Rocky Reach Dam. The Rock Island and Rocky Reach Dam counts were 43 and 84% higher than last year, respectively, and 3.8 and 4.8 times higher than their corresponding 10-year averages. The majority of these returning adult Coho were destined for the Wenatchee River with the remainder going to the Methow River as a result of current hatchery programs in these drainages.

6. Steelhead

The 2005 count of steelhead at Bonneville Dam totaled 315,036, which was 0.5% higher than last year and 2% greater than the 10-year average. The count at The Dalles, John Day, and McNary dams all remained above last year's count and the 10-year average. Adult steelhead returning to the Bonneville pool tributaries include summer and winter runs, with most tributaries receiving fish of Skamania stock and the Hood River receiving fish from Oak Springs Hatchery. Above The Dalles Dam, the Deschutes River has a large return of summer run steelhead, both hatchery and wild. Above John Day Dam, the John Day River remains a wild-only stock river, while the Umatilla River returns are mainly from hatchery reared steelhead planted as juvenile fish in that basin.

The Snake River continues to receive the bulk of adult steelhead returning to the Columbia River basin. In 2005, the turnoff into the Snake River as measured by the Ice Harbor Dam count was 68% of the total steelhead counted at McNary Dam. The Snake River steelhead count at Lower Granite Dam was 155,695, which was 13% higher than last year and 37% greater than the 10-year average. Adult returns of steelhead to the Snake River are comprised mainly of hatchery-reared fish and support a sport fishery while the "wild" steelhead remain depressed and are listed as "threatened" under the ESA. Counts of "wild" steelhead (non-clipped status only) at Lower Granite dam were just under 36,000 fish in 2005.

The Mid-Columbia count of steelhead at Priest Rapids Dam was 12,472, which is about 33% lower than last year and nearly identical (down less than 1%) to the 10-year average. The 2005 steelhead counts at Rock Island, Rocky Reach, and Wells dams remained below last year's counts, but were higher than 10-year averages by between 5 and 12%. Wild steelhead and Wells stock hatchery steelhead in the upper Mid-Columbia River remain depressed and are listed as "threatened" under the ESA.

TABLE 33. 2005 counts of returning adults (and jacks) for Chinook (by run type), Coho, sockeye, and steelhead at Columbia River basin dams with comparisons with last year and the 10-year average (1995 - 2004).

Cumulative Adult Passage at Mainstem Dams Through: 12/31/2005

Dam	Spring Chinook						Summer Chinook					
	2005		2004		10-Yr Avg.		2005		2004		10-Yr Avg.	
	Adult	Jack	Adult	Jack	Adult	Jack	Adult	Jack	Adult	Jack	Adult	Jack
BON	74,053	4,288	170,152	8,885	145,297	8,221	78,373	4,467	92,143	12,889	54,750	7,484
TDA	61,000	3,209	130,240	7,717	99,119	5,946	69,436	3,481	79,495	8,430	47,296	5,446
JDA	55,892	2,715	112,153	6,367	82,666	4,703	63,589	5,358	72,518	10,542	44,153	5,186
MCN	51,856	3,201	107,497	7,682	76,092	4,941	63,780	3,081	65,457	8,760	43,906	5,144
IHR	28,039	1,267	76,806	4,646	51,680	3,159	8,837	983	13,173	3,012	10,235	1,807
LMN	25,933	1,002	71,673	3,786	49,507	2,979	8,347	802	10,593	2,196	9,755	1,500
LGS	23,995	923	62,458	3,404	47,589	3,042	6,970	974	9,304	2,263	8,528	1,742
LGR	26,028	1,258	70,742	4,482	47,410	3,274	6,736	1,078	8,767	2,510	8,638	1,901
PRD	14,148	515	13,521	1,020	15,454	477	61,227	1,898	67,060	5,613	39,202	1,885
RIS	11,908	504	10,917	958	12,149	699	54,033	2,443	62,311	4,834	36,079	4,459
RRH	4,568	417	4,365	734	4,426	242	42,348	2,261	41,532	8,093	26,362	2,921
WEL	4,897	99	4,615	168	3,006	190	30,161	678	31,474	1,377	19,609	1,386

Dam	Fall Chinook					
	2005		2004		10-Yr Avg.	
	Adult	Jack	Adult	Jack	Adult	Jack
BON	416,091	21,219	578,581	38,238	325,277	38,919
TDA	234,217	18,290	299,270	32,245	170,124	28,193
JDA	179,930	14,749	211,722	30,538	123,697	23,556
MCN	134,881	13,290	166,270	23,788	100,410	20,182
IHR	14,716	4,502	20,856	11,046	9,538	5,759
LMN	13,096	3,049	19,624	5,825	8,187	4,769
LGS	11,411	2,273	17,626	5,252	6,807	3,397
LGR	11,182	3,235	14,137	7,093	5,760	3,913
PRD	31,289	352	38,894	3,715	24,001	3,183
RIS	11,255	799	14,499	1,957	8,737	2,205
RRH	5,313	599	7,795	1,417	5,444	1,604
WEL	2,880	448	4,892	518	2,698	601

Dam	Coho						Sockeye			Steelhead			
	2005		2004		10-Yr Avg.		2005	2004	10-Yr Avg.	2005	2004	10-Yr Avg.	Wild 2005
	Adult	Jack	Adult	Jack	Adult	Jack							
BON	83,326	5,483	115,042	4,809	76,516	5,022	72,448	123,286	53,716	315,036	313,378	308,826	88,893
TDA	34,217	2,187	35,735	1,853	18,811	1,800	65,018	107,466	44,480	244,004	234,900	230,211	72,150
JDA	33,265	3,322	27,781	2,072	14,996	1,673	69,078	113,497	48,145	233,229	221,077	225,360	66,567
MCN	19,303	1,227	16,425	1,060	7,583	714	63,542	89,707	41,398	223,981	193,152	172,549	58,890
IHR	1,606	26	2,844	37	557	21	19	91	24	152,801	163,331	130,522	34,891
LMN	2,116	26	2,806	134	433	33	17	77	28	154,254	140,906	123,206	37,208
LGS	1,913	80	2,357	115	335	8	14	81	32	143,408	134,062	112,090	31,156
LGR	2,078	106	2,968	93	479	22	17	113	32	155,695	137,714	113,701	35,996
PRD	1,173	87	4,406	773	1,482	204	74,563	124,943	52,082	12,472	18,545	12,590	n/a
RIS	6,581	0	4,592	0	1,753	0	71,226	106,771	47,463	12,409	19,206	11,829	6,446
RRH	1,225	0	667	0	253	0	55,570	81,296	32,418	9,710	14,168	8,945	4,229
WEL	346	0	188	0	40	0	53,218	77,974	31,671	7,163	8,932	6,400	2,715

PRD is missing 8/10 to 8/14, 8/23, 09/09.

*PRD is not posting wild steelhead numbers.

These numbers were collected from USACE, Grant PUD, Douglas PUD, Chelan PUD, ODFW and DART.

Wild steelhead numbers are included in the total. Wild Steelhead are defined as unclipped fish.

Historic counts (pre-1996) were obtained from CRITFC and compiled by the FPC.

Historic counts 1997 to present were obtained from the Corps of Engineers.

FIGURE 31. Trend in adult counts at Bonneville Dam from 1977 to 2005.

FIGURE 32. Trend in counts of Upriver Bright Fall Chinook at McNary Dam and Tule Fall Chinook returns to Spring Creek Hatchery, 1987 to 2005.

V. 2005 COLUMBIA RIVER BASIN HATCHERY RELEASES

A. Overview

The Fish Passage Center maintains a hatchery database of anadromous salmon species released from State, Federal, and Tribal hatcheries in the Columbia River Basin for archived numbers of hatchery fish released above Bonneville Dam since 1979 and released below Bonneville Dam since 1987. The FPC database was upgraded to also facilitate its use for Artificial Production Review and Evaluation (APRE) and Hatchery Genetic Management Plan (HGMP) purposes. Explanation of the new fields/columns can be found in the FPC hatchery Metadata section. Hatchery data are normally entered into the database as follows. For hatcheries releasing fish above Bonneville Dam, the FPC receives preliminary hatchery release schedules from State, Federal and Tribal agencies (normally the agencies' coordinator for their hatchery programs) prior to the juvenile fish migration. These release schedules are initially entered in the FPC database; then updated on a weekly or monthly basis throughout the year until the release numbers are "finalized" by the State, Federal, and Tribal fish agencies. For hatcheries releasing fish below Bonneville Dam, the hatchery release information is normally gathered after the fish have been released from the hatchery facilities. Most hatchery releases are completed during the spring and summer season. Hatchery release schedules are available on the FPC website. These schedules provide Salmon Managers and others with hatchery release information for assessing that year's migration of juvenile hatchery fish through the hydro system.

The FPC hatchery release schedules do not include eggs that might be placed in egg boxes or planted in the gravel of Columbia River streams. Fry plants other than fall Chinook fry are included in the release schedules and are normally listed as migrating the following year. Also fish that fall in the category of "non anadromous" by the fish managers are not included in the FPC hatchery release schedule (e.g., subyearling summer Chinook released in Lake Chelan, since these fish normally do not migrate from the lake).

In 2005, about 83.1 million juvenile salmon were released from Federal, State, Tribal or private hatcheries into the Columbia River Basin above Bonneville Dam. Table 34 gives hatchery release totals for three river zones: Snake River, Mid-Columbia River, and Lower Columbia

River. The 2005 hatchery release totals were about 287,000 less than the preceding year in the Columbia River Basin above Bonneville Dam. In 2005, about 50.9 million juvenile salmon were released into the Columbia River Basin below Bonneville Dam. Because these hatchery salmonids do not pass through the Columbia River Basin hydro system, we do not further discuss their release schedules in this report.

TABLE 34. Hatchery release totals by River Zone: Snake River, Mid-Columbia River (above McNary Dam) and Lower Columbia River (Bonneville Dam to McNary Dam).

Race/Species	2005 Hatchery Releases by Zone			
	Snake River	Mid-Columbia	Lower Columbia	Total Release
Fall Chinook	4,907,703	11,749,112	21,568,089	38,224,904
Spring Chinook	9,440,350	5,158,795	5,150,955	19,750,100
Summer Chinook	2,348,012	3,363,640		5,711,652
Coho	816,300	1,868,096	5,149,621	7,834,017
Sockeye	209,046	592,459		801,505
Summer Steelhead	8,887,794	1,209,657	523,769	10,621,220
Winter Steelhead			118,793	118,793
Total	26,609,205	23,941,759	32,511,227	83,062,191

The 2005 Hatchery Release Schedule (Appendix G) lists the agency, hatchery, and release numbers along with other pertinent data such as mark groups, number per pound, date of release, release site, and river zone. The 2005 Release Schedule and prior years can also be accessed at the FPC Website Home Page under Hatchery Data, and then Query Current and Historic Hatchery Database (1979-present). Table 35 through Table 37 list the hatchery release totals from 1979 through 2005 for the Lower Columbia, Mid-Columbia, and Snake River zones, respectively.

Results on hatchery releases for migration year 2005 are presented in each River Zone section with some highlights listed below:

1. Hatchery fall Chinook numbers were increased by about 1.5 million above the previous season with the largest gain coming from Snake River hatcheries.
2. Hatchery Coho production was about 1.9 million fewer than in 2004 with each zone having fewer numbers of coho released.
3. Hatchery sockeye numbers were almost double in 2005 with most of the increase resulting from a large release on June 2, 2004, of sockeye fry in Lake Skaha, near the Canadian border.

4. Hatchery steelhead releases in the Snake River Zone accounted for about 83% of the total Columbia River basin-wide steelhead production.

B. Lower Columbia River

In the FPC database, the Lower Columbia River Zone is designated as the area from Bonneville Dam to McNary Dam. This zone had a total of 32.5 million juvenile salmon released from the different hatcheries for migration year 2005, which accounts for approximately 32% of all hatchery fish released above Bonneville Dam (Table 35). Two-thirds of the total release in the Lower Columbia River Zone (21.6 million fish) were fall Chinook consisting of upriver Bright and Tule stocks.

About 14.5 million Tule fall Chinook were released from Spring Creek NFH in March through May with the March release the initial large hatchery release (7.3 million) completed in the Columbia River. About 7.0 million Bright fall Chinook were released in the Klickitat, Little White Salmon, and Umatilla rivers, about 200k less than the previous year. Yearling fall Chinook released in the Umatilla River in March and April comprise a small portion of the total release; most Upriver bright fall Chinook are 0-age (subyearling) fish released during the late spring and early summer time frame. This year's total of 21.6 million fall Chinook was only slightly reduced from 2004 and the normal range of releases listed in the FPC database since 1980.

The 2005 hatchery releases of yearling and subyearling spring Chinook in the Lower Columbia River Zone totaled about 5.15 million fish, which is fairly close to the levels of the previous six years (Table 35). This production level was nearly equal to the release totals of spring Chinook in the Mid-Columbia River Zone (5.6 million); however, it was only 54.6% of the Snake River Zone release total. Subyearling spring Chinook (269,800) were released in the upper Klickitat River in May 2005; no spring Chinook were released in the Big White Salmon River as was done for many years. A total of about 4.9 million yearling spring Chinook were released from Carson NFH (Wind River), Klickitat Hatchery, Little White Salmon NFH, Hood River and Umatilla River acclimation ponds, and Round Butte Hatchery and Warm Springs NFH (Deschutes River) from late March to early May.

The number of Coho salmon released in the Lower Columbia River Zone during 2005 was about 5.1 million. This was the lowest total released in this zone since 1986 and well below the

previous year's level. Based on current schedules, Coho salmon will likely remain near this level through the next few years, as Willard NFH did not release Coho salmon in the Little White Salmon River in 2005 and no plans are set to increase coho production for this area. Hatchery reared Coho (both Type-S and Type-N) were released in the Klickitat, Little White Salmon, and Umatilla rivers this season, with hatcheries located below Bonneville Dam continuing to supply a large portion of the Coho planted in both the Klickitat and Umatilla rivers.

Both summer and winter races of steelhead are released in this zone, with Fifteen- Mile Creek (just below The Dalles Dam) being the upper boundary for the winter-run steelhead. The number of steelhead (summer and winter races) released in 2005 was 642,562, which fell within the normal range recorded in this zone since 1991. Winter-run steelhead released in the Hood and Big White Salmon rivers totaled 118,793 for 2005, which was 20,000 to 30,000 fish greater than the previous five years. Approximately 524,000 summer-run steelhead were stocked in the Klickitat, White Salmon, Hood, Deschutes, and Umatilla rivers. Hatcheries located below Bonneville Dam (i.e., Skamania [WDFW], and Oak Springs [ODFW]) supplied all of the winter-run steelhead and a portion of the summer-run steelhead released in this zone.

TABLE 35. Lower Columbia River Zone hatchery releases, 1979 - 2005.

Year	2005 Lower Columbia Hatchery Releases						
	Spr Chinook	Sum Chinook	Fall Chinook	Steelhead	Coho	Sockeye	Totals
1979	3,491,456	110,500	40,975,000	462,722	3,288,000		48,327,678
1980	5,828,561		31,896,000	816,084	5,495,500		44,036,145
1981	6,044,500		35,936,500	609,500	4,391,500		46,982,000
1982	4,692,500		28,093,500	746,000	4,412,500		37,944,500
1983	6,003,500		34,141,500	631,000	4,912,500		45,688,500
1984	6,529,645		24,256,048	777,125	4,984,334		36,547,152
1985	6,344,905		20,804,201	744,290	2,162,846		30,056,242
1986	7,234,772		19,245,721	588,905	6,736,127	64,384	33,869,909
1987	6,099,130		18,149,291	404,000	9,292,000		34,002,428
1988	7,628,500		20,147,500	447,000	8,690,000		36,913,000
1989	8,891,430		24,805,762	555,526	8,451,762		42,709,616
1990	11,977,052		19,347,320	513,171	8,579,511		40,417,054
1991	9,046,069		27,266,266	583,156	8,467,969		45,363,460
1992	8,503,011		33,013,100	671,066	6,405,391		48,592,568
1993	7,435,146		30,927,448	689,196	8,954,465		48,006,255
1994	8,204,213		27,950,458	652,320	6,299,002		43,105,993
1995	6,939,030		24,858,274	587,171	6,712,604		39,097,079
1996	4,766,136		26,442,513	676,167	8,021,423		39,906,239
1997	4,093,528		23,233,638	688,909	6,763,470		34,779,545
1998	8,191,856		31,805,034	681,591	7,254,648		47,933,129
1999	5,488,404		19,322,806	621,079	7,186,404		32,618,693
2000	5,320,322		28,615,317	635,308	8,021,720		42,592,667
2001	5,853,807		17,405,628	603,293	6,762,367		30,625,095
2002	5,748,143		26,343,158	620,529	6,069,435		38,781,265
2003	5,441,505		25,531,102	585,608	5,732,260		37,290,475
2004	5,272,710		21,996,183	580,439	6,017,123		33,866,455
2005	5,150,955		21,568,089	642,562	5,149,621		32,511,227

C. Mid-Columbia River

The Mid-Columbia River Zone encompasses the area from above McNary Dam to Chief Joseph Dam. In 2005, approximately 23.9 million juvenile salmonids were released in this zone (Table 36). Hatchery releases of juvenile summer and fall Chinook, steelhead, and Coho have remained relatively stable since 1996. After 5 years of less than 4 million spring Chinook released annually, the 2005 production reached 5.2 million fish.

Production releases of juvenile fall Chinook (up-river Bright stock) totaled 11.7 million, well within the range of totals reported since 1996. Fall Chinook releases from Ringold Hatchery and Priest Rapids Hatchery were approximately 9.4 million with the remainder released in the

Yakima River basin. All these releases were subyearling fish. Hatchery fall Chinook comprised about 49.1% of the total fish released in this zone.

About 3.4 million summer Chinook salmon were released from hatcheries, acclimation ponds or directly into streams and tributaries located above Rock Island Dam. Most summer Chinook are reared in the hatchery facilities until yearling age (about 18 months) and released during the spring. The subyearling releases (about 1.2 million) were liberated in May through late June, and migrate through the Columbia River from June through August. Summer Chinook were released in the Wenatchee, Similkameen, and Methow rivers, and the mainstem Columbia River from Wells and Turtle Rock hatcheries. From 1979 through 1994, releases averaged about 2.1-million summer Chinook per year while from 1995 to present, releases have increased and now range between 2.8 and 4.3 million per year. As a point of interest, Coded Wire Tag returns of yearling and subyearling hatchery summer Chinook have shown a far greater survival rate of fish released as yearling than as subyearling. The "wild" summer Chinook from this zone migrate as subyearling fish.

During 2005, Mid-Columbia hatcheries released about 5.2 million yearling spring Chinook, an increase of about 1.2 million from the previous year. Hatchery spring Chinook releases increased in this zone as the production of spring Chinook at Ringold Hatchery that was terminated in 2001 was again back on line this season with a release of nearly 419,000 fish. Normal production of spring Chinook continued in the Methow, Entiat, and Wenatchee rivers and their tributaries this season. The efforts of the Colville Tribe, started during the past few years, to reintroduce spring Chinook into the Okanogan River basin continued in 2005. The Yakama Tribe continued spring Chinook production from their acclimation facilities located in the Yakima River basin, and in 2005 released approximately 824,000 fish from the Clark Flat, Easton, and Jack Creek acclimation ponds. Hatchery spring Chinook are also now being planted in the Walla Walla River basin (mainly in the South Fork), with about 250,000 fish released in 2005. Overall, releases of juvenile spring Chinook in this zone should continue in the 5-million range in future years with the added production from Ringold Hatchery and the Walla Walla River.

Production releases of Coho salmon from Mid-Columbia acclimation ponds and hatcheries were approximately 1.9 million fish in 2005, a level within the range observed since 2001. All juvenile Coho salmon released from the facilities in this zone were originally transferred from hatcheries located below Bonneville Dam or from Willard Hatchery (Bonneville Pool). The

Coho releases in the Mid-Columbia River Zone are part of the Yakama Tribal Program to re-establish Coho runs in the Yakima, Methow and Wenatchee River basins.

About 592,500 juvenile Sockeye salmon were released from June through early November 2004 from the net pens located in Lake Wenatchee and a new release from the Canadian Fisheries and Ocean into Lake Skaha, a tributary of the Okanogan River basin. The majority of these fish were expected to reside in the lake through the winter and migrate from the lake in spring of 2005. The Wenatchee sockeye were 100% adipose clipped and coded-wire tagged. The Osoyoos/Okanogan Program had a release group of hatchery-reared fry that were near 567 fish per pound and were directly released into Lake Skaha in June 2004. These fish were also expected to rear to smolt size and migrate through Lake Osoyoos and Okanogan River to the Columbia River in spring of 2005. This group of fish was unmarked.

Since 1992, hatchery production of juvenile steelhead has been fairly stable in this zone, averaging around 1.4 million per year with 2005 releases dropping to 1.2 million fish. Of this total, about 246,000 juvenile steelhead were released in the Walla Walla River basin with the remainder in the Okanogan, Methow, Wenatchee rivers and tributaries as well as the mainstem release from Ringold Hatchery. As in previous years, hatchery steelhead (Wells stock) remain listed as "threatened" under the ESA. There continued to be no hatchery-produced steelhead released in the Yakama River.

TABLE 36. Mid-Columbia River Zone hatchery releases, 1979 - 2005.

Year	2005 Mid-Columbia Hatchery Releases						
	Spr Chinook	Sum Chinook	Fall Chinook	Steelhead	Coho	Sockeye	Totals
1979	3,509,000	2,501,000	826,500	592,500	640,000		8,069,000
1980	4,788,000	2,638,000	3,327,500	873,000	1,206,500		12,833,000
1981	5,161,000	2,301,000	5,115,500	985,000	1,089,500		14,652,000
1982	5,186,500	2,981,000	6,297,500	1,263,500	482,500		16,211,000
1983	4,369,000	1,609,000	10,276,500	1,471,500	536,000		18,262,000
1984	6,492,744	1,240,865	15,548,324	1,587,329	517,100		25,386,362
1985	4,796,554	1,630,322	10,789,141	1,345,923	389,005	64,031	19,016,813
1986	4,651,848	1,992,057	10,402,956	1,504,450	556,017	64,926	19,259,428
1987	4,585,223	1,413,000	8,606,441	1,748,868	911,500	25,000	17,308,132
1988	6,034,795	2,144,500	9,769,500	2,167,000	1,329,500	47,500	21,492,795
1989	4,565,017	2,597,099	7,571,364	1,810,287	1,084,753	107,299	17,735,819
1990	8,800,002	1,912,708	9,339,478	1,822,491	1,118,138	91,999	23,084,816
1991	6,455,727	2,258,293	7,195,765	1,913,905	1,126,683	616,038	19,566,411
1992	5,250,389	2,551,616	7,216,100	1,382,511	1,246,195	112,205	17,759,016
1993	4,305,286	1,800,199	8,862,582	1,368,682	1,167,694	354,595	17,859,038
1994	3,803,697	2,097,319	14,162,311	1,440,117	857,783	428,200	22,789,427
1995	5,076,896	2,760,748	14,399,490	1,414,719	666,862	40,963	24,359,678
1996	3,243,054	3,889,547	12,422,257	1,411,096	1,680,209	150,000	22,796,163
1997	1,328,576	3,403,136	12,407,097	1,420,394	1,124,821	339,158	20,023,182
1998	3,328,869	3,537,781	11,924,206	1,472,296	1,739,476	365,784	22,368,412
1999	4,954,855	2,977,364	11,870,800	1,726,741	1,486,500	210,591	23,226,851
2000	3,926,812	2,853,950	12,293,934	1,396,898	1,662,994	142,901	22,277,489
2001	3,351,699	4,324,169	11,976,344	1,291,813	2,151,318	241,216	23,336,559
2002	3,815,814	3,520,683	10,913,482	1,312,693	1,911,684	308,042	21,782,398
2003	3,538,365	3,001,618	12,255,089	1,289,063	1,876,158	208,986	22,169,279
2004	3,973,904	3,331,738	12,183,684	1,184,775	2,387,222	315,790	23,377,113
2005	5,158,795	3,363,640	11,749,112	1,209,657	1,868,096	592,459	23,941,759

D. Snake River

The total release of salmon species in the Snake River basin was approximately 26.6 million for the 2005 migration season (Table 37). This is the fourth straight year since 2002 of total hatchery releases in this zone exceeding 26 million salmonids. Spring/summer Chinook salmon remained fairly consistent after rebuilding from the all-time low production in 1996 and 1997. Fall Chinook production levels were increased in 2005 from the preceding year with releases from Lyons Ferry Hatchery and associated acclimation facilities nearing production goals. The Nez Perce Tribal hatchery will continue to rear and release spring and fall Chinook for the Clearwater River tributaries.

The 2005 production of hatchery spring Chinook in the Snake River basin totaled approximately 9.4 million. Although the 2005 release was about one million less than in the prior two years, many of the hatcheries were still at full production for the season. Yearling spring Chinook were released in the Snake (Hells Canyon area), Clearwater, Grande Ronde, Salmon, Tucannon, and Imnaha River basins from hatcheries or acclimation ponds mainly during the spring season with supplemental and acclimation sites releasing more than one million fish during the fall of 2004. As in prior years, most hatchery spring/summer Chinook were distinguishable in 2005 based on either (1) an adipose or ventral fin clip or (2) coded-wire tag without fin clips. A portion of the hatchery production of spring Chinook from IDFG, ODFW and WDFW hatcheries remain listed as "threatened" under the ESA. Captive brood stock releases of juvenile salmon continued at some of these State hatcheries. Hatchery production of spring Chinook should be stabilizing in this zone if facilities continue meeting production goals.

About 2.3 million juvenile summer Chinook were released from McCall and Pahsimeroi hatcheries in 2005, a production level similar to the past two years. Summer Chinook production should also level off in the Snake River as these summer Chinook facilities reach capacity. A portion of the hatchery summer Chinook from McCall and Pahsimeroi hatcheries is listed as "threatened" under the ESA. Yearling-age summer Chinook from McCall Hatchery are annually trucked and released at Knox Bridge located on the mainstem South Fork Salmon River and in Johnson Creek, a tributary of the South Fork Salmon River.

Hatchery production of fall Chinook was 4.9 million, the second highest release since 1983, when hatchery fall Chinook production began in the Snake River Zone. The trend beginning in 1998 continues to show an overall increase in numbers released in the Snake River basin. Approximately 743,400 fall Chinook were released as yearlings from Lyons Ferry Hatchery and acclimation facilities at Pittsburg Landing in the Snake River and Big Canyon Creek in the Clearwater River. The remainder of the fall Chinook production in the Snake River Zone was subyearlings from Captain John Rapids, Big Canyon Creek, and Pittsburg Landing acclimation ponds' releases, direct stream releases below Hells Canyon Dam, and Nez Perce Tribal Hatchery releases in the Clearwater River. The 2005 season marked the initial release of subyearling Chinook in the Grande Ronde River. All yearling fall Chinook releases were completed in April while the subyearling fall Chinook releases occurred in May and June. A portion of the subyearling fall Chinook released from acclimation sites were unmarked and unclipped. Distinguishing hatchery

from wild fall Chinook will remain a challenge with both the juvenile migrants and returning adult fish in future years.

Production of yearling sockeye salmon totaled 209,046 with releases made in Red Fish, Alturas, and Pettit lakes as well as Red Fish Lake Creek for the 2005 migration. Approximately 63% of the sockeye releases occurred in October 2004, with the remaining 27% occurring in May 2005. Sockeye were 100% marked with adipose fin clips. To complement the hatchery-reared sockeye released each year, efforts continue to allow some adult sockeye to spawn naturally in these lake systems. In addition, egg boxes were used to supplement the production releases.

A total of 816,300 juvenile Coho salmon were released in the Clearwater River basin in 2005. Although this year's release total was lower than the preceding three years, it was within the range (0.6 - 1.4 million) recorded since hatchery production of Coho began in 1998 in this zone. These Coho releases are part of the Nez Perce Tribe's program to re-introduce Coho into Clearwater River basin and are expected to continue in upcoming years. The majority of the Coho production releases do not have fin clips. Adult Coho salmon continue to return to these natal upstream sites to spawn.

Juvenile hatchery steelhead released in the Snake River basin totaled 8.9 million in 2005. This production level is within the range (8.1 - 12.1 million) of steelhead released since 1981. About 33.4% of the anadromous salmonids released from Snake River basin hatcheries were steelhead. For the total 2005 steelhead production in the Snake River Zone, approximately 58.3% were B-run steelhead released in the Clearwater River basin and selected areas in the Salmon River basin. The remaining 41.7% were A-run steelhead released in the Salmon, Grande Ronde, Imnaha, Snake River (below Hells Canyon), and Tucannon River basins.

TABLE 37. Snake River Zone hatchery releases, 1979 - 2005.

Year	2005 Snake River Hatchery Releases						
	Spr Chinook	Sum Chinook	Fall Chinook	Steelhead	Coho	Sockeye	Totals
1979	5,641,235	236,500		4,064,095			9,941,830
1980	5,123,988			6,328,000			11,451,988
1981	6,757,307	249,500		8,409,500			15,416,307
1982	3,068,233	122,000		9,664,109	209,500		13,063,842
1983	5,393,623	198,500	79,000	8,279,500			13,950,623
1984	7,076,708	356,673	427,191	10,882,598			18,743,170
1985	8,084,943	781,405	1,317,921	9,437,250		210,000	19,831,519
1986	6,314,421	982,443	2,453,010	8,085,953			17,852,565
1987	10,743,364	1,217,000	1,060,971	8,242,200			21,263,535
1988	11,230,300	1,777,500	4,981,287	11,726,776			29,715,863
1989	10,446,274	1,991,300	2,153,882	9,146,283			23,737,739
1990	13,306,749	2,882,400	4,248,422	11,149,502			31,587,073
1991	8,908,172	936,100	224,660	12,068,104			22,137,036
1992	8,178,071	1,507,400	689,601	9,510,474			19,885,546
1993	4,046,446	982,300	966,793	10,302,377			16,297,916
1994	6,752,805	1,190,673	603,661	9,600,381			18,147,520
1995	8,557,388	2,095,143	374,982	10,109,372		30,973	21,167,858
1996	1,541,127	676,894	629,911	10,461,986		84,599	13,394,517
1997	477,929	360,603	1,137,678	9,959,153		1,926	11,937,289
1998	3,176,804	577,618	842,007	9,209,992	695,716	335,803	14,837,940
1999	9,310,024	1,574,369	1,835,896	9,841,543	788,358	151,899	23,502,089
2000	5,968,537	1,172,717	3,233,860	9,775,735	797,474	40,419	20,988,742
2001	2,801,460	1,343,943	2,536,218	9,796,039	597,192	86,029	17,160,881
2002	10,206,719	1,676,957	3,665,801	9,509,463	1,089,672	144,838	26,293,450
2003	10,473,825	2,332,578	4,091,468	9,687,941	1,277,246	140,410	28,003,468
2004	10,482,986	2,374,050	2,579,347	9,225,386	1,367,111	76,927	26,105,807
2005	9,440,350	2,348,012	4,907,703	8,887,794	816,300	209,046	26,609,205

APPENDIX A

Memorandums & Other Documents

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**Power point presentation titled 2005 Subyearling Migration
and presented to the ISAB on December 7, 2005**

2005 Subyearling Migration

Fish Passage Center

Overview – summer migration

- Court ordered summer spill occurred from June 20 to August 31, 2005
- Question was posed to FPC if any response could be determined for the juvenile migrants
- No specific studies related to spill were conducted in 2005. RT studies were conducted, but did not address reach survival of juvenile migrants.
- PIT tags data were available from production marking, as well as wild fish marking and various studies (transportation, hatchery operations)

Historic Data Set

- PIT tags available included: production/acclimation fish, wild chinook and research/surrogate fish.
- Reach survival estimates (LGR to McN) possible since 1998. This was partly due to increases in the numbers of tags released and PIT tag recapture location at JDA.
- Typical hydrograph – high flows occur in late May-early June – with subsequent decreasing trend.
- Summer spill prior to 2005, if spill occurred, was during late high flow periods or during periods of excess market capacity (2002).

Daily Avg Q Little Goose 1998 to 2005

1998 to 2005 Conditions

Preliminary Analysis

- Used available PIT-tags – conduct temporal analyses similar to those conducted with yearling migrants
- 2 groups separated as much as possible into before/after spill began on June 20
- Estimated LGR to MCN survival of two groups
- Assigned exposure indices for environmental variables
- Compared 2005 to patterns observed in other recent past years
- Originally compared back to 2001

Survival LGR to McN for Subyearling Chinook before and during summer spill in 2005 with 90% CI's

Survival for Subyearling Chinook

LGR to McN 2001 to 2005 with 90% CI's

Updates to Preliminary Analysis

- Use shorter time intervals to better match reach survivals to environmental conditions
- Adds distinct pre-6/20 (at LGS-IHR), transitional, post 6/20 groups
- Expanded to include 1998 to 2000 migration years
- Used weighted regression (inverse variance)
- Introduces higher variability in survival estimates due to lower sample sizes

Lower Granite Detection date ranges for Survival Groups

Update Groups	GRJ Dates	Prel. Groups
1	5/20-6/02	5/20 – 6/16
2	6/03-6/16	
3	6/17-6/30	6/17 – 7/15
4	7/01-7/14	

Percent Post LGR Detects of Fall Chinook seen as Yearlings downstream of LGR – 7 d moving average

Index of increasing holdover rates by mid-July

Environmental Variables

- Assigned Flow, Spill, Temperature variables for each group through each reach segment (LGR to LGS, LGS to LMN, LMN to IHR, IHR to MCN)
- Averaged env. variable using two-week moving “window” based on median travel time for each detection group
- Then averaged these assigned variables for an exposure index related to reach survivals

Detection Group date range compared to Avg Total Q at Little Goose Dam

Detection Group date range compared to Avg Spill Q at Little Goose Dam

Detection Group date range compared to Avg Temp C at Little Goose Dam

Subyearling Survival 1998 to 2005 Lower Granite Tailwater to McNary Tailwater

Subyearling Chinook Survival versus Avg Spill Percent Lower Granite Tailwater to McNary Tailwater

Subyearling Chinook Survival versus Avg Total Discharge Lower Granite Tailwater to McNary Tailwater

Subyearling Chinook Survival versus Avg Temperature Lower Granite Tailwater to McNary Tailwater

Subyearling Chinook Survival versus Median Travel Time Lower Granite Dam to McNary Dam

Correlation Matrix Subyearling Data 1998 to 2005

	SURVIVAL	AVSPLPCT	AVGFLOW	AVTEMPC
SURVIVAL	1			
AVSPLPCT	0.71	1		
AVGFLOW	0.74	0.66	1	
AVTEMPC	-0.76	-0.59	-0.82	1

Multivariate Analysis

- Tested for significant interactions between main effects (flow, spill, temperature)
- No significant interactions detectable but variability and low sample size make multivariate approach tenuous
- Backward Stepwise regression AvgFlow removed from model
- Final Model N=26, adj mult $R^2 = 0.651$

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2Tail)
CONSTANT	1.14803	0.23617	0		4.86099	0.00007
SPILLPCT	0.5393	0.19793	0.39827	0.65352	2.72474	0.01208
AVTEMP	-0.04094	0.01142	-0.52399	0.65352	-3.58481	0.00157

Conclusions

- Relations between survival and flow, temperature and spill were significant based on weighted linear regression at $p \leq 0.01$
- Stepwise regression resulted in Spill and Temp remaining in model; flow and temp variables were highly correlated; interactions could not be fully assessed
- Trend of survival in most years since 1998 was higher early decreasing throughout the period reflecting annual patterns in flow, spill and temperature.

Conclusions

- The notable exceptions were 2001 and 2005. The 2001 estimates were low throughout the extreme drought year. However, the 2005 survival estimates showed a distinctly different trend with higher survival observed for the later time period.
- Given the relatively low flows and relatively warm temperature, the change in survival pattern in 2005 was likely due to the provision of spill.
- Similarly, travel time estimates were shorter than expected for the late group in 2005, based on flow levels that occurred in that time 2005.

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MEMORANDUM

TO: Bob Heinith, CRITFC
FPAC

FROM: FPC Staff

DATE: November 18, 2005

RE: Review of PowerPoint Presentation

We received your request to review the PowerPoint presentation titled "Injunctive Spill Retrospective Analysis" that apparently was developed by the University of Washington. The presentation includes a section on the radio tag studies that were conducted this year, a presentation of fish passage and spill timing, a listing of concerns regarding the FPC analysis and a section on power impacts.

Similar to what we responded in our comments on the After Action Report, the FPC is not prepared to make any comments on the economic impact estimates. Nor can we make comments on the RSW preliminary analysis because study sponsors are not required to make the preliminary data available to the public or to provide details of their analysis, such as assumptions and methodology. Therefore, it is impossible to comment without access to the data and the analysis.

The University of Washington (UW) criticizes of the FPC analysis and then provides different conclusions. The FPC analysis provided the data set and methodology used to develop the survival, travel time estimates, environmental parameters and conclusions. On the other hand, the UW results are presented without providing the data set utilized and the assumptions or methodology used. As a result it is impossible to determine how their estimates were generated and therefore how they reached the conflicting conclusions they present.

In order to help you interpret the PowerPoint presentation we offer the following comments relative to some of the concerns expressed:

FPC's analysis does not consider the main issue, which is whether to transport or leave juvenile fall Chinook migrants inriver. A comprehensive evaluation of adult returns is required to compare inriver vs transport survival.

We agree with this statement and the FPC memos, including the response to the Federal After Action Report and the PPC-PNGC comments, clearly documented the fact that we did not and could not address the issue of transported fall Chinook because that particular analysis requires adult returns. Generating predictions of smolt to adult returns on the basis of juvenile survival estimates plus a myriad of assumptions without actual adult returns is, at best, an exercise and has the dangerous potential of misdirecting passage management decisions. Although there have been estimates of smolt-to-adult returns for transported fall Chinook calculated for past years, which were included in the NOAA technical memorandums supporting the Biological Opinion, these transportation benefits from past years were not optimistic. We agree with the inference of the UW power point presentation, that several years of study of the summer spill operation will be required before the efficacy of transportation and spill can be assessed relative to the effect on adult returns. We agree and stated in the FPC analysis that it was simply an assessment of the migration characteristics, survival and travel time that occurred in 2005.

The FPC document can be easily misinterpreted as evidence that overall survival in 2005 was better than the past few years.

The FPC analysis clearly stated the methods and data used and included in the estimation of survival and travel time and clearly stated the results. The FPC analysis did not make predictions or recommendations.

*UW found technical flaws in the FPC analysis
FPC regression analysis of a spill survival relationship incorrectly assumes all survival estimates are measured with equal error*

Here the UW seems to be suggesting that the data be analyzed using a weighted regression analysis, where estimates with tighter confidence intervals are given more weight in the analysis. If the UW had provided the data set, methods and actual calculations the reference would be more clear. In fact the FPC conducted the analysis using both simple regression and weighted regression techniques. However, utilizing the same data set and applying a weighting methodology to the same data set, as inferred by the UW did not change the results. The relation between spill and survival was equally strong and the coefficients remained essentially the same in both instances. Additionally, the results were basically unchanged when the 2005 data was incorporated, and when it was not included in the analysis. This suggests that the 2005 post spill data point was not highly influential in determining the relation between survival and spill. Most of the shape of the relation is dependent on the survival estimates for earlier migrating fall Chinook in past years that migrated during the tail end of the spring spill. Because UW did not provide their data set or analysis, we cannot determine why they generated different results. One possibility is that they used a different data set. We cannot duplicate the UW analysis or results without their data set.

FPC analysis used mean percent spill across multiple dams to characterize spill in the early and late periods each year.

The FPC recognizes the difficulty associated with quantifying environmental variables. There may be other methods but again without any information we cannot assess the UW methods. The FPC method of characterizing spill is very similar to and consistent with the way other regional groups (like NOAA) characterize environmental variables in their analyses. The FPC utilized standard methods used in the region.

Spill conditions overlapped significantly across the early and late blocks used in the analysis.

The FPC divided the fish into two groups for this analysis, those that migrated prior to the court ordered spill program and those that migrated post implementation of the court ordered spill program. The fact that the two groups were likely to have some overlap was recognized in the original document, "For the pre-spill group (group 1) the date range May 20 to June 12 was chosen. Looking at PIT-tag timing at Lower Granite Dam it appeared that May 20 encompassed the beginning of the run, while June 12 was chosen to assure that many of the migrants would pass through at least part of the hydrosystem prior to spill beginning." The exposure of the early group to some spill was not considered a problem for the analysis because given the higher survival observed for the later migrants that passed inriver during spill, we assumed that the survival of the group 1 fish was likely biased high. Also, the early group was mostly hatchery origin fish, which typically show higher survival through the reach than wild fish and surrogates that made up the majority of fish in the late 2005 group. Given the fact that we observed a difference, in spite of the fact that the Group 1 estimate was likely biased high, only strengthened our conclusion

UW recalculated the survival estimates for the periods used in the FPC analysis

It is impossible to respond to any of these remarks since there is no way of evaluating what data the UW used for their analysis. We cannot conclude why the UW analysis does not support the conclusions relative to spill and cannot duplicate with our data any relation of that magnitude of significance with temperature without the provision of the actual UW data sets. There was an error in one number in the earliest data sets the FPC used, however, when recalculated with the corrected estimate it only yielded a relation between spill and survival with a higher r^2 (0.71) than the original analysis (0.61). The slide also refers to a data point from 2000 when the FPC did not include data from 2000 in our analysis. There is also considerable knowledge required of which fish to include in an analysis to assure that one does not inadvertently include yearling Chinook in the survival estimation procedure. Perhaps this is what led to the inconsistency of the UW data versus the FPC data. We have looked at using various groupings of fish, including all possible tags and find that the linear regression relationships between survival and flow and spill variables are always significant and that coefficients of the relationships are quite stable even when survival estimates are weighted by inverse variance.

Based on the operations and passage index data, the majority of the fall Chinook migration occurred before the court ordered spill

This is a true statement only if one purposely ignores the passage of the wild Snake River fall Chinook and the Clearwater fall Chinook. The passage indices are predominated by hatchery-released fish. The run of hatchery fish was early this year since some of the major production lots were released earlier than usual because of deteriorating in-river migration conditions (this was prior to the decision to grant the injunctive relief for spill). However, it has clearly been demonstrated that the majority of Snake River fall Chinook and most of the Clearwater fall Chinook were in river during the court ordered spill program.

Conclusion:

- The UW does not provide adequate description of assumptions or data sets to actually conclusively determine how they generated their estimates. When a weighting methodology was applied to the FPC data set the relationship did not change.
- When all FPC calculations were reviewed and recalculated the spill survival relationship actually strengthened to a higher r^2 value.
- We cannot duplicate the UW results because they did not provide the data set they used.
- The UW may have used a data set that included yearling fall Chinook or sub-yearling spring Chinook.

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MEMORANDUM

TO: Fish Passage Advisory Committee

FROM: Michele DeHart

DATE: November 10, 2005

RE: Federal Columbia River Power System –Summer Spill – After Action Report –
October 31, 2005

We have reviewed the Federal Columbia River Power System, Summer Spill 2005 After Action Report, (After Action Report) posted on the Federal Salmon Recovery. We offer the following review comments for your consideration. The Fish Passage Center (FPC) provided FPAC with in-season updates of passage throughout the 2005 salmon migration season. The FPC provided FPAC and the region with four preliminary summaries of juvenile fall Chinook passage, on September 12, September 16 and on October 21, October 25, 2005. Following are our general conclusions regarding the Federal After Action Report:

General Conclusions

- The only information provided in the After Action Report that was additional to the FPC analysis was the estimated economic impacts and the preliminary RSW study and radio tag study results. The FPC is not prepared to make any comments on the economic impact estimates. Nor can we make comments on the RSW preliminary analysis because study sponsors are not required to make the preliminary data available to the public. Therefore, it is impossible to comment without access to the data and the analysis.
- We agree with the action agencies statement that a life cycle study of fall Chinook needs to be conducted that evaluates in-river and transportation of fall Chinook. In fact the state, tribal and USFWS proposed a collaborative study in 2005, which would have evaluated transportation and in-river passage with spill. The study design and collaborative process required a collaborative agreement on study design, study implementation and analysis and reporting of results. The COE and NOAA Fisheries rejected this proposal in 2005.
- We agree with the action agencies concern that one-year of study with summer spill is inadequate to determine life cycle effects of spill and transportation. We agree that the

life cycle study as included in the collaborative proposal by the agencies and tribes needs to be repeated for several years with summer spill and transportation to evaluate the most beneficial operation for future years.

- The NOAA estimates of survival and passage of fall Chinook juvenile migrants are not significantly different from the FPC estimates in the preliminary migration updates. There is no information in the After Action Report that conflicts with, or causes modification in FPC conclusions.

Specific Comments

Holdovers, page 5, pg 2 – The After Action Reports states that holdovers will determine the final survival estimate for the 2005 summer migration. In addition, the After Action Report states that in recent years “holdovers” accounted for over 50% of the adult returns to the Snake River. On May 10, 2005 the FPC staff provided FPAC with a memorandum that summarized the over-wintering data collected to date. The After Action Report statement on 2005 survival and 2006 “holdover” out-migrants should be considered with caution. The 2005 survival of fish migrating in-river is unlikely to change significantly with the consideration of “holdover” fish, since past data indicates that most “holdover” fish are migrants that pass Lower Granite Dam later than mid-July or hold over above Lower Granite Dam. Present preliminary estimates do not incorporate large numbers of late migrants. We do not agree with NOAA that juvenile survival can be readily adjusted to account for “holdover” migrants. The uncertainties surrounding the “holdover” phenomenon for fall Chinook were addressed in the May 10, FPC memorandum.

- There are indications that the holdover phenomenon in fall Chinook may largely be the result of human activities.
- A life cycle accounting for “holdover” fall Chinook needs to account for the number of subyearlings that do not migrate in the fall and attempt to over-winter. In addition an estimate of over-wintering mortality needs to be developed. The method for estimating over-wintering mortality and the starting population of holdovers is a key question and is not identified or described by NOAA.
- Smolt-to-adult returns cannot be accurately assessed for “holdover” fish unless a method to estimate the starting population and the over-wintering mortality is developed.
- Past PIT tag data indicate that “holdover fall Chinook tend to result from late migrating wild fall Chinook from the Clearwater River, and backfill releases of small hatchery fish which have later release dates.’ In addition past data indicate that most of the “holdover” phenomenon takes place in lower river reaches.

PIT Tag Reach Survival Data and Estimates

Page 5, pg 3 – In this paragraph NOAA predicts relative and absolute differences in overall system survival between a no-spill summer operation and a spill summer operation. These estimates should be considered cautiously and should be considered in the context of the passage experience of the total population. NOAA predicts that the system overall survival difference between the spill and no-spill operation could be in absolute terms from -1 to +1 percent. A 1% difference in adult returns is significant. However, this absolute value primarily reflects the proportion of the population that was transported and experienced the D-value range assumed by NOAA compared to the proportion of the population that migrated in-river and experienced spill. NOAA compared summer 2004 with summer 2005. The passage timing distribution was

different in each year. The proportion of the fall Chinook juvenile population transported is calculated for each year and included in the FPC Annual Smolt Monitoring Report. In 2004 approximately 97% of the outmigration population approaching Lower Granite Dam was destined for transport, in 2005 over 80% of the outmigration population was transported. The difference in absolute survival of the two operations is a direct result of the proportion of the population that experienced in river migration. Repetition of the operation and actual adult returns will determine whether or not NOAA predictions contained in the After Action Report are accurate or not.

Fish Passage Center (FPC) Analysis

Page 9, pg 1- The After Action Report discusses points that were not included in the FPC analysis. The FPC analysis clearly stated the methods and data used and included in the estimation of survival and travel time. The FPC memorandum dated, October 5, 2005 and posted on the FPC web site addresses some of these concerns. We agree and clearly documented the fact that we did not and could not address the issue of transported fall Chinook. Although there have been estimates of smolt-to-adult returns for transported fall Chinook calculated for past years, which were included in the NOAA technical memorandums supporting the Biological Opinion, these transportation benefits from past years were not optimistic. We agree that the overall assessment of the efficacy of transportation and spill requires several additional years of study with summer spill provided, in order to assess the effect on adult returns. We agree and stated in the FPC analysis that it was simply an assessment of the migration characteristics, survival and travel time that occurred in 2005.

Overall the After Action Report does not disagree with the findings of the FPC memorandum but criticizes the FPC analysis for questions it did not cover, such as transportation and holdover fish. The FPC analysis did not attempt to address these questions or determine the final disposition of passage mitigation programs for fall Chinook, nor did the FPC analysis address what should have or could have happened relative to the court ordered spill program.

The After Action Report indicates that the summer spill program may have influenced “holdover” fish and infers that “holdover” fish have a high value in terms of adult returns. The inference as to the value of holdover fish should be considered with caution. Past data on “holdover” fish was summarized in the May 10, 2005 FPC memorandum to FPAC. Valid estimates of smolt-to-adult return on “holdover” fish will require accurate estimates of the starting population of “holdovers” and the over-wintering mortality. The After Action Report fails to mention or recognize the possibility that the contribution rate of “holdover” fish to adult returns could be linked to the fact that “holdover” fish are not transported and they migrate the following spring under spring spill conditions. In addition the proportional contribution of “holdover” fish to adult returns varies a great deal from year to year and is affected by the passage conditions and survival of within year migrants. In other words, poor summer passage conditions and poor transportation survival of sub-yearling migrants would by necessity affect the proportion of the resulting total adult return that is comprised of sub-yearlings migrants versus “holdover” migrants. We agree that the “holdover” phenomenon needs to be studied relative to overall lifecycle survival but would recommend caution on statements regarding the value of “holdovers” to the entire population until additional data is available.

2005 Summer Survival Studies

It is impossible to provide specific comments on the After Action Report regarding RSW, and radio-tagging survival estimates. The actual data and methods utilized to arrive at these estimates are not available to the public. However, the agencies and tribes have repeatedly expressed their concerns regarding the appropriate application of these study results and their limitations to management applications. In addition the agencies and tribes have expressed their concern that RSW studies done to date do not address reach survival and tailrace survival issues adequately. In addition RSW studies have emphasized the reduction of spill without addressing the question of how to maximize project survival utilizing spill and RSWs in concert with each other.

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MEMORANDUM

TO: Fish Passage Advisory Committee
Fish Passage Center Oversight Board
Ed Sheets, Consulting Services
Robert Lothrop, CRITFC
Bert Bowler, Idaho Rivers United

Michele DeHart

FROM: Michele DeHart

DATE: October 25, 2005

RE: Preliminary Survival Analysis for Subyearling Chinook originating Above LGR

This memo updates and replaces the memo entitled "Preliminary Survival Analysis for Subyearling Chinook originating Above LGR" dated September 12, 2005. Further updates, including data from other recent years as well as multivariate analysis, will be part of the final analysis that will be included in the FPC annual report. All graphs and the data tables have been updated, including the incorporation of recovery data through October 1, 2005. All trend lines in plots of data are now shown as linear functions, the nature of the final functional relationships may change when our analyses are completed. Further changes include an updated survival estimate for 2002 as well as refinement to the temperature variables used in the analysis. While some changes to the dataset have been made, our conclusions have not changed from the previous memo.

This was a unique year in that spill occurred throughout the summer in the Snake River as part of a court ordered spill for fish passage program. In this analysis the FPC specifically addressed the primary migration characteristic data (juvenile survival and travel time) to determine if an effect of the court ordered summer spill operations could be documented. In order to address this question the travel time and survival of juvenile subyearling Chinook that migrated prior to the initiation of the summer spill program in 2005 was compared to subyearling Chinook survival and travel time from the period after summer spill had been initiated. The 2005 migration was also analyzed compared to past years (2001 to 2004).

Our conclusions based on our preliminary analysis:

- The point estimate for subyearling Chinook survival was the highest recorded in recent years (2001-2005) in the reach from Lower Granite Dam to McNary Dam during the period when spill was occurring in the Snake River.
- And, unlike other recent years where survival either remained low throughout the summer period as in 2001 or declined as in 2002, 2003 and 2004, the 2005 survival increased significantly later in the season.
- This analysis is preliminary. The subyearling migration in the Snake River typically continues through September and into October.
- The preliminary survival estimation is comparable to past years' because the time period of the analysis minimizes the potential of including fish that may over-winter. Over-wintering has been shown to occur mostly in late migrating fall Chinook from the Clearwater River and from groups of "backfill" late hatchery releases. (FPC Memorandum, 5/10/2005, #76-05, www.fpc.org).
- The group 2 fish in 2005 exhibited an extremely fast travel time through the Snake River. The only other year with a travel time estimate as fast was observed for the 2005 migration was group 1 in 2003. The average flow during the time period when the 2003 group 1 migrated was nearly 120 Kcfs, while the average flow in 2005 during the time when group 2 migrated was only 43 Kcfs. This again illustrates the importance of spill in determining the decreased amount of time fish take to migrate through the system when not having to experience the delay associated with passing through a hydroproject.

Methods

Survival and travel time were estimated using PIT-tagged subyearling Chinook of hatchery or wild origin that originated above Lower Granite Dam. Fish released in the Snake River and early releases from the Clearwater River, such as May or June releases from the Big Canyon Creek acclimation facility, were included in the analysis. Late releases of wild Clearwater tagged fish or late season surrogate wild tagged fish from Big Canyon Creek were not included, since these fish exhibit a much later and, therefore, different, migration than the Snake River fish. Consequently, survival and travel time analyses for these later fish will have to be conducted separately, as these fish still continue to pass Lower Granite Dam and other sites.

To estimate travel time and survival, fish detected and returned to the river at Lower Granite Dam were used in the analysis. Survival and travel time for the subyearling Chinook migrants were estimated and analyzed for two distinct time periods in 2005. Separating the migrants into two groups was done to assess survival prior to and after implementation of the court ordered summer spill program. Spill began June 20 at the Lower Snake River projects and July 1 at McNary Dam. For the pre-spill group (group 1) the date range May 20 to June 12 was chosen. Looking at PIT-tag timing at Lower Granite Dam it appeared that May 20 encompassed the beginning of the run, while June 12 was chosen to assure that many of the migrants would pass through at least part of the hydrosystem prior to spill beginning.

For the post-spill group (group 2) June 17 was chosen as the start date for grouping at Lower Granite Dam, since the PIT-tagged fish would not experience spill until reaching Little Goose Dam. Based on PIT-tag travel time, nearly all fish passing Lower Granite Dam on June 17 would not reach Little Goose Dam until June 20. Minimum travel time was nearly 3 days for the tag groups, while median travel time was 6 days. July 15 was chosen as the end date for the release groups to assure that nearly all fish in the group would pass through the hydrosystem and complete detection and travel time data would be available. It is possible that some of these fish may still be migrant or holding over in reservoirs, but it is likely that the few additional detections on these fish would not greatly change the survival and travel time estimates.

Similar groupings were created for other recent years in order to conduct a comparison among years. For the years 2001 to 2004, the tagged fish were divided into two groups; those detected from May 20 to June 16 were assigned to group 1 and those detected between June 17 to July 15 were assigned to group 2. (Since there were no abrupt operational changes in operations in the season as had occurred in 2005, the groups were not separated by 5 days as had been done for the 2005 migrants).

Average flow, spill and river temperature variables were created based on travel time and a moving 30-day-average to represent downstream passage for each group. For each variable, the daily average measurements were then averaged at each downstream dam based on a moving window, offset by the median travel time for the PIT-tagged group. For example, median travel time from Lower Granite to Little Goose Dam for the early 2005 detection group (5/20 to 6/12) was estimated to be 6 days. The average flow at Little Goose Dam was for this detection group was calculated beginning May 26 through June 24. In a similar manner, average flow, spill, and river temperature for each detection group were calculated at each project downstream to McNary Dam. The data were then averaged over the four projects to produce the overall average values for the total discharge, spill volume, spill percentage, and river temperature variables. Subsequent analyses may be conducted as time permits using water transit time to address the difference in scale of discharge between the two rivers. However, the percentage spill variable is not affected by the discharge difference and spill was the variable of primary interest in this analysis.

Results

Survival

Reach survival estimates are shown in Figure 1 for PIT-tagged subyearling Chinook detected and released at Lower Granite Dam during early summer migration period (group 1) compared to later season (group 2) for the years 2001 through 2005. There are two important trends evident in the survival data. First, the highest point estimate for survival for all years presented is for the late season 2005 (group 2) that migrated during summer spill operations. Second, in the years 2001 through 2004 the differences in survival between groups 1 and 2 was either relatively flat or slightly increasing (2001), or lower for the later group (2002, 2003 and 2004). The differences in the trends among years may be attributable to the amount of spill that occurred in the years during the migration. For example, in 2001, as was the case in 2005, the early group passed during periods of little or no spill at Little Goose and Lower Monumental dams. In 2002, the early group passed Little Goose Dam during a period of spill, whereas it

passed Lower Monumental Dam during a period of virtually no spill. However, in 2003 and 2004, the early summer groups passed through the Snake River during periods of late spring spill. In 2001 survival was low for both early and late season groups, while in 2002, 2003 and 2004 there was a decrease in survival between the group 1 and group 2 migrants. The 2005 estimates show a different trend, with the late group showing a substantially higher survival than the early group. In 2005 there was very little spill during May and early June at Little Goose and Lower Monumental dams as well as relatively low average flows. When the court ordered summer spill began in 2005, spill increased to 70% of daily average flow at Little Goose (subsequently spill was reduced to 40% to address concerns regarding adult passage), while spill at Lower Monumental Dam fluctuated between 40% and 60% of daily average flow. At McNary Dam spill increased from roughly 10% of daily average flow in late June, to roughly 70% July 1. The addition of spill at Little Goose, Lower Monumental and McNary dams appears to have greatly improved survival of the group 2 subyearling Chinook migrants in 2005.

A scatter plot of survival and spill percentage, with second order polynomial trend line (Figure 2), shows that percent spill and survival were highly correlated ($R^2 = 0.71$). A similar plot comparing survival to average total discharge (Figure 3) showed a strong relationship between flow and survival ($R^2 = 0.59$). The late season data point for 2005 appears farthest from the trend line, showing survival much higher than what might be predicted given the low flows alone, another indication of the beneficial effects of summer spill on survival.

Travel Time

A plot of survival and travel time shows that the highest survivals occurred during the periods with the shortest travel times (Figure 4). The only other year with a travel time estimate as fast as was observed for the 2005 migration was group 1 in 2003. The average flow during the time period when the 2003 group 1 migrated was nearly 120 Kcfs, while the average flow in 2005 during the time when group 2 migrated was only 43 Kcfs. This again indicates the importance of spill in determining the decreased amount of time fish take to migrate through the system when not having to experience the delay associated with passing through a hydroproject.

Temperature

A preliminary analysis was conducted relative to temperature for the different groups among years. Temperature was not predicted to have major influence on the survival of the groups in this analysis because of the time period of passage at Lower Granite Dam (prior to July 15). However, a bivariate regression was developed to determine if the survival estimates were influenced by temperature in the same way as they were influenced by the flow and spill variables. Figure 5 shows the relation between the temperature variable and the survival estimates. As can be seen from the graph, little of the variation in survival for the groups of fish used in this analysis can be explained by the temperature variable.

Survival for Subyearling Chinook LGR to McN 2001 to 2005 with 90% Confidence Intervals

Figure 1. Survival of subyearling Chinook from Lower Granite Dam to McNary Dam by detection period for the years 2001 through 2005. Note that 2005 group 1 end date is actually June 12. The (*) denotes non-overlapping confidence intervals between groups 1 and 2 in those years.

Survival for Subyearling Chinook LGR to McN 2001 to 2005 versus Average Percent Spill

Figure 2. Relationship between Survival and Average Spill Percentage at Little Goose, Lower Monumental, Ice Harbor and McNary dams.

Figure 3. Survival versus Average Discharge at Little Goose, Lower Monumental, Ice Harbor and McNary dams for the years 2001 to 2005.

Figure 4. Survival versus Median Travel Time.

**Survival for Subyearling Chinook
LGR to McN 2001 to 2005 versus Average Temperature LGS, LMN,
IHR, MCN**

Figure 5. Average Temperature at Lower Granite Dam versus survival.

Appendix A

Table 1. Summary of Survival, Flow, Spill and Temperature data used in analysis for years 2001 to 2005.

Migr year	LGR Dates	Group	Site	Median Travel Time LGR ^a to	Begin Date for flow Parameter	30d Avg Total Q	30d Avg Total Spill	30d Avg Spill Percent	30d Avg Temp at LGR	LGR to MCN Survival Estimate (95% CI)
2005	5/20 to 6/12	1	lgs	6.1	05/26/05	64.7	5.9	0.12	14.37	0.448 (0.403-0.492)
2005	5/20 to 6/12	1	lmn	10.6	05/30/05	60.0	6.7	0.14	15.29	
2005	5/20 to 6/12	1	ihr	15.1	06/04/05	54.0	33.7	0.63	15.79	
2005	5/20 to 6/12	1	mcn	19.6	06/08/05	191.4	74.9	0.39	16.93	
2005	6/17 to 7/15	2	lgs	5.1	06/22/05	42.6	20.9	0.48	11.40	0.737 (0.443-1.031)
2005	6/17 to 7/15	2	lmn	7.3	06/24/05	40.2	21.0	0.53	16.62	
2005	6/17 to 7/15	2	ihr	9.5	06/26/05	39.0	23.4	0.60	16.99	
2005	6/17 to 7/15	2	mcn	11.6	06/28/05	186.9	120.5	0.64	19.25	
2004	5/20 to 6/16	1	lgs	3.6	05/23/04	89.8	1.6	0.01	13.43	0.700 (0.6-0.8)
2004	5/20 to 6/16	1	lmn	7.7	05/27/04	89.6	3.5	0.03	14.53	
2004	5/20 to 6/16	1	ihr	11.8	05/31/04	80.1	52.2	0.68	14.95	
2004	5/20 to 6/16	1	mcn	15.9	06/04/04	210.6	53.0	0.23	16.42	
2004	6/17 to 7/15	2	lgs	4.7	06/21/04	40.7	0.0	0.00	17.14	0.512 (0.416-0.609)
2004	6/17 to 7/15	2	lmn	8.9	06/25/04	39.5	0.0	0.00	17.69	
2004	6/17 to 7/15	2	ihr	13.2	06/30/04	38.4	29.9	0.78	18.52	
2004	6/17 to 7/15	2	mcn	17.4	07/04/04	139.2	0.0	0.00	20.50	
2003	5/20 to 6/16	1	lgs	3.8	05/23/03	117.4	30.0	0.24	13.67	0.671 (0.616-0.726)
2003	5/20 to 6/16	1	lmn	6.4	05/26/03	113.4	28.7	0.24	14.73	
2003	5/20 to 6/16	1	ihr	9.0	05/29/03	106.0	58.6	0.55	14.97	
2003	5/20 to 6/16	1	mcn	11.6	05/31/03	250.4	79.1	0.29	15.65	
2003	6/17 to 7/15	2	lgs	4.9	06/21/03	39.2	0.0	0.00	16.70	0.420 (0.384-0.456)
2003	6/17 to 7/15	2	lmn	9.1	06/26/03	36.6	0.0	0.00	17.36	
2003	6/17 to 7/15	2	ihr	13.2	06/30/03	33.3	13.5	0.41	18.11	
2003	6/17 to 7/15	2	mcn	17.3	07/04/03	142.3	0.0	0.00	20.34	
2002	5/20 to 6/16	1	lgs	9.2	05/29/02	94.7	21.3	0.21	13.28	0.644 (0.276-1.011)
2002	5/20 to 6/16	1	lmn	17.7	06/06/02	81.4	0.0	0.00	14.09	
2002	5/20 to 6/16	1	ihr	26.1	06/15/02	70.1	51.7	0.75	15.34	
2002	5/20 to 6/16	1	mcn	34.5	06/23/02	268.7	98.5	0.35	17.56	
2002	6/17 to 7/15	2	lgs	5.2	06/22/02	53.9	8.4	0.16	15.10	0.499 (0.429-0.569)
2002	6/17 to 7/15	2	lmn	8.8	06/25/02	49.8	0.0	0.00	15.40	
2002	6/17 to 7/15	2	ihr	12.3	06/29/02	45.2	36.0	0.80	16.24	
2002	6/17 to 7/15	2	mcn	15.9	07/02/02	227.8	62.4	0.25	18.67	
2001	5/20 to 6/16	1	lgs	24.4	06/13/01	29.3	0.0	0.00	15.54	0.235 (0.179-0.291)
2001	5/20 to 6/16	1	lmn	29.9	06/18/01	28.2	0.0	0.00	15.88	
2001	5/20 to 6/16	1	ihr	35.5	06/24/01	26.6	0.0	0.00	16.72	
2001	5/20 to 6/16	1	mcn	41.0	06/29/01	89.0	0.0	0.00	17.11	
2001	6/17 to 7/15	2	lgs	7.3	06/24/01	26.5	0.0	0.00	16.45	0.289 (0.235-0.343)
2001	6/17 to 7/15	2	lmn	10.9	06/27/01	27.9	0.0	0.00	16.41	
2001	6/17 to 7/15	2	ihr	14.6	07/01/01	27.2	0.0	0.00	20.00	
2001	6/17 to 7/15	2	mcn	18.3	07/05/01	81.4	0.0	0.00	20.17	

^a Travel times to Little Goose and McNary Dam were calculated, while those for LMN and IHR were interpolated between those values.

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MEMORANDUM

TO: Brian Lipscomb, CBFWA
Tony Nigro, ODFW

Michele DeHart

FROM: Michele DeHart

DATE: October 25, 2005

RE: Libby Operations Review and Preliminary Analysis

In response to your request we have reviewed alternative operations for flow augmentation from Libby Dam. This analysis is preliminary. The proposed alternative presented in this memo does not address all the concerns or desires expressed by either party. Instead, recognition is given to the most important factors identified for both resident and anadromous fish. Efforts were made to remove double peaking flows from Libby Reservoir and preserve productivity in both Libby Reservoir and the Kootenai River, while providing the augmentation volume for anadromous fish when most fish are migrating.

Issue:

The Biological Opinion designates 20-foot withdrawals of water from Libby and Hungry Horse Reservoirs to contribute to meeting Biological Opinion flows for listed juvenile migrants during the summer months. The reservoirs are to be 20 feet from full on August 31 of each year. The objective of the Salmon Managers is to meet salmon flows (200 Kcfs at McNary Dam) as often as possible. The natural flow in the lower Columbia River typically decreases through the summer months. In order to try and maintain August flows as high as possible, the Salmon Managers prefer drafting of the upriver reservoirs during August. This leads to outflow from Libby Dam that is high during the spring for the sturgeon pulse, decreases substantially in July and increases again during August. This operation is referred to as the double peak.

Brian Marotz of Montana Fish Wildlife and Parks gave a presentation to the Technical Management Team in November 2004. Brian analyzed five different flow scenarios and presented model results for primary and secondary productivity in both the reservoir, and downstream of the reservoir in the Kootenai River. Brian's primary concern was that the double

peak operation favored by the Salmon Managers disrupted productivity in the Libby/Kootenai system. The five alternative flow regimes he considered were:

- **Alternative 1.** Flat flows of 12.5 Kcfs till Aug 31, Libby elevation of 2439 feet at the end of August.
- **Alternative 2.** Steady decreasing flow of 16 Kcfs to 6 Kcfs by Aug 31, Libby elevation of 2439 feet at the end of August.
- **Alternative 3.** Steady decreasing flow of 16 Kcfs to 6 Kcfs by Aug 31, Libby elevation of 2439 feet at the end of September.
- **Alternative 4.** Flat flow of 10 Kcfs, Libby elevation of 2439 feet at the end of September.
- **Alternative 5.** Double peak flow, Libby elevation of 2439 feet at the end of August.

The following are some key points of Brian's analysis and are derived from the information presented in Figures 1-4:

1. Under the double peak operation secondary productivity in Libby Reservoir, as well as productivity in the Kootenai River, is considerably less than optimal.
2. Primary productivity in Libby Reservoir is highest under alternatives 4 (flat flow till the end of September) and 5 (double peak), since the reservoir surface area is maintained during July. This same pattern is seen for zooplankton; however, benthic productivity is lower under these scenarios.
3. The productivity in the Kootenai River is highest under a flat flow of 12 Kcfs until the end of August and next highest under a flat flow of 10 kcfs until September 30.

In order to determine an operation of Libby Reservoir that provides benefits to both anadromous and resident fish, we plotted the operation and resulting flows at McNary Dam for both the **Montana Plan** and the **August Flow preference**, together with an alternative called the **Compromise**, for the past eleven years of operation (1995-2005). The model assumed Libby Reservoir was at the actual reservoir level that occurred on July 1 of each of the years (either full or some other elevation depending on inflow). The Montana Plan was modeled as a steady outflow from Libby Reservoir from the starting elevation to 2439 feet by September 30. The August flow preference models the preferred operation for anadromous fish and holds the reservoir full or at the starting elevation for July and drafts to 2439 feet during August. The Compromise operation sets flows flat from July 1 through August 30 and drafts the full 20 feet from Libby by August 31. Unusually high inflows to Libby Dam in September of 2004 made it difficult to accurately compare the Montana Plan to the Compromise Plan. Inflows to Libby averaged 12.6 Kcfs in September of 2004, as compared to 5.2 and 4.3 Kcfs over the same periods in 2002 and 2003. In the Montana Plan scenario, had inflows been relatively normal in September, the draft of Libby over July and August would have been more gradual and the flat flow maintained July through August would have been less than seen in the modeled Montana Plan. In the modeled Compromise Plan the relatively high September inflows resulted in Libby actually refilling approximately seven feet after drafting to 2439 feet by the end of August and dropping Libby outflows to 6 Kcfs in September. Plots showing the differences in 2000 flows at

McNary under each of the model scenarios also need some explanation. The plots show no significant difference between any of the three model scenarios. In actuality, there is little difference between the scenarios. In 2000 under the MT Plan a flat flow of the bull trout minimum 6 Kcfs is maintained from July to September and in the Compromise plan a flat flow of 6.8 Kcfs is maintained July-August (while drafting to 2439 feet by the end of August) then reduced flows to the 6 Kcfs minimum in September.

The Hungry Horse outflows are assumed to have occurred as they did in each of the years. (At this point there is no information to suggest that Hungry Horse Reservoir needs to be operated differently. Should this be the case, additional model runs can be accomplished with different Hungry Horse operations). The resulting McNary Dam flows and Libby operations are shown for each year in the attached figures (Appendices 1 and 2).

In summary, under the proposed compromise operation plan most needs are benefited. Upriver productivity of the lake may not be maximum, but Kootenai River productivity is high. The Salmon Managers maintain flows during July and August that are higher than would occur under the Montana Plan, and would give up the double peaking operation for flat flows, but the water comes out by August 31. There are still two other options that can be considered. First, with the compromise operation the reservoir is drawn down the full 20 feet by August 31. However, in order to transition the flows from the salmon flows to the bull trout flows of 6 Kcfs, a transition period of 3 to 5 days into September might be considered. Second, in years where flows are projected to exceed the 200 Kcfs at McNary throughout the migration period, the consideration may be to alternate between the competing needs. For example, one year when the flows are projected to exceed 200 Kcfs, Libby and Hungry Horse may retain the 20-foot drawdown, and the next year when flows are high the benefit would go to the anadromous stocks and flows would exceed the 200 Kcfs. The next steps may be to conduct additional modeling with Montana Fish, Wildlife and Parks. If possible, the alternatives need to be modeled in the Montana productivity model under the actual conditions that occurred in 1995-2005.

Please do not hesitate to contact us if you have any questions or comments regarding the analysis. We wait to hear from you to advise us as to how you wish to proceed.

Figure 1. Libby Reservoir primary productivity.

Figure 2. Libby Reservoir Zooplankton productivity.

Figure 3. Libby Reservoir benthic productivity.

Figure 4. Kootenai River benthic biomass.

Appendix 1. McNary flows under the different operations scenarios 1995-2005.

1997

1998

1999

2000

2001

2002

2003

2004

2005

Appendix 2. Libby MT Plan and Compromise Reservoir Elevations and Outflows 1995-2005.

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MEMORANDUM

TO: FPAC
The Files

FROM: FPC Staff

DATE: October 21, 2005

RE: Timing Estimation of Juvenile Salmonid Migration at Lower Granite Dam

Recently there has been considerable discussion regarding the proportion of the juvenile fall Chinook migration that passed Lower Granite Dam prior to the court ordered spill program. Questions relative to passage timing are raised every year in discussions of fish passage protection measures. The following reiterates the discussions of the issues that have occurred at the Technical Management Team and the Implementation Team of the Federal Regional process.

The application of the fish passage data is generally discussed and invariably the cumulative passage index or the cumulative passage of a single tag group is presented as a basis to end fish protection measures. However, both of these approaches have limitations, and if used as a basis for management decisions alone can lead to a flawed decision. As we have often explained, when considering the timing of juvenile passage the following facts must be incorporated into decision-making:

- The passage index is an index and is not fully expanded for collection efficiency and does not represent a population estimate. These calculations are detailed in the metadata provided on the FPC web site.
- The passage index of the run-at-large primarily reflects the release time and passage of large upstream hatchery releases and obscures the passage of smaller groups of fish with different timing characteristics, which generally migrate in the tails of the migration.
- The timing of large hatchery releases masks the timing of smaller groups of wild/natural fish. In part this can lead to less protection for wild/natural stocks that do not have the same timing as hatchery fish if protection is only based on the timing of the run-at-large.
- The run-at-large passage index does not always reflect passage timing of specific components of a population. For instance, the Snake River fall Chinook ESU is

comprised of two specific migration timing distributions where the wild/natural Clearwater fall Chinook have a later passage timing than Snake River wild/natural fall Chinook

- The passage index is an expansion of a sample of fish passing through the powerhouse system, and is adjusted for spill using a one to one ratio. It is possible that the RSW operation and the recent summer spill are not adequately reflected in the passage index expansions.
- Mark PIT tag groups, in general cannot be used to represent the passage timing of the entire population unless a known specific proportion of the population has been marked. Present PIT tag marking of wild/natural fish is not designed to represent the population. Because PIT tags have a sampling, handling, size and timing limitation, they can represent the earliest components of a particular population. This has been shown in past years for Snake River fall Chinook PIT tag groups.

Passage Indices

The passage index of the migration run-at-large primarily reflects the passage of large groups of hatchery fish. This has been illustrated in many documents and summaries of historical passage data that can be reviewed at www.fpc.org. The passage index of the run-at-large can show an early date of passage timing of a proportion of the migration if large hatchery groups have earlier timing or if the later periods of the migration have very low survival.

PIT tag passage distribution

Each year the limitations of reliance only on passage timing as determined on the basis of wild fall Chinook PIT tag recoveries is discussed. Marking of the wild fall Chinook is limited by two factors, the first is size at time of marking and the second is availability of fish to mark. As fish grow and mature they move from near shore areas and decrease in availability to beach seining techniques used for collection. Consequently, it is difficult to determine the portion of the run that is represented by the wild PIT tagged fall Chinook. Likely, because of the accessibility of early fish the PIT tagged distribution is skewed early. This concern was presented in the earlier years of wild fish tagging, prior to the input of large groups of hatchery fish. In these years the migration timing of the PIT tagged group could be compared to the migration timing of the run at large, since the run at large was all wild fish. In these instances the PIT tag timing often predicted an earlier 95% passage date than did the run at large data. This suggests that the PIT tagged fish timing may be biased towards earlier migrating fish.

2005 Fall Chinook

Both of these issues and considerations apply to issues raised this summer in discussions of the court ordered summer spill program. There have been arguments raised regarding the timing of the summer spill program and the passage of fall Chinook juvenile migrants. These concerns were raised to our attention in Northwest River Partners and Pacific Northwest Generating Group comments regarding the FPC summer spill analysis. The comments did not actually apply to the FPC survival analysis. However, the PNGC and Northwest River partners' comments have prompted us to reiterate discussions that occurred in past years and discuss 2005 specifically in terms of passage proportions.

The status of the juvenile fall Chinook migration was also discussed on August 10, 2005 at the Technical Management Team of the Federal Regional Process. The material discussed along with the presentation slides are posted on the TMT website. During the meeting calculations of juvenile survival, composition of the passage, and timing were discussed.

We reviewed the passage data and reached the following preliminary conclusions regarding fish passage during the Biological Opinion summer migration period.

- Approximately, 40% - 60% of wild /natural Snake River origin fall Chinook passed Lower Granite during the Biological Opinion summer migration period June 20 through August 31.
- In addition, accounting for the 18-day travel time from Lower Granite to McNary dams, fish passing Lower Granite from June 2 through June 19 would have been traveling the reach between Lower Granite and would have some benefit from the summer spill.
- By June 20, only 1% of the Snake River wild/natural migrants had reached McNary Dam.
- These proportions do not include Clearwater origin wild/natural fall Chinook, which migrate later than Snake River wild/natural fall Chinook.
- Large hatchery releases occurred two to three weeks earlier than planned, which shifted the run-at-large passage distribution and the passage index earlier.

Summer spill operations began June 20 in 2005 in the Snake River. This was a significant change in operations during the subyearling Chinook migration and necessitated modifications to the expansion of both collected fish and PIT tag recaptures. The passage index does not capture the full impact of the effect of spill. Cumulative population timing plots for the run-at-large subyearling Chinook and for wild PIT-tagged subyearling Chinook from the Snake River, were developed based upon PIT tag estimates of collection efficiency at Lower Granite Dam. The population timing data presented here is corrected for the changes in collection efficiency that occurred as operations and flows changed at the dam.

Collection efficiency – In order to capture the potential range of passage proportions, two methods were used to estimate the collection efficiency based on different PIT-tag groups. The first method used a combination of PIT-tag wild, hatchery, and acclimation releases of subyearling Chinook. The method used a large pool of released fish so that daily collection efficiency estimates could be calculated over a large portion of the season. The collection efficiency was plotted against spill proportion at Lower Granite Dam (Figure 1). From that relationship, daily estimates of collection efficiency were developed for the entire migration season based on the daily spill percentage. The daily collection numbers from the Smolt Monitoring Program (SMP) sampling were expanded based on these daily estimates of collection efficiency, as were the daily PIT-tag detections of Snake River wild PIT tags. From these daily estimates plots of cumulative passage timing estimates were generated for the run-at-large and for wild PIT-tagged Snake River subyearlings.

The first method of calculating collection efficiency relied on a broad group of marks and largely represents hatchery origin or acclimation released fish, since these made up the great majority of marks. A second estimate was developed using only the wild PIT-tag marks released

in the Snake River. Because of the relatively smaller number of detections from this population, collection efficiency was only calculated for two time periods, prior to June 20 and after June 20. These estimates were then used to expand daily detections to daily PIT-tag population estimates.

The resulting cumulative passage timing curves for the run-at-large and wild PIT-tagged Snake River subyearlings in 2005 are plotted in Figure 2.

- The Snake River origin PIT-tagged wild subyearling fall Chinook showed a later timing distribution compared to the run-at-large, which was predominated by hatchery fish. The wild Snake River fish, based on PIT-tagged fish timing, reached about 50% passage on June 20 (43% to 60% based on the two different methods of estimating CE)
- Approximately 90% of the run-at-large subyearling population, comprised primarily of large hatchery releases, passed Lower Granite Dam by June 20.
- The Snake River fall Chinook ESU is defined by two very different segments of the population, Snake River wild fall Chinook and Clearwater River wild fall Chinook, the passage timing of the Clearwater fish must also be considered. The Clearwater wild fish continue to pass Lower Granite Dam at the time of this writing. As of October 5, of the 1,872 fish marked this summer, 20 have been detected at Lower Granite Dam. As was described earlier in this memo, the population that has passed Lower Granite is likely much higher than that number. There were 8 detections prior to spill beginning, 10 detections during summer spill operations and 2 since the end of August (one each in September and October).

The estimated 90% passage date for the Snake River wild/natural PIT-tags was reached between July 2 and July 5. Based on travel time to McNary Dam the Snake River wild/natural subyearling fall Chinook would have been passing through the lower Snake River through July. The median travel time from Lower Granite to McNary Dam, prior to June 20, was estimated at 17.8 days. After June 20 the median travel time was calculated at about 15.5 days, but was based on only 4 fish that were detected at both sites. The 90% passage date for the wild/natural Snake River subyearling fall Chinook at McNary Dam was July 25th. After that time, based on PIT-tag detections and mark data from SMP, the run at Lower Granite was likely predominated by wild/natural subyearling fall Chinook from the Clearwater River. The Clearwater wild/natural subyearling fall Chinook are also part of the ESU.

Figure 1. The relationship between estimated collection efficiency based on all PIT-tag detections of hatchery and wild subyearling Chinook compared to percent spill at Lower Granite Dam in 2005.

Figure 2. Estimated cumulative passage timing of run-at-large subyearling Chinook in 2005 at Lower Granite Dam compared to two estimates of timing for wild PIT-tag marks from the Snake River.

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MEMORANDUM

TO: Joan Dukes, Chairperson
Fish Passage Center Oversight Board

FROM: Michele DeHart

DATE: October 5, 2005

RE: Response to PNGC and Northwest River Partners Comments on FPC
Preliminary In-River Survival Analysis

In August you requested information regarding the passage of subyearling fall Chinook through the Snake River. We discussed concerns that the passage timing of fall Chinook had occurred in such a way that the court ordered summer spill program had not started until the majority of fish had passed the Snake River projects. In response to your questions we provided a summary analysis (memorandum dated August 16, posted at www.fpc.org) of the passage distribution and timing of the sub-yearling fall Chinook migration. In that memorandum we pointed out that the run-at-large passage timing for fall Chinook reflected the early releases of hatchery fish in late April and May. We also pointed out that PIT tag data indicated that fish collected since August 1, were of wild natural origin. On September 12, in response to several requests for preliminary estimates of in-river survival, we provided a preliminary analysis of the in-river survival of juvenile fall Chinook through September 1. Subsequently, we received a request to repeat the analysis to include all fish that had arrived at Lower Granite Dam through August 31, the end of the spill period. That preliminary analysis was distributed on September 16; the survival estimates did not change appreciably from the first analysis.

We have not received any technical comments on this analysis; however, we have seen criticism of the FPC's analyses reported by the media. These accounts are similar to two documents posted at www.pngcpower.com, which are attached. This memorandum reviews the technical arguments presented in the PNGC-posted documents, which appear to be authored by a group calling itself "Northwest River Partners." Our overall conclusion after review of the PNGC comments is that the comments are primarily directed at the court ordered spill program, rather than the FPC analysis. The FPC analysis is limited to the question of estimating in-river survival under the spill and no spill conditions which occurred in 2005. PNGC and the

Northwest River Partners (NRP) are always welcome to raise their concerns and questions directly to us.

In the following we have addressed each NRP and PNGC concern specifically:

The FPC answers only part of the scientific question of how the court ordered spill affected Snake River Fall Chinook survival.

The FPC was asked to provide a preliminary summary of summer passage for 2005 in the Snake River. The FPC stated that the analysis was preliminary seven different times in the memo. The memo stated that the final analysis would be in the FPC's annual report, which is the ordinary course of business. We recognize that adult returns will provide additional information on the effect of passage conditions provided this summer. As requested, the FPC analysis does address the comparison of juvenile in-river survival before and after the initiation of the court ordered spill program.

The FPC report focused on survival in only the Snake River, ignoring survival through the lower Columbia River.

- The FPC analysis was in response to specific requests to develop a preliminary estimate of the effect of the summer spill program. The survival estimation methodology used by the FPC, which has been peer reviewed and accepted by the region, (Burnham et al, and Cormack, Seber, Jolly), requires tag recaptures at John Day and Bonneville dams to estimate survival to McNary Dam. Survival estimates below McNary Dam are difficult to obtain because of PIT tag recapture limitations.
- The FPC analysis and survival estimates were based upon recapture of PIT tags at Bonneville and John Day dams.
- To overcome tag recapture limitations, large numbers of PIT tagged fish are needed to estimate survival of Snake River migrants through the Lower Columbia. Empirically derived estimates of survival to Bonneville Dam would require a tag recapture site below Bonneville. In 2005 there were not enough tags released or recapture sites available in the Lower Columbia to estimate survival to Bonneville or John Day dams consistent with Burnham/Cormack methodology.

The FPC report analyzes survival for only four weeks of the over ten week court ordered spill omitting roughly 65% of the program.

- The FPC analysis utilized all of the PIT tag recaptures that had occurred at John Day and Bonneville dams (recapture sites) through September 1, the fish travel time between Lower Granite and Bonneville limited the first (memo dated Sept.12) analysis to fish that passed Lower Granite Dam (release site) by July 15. The second analysis (memo dated September 16), which included fish passing Lower Granite Dam (release site) during the entire spill period through August 31, showed the same juvenile survival estimate.

The FPC report only analyzes survival of fish migrating in-river and ignores the 98% survival rate of transported fish.

- The FPC memo estimated the survival of in-river migrants that passed in spill versus those that passed without spill. The memo said nothing about adult returns.
- There is no technical or scientific basis for the 98% survival rate statement; it is an assumption with no statistical rigor. The NOAA white papers discuss this matter more fully. Moreover, delayed mortality of transported fish appears to very high.
- The FPC did not conduct a comparison between transported and in-river migrants. The effects of transportation cannot be analyzed until the adult fish return, which is not going to be for a few years. Interest was expressed regarding the in-river survival of juveniles this year. The Fish Passage Center analysis addresses that question.

The FPC report presents a broad range of uncertainty, from 44% to 103% for the actual survival rate of Fall Chinook in the Snake River.

- The FPC presents the confidence intervals and the data and the methods in the appendix so that the analysis is transparent and to avoid misrepresentation. The confidence intervals do not overlap ($\alpha = 0.1$), which means the difference in survival between spill and no spill is significant.

The great majority of salmon had already migrated past the dams in question by the time spill started.

- This comment fails to recognize that the early release of hatchery fish, determined the early passage timing of the run-at-large.
- The groups used in the FPC analysis were migrating both through the spill and no spill period (the data was attached to the memo) so the NRP and PNGC statement is incorrect relative to this analysis.
- The run-at-large timing is heavily influenced by the passage of hatchery fish and does not represent the timing of wild, natural fall Chinook.
- Timing of the court order was accounted for in the FPC analysis. The NRP and PNGC comment seems to argue that spill should have commenced earlier. This again is irrelevant to the FPC analysis which only addressed what actually happened, not what should or could have happened.

The FPC report suggests that 10% of juvenile Snake River fall Chinook experienced court ordered spill at a cost of about \$80 million. However, survival for these fish to below Bonneville Dam was not reported in the FPC report leaving overall system survival as a significant unknown.

- The FPC analysis did not address the cost of spill or the merits of the court order.
- The FPC memo does not address the run-at-large, other summer migrating runs (e.g. Hanford Reach) or any percentage of the hatchery or wild populations.

- The passage index is mathematically irrelevant to the survival rate estimates reported in FPC analysis. The passage index concerns appear to be directed to concerns about the timing of the court ordered spill in relation to the run at large at Lower Granite Dam.
- Natural/wild fish Snake River fall Chinook are listed under the ESA because their numbers are small. Because their numbers are small, this population does not appreciably affect the passage timing of the run-at-large, since the small numbers of natural origin fish are statistically overwhelmed by hatchery fish.
- The FPC did not estimate system survival (i.e. survival from Lower Granite to Bonneville Dam) because insufficient numbers of tagged fish were released and the recapture site capabilities downstream of McNary Dam are limited. The FPC estimated reach survival from Lower Granite to McNary Dam.
- The FPC has conducted a separate analysis of the passage timing based on the PIT tag recaptures. This analysis demonstrates that 40% to 60% of wild/natural Snake River fish passed Lower Granite Dam after the initiation of the spill program. This proportion does not include Clearwater River migrants which migrate later than fall Chinook of Snake River origin. Including fall Chinook of Clearwater origin in this estimate will increase the proportion of fish that migrated after spill was initiated.
- Juvenile fall Chinook travel time between Lower Granite and McNary dams averaged 18 days in 2005. This means that some portion of fish arriving at Lower Granite dam prior to June 20 when summer spill started, were migrating in the reach between Lower Granite and McNary dams and benefited from the court ordered spill program at Little Goose and Lower Monumental dams. To illustrate this point, on June 20 when court ordered spill started at the upstream projects, the percent of Snake River wild/natural PIT tagged fish which had arrived at McNary Dam was only 1%.

Conclusion

Overall, the NRP and PNGC comments primarily appear to respond to the court-ordered spill program that occurred this year. The comments do not identify technical inaccuracies in the FPC analysis of survival. The FPC's estimates of juvenile in-river survival are sound and use the estimation methodology that has been peer reviewed and accepted and employed within the Region. The data were presented with detailed and transparent descriptions of the methods and results. The FPC's analysis did not make management recommendations or attempt to resolve larger questions about the efficacy of transportation. Rather the FPC analysis provides preliminary technical insights to the effects of the court ordered spill on juvenile fall Chinook in the Snake River. We encourage both the NRP and PNGC to contact us directly when they have specific technical questions regarding an analysis that we conducted or survival estimation methodology. We are more than happy to discuss their questions at any time.

Northwest River Partners Response
Fish Passage Center Report
September 13, 2005

There are several issues with the Fish Passage Center (FPC) report that raise serious questions about its accuracy and usefulness. The FPC report is a partial and preliminary analysis that does not scientifically support its conclusions. Some shortcomings of the report are highlighted below.

- The FPC report only addresses a part of the scientific question of how the court-ordered spill affected Snake River Fall chinook survival.
 - The FPC report focused on survival in only the Snake River, ignoring survival through the lower Columbia River.
 - Survival in the lower Columbia River is typically lower due to warmer river temperatures, lower flows and increased predation.
 - The FPC report analyzes survival for only four weeks of the over ten week court-ordered spill program, omitting roughly 65% of the program.
 - The FPC report only analyzes survival of fish migrating in-river, and ignores the 98% survival rate of transported fish.
- The FPC report presents a broad range of uncertainty, from 44 to 103%, for the actual survival rate for Fall Chinook in the Snake River.
- The great majority of salmon had already migrated past the dams in question by the time spill started.
 - According to FPC data on fish passage, over 90% of Snake River fall chinook had already migrated past Lower Granite Dam by the time the court-ordered spill was implemented, this information was not disclosed in the FPC report.
 - The FPC report suggests that about 10% of juvenile Snake River Fall Chinook experienced court-ordered spill at a cost of about \$80 million. However, survival for these fish to below Bonneville Dam was not reported in the FPC report, leaving overall system survival as a significant unknown.

Northwest River Partners Statement
On
Fish Passage Center Preliminary Analysis of September 13, 2005

Recently, the Fish Passage Center (FPC) issued a preliminary analysis of in-river survival rates of Snake River fall Chinook from court-ordered spill at federal dams this summer. It must be pointed out that the FPC work is very preliminary and has not been thoroughly analyzed or peer-reviewed. The data behind the report has not been provided.

The FPC report is an incomplete look at the issue of spill and salmon survival through the hydrosystem this summer. For example, the report only looks at survival in the Snake River, ignoring the Columbia River. It does not compare in-river salmon survival to survival of transported salmon which is at the heart of the scientific debate. It also only covers the first four weeks of the spill leaving out the last ten Weeks. Survival in the late summer timeframe is typically far lower as a result of high temperatures and predation. That these late summer effects have been ignored suggests a selective use of the data.

Unfortunately, the report's results, incomplete as they are, have been provided to the press and media in the region and are being portrayed as evidence that the spill program is working. This approach does a grave disservice to the people who support and care about the protection of salmon, including Northwest River Partners members. This issue merits an approach that is thoughtful, scientifically rigorous and is based on a complete set of data and facts.

Northwest River Partners supports restoration of the region's salmon resources based on the best possible science and in ways that optimize the investment this region is making. This preliminary, incomplete report does not promote good science or objective findings and should not be taken as credible evidence to support an \$80 million spill program.

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MEMORANDUM

TO: George Waters, George Waters Consulting

FROM: Michele DeHart

DATE: September 16, 2005

RE: Snake River Summer Spill Analysis through August 31, 2005 at Lower Granite Dam

In response to your request, we conducted the summer spill survival and travel time analysis again. The original analysis included PIT- tagged fall Chinook which passed Lower Granite Dam through July 15. In response to your request we conducted the analysis again utilizing fish that had passed Lower Granite Dam through August 31, 2005--the end of the summer spill period. The detections at the downstream sites, John Day and Bonneville dams were through September 15, 2005.

- Including all of the tagged fish through August 31, the end of the spill period resulted in a slightly higher survival estimate for group 2.
- This does not change any of the conclusions of our original September 12, preliminary analysis.

We estimated survival for the group of fish passing during the spill operation from their detection at Lower Granite Dam to McNary Dam including detections through the end of August, and including subyearlings from the Clearwater River released later in the season (i.e. all tags from late Big Canyon Creek Acclimation Pond releases as well as wild Clearwater marks). This represents all the PIT-tags available that were detected at Lower Granite Dam during the period June 17 to August 31.

The results of this analysis did not differ significantly from the original survival estimates in the September 12 memorandum, (Figure 1.). The original estimate included 2664 PIT-tagged fish while the updated estimate included 2784 fish. The original estimate was reported as 0.737, with 95% CI's (0.443-1.031), while the modified group 2 (through August 31) resulted in an estimate of 0.741, with 95% CI's (0.444-1.037).

**Comparison of LGR Dam to McNary Dam Survival Estimates using
original FPC estimate and a Modified Estimate with LGR detects
through August 31 and including BCCAP and CLWR tags**

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MEMORANDUM

TO: Fish Passage Advisory Committee
Fish Passage Center Oversight Board
Ed Sheets, Consulting Services
Robert Lothrop, CRITFC
Bert Bowler, Idaho Rivers United

FROM: Michele DeHart

DATE: September 12, 2005

RE: Preliminary Survival Analysis for Subyearling Chinook originating Above LGR

The Fish Passage Center (FPC) has been providing weekly status reports of the fall Chinook migration to the Fish Passage Advisory Committee throughout the summer migration period. The Fish Passage Center Oversight Board requested a preliminary summary of the spring migration period and the summer migration period. In addition, we received individual requests for analysis of the summer migration of fall Chinook through the Snake River. We have developed the following memorandum in a combined response to all of these requests. The FPC Staff conducted this preliminary analysis of the recent data collected for subyearling Chinook originating above Lower Granite Dam in 2005. The fall Chinook migration is still continuing in the Snake River, consequently, the final analysis will be presented in the Fish Passage Center 2005 Annual Report later this year.

This was a unique year in that spill occurred throughout the summer in the Snake River as part of a court ordered spill for fish passage program. In this analysis the FPC specifically addressed the primary migration characteristic data (juvenile survival and travel time) to determine if an effect of the court ordered summer spill operations could be documented. In order to address this question the travel time and survival of juvenile subyearling Chinook that migrated prior to the initiation of the summer spill program in 2005 was compared to subyearling Chinook survival and travel time from the period after summer spill had been initiated. The 2005 migration was also analyzed compared to past years (2001 to 2004).

Our conclusions based on our preliminary analysis:

- The point estimate for subyearling Chinook survival was the highest recorded in recent years (2001-2005) in the reach from Lower Granite Dam to McNary Dam during the period when spill was occurring in the Snake River.
- And, unlike other recent years where survival either remained low throughout the summer period as in 2001 and 2002 or declined as in 2003 and 2004, the 2005 survival increased significantly later in the season.
- This analysis is preliminary. The subyearling migration in the Snake River typically continues through September and into October.
- The preliminary survival estimation is comparable to past years' because the time period of the analysis minimizes the potential of including fish that may over-winter. Over-wintering has been shown to occur mostly in late migrating fall Chinook from the Clearwater River and from groups of "backfill" late hatchery releases. (FPC Memorandum, 5/10/2005, #76-05, www.fpc.org).
- The group 2 fish in 2005 exhibited an extremely fast travel time through the Snake River. The only other year with a travel time estimate as fast was observed for the 2005 migration was group 1 in 2003. The average flow during the time period when the 2003 group 1 migrated was nearly 120 Kcfs, while the average flow in 2005 during the time when group 2 migrated was only 43 Kcfs. This again illustrates the importance of spill in determining the decreased amount of time fish take to migrate through the system when not having to experience the delay associated with passing through a hydroproject.

Methods

Survival and travel time were estimated using PIT-tagged subyearling Chinook of hatchery or wild origin that originated above Lower Granite Dam. Fish released in the Snake River and early releases from the Clearwater River, such as May or June releases from the Big Canyon Creek acclimation facility, were included in the analysis. Late releases of wild Clearwater tagged fish or late season surrogate wild tagged fish from Big Canyon Creek were not included, since these fish exhibit a much later and, therefore, different, migration than the Snake River fish. Consequently, survival and travel time analyses for these later fish will have to be conducted separately, as these fish still continue to pass Lower Granite Dam and other sites.

To estimate travel time and survival, fish detected and returned to the river at Lower Granite Dam were used in the analysis. Survival and travel time for the subyearling Chinook migrants were estimated and analyzed for two distinct time periods in 2005. Separating the migrants into two groups was done to assess survival prior to and after implementation of the court ordered summer spill program. Spill began June 20 at the Lower Snake River projects and July 1 at McNary Dam. For the pre-spill group (group 1) the date range May 20 to June 12 was chosen. Looking at PIT-tag timing at Lower Granite Dam it appeared that May 20 encompassed the beginning of the run, while June 12 was chosen to assure that many of the migrants would pass through at least part of the hydrosystem prior to spill beginning.

For the post-spill group (group 2) June 17 was chosen as the start date for grouping at Lower Granite Dam, since the PIT-tagged fish would not experience spill until reaching Little Goose Dam. Based on PIT-tag travel time, nearly all fish passing Lower Granite Dam on June 17 would not reach Little Goose Dam until June 20. Minimum travel time was nearly 3 days for the tag groups, while median travel time was 6 days. July 15 was chosen as the end date for the release groups to assure that nearly all fish in the group would pass through the hydrosystem and complete detection and travel time data would be available. It is possible that some of these fish may still be migrant or holding over in reservoirs, but it is likely that the few additional detections on these fish would not greatly change the survival and travel time estimates.

Similar groupings were created for other recent years in order to conduct a comparison among years. For the years 2001 to 2004, the tagged fish were divided into two groups; those detected from May 20 to June 16 were assigned to group 1 and those detected between June 17 to July 15 were assigned to group 2. (Since there were no abrupt operational changes in operations in the season as had occurred in 2005, the groups were not separated by 5 days as had been done for the 2005 migrants).

Average flow and spill variables were assigned based on travel time and a moving 30-day-average to represent downstream passage for each group. Flow was averaged at each downstream dam based on a moving window, offset by the median travel time for the PIT-tagged group. For example, median travel time from Lower Granite to Little Goose Dam for the early 2005 detection group (5/20 to 6/12) was estimated to be 6 days. The average flow at Little Goose Dam was calculated beginning May 26 through June 24. Similarly average flow and spill were calculated at each project downstream to McNary Dam. Data were then averaged over the four projects, including overall average total discharge, spill volume and spill percentage. Subsequent analyses may be conducted as time permits using water transit time to address the difference in scale of discharge between the two rivers. However, the percentage spill variable is not affected by the discharge difference and spill was the variable of primary interest in this analysis. Average temperature variable was calculated as the 30-day average for the temperature reading at the Lower Granite tailrace monitor, beginning on the day the group was estimated to pass Lower Granite Dam.

Results

Survival

Reach survival estimates are shown in Figure 1 for PIT-tagged subyearling Chinook detected and released at Lower Granite Dam during early summer migration period (group 1) compared to later season (group 2) for the years 2001 through 2005. There are two important trends evident in the survival data. First, the highest point estimate for survival for all years presented is for the late season 2005 (group 2) that migrated during summer spill operations. Second, in the years 2001 through 2004 the differences in survival between groups 1 and 2 was either relatively flat or slightly increasing (2001 and 2002), or lower for the later group (2003 and 2004). The differences in the trends among years may be attributable to the amount of spill that occurred in the years during the migration. For example, in 2001 and 2002, as was the case in 2005, the early group passed during periods of little or no spill at Little Goose and Lower Monumental dams. However, in 2003 and 2004, the early summer groups passed through the

Snake River during periods of late spring spill. In 2001 and 2002 survival was low for both early and late season groups, while in 2003 and 2004 there was a marked decrease in survival between the group 1 and group 2 migrants. The 2005 estimates show a different trend, with the late group showing a substantially higher survival than the early group. In 2005 there was very little spill during May and early June at Little Goose and Lower Monumental dams as well as relatively low average flows. When the court ordered summer spill began in 2005, spill increased to 70% of daily average flow at Little Goose (subsequently spill was reduced to 40% to address concerns regarding adult passage), while spill at Lower Monumental Dam fluctuated between 40% and 60% of daily average flow. At McNary Dam spill increased from roughly 10% of daily average flow in late June, to roughly 70% July 1. The addition of spill at Little Goose, Lower Monumental and McNary dams appears to have greatly improved survival of the group 2 subyearling Chinook migrants in 2005.

A scatter plot of survival and spill percentage, with second order polynomial trend line (Figure 2), shows that percent spill and survival were highly correlated ($R^2 = 0.61$). A similar plot comparing survival to average total discharge (Figure 3) showed a strong relationship between flow and survival ($R^2 = 0.35$). The late season data point for 2005 appears farthest from the trend line, showing survival much higher than what might be predicted given the low flows alone, another indication of the beneficial effects of summer spill on survival.

Travel Time

A plot of survival and travel time shows that the highest survivals occurred during the periods with the shortest travel times (Figure 4). The only other year with a travel time estimate as fast as was observed for the 2005 migration was group 1 in 2003. The average flow during the time period when the 2003 group 1 migrated was nearly 120 Kcfs, while the average flow in 2005 during the time when group 2 migrated was only 43 Kcfs. This again indicates the importance of spill in determining the decreased amount of time fish take to migrate through the system when not having to experience the delay associated with passing through a hydroproject.

Temperature

A preliminary analysis was conducted relative to temperature for the different groups among years. Temperature was not predicted to have major influence on the survival of the groups in this analysis because of the time period of passage at Lower Granite Dam (prior to July 15). However, a bivariate regression was developed to determine if the survival estimates were influenced by temperature in the same way as they were influenced by the flow and spill variables. Figure 5 shows the relation between the temperature variable and the survival estimates. As can be seen from the graph, little of the variation in survival for the groups of fish used in this analysis can be explained by the temperature variable.

* Denotes statistically significant difference between early season and late season survival estimates at $p = 0.10$ level

Figure 1. Survival of subyearling Chinook from Lower Granite Dam to McNary Dam by detection period for the years 2001 through 2005. Note that 2005 group 1 end date is actually June 12.

Figure 2. Relationship between Survival and Average Spill Percentage at Little Goose, Lower Monumental, Ice Harbor and McNary dams.

Figure 3. Survival versus Average Discharge at Little Goose, Lower Monumental, Ice Harbor and McNary dams for the years 2001 to 2005.

Figure 4. Survival versus Median Travel Time.

Figure 5. Average Temperature at Lower Granite Dam versus survival.

Appendix A

Table 1. Summary of Survival, Flow, Spill and Temperature data used in analysis for years 2001 to 2005.

Migr year	LGR Dates	Group	Site	Median Travel Time LGR ^a to	Begin Date for flow Parameter	30d Avg Total Q	30d Avg Total Spill	30d Avg Spill Percent	30d Avg Temp at LGR	LGR to MCN Survival Estimate (95% CI)
2005	5/20 to 6/12	1	lgs	6.1	05/26/05	64.7	5.9	0.12	12.9	0.448 (0.403-0.492)
2005	5/20 to 6/12	1	lmn	10.6	05/30/05	60.0	6.7	0.14		
2005	5/20 to 6/12	1	ihr	15.1	06/04/05	54.0	33.7	0.63		
2005	5/20 to 6/12	1	mcn	19.6	06/08/05	191.4	74.9	0.39		
2005	6/17 to 7/15	2	lgs	5.1	06/22/05	42.6	20.9	0.48	18.3	0.737 (0.443-1.031)
2005	6/17 to 7/15	2	lmn	7.3	06/24/05	40.2	21.0	0.53		
2005	6/17 to 7/15	2	ihr	9.5	06/26/05	39.0	23.4	0.60		
2005	6/17 to 7/15	2	mcn	11.6	06/28/05	186.9	120.5	0.64		
2004	5/20 to 6/16	1	lgs	3.6	05/23/04	89.8	1.6	0.01	12.5	0.700 (0.6-0.8)
2004	5/20 to 6/16	1	lmn	7.7	05/27/04	89.6	3.5	0.03		
2004	5/20 to 6/16	1	ihr	11.8	05/31/04	80.1	52.2	0.68		
2004	5/20 to 6/16	1	mcn	15.9	06/04/04	210.6	53.0	0.23		
2004	6/17 to 7/15	2	lgs	4.7	06/21/04	40.7	0.0	0.00	19.3	0.512 (0.416-0.609)
2004	6/17 to 7/15	2	lmn	8.9	06/25/04	39.5	0.0	0.00		
2004	6/17 to 7/15	2	ihr	13.2	06/30/04	38.4	29.9	0.78		
2004	6/17 to 7/15	2	mcn	17.4	07/04/04	139.2	0.0	0.00		
2003	5/20 to 6/16	1	lgs	3.8	05/23/03	117.4	30.0	0.24	11.8	0.671 (0.616-0.726)
2003	5/20 to 6/16	1	lmn	6.4	05/26/03	113.4	28.7	0.24		
2003	5/20 to 6/16	1	ihr	9.0	05/29/03	106.0	58.6	0.55		
2003	5/20 to 6/16	1	mcn	11.6	05/31/03	250.4	79.1	0.29		
2003	6/17 to 7/15	2	lgs	4.9	06/21/03	39.2	0.0	0.00	18.4	0.420 (0.384-0.456)
2003	6/17 to 7/15	2	lmn	9.1	06/26/03	36.6	0.0	0.00		
2003	6/17 to 7/15	2	ihr	13.2	06/30/03	33.3	13.5	0.41		
2003	6/17 to 7/15	2	mcn	17.3	07/04/03	142.3	0.0	0.00		
2002	5/20 to 6/16	1	lgs	9.2	05/29/02	94.7	21.3	0.21	11.5	0.400 (0.359-0.442)
2002	5/20 to 6/16	1	lmn	17.7	06/06/02	81.4	0.0	0.00		
2002	5/20 to 6/16	1	ihr	26.1	06/15/02	70.1	51.7	0.75		
2002	5/20 to 6/16	1	mcn	34.5	06/23/02	268.7	98.5	0.35		
2002	6/17 to 7/15	2	lgs	5.2	06/22/02	53.9	8.4	0.16	16.4	0.499 (0.429-0.569)
2002	6/17 to 7/15	2	lmn	8.8	06/25/02	49.8	0.0	0.00		
2002	6/17 to 7/15	2	ihr	12.3	06/29/02	45.2	36.0	0.80		
2002	6/17 to 7/15	2	mcn	15.9	07/02/02	227.8	62.4	0.25		
2001	5/20 to 6/16	1	lgs	24.4	06/13/01	29.3	0.0	0.00	13.8	0.235 (0.179-0.291)
2001	5/20 to 6/16	1	lmn	29.9	06/18/01	28.2	0.0	0.00		
2001	5/20 to 6/16	1	ihr	35.5	06/24/01	26.6	0.0	0.00		
2001	5/20 to 6/16	1	mcn	41.0	06/29/01	89.0	0.0	0.00		
2001	6/17 to 7/15	2	lgs	7.3	06/24/01	26.5	0.0	0.00	18.2	0.289 (0.235-0.343)
2001	6/17 to 7/15	2	lmn	10.9	06/27/01	27.9	0.0	0.00		
2001	6/17 to 7/15	2	ihr	14.6	07/01/01	27.2	0.0	0.00		
2001	6/17 to 7/15	2	mcn	18.3	07/05/01	81.4	0.0	0.00		

^a Travel times to Little Goose and McNary Dam were calculated, while those for LMN and IHR were interpolated between those values.

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MEMORANDUM

TO: Michele DeHart

FROM: Jerry McCann

DATE: August 16, 2005

RE: Origin (Hatchery or Wild) of run-at-large at LGR in August

In response to your request, we reviewed the composition and passage distribution of the fall chinook in the Snake River.

We looked at two main sources of information to determine whether the remaining unmarked subyearling chinook passing Lower Granite Dam are hatchery or wild in origin. First, we looked at PIT-tag timing data which shows the various groups of fish that have passed and are currently passing the project and the areas where they were released. Second, we compared the proportion of adipose-clipped fish versus unclipped fish in the sample, this month compared to the season as a whole.

- The available data suggest that nearly all the fish collected at Lower Granite since August 1 were of wild origin.
- Analysis of the cumulative timing curve for the run-at-large shows that it reflects the passage timing of large hatchery releases made from late April to the end of May.

In August, a total of 1,976 subyearling chinook have been sampled at the site, of those sampled, only 10 were fin-clipped, whereas over 60% of all hatchery releases above Lower Granite Dam of subyearling chinook were adipose clipped. At the same time, of PIT-tagged fish passing the project only 1 PIT-tag detected this month was from a production release of hatchery fish, and all fish in that release were adipose clipped. Based on these data we concluded that well over 90% of the subyearling chinook collected at the dam are wild origin.

Hatchery subyearling Chinook PIT-tag timing information

PIT-tag timing at Lower Granite Dam of hatchery subyearling Chinook that were released in 2005 are summarized in Figure 1. Based on PIT-tag timing all hatchery PIT-tag groups passed prior to mid- June. The hatchery release group detection timing depicted in Figure 1 were grouped into three geographic areas, the Snake River, Clearwater River and Oxbow Hatchery. The Oxbow release was shown separately because those fish show a different, even earlier passage timing than the acclimation releases at Captain John's Rapid and Pittsburg Landing lower in the Snake River. All but of few of these hatchery released PIT-tag detections at Lower Granite Dam occurred prior to by July 1. Two large research releases of PIT-tagged hatchery fish were not included. A release of 121,000 PIT-tags in the Snake River and a release of nearly 46,000 in the Clearwater river at Big Canyon Creek were released as part of a transportation study. These releases do not represent hatchery fish timing and do not represent a large portion of the unmarked population passing the project in August.

Figure 1. PIT-tagged hatchery subyearling fall Chinook detections at Lower Granite Dam 2005 grouped by geographic area of release. Plot includes all tag groups that represent production hatchery releases (i.e. excluding research PIT-tag releases).

Looking just at PIT-tag passage in August, there have been detections from 5 different releases of fish Table 1. The largest number of detections this month are from research releases in the Clearwater River of hatchery origin fish (BCCAP – DMM) with 63 observations. These fish are part of a research release and as such all but a few were marked with PIT-tags and do not contribute significantly to the unmarked population passing Lower Granite Dam. It is likely that

detections from this release will continue through the end of the season. The second largest number of detections are for another research release group (SNAKE3 – DMM) of which 5 have been detected this month. The one production hatchery release detection (SNAKER – MLS) is from a release that was 100% adipose clipped and so would not represent unmarked fish passing at this time. The other detections represent wild unmarked fish from the Snake River and Clearwater River passing the project at this time.

Table 1. Numbers of PIT-tag detections at Lower Granite Dam in August grouped by PIT-tag release river and rearing disposition.

Release site/ Rearing type	PTAGIS Release Site Code and Coordinator ID	Number of Detections in August at LGR
Snake River/ Wild	(SNAKE3 and SNAKE4) – WPC	2
Snake River/ Research - Hatchery	SNAKE3 – DMM	5
Snake River/ Production - Hatchery	SNAKER - MLS	1
Clearwater River/ Wild	CLWR - BDA	1
Clearwater River/ Research - Hatchery	BCCAP - DMM	63

Sampling Data

Information from hatchery release data shows the proportion of hatchery subyearling chinook released above Lower Granite Dam that were fin clipped or unclipped in 2005 (Table 2). From these data it is apparent that a large portion of hatchery fish were released with external marks. Some unclipped hatchery releases also had coded wire tags, however those tags were not summarized in this analysis but also would lead to similar conclusions. For example, for the week August 5 to 11, of the 1,123 unclipped subyearling collected, only 1 coded wire tagged fish was detected.

Table 2. The number of hatchery released subyearling chinook

Release River	Number with adipose clip	Number with no fin clips	Percent fin-clipped	Total
Clearwater	717,226	1,109,220	0.39	1,826,446
Grande Ronde	200,000	282,460	0.41	482,460
Snake River	1,892,272	355,030	0.84	2,247,302
Total	2,809,498	1,746,710	0.61	4,556,208

Given the high proportion of clipped fish in the hatchery releases, it would be expected that if a large portion of fish passing Lower Granite Dam were of hatchery origin that would be reflected in the marked proportion. However, as can be seen from Table 3 below, there were very few clipped fish detected in August at the project.

Table 3. Number of subyearling chinook collected at Lower Granite Dam and proportion with clipped adipose fins prior to and after August 1.

Time period when at LGR	Clipped	Unclipped	Percent clipped
Prior to August 1	692,562	879,409	0.44
August	10	1,966	0.01

Assuming the overall proportion of hatchery fish passing the project reflects the ratio of marked to unmarked hatchery fish then we would expect roughly 60% of hatchery fish collected at Lower Granite would be marked. Expanding for that 40% of the hatchery release population that would be unclipped yielded an estimated 1% of fish passing Lower Granite Dam in August were of hatchery origin (Table 4).

Table 4. Estimated number of Total Subyearling Chinook collected at Lower Granite Dam that were hatchery or wild based on marked proportion in SMP samples.

Time period when at LGR	Estimated Hatchery Origin	Estimated Wild Origin	Percent Hatchery
Prior to August 1	1,154,270	417,701	73%
August	17	1,959	< 1%

Based on PIT-tag timing, proportion hatchery marks as well as the numbers of marked versus unmarked fish, it appears that nearly all fish passing the project at this time are wild origin.

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MEMORANDUM

TO: FPAC
Michele DeHart
FROM: Michele DeHart
DATE: August 8, 2005
RE: Update of Adult Passage in the Snake River

At your request the Fish Passage Center provided a July 7, 2005 and a July 28, 2005 memo to you describing the adult passage conditions this year. This is an update of those memos.

Coincident with the initiation of spill on June 20, it was observed that the adult counts declined at Little Goose Dam. The situation was immediately addressed by changing spill patterns and by reducing daytime spill percentages. Spill patterns were changed on the weekend following the initiation of spill on June 20th. When the adult passage did not improve, efforts were undertaken to reduce the spill volume relative to the amount of water passing through the powerhouse in order to draw more adults to the fishway entrances. Spill was reduced to 50% of total river flow during daytime hours on June 28, and then when adult passage numbers did not increase, spill was further reduced to 30% of river flow during daytime hours on June 30. Adult fish counts at Little Goose Dam responded and exceeded 1500 fish for the day. Adult passage appears to have proceeded without problems, except for July 5 when the adult count decreased to 57 fish. This appeared to be due to a delayed operational change from the nighttime to the daytime spill pattern at the project. The FPC concluded in the original memo that “, the delay in passage at Little Goose Dam due to the high volume of spill at that project relative to river flow appears to have been addressed by the reduction of daytime spill at that project to 30% of total flow. In addition, given the variability in traditional counts among years and the PIT tagged fish conversion percentages observed, there does not at this time appear to be an issue with delay or with survival of adult fish this year when the data are compared to past years.”

In the original memo the FPC used two sources of information to review adult passage in the Snake River, 1) the traditional adult counts for which there is a long time

series of data, and 2) the more recent adult PIT tag detections that are available since the installation of the adult PIT tag detector at Ice Harbor Dam in 2003.

Traditional Adult Counts

Traditional adult counts are made visually at all the Snake River Projects. Counts are provided via the US Army Corps of Engineer's web page. Table 1 presents the conversion percentages (percentage of fish from the downstream dam passing the upstream dam) between the Snake River projects for 2005 to-date and compares those percentages to past years. As can be observed from the table there is a considerable variation in conversion percentages among years for any of the projects using traditional counts. From these data it appears that the conversion percentage observed thus far in 2005 is not different from what has been observed from the past five years when summer spill did not occur at the projects.

Table 1. 2000 to 2004 Adult Chinook Passage at Snake River Dams using Traditional Summer Chinook Count Dates. Traditional counting dates for summer chinook begin on 6/12 at Ice Harbor, 6/14 at Lower Monumental, 6/16 at Little Goose and 6/18 at Lower Granite. The 2005 Count data is from traditional start date to August 7, 2005. (%) = Number of fish counted at downstream dam and passing next upstream dam.

Dams	2005	2004	2003	2002	2001	2000
Ice Harbor	8,771	13,173	20,742	26,607	15,270	4,241
Lower Monumental	8,274 (94.3%)	10,593 (80.4%)	18,718 (90.2%)	23,744 (89.2%)	19,287 (126.3%)	4,680 (110.4%)
Little Goose	6,885 (83.2%)	9,304 (87.8%)	14,340 (76.6%)	20,854 (87.8%)	15,929 (82.6%)	4,160 (88.9%)
Lower Granite	6,666 (96.8%)	8,767 (94.2%)	16,422 (114.5%)	22,159 (106.3%)	13,735 (86.2%)	3,939 (94.7%)

PIT Tagged Fish Data

There is a two-year record for the conversion percentage for PIT tagged fish between Ice Harbor and Lower Granite Dam. The data set used was fish that were detected at Ice Harbor Dam and subsequently detected at Lower Granite Dam. Fish that were detected at Ice Harbor, but were bound for the Yakima River were removed from the data set as well as those bound for the Tucannon River. In addition, fish that were tagged at Ice Harbor Dam were removed so as not to include handling and tagging effects. In 2003 the conversion percentage was 94.05% and in 2004 the conversion percentage was 93.14%.

A few more adults have been detected since the last update in the later groups (see table). The 2005 conversion percentage to Lower Granite Dam thus far of all PIT tagged fish that were detected at Ice Harbor Dam between 6/15/2005 and 7/1/2005 remains at 92.53%.

In addition to the overall conversion percentage we also looked at the conversion percentages for the detections at Ice Harbor Dam grouped on a daily basis. Here the sample sizes are very small (1 to 19 fish) and consequently one missing fish can cause the percentage to be small, but it appears overall from the data that the daily conversions percentages are

similar to what was observed for the 2003 and 2004 data. Again, these data are preliminary and the percentages are expected to increase as more fish are expected to pass Lower Granite Dam from these groups.

In summary, the updated information suggests that the conclusions reached in the previous memos remain valid.

Table 3. Percent of fish detected at Lower Granite Dam of daily group originating at Ice Harbor Dam and the available historic data for the same time period.

Date	Daily Detection at Ice Harbor	Number Detected at Lower Granite	% Conversion
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6/21/2005	10	6	60.00%
6/22/2005	8	8	100.00%
6/23/2005	13	12	92.31%
6/24/2005	12	12	100.00%
6/25/2005	5	5	100.00%
6/26/2005	6	6	100.00%
6/27/2005	1	1	100.00%
6/28/2005	18	17	94.44%
6/29/2005	10	10	100.00%
6/30/2005	6	3	50.00%
7/1/2005	4	3	75.00%
7/2/2005	5	5	100.00%
7/3/2005	4	4	100.00%
7/4/2005	4	3	75.00%
7/5/2005	2	2	100.00%
7/6/2005	9	8	88.89%
7/7/2005	5	3	60.00%
7/8/2005	4	4	100.00%
7/9/2005	4	4	100.00%
7/10/2005	1	1	100.00%
7/11/2005	0	0	0.00%
7/12/2005	3	2	66.67%
7/13/2005	0	0	0.00%
7/14/2005	0	0	0.00%
7/15/2005	0	0	0.00%
Total through 7/1	174	161	92.53%
Total through 7/7	203	186	91.63%
Total through 7/15	215	197	91.63%
6/15-7/15 2004	277	264	95.31%
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MEMORANDUM

TO: Fish Passage Advisory Committee
Bill Tweit, WDFW

FROM: Michele DeHart

DATE: August 1, 2005

RE: Juvenile passage update

In response to your requests we have again updated the juvenile passage data for wild fall Chinook in the Snake River. The following juvenile passage data is updated through July 31, 2005. We plan on continuing to update this data throughout the migration. This is our second update of the data (the first update was July 29). There are two distinct populations of listed wild fall Chinook in the summer migration through the lower Snake River. Those are the wild Snake River component and the wild Clearwater River component. Both of these stocks are ESA listed. The following update only addresses wild stocks and does not address hatchery stocks. Hatchery managers, anticipating poor outmigration conditions, released production groups two to three weeks earlier than planned. The hatchery portion of the population is large compared to wild production and so often defines and skews the passage distribution and timing of the population as a whole. The passage timing and duration of wild stocks is not apparent from review of the passage-at-large information. For that reason our review relies on wild PIT tagged fall Chinook detections. We discuss the detailed calculations and assumptions in the following discussion. The following points summarize the status of the wild migration to date.

- The Snake River and Clearwater River populations of wild fall Chinook are exhibiting different passage distributions. This is consistent with past years' data where Clearwater fall Chinook traditionally out-migrate later and are present throughout August.
- The recovery of Snake River wild PIT tagged fish at Lower Granite Dam remains at 30% to 54% using three methods to estimate the number of tags that passed in spill. This is within the range of expected recovery. While small numbers of this population will continue to pass at Lower Granite Dam, the majority of this segment of the population is past Lower Granite Dam and migrating through the

Snake River. It is important to note that these fish migrate slower in the upper portion of the Snake River than in the lower portions. These Snake River fish continue to have a travel time of 10 days from lower Granite to Little Goose dams, and an average of 18 day travel time from Lower Granite to McNary Dam as well as an average travel time of 25 days from Lower Granite to Bonneville Dam.

- The recovery of PIT tagged Clearwater wild fall Chinook passage remained between 3% to 5% using all three estimation methods. The average travel time for Clearwater fall Chinook from Lower Granite to Little Goose is 6 days.
- Snake River wild fall Chinook PIT tags have been consistently detected at sites downstream from Lower Granite. At Little Goose Snake River wild fall Chinooks have been detected throughout July. The first detection of Clearwater wild fall Chinook occurred at Little Goose on July 18. In the past week additional Clearwater wild fall Chinook tags have been detected at Little Goose. In the past week Clearwater wild fall Chinook detections have increased consistently at Lower Granite Dam.
- Snake River fall Chinook have been detected at McNary consistently throughout July.
- Clearwater fall Chinook are migrating downstream. In past years there has been a variable proportion of Clearwater fall Chinook that over winter in various places in the system. A proportion of Clearwater fall Chinook out-migrate as subyearlings. Since over wintering may occur at locations downstream of Lower Granite, both subyearling migrants and potential over wintering migrants benefit from the present spill for fish passage by avoiding turbine passage.
- PIT tag recaptures indicate that the migration of Snake River fall Chinook is continuing through the Snake River and that the downstream migration of Clearwater wild fall Chinook is in the early stage.

We have been working collaboratively with William Connor at US Fish and Wildlife Service in reviewing passage of PIT tagged fall Chinook through the Snake River. Past methods for assessing the outmigration are not applicable in 2005 because spill has not occurred in previous years during the fall Chinook migration. The attached spread sheet and graphs displays three different methods for assessing the percentage of the PIT tagged wild fall Chinook from Snake River and Clearwater River origins which have passed Lower Granite Dam. The methods all expand for spill passage. The expansion marked WPC accounts for PIT tagged fish passing in spill by using a 1.2 to 1 efficiency for spill. Both FPC1 and FPC2 rely on the in-season PIT tagged fish collected at Little Goose Dam and estimates collection efficiency at Lower Granite Dam based on the relation between fish detected at Lower Granite and those that were undetected at Lower Granite. FPC1 is based on all the PIT tagged information, and FPC2 only considers the wild Snake River fall Chinook. These assumptions for estimating passage are based on Snake River fall Chinook data and are also applied to Clearwater wild fall Chinook detections.

Group	Release Site	N	n	Release Date		FL	Status
				min	max		
Hatchery Production/Supplementation Releases							
Oxbow hatchery	Snake	189,119	9,474	28-Apr	28-Apr	80	Complete
Pittsburg Landing	Snake	397,704	2,492	26-May	26-May	86	Complete
Captain John Rapids	Snake	505,087	3,499	25-May	30-May	87	Complete
Couse Creek	Snake	434,221	3,465	23-May	26-May	90	Complete
Grand Ronde	Grand Ronde	482,460	0	24-May	25-May	83	Complete
Big Canyon Creek	Clearwater	510,226	2,498	31-May	31-May	90	Complete
NPT Hatchery	Clearwater	879,309	0	07-May	07-May	78	Complete
Clearwater River Research Releases			WPC diff	1707			
Clearwater Wild	Clearwater	N/A		1,672	3-May	14-Jul	70 Complete
Clearwater Surrogates	Clearwater	45,791	45,790	22-Jun	8-Jul		Complete
Hanford Reach Marking							
	GAM		22369	31-May	29-Jun		
Updated Pct LGR Detects	srrt	Org	River	Marks	LGR Detects	Pct	
	15W	USFWS	Snake R	9302	1037	11.15%	
	13Ws	NPT	Clearwater R	1869	14	0.75%	
	13H	NOAA	Clearwater R	NA	NA		
	13H	NOAA	Snake R	121833	25425	20.87%	
Number 15Ws Passing LGR	WPC (n/.5)/(1-(S%+.2))				5033	54.11%	
including spill as of 7/27/05	FPC1 (n/0.5) then (n/0.2)				2719	29.23%	
	FPC2 (n/0.42) then (n/.09)				4357	46.84%	

	13Ws	NPT	Clearwater R		1869		
Number of CLWR 13Ws	WPC (n/.5)/(1-(S%+.2))					93	4.98%
passing LGR as of 7/27/05	FPC1 (n/0.5) then (n/0.2)					49	2.62%
	FPC2 (n/0.42) then (n/.09)					94	5.03%
Average Travel Time for 15Ws LGR-LGS as of 7/27/05				10 days			
Average Travel Time for 15Ws LGR-MCN as of 7/27/05				18 days			
Average Travel Time for 15Ws LGR-BON as of 7/27/05				25 days			
Average Travel Time for CLWR 13Ws LGR-LGS as of 7/27				6 days			

Lower Granite PIT-tag (WPC15W) timing expansion comparison (9,302 tags released, observations after 5/15)

Lower Granite PIT-tag (CLWR - 13W) timing expansion comparison (1869 tags released, observations after 5/15)

Observations at Lower Granite Dam for non-hatchery fall chinook PIT tagged and released in the Clearwater River

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MEMORANDUM

TO: FPAC

FROM: Michele DeHart

DATE: July 28, 2005

RE: Update of Adult Passage in the Snake River

At your request the Fish Passage Center provided a July 7, 2005 memo to you describing the adult passage condition this year. This is an update of that memo.

Coincident with the initiation of spill on June 20, it was observed that the adult counts declined at Little Goose Dam. The situation was immediately addressed by changing spill patterns and by reducing daytime spill percentages. Spill patterns were changed on the weekend following the initiation of spill on June 20th. When the adult passage did not improve, efforts were undertaken to reduce the spill volume relative to the amount of water passing through the powerhouse in order to draw more adults to the fishway entrances. Spill was reduced to 50% of total river flow during daytime hours on June 28, and then when adult passage numbers did not increase, spill was further reduced to 30% of river flow during daytime hours on June 30. Adult fish counts at Little Goose Dam responded and exceeded 1500 fish for the day. Adult passage appears to have proceeded without problems, except for July 5 when the adult count decreased to 57 fish. This appeared to be due to a delayed operational change from the nighttime to the daytime spill pattern at the project. The FPC concluded in the original memo that “, the delay in passage at Little Goose Dam due to the high volume of spill at that project relative to river flow appears to have been addressed by the reduction of daytime spill at that project to 30% of total flow. In addition, given the variability in traditional counts among years and the PIT tagged fish conversion percentages observed, there does not at this time appear to be an issue with delay or with survival of adult fish this year when the data are compared to past years.”

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The 2005 conversion percentage to Lower Granite Dam thus far of all PIT tagged fish that were detected at Ice Harbor Dam between 6/15/2005 and 7/1/2005 is 92.53%. However, keep in mind that this is a minimum conversion percentage since fish from this group may continue to be detected through the remainder of the season and given the small sample size, even one additional fish can make a difference.

In addition to the overall conversion percentage we also looked at the conversion percentages for the detections at Ice Harbor Dam grouped on a daily basis. Here the sample sizes are very small (1 to 19 fish) and consequently one missing fish can cause the percentage to be small, but it appears overall from the data that the daily conversions

percentages are similar to what was observed for the 2003 and 2004 data. Again, these data are preliminary and the percentages are expected to increase as more fish are expected to pass Lower Granite Dam from these groups.

In summary, the updated information suggests that the conclusions reached in the July 7 memo remain valid.

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MEMORANDUM

TO: Fish Passage Advisory Committee
Bill Tweit, WDFW

Michele DeHart

FROM: Michele DeHart

DATE: July 28, 2005

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Snake River. It is important to note that these fish migrate slower in the upper portion of the Snake River than in the lower portions. These Snake River fish have a travel time of 10 days from lower Granite to Little Goose dams, an average 18 day travel time from Lower Granite to McNary Dam and an average travel time of 25 days from Lower Granite to Bonneville Dam.

- The recovery of PIT tagged Clearwater wild fall Chinook passage is at 3% to 5% using all three estimation methods. The average travel time for Clearwater fall Chinook from Lower Granite to Little Goose is 6 days.
- Snake River wild fall Chinook PIT tags have been consistently detected at sites downstream from Lower Granite. At Little Goose Snake River wild fall Chinooks have been detected throughout July. The first detection of Clearwater wild fall Chinook occurred at Little Goose on July 18. In the past week additional Clearwater wild fall Chinook tags have been detected at Little Goose. In the past week Clearwater wild fall Chinook detections have increased consistently at Lower Granite Dam.
- Snake River wild PIT tagged fall Chinook continue to dominate passage at Little Goose and Lower Monumental dams. Snake River fall Chinook have been detected at McNary consistently throughout July.
- Clearwater fall Chinook are migrating downstream. In past years there has been a variable proportion of Clearwater fall Chinook that over winter in various places in the system. A proportion of Clearwater fall Chinook out-migrate as subyearlings. Since over wintering may occur at locations downstream of Lower Granite, both subyearling migrants and potential over wintering migrants benefit from the present spill for fish passage by avoiding turbine passage.
- PIT tag recaptures indicate that the migration of Snake River fall Chinook is continuing through the Snake River and that the downstream migration of Clearwater wild fall Chinook is in the early stage.

We have been working collaboratively with William Connor at US Fish and Wildlife Service in reviewing passage of PIT tagged fall Chinook through the Snake River. Past methods for assessing the outmigration are not applicable in 2005 because spill has not occurred in previous years during the fall Chinook migration. The attached spread sheet and graphs displays three different methods for assessing the percentage of the PIT tagged wild fall Chinook from Snake River and Clearwater River origins which have passed Lower Granite Dam. The methods all expand for spill passage. The expansion marked WPC accounts for PIT tagged fish passing in spill by using a 1.2 to 1 efficiency for spill. Both FPC1 and FPC2 rely on the in-season PIT tagged fish collected at Little Goose Dam and estimates collection efficiency at Lower Granite Dam based on the relation between fish detected at Lower Granite and those that were undetected at Lower Granite. FPC1 is based on all the PIT tagged information, and FPC2 only considers the wild Snake River fall Chinook. These assumptions for estimating passage are based on Snake River fall Chinook data and are also applied to Clearwater wild fall Chinook detections.

Group	Release Site	N	n	Release Date		FL	Status
				min	max		
Hatchery Production/Supplementation Releases							
Oxbow hatchery	Snake	189,119	9,474	28-Apr	28-Apr	80	Complete
Pittsburg Landing	Snake	397,704	2,492	26-May	26-May	86	Complete
Captain John Rapids	Snake	505,087	3,499	25-May	30-May	87	Complete
Couse Creek	Snake	434,221	3,465	23-May	26-May	90	Complete
Grand Ronde	Grand Ronde	482,460	0	24-May	25-May	83	Complete
Big Canyon Creek	Clearwater	510,226	2,498	31-May	31-May	90	Complete
NPT Hatchery	Clearwater	879,309	0	7-May	7-May	78	Complete
Snake River Research Releases							
Snake Wild	Snake		9,302	14-Apr	5-Jul	69	Ongoing
Snake Surrogates	Snake	121,833	121,833	16-May	27-May	75	Complete

Clearwater River Research Releases		WPC diff	1707				
Clearwater Wild	Clearwater	N/A	1,672	3-May	14-Jul	70	Complete
Clearwater Surrogates	Clearwater	45,791	45,790	22-Jun	8-Jul		Complete

Hanford Reach Marking							
	GAM		22369	31-May	29-Jun		

Updated Pct LGR Detects	srrt	Org	River	Marks	LGR Detects	Pct
	15W	USFWS	Snake R	9302	1036	11.14%
	13Ws	NPT	Clearwater R	1807	14	0.77%
	13H	NOAA	Clearwater R	NA	NA	
	13H	NOAA	Snake R	121833	25425	20.87%
Number 15Ws Passing LGR	WPC (n/.5)/(1-(S%+.2))				5023	54.00%
including spill as of 7/27/05	FPC1 (n/0.5) then (n/0.2)				2714	29.18%
	FPC2 (n/0.42) then (n/.09)				4346	46.72%
<hr/>						
	13Ws	NPT	Clearwater R	1807		
Number of CLWR 13Ws	WPC (n/.5)/(1-(S%+.2))				84	4.65%
passing LGR as of 7/27/05	FPC1 (n/0.5) then (n/0.2)				46	2.55%
	FPC2 (n/0.42) then (n/.09)				86	4.76%
Average Travel Time for 15Ws LGR-LGS as of 7/27/05				10 days		
Average Travel Time for 15Ws LGR-MCN as of 7/27/05				18 days		
Average Travel Time for 15Ws LGR-BON as of 7/27/05				25 days		
Average Travel Time for CLWR 13Ws LGR-LGS as of 7/27				6 days		

Lower Granite PIT-tag (WPC15W) timing expansion comparison (9,302 tags released)

Lower Granite PIT-tag (CLWR - 13W) timing expansion comparison (1807 tags released)

Observations at Lower Granite Dam for non-hatchery fall chinook PIT tagged and released in the Clearwater River

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MEMORANDUM

TO: Joan Dukes, Chairperson
Fish Passage Center Oversight Committee

Michele DeHart

FROM: Michele DeHart

DATE: July 18, 2005

RE: Preliminary Review of the 2005 Spring Migration

At your request the FPC staff has been working on summarizing the information collected to-date regarding the juvenile migration characteristics observed throughout the Columbia River Basin. The volume of information we are considering is large and we have not yet completed our analyses. However, at this time we are providing a preliminary update regarding the information we have analyzed thus far. The complete analysis will be presented in our 2005 Annual Report.

Migration River Conditions for Spring 2005

The runoff volume for 2005 was approximately 74% of average at The Dalles Dam and 68% of average at Lower Granite Dam. This low runoff volume associated with 2005 resulted in two significant results: first, Biological Opinion seasonal flow targets of 85 Kcfs at Lower Granite Dam, 220 Kcfs at McNary Dam and 135 at Priest Rapids Dam were not met; and secondly, since flows were predicted to be below 85 Kcfs at Lower Granite Dam, the Biological Opinion spring spill did not occur at the transportation collector projects in the Snake River. Spill at Ice Harbor Dam occurs under any conditions according to the Biological Opinion.

The Spring Flow Objective period in the Lower Snake River began on April 3rd, 2005 and ended on June 20th, 2005. In 2005, flows averaged 66.3 Kcfs at Lower Granite Dam between April 3rd and June 20th. Flow at Lower Granite was well below 50 Kcfs throughout April, however, above average precipitation in the Snake River Basin combined with increased temperatures causing runoff resulted in flows rapidly increasing in early May to near 100 Kcfs at Lower Granite Dam and peaking at 138 Kcfs on May 21, 2005. The high flows during this time period resulted in unplanned spill at the Lower Snake projects. Flows at McNary Dam averaged 195.7 Kcfs, and flows at Priest Rapids averaged 122.7 Kcfs from April 10th through June 30.

The Biological Opinion flow targets were 220 Kcfs at McNary and 135 Kcfs at Priest Rapids, respectively.

Migration Timing for Snake River Spring Chinook and Steelhead

It appears that the Spring Migration passage duration for the middle 80% of the run in the Snake River at Lower Granite Dam in 2005 was more condensed for yearling Chinook and steelhead (Table 1) as compared to past years' migrations. The 2005 spring migration in the Snake River began later, especially for yearling chinook, with the indices well behind projected totals until the last week of April. Fish appeared to be accumulating in Lower Granite Pool under the low river flows. In early May rain events and the beginning of the freshet produced higher flows and with it yearling Chinook and steelhead passage increased very quickly. The flows, while relatively low, doubled from the last week of April to the second week of May. The increase seemed to move the fish through the system and by mid-May the indices at Lower Granite quickly fell off indicating the migration was mostly ended. For steelhead the run seemed even more condensed with high passage numbers occurring mainly in the first 2 weeks of May. The 90% passage date was about 10 days earlier than had been observed in past years' migrations. The late start date and early end date was due to a combination of flow and spill conditions, as well due to the earlier than normal release of hatchery fish this year.

Table 1. Timing of Spring Migrants at Lower Granite Dam in 2005

Species	10% Passage	50% Passage	90% Passage
Yearling Chinook	4/25	5/5	5/11
Steelhead	4/27	5/9	5/19

Spring Migrant Survival – Snake River Spring Chinook and Steelhead

The migration pattern this year resulted in most fish passing Lower Granite Dam during a more confined period. Low numbers of migrants on either side of this time period resulted in few marked fish being available to use for survival estimation. Consequently, the survival estimates for 2005 come from a confined time period during which flows were higher than observed over the whole season and unplanned spill occurred in the Snake River. It can be seen from Figure 1, that for the middle period of the Spring migration (April 22 to May 15 passage dates at LGR) in 2005 spring migrants survived at levels similar to those seen the past few years in the Lower Granite to McNary Dam reach. Again, fish that passed through the Snake River during late April and early May were provided better survival conditions by providing a period of higher flows (exceeding 100 Kcfs) and unplanned spill.

Figure 1. Comparison of 2005 survivals to other recent years.

Passage indices for yearling chinook totaled 4 million while steelhead totaled 3.8 million between April 29 to May 12 at Lower Granite Dam during the peak two weeks of the migration.

Project Operation Mishaps

At Little Goose Dam, turbine unit (4) was operated with orifices shut in slot 4B resulting in several thousand juvenile salmonid mortalities. When the orifice was opened the morning of May 9, several thousand dead fish overwhelmed the separator. The COE estimated the loss at 6,000 fish mostly hatchery steelhead, but personnel at Lyons Ferry Hatchery reported many hundreds, maybe thousands, of dead yearling chinook and steelhead floating in the river downstream of the project.

At Lower Granite Dam on May 10 approximately 31,000 juvenile salmonids were diverted to a raceway designated for research tagging. Due to a closed gate in the flume that led to the raceway, the fish were stranded inside the flume, or overflowed from the flume to the ground where they died. The overall mortality exceeded 16,000 due to operation at the juvenile fish facility at Lower Granite Dam.

On April 27 a fish barge accidentally released fish in the forebay at Bonneville Dam when a valve was incorrectly positioned, and resulted in this barge discharging the fish when the

valve system was pressurized. Although near the release site, these juvenile fish were then required to either pass through the navigation lock near their ultimate release; swim back out of the old powerhouse channel to the spill section of the dam, or potentially go through the juvenile bypass systems at the old and new powerhouses.

On the morning of April 6, 2005, a total of 718 mortalities were found in the dewatering section of the fish distribution flume just upstream of the sample holding tank at the John Day Smolt monitoring facility. At the downstream end of this dewatering section there is a slide gate used to shut off inflow while positioning the crowder. After sampling on the afternoon of 5 April, this gate was inadvertently left closed. In this condition, water and fish pile up behind the gate when the sample is being collected. This is the condition the sample collection system was in from approximately 1400 hours on the 5th through 0600 hours on the 6th. This action resulted in mortality of most of the fish shunted to the sampling tank.

Hatchery Releases

Yearling Chinook, steelhead and subyearling Chinook hatchery releases were earlier than normal this year as hatchery production managers and release coordination personnel were anticipating poor migration conditions for the juvenile fish. High precipitation events in the Snake River basin in late April and through May increased stream flows and juvenile fish began migrating rapidly downstream through the river system.

Hatchery releases were again at near record levels from the State, Federal, and Tribal facilities. The latest release numbers include about 83.8 million fish released during 2005 and including some yearling Chinook and sockeye salmon released the previous summer and fall.

Hatchery Zone Release –2005
Report

	Wednesday 29-Jun-2005			Total Release
	Snake River	Mid-Columbia	Lower Columbia	
Fall Chinook	4907703	12549219	21567139	39024061
Spring Chinook	9440350	5112676	5166138	19719164
Summer Chinook	2348012	3369490		5717502
Coho	816300	1868096	5149846	7834242
Sockeye	209046	592459		801505
Summer Steelhead	8908003	1167754	533735	10609492
Winter Steelhead			115453	115453
Total	26629414	24659694	32532311	83821419

Smolt to Adult Survival Estimates

As in 2004, adult returns of spring/summer Chinook in 2005 were lower than anticipated for the Columbia River Basin. The traditional count (starting March 15) of adult spring Chinook at Bonneville Dam was near 74,000, with the newer ending date of June 15 having greater than 90,000 in the count. Overall, the adult spring Chinook were late in arriving at Bonneville Dam and as stated above, fewer arrived and were available for the upstream spawning areas. Fewer numbers of “jack” spring/summer Chinook salmon were counted than average suggesting the trend of lower trends to continue next year.

The effect of low adult returns in 2004 and 2005 is evident in the downward trend in the wild Chinook annual estimated smolt-to-adult (SAR) survival rates (indexed from Lower Granite Dam to Lower Granite Dam) since 2001. Migration year 2003, though incomplete with only 2-salt returns available, is unlikely when completed next year to achieve an estimated annual SAR any higher than the low SARs (<0.5%) estimated in the three years prior to migration year 1997. The migration year with the highest SAR of nearly 2.5% was 1999 when both good riverine flows and good ocean conditions prevailed. The lower juvenile survival estimates observed for these years as well as poorer ocean conditions appears to be contributing to the lower SAR for migration year 2003 spring/summer Chinook.

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MEMORANDUM

TO: Bill Tweit, WDFW

Michele DeHart

FROM: Michele DeHart

DATE: July 13th, 2005

RE: Projected Flow Impact of Montana SOR for Libby and Hungry Horse

In response to your request, the Fish Passage Center has estimated the potential Columbia River flow impacts if SOR 2005 MT-1 Final V2 were implemented. To estimate this impact, the most recent flow projections were utilized, which contained projected inflows, outflows, and reservoir elevations for both Libby and Hungry Horse from July 11th through September 30th, 2005. *The flow projections also assumed BiOp drafts at both Hungry Horse and Libby by the end of August.*

The following outlines the method used to estimate July 11th through September 30th average outflows under the Montana SOR. From the flow projections, the average inflow to Hungry Horse and Libby from July 11th to September 30th was calculated to be 0.9 Kcfs and 7.5 Kcfs, respectfully. The storage available between the projected elevations on July 11th (HGH: 3558.3 feet, Libby 2458.2 feet) and the 20-foot draft elevations (HGH: 3540 feet, Libby 2439 feet) were calculated using the reservoir storage tables for each Libby and Hungry Horse. The amount of storage between the July 11th projected elevation and the 20-foot draft elevation (HGH: 3558.3-3540 feet = 438.8 Kaf, Libby 2458.2-2439 feet = 854.5 Kaf) at each project was converted to a draft flow over the period from July 11th to September 30th (82 days). The draft flow represented the average daily flow over the period from July 11th to September 30th that could be expected only from the drafting of Hungry Horse and Libby to BiOp elevations by the end of September (HGH: 2.7 Kcfs, LIB: 5.3 Kcfs). To estimate the average outflows from July 11th to September 30th for each Libby and Hungry Horse that would result from the Montana SOR, the daily average inflows were simply added to the calculated draft flows at each project. The resulting estimated outflows over the July 11th to September 30th period was 12.7 Kcfs at Libby and 3.6 Kcfs at Hungry Horse. Considering all operations downstream of these projects to be identical to those assumed in projections, these flows would be the target below Libby and Hungry Horse under the Montana SOR from July 11th to September 30th.

The second stage of this analysis dealt with comparing Columbia River flows from the projected BiOp operation with estimated flows from the Montana SOR operation. Monthly projected BiOp outflows were averaged at Hungry Horse and Libby, again these flows represented BiOp operations as drafts were to 20-feet by the end of August. The following table summarizes the differences in the projected BiOp flows and the Montana SOR over July, August and September at both Hungry Horse and Libby.

	Projected BiOp Average Flows (Kcfs)	Estimated Flows With MT SOR (Kcfs)	Difference Projected BiOp – MT SOR (Kcfs)
Hungry Horse July 11-31	5.2	3.6	1.6
Hungry Horse August 1-31	5.2	3.6	1.6
Hungry Horse September 1-30	2.0	3.6	-1.6
Libby July 11-31	18.5	12.7	5.8
Libby August 1-31	16.8	12.7	4.1
Libby September 1-30	7.5	12.7	-5.2

*Reflects BIOP 20-foot end of August drafts

Using the above table, the combined (Libby and Hungry) flow impacts of the Montana SOR (relative to the BiOp) were computed to be a 7.3 Kcfs decrease in flows in July, a 5.6 Kcfs decrease in flows in August, and a 6.8 Kcfs increase in flows in September. The following table displays projected BiOp flows at McNary over July, August and September along with the estimated flows at McNary under the Montana SOR.

	McNary Average Flows under Projected BiOp Operation (Kcfs)	Estimated McNary Average Flows With MT SOR (Kcfs)	Difference Projected BiOp – MT SOR (Kcfs)
July 11-31	173.8	166.5	7.3
August 1-31	145.5	139.9	5.6
September 1-30	106.7	113.5	-6.8

Conclusions:

- The implementation of the Montana SOR is estimated to decrease flows in the Columbia River by and average of 7.3 Kcfs in July, 5.6 Kcfs average in August and increase flow in September by an average of 6.8 Kcfs, relative to the BiOp operation.
- The combined estimated volume loss in water in the Columbia River over July and August (BiOp summer flow period) is approximately 648 Kaf.
- According to the latest flow projections the end of August BiOp elevation will be reached at Libby by providing an average outflow of 17.5 Kcfs between July 11th

and August 31st, this discharge is within the 13-18 Kcfs range identified as suitable.

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MEMORANDUM

TO: Joan Dukes, Fish Passage Center Oversight Board

FROM: Michele DeHart, FPC

DATE: June 22, 2005

RE: Senate appropriations Report Language

In response to your request we have developed the attached list of tasks that are conducted by the Fish Passage Center and the tasks that are accomplished by DART. These tasks were taken from the statements of work submitted to the Bonneville Power Administration Pisces system.

The Senate Appropriations Report language makes three inferences; One that the FPC data has accuracy issues; 2) that Universities (DART) can carry out the tasks presently carried out by FPC; and 3) DART can do the same tasks for less costs. None of these inferences are valid.

The FPC data base has been audited by an independent auditing firm and no problems with accuracy were reported. All FPC analyses are all available for review by the public. The ISRP has reviewed the FPC and DART and other data systems (May 11, 2000 report) and concluded that these systems did not duplicate each other. A review of work statement tasks show that DART and FPC are not doing the same things.

Review of this list clearly identifies DART as a second tier data system which primarily collects data from other databases and displays the data in various ways. The FPC system is a first tier data system which collects data from the field and presents it in raw form for access by other data systems such as DART and Streamnet. The FPC in contrast to DART primarily provides technical support to the agencies and tribes through data compilations and analyses. The FPC staff has extensive practical and analytical expertise in fish passage management and analysis, computer programming for fish passage analysis, hydrology and reservoir operations expertise, fish physiology and adult and juvenile facility expertise that is not present at DART. The FPC participates in the NOAA regional forum as technical advisors to the state, tribal and federal fishery

agencies. DART can not fill the role that FPC is filling. In addition DART is housed at Columbia Basin Research Offices in Seattle which is part of the UW School of Fisheries just as the Fish Passage Center is part of the Pacific States Marine Fisheries Commission. The UW is filling the administrative role that Pacific States Marine Fisheries Commission is filling for FPC. However the UW charges a 26% indirect rate and PSMFC charges a 15% indirect rate. It is doubtful that the same products and services provided by the FPC can be provided at less cost by the UW.

The most serious concern is that the FPC plays a critical role in supporting the fishery agencies and tribes role in day-to-day fish passage management and interaction with the federal hydrosystem operators and regulators and the implementation of the Smolt Monitoring and Comparative Survival studies which inform the regions fish passage management and mitigation decisions. Eliminating funding for the FPC will collapse the regional structure for the federal, state and tribal role in fish passage management.

Fish Passage Center – DART - FACT SHEET

FPC began operation in 1984 as the Water Budget Center, through regional agreement of the Columbia Basin Treaty tribes, the state and federal fish and wildlife agencies and established as a measure in the Northwest Power Planning and Conservation Council.

The FPC carries out the following tasks which are determined by the NPCC Fish and Wildlife Program and which apply directly to the NOAA Biological Opinion(s) measures. These tasks are outlined in our statement of work.

- **Provide technical support to Oregon Department of Fish and Wildlife, Washington Department of Fish and Game, Idaho Department of Fish and Wildlife, NOAA Fisheries, US Fish and Wildlife Service, Montana Fish Wildlife and Parks, the Columbia River Inter-tribal Fish Commission and their member tribes and the thirteen Columbia Basin tribes. Provide technical assistance and data to the public at large.**
 - The FPC provides direct technical analysis, review of research results and proposals, data analysis relative to specific hypothesis as directed by the state, federal and tribal fishery agencies. These are included on our web site and provided to the region. Some examples of analysis that were recently requested by the agencies and tribes and posted as memos on our web site are: *“Analysis of Fall Chinook Overwintering”*, *“Review of flow conditions experienced by the 2001-2005 spring migration”*, *“Calculation of water travel times”*, *“Estimated proportions of Snake River yearling migrants transported”*.
 - The FPC reviews and participates in the development of research proposals regarding adult and juvenile fish passage and provides comments to the agencies and tribes and the US Army Corps of Engineers in their Anadromous Fish Evaluation Program (AFEP).
 - Since the beginning of the year the FPC has provided 57 different data analyses and compilations for various agencies, tribes, private individuals, and organizations. This includes a wide scope ranging from individual fishing guides, to NOAA Fisheries and the Bonneville Power Administration.
- **The FPC designs and implements the Annual Smolt Monitoring Program which is a measure in the NOAA Biological Opinion**
 - The FPC develops, and coordinates the review and implementation of the Smolt Monitoring Program with the state, federal and tribal fishery agencies through the Fish Passage Advisory Committee.
 - The FPC prepares the final budget, and work statement for the regional Smolt Monitoring Program.
 - The FPC applies for the ESA Section 10 permit for the SMP and completes all of the required reporting for the section 10 permit.
 - The FPC completes the consolidated final report for the Smolt Monitoring Program.
 - The FPC staff writes the software programs for remote data entry from each of the FPC sites.
 - The FPC staff provides software, hardware and network support for the individual SMP remote sampling sites.

- **The FPC develops and implements the dissolved gas bubble trauma monitoring program.**
 - The FPC provides technical training for gas bubble trauma monitoring components of the SMP.
 - The FPC stores and maintains dissolved gas trauma monitoring data.
 - The FPC analyses, summarizes and reports gas bubble trauma data and writes the annual report for NOAA and the US Army Corps of engineers report to Oregon Department of Environmental Quality.
- **The FPC manages the Fish Facility Inspection Program**
 - The FPC trains fish facility inspectors, oversees monthly inspection schedules, summarizes inspection reports and writes an annual inspections report.
 - FPC advises the COE of any problems with operations of juvenile or adult facilities following inspections and discusses resolution with the project operators.
- **The FPC develops the design and analysis of the Comparative Survival Study**
 - The FPC develops the design and analysis of the CSS under the Comparative Survival Study Oversight Committee.
 - The FPC coordinates marking and tagging logistics including meeting PITAGIS system requirements for acquiring and using PIT tags.
 - FPC completes CSS data summaries, tables and analyses and draft report for review by the CSS Oversight Committee.
 - The FPC staff writes the programs necessary to conduct the smolt to adult return rates analysis including the calculation of confidence intervals on all parameters.
- **The FPC advises the state, federal and tribal fishery agencies of current and historic migration data, for there use in recommendations, on a daily, weekly and monthly basis to the hydro system operators and regulators regarding hydrosystem operations for fish passage, such as implementation of BIOP passage measures, spill and flow.**
 - The FPC staff provides weekly summaries of flow and spill, projected flow and spill, hatchery releases, mark recaptures, water temperature and fish passage indices by species for the Fish Passage Advisory Committee.
 - The FPC summarizes data and prepares System Operations Requests as directed by the agencies and tribes for there submittal to the operators and regulators through the federal regional process.
 - The FPC prepares data summaries and displays as requested by agencies, tribes and federal operators and regulators.
- **The FPC maintains first tier data bases to support FPC analysis, technical support and reporting requirements.**
 - The FPC maintains flow, spill, juvenile passage index, hatchery release, water temperature, adult count, mark recapture, dissolved gas, gas bubble trauma, to support FPC analyses for agencies and tribes.
 - The FPC makes all of the data bases that are used and support FPC analysis available to the public through the FPC web site.
 - All SMP data are reported to the FPC electronically on a 24 hour basis.
 - The FPC collects hatchery data weekly through personnel contacts with hatchery personnel.
 - DART and Streamnet data systems are second tier data bases which download data from the FPC first tier data everyday and display it on their page.

- The FPC web site has averaged 578,000 hits per month and over the past 18 months, over 10 million hits. The web site has had over 330,000 user sessions, 100,000 custom graphs, 40,000 custom data tables in the past 12 months.
- The top 50 web site users are USFWS, Nez Perce, USDA, Columbia Energy, BPA, USACE, Comcast Customers, CRITFC, Idaho Power Company, Microsoft MSN Customers, Hanford, State of Idaho, Associated Grocers, Qwest Customers, CTUIR, Cutthroat.net, BLM, State of Oregon, USACE, Wildoats.com, Portland Oregon Area Residents, Cutthroat.net, Grant County PUD, Micron.com, Public residents near Spokane, MPC Corp., Seattle Area Residents, Comcast customers, Cable One customers, NW Tel Customers.

DART does the following tasks – These tasks were taken directly from the DART work statement in the BPA Pisces system.

Project: Second Tier Database and World Wide Web support service

This Project accomplishes three distinct work elements with additional administrative activities. The three pertinent work elements include:

- 1) Manage/Maintain Database.**
- 2) Disseminate Raw and Summary data via DART (Data Access Real Time).**
- 3) Disseminate Raw and Summary Data - Regional Monitoring, Evaluation and Regional Services.**

- 1. Manage/Maintain Database.** The Project is responsible for maintaining and administering the INGRES database running on a SUN ultra 450 Enterprise server. The following is a partial list of tasks associated with database management and maintenance:
 - Provide, maintain and improve hardware, software and procedural systems.
 - Maintain and update database architecture.
 - Database design, tuning and development.
- 2. Disseminate Raw and Summary Data via DART.** DART is a public Internet interface that allows the user to view data that is summarized in various ways and can be used to compare current information to historic information.
 - Juvenile and adult salmonid data is collected from primary sources and loaded into database. These include data from the Fish Passage Center, US Army Corps of Engineers, Public Utility Districts, US Bureau of Reclamation, PIT Tag Database and others.
 - Data are summarized in a variety of fashions including: fish travel time, survival estimates, and release and observation summaries.
 - Data from various sources are integrated into the database to facilitate regional modeling, monitoring and evaluation efforts.
- 3. Disseminate Raw and Summary Data for Regional Monitoring, Evaluation and Data Services.** The effort will include simple posting of information on the Internet and will

attempt to integrate online information into effective monitoring and evaluation products for recovery efforts.

- **Online data analysis includes the generation of graphs and summary tables. Summary tables of fish exposure to hydrosystem conditions (temperature, dissolved gas, flow, spill and turbidity) can be generated.**
- **Generation of survival and travel time plots.**
- **Development of smolt to adult return ratios for coded wire tag information.**

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MEMORANDUM

TO: Bob Heinith, CRITFC
Michele DeHart
FROM: Michele DeHart
DATE: June 16, 2005
RE: Review of Court Ordered Spill Implementation Plan

In response to your request the FPC staff reviewed the U.S. Army Corps of Engineers Spill Implementation Plan. We offer the following comments for your consideration. Overall, the COE has successfully developed a plan that combines the court ordered summer spill program with the previously planned summer migration studies.

The summer spill program planned for 2005 is presenting a unique opportunity to explore questions regarding summer spill passage, summer RSW passage and survival of fall chinook migrants, which have not been previously possible. The court ordered spill program is a unique opportunity to collect fall chinook migration data in spill conditions which to date have not occurred and have been one of the primary information gaps in consideration of long-term mitigation options for fall chinook. The COE plan is consistent with planned Smolt Monitoring Program, and we will take actions to increase tagging on fall chinook migrants at traps and monitoring for gas bubble trauma to support the implementation of the order and the COE plan.

Water Quality

FPC staff attended the meetings of the Water Quality Team and Technical Management Team meetings in which the summer plan and court ordered spill were discussed. The Spill Implementation Plan distributed by the COE on June 16, 2005 is consistent with, and reflects, the regional discussions with respect to the definition of "station service" and the desire to meet water quality criteria. A note should be made regarding the third sentence in the first paragraph of the Summer Monitoring and Adjustment strategy section. The COE suggests that spill may be stopped at Lower Monumental for several hours, or several days if TDG is

exceeded, to allow the river to equilibrate. We are hopeful that discussions of potential alternative operations will be possible with the COE in the event that elevated gas levels occur.

The definition of “station service” was interpreted to mean the minimum generation required at a project to assure system reliability as defined by BPA (2000 Biological Opinion). In general this means the operation of one unit at the low end of the 1 % efficiency range (approximately 11.5 Kcfs at LGR, LGO, LMN and 9.5 Kcfs at IHR) at the Snake projects and 50 Kcfs at McNary Dam. At the Water Quality Team discussion of the total dissolved gas was clarified in the context of the plaintiff’s declarations, which specified that gas would not exceed the water quality waivers. Additionally, the Water Quality Agencies expressed their desire that Clean Water Act standards not be exceeded.

Given the Water Quality Team outcome, the discussion at the Technical Management Team centered on a spill program implementation that stayed within the guidance of water quality and incorporated the unit operation requirements. The COE stated that they would plan on spilling all water above the 11.5 at Lower Granite and Little Goose dams, since they believed this implementation would not exceed the gas cap. However, the COE expressed concern that the model (SYSTDG) was not predicting TDG levels below 120% at Lower Monumental Dam so they recommended an approach of initiating spill at 10 –15 Kcfs and increasing levels up to the gas cap. Spill at IHR would continue as in past years. In addition, spill will be modified as necessary to accommodate the RSW testing at LGR and IHR.

Spill Volume

In addition the FPC staff reviewed projected flows for the summer period. Although the COE plan implementation reduces the spill volume when compared to the direct court ordered spill the difference per day is small, with the largest daily difference occurring on high flow days. On most days of RSW testing at Lower Granite Dam, flows are predicted to be below 30 kcfs when the proposed RSW flow of 18 kcfs will be close to the court ordered spill operation.

Daily STP (6-14-05 STP run) flows at Lower Granite dam were utilized to quantify the difference in spill expected at Lower Granite if spill were conducted in accordance with the COE “RSW” Operation versus spilling all outflow above 11.5 Kcfs from June 20th through August 31st. For this analysis, Table 1 of the COE Summer Spill Implementation Plan was used to determine the level of RSW spill associated with each daily STP flow (spill varies depending on discharge). Also, spill above the powerhouse flow of 11.5 Kcfs was calculated by subtracting 11.5 Kcfs from each daily STP predicted discharge at Lower Granite Dam. From this analysis, it is estimated that 231 Kaf less spill would occur under the RSW Plan relative to spilling everything above 11.5 Kcfs from 6-20 to 8-31. Each day between 6-20-05 and August 31st would receive more spills if spill were everything above 11.5 Kcfs, this amount varied daily between 0.4 and 6.9 Kcfs over the specified time period. The largest deviations from the RSW Plan and spills of everything above 11.5 Kcfs occurred at higher daily flows (i.e., above 34 Kcfs).

Research

We agree with the research outlined in the implementation plan the COE has submitted. We agree with inclusion of a spill to gas cap treatment in their tests at Lower Granite and Ice

Harbor for comparison to RSW treatments. We realize that with the low flows projected for late June, the gas cap spill and RSW spill treatments will be very close in terms of volume spilled. This could have implications on how the results are interpreted, since typical summer flows would be higher than the gas cap being tested during this low flow year. We anticipate that discussions among the parties will address these questions.

In addition the document needs to clarify the language for the operations that will occur after the study is completed. We interpret the COE plan as proposed, as intending to spill according to the court order at the completion of the study, utilizing bulk spill up to the gas cap, above the one unit operation.

At McNary the parties could consider not splitting the radio-telemetry (RT) study into two operational periods to increase the precision of results, or add additional radio tags. As an alternative the COE could delay the start of the RT study until July 1. The two operations, a non-spill operation prior to July 1, combined with a spill operation thereafter would likely lead to increased variability in the data. If the COE would like to gather non-spill operation data, they could increase sample sizes to make up for those tags used during the non-spill operation. Again, we anticipate that the parties will discuss study details and analysis as implementation progresses.

The U.S. Army Corps of Engineers operational plan for implementing court ordered spill this summer should not negatively impact the ongoing NOAA subyearling fall Chinook transportation study. This is because of the type of design NOAA implemented this year. It is patterned after the approach currently being used by the Nez Perce Tribe in estimating SARs with PIT-tagged fish for the run-at-large wild Chinook populations in two tributary sub-basins. In this approach, the tagged population is split into two segments with one segment planned to represent the untagged run-at-large fish and the other segment planned to provide in-river survival estimates. When PIT-tagged fish in the segment mimicking the untagged run-at-large are collected at Lower Granite, Little Goose, Lower Monumental, or McNary dams, they are transported. If not collected at any transportation site, the PIT-tagged fish in this group will simply pass undetected through the four collector dams in the same proportion as the untagged run-at-large fish. The overall SAR from release site as smolts to Lower Granite Dam as adults based on these PIT-tagged fish will directly reflect the overall SAR of the untagged run-at-large fish. The PIT-tagged group released to provide the in-river reach survival estimates will also provide the subset of fish known to pass through bypasses at collector dams. These fish would be used in the NOAA secondary evaluations that compare the SARs of fish transported versus bypassed at Lower Granite Dam. Given that a RSW spill study was already planned for this facility, the level of spill ordered for this site should not cause much of a reduction in collected PIT-tagged fish there from what NOAA originally planned.

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MEMORANDUM

TO: Fish Passage Advisory Committee

FROM: Michele DeHart

DATE: May 10, 2005

RE: Fall Chinook Overwintering

Overview

At the April 26, 2005 FPAC conference call, the committee asked the Fish Passage Center to begin to summarize juvenile fall Chinook migration data as part of an FPAC summary of fall Chinook passage data. The following memorandum addresses a review of PIT tag data regarding the overwintering or holdover of fall Chinook. Although there have been discussions of the holdover phenomenon and various statements that have been made about smolt-to-adult return of holdover fall Chinook, there has not been an attempt to discuss the holdover phenomenon in the context of the entire fall Chinook out-migrating population. The magnitude of the overwintering phenomenon, as well as the specific components of the population that over-winter are important considerations. Some have suggested that a relatively large rate of overwintering would mean that less emphasis is needed on improving the downstream migration conditions for summer migrating juvenile fall Chinook, since the fish that survive through the summer and over-winter could take advantage of migration under spring higher flow and spill conditions. However the data collected to date do not support this conclusion. Data from scale sampling of adults suggests that under the recent management of the hydrosystem, some portion of the returning adults apparently outmigrated as yearlings. These scale data do not indicate where fish holdover in the river system, how many smolts that began their outmigration as subyearlings actually complete it as yearlings or the effect that transporting most fall chinook may have on the relative proportion that appear as adults if juveniles do not survive transportation.

Information on these uncertainties, as well as the overall magnitude of the overwintering phenomenon and possible effects of the hydrosystem on the proportion of overwintering, is necessary prior to consideration of alternative passage management scenarios for fall Chinook. We began to examine these uncertainties by summarizing the available PIT tag data on fall

Chinook. PIT tag detection data can be used to summarize the number of fish that were detected at various projects as subyearlings or yearlings. While these summaries do not conclusively estimate the absolute magnitude of the overwintering phenomenon, they may help establish the scope and general magnitude of overwintering.

This summary concentrates on the PIT-tag detections at the dams and summarizes trends in the proportion of subyearling Chinook detected in the year they were released as subyearlings and in the subsequent spring as yearlings, as well as marked fish detected only as yearlings the spring following their release.

PIT-tagged wild fall Chinook

From migration year 1994 to 2003 (excluding 1999), there have been 465 to 4,740 subyearling wild fall Chinook PIT-tagged at various locations of the mainstem Snake River between Asotin and Hells Canyon Dam by USFWS researchers. The year 1999 is excluded because the shift to new ISO PIT tags in 2000 precluded detection capabilities for tags from 1999 in year 2000 at the dams. The percentage of detections for these fish that migrated in-river (non-transported) through the hydrosystem and were detected in the following year as holdovers was 6% or less in five of these nine years examined (Figure 1), three of the nine years showed holdover rates of 10 to 15% and in one of the nine years (1994), the holdover rate was 34%. In years where the holdover rate was higher it was noted that the overall tag detection rate decreased, suggesting a **fairly substantial overwintering mortality is occurring and that this overwintering mortality must be factored in when one compares adult return of subyearling out-migrants versus adult returns of the yearling survivors detected the following year.**

In the Clearwater River, at least 350 wild subyearling Chinook were PIT tagged in seven years between 1993 and 2003. Of the fish that were detected the holdover percent for in-river migrants was 87 to 94% in three years, 21 to 51% in three years and 11% in one year (Figure 1). It is apparent that there are major differences between the migration characteristics of wild fall Chinook from the Clearwater River and mainstem Snake River.

PIT-tagged hatchery fall Chinook

Over the years from 1995 to 2003 there were large numbers of hatchery fall Chinook subyearlings PIT tagged in the mainstem Snake River near or within the acclimation ponds at Captain Johns Rapids (Rk 263) and Pittsburg Landing (Rk 346) and in the lower Clearwater River near or within the acclimation pond at Big Canyon Creek (Rk 57). The releases of the PIT-tag subyearling Chinook in the vicinity of the acclimation ponds were typically made weekly over a series of 6 weeks in most years, 1995-2003. Releases of PIT-tag fish within production are available since 2000 and have been increased in 2004 to cover additional hatchery production from the Nez Perce Hatchery on the Clearwater River. In years when the acclimation ponds made a second (back-fill) release, there was the trend toward higher percent holdovers in the later releases compared to the primary production releases (Figure 2) of PIT-tagged fish available in both releases.

The temporal release schedule for the hatchery fall Chinook subyearlings provided evidence of increased holdovers in later releases. For migration years 1995 to 2003 (1999

unavailable as stated earlier in this document), the in-river migrating (non-transported) PIT-tagged fish released early in the season through June 8 in most years (two years stratified at June 2 due to early migration timing) had less than 5% of their detections from holdover fish (Figure 3). The PIT-tagged fish released in the next 2-week interval tended to have about double the number of detections of holdover fish compared to the earlier interval. And by the last temporal interval, starting after June 17 (or June 23 in some years), there was again about a doubling or greater increase in number of detections of holdover fish. In the years through 1998, the latest temporal strata had fish groups with 7-20% of their detections as holdovers, while in the later years from 2000 to 2002 these percentages rose to 12-44% (Figure 3). There has been an overall trend toward more holdover fish detected from the later temporal releases of PIT-tagged fish over the years.

The size at release of the subyearling fall chinook may also be influencing the holdover rate. In 2003, the PIT-tagged fish released with the NPT Hatchery production fish in the later (back-fill) release were smaller (median length 83 mm) compared to the earlier main production release (median length 105 mm). Likewise, the NOAA transportation study subyearling hatchery fall Chinook were specifically reared to be smaller, since NOAA believed this would mimic wild fall Chinook. Although these NOAA study fish had very few holdovers from the 2003 outmigration, the occurrence of holdovers from in-river migrating NOAA study fish in 2001 (overall few numbers since most were transported) and 2002 was much higher (at 29 and 20%, respectively) than occurred for other hatchery fish being released at a similar time period (mostly less than 5%).

Unlike their wild fall Chinook counterparts, the hatchery fall Chinook subyearlings from the releases in the Clearwater River had percentages of detected fish seen as yearlings that were similar to that of the hatchery fall Chinook subyearlings from the mainstem Snake River. This result was unexpected since the migration timing observed at Lower Granite Dam of the Clearwater River releases tend to extend later into the summer season than does the timing of the mainstem Snake River releases.

Summary

In summary, this review revealed patterns in the PIT-tag detection data that begin to address some of the uncertainties surrounding the holdover phenomenon for fall chinook. There are indications that this phenomenon may largely be the result of human activities, the hatchery program and hydrosystem operations. In addition, it became apparent that recent broad statements regarding the “advantages” of the holdover migration may be inaccurate. Our review indicates that:

- The smolt-to-adult returns that have been discussed for holdover fish are inaccurate because they are not based on the number of subyearlings that remain in the hydrosystem after August 31. They are based upon passage the following spring of survivors and do not account for the summer and overwintering mortality which are likely substantial.**
- Wild fall Chinook from the Clearwater River tend to have higher percentages of holdovers in their detections at the dams than do Snake River wild fall Chinook.**
- Hatchery fall Chinook that are smaller fish tend to have higher percentages of holdovers in their detections at the dams.**
- Later released (backfill) hatchery fall Chinook likewise have higher percentages of holdovers in their detections at the dams.**

Figure 1: Percent of total detections occurring as yearlings for inriver migrating PIT-tagged wild subyearling fall Chinook of Snake and Clearwater River origin

Figure 2: Percent of total detections occurring as yearlings for inriver migrating PIT-tagged hatchery subyearling fall Chinook from primary and back-fill releases at Big Canyon, Pittsburg Landing, and Captain John Rapids acclimation ponds

Figure 3: Average percent of total detections occurring as yearlings for PIT-tagged hatchery subyearling fall Chinook released temporally near acclimation ponds (Mid spans a 2-week interval starting 6/3-9 and ending 6/16-23)

APPENDIX

Tables for Memorandum on Overwintering of Subyearling Fall Chinook from Snake and Clearwater Rivers

Percent of PIT tagged fall chinok detected from total release, detected outmigrating in migration year (MY) vs holding over to the following year (H0), and percent of hold-over fall chinook with prior upstream dam detection as subyearlings (partial)

CRITERIA: rel_num ≥ 350 fish

Snake River wild fall chinook

Clearwater River wild fall chinook

mig_yr	rel_num	data	in-river	transport	mig_yr	rel_num	data	in-river	transport
					1993	366	%det/rel	13.4%	6.6%
							%det_MY	10.2%	87.5%
							%det_HO	89.8%	12.5%
							%partial/HO	0.0%	0.0%
1994	2,343	%det/rel	9.2%	5.2%	1994	696	%det/rel	2.3%	1.1%
		%det_MY	65.7%	88.6%			%det_MY	6.3%	12.5%
		%det_HO	34.3%	11.4%			%det_HO	93.8%	87.5%
		%partial/HO	5.4%	0.0%			%partial/HO	0.0%	0.0%
1995	1,374	%det/rel	43.8%	6.6%	1995	499	%det/rel	8.8%	2.4%
		%det_MY	97.7%	97.8%			%det_MY	88.6%	100.0%
		%det_HO	2.3%	2.2%			%det_HO	11.4%	0.0%
		%partial/HO	28.6%	0.0%			%partial/HO	0.0%	-----
1996	465	%det/rel	39.7%	3.7%					
		%det_MY	94.0%	100.0%					
		%det_HO	6.0%	0.0%					
		%partial/HO	18.2%	-----					
1997	640	%det/rel	30.5%	4.1%					
		%det_MY	85.1%	88.5%					
		%det_HO	14.9%	11.5%					
		%partial/HO	20.7%	0.0%					
1998	2,060	%det/rel	45.4%	4.0%	1998	395	%det/rel	42.5%	1.8%
		%det_MY	96.8%	97.6%			%det_MY	78.6%	57.1%
		%det_HO	3.2%	2.4%			%det_HO	21.4%	42.9%
		%partial/HO	20.0%	0.0%			%partial/HO	11.1%	0.0%
2000	1,213	%det/rel	36.2%	5.5%					
		%det_MY	87.2%	97.0%					
		%det_HO	12.8%	3.0%					
		%partial/HO	55.4%	100.0%					
2001	1,392	%det/rel	15.9%	2.3%	2001	492	%det/rel	11.2%	2.2%
		%det_MY	90.1%	100.0%			%det_MY	69.1%	100.0%
		%det_HO	9.9%	0.0%			%det_HO	30.9%	0.0%
		%partial/HO	59.1%	-----			%partial/HO	5.9%	-----
2002	2,405	%det/rel	31.1%	2.7%	2002	478	%det/rel	7.9%	0.6%
		%det_MY	96.5%	97.0%			%det_MY	13.2%	66.7%
		%det_HO	3.5%	3.0%			%det_HO	86.8%	33.3%
		%partial/HO	38.5%	100.0%			%partial/HO	6.1%	0.0%
2003	4,740	%det/rel	39.1%	3.1%	2003	663	%det/rel	10.7%	2.3%
		%det_MY	97.4%	99.3%			%det_MY	49.3%	100.0%
		%det_HO	2.6%	0.7%			%det_HO	50.7%	0.0%
		%partial/HO	45.8%	100.0%			%partial/HO	16.7%	-----

Tables for Memorandum on Overwintering of Subyearling Fall Chinook from Snake and Clearwater Rivers

Hatchery fall chinook released in 1995 as subyearlings and number residualizing to 1996

mig_yr	data	coord	RELEASED 5/31 -- 6/08			RELEASED 6/09 -- 6/23			RELEASED 6/23 -- 7/05		
			rel_site	in-river	transport	rel_site	in-river	transport	rel_site	in-river	transport
Clearwater River direct stream releases near Big Canyon Ck AP											
1995	%det/rel	WPC	SNK-BC1	41.8%	8.5%	SNK-BC2	37.9%	9.3%			
	%det_MY			97.1%	98.1%		93.0%	99.0%			
	%det_HO			2.9%	1.9%		7.0%	1.0%			
	%partial/HO			40.0%	0.0%		20.7%	0.0%			
1995	%det/rel	RNI				SNK-CJ2	30.8%	8.3%	SNK-CJ3	21.1%	6.8%
	%det_MY						92.7%	95.6%		91.5%	94.3%
	%det_HO						7.3%	4.4%		8.5%	5.7%
	%partial/HO						22.6%	30.0%		20.8%	13.0%
Snake River direct stream releases near Pittsburg Landing AP											
1995	%det/rel	WPC	SNK-PL1	44.3%	8.4%	SNK-PL2	36.6%	9.4%			
	%det_MY			97.3%	95.5%		95.6%	92.6%			
	%det_HO			2.7%	4.5%		4.4%	7.4%			
	%partial/HO			35.5%	10.0%		19.0%	33.3%			

Hatchery fall chinook released in 1996 as subyearlings and number residualizing to 1997

mig_yr	data	coord	RELEASED 6/06 -- 6/08			RELEASED 6/09 -- 6/23			RELEASED 6/23 -- 7/10		
			rel_site	in-river	transport	rel_site	in-river	transport	rel_site	in-river	transport
Clearwater River direct stream releases near Big Canyon Ck AP											
1996	%det/rel	RNI	CLWR-1	42.8%	3.7%	CLWR-2	37.6%	5.2%	CLWR-3	11.7%	1.4%
	%det_MY			95.0%	100.0%		94.0%	93.4%		81.4%	66.0%
	%det_HO			5.0%	0.0%		6.0%	6.6%		18.6%	34.0%
	%partial/HO			28.0%	-----		43.5%	42.9%		14.9%	0.0%
Snake River direct stream releases near Pittsburg Landing AP											
1996	%det/rel	RNI	SNK-PL1	41.1%	5.9%	SNK-PL2	41.4%	5.5%	SNK-PL3	10.9%	1.6%
	%det_MY			95.7%	95.7%		93.8%	93.5%		83.6%	82.4%
	%det_HO			4.3%	4.3%		6.2%	6.5%		16.4%	17.6%
	%partial/HO			23.8%	33.3%		40.3%	31.9%		23.2%	22.2%

Tables for Memorandum on Overwintering of Subyearling Fall Chinook from Snake and Clearwater River

Hatchery fall chinook released in 1997 as subyearling and number residualizing to 1998

mig_yr	data	coord	RELEASED 5/15 -- 6/08			RELEASED 6/09 -- 6/18			RELEASED 6/19 -- 7/08		
			rel_site	in-river	transport	rel_site	in-river	transport	rel_site	in-river	transport
Clearwater River direct stream releases near Big Canyon Ck AP											
1997	%det/rel	BDA	CLWR-1	35.1%	3.2%	CLWR-2	34.6%	2.7%	CLWR-3	10.1%	0.7%
	%det_MY			97.5%	98.1%		97.5%	96.9%		92.5%	86.8%
	%det_HO			2.5%	1.9%		2.5%	3.1%		7.5%	13.2%
	%partial/HO			48.8%	33.3%		43.5%	26.7%		35.4%	30.0%
1997	%det/rel	RNI	CLWR-1	27.7%	3.1%	CLWR-2	20.5%	1.4%	CLWR-3	10.1%	0.8%
	%det_MY			99.7%	100.0%		99.6%	100.0%		92.2%	86.2%
	%det_HO			0.3%	0.0%		0.4%	0.0%		7.8%	13.8%
	%partial/HO			0.0%	-----		0.0%	-----		33.3%	50.0%
1997	%det/rel	WPC				CLWR-2	22.7%	2.3%			
	%det_MY						95.0%	93.1%			
	%det_HO						5.0%	6.9%			
	%partial/HO						57.1%	50.0%			
Snake River direct stream releases at Billy Ck near Captain John Rapids AP											
1997	%det/rel	WPC	SNK-BC1	31.4%	2.8%	SNK-BC2	31.3%	2.8%	SNK-BC3	13.6%	1.2%
	%det_MY			99.0%	100.0%		99.0%	100.0%		77.6%	82.8%
	%det_HO			1.0%	0.0%		1.0%	0.0%		22.4%	17.2%
	%partial/HO			25.0%	-----		50.0%	-----		33.3%	0.0%
1997	%det/rel	RNI				SNK-BC2	38.1%	2.9%	SNK-BC3	34.4%	3.4%
	%det_MY						91.2%	94.4%		87.2%	83.3%
	%det_HO						8.8%	5.6%		12.8%	16.7%
	%partial/HO						31.7%	50.0%		31.5%	42.9%
Snake River direct stream releases near Pittsburg Landing AP											
1997	%det/rel	RNI	SNK-PL1	45.9%	3.9%	SNK-PL2	35.3%	3.4%	SNK-PL3	18.6%	1.4%
	%det_MY			98.4%	99.1%		97.1%	94.0%		87.2%	88.5%
	%det_HO			1.6%	0.9%		2.9%	6.0%		12.8%	11.5%
	%partial/HO			44.4%	40.0%		40.0%	20.0%		33.7%	16.7%
1997	%det/rel	WPC				SNK-PL2	33.8%	3.2%			
	%det_MY						94.0%	92.9%			
	%det_HO						6.0%	7.1%			
	%partial/HO						37.5%	32.6%			

Tables for Memorandum on Overwintering of Subyearling Fall Chinook from Snake and Clearwater River

Hatchery fall chinook released in 1998 as subyearlings and number residualizing to 1999

mig_yr	data	coord	RELEASED 5/15 -- 6/02			RELEASED 6/03 -- 6/16			RELEASED 6/17 -- 7/07		
			rel_site	in-river	transport	rel_site	in-river	transport	rel_site	in-river	transport
Clearwater River direct stream releases near Big Canyon Ck AP											
1998	%det/rel	BDA	CLWR-1	54.6%	2.8%	CLWR-2	54.7%	2.4%	CLWR-3	43.8%	2.3%
	%det_MY			99.4%	100.0%		98.4%	97.9%		92.4%	93.6%
	%det_HO			0.6%	0.0%		1.6%	2.1%		7.6%	6.4%
	%partial/HO			53.8%	-----		37.3%	50.0%		36.6%	27.8%
1998	%det/rel	WDM	CLWR-1	39.1%	2.0%	CLWR-2	42.8%	2.2%	CLWR-3	25.1%	1.1%
	%det_MY			99.6%	100.0%		96.8%	98.2%		89.3%	93.0%
	%det_HO			0.4%	0.0%		3.2%	1.8%		10.7%	7.0%
	%partial/HO			100.0%	-----		28.6%	0.0%		27.5%	0.0%
Snake River direct stream releases at Billy Ck and Heller Bar near Captain John Rapids AP											
1998	%det/rel	WDM	SNK-BC1	44.1%	2.4%	SNK-BC2	39.7%	1.5%	SNK-BC3	18.6%	1.3%
	%det_MY			99.5%	100.0%		97.3%	100.0%		91.9%	93.8%
	%det_HO			0.5%	0.0%		2.7%	0.0%		8.1%	6.3%
	%partial/HO			33.3%	-----		37.0%	-----		40.4%	33.3%
1998	%det/rel	WDM				SNK-HE2	56.9%	2.3%			
	%det_MY						98.7%	98.1%			
	%det_HO						1.3%	1.9%			
	%partial/HO						43.0%	16.7%			
Snake River direct stream releases near Pittsburg Landing AP											
1998	%det/rel	WDM	SNK-PL1	40.6%	1.3%	SNK-PL2	40.6%	1.7%	SNK-PL3	14.3%	0.9%
	%det_MY			98.1%	100.0%		95.4%	97.7%		92.9%	83.3%
	%det_HO			1.9%	0.0%		4.6%	2.3%		7.1%	16.7%
	%partial/HO			20.0%	-----		29.8%	0.0%		30.8%	25.0%
1998	%det/rel	WPC	SNK-PL1	57.1%	3.1%				SNK-PL3	45.0%	2.2%
	%det_MY			100.0%	100.0%					95.9%	96.1%
	%det_HO			0.0%	0.0%					4.1%	3.9%
	%partial/HO			-----	-----					40.2%	23.5%

Tables for Memorandum on Overwintering of Subyearling Fall Chinook from Snake and Clearwater River

Hatchery fall chinook released in 2000 as subyearlings and number residualizing to 2001

mig_yr	data	coord	RELEASED 5/25 -- 6/08			RELEASED 6/09 -- 6/23			RELEASED 6/24 -- 7/13		
			rel_site	in-river	transport	rel_site	in-river	transport	rel_site	in-river	transport
Clearwater River -- Two Big Canyon Ck AP production releases and nearby direct stream releases											
2000	%det/rel	BDA	BCCAP-P1	48.3%	8.0%	BCCAP-P2	39.7%	7.7%	BCCAP-3	13.3%	1.5%
	%det_MY			96.5%	98.8%		91.4%	97.0%		53.0%	68.8%
	%det_HO			3.5%	1.2%		8.6%	3.0%		47.0%	31.2%
	%partial/HO			47.1%	0.0%		48.9%	22.2%		15.3%	12.5%
Snake River -- Pittsburg Landing AP production release and nearby direct stream releases											
2000	%det/rel	BDA	PLAP-P1	38.8%	4.3%						
	%det_MY			97.2%	97.7%						
	%det_HO			2.8%	2.3%						
	%partial/HO			72.7%	100.0%						
2000	%det/rel	WDM	SNK-PL1	6.8%	1.5%	SNK-PL2	3.7%	0.6%	SNK-PL3	1.9%	0.1%
	%det_MY			92.9%	100.0%		89.1%	100.0%		73.9%	50.0%
	%det_HO			7.1%	0.0%		10.9%	0.0%		26.1%	50.0%
	%partial/HO			66.7%	-----		20.0%	-----		0.0%	100.0%
Snake River -- Captain John Rapids AP production release and nearby direct stream releases at Billy Ck											
2000	%det/rel	BDA	CJRAP-P1	48.8%	6.4%						
	%det_MY			98.2%	98.4%						
	%det_HO			1.8%	1.6%						
	%partial/HO			66.7%	100.0%						
2000	%det/rel	WDM	SNK-BC1	20.4%	4.1%	SNK-BC2	8.6%	2.3%	SNK-BC3	2.9%	1.2%
	%det_MY			90.9%	98.0%		85.8%	94.6%		63.4%	90.0%
	%det_HO			9.1%	2.0%		14.2%	5.4%		36.6%	10.0%
	%partial/HO			34.8%	0.0%		43.3%	0.0%		23.1%	0.0%

Tables for Memorandum on Overwintering of Subyearling Fall Chinook from Snake and Clearwater River

Hatchery fall chinook released in 2001 as subyearlings and number residualizing to 2002

mig_yr	data	coord	RELEASED 5/18 -- 6/02			RELEASED 6/03 -- 6/16			RELEASED 6/17 -- 7/04		
			rel_site	in-river	transport	rel_site	in-river	transport	rel_site	in-river	transport
Clearwater River -- released with Big Canyon Ck AP production and nearby stream releases											
2001	%det/rel	BDA	BCCAP-P1	49.3%	6.1%	BCCAP-P2	29.2%	4.0%			
	%det_MY			96.3%	100.0%		92.2%	97.0%			
	%det_HO			3.7%	0.0%		7.8%	3.0%			
	%partial/HO			54.1%	-----		42.1%	66.7%			
2001	%det/rel	BDA	BCCAP-1	39.4%	4.4%	BCCAP-2	26.5%	3.2%	BCCAP-3	14.5%	2.3%
	%det_MY			96.2%	99.4%		94.0%	97.5%		83.5%	95.6%
	%det_HO			3.8%	0.6%		6.0%	2.5%		16.5%	4.4%
	%partial/HO			50.8%	0.0%		34.0%	42.9%		19.9%	9.1%
Mainstem Snake River -- released with Pittsburg Landing AP production and nearby stream releases											
2001	%det/rel	BDA	PLAP-P1	20.7%	3.1%						
	%det_MY			98.3%	100.0%						
	%det_HO			1.7%	0.0%						
	%partial/HO			71.4%	-----						
2001	%det/rel	WDM	PLAP-1	6.5%	0.5%	PLAP-2	0.9%	0.1%	PLAP-3	0.3%	0.0%
	%det_MY			95.0%	100.0%		95.5%	100.0%		87.5%	100.0%
	%det_HO			5.0%	0.0%		4.5%	0.0%		12.5%	0.0%
	%partial/HO			25.0%	-----		100.0%	-----		0.0%	-----
Snake River -- released with Captain John Rapids AP production and nearby stream release at Billy Ck											
2001	%det/rel	BDA	CJRAP-P1	54.5%	7.2%						
	%det_MY			96.5%	100.0%						
	%det_HO			3.5%	0.0%						
	%partial/HO			55.3%	-----						
2001	%det/rel	WDM	SNK-BC1	28.9%	3.2%	SNK-BC2	5.8%	0.5%	SNK-BC3	1.0%	0.1%
	%det_MY			97.2%	100.0%		96.5%	100.0%		76.9%	100.0%
	%det_HO			2.8%	0.0%		3.5%	0.0%		23.1%	0.0%
	%partial/HO			40.0%	-----		60.0%	-----		16.7%	-----
Snake River -- transportation study release near Captain John Rapids AP											
2001	%det/rel	DMM	SNAKER	2.9%	35.9%						
	%det_MY			71.4%	99.9%						
	%det_HO			28.6%	0.1%						
	%partial/HO			3.0%	11.1%						

Tables for Memorandum on Overwintering of Subyearling Fall Chinook from Snake and Clearwater River

Hatchery fall chinook released in 2002 as subyearlings and number residualizing to 2003

mig_yr	data	coord	RELEASED 5/24 -- 6/08			RELEASED 6/09 -- 6/18			RELEASED 6/19 -- 7/02		
			rel_site	in-river	transport	rel_site	in-river	transport	rel_site	in-river	transport
Clearwater River -- released with Big Canyon Ck Ap production and nearby stream releases											
2002	%det/rel	SJR	BCCAP-P1	37.3%	2.3%	BCCAP-P2	25.5%	2.5%			
	%det_MY			96.9%	100.0%		89.4%	91.9%			
	%det_HO			3.1%	0.0%		10.6%	8.1%			
	%partial/HO			34.5%	-----		19.4%	40.0%			
Snake River -- released with Pittsburg Landing AP production and nearby stream releases plus below Hells Canyon Dam											
2002	%det/rel	SJR	PLAP-P1	29.7%	2.1%						
	%det_MY			98.8%	100.0%						
	%det_HO			1.2%	0.0%						
	%partial/HO			44.4%	-----						
2002	%det/rel	WDM	SNK-PL1	7.7%	0.4%	SNK-PL2	2.7%	0.3%	SNK-PL3	1.4%	0.3%
	%det_MY			96.3%	100.0%		92.3%	100.0%		84.0%	100.0%
	%det_HO			3.7%	0.0%		7.7%	0.0%		16.0%	0.0%
	%partial/HO			66.7%	-----		60.0%	-----		50.0%	-----
2002	%det/rel	DTV	HCD-1	48.3%	3.3%						
	%det_MY			100.0%	100.0%						
	%det_HO			0.0%	0.0%						
	%partial/HO			-----	-----						
Snake River -- released with Captain John Rapids AP production and nearby stream releases including Billy Ck											
2002	%det/rel	SJR	CJRAP-P1	43.7%	3.9%	CJRAP-P2	33.2%	3.3%			
	%det_MY			98.6%	100.0%		92.7%	93.9%			
	%det_HO			1.4%	0.0%		7.3%	6.1%			
	%partial/HO			53.3%	-----		33.3%	20.0%			
2002	%det/rel	WDM	SNK-BC1	25.3%	1.2%	SNK-BC2	12.4%	1.0%	SNK-BC3	4.0%	0.3%
	%det_MY			93.3%	100.0%		88.7%	92.3%		67.0%	85.7%
	%det_HO			6.7%	0.0%		11.3%	7.7%		33.0%	14.3%
	%partial/HO			35.7%	-----		22.9%	50.0%		15.2%	100.0%
2002	%det/rel	HLB	SNK-RIV1	54.0%	4.8%	SNK-RIV2	44.6%	0.0%			
	%det_MY			99.0%	100.0%		100.0%	-----			
	%det_HO			1.0%	0.0%		0.0%	-----			
	%partial/HO			100.0%	-----		-----	-----			
Snake River -- transportation study release near Captain John Rapids AP											
2002	%det/rel	DMM	SNAKER1	5.5%	22.8%	SNAKER2	3.8%	13.2%			
	%det_MY			79.8%	99.8%		65.2%	99.6%			
	%det_HO			20.2%	0.2%		34.8%	0.4%			
	%partial/HO			12.3%	0.0%		8.5%	4.5%			
Snake River -- released in reservoir near Asotin and Lewiston											
2002	%det/rel	HLB	SNK-RES1	47.2%	7.8%	SNK-RES2	61.4%	5.3%			
	%det_MY			97.8%	100.0%		100.0%	100.0%			
	%det_HO			2.2%	0.0%		0.0%	0.0%			
	%partial/HO			50.0%	-----		-----	-----			

Tables for Memorandum on Overwintering of Subyearling Fall Chinook from Snake and Clearwater River

Hatchery fall chinook released in 2003 as subyearling and number residualizing to 2004

mig_yr	data	coord	RELEASED 5/22 -- 6/08			RELEASED 6/09 -- 6/18		
			rel_site	in-river	transport	rel_site	in-river	transport

Clearwater River -- released with Big Canyon Ck, Lapwai AP, Nez Perce Hatchery production

2003	%det/rel	SJR	BCCAP-P1	56.9%	3.1%			
	%det_MY			98.7%	100.0%			
	%det_HO			1.3%	0.0%			
	%partial/HO			50.0%	-----			
2003	%det/rel	BDA	NLVP	58.8%	2.8%			
	%det_MY			99.3%	100.0%			
	%det_HO			0.7%	0.0%			
	%partial/HO			9.1%	-----			
2003	%det/rel	BDA	NPTH-P1	70.2%	3.3%	NPTH-P2	21.9%	3.6%
	%det_MY			99.6%	100.0%		89.3%	96.5%
	%det_HO			0.4%	0.0%		10.7%	3.5%
	%partial/HO			62.5%	-----		21.4%	33.3%

Snake River -- release with Pittsburg Landing AP production and nearby stream releases including below Hells Canyon Dam

2003	%det/rel	SJR	PLAP-P1	53.3%	2.6%			
	%det_MY			99.3%	100.0%			
	%det_HO			0.7%	0.0%			
	%partial/HO			44.4%	-----			
2003	%det/rel	WDM	SNK-PL1	13.7%	47.9%			
	%det_MY			99.3%	100.0%			
	%det_HO			0.7%	0.0%			
	%partial/HO			7.1%	-----			
2003	%det/rel	DTV	HCD	43.1%	1.5%			
	%det_MY			100.0%	100.0%			
	%det_HO			0.0%	0.0%			
	%partial/HO			-----	-----			

Snake River -- released with Captain John Rapids AP production and nearby stream releases including transport study fish

2003	%det/rel	SJR	CJRAP-P1	68.5%	2.7%			
	%det_MY			100.0%	100.0%			
	%det_HO			0.0%	0.0%			
	%partial/HO			-----	-----			
2003	%det/rel	DMM	SNKDMM-1	12.9%	56.6%			
	%det_MY			99.2%	100.0%			
	%det_HO			0.8%	0.0%			
	%partial/HO			13.2%	0.0%			
2003	%det/rel	MLS				SNKMLS-2	65.8%	5.2%
	%det_MY						99.8%	100.0%
	%det_HO						0.2%	0.0%
	%partial/HO						50.0%	-----

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MEMORANDUM

TO: Rod Sando, CBFWA

FROM: Michele DeHart
DATE: May 5, 2005
RE: Data Request for Historical Operations

In response to your recent data request, regarding historical operations efficiency and management of the hydrosystem for fish passage, the Fish Passage Center staff reviewed historical files, system operations requests and annual reports. In addition you asked about the juvenile migration conditions and operations that were in place to protect juvenile migrants that are making up the 2005 adult spring chinook return.

Most of the returning adult spring chinook migrated as juveniles from the Columbia Basin in 2002 and 2003. In response to a previous data request, the FPC staff summarized the passage data for these years in comparison to the 1998 and 1999 juvenile migration of spring chinook, which would have returned as adults in 2001. The attached graphs show the percentage of the spring chinook juveniles that migrated under the various flow conditions in those years. This is a simple visual representation of the data. It shows that in 2002 and 2003 a significant proportion of spring chinook juveniles migrated in lower than the Biological Opinion target flows. These juvenile migrants comprise the 2005 adult return of spring chinook. In contrast we also display the 1998 and 1999 juvenile migration flow conditions for out-migrating spring chinook. These juvenile migrants would have comprised most of the adult return in 2001.

The differing juvenile migration conditions for the spring chinook that are returning in 2005 and that returned in 2001 were largely determined by the runoff volume in those years. The following table shows the April final forecasts for key sites in those years.

The Dalles and Lower Granite Runoff volumes compared to the average of the 1971-2000 historical record

Year	Actual Jan-July Runoff Volume at The Dalles	Actual Jan-July Runoff Volume at L.Granite
	Average 1971-2000 107.3 MAF	Average 1971-2000 30.0 MAF
1998	104.5 MAF	31.3 MAF
1999	124.1 MAF	36.1 MAF
2002	103.8 MAF	24.0 MAF
2003	87.7 MAF	23.8 MAF

At The Dalles, the runoff volume that occurred in 1998 at The Dalles was 97% of average and was 115 % of average in 1999. At The Dalles, in 2002 the runoff volume was 96 % of average, very close to the 1998 runoff volume. In 2003 the runoff volume at The Dalles was 81% of average.

At Lower Granite, the runoff volume in 1998 was 104% of average, in 1999 120% of average, in 2002, 80 % of average and in 2003, 79% of average. At Lower Granite, the 1998 and 1999 were above average water years, while 2002 and 2003 were below average water years. At The Dalles, 1999 was an above average water year and 1998 and 2002 had similar near average runoff volumes. At The Dalles, like Lower Granite, 2003 was a below average water year.

In our September 2000 comments to NOAA on the Draft Biological Opinion (attached) we commented that the measures described in the NOAA draft were not adequate to meet flow targets and that the 2000 draft Opinion provided less protection for spring migrants than previous Opinions, for spring flows at McNary Dam. Therefore, we were not surprised that the majority of spring migrants in 2002 and 2003 experienced lower flows during their out-migration than the out-migrations in 1999. However 2002 and 1998 had similar runoff volumes yet the spring out-migrants in 2002 experienced much lower juvenile migration flows.

We reviewed the 2002 operations and requests, and on May 14 the agencies and tribes submitted SOR 2002-3 (attached) which requested the use of system flexibility to meet Biological Opinion flow targets, including the drafting of reservoirs. This request was not implemented. Although the runoff volume in 2002 was similar to the runoff volume in 1998 the juvenile migrants in 1998 experienced better flow conditions because the shape of the runoff created higher flows throughout late April and May. In 2002 flows did not increase until late in May, after most of the spring migrants had passed McNary. Reshaping the runoff to provide higher flows to spring migrants would have required utilizing the flexibility of the hydrosystem to benefit migrants, by more drafting of reservoirs as requested by the agencies and tribes.

Spill operations during the juvenile migration can be another source of difference in conditions for 1998 and 1999 juvenile migrants versus 2003 and 2004 juvenile migrants. The following table briefly summarizes the spill operations that occurred at each project during the

spring migration. The 120% spill cap limited spill at Dworshak Dam in 1998, but waivers from the TDG standard were not provided in subsequent years and spill was limited by the 110% standard. The 110% limitation effectively controls the amount of flow that can be shaped from the Dworshak project for flow augmentation.

Notable differences in spill between 1998, 1999 and 2002, 2003 include reductions of spill at Little Goose and The Dalles dams and no spill at Lower Monumental Dam in 2002. Spill amounts at most other projects were affected by testing of different volumes and patterns in 2002 and 2003, versus what occurred in 1998 and 1999.

Project	1998	1999	2002	2003
Dworshak	Spill to 120% TDG	Spill to 110 % TDG	Spill to 110 % TDG	Spill to 110 % TDG
Lower Granite	Surface Bypass Test	98 Supplemental BIOP	RSW Testing	RSW Testing
Little Goose	60 Kcfs for 12 hours	60 Kcfs for 12 hours	45 Kcfs for 12 hours	45 Kcfs for 12 hours
Lower Monumental	40 Kcfs for 12 hours	40 Kcfs for 12 hours	No spill	Testing 40 kcfs for 24 hours vs 50% spill
Ice Harbor	24 hour gas cap spill	24 hour gas cap spill	24 hour gas cap spill	24 hour gas cap vs 50% spill
McNary	12 hour gas cap	12 hour gas cap	12 hour gas cap	12 hour gas cap
John Day	BIOP spill	BIOP spill	test of 60% nighttime vs 30% daytime/nighttime spill	test of 60% vs 45% nighttime spill
The Dalles	Spill Test of alternating 30% vs 64% days	Spill Test of alternating 30% vs 64% days	40 % of instantaneous	40 % of instantaneous
Bonneville	75 Kcfs day and gas cap at night	75 Kcfs day and gas cap at night	test of BIOP vs 24 hour gas cap spill	test of BIOP vs 24 hour gas cap spill

To conclude, out migrations in 2002 and 2003 had poorer juvenile migration conditions than previous years, due to lower run off volumes, the operators and regulators decision not to use flexibility to reshape flows to benefit the migration and the differences in spill conditions and volumes. These are simple observations of differences in migration conditions for these years. There is no attempt to provide a definitive explanation for the low return of spring chinook adults in 2005 which migrated as juveniles in 2002 and 2003, this is simply a description of some of the migration conditions they encountered compared to the better conditions encountered by the 1998 and 1999 out migrants. To summarize:

- The 2002 and 2003 spring juvenile migrants experienced lower than the biological opinion target flows for most of their migration
- They likely experienced decreased spill passage when compared to the 1998 and 1999 out migrants.
- In similar runoff volume years of 2002 and 1998, passage conditions were better for 1998 spring migrants. The agencies and tribes request to utilize system flexibility to improve migration conditions for spring migrants in 2002 was denied.
- There were opportunities to use system flexibility to draft reservoirs to reshape flows to benefit spring migrants.
- The overall approach to the implementation of BIOP measures has been to wherever possible minimize their implementation within the flexibility of the BIOP language.

ATTACHMENT

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MEMORANDUM

TO: Liz Hamilton

FROM: Michele DeHart

DATE: April 19, 2005

RE: Data Request

In response to your request we have reviewed the outmigration flow conditions experienced by the 2001 and 2005 spring Chinook adult returns. The 2001 returning adults primarily migrated as juveniles during 1998 and 1999. The 2005 adult return would have primarily migrated during 2002 and 2003. The attached graphs show the percentage of juveniles that migrated under the various flow conditions in those years. Feel free to contact us if you need any further information.

Percentage of 2003 Chinook Yearling Outmigrants Passing Lower Granite Dam at Various Flows

Percentage of 2002 Chinook Yearling Outmigrants Passing Lower Granite Dam at Various Flows

Percentage of 1999 Chinook Yearling Outmigrants Passing Lower Granite Dam at Various Flows

Percentage of 1998 Chinook Yearling Outmigrants Passing Lower Granite Dam at Various Flows

Percent of 2003 Chinook Yearling Outmigrants Passing McNary Dam at Various Flows

Percent of 2002 Chinook Yearling Outmigrants Passing McNary Dam at Various Flows

**Percent of 1999 Chinook Yearling Outmigrants
Passing McNary Dam at Various Flows**

**Percent of 1998 Chinook Yearling Outmigrants
Passing McNary Dam at Various Flows**

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Percentage of 2003 Chinook Yearling Outmigrants Passing Lower Granite Dam at Various Flows

Percentage of 2002 Chinook Yearling Outmigrants Passing Lower Granite Dam at Various Flows

Percentage of 1999 Chinook Yearling Outmigrants Passing Lower Granite Dam at Various Flows

Percentage of 1998 Chinook Yearling Outmigrants Passing Lower Granite Dam at Various Flows

Percent of 2003 Chinook Yearling Outmigrants Passing McNary Dam at Various Flows

Percent of 2002 Chinook Yearling Outmigrants Passing McNary Dam at Various Flows

**Percent of 1999 Chinook Yearling Outmigrants
Passing McNary Dam at Various Flows**

**Percent of 1998 Chinook Yearling Outmigrants
Passing McNary Dam at Various Flows**

APPENDIX B

Total Dissolved Gas Saturation Plots

FIGURE B-1. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the Lower Granite Forebay and daily average spill at Dworshak.

FIGURE B-2. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the Lower Granite tailwater and daily average spill at Lower Granite.

FIGURE B-3. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the Little Goose Forebay and daily average spill at Lower Granite.

FIGURE B-4. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the Little Goose Tailwater and daily average spill at Little Goose.

FIGURE B-5. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the Lower Monumental Forebay and daily average spill at Little Goose.

FIGURE B-6. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the Lower Monumental Tailwater and daily average spill at Lower Monumental.

FIGURE B-7. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the Ice Harbor Forebay and daily average spill at Lower Monumental.

FIGURE B-8. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the Ice Harbor Tailwater and daily average spill at Ice Harbor.

FIGURE B-9. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the McNary-Washington Forebay and daily average spill at Ice Harbor and Priest Rapids.

FIGURE B-10. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the McNary-Oregon Forebay and daily average spill at Ice Harbor and Priest Rapids.

FIGURE B-11. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the McNary Tailwater and daily average spill at McNary.

FIGURE B-12. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the John Day Forebay and daily average spill at McNary.

FIGURE B-13. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the John Day Tailwater and daily average spill at John Day.

FIGURE B-14. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in The Dalles Forebay and daily average spill at John Day.

FIGURE B-15. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in The Dalles Tailwater and daily average spill at The Dalles.

FIGURE B-16. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) in the Bonneville Dam Forebay and daily average spill at The Dalles.

FIGURE B-17. Comparison of the daily average of the 12 highest hourly TDGS readings (as reported by the COE) at Camas/Washougal and daily average spill at Bonneville Dam.

APPENDIX C

Gas Bubble Trauma and Total Dissolved Gas Saturation

FIGURE C-1. Percent of fish examined at Bonneville Dam showing signs of GBT with associated dissolved gas saturation levels in the Bonneville Dam forebay and The Dalles Dam tailwater.

FIGURE C-2. Percent of fish examined at McNary Dam showing signs of GBT with associated dissolved gas saturation levels in the McNary Dam forebay (both Oregon and Washington sides) and the Ice Harbor Dam tailwater.

FIGURE C-3. Percent of fish examined at Lower Monumental Dam showing signs of GBT with associated dissolved gas saturation levels in the Lower Monumental Dam forebay and the Little Goose Dam tailwater.

FIGURE C-4. Percent of fish examined at Little Goose Dam showing signs of GBT with associated dissolved gas saturation levels in the Little Goose Dam forebay and the Lower Granite Dam tailwater.

FIGURE C-5. Percent of fish examined at Rock Island Dam showing signs of GBT with associated dissolved gas saturation levels in the Rock Island forebay and Rocky Reach Dam and Grand Coulee Dam tailwaters.

APPENDIX D

Migration Timing Plots

FIGURE D-1. Smolt migration timing at Salmon River trap (WTB) with associated flow, 2005.

FIGURE D-2. Smolt migration timing at Snake River trap (LEW) with associated flow, 2005.

FIGURE D-3. Smolt migration timing at Imnaha River trap (IMN) with associated flow, 2005.

FIGURE D-4. Smolt migration timing at Grande Ronde River trap (GRN) with associated flow, 2005.

FIGURE D-5. Smolt migration timing at Lower Granite Dam (LGR) with associated flow, 2005.

FIGURE D-6. Smolt migration timing at Little Goose Dam (LGS) with associated flow, 2005.

FIGURE D-7. Smolt migration timing at Lower Monumental Dam (LMN) with associated flow, 2005.

FIGURE D-8. Smolt migration timing at Rock Island Dam (RIS) with associated flow, 2005.

FIGURE D-9. Smolt migration timing at McNary Dam (MCN) with associated flow, 2005.

FIGURE D-10. Smolt migration timing at John Day Dam (JDA) with associated flow, 2005.

FIGURE D-11. Smolt migration timing at Bonneville Dam (BO2) with associated flow, 2005.

FIGURE D-12. Subyearling Chinook smolt migration timing at Snake River sites with associated flow, 2005.

FIGURE D-13. Subyearling Chinook smolt migration timing at Snake River sites with associated flow, 2005.

Spring Creek Hatchery Chinook (Tule) released on:

Date	Number Released
03/02/05	7,348,976
04/15/05	3,915,785
05/04/05	3,268,727

FIGURE D-14. Subyearling Chinook smolt migration timing at Columbia River sites with assoc flow, 2005.

APPENDIX E

Travel Time Tables

DISTANCES OVER WHICH TRAVEL TIME IS MEASURED:**Snake River Basin Traps**

<u>Drainage</u>	<u>Trap Location</u>	<u>Distance to Lower Granite Dam</u>	
		<u>Kilometers</u>	<u>Miles</u>
Salmon River	km 103	233	145
Imnaha River	km 7	142	88
Grande Ronde River	km 5	103	64
Snake River	km 225	52	32

Key Index Reaches

<u>Reach Location</u>	<u>Reach Distance</u>	
	<u>Kilometers</u>	<u>Miles</u>
Lower Granite Dam to McNary Dam	225	140
Rock Island Dam to McNary Dam	260	161
McNary Dam to Bonneville Dam	236	147

Distance Source: Kilometers of sites obtained from 1998 PIT Tag Specification Document, [editor] Carter Stein, Pacific States Marine Fisheries Commission, March 17, 1998. Miles computed using conversion 0.621 miles per kilometer.

Computation of average flow and average temperature: Flow data are averaged over the period of days equal to the estimated median travel time commencing on the date of release (or date of passage at upstream dam for the Snake River and lower Columbia River index reaches). The flows are indexed at Lower Granite Dam for the release to Lower Granite Dam travel time data. They are indexed at Ice Harbor Dam for the Lower Granite Dam to McNary Dam index reach and at the Dalles Dam for the McNary Dam to Bonneville Dam index reach. For the release to McNary Dam travel time data of mid-Columbia River basin released fish, the flows are indexed at Priest Rapids Dam.

TABLE E- 1. 2005 travel time of PIT-tagged wild Chinook released from the Salmon River trap to Lower Granite Dam.

Salmon Trap	Travel Time			Confidence Limits		Lower Granite	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
3/12	24.5	43.2	54.2	39.5	45.9	51	33.9
3/13	26.1	44.4	65.5	42.4	45.1	126	34.8
3/14	23.3	43.9	62.3	43	44.1	128	35.6
3/15	21.7	43.2	60.6	42.1	44.4	114	35.9
3/16	21.9	41.9	54.8	41.1	42.5	61	36.1
3/17	25	40.1	47.5	28	45.8	10	36
3/18	21.5	40	51.7	32.5	44.4	33	36.8
3/19	21.7	28.8	46.2	-	-	6	34.7
3/20	26.1	38.3	47.7	-	-	6	37.4
3/21	21.3	30.6	48.9	22.3	44.9	11	36.4
3/22	16.6	36	54.7	31.7	38	38	38.1
3/23	23.1	28.7	39.7	-	-	4	37.3
3/24	15.7	36.6	45.2	15.7	45.2	8	40.2
3/25	16.7	29	36.5	-	-	4	38.5
3/26	12.4	26.6	44.7	20.5	36.1	9	39
3/27	24	28.4	32.8	-	-	2	39.6
3/28	9.2	29.3	54.9	29	29.7	518	40.6
3/29	14.8	29.1	43.8	28.7	30.1	154	41.2
3/30	14.3	28.6	41.3	28	32	94	41.5
3/31	12.8	27.2	50.8	26.7	29.9	97	40.9
4/1	11.4	26.2	52.5	25.9	28.4	82	40.9
4/2	12.8	25.2	43.7	23.5	28.9	56	40.9
4/3	12.4	24.4	46.2	23.6	25.2	77	41.1
4/4	14.4	22.5	37.5	20	24.2	66	41.3
4/5	10.8	22.1	35.2	21.4	22.8	61	41.6
4/6	11.8	20.8	34.2	17.5	21.5	66	41.6
4/7	11	19	33.7	18.5	20	51	41
4/8	11.8	18.6	43.5	18	19.2	124	41.7
4/9	10.5	18	40.5	17.8	18.6	287	42
4/10	9.9	17.2	40.5	17	17.8	282	42
4/11	9	16.8	42.9	16.2	17.5	474	42.8
4/12	8.2	17	43.4	16.1	18.1	388	43.2
4/13	9.5	15.4	41.9	14.6	17.8	135	42.9
4/14	8.6	15.6	41.5	14.5	17.8	109	44.5
4/15	7.7	14.2	36.1	13.5	14.8	129	44.3
4/16	7.8	13.9	38.9	12.7	15.7	121	45.2
4/17	8.6	14.2	33.6	12	15.9	73	46.3
4/18	7.5	14.7	30.9	13.5	16.4	143	46.9
4/19	9.5	15.5	31.6	14.6	15.8	143	48
4/20	9.7	14.5	29.5	11.8	15.9	44	48.2
4/21	7.9	13.5	27.6	11.1	14.2	61	48.6
4/22	6.9	10.4	17.1	9.5	11.9	55	48.3

TABLE E- 1. 2005 travel time of PIT-tagged wild Chinook released from the Salmon River trap to Lower Granite Dam.

continued

Salmon Trap	Travel Time			Confidence Limits		Lower Granite	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
4/23	6	8.8	35.6	8.4	10.2	51	49.2
4/24	5.5	8.3	14	7.6	9.1	128	50.2
4/25	5.3	8.1	31.8	7.4	8.4	181	50.7
4/26	4.9	8.6	29.7	8.5	8.7	259	52
4/27	5.5	8.2	28	7.9	8.4	300	52.4
4/30	5.8	8	29.2	7.7	8.5	122	59.8
5/1	5	7.6	35.9	7.5	7.7	293	62.4
5/2	5	6.6	26.5	6.5	6.9	65	63.7
5/3	4.9	6.9	27.7	6	8.2	25	69.2
5/4	4.8	6.2	17.6	5.7	7.3	23	72.5
5/5	3.6	5.9	39.8	5.3	6.5	89	79.6
5/6	3.5	5.6	24.6	5.1	6	61	83.6
5/7	3.4	5.6	23.6	3.9	9.4	11	86.2
5/8	3.5	5.6	17.7	4.7	7.5	27	87
5/9	3.5	5.6	8.6	-	-	4	87.2
5/10	5.7	7	8.4	-	-	4	93.6
5/11	6.6	7.7	15.5	7.3	9.8	12	99.7
5/12	5.4	6.7	9.2	6.5	7.9	9	99.8
5/13	5.7	7.6	8.9	5.7	8.9	7	109.2
5/14	5.9	6.6	12.2	-	-	4	112.3
5/15	3.8	4.6	10.8	3.9	5.9	14	112.6

TABLE E- 2. 2005 travel time of PIT-tagged hatchery Chinook released from the Salmon River trap to Lower Granite Dam.

Salmon Trap	Travel Time			Confidence Limits		Lower Granite	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
3/13	24.2	47.5	58.3	45.8	48.6	83	36.4
3/14	22.5	47.6	62.7	45	50.9	60	37.1
3/15	28.6	48	58.8	45.4	51.9	51	37.6
3/16	22.9	46	97.9	43.5	48.5	60	37.7
3/17	23.2	42.1	51.4	36.6	45.6	15	36.8
3/21	18.9	39.4	49.3	37.8	41.5	46	38.6
3/22	13.4	36.9	46.1	35.2	38.6	55	38.6
3/23	16.5	37.1	47.1	35.5	39.2	59	39.4
3/24	18.5	35.4	43.5	33.2	36.6	43	39.4
3/25	15.2	35.7	44.1	32.8	37.8	35	40.7
3/26	13.2	34	41.5	31.6	36.9	25	40.9
3/27	25.8	29.2	32.5	-	-	2	39.9
3/28	14.3	33.9	41.7	32	36.8	69	42.5
3/29	14.2	33.5	42.5	32.4	37	73	42.9
3/30	20.2	34.6	41.2	32.6	36.2	63	43
3/31	13.4	33.7	39.9	31.5	35.3	71	43
4/1	18.4	33.9	39.4	30.7	35	62	43.5
4/4	12.1	28.7	36.6	25.4	30.8	71	43.3
4/5	17.6	25.7	35.1	24.4	29.9	67	43.4
4/6	8.3	23.6	32.6	22.1	26.5	68	43.2
4/7	12.7	24.1	32.8	22.2	27.3	41	43.5
4/8	9.2	22.4	32.6	21.2	23.5	92	43.4
4/11	9.2	20.8	29.2	20	23.6	64	44.5
4/12	9.1	22.2	30	19.5	23.7	71	44.6
4/13	9.5	18.8	28.3	18	22.3	67	44.7
4/14	8.5	21.2	27.5	20.1	22.3	77	46
4/15	8.9	20	27.7	16.8	20.7	66	46.3
4/18	8.9	17	23.9	15.5	18.3	70	47.8
4/19	12	17.2	20.7	16.1	17.5	59	49
4/20	9.8	15.8	28.6	14.8	16.5	74	49.4
4/21	9.2	15.4	20.9	14.5	15.5	64	49.7
4/22	8.4	14.2	27.4	13.2	14.9	60	50.3
4/25	4.5	10.7	17.8	10.3	11.2	79	52.7
4/26	5.3	10.5	14.3	10.3	11	77	55.5
4/27	7.6	10.7	19.5	10	11.2	73	58.4
4/30	4.7	9.6	21.8	8.9	10	104	64.3
5/2	6.1	8.4	20.1	7.9	9.4	63	66.8
5/3	5.4	7	19.6	6.6	8	61	69.2
5/4	4.8	6.7	19.4	6.4	8.7	23	75.8
5/5	4	6.2	19.7	5.7	7.7	48	79.6
5/6	3.6	6.7	22.6	5.6	7.9	38	83.8
5/7	4.6	7.1	20.6	4.6	20.6	7	86
5/8	3.1	6.3	17.6	5.5	10.6	17	87

TABLE E- 3. 2005 travel time of PIT-tagged wild steelhead released from the Salmon River trap to Lower Granite Dam.

Salmon Trap	Travel Time			Confidence Limits		Lower Granite	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
4/24	4.8	6.4	15.8	5.5	7.3	10	50.4
4/25	4.4	5.5	14.1	4.5	6.5	13	51.8
4/26	3.7	4.6	5.4	4.4	5.1	11	52.7
4/27	4.4	4.8	11.5	4.6	7.9	14	52.7
4/30	4.9	6.4	9	5.4	7.7	18	53.8
5/1	5.1	5.6	7.1	5.2	6.7	10	57.4
5/2	4.5	4.6	6.6	-	-	3	58.3
5/3	4.5	5.3	6.7	-	-	4	64.1
5/4	4.5	4.5	4.5	-	-	1	69.4
5/5	3.6	4	4.9	3.6	4.9	7	73.4
5/6	3.5	4.2	4.7	3.8	4.4	10	79.5
5/7	3	3	3	-	-	1	82.7
5/8	2.9	3.9	5.5	3.1	4.2	9	87.8
5/9	2.9	3.2	7.5	-	-	6	89.1
5/10	2.9	4.5	7.7	-	-	6	88.8
5/11	3.4	5.2	6.5	4.2	6.4	12	88.8
5/12	3.5	4.4	7.3	3.6	6.7	11	86.8
5/13	3.7	3.7	3.7	-	-	1	93.9
5/14	2.7	3.2	6	2.7	6	8	96.1

TABLE E- 4. 2005 travel time of PIT-tagged hatchery steelhead released from the Salmon River trap to Lower Granite Dam.

Salmon Trap Release Date	Travel Time			Confidence Limits		Lower Granite	
	Min	Med	Max	Lower	Upper	Number	Flow
3/28	6.3	19.4	42.6	8	34.7	12	39.6
3/30	6.5	32.7	35.8	-	-	3	42.7
3/31	34.8	34.8	34.8	-	-	1	43.5
4/2	16.4	28.2	35.6	-	-	6	42.4
4/3	8.1	19.8	27.8	10.8	23.8	13	39.9
4/4	7.7	18.9	37.9	11.7	25.7	13	40.1
4/5	6.1	17	39.7	10	22.7	17	40.4
4/6	5.8	12.7	30.1	11.8	21.9	19	40.2
4/7	4.8	11.6	31.6	8.2	22.7	18	40
4/8	5.7	17.8	30.6	13.5	22.4	36	41.2
4/9	5.5	16.8	37.7	12.2	22.6	40	41.4
4/10	6.8	19.7	29.9	16	21.8	19	43.8
4/11	10.4	19.8	28.6	11	25.7	13	44.3
4/12	8.8	18.6	28	8.8	21.6	9	44.2
4/13	7.6	13.8	27.2	9.7	24.7	16	42.1
4/14	5.8	16.2	29.3	10.1	21	16	44.5
4/15	5.9	13.7	36	9.8	21.6	21	44.3
4/16	3.9	6.9	11.7	5.9	8.9	17	40.7
4/17	3.9	6.4	22	5.7	10.1	22	41.4
4/18	4.7	12.7	24.9	8.8	14.3	50	46.9
4/19	5.7	10.7	39.8	7.8	15.8	19	46.7
4/20	5.8	10.7	30.5	7.7	15.8	22	47.4
4/21	5.8	10.7	17.8	6.2	15.8	11	47.7
4/22	4.8	7.2	16.9	5	7.9	12	47.2
4/23	4.6	7	12.8	5.7	7.7	10	49.1
4/24	5.1	6.6	14.3	5.9	6.9	26	50.5
4/25	4.4	6.6	15.5	5.7	7	38	51.2
4/26	3.4	5.9	19.7	5.5	8.6	51	52
4/27	4.5	8.7	16.6	7.8	9.4	60	53.9
4/30	4.5	7.1	23.3	6.7	8.1	153	57
5/2	4.4	6.2	18.5	5.7	6.8	79	61.8
5/3	3.7	5.7	15.5	5.5	6.4	55	66
5/4	3	4.7	17	4.6	4.9	81	69.4
5/5	2.8	4.3	36.8	4.1	4.6	90	73.4
5/6	3	4	12.5	3.9	4.3	95	79.5
5/8	2.7	3.4	16.1	3	3.6	50	87.6
5/9	2.7	3.1	10	2.9	3.8	33	89.1
5/10	2.8	4.6	19.6	3.6	6	34	88.8
5/11	2.7	4.7	16.7	4.3	5.1	59	88.8
5/12	3	4.7	18.6	4.3	5.3	57	93
5/13	2.9	4	10.8	3.7	5.6	22	93.9
5/14	2.5	3.8	16.1	3.5	4.9	47	101.2
5/15	2.2	3.7	8.8	2.9	4.3	17	108
5/16	2.3	3.1	8.3	2.6	6.4	16	114.1

TABLE E- 5. 2005 travel time of PIT-tagged wild Chinook released from the Snake River trap to Lower Granite Dam.

Snake Trap	Travel Time			Confidence Limits		Lower Granite	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
4/16	5.3	8.6	9.6	-	-	4	41.4
4/17	8.8	8.9	10.5	-	-	3	42.6
4/18	4.5	5.6	7.3	-	-	3	42
4/19	4.4	7.5	9.9	7.1	8.1	33	44
4/20	6.6	6.6	6.6	-	-	1	44.1
4/22	3.9	5.1	6.8	-	-	3	44.6
4/24	3.6	4.2	4.7	-	-	2	48.7
4/25	4.1	4.2	4.4	-	-	2	51.3
4/26	5.4	5.4	5.4	-	-	1	52.7
4/27	4	5.1	6.9	-	-	3	52.7
4/30	4.2	5	5.8	4.2	5.8	7	51.5
5/1	3.8	5	5.9	-	-	3	53.7
5/2	3.9	3.9	3.9	-	-	1	54.1
5/5	3.4	3.5	3.6	-	-	2	73.4
5/6	2.4	2.4	2.4	-	-	1	76.2
5/8	2.5	3.1	4.3	-	-	5	87.6
5/9	2	3.2	20.7	2	20.7	8	89.1
5/10	5.5	8.2	10.9	-	-	2	96.7
5/11	2.9	9.5	22.9	-	-	5	106.4
5/12	3.7	4.5	8.5	-	-	4	93
5/13	6.5	8	9.5	-	-	2	109.2
5/14	7.7	7.7	7.7	-	-	1	113.7

TABLE E- 6. 2005 travel time of PIT-tagged hatchery Chinook released from the Snake River trap to Lower Granite Dam.

Snake Trap	Travel Time			Confidence Limits		Lower Granite	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
4/12	7.8	13.6	26.3	-	-	4	41
4/13	15.8	15.8	15.8	-	-	1	43.6
4/14	4.3	12.5	20.7	-	-	2	42.3
4/15	5.1	9.1	13.1	-	-	2	40.7
4/16	4.6	13.1	13.6	-	-	4	44.6
4/17	12.8	13.5	14.2	-	-	2	46.3
4/18	6.7	10	13.6	-	-	3	45.1
4/19	3.1	8	16.9	7.4	8.6	84	44
4/20	4.5	7	12.8	-	-	5	44.1
4/21	8.5	9.8	13.9	-	-	4	47.7
4/22	4.4	7	16.4	-	-	4	47.2
4/23	4	5	6.6	-	-	4	47.2
4/24	5.7	9.8	13.9	-	-	2	49.8
4/25	4.6	5	5.5	-	-	2	51.8
4/26	3.4	4.4	5.4	-	-	2	53
4/27	2.6	4.1	8	2.6	8	7	53.7
4/28	3.7	7.1	10.3	4	7.7	16	52.4
4/29	5.8	5.9	7.1	-	-	3	52
4/30	4.8	6.1	9.8	5.2	7.5	18	53.8
5/1	4.1	4.6	30	-	-	4	53.7
5/2	4.4	4.9	6.1	-	-	5	58.3
5/3	3.7	3.7	3.7	-	-	1	60.5
5/4	4.6	16.4	28.2	-	-	2	90.6
5/5	2.9	4.6	26.2	3.2	25.4	11	76.4
5/6	2.5	4.3	24.1	-	-	6	79.5
5/7	2.1	2.2	31.3	-	-	3	79.8
5/8	2.2	3.2	26	2.8	3.5	35	87.6
5/9	2.1	3.8	12.3	3.4	4.5	24	88.3
5/10	1.9	12.6	21.5	-	-	6	107.9
5/11	2.5	12.2	28.4	4.8	19.1	22	109.2
5/12	3.7	18.5	22	6.5	20.5	13	102.9
5/13	4.5	17.6	19.1	16.5	17.6	22	103.6
5/14	5.7	17.5	20.2	8.2	19.2	9	103.8
5/15	3.4	14.9	22.8	-	-	5	107.5

TABLE E- 7. 2005 travel time of PIT-tagged wild steelhead released from the Snake River trap to Lower Granite Dam.

Snake Trap Release Date	Travel Time			Confidence Limits		Lower Granite	
	Min	Med	Max	Lower	Upper	Number	Flow
3/29	3.3	4.2	5.4	-	-	4	42.1
3/30	7.5	8.7	10.5	-	-	3	39
3/31	4	6	31.1	4.6	9.5	10	39
4/1	4.7	5.8	8.5	4.7	8.5	8	38.4
4/2	5.4	9.2	18.8	5.4	18.8	8	39.7
4/3	4.7	5.8	26.3	-	-	5	38.7
4/4	7.2	9.5	49.7	7.2	49.7	7	39.7
4/5	4.9	6.7	6.8	-	-	3	40.7
4/7	3.7	11.5	29.6	-	-	6	40
4/10	6.6	6.6	6.6	-	-	1	39.3
4/11	28.9	28.9	28.9	-	-	1	51.1
4/12	3.5	7.6	16.6	-	-	4	39.9
4/13	3.6	4.4	5.1	-	-	2	38
4/14	4	4.5	41.1	-	-	3	40
4/15	4.3	4.8	5.9	4.3	5.9	8	40.8
4/16	3.7	3.7	3.7	-	-	2	41
4/17	3.6	4	4.5	-	-	2	42.1
4/18	3.1	3.1	3.1	-	-	1	43.3
4/19	3.4	6.2	9.4	3.4	9.4	7	42.2
4/20	7.1	7.1	7.1	-	-	1	44.1
4/21	3.5	5.6	8	4.6	6.5	22	44.2
4/22	3.8	5.2	5.2	-	-	4	44.6
4/23	2.7	4.1	13.7	3.7	4.9	20	45.7
4/24	3.2	4.8	5.5	-	-	6	49.8
4/25	2.8	3.6	5.9	3.5	4.3	31	51.3
4/26	2.4	3.6	5.4	3.4	4.4	20	53
4/27	2.5	3	4.7	2.7	3.5	26	54.2
4/28	2.4	3.1	13.9	3	3.5	31	53.9
4/29	3.5	5.1	6.7	-	-	2	50.6
4/30	3.3	4.5	6.5	3.7	4.9	15	51.5
5/1	3.5	4.2	6.6	3.6	6.2	10	51
5/2	2.8	3.6	4.6	-	-	5	54.1
5/3	3	3.6	5.8	-	-	6	60.5
5/4	2.6	2.7	3.4	-	-	4	64.1
5/5	2.4	2.8	3.7	2.4	3.7	8	72.3
5/6	1.7	2.5	2.7	1.7	2.7	8	76.6
5/7	1.9	2.3	5.4	2.1	2.4	25	79.8
5/8	1.7	2.1	4.5	2.1	2.1	253	83.8
5/9	1.7	2	2.6	1.9	2.1	40	89.3
5/10	1.4	1.9	15.1	1.8	2	56	93

TABLE E- 7. 2005 travel time of PIT-tagged wild steelhead released from the Snake River trap to Lower Granite Dam.

continued

Snake Trap	Travel Time			Confidence Limits		Lower Granite	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
5/11	1.7	2.2	11.2	2.1	2.4	64	90.9
5/12	1.7	2.4	9.7	1.9	3.1	16	86.2
5/13	2.4	2.6	4.5	2.5	2.8	12	86.3
5/14	1.8	2.4	4.4	1.8	4.4	8	86.7
5/15	1.5	2	2.4	1.5	2.4	8	99.9
5/16	1.4	1.5	2.5	1.4	2.5	7	112.6
5/17	1.3	1.6	3.6	1.5	1.7	39	121.6
5/18	1.3	1.5	10.3	1.4	1.6	38	125.3
5/19	1.4	1.7	6.2	1.4	3.1	9	130.7
5/20	1.2	1.6	8.4	1.4	1.7	30	133

TABLE E- 8. 2005 travel time of PIT-tagged hatchery steelhead released from the Snake River trap to Lower Granite Dam.

Snake Trap Release Date	Travel Time			Confidence Limits		Lower Granite	
	Min	Med	Max	Lower	Upper	Number	Flow
3/29	2.8	4.3	20.3	3.8	8.5	13	42.1
3/30	3.6	5.8	32.2	5.2	6.5	42	39.1
3/31	3.2	5.8	38.4	4.5	6.4	43	39
4/1	3.2	6	34.5	5.2	8.9	43	38.4
4/2	2.8	6.4	36.4	5	10.5	35	38
4/3	3.8	15.2	36.5	7.4	23	32	39.4
4/4	4.7	10.3	32.7	6.8	17.5	19	39.7
4/5	3.8	8.9	22.2	6.8	14.2	25	40.2
4/6	3.7	5.3	33.5	4.9	10.5	35	41.2
4/7	3.8	8	23.7	3.8	23.7	8	39.8
4/8	3.1	6.6	16.6	3.1	16.6	8	40
4/9	3.7	7	10.4	-	-	2	40
4/10	7.2	12.8	17.3	7.7	16.9	9	40.5
4/11	5.9	5.9	5.9	-	-	1	39.2
4/12	2.8	6	19.5	5.5	7.7	45	38.9
4/13	4	8.8	17.1	-	-	6	40.3
4/14	3.8	5.9	17	4.3	13.8	12	40.5
4/15	2.8	6.2	37	5.6	7.5	46	40.8
4/16	2.5	7.1	29.5	3.8	15.2	11	40.7
4/17	1.7	3.8	15.3	2.6	12.8	10	42.1
4/18	2.9	3.6	13.9	-	-	5	42.5
4/19	3.4	4.8	17.7	3.9	8.9	18	41.6
4/20	3.5	6.6	18.2	4	14.3	14	44.1
4/21	3.4	5.8	47.1	5.5	6.4	92	44.2
4/22	3.7	5.6	9.6	4.8	7.5	20	46.1
4/23	1.9	4.1	15.4	3.9	4.5	163	45.7
4/24	1.8	4.8	15.4	3.7	6.6	20	49.8
4/25	1.8	4.6	27.6	4.5	4.7	219	51.8
4/26	2.5	3.7	14.3	3.6	4.4	60	53
4/27	2.5	3.5	12.3	3	3.8	41	53.7
4/28	1.8	3	10.3	2.7	3.6	57	53.9
4/29	2.7	5.5	7.7	-	-	5	52
4/30	3.5	5.7	11.9	4.9	6.1	45	53.8
5/1	3.5	4.7	8	3.8	5.7	17	53.7
5/2	3.2	4.4	6.7	3.6	5	14	54.1
5/3	3.6	3.8	5.4	3.6	5.2	10	60.5
5/4	2.5	2.7	4.5	2.5	4.5	8	64.1
5/5	1.7	3.4	4.4	2.7	3.5	35	72.3
5/6	1.5	2.5	2.9	2	2.7	11	76.6
5/7	1.8	2.3	9.7	2.2	2.5	61	79.8
5/8	1.7	2	19	2	2.1	278	83.8
5/9	1.5	1.9	6.2	1.8	2	69	89.3

TABLE E- 8. 2005 travel time of PIT-tagged hatchery steelhead released from the Snake River trap to Lower Granite Dam.

continued

Snake Trap	Travel Time			Confidence Limits		Lower Granite	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
5/10	1.5	1.9	6	1.8	1.9	77	93
5/11	1.5	2	18.5	1.9	2.1	86	90.9
5/12	1.4	2.2	15.7	1.9	2.5	92	86.2
5/13	2.1	2.7	9.6	2.6	2.8	47	86.3
5/15	1.4	1.7	8.8	1.7	1.8	32	99.9
5/16	1.4	1.6	9.2	1.5	1.7	35	112.6
5/17	1.2	1.6	4.5	1.5	1.6	76	121.6
5/18	1.3	1.6	10.9	1.6	1.8	36	125.3
5/19	1.2	1.6	7.7	1.4	1.9	23	130.7
5/20	1.1	1.5	6.9	1.4	1.6	46	133
5/22	1.3	1.8	4.7	1.6	2.3	13	121.5

TABLE E- 9. 2005 travel time of PIT-tagged wild Chinook released from the Imnaha River trap to Lower Granite Dam.

Imnaha Trap Release Date	Travel Time			Confidence Limits		Lower Granite	
	Min	Med	Max	Lower	Upper	Number	Flow
3/9	27.1	33.3	48.2	27.1	48.2	7	30.4
3/10	27.4	39.2	47.5	29.4	43.2	12	32.2
3/11	25	33.9	46.9	31.1	36.8	30	31.5
3/12	30	39.2	46.8	36.9	46.7	9	33.3
3/13	22.7	37.6	46.7	29.4	44.1	14	33.6
3/14	22	33.3	44.6	30.8	36.1	41	33
3/15	21.1	32	53.4	27.9	36.6	32	33.3
3/16	25.9	37.6	43.5	26.2	41.6	10	35
3/17	18.5	35.2	43.1	29.8	41.2	18	35
3/18	17.7	28.9	38.9	24.5	33.8	16	34.3
3/19	13.6	31	43.4	23.1	37.1	26	35.3
3/20	15.5	33.1	38.7	15.5	38.7	7	36.2
3/21	18	24.9	38.6	22.1	35.7	21	35.3
3/22	14.4	28.4	37.4	15.6	36.4	9	36.5
3/23	14.5	18.9	31.1	14.8	30.2	9	36
3/24	10.5	22	32.6	-	-	4	36.9
3/25	10.6	20.9	41.8	16.9	24.5	25	37.6
3/26	10.3	23	42	17.4	26.9	35	38.5
3/27	8.5	15	46.7	8.5	46.7	7	39.3
3/30	10.7	26.1	68.7	22.3	27.4	136	40.3
3/31	10.3	26.1	38.1	21.1	28.2	37	40.5
4/1	9.8	24.7	58.1	20.2	25.4	86	40.4
4/2	11.5	23.8	42.4	19.6	26	69	40.5
4/3	8.2	22.5	54	18.3	23.7	54	40.6
4/4	13.5	21.8	30.7	19.2	24	18	40.8
4/5	12.1	21.1	32.3	17.3	22.4	33	41.1
4/6	11.2	20.7	43.4	20.5	23.1	49	41.6
4/7	11	19.5	33.1	16.2	21.8	35	41.5
4/8	9.1	17.8	26.1	13	19	21	41.2
4/9	10.9	17.5	31.6	16.1	19	44	42
4/10	10	18	31.4	15.9	19.5	47	42.7
4/11	8	16	27.1	14.3	17.7	30	42.1
4/12	9.8	15.1	24.4	13.3	18	19	41.8
4/13	7.3	14.8	35.2	13	16.1	32	42.9
4/14	8	14.7	19	12.7	15.1	25	43.9
4/15	7.2	14.3	35.5	13.5	17.1	42	44.3
4/16	6	14.2	21.6	11.1	17.2	23	45.2
4/17	9.4	12.1	41.3	10	18.3	17	45.3
4/19	9	13.4	36.3	12	14.5	89	47.1
4/21	7.1	10.6	18.6	10	13.5	42	47.7
4/22	6.4	9.3	15.2	8.6	11	31	48.4
4/23	6.1	8.6	35.5	8	11.1	25	49.2

TABLE E- 9. 2005 travel time of PIT-tagged wild Chinook released from the Imnaha River trap to Lower Granite Dam.

(continued)

Imnaha Trap Release Date	Travel Time			Confidence Limits		Lower Granite	
	Min	Med	Max	Lower	Upper	Number	Flow
4/24	5.5	9.8	24.1	8.6	11.2	50	49.8
4/25	5.7	9	12.9	7.2	10.5	18	50.5
4/26	4.5	9.7	13	5.6	12	10	53.4
4/28	8.3	8.3	8.3	-	-	1	54
4/30	5.6	7	15.2	6.3	8.1	33	57
5/1	5.2	6.2	11	5.7	6.6	30	57.4
5/2	4.2	5.9	27.3	5.6	6	72	61.8
5/3	4.1	5	28.4	5	5.3	38	64.1
5/4	3.7	4.1	27.3	4	4.7	38	67.7
5/5	3.4	4	5	3.4	5	8	73.4
5/6	2.4	2.4	2.4	-	-	1	76.2
5/11	5.7	8.4	13.3	5.7	13.3	7	99.7
5/12	4.7	6.6	8.5	-	-	2	99.8
5/13	5.2	8.3	15	5.2	15	7	109.2
5/14	4.2	5.3	14.2	4.2	14.2	8	104.1
5/15	3	4.9	9.4	3	9.4	8	112.6
5/23	4	7.7	19.7	5	9.7	11	95.6
5/24	4.5	6.6	7	-	-	5	92.2
5/25	4.4	5.5	7.3	5	6.1	9	88.7
5/26	4	5.3	7	4.1	6.8	11	86.7
5/27	3.9	5.1	7.5	4.5	5.6	18	85
5/28	4.1	5.6	8.1	4.1	8.1	7	84.9
5/29	3.5	6.2	8.5	5	7.9	13	83.4
5/30	3.2	4.7	9.6	4.3	6.6	19	83.2
5/31	3.6	5.8	8.3	4.2	6.4	14	80.9
6/1	4.2	5.9	16.9	5.2	7.3	28	80.2
6/2	5.7	7.8	12.6	6.6	10.5	16	72.2
6/3	5	6.8	11.8	5.3	8.3	14	69.9
6/4	3.6	6.4	14.2	5.2	10.7	9	68
6/5	5	7.4	11.4	5.6	8.7	13	62.6
6/6	6.1	8.1	12.6	7.4	12.3	15	58.6
6/7	6	7.4	11.7	6.6	9.2	16	56.7
6/8	8.3	10	23.5	8.9	10.9	10	51.8
6/9	4.8	8.6	11.7	8.1	10	13	50.7
6/10	5.6	7.8	8.1	-	-	4	49.7
6/11	6.1	6.4	8.2	6.1	8.2	7	48.9
6/12	5.5	6.3	6.8	5.5	6.8	7	48.8

TABLE E- 10. 2005 travel time of PIT-tagged wild steelhead released from the Innaha River trap to Lower Granite Dam.

Innaha Trap Release Date	Travel Time			Confidence Limits		Lower Granite	
	Min	Med	Max	Lower	Upper	Number	Flow
3/30	8	28.2	60.7	23	31	31	41
3/31	12.1	25.3	38.3	-	-	6	40.2
4/1	15.2	21.3	38.1	-	-	5	39.8
4/2	11.5	27.2	35.6	23.1	29.3	16	41.9
4/3	8	27.1	37.7	8.1	37.1	9	42.5
4/4	7.3	31.7	34.5	-	-	3	44.7
4/5	7.2	11.1	32.9	7.2	32.9	7	39.8
4/6	9.8	32	33.6	14.4	33	14	47.4
4/7	5.6	12.7	31.2	5.6	31.2	8	40.2
4/8	6.8	10.1	29.2	7.3	12.5	9	39.9
4/9	7	14.2	57.1	11.3	26.2	13	40.7
4/10	6	19.3	38.2	10.1	28	15	43.3
4/11	4.9	10.3	28.6	4.9	28.6	8	40.6
4/12	6	10.3	37.4	8.4	13	25	40
4/13	6.4	9.4	26.7	7	15.2	12	40.3
4/14	5.2	13.8	22.5	-	-	2	43.2
4/15	6.2	11.7	24.2	6.4	19.3	9	42.6
4/16	4.4	7.9	23.4	5.7	12.2	19	40.9
4/17	5	9.2	43.1	7	13.4	19	42.6
4/19	5.2	10.4	27.3	9.4	12.3	66	46
4/21	4.1	6.8	19.8	5.7	8	30	45.5
4/22	4	7	25.3	5.7	8.3	47	47.2
4/23	3.7	6	19.6	5.7	6.3	49	48.3
4/24	4	5.2	17.1	5.1	5.4	103	49.8
4/25	3.7	5.2	41.2	4.9	5.7	77	51.8
4/26	3	5	22.7	4.8	5.3	75	52.7
4/28	3.5	8	11.8	7.1	8.2	68	54
4/30	3.8	5.7	9.6	5.3	6.1	127	53.8
5/1	3.2	5.3	10.2	5.2	5.8	167	53.7
5/2	3	4.8	9	4.4	5.1	160	58.3
5/3	3	4.2	27.3	4	4.3	138	60.5
5/4	2.1	3.8	6.4	3.5	4	138	67.7
5/5	2.2	3.5	12.2	3.3	3.7	98	73.4
5/6	2.1	3	4.2	2.4	3.3	22	76.6
5/12	3.2	4.6	9.2	4.1	5.1	59	93
5/13	2.6	4	7.4	3.5	4.4	62	93.9
5/14	2.2	3.3	8.2	3.1	3.7	47	96.1
5/15	1.9	2.6	6.4	2.3	3	48	105.4
5/16	2.5	2.5	2.9	-	-	3	114.1
5/23	1.1	5.2	21	4.2	6.6	63	102.6
5/24	2.1	4.1	12.2	3.3	6	39	98.5

TABLE E- 10. 2005 travel time of PIT-tagged wild steelhead released from the Imnaha River trap to Lower Granite Dam.

continued

Imnaha Trap	Travel Time			Confidence Limits		Lower Granite	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
5/25	2.1	4	23.5	3.5	4.5	68	92.2
5/26	2	4	14.6	3.4	4.1	75	88.2
5/27	2	3.3	324.7	3.1	3.6	71	85.6
5/28	2	3.3	11.1	2.5	4	24	83
5/29	2	3.2	7.1	3	3.6	36	83.4
5/30	2	3.6	18.2	2.9	4	38	84.6
5/31	2.1	3.3	17.4	3.1	4	51	85.4
6/1	2	3.6	11.5	3.1	4.2	53	82.7
6/2	2	4	17.2	3.3	4.3	40	79.7
6/3	2.5	5	15.1	3.4	7.5	17	74.2
6/4	3.2	4.5	12.8	3.5	9.8	11	70.3
6/5	5	5.6	13	-	-	4	64.4
6/6	3.3	6.7	12.3	5.6	8.7	19	59.7
6/7	3.3	7.6	10.6	6.3	8.6	12	55.8
6/8	5.2	7.7	10.3	5.4	10.1	11	52.5
6/9	4.4	7.2	10.2	-	-	6	51.3
6/10	3.2	5.3	8.1	3.2	8.1	7	50.9

TABLE E- 11. 2005 travel time of PIT-tagged hatchery steelhead released from the Imnaha River trap to Lower Granite Dam.

Imnaha Trap Release Date	Travel Time			Confidence Limits		Lower Granite	
	Min	Med	Max	Lower	Upper	Number	Flow
4/13	4.4	13.1	35.2	9.6	16.2	119	41.3
4/14	4.1	12.3	34.3	10.3	15	155	41.6
4/15	3	11.7	61.4	9.3	14.5	190	42.6
4/16	3.2	12	63.4	10.5	13.5	176	43.8
4/17	3.1	9.2	31.7	8	10.2	148	42.6
4/19	4.4	12.4	47.6	11.7	15.3	335	47
4/21	3.3	9.2	24.5	8.7	15.3	57	47.3
4/24	3.1	7.3	35.3	6.5	8.2	127	50.5
4/25	3.1	6.7	22.6	6.2	9.1	130	51.2
4/26	3	8.9	28.1	5.5	10.2	92	52
4/28	3.4	9.6	20	8.3	10.2	46	58.9
4/30	3.4	8.4	38	8.2	8.5	198	59.8
5/1	3.3	7	20.3	6.4	7.2	166	60.5
5/2	3.1	6.1	24.4	5.4	6.2	145	61.8
5/3	3	5.2	15.7	4.7	5.3	159	64.1
5/4	2	4.3	14.9	4.2	4.4	145	67.7
5/5	2.2	3.4	14.8	3.2	3.5	56	72.3
5/12	2.2	5.6	40.3	5.3	6.1	92	97.1
5/13	2.3	4.5	25.1	4.1	4.8	117	98.5
5/14	2	3.3	35.3	3.2	3.8	110	96.1
5/15	1.5	2.9	20.3	2.6	3	117	105.4
5/16	2	2.8	25.2	-	-	4	114.1
5/18	0.4	2.8	5.2	-	-	2	128.4
5/23	1.6	6.4	26.7	4	7.5	53	100
5/24	1.9	5	15	3.8	6	46	96.2
5/25	2	4.6	22.3	4	5.1	85	90.4
5/26	2.1	3.6	24.1	3.4	4.3	75	88.2
5/27	2	3.3	19.7	3.2	3.6	94	85.6
5/28	2	2.7	21	2.3	3.3	32	83
5/29	2	3.3	20.4	2.6	3.6	40	83.4
5/30	2	3.4	19.5	2.5	4.1	46	84.8
5/31	2.2	5.1	21.2	3.1	6.5	29	82.1

TABLE E- 12. 2005 travel time of PIT-tagged wild Chinook released from Grande Ronde River trap to Lower Granite Dam.

Grande Ronde Trap	Travel Time			Confidence Limits		Lower Granite	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
3/12	26.1	33.6	48.1	26.1	48.1	8	32.2
3/13	23.1	23.1	23.1	-	-	1	29.4
3/14	21.3	29.4	44.9	22.2	37.4	14	32.3
3/15	20.8	30.1	55.2	27.3	32.5	29	33
3/16	25.1	31.7	34.6	-	-	6	33.7
3/17	22	26.5	41	22.6	40.2	9	33.4
3/18	19.3	26.6	39.2	21.9	33.6	9	34.1
3/19	30.4	30.4	30.4	-	-	1	35
3/20	17.4	17.4	17.4	-	-	1	32.6
3/22	13.6	14.1	23.7	-	-	3	33
3/23	16.8	18.2	19.6	-	-	2	35.4
3/25	11.3	16.7	45.4	-	-	3	37.5
3/26	20.5	24.9	34.6	-	-	5	38.9
3/27	11.2	19.2	22.4	-	-	4	39.1
3/29	13.3	20.4	29.9	-	-	4	40
3/30	12.7	21	61.7	17	26.6	21	40
3/31	11.4	21.6	35.9	18.9	24.9	51	39.9
4/1	8.5	20.3	38	16.8	23.1	60	39.8
4/2	13.5	21.3	29.5	15.6	25.8	16	39.8
4/3	13.6	18.5	55.3	15.8	22.7	20	39.9
4/4	12.8	15.8	21.7	-	-	6	40.1
4/5	13.6	17.4	24.1	13.8	22.1	11	40.4
4/6	8.2	19.4	30.4	15.2	21.4	21	40.7
4/8	11.3	17.9	21.5	11.3	21.5	8	41.2
4/9	9.4	13.9	27.2	12	17.4	23	40.7
4/10	9.8	17	29.2	15.7	17.7	28	42
4/11	10.4	15.1	27.9	11.6	18.1	10	41.4
4/12	14.7	15.6	18.6	-	-	6	42.5
4/13	8.6	12.1	26.8	-	-	6	40.8
4/14	8.2	12.1	19.1	10.6	14.9	13	41.6
4/15	8.5	11.9	14.9	8.7	14.7	10	42.6
4/16	10.7	11.8	15	-	-	4	43.8
4/17	10.3	10.5	10.7	-	-	2	44.5
4/18	10.5	10.6	16.6	-	-	5	45.9
4/19	7.7	9.2	15.7	8.1	10.6	16	45.1
4/20	8.1	9.4	10.5	8.1	10.5	7	46.3
4/21	7.6	8.6	9.9	-	-	3	47.3
4/23	6.2	7.2	8.3	-	-	2	49.1
4/24	7	7.8	8.4	-	-	5	50.2

TABLE E- 12. 2005 travel time of PIT-tagged wild Chinook released from Grande Ronde River trap to Lower Granite Dam.

continued

Grande Ronde Trap Release Date	Travel Time			Confidence Limits		Lower Granite	
	Min	Med	Max	Lower	Upper	Number	Flow
4/25	4.7	5.7	13.6	-	-	6	51.8
4/26	3.7	6.7	11.3	5.5	8.7	29	51.3
4/27	3.2	6.9	10.9	6.3	7.4	62	51.5
4/28	4.7	7.2	9.8	6.8	7.6	67	52.4
4/29	4.4	7	10	6.8	7.2	61	53.9
4/30	5.4	6.4	7.6	5.4	7.6	8	53.8
5/1	4.7	6.2	7.3	5.6	6.7	24	57.4
5/2	5	5	6.1	-	-	6	58.3
5/3	3.4	4.6	6.4	3.7	5.5	14	64.1
5/4	4.3	4.4	4.8	-	-	6	67.7
5/5	3.3	3.4	4.3	3.3	4.3	7	72.3
5/6	2.3	3	7.2	2.6	3.3	42	76.6
5/8	3.6	3.9	9.2	3.6	9.2	7	87.8
5/9	2.3	5.1	18.7	4.4	5.5	51	87.7
5/10	2.4	4.6	20.8	3.5	5.4	35	88.8
5/11	3.1	7.3	11.3	5.3	7.6	22	97.4
5/12	2.9	6.4	25.7	5.3	6.9	23	97.1
5/13	3.6	5.5	10	4.4	6.8	17	101.4
5/14	3.5	4.6	9.6	4.4	5.7	16	104.1
5/15	3.1	3.6	21.5	3.4	5.7	16	108
5/16	2.4	3.7	20.6	3	5.5	25	118.3
5/17	2	4.5	15.5	3.6	5.8	27	127.3
5/18	2.7	4.1	5.4	-	-	2	127.9
5/19	2.3	5.2	10.2	3.4	6.9	15	126.1
5/20	2.4	4.6	10.7	2.9	7.4	12	123.1
5/21	2.7	3.7	7.2	2.7	5.8	9	120.7
5/22	2.5	4.9	8.8	3.1	6.6	21	108.9
5/23	2.5	4.6	6.9	3.9	5.1	22	102.6
5/24	3.4	4.7	11.3	4.3	6.2	26	96.2

TABLE E- 13. 2005 travel time of PIT-tagged hatchery Chinook released from the Grande Ronde River trap to Lower Granite Dam.

Grande Ronde Trap Release Date	Travel Time			Confidence Limits		Lower Granite	
	Min	Med	Max	Lower	Upper	Number	Flow
3/15	22.8	42.4	51	25.7	50.6	11	35.5
3/16	17.7	41.4	52.5	40.3	42.1	42	35.7
3/17	21.9	40.5	50.3	37	42.8	29	36.4
3/18	23.7	41.1	48.2	39.9	44.4	19	37.2
3/19	20.7	39.5	49.3	38.6	43.2	17	37.5
3/20	24.4	24.4	24.4	-	-	1	34.7
3/21	12	32.3	39.4	12	39.4	8	36.5
3/22	21.3	36.1	40.7	33.8	38.5	27	38.1
3/23	17.1	33.6	44.4	27	36.7	21	38.2
3/24	12.4	34.4	46.4	28.5	36.4	24	38.9
3/25	15.5	33.2	37.8	24.9	36.5	17	39.5
3/26	10.5	33.3	42	30.6	34.5	38	40.5
3/27	10.4	30.1	41	25.4	32.5	31	40.1
3/29	21.8	28.1	29.7	-	-	5	40.8
3/30	7	30.5	37.4	28.3	32.6	26	42.3
3/31	10.7	28.8	39.8	27.4	30.8	66	41.8
4/1	10.3	29.5	37	26.9	31.2	45	42.6
4/2	9.4	29.3	36.2	26.7	30.6	39	42.7
4/3	9.3	28	36.9	25.8	29	73	42.8
4/4	10.9	27.4	35.7	25.6	28.5	41	43.1
4/5	18.4	24.5	29.1	18.4	29.1	7	43.1
4/12	14.1	21.7	22.5	-	-	5	44.6
4/13	16.5	19.2	23.3	-	-	3	44.7
4/14	15.1	15.5	19.6	-	-	3	44.5
4/17	14.1	14.1	14.1	-	-	1	46.3
4/18	9.4	12.1	18	-	-	5	46.5
4/19	8	12.7	17.4	-	-	2	47.1
4/21	10.6	11.1	11.6	-	-	2	47.7
4/22	7.5	7.5	7.5	-	-	1	48
4/23	5.6	8.6	12.9	-	-	5	49.2
4/26	5.5	7.4	10	-	-	4	51.3
4/27	7.1	8.4	9.7	-	-	2	52.4
4/28	5.9	6.4	6.8	-	-	2	51.3
4/29	6.5	8.2	9.3	-	-	4	56.7
4/30	5.5	5.6	6.1	-	-	3	53.8
5/1	4.8	6.5	8.5	-	-	4	60.5
5/2	4.6	4.8	5.4	-	-	4	58.3
5/3	3.7	4.5	8.6	3.9	7.5	11	64.1
5/4	3.9	4.4	4.8	3.9	4.8	8	67.7
5/5	2.6	3.8	4.9	3	4.9	11	73.4
5/6	2.3	3.2	8.2	3	3.3	42	76.6
5/8	2.8	3.4	5.6	-	-	3	87.6
5/9	3.6	4.8	10.7	3.6	10.7	8	87.7
5/10	4.3	6.1	11.9	4.4	8.3	11	89.2

TABLE E- 14. 2005 travel time of PIT-tagged wild steelhead released from the Grande Ronde River trap to Lower Granite Dam.

Grande Ronde Trap	Travel Time			Confidence Limits		Lower Granite	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
4/19	4.4	8.5	14.6	-	-	4	45.1
4/20	3.9	7.3	10.7	-	-	2	44.1
4/21	5.5	5.5	8.7	-	-	3	44.2
4/22	4.5	4.5	4.5	-	-	1	44.6
4/23	3.8	4.1	5.5	-	-	3	45.7
4/24	5	5.2	5.4	-	-	2	49.8
4/25	3.5	3.7	4.9	-	-	3	51.3
4/26	3.5	4.4	5.9	-	-	6	53
4/27	2.6	4.4	9.7	3.3	7.5	17	53.7
4/28	3.2	5.2	10.7	4.1	6.2	29	51.6
4/29	3.3	5.7	10.2	5.4	6.6	37	52
4/30	4.4	5.4	8.6	4.6	5.9	20	51.5
5/1	3.6	4.4	5	3.6	5	8	51
5/2	5.6	5.6	5.6	-	-	1	61.8
5/3	3.3	4.2	4.9	-	-	4	60.5
5/4	2.6	4	4.8	-	-	3	67.7
5/5	2.4	2.6	2.6	-	-	3	72.3
5/6	2.1	2.6	4.1	2.4	3	16	76.6
5/8	2.2	2.8	17.4	2.3	3.4	12	87.6
5/9	1.9	2.5	9.3	2.4	2.8	47	89.1
5/10	1.7	2.7	8.6	2.5	2.8	63	91
5/11	1.9	2.9	39	2.5	3.4	86	89.3
5/12	2.4	3.6	7.5	3.4	3.9	41	86.8
5/13	2.6	3.4	5.7	2.7	4.5	9	86.3
5/14	2	2.7	4.7	2.4	3.8	13	96.1
5/15	1.7	2.4	3.4	1.7	3.4	8	99.9
5/16	1.4	2.3	3.5	1.5	2.7	11	112.6
5/17	1.5	1.9	32.9	1.8	2.3	43	121.6
5/18	1.8	3.1	5.1	-	-	6	128.4
5/19	1.7	2.2	8.2	1.8	4.9	11	130.7
5/20	1.4	1.8	4.7	1.7	2.9	15	133
5/21	1.5	2.3	3.7	1.5	3.7	7	128.8
5/22	1.7	2.2	8	1.7	3.4	10	121.5
5/23	1.5	2.2	6.2	-	-	4	113.3
5/24	2.1	3	5	2.1	5	8	101.3

TABLE E- 15. 2005 travel time of PIT-tagged hatchery steelhead released from the Grande Ronde River trap to Lower Granite Dam.

Grande Ronde Trap	Travel Time			Confidence Limits		Lower Granite	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
3/30	5.4	10.1	31.9	5.4	31.9	7	39.4
3/31	3.7	9.4	38.7	7.6	15	87	39
4/1	4.3	13.8	37.5	11.1	17.7	101	39.3
4/2	5.5	22.6	36.8	12.4	32.7	26	40.2
4/3	4.6	12.6	32.8	7.2	23.6	14	39.1
4/4	13.7	14.8	35.5	-	-	3	39.8
4/5	14.7	30	33.9	-	-	6	44.4
4/9	21.6	21.6	21.6	-	-	1	44.1
4/11	12.9	13.7	24.9	-	-	3	41
4/14	11.4	11.4	11.4	-	-	1	41
4/15	4.6	5.8	7.9	-	-	3	40.8
4/16	4.2	18.2	32.2	-	-	2	46
4/18	3.7	5.3	17.4	4	8.7	12	42.1
4/19	3.8	7.6	20.6	4.9	10.4	16	44
4/20	4.5	8.3	26.4	6.1	20.8	11	45.3
4/21	9.4	9.6	9.6	-	-	3	47.7
4/22	8.6	8.6	8.6	-	-	1	48.4
4/23	4.7	6	9.3	-	-	4	48.3
4/24	4.5	6.5	7	-	-	3	50.5
4/25	3.7	7.3	11.7	-	-	4	51.2
4/26	3.4	4.5	11.6	3.6	5.6	13	52.7
4/27	2.4	3.4	11.7	3.3	4.4	34	54.2
4/28	2.3	3.4	11.4	3.4	4.3	44	53.9
4/29	2.8	6.6	10.4	5.8	6.7	56	53.9
4/30	4	5.8	9.7	5	6.9	26	53.8
5/1	3.7	5.4	8.7	4.5	5.7	16	53.7
5/2	4.6	5.4	6.1	-	-	2	58.3
5/3	2.7	3.7	5	3.3	4.7	9	60.5
5/4	2.6	3.2	4.6	-	-	6	64.1
5/5	2.4	3.5	5.5	2.8	3.6	22	73.4
5/6	2.2	2.5	9.6	2.4	2.6	72	76.6
5/8	2.7	3	9.2	-	-	5	87.6
5/9	1.8	2.6	9.2	2.3	2.9	28	89.1
5/10	1.8	2.6	22	2.3	2.9	58	91
5/11	1.9	2.6	20.4	2.4	2.7	36	89.3
5/12	2.9	3.5	6.6	3.2	4.2	19	86.8
5/13	2.5	2.7	4.2	-	-	6	86.3
5/14	2.2	2.8	9.2	2.7	4.3	12	96.1
5/15	1.5	2	2.4	1.5	2.4	8	99.9
5/16	1.6	1.8	3.8	1.7	3	10	112.6
5/17	1.5	1.8	5.7	1.6	2.4	13	121.6
5/19	1.6	1.8	2.5	-	-	3	130.7
5/20	1.5	1.7	8.2	-	-	5	133
5/21	1.4	1.6	2.8	-	-	5	128.8
5/22	1.6	1.7	1.8	-	-	2	121.5
5/23	1.5	2	4.5	1.6	4.3	11	113.3
5/24	1.8	2.8	4.4	2.5	3.6	10	101.3

TABLE E- 16. 2005 travel time of PIT-tagged subyearling Chinook released from Rock Island Dam to McNary Dam.

Rock Island Dam	Travel Time			Confidence Limits		Priest Rapids	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
6/28	9.9	13.4	16.8	-	-	2	139.7
6/29	10.7	12.9	34.1	-	-	4	141.2
6/30	10.6	24.6	37.6	-	-	6	140.7
7/1	9.7	10.3	10.9	-	-	2	135.2
7/3	11.7	11.7	11.7	-	-	1	140
7/4	10.9	10.9	10.9	-	-	1	140.8
7/5	10.1	15.7	20.7	-	-	3	143.3
7/6	7.8	8.6	9.3	-	-	2	146
7/7	7.4	12.5	26.9	-	-	5	148.7
7/8	7.7	9.8	23.6	-	-	6	149.8
7/9	6.8	6.8	6.8	-	-	1	148.7
7/10	13.1	13.8	57.8	-	-	3	142
7/11	6.8	10.8	14.7	-	-	2	147.7
7/12	7.7	11	25.7	-	-	6	145.5
7/13	7.4	13.8	17.8	-	-	3	141.5
7/17	6.4	6.4	6.4	-	-	1	135.9
7/18	11.4	11.4	11.4	-	-	1	138.1
7/21	17.7	17.7	17.7	-	-	1	127.1
7/22	8.9	9.4	9.8	-	-	2	136.2
7/23	99.3	99.3	99.3	-	-	1	90.5
7/25	11.6	48.2	84.7	-	-	2	103.5
7/26	12.7	12.7	12.7	-	-	1	126
7/27	6.8	10.8	109.6	-	-	3	127.7
7/28	7.4	46.2	103.7	-	-	6	100.1
7/29	8.8	50	91.3	-	-	2	96.2
7/31	6.4	12.7	106.4	-	-	3	114.5

TABLE E- 17. 2005 travel time of PIT-tagged yearling Chinook released from Rock Island Dam to McNary Dam.

Rock Island Dam	Travel Time			Confidence Limits		Priest Rapids	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
4/23	10.8	12.3	13.8	-	-	2	111.7
4/24	10.3	11.2	12.1	-	-	2	114
4/25	10.5	11.3	16.4	-	-	3	117.3
4/26	11.1	11.1	11.1	-	-	1	118.9
4/27	10.8	10.8	10.8	-	-	1	118.4
4/28	9.5	28.4	33.7	-	-	3	129.6
4/29	9.5	10.2	13.9	-	-	4	119.6
4/30	11.5	11.6	14.1	-	-	3	127.8
5/1	9.4	10.1	11.1	-	-	5	128.2
5/2	8.1	12.3	39.3	8.1	39.3	8	133.8
5/3	10.6	12.2	13	-	-	4	134.9
5/4	8.3	12.3	18.1	8.4	13.3	10	135.3
5/5	8.5	9.9	12.5	8.7	12.4	11	135.5
5/6	8.8	10.2	10.8	-	-	5	136.2
5/7	6.9	8.1	17.9	-	-	4	138.4
5/8	6.5	9.2	10.1	-	-	4	138.4
5/9	9.2	10	10.7	-	-	2	140.7
5/10	7.1	7.1	7.1	-	-	1	141
5/11	8.6	10	31.6	8.9	15.3	12	137.1
5/12	5.6	9.3	33.1	8.4	11.4	24	135.8
5/13	5.2	10.7	17.9	7.4	16.2	17	131.3
5/14	6.3	9	11.7	-	-	2	130.7
5/15	8.7	9.6	21.4	-	-	4	129.1
5/16	7.8	7.8	7.8	-	-	1	127.8
5/17	7.4	12.2	17.2	7.4	17.2	7	133.5
5/18	8	10.8	14.1	-	-	5	134.1
5/19	9.1	9.6	23.1	-	-	5	134
5/20	9.4	9.6	9.9	-	-	2	130.1
5/22	7.7	11.4	35.4	-	-	4	132.8
5/24	5.5	5.5	5.5	-	-	1	133.5
5/25	17.5	17.5	17.5	-	-	1	129.5
5/27	7.2	9.2	11.1	-	-	2	128.3
5/31	11.3	15.9	24.7	-	-	4	127.4

TABLE E- 18. 2005 travel time of PIT-tagged wild steelhead released from Rock Island Dam to McNary Dam.

Rock Island Dam	Travel Time			Confidence Limits		Priest Rapids	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
4/25	11.1	11.1	11.1	-	-	1	117.3
4/26	6.4	7.4	10.7	-	-	3	115.8
4/27	5.4	9.1	10.4	7.8	10.2	9	118.7
4/28	7.2	7.9	9.3	7.3	8.9	12	117.8
4/29	6.9	8.7	12.2	8	10.2	21	117.4
4/30	6.9	7.8	15.1	7.2	9.5	25	119.4
5/5	5.9	7.5	11.5	6	8.8	9	135
5/6	5.8	8	10.7	7.1	8.9	20	137.6
5/7	6.5	7.8	14.1	7.3	8.2	28	138.4
5/8	5.8	7	10.9	6.3	7.5	16	140.8
5/9	6.8	8.4	24.9	-	-	5	141.1
5/19	6.7	8.7	9.4	6.7	9.2	9	137.7
5/20	6.8	8.2	8.9	-	-	6	137.3
5/21	8	8.4	8.8	-	-	4	133.2
5/22	6.6	7.7	16.8	-	-	4	130.4
5/23	6.5	7.7	8.4	-	-	3	132.7
5/24	10.9	10.9	10.9	-	-	1	132.8
5/25	11.2	11.2	11.2	-	-	1	132.3
5/26	6.5	6.5	6.5	-	-	1	136.8
5/31	4.7	5.9	10.9	-	-	3	124.5

TABLE E- 19. 2005 travel time of PIT-tagged hatchery steelhead released from Rock Island Dam to McNary Dam.

Rock Island Dam	Travel Time			Confidence Limits		Priest Rapids	
Release Date	Min	Med	Max	Lower	Upper	Number	Flow
4/28	7.2	8.8	10.5	-	-	2	117.9
4/30	7.5	8.2	8.8	-	-	2	119.4
5/2	5.7	8.3	14.1	5.7	14.1	7	128
5/3	7.2	8.1	8.5	-	-	6	132.1
5/4	6.8	9.1	26.4	6.8	26.4	7	135.1
5/5	6.1	6.8	21.4	6.3	15.4	10	133.2
5/6	5	7.6	16.1	6	8.8	16	137.6
5/7	5.8	11.6	14.3	7.3	13.9	12	137
5/8	6.4	11	20.8	7.2	13.4	13	138.5
5/9	6.4	13.2	21.3	9.1	16	16	137.8
5/10	7.3	11	23.4	9	14.2	22	138.6
5/11	6.7	9.3	22.1	8.8	12.4	35	138.4
5/19	7.8	10.6	15	-	-	4	131
5/20	5.8	9.1	13.2	5.8	13.2	7	133.2
5/21	5.8	7.4	12.2	-	-	6	137.8
5/22	8.9	8.9	8.9	-	-	1	131.8
5/23	8.9	9.8	9.9	-	-	3	133.5
5/24	8.9	8.9	8.9	-	-	1	135.4
5/25	6.6	6.8	6.9	-	-	2	139.4
5/27	11.3	11.3	11.3	-	-	1	124.4
5/28	10.9	11	11	-	-	2	120.3
5/30	6.2	7.1	8.2	-	-	3	121.2
5/31	5.6	8.6	13.6	-	-	4	127
6/1	5.6	7.2	8.9	-	-	2	121.9

TABLE E- 20. 2005 travel time of PIT-tagged yearling spring/summer Chinook released in the Snake River basin between Lower Granite and McNary Dam (grouped by observation date at Lower Granite Dam).

Lower Granite	Travel Time			Confidence Limits		Ice Harbor Dam	
Passage Date	Min	Med	Max	Lower	Upper	Number	Flow
04/05	18.2	29.3	36	27.7	31.9	12	46.8
04/06	23.1	29	33.2	26.4	32.7	10	47.4
04/07	26.4	30.4	38	28.6	31.8	12	49.3
04/08	25	29.8	35.7	26.8	32.8	13	50.7
04/09	20.9	28.5	35.2	26.8	30.3	17	51.1
04/10	21.3	26.4	34.5	23	31.3	15	49.1
04/11	14.9	26	35.2	25.1	27.4	32	50.4
04/12	19.1	26	34.3	25.2	27.4	44	51.5
04/13	17.4	24.4	33.7	23.6	25.3	41	50.2
04/14	15.2	23.2	31.1	22.2	24.2	44	50.4
04/15	17.1	22.7	31.4	21.9	23.2	46	52.2
04/16	16.9	21.4	34.2	20.8	23.4	41	51.2
04/17	15.1	20.4	24.5	19.6	21.8	28	52
04/18	12.8	20.1	29.3	19.5	21.5	83	54
04/19	11.8	18.8	29.1	18.4	19.8	78	54.3
04/20	11.7	18.5	57.2	17.9	19.5	151	56.1
04/21	10.7	17.8	33.4	17	18.3	94	56.6
04/22	12.6	16.8	25.8	16	17.4	104	57.3
04/23	12.5	16.3	30.7	15.7	16.8	99	58.2
04/24	11.7	15.5	23.7	14.6	16	97	61.1
04/25	10.4	14.6	41.4	13.8	15	154	62.4
04/26	8.6	13.9	30.1	13.6	14.2	360	63.2
04/27	8.8	13.5	26.8	13.3	13.7	661	66.6
04/28	8.4	13	26.7	12.7	13.3	484	67.4
04/29	7.6	12.3	28.6	12	12.5	763	68.3
04/30	7.9	12.1	25.6	11.5	12.6	484	71.5
05/01	7.5	11	22.7	10.6	11.3	811	72.9
05/02	7.2	11.7	23.3	11.4	12	655	76.7
05/03	3.7	11.2	22.4	11	11.4	351	79
05/04	6.7	10.3	18.4	10.1	10.5	498	81.5
05/05	3.3	10	20.1	9.9	10.1	1360	85
05/06	5.7	9.5	21.6	9.4	9.6	1954	87.6
05/07	5.8	9.5	28.6	9.4	9.6	1427	93
05/08	5.4	9.2	22.2	9	9.3	1381	94
05/09	5.2	9.4	28.1	9.3	9.6	1421	98
05/10	5.4	9.8	25.8	9.7	10	624	104.5
05/11	5.1	9.8	27.7	9.6	10	363	108.6
05/12	6.2	10.2	32.3	9.3	11.3	174	110.8
05/13	6.7	11.3	37.7	11.1	11.6	161	113.5
05/14	8.2	11.6	25.1	10.7	12.4	85	114.2
05/15	7.4	10.6	40.8	9.8	12.7	78	116.3

TABLE E- 20. 2005 travel time of PIT-tagged yearling spring/summer Chinook released in the Snake River basin between Lower Granite and McNary Dam (grouped by observation date at Lower Granite Dam).

continued

Lower Granite	Travel Time			Confidence Limits		Ice Harbor Dam	
Passage Date	Min	Med	Max	Lower	Upper	Number	Flow
05/16	7	9.2	23.6	8.8	10.7	58	120.1
05/17	6.4	9.1	23.6	8.1	10.3	46	121.6
05/18	2.4	9	18.5	8.1	10.4	54	118.2
05/19	5.9	9.7	17.6	9	10.4	64	112.7
05/20	6.4	10.1	17.5	9.8	11	46	109.2
05/21	6.6	10.1	39.8	9.6	10.8	55	104.4
05/22	6.4	10.8	16.8	9.4	12.6	44	99.7
05/23	7.9	13	26.2	11.2	14.4	28	93.7
05/24	7.3	13	24.7	12	13.5	21	90.8
05/25	7.3	11.2	34.3	10.5	12.2	38	89.6
05/26	8.3	11	29.6	10.5	12.3	41	87.2
05/27	7.3	10.2	26.8	9.8	11.3	46	85.5
05/28	6.3	9.7	31.1	9.2	10.7	46	83.9
05/29	6	9	32.5	8.2	9.5	92	83.3
05/30	5.2	9.2	32	8.3	10.7	78	80.6
05/31	6	9.5	27.8	8.2	14.6	76	76.9
06/01	6.2	19.4	26.8	12.4	22.8	64	64
06/02	8.7	21.5	29.8	18.6	22.7	42	60.3
06/03	7.1	20.4	28.7	18.6	21.2	63	59.2
06/04	8.4	20.1	28.1	18.7	20.5	48	57.2
06/05	7.1	19.4	24.4	18.3	21.1	39	56
06/06	9.3	18.6	24.6	17.6	19.7	46	54.8
06/07	7.4	16.3	23.8	15.4	18.2	29	54.3
06/08	10.7	17.7	21.4	16.1	20.4	13	51.8
06/09	8.9	15.4	21.2	14.2	17.2	32	52
06/10	10.5	14	19.1	13.1	15.7	20	51.2
06/11	8.6	14.4	19.3	13.1	14.9	21	50.6
06/12	10.3	13.6	16.9	12	14.8	19	49.8
06/13	9.7	12.8	16.5	12	13.4	30	49.6
06/14	8.7	11.6	15.7	10.3	12.7	29	49.5
06/15	9.1	11	13.8	10.5	11.8	20	49.2
06/16	6.9	9.1	13.6	8.6	10.6	19	49.8
06/17	6.7	8.8	13.7	8.1	9.4	28	49.3
06/18	5.7	8.4	12.4	7.7	8.8	60	49.5
06/19	5.8	8.2	13.2	7.8	8.7	62	48.7
06/20	5.9	7.4	9.2	6.6	7.9	19	48.1

TABLE E- 21. 2005 travel time of PIT-tagged steelhead released in the Snake River basin between Lower Granite and McNary Dam (grouped by observation date at Lower Granite Dam).

Lower Granite	Travel Time			Confidence Limits		Ice Harbor Dam	
Passage Date	Min	Med	Max	Lower	Upper	Number	Flow
04/03	15.2	27.3	33.5	-	-	5	45.2
04/04	16.7	24.3	41.8	-	-	4	44.9
04/05	46.5	46.5	46.5	-	-	1	66.6
04/06	14.9	26.4	34.8	-	-	5	46.6
04/07	24.1	27.3	37.5	-	-	5	47.1
04/08	24.5	29.8	33.9	-	-	4	50.7
04/08	5.5	6.2	6.8	-	-	2	131.2
04/09	25.1	25.1	25.1	-	-	1	47.6
04/10	13.1	30.2	35	-	-	5	53.7
04/11	22.5	26.4	35.7	-	-	4	50.4
04/12	19.5	26.2	28.1	-	-	4	51.5
04/13	17.4	22.4	27.9	-	-	3	48.1
04/14	13.3	20	36.8	-	-	3	47.6
04/15	14.2	14.7	18.7	-	-	3	47
04/16	16.3	17	19.9	-	-	3	48.1
04/17	18.1	20.4	22.6	-	-	2	52
04/18	15.3	16.7	19	-	-	3	50.1
04/19	11.8	19	26.3	18	21.4	12	54.3
04/20	10.2	18.3	29.7	15.2	19.9	25	54.7
04/21	9.5	15.6	23.7	14.2	20	22	53.4
04/22	9.9	14.8	22.8	13.2	18.2	24	54
04/23	9.4	14.8	22.9	13.7	18.9	27	56.7
04/24	6.7	14.9	24.9	12.5	17.2	34	59.1
04/25	9.3	13.9	23.5	12	15.8	30	60.3
04/26	8.7	15.1	23.2	13.8	16.2	45	65.8
04/27	7.6	13.1	27.6	11.6	14.7	73	63.9
04/28	8	12.8	19.1	11.3	13.5	42	67.4
04/29	6.9	11.6	24.7	11.1	12.1	96	68.3
04/30	7.4	11.6	24.4	11.1	12.9	170	71.5
05/01	7.7	12.1	26.4	10.6	12.7	114	74.1
05/02	7	11.8	19.6	11.4	12.1	85	76.7
05/03	7.4	11.1	17	9.7	11.8	24	79
05/04	7.8	10	15.8	9.6	10.7	36	81.5
05/05	6.4	9.1	15.2	8.9	9.3	95	84.6
05/06	5.7	8.1	18.9	7.9	8.3	155	87.1
05/07	5.7	7.4	19.4	7.1	7.7	212	89.8
05/08	5.1	8.8	17.1	8.1	9.4	154	94
05/09	5.7	10.3	19.8	9.9	10.6	345	99.9
05/10	6.1	9.6	21.2	9.2	9.8	316	104.5

TABLE E- 21. 2005 travel time of PIT-tagged steelhead released in the Snake River basin between Lower Granite and McNary Dam (grouped by observation date at Lower Granite Dam).

continued

Lower Granite	Travel Time			Confidence Limits		Ice Harbor Dam	
Passage Date	Min	Med	Max	Lower	Upper	Number	Flow
05/11	6.1	9	18.1	8.8	9.3	144	105.7
05/12	5.8	8.2	15.9	7.9	8.5	186	105.8
05/13	5.5	7.5	15.3	7.2	7.6	195	110.7
05/14	5	6.9	24.8	6.6	7.3	83	113.4
05/15	4.8	8.3	12.7	6.8	8.8	45	118.3
05/16	4.1	6.9	14.7	6.2	7.5	69	122
05/17	4.7	7	12.9	6.6	7.5	75	125.5
05/18	4.5	6.5	12.5	6.1	6.7	87	123.1
05/19	4.4	6.3	11.4	5.9	7	77	123.1
05/20	4.9	7.6	11	6.1	8.2	24	114.4
05/21	4.8	7.1	17.4	6.3	7.9	33	112.1
05/22	5.5	7.2	14	6.4	9.6	24	106.1
05/23	5.3	7.6	14.8	6.4	9.2	19	98
05/24	5.2	8.1	9	-	-	6	95
05/25	12.7	12.7	12.7	-	-	1	87.6
05/26	9.8	10.2	10.5	-	-	2	88.1
05/27	6.2	6.4	8.4	-	-	6	88.5
05/28	5.5	6.9	31.3	5.5	31.3	7	87.3
05/29	6.1	7.7	28	-	-	5	84.3
05/30	8.3	19.1	23.5	-	-	3	66.6
05/31	4.7	6.8	9.9	5.7	7.9	9	82.5
06/01	5.2	7.4	11.1	5.3	8.9	9	80.7
06/02	5.1	7.2	21.9	-	-	4	77.2

TABLE E- 22. 2005 travel time of PIT-tagged subyearling fall Chinook released in the Snake River basin between Lower Granite and McNary Dam (grouped by observation date at Lower Granite Dam).

Lower Granite	Travel Time			Confidence Limits		Ice Harbor Dam	
Passage Date	Min	Med	Max	Lower	Upper	Number	Flow
05/07	17.7	28.8	33.5	22.4	32.6	11	99.2
05/08	18.1	28.9	47.1	26.6	32.8	16	99
05/09	10.9	27.9	46.7	26.2	29.5	37	99.6
05/10	18.4	26.9	47.2	22.3	29.1	25	100.2
05/11	17.5	26.6	48.7	25.2	31	22	99.5
05/12	15.2	25.6	45.5	22.5	29.6	12	99.3
05/13	20.4	24.2	45.6	22.6	25.5	20	100.5
05/14	20.9	24.8	33.6	23.2	30.6	14	98.6
05/15	15.6	22.9	34.8	15.6	34.8	7	100.4
05/16	22	31.1	40.2	-	-	2	87.9
05/17	15.8	19.8	25.6	-	-	4	102.7
05/18	17.8	18.6	21.3	-	-	4	101.6
05/19	14.6	19.4	41.3	-	-	6	99.1
05/20	17.6	27.7	37.2	-	-	4	82.8
05/21	17.4	17.8	18.3	-	-	2	94.4
05/22	11.9	19.2	29.7	-	-	6	88.8
05/23	14.3	14.6	16.9	-	-	4	91.5
05/24	11.1	16.4	35.8	14.2	35.1	11	86.6
05/25	15.8	19.6	23.4	-	-	2	77.1
05/26	10.8	16.9	30.5	-	-	6	78.3
05/27	8.9	21.2	35.9	10.5	31.7	18	70.6
05/28	7.2	9	30.3	8.8	9.8	25	84.9
05/29	6.1	9.3	57.1	8.6	9.6	79	83.3
05/30	5.9	8.8	57.5	8.3	9.3	182	80.6
05/31	5.6	10.5	32	9.6	12.3	197	74.7
06/01	6	18.3	78.6	15.9	20.4	182	64.5
06/02	8.1	22.6	45.6	21.7	23.7	229	59.8
06/03	6.3	22.9	52.9	22	23.6	191	57.5
06/04	9.8	21.2	28	20.2	22.8	98	56.8
06/05	8.9	21.4	53.2	20.6	22.8	83	55
06/06	8.1	19.5	28	18.8	20.5	139	54.1
06/07	9.6	19.3	36.9	18.8	20.3	178	52.9
06/08	9.3	19.6	35.5	18.8	20.4	159	51.3
06/09	10.5	18.1	53.1	17.4	19.4	145	50.8
06/10	8.7	16.6	46.4	16	17.6	86	50.1
06/11	8.7	15.9	22.7	15	16.4	77	49.6
06/12	9.7	16.2	28.6	15	17.4	80	49.4
06/13	8.5	15.7	41.1	15	16.3	137	49.7
06/14	10.2	15.5	22.4	14.8	15.8	91	49.9
06/15	9.1	14.4	89.5	13	14.8	55	49.4

TABLE E- 22. 2005 travel time of PIT-tagged subyearling fall Chinook released in the Snake River basin between Lower Granite and McNary Dam (grouped by observation date at Lower Granite Dam).

continued

Lower Granite	Travel Time			Confidence Limits		Ice Harbor Dam	
Passage Date	Min	Med	Max	Lower	Upper	Number	Flow
06/16	8.2	13.1	21.1	12.5	13.6	55	49.1
06/17	8.1	12.5	30.4	12.1	13	83	49.8
06/18	6.9	12.1	34.7	11.6	12.4	108	49.9
06/19	7.8	10.9	20.8	10.7	11.2	76	49.8
06/20	7.4	10.1	15.3	9.9	10.9	20	49.4
06/21	11.2	11.2	11.2	-	-	1	48.5
06/22	13.7	14.7	15.7	-	-	2	46.2
06/24	9.7	9.7	9.7	-	-	1	46.5
06/25	7.3	8.6	9.4	-	-	3	46.5
06/26	8.4	8.7	9	-	-	2	45.6
06/27	8.1	8.1	8.1	-	-	1	46.3
06/28	5.7	7.4	21.3	-	-	4	46.4
06/29	10	12.6	23	-	-	4	42.6

TABLE E- 23. 2005 travel time of PIT-tagged yearling spring/summer Chinook released in any basin above McNary Dam between McNary Dam and Bonneville Dam (grouped by observation date at McNary Dam).

McNary Dam	Travel Time			Confidence Limits		The Dalles Dam	
Passage Date	Min	Med	Max	Lower	Upper	Number	Flow
04/22	7.2	9.8	10.3	-	-	5	160.2
04/23	7	8.7	12.1	-	-	5	159.7
04/24	7.3	8.7	9.3	7.3	9.3	7	163.3
04/25	7.2	8.7	12.8	-	-	5	168.2
04/26	6.9	9.4	10.9	-	-	3	174.1
04/27	6.8	9.4	12.1	-	-	6	175.3
04/28	6.2	8.5	13.4	-	-	5	176.9
04/29	6.2	8	10.9	7.5	8.8	38	175.3
04/30	5.9	8.5	12.6	7.4	9	37	186.1
05/01	5.6	7.5	14	7.2	8	83	188.5
05/02	4.9	7.3	12.1	7	7.9	50	192.4
05/03	5.2	7.2	14.7	6.6	7.9	42	198.4
05/04	5	6.9	14.1	6.4	7.2	57	207.8
05/05	4.8	7	10.9	6.2	7.4	62	219
05/06	5	6.5	12.2	6.3	7.3	45	225.8
05/07	4.3	5.8	24.6	5.6	6	189	231
05/08	3.8	5.4	11.3	5.2	5.5	194	237.3
05/09	3.8	5.2	11.5	5.1	5.4	164	242.4
05/10	3.9	5.2	13.5	5	5.4	132	240.3
05/11	4	5.6	13.2	5.4	5.8	209	242.1
05/12	3.8	5.4	12.2	5.2	5.7	116	240.3
05/13	3.7	5.1	21.2	5	5.2	264	244.3
05/14	3.6	4.9	13.7	4.8	5.1	306	247.6
05/15	3.3	4.7	15.1	4.7	4.8	411	250.6
05/16	3.6	4.7	17.3	4.6	4.8	297	258.4
05/17	3.3	4.9	16.2	4.8	5	329	264.2
05/18	3.4	4.9	8.8	4.7	5.1	203	264.9
05/19	3.5	4.9	10.4	4.7	4.9	441	258.2
05/20	3.4	4.9	28.2	4.8	4.9	343	252.7
05/21	3.5	4.7	22.2	4.7	4.9	366	251.3
05/22	3.3	4.8	8.5	4.6	5	167	248.2
05/23	3.4	4.8	7.2	4.7	4.9	113	250
05/24	3.5	4.6	8.6	4.4	4.7	153	243.1
05/25	3.5	4.5	15.9	4.4	4.6	137	231.1
05/26	3.1	4.4	8.1	4.1	4.9	66	231.9
05/27	3.3	4.5	8.7	4.3	4.7	76	218
05/28	3.4	4.8	7.6	4.6	5.1	76	214.2
05/29	3.7	4.7	9.8	4.4	5	91	205.2
05/30	3.5	4.3	12.1	4.2	4.5	61	202.5
05/31	3.3	4.4	6.6	4.1	4.6	53	213.2
06/01	3.6	4.6	11.4	4.1	5.4	15	208.3
06/02	3.9	4.8	24.2	4.4	5.7	16	201.3
06/03	4.2	4.8	8.6	4.2	8.6	8	192

TABLE E- 23. 2005 travel time of PIT-tagged yearling spring/summer Chinook released in any basin above McNary Dam between McNary Dam and Bonneville Dam (grouped by observation date at McNary Dam).
continued

McNary Dam	Travel Time			Confidence Limits		The Dalles Dam	
Passage Date	Min	Med	Max	Lower	Upper	Number	Flow
06/04	4.2	5	7.7	4.8	5.7	16	190.6
06/05	4.4	4.8	11	4.6	6	16	183
06/06	4.1	5.1	5.9	4.8	5.2	26	188.4
06/07	4.1	4.7	6	4.4	5.2	9	181.1
06/08	3.9	4.8	5.6	3.9	5.3	10	179.9
06/09	6.1	7.2	10.8	-	-	4	179.4
06/10	4.4	5	12.2	-	-	6	177.2

TABLE E- 24. 2005 travel time of PIT-tagged steelhead released in any basin above McNary Dam between McNary Dam and Bonneville Dam (grouped by observation date at McNary Dam).

McNary Dam	Travel Time			Confidence Limits		The Dalles Dam	
Passage Date	Min	Med	Max	Lower	Upper	Number	Flow
04/16	6.3	8.9	19.6	8.1	10.8	24	128
04/17	5.9	9.6	18	8.4	11.1	87	138.2
04/18	6.8	12.1	25.4	11.7	12.7	79	147.4
04/19	7.5	11.2	22.6	10.7	11.7	85	150
04/20	7.5	11.3	18.3	10.4	12.2	39	152.6
04/21	7	9.4	17.1	9	10.3	49	154.6
04/22	5.9	8.8	13.6	7.7	11.4	14	158.4
04/23	6.4	8.1	10.2	7.1	9	18	157.7
04/24	6.1	9.6	13.9	-	-	4	164.2
04/25	6.1	8	28.2	7.3	8.6	20	167.7
04/26	5.9	7.8	12.4	6.7	9.5	12	172.8
04/27	5.3	6.4	12.8	5.9	10	12	171.9
04/28	5.8	6.4	13.4	5.8	13.4	8	171.5
04/29	6	8	13.8	6.8	10.9	12	175.3
04/30	6.3	8.8	12.6	6.6	10.7	11	186.1
05/01	5	6.7	10	5.8	7.9	17	182.5
05/02	5.3	7.4	8.6	-	-	5	192.4
05/03	4.9	6.4	14.9	5.9	10.7	10	194.5
05/04	4.8	5.8	9.5	4.9	8.5	11	201.4
05/05	4.3	5.7	9.2	5.3	6.5	21	212.8
05/06	4.5	5.7	10.4	4.8	6.7	15	223.7
05/07	4.3	5.2	11.8	5	6.3	47	229.3
05/08	4.6	5.8	12.3	5.2	7.9	14	237.2
05/09	3.9	5.1	15.6	4.7	6.3	31	242.4
05/10	4.3	5.4	7.7	4.9	5.9	25	240.3
05/11	4	5.4	12.6	5	5.5	62	239.8
05/12	4.4	4.9	8.9	4.8	6	18	240.3
05/13	4.4	5.7	18.3	5	6	19	246.6
05/14	3.9	4.8	7.2	4.6	5	28	247.6
05/15	3.7	4.5	8.7	4.3	5	34	250.6
05/16	4.2	6	11.9	4.2	11.9	8	258.2
05/17	3.9	5.7	13.5	4.9	7.1	16	263.6
05/18	4	5.3	10.3	5	5.9	29	264.9
05/19	3.4	4.5	15	4.2	4.7	64	258.2
05/20	3.5	5	16.7	4.7	7	41	252.7
05/21	3.6	5.6	11.9	5.1	6.7	42	251.4
05/22	4.2	5.6	10.5	4.3	7	10	250.9
05/23	4	5.2	13.3	5	6	23	250
05/24	3.8	5.2	7.3	4.5	5.7	32	243.1
05/25	3.8	4.8	13	4.7	5	65	231.1
05/26	3.8	5.4	22.9	4.8	8.3	32	223.6
05/27	3.9	7	17.2	4.6	8.3	24	218.9
05/28	3.9	7.3	11.9	3.9	11.9	7	215.8
05/29	4.8	6	14.5	5.4	7.4	29	208.5

TABLE E- 24. 2005 travel time of PIT-tagged steelhead released in any basin above McNary Dam between McNary Dam and Bonneville Dam (grouped by observation date at McNary Dam).

(continued)

McNary Dam	Travel Time			Confidence Limits		The Dalles Dam	
Passage Date	Min	Med	Max	Lower	Upper	Number	Flow
05/30	4.4	5	8.8	4.6	6.2	14	206.8
05/31	3.9	4.8	14.7	3.9	14.7	7	204.9
06/01	3.9	5	6.5	-	-	5	208.3
06/02	4.2	5.2	9.7	4.4	8.8	11	201.3
06/03	4.5	6.1	8.3	-	-	4	193.9
06/04	4.9	6.1	13.4	-	-	5	189.5
06/05	4.6	5.4	12.4	-	-	6	183
06/06	4.1	6.8	11.3	-	-	6	181.6

TABLE E- 25. 2005 travel time of PIT-tagged subyearling summer/fall Chinook released in any basin above McNary Dam between McNary Dam and Bonneville Dam (grouped by observation date at McNary Dam). Table excludes Hanford Reach wild fall Chinook - those fish are shown in Table E-26.

McNary Dam	Travel Time			Confidence Limits		The Dalles Dam	
Passage Date	Min	Med	Max	Lower	Upper	Number	Flow
06/05	4.8	5.2	5.8	-	-	4	183
06/06	4.8	5.6	19.5	5.2	6.8	20	184.2
06/07	4.2	5.1	6.2	-	-	5	181.1
06/08	4.6	5.6	9.4	5.3	6	18	179.5
06/10	5.7	6.6	8.3	-	-	4	175.7
06/11	5.6	7	10.3	-	-	3	176.2
06/12	6.8	8.5	10.2	-	-	2	170.7
06/13	5.6	6.8	7.5	-	-	4	171.5
06/14	5.6	7.8	13.4	5.6	13.4	8	175.4
06/15	5.3	8	16.8	6.5	15.2	11	180.5
06/16	4.5	7.2	16	5.2	9.4	9	179.9
06/17	5	6.7	12.5	5.3	10.2	14	183.7
06/18	4.5	8.1	14.9	6.3	12	15	187.1
06/19	6	7.1	11.4	6	11.4	7	187.1
06/20	4.2	4.9	5.3	-	-	6	195.8
06/21	4	4.2	11.8	4	11.8	7	199
06/22	4	6	15.5	4.3	8.2	10	198.1
06/23	4.1	6.5	14.5	5.5	7.7	20	198
06/24	4.3	5.3	22.1	5	6.1	27	193.8
06/25	3.9	5.5	10.3	4.5	7.4	16	195.9
06/26	4	4.9	20.2	4.6	5.5	25	194.4
06/27	4	5	15.7	4.8	5.5	30	195.5
06/28	3.8	5.2	18.5	4.8	7.4	22	190
06/29	4.1	5	14.2	4.1	8.7	14	182.3
06/30	4.2	5.7	13.5	5.2	8.2	23	176.1
07/01	5.6	8	15.9	-	-	3	173.1
07/02	4.8	6.7	9.9	-	-	4	168.9
07/03	5	5.5	6.5	-	-	5	165.6
07/04	5	5.9	9.7	-	-	4	164.7
07/05	5.5	6.6	7.7	-	-	2	169.2
07/08	4	4	4	-	-	1	171.7
07/09	4.4	5	9.5	-	-	3	174.4

TABLE E- 26. 2005 travel time of PIT-tagged wild fall Chinook released in Hanford Reach between McNary Dam and Bonneville Dam (grouped by observation date at McNary Dam).

McNary Dam	Travel Time			Confidence Limits		The Dalles Dam	
Passage Date	Min	Med	Max	Lower	Upper	Number	Flow
06/06	4.1	4.1	19.5	-	-	1	186.9
06/11	5.2	5.2	10.3	-	-	1	174.6
06/12	5	5	10.2	-	-	1	171.1
06/14	4.4	5.2	13.4	-	-	6	171.4
06/15	4.5	5.3	16.8	-	-	6	171.9
06/16	3.9	4.7	16	-	-	6	170.5
06/17	4.1	5.2	12.5	-	-	4	174.9
06/18	4.5	5.4	14.9	4.5	7.1	8	182.8
06/19	4.4	4.4	11.4	-	-	1	182
06/21	4	4	11.8	-	-	2	199
06/22	3.7	4.1	15.5	-	-	4	200.7
06/23	3.4	4.1	14.5	-	-	5	202.7
06/24	4.2	4.3	22.1	-	-	3	194
06/25	3.7	3.7	10.3	-	-	1	193.1
06/26	4	4	20.2	-	-	3	191.9
06/27	3.7	4.1	15.7	3.7	4.3	7	196.2
06/28	3.7	4.2	18.5	3.7	4.5	8	193.9
06/29	3.6	4.1	14.2	-	-	5	192.1
06/30	3.5	4.7	13.5	4.1	5.2	9	181
07/01	3.1	3.1	15.9	-	-	1	175.6
07/02	4.8	4.8	9.9	-	-	1	165.2
07/04	5	5	9.7	-	-	1	164.8
07/05	5.5	5.5	7.7	-	-	1	169.8
07/09	4.4	4.7	9.5	-	-	2	174.4

APPENDIX F

Reach Survival Tables

Description of Reach Survival Tables:

Table F-1 presents 2005 survival estimates for PIT tagged yearling chinook and steelhead released from traps on the lower Salmon (103 km above mouth at Twin Bridges), lower Imnaha (6.8 km above mouth), lower Grande Ronde (5 km above mouth), and mainstem Snake (225 km above mouth at Lewiston) rivers through a series of three reservoirs and dams to the tailrace of Lower Monumental Dam. The Seber (1965) and Jolly (1965) methodology and computer program Mark (Burnham *et al.* 1987) were used to obtain point estimates of survival for the series of reaches, along with corresponding standard errors of the estimates and the correlation between estimates from adjacent reaches. The three reaches were: trap location to Lower Granite Dam tailrace (denoted **lgr**); Lower Granite Dam tailrace to Little Goose Dam tailrace (denoted **lgs**); and Little Goose Dam tailrace to Lower Monumental Dam tailrace (denoted **lmn**). The product of these three reach estimates produced the entire 3-dam reach survival estimate from the trap's location to Lower Monumental Dam tailrace (denoted **surv_reach**). The associated standard errors (denoted **se_lgr**, **se_lgs**, and **se_lmn** for the respective reach estimates) and covariances derived from the correlation estimates (denoted **corr_lgrlgs** and **corr_lgslmn**) went into computing the variance for the overall reach estimate (denoted **var_reach**) using Meyer's (1975) formulas for propagation of error (*i.e.*, variance of the product of three random variables whose error may be correlated). Normally distributed 95% confidence intervals were computed for the overall reach survival point estimates, and are denoted **ul_reach** for the upper limit and **ll_reach** for the lower limit. Plots of the reach survival estimates with associated 95% confidence intervals are presented in Table F-1 for PIT tag releases from the traps on the Salmon, Snake, Imnaha, and Grande Ronde rivers.

Table F-2 presents 2005 survival estimates for PIT tagged yearling chinook from selected hatcheries in the Snake River basin through a series of reservoirs and dams to John Day Dam tailrace. Survival estimates through the 3-dam reach as described in the preceding paragraph are extended further downstream to encompass the Lower Monumental Dam tailrace to McNary Dam tailrace reach (denoted **mcn**), and McNary Dam tailrace to John Day Dam tailrace reach (denoted **jda**). The product of the five reach estimates produced the entire 5-reach survival estimate from trap's release location to the tailrace of John Day Dam (again denoted **surv_reach**). Along with the additional standard errors (**se_mcn**, and **se_jda**) and correlations (**corr_lmnmcn**, and **corr_mcnjda**), the variance for the entire 5-reach survival estimate was computed using Meyer's

(1975) formulas.

Table F-3 presents 2005 survival estimates for PIT tagged yearling and subyearling chinook, steelhead, and sockeye from several release sites in the Mid-Columbia River basin through one reach consisting of multiple reservoirs and dams. Winthrop Hatchery yearling chinook passed six dams, Wells Hatchery subyearling chinook passed five dams, Leavenworth Hatchery yearling chinook passed four dams, Rock Island Dam releases passed three dams, and Priest Rapids Hatchery and Ringold Hatchery passed one dam. The tables present survival estimates to John Day Dam tailrace using the same procedures as described for the previous estimates. Table F-4 presents 2005 estimates from release at Rock Island Dam juvenile bypass to John Day Dam.

Sources:

Burnham, K.P., D.R. Anderson, G.C. White, C. Bronwnie, and K.H. Pollock, 1987, *Design and analysis methods for fish survival experiments based on release-recapture*, American Fisheries Society Monograph 5, 437 pp.

Jolly, G.M., 1965, Explicit estimates from capture-recapture data with both death and immigration – stochastic model, *Biometrika*, 52: 225-247.

Meyer, S.L., 1975, *Data analysis for scientists and engineers*, John Wiley and sons, N.Y., 513 pp.

Seber, G.A.F., 1965, A note on the multiple-recapture census, *Biometrika*, 52: 249-259.

TABLE F- 1. 2005 survival estimates for trap released fish to Lower Granite Dam tailrace (lgr), between subsequent dams (lgs and lmn), and within the entire reach (surv-reach).

Site	Imnaha River Trap		
species/ reartype	CH1W	STH	STW
dates	3/4-5/18	4/12-5/31	3/20-5/31
lgr	0.791	0.828	0.821
se_lgr	0.009	0.006	0.007
lgs	0.899	0.890	0.891
se_lgs	0.014	0.008	0.009
lmn	0.906	0.821	0.803
se_lmn	0.037	0.022	0.027
corr_lgrlgs	-0.258	-0.350	-0.284
corr_lgslmn	-0.188	-0.121	-0.101
N	2763	6570	4084
ul_reach	0.697	0.637	0.627
ll_reach	0.592	0.572	0.548
surv_reach	0.645	0.604	0.588
var_reach	0.0007	0.0003	0.0004

Site	Salmon River Trap			
species/ reartype	CH1H	CH1W	STH	STW
dates	3/12-5/18	3/12-5/17	3/21-5/17	3/31-5/16
lgr	0.761	0.808	0.829	0.845
se_lgr	0.007	0.005	0.009	0.024
lgs	0.922	0.900	0.914	0.947
se_lgs	0.010	0.008	0.010	0.028
lmn	0.929	0.840	0.853	0.890
se_lmn	0.030	0.019	0.030	0.117
corr_lgrlgs	-0.257	-0.262	-0.265	-0.263
corr_lgslmn	-0.201	-0.181	-0.108	-0.117
N	4743	9478	2625	314
ul_reach	0.694	0.638	0.691	0.897
ll_reach	0.609	0.583	0.600	0.526
surv_reach	0.652	0.610	0.646	0.711
var_reach	0.0005	0.0002	0.001	0.009

TABLE F- 1. 2005 survival estimates for trap released fish to Lower Granite Dam tailrace (lgr), between subsequent dams (lgs and lmn), and within the entire reach (surv-reach).

(continued)

Site	Grande Ronde River Trap			
species/ reartype	CH1H	CH1W	STH	STW
dates	3/15-5/22	3/8-5/24	3/30-5/24	3/29-5/24
lgr	0.748	0.900	0.858	0.913
se_lgr	0.014	0.011	0.011	0.012
lgs	0.880	0.884	0.912	0.930
se_lgs	0.020	0.020	0.014	0.016
lmn	0.897	0.926	0.850	0.866
se_lmn	0.057	0.044	0.048	0.062
corr_lgrlgs	-0.259	-0.582	-0.294	-0.377
corr_lgslmn	-0.188	-0.151	-0.110	-0.099
N	1402	1975	1417	978
ul_reach	0.664	0.806	0.740	0.838
ll_reach	0.516	0.669	0.591	0.631
surv_reach	0.590	0.737	0.666	0.735
var_reach	0.0014	0.0012	0.0015	0.0028

Site	Snake River Trap		
species/ reartype	CH1H	STH	STW
dates	3/30-5/16	3/29-6/2	3/29-6/1
lgr	0.899	0.970	0.959
se_lgr	0.019	0.005	0.008
lgs	0.892	0.940	0.944
se_lgs	0.029	0.008	0.012
lmn	0.876	0.875	0.845
se_lmn	0.063	0.024	0.046
corr_lgrlgs	-0.412	-0.396	-0.356
corr_lgslmn	-0.242	-0.130	-0.113
N	625	3357	1356
ul_reach	0.800	0.842	0.847
ll_reach	0.606	0.755	0.684
surv_reach	0.703	0.799	0.765
var_reach	0.0025	0.0005	0.0017

TABLE F- 2. 2005 survival estimates for Snake River basin fish from release site to John Day Dam tailrace (jda).

Hatchery & species	McCall Chinook	Dworshak Chinook	Rapid R Chinook	Imnaha R Chinook	Catherine Ck Chinook
lgr	0.611	0.836	0.738	0.536	0.234
se_lgr	0.003	0.003	0.002	0.004	0.003
lgs	0.905	0.911	0.938	0.913	0.920
se_lgs	0.006	0.005	0.005	0.009	0.014
lmn	0.908	0.887	0.900	0.865	0.894
se_lmn	0.015	0.012	0.014	0.022	0.033
mcn	0.922	0.954	0.899	1.020	0.956
se_mcn	0.030	0.025	0.026	0.054	0.072
jda	0.963	0.872	0.844	0.812	0.837
se_jda	0.106	0.069	0.065	0.112	0.190
corr_lgrlgs	-0.356	-0.540	-0.341	-0.351	-0.271
corr_lgslmn	-0.224	-0.226	-0.211	-0.236	-0.235
corr_lmnmcn	-0.451	-0.453	-0.483	-0.396	-0.416
corr_mcnjda	-0.227	-0.254	-0.274	-0.314	-0.264
N	51901	51819	51975	20917	20839
c-hat	1.00	1.29	2.88	1.00	0.82
surv_reach	0.446	0.562	0.472	0.350	0.154
se_reach	0.003	0.002	0.002	0.003	0.001
UI_reach	0.548	0.656	0.549	0.454	0.227
LI_reach	0.345	0.469	0.395	0.247	0.081

TABLE F- 3. 2005 survival estimates for Mid-Columbia River basin fish from Hatchery to John Day Dam tailrace (jda).

Site	Leavenworth Hatchery	Priest Rapids Hatchery	Wells Hatchery
species/ reartype	CH1H	CH0H	CH0H
dates	4/15	4/15	5/18
mcn	0.526	0.655	0.323
se_mcn	0.014	0.040	0.048
jda	0.757	1.119	0.720
se_jda	0.051	0.403	0.402
corr_mcnjda	-0.345	-0.161	-0.257
N	14,969	2,996	792
ul_reach	0.658	1.244	0.479
ll_reach	0.139	0.222	-0.246
surv_reach	0.398	0.733	0.233
var_reach	0.017	0.068	0.016

TABLE F- 4. 2005 survival estimates for Mid-Columbia River basin fish from Rock Island to John Day Dam tailrace (jda).

Site	Rock Island Dam				
species/ reartype	RIS CH0	RIS CH1	RIS STH	RIS STW	RIS SO
dates	6/26-8/31	4/22-5/31	4/24-6/1	4/22-6/1	4/22-5/31
mcn	0.522	0.606	0.538	0.533	0.697
se_mcn	0.249	0.085	0.074	0.064	0.135
jda	0.597	0.504	1.295	0.512	0.558
se_jda	0.634	0.161	0.622	0.137	0.269
corr_mcnjda	-0.448	-0.418	-0.280	-0.425	-0.157
N	3,529	721	1,712	1,138	886
ul_reach	0.891	0.920	1.327	0.402	1.251
ll_reach	-0.268	-0.308	-0.630	-0.130	-0.474
surv_reach	0.312	0.306	0.697	0.273	0.389
var_reach	0.088	0.098	0.103	0.004	0.194

APPENDIX G

Hatchery Release Schedule

Colville Tribe

Cassimer Bar Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
ST		SU	4/19/2005	4/19/2005	13,232	6.0	Omak Creek	Okanogan River	2004	100% ad + PIT tag; rel = RM2.
Cassimer Bar Hatchery Total					13,232					

Leavenworth NFH

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH1		1 SP	4/8/2005	4/18/2005	99,399	17.0	Bonaparte Acclimation Pond	Okanogan River	2003	100% ad clip; rel = ~1 mile d/s of Tonasket.
CH		1 SP	4/11/2005	4/12/2005	49,576	19.6	Omak Creek	Okanogan River	2003	Rel = Rm 1.25; 100% LV clip only.
Leavenworth NFH Total					148,975					

Colville Tribe Total	162,207
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Fisheries and Oceans Canada

Shuswap Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
SO		UN	6/2/2004	6/2/2004	352,000	567.5	Lake Skaha	Okanogan River	2003	Fry plants rel in Lake Skaha to rear; unmarked.

Fisheries and Oceans Canada Total	352,000
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Idaho Dept. of Fish and Game

Clearwater Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	9/25/2004	9/26/2004	343,967	17.3	Powell Acclim Pond	Lochsa River	2003	100% ad clip; .7k PIT tag.
CH		1 SP	3/21/2005	4/4/2005	401,362	15.5	Red River Acclim Pond	S Fk Clearwater River	2003	100% ad clip; 80k ad+CWT; .3k PITs.
CH		1 SP	3/24/2005	4/5/2005	403,917	15.7	Powell Acclim Pond	Lochsa River	2003	100% ad clip; 80k ad+CWT; .3k PITs.
CH		1 SP	3/29/2005	3/31/2005	700,387	15.8	Crooked R Acclim Pond	S Fk Clearwater River	2003	100% ad clip; 80k ad+CWT; .3k PITs.
Spring Chinook Yearling Total					1,849,633					

ST		SU	4/9/2005	4/19/2005	98,981	3.9	Red River Acclim Pond	S Fk Clearwater River	2004	100% ad clip; 2.5k PITs.
ST		SU	4/11/2005	4/13/2005	148,352	3.9	Crooked R Acclim Pond	S Fk Clearwater River	2004	100% ad clip; 60k adLV+CWT; .3k PITs.
ST		SU	4/13/2005	4/18/2005	267,414	4.0	Redhouse (SFk ClearH20 R)	S Fk Clearwater River	2004	100% ad clip; 63k adLV+CWT; .3k PITs.

Summer Steelhead Total	514,747
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Clearwater Hatchery Total	2,364,380
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Magic Valley Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
ST		SU	3/15/2005	3/16/2005	84,828	5.2	Little Salmon River	Salmon River (ID)	2004	100% ad clip; .3k PITs; Rel = Stinky Spr.
ST		SU	3/17/2005	4/4/2005	214,443	5.4	Little Salmon River	Salmon River (ID)	2004	Rel = Stinky Spr; 100% ad clip; 60k adLV+CWT; .3k PITs.
ST		SU	4/4/2005	4/4/2005	87,108	4.2	Squaw Cr Acclim Pond	Salmon River (ID)	2004	100% ad clip; 1.8k PITs.
ST		SU	4/7/2005	4/7/2005	125,873	4.5	Salmon River (ID)	Salmon River (ID)	2004	100% ad clip; 30k ad+CWT; .3k PITs; rel = Red Rock.
ST		SU	4/8/2005	4/8/2005	42,285	4.8	Lemhi River	Salmon River (ID)	2004	100% ad clip; 30k ad+CWT; .3k PITs.
ST		SU	4/8/2005	4/15/2005	90,508	4.5	Lemhi River	Salmon River (ID)	2004	No fin clips; .3k PITs; also rel = 55k Hayden Cr.
ST		SU	4/11/2005	4/14/2005	236,487	4.7	Salmon River (ID)	Salmon River (ID)	2004	100% ad clip; 30k ad+CWT; .3k PITs; Rel = Colston & Lemhi Hole.
ST		SU	4/12/2005	4/12/2005	27,342	4.4	Pahsimeroi River	Pahsimeroi River	2004	Rel = (below Weir); 100% ad+CWT.
ST		SU	4/13/2005	4/14/2005	183,698	4.6	McNabb/Salmon n River	Salmon River (ID)	2004	100% ad clip; 30k ad+CWT; .3k PITs; Rel (Tunnel Rock - 60k)
ST		SU	4/15/2005	4/21/2005	236,818	4.3	East Fk Salmon River	Salmon River (ID)	2004	100% ad clip; lower rel site.
ST		SU	4/18/2005	4/22/2005	244,237	4.3	Squaw Creek	Salmon River (ID)	2004	100% ad clip; 30k adRV+CWT; .5k PITs.
ST		SU	4/22/2005	4/22/2005	11,116	4.7	East Fk Salmon River	Salmon River (ID)	2004	No fin clips; BWT only; (above E Fk Weir).
ST		SU	4/26/2005	4/26/2005	190,451	4.1	Yankee Fk (Salmon R)	Salmon River (ID)	2004	30k no fin clips; 160k ad clip; 28k ad+CWT; .3k PITs.
ST		SU	4/26/2005	4/26/2005	30,100	4.3	Valley Creek	Salmon River (ID)	2004	No fin clips; .3k PITs.
Magic Valley Hatchery Total					1,805,294					
McCall Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SU	9/23/2004	9/24/2004	220,000	32.5	Knox Bridge	Salmon River (ID)	2003	100% ad clip; Excess to program; Rel = below S Fk Trap.
CH		1 SU	3/18/2005	3/21/2005	1,047,530	20.9	Knox Bridge	Salmon River (ID)	2003	100% ad clip; 269k ad+CWT; 75k PIT tag.
McCall Hatchery Total					1,267,530					
Niagara Springs Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
ST		SU	3/14/2005	3/24/2005	526,024	4.9	Hells Canyon Dam	Snake River	2004	100% ad clip; 33k adLV+CWT; .3k PITs.
ST		SU	3/24/2005	3/31/2005	358,387	4.8	Hazard Creek/Little Salmon R	Little Salmon River	2004	100% ad clip; 60k ad+CWT; .6k PITs; 115k rel = Stinky Spr.
ST		SU	4/2/2005	4/21/2005	820,667	4.4	Pahsimeroi Hatchery	Pahsimeroi River	2004	100% ad clip; 62k ad+CWT; .3k PITs.
Niagara Springs Hatchery Total					1,705,078					
Oxbow-Idaho Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 FA	4/28/2005	4/28/2005	189,119	61.5	Hells Canyon Dam	Snake River	2004	100% ad+CWT; 10k PITs.
Oxbow-Idaho Hatchery Total					189,119					

Pahsimeroi Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SU	3/22/2005	4/4/2005	975,252	18.1	Pahsimeroi Hatchery	Pahsimeroi River	2003	100% ad clip; 109k ad+CWT; .5k PITs.

Pahsimeroi Hatchery Total **975,252**

Rapid River Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	3/8/2005	3/10/2005	300,000	20.8	Hells Canyon Dam	Snake River	2003	100% ad clip.
CH		1 SP	3/11/2005	3/11/2005	200,000	24.4	Hazard Creek/Little Salmon R	Little Salmon River	2003	100% ad clip.
CH		1 SP	3/15/2005	4/22/2005	2,761,430	19.1	Rapid River Hatchery	Little Salmon River	2003	100% ad clip; 100k ad+CWT; 52k PITs.

Rapid River Hatchery Total **3,261,430**

Sawtooth Hatchery

CH		1 SP	3/31/2005	3/31/2005	134,769	19.0	Sawtooth Hatchery	Salmon River (ID)	2003	100% LV clip; no ad clip; .5k PITs.
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Spring Chinook Yearling Total **134,769**

SO		1 UN	10/5/2004	10/5/2004	79,887	43.0	Redfish Lake	Salmon River (ID)	2003	100% ad clip; 1k PIT tag.
SO		1 UN	10/6/2004	10/6/2004	29,700	43.3	Pettit Lake	Salmon River (ID)	2003	100% ad clip; 1k PIT tag.
SO		1 UN	10/6/2004	10/6/2004	21,129	43.9	Alturas Lake	Salmon River (ID)	2003	100% ad clip; 1k PIT tag.
SO		1 UN	5/10/2005	5/10/2005	39,269	12.7	Redfish Lake Creek	Salmon River (ID)	2003	100% ad+CWT; 2k PITs; 19.4k LV clip.
SO		1 UN	5/10/2005	5/10/2005	39,061	13.2	Salmon River (ID)	Salmon River (ID)	2003	100% ad+CWT; 19.2k LV clip.

Sockeye Yearling Total **209,046**

Sawtooth Hatchery Total **343,815**

Idaho Fish and Game Total	11,911,898
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National Marine Fisheries Service**Lyons Ferry Hatchery**

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 FA	6/21/2005	7/8/2005	55,000	75.0	Big Canyon (Clearwater River)	Clearwater River M F	2004	NOAA transp stdy; 50k PITs; rel = near Big Cany @ 3.6k/da.

Lyons Ferry Hatchery Total **55,000**

NMFS Total	55,000
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Nez Perce Tribe**Clearwater Hatchery**

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
ST		SU	4/9/2005	4/19/2005	149,748	5.3	Red River Acclim Pond	S Fk Clearwater River	2004	No fin clips; 100k CWT+VI (L eye OR & L eye blue) tag + 5k PIT tag.
ST		SU	4/11/2005	4/15/2005	83,674	4.2	Crooked R Acclim Pond	S Fk Clearwater River	2004	100% no fin clip; 20k CWT only; .3k PITs.
ST		SU	4/18/2005	4/18/2005	22,757	5.0	Meadow Creek - CLES	S Fk Clearwater River	2004	100% CWT+VI (R eye Orange) tag; 1.2k PITs; No fin clips.
ST		SU	4/18/2005	4/18/2005	22,757	5.0	Mill Cr Bridge	S Fk Clearwater River	2004	No fin clips; 100% CWT+VI (R eye orange) tag; 1.2k PITs.
ST		SU	4/20/2005	4/20/2005	53,046	5.0	Lolo Creek	Clearwater River M F	2004	No fin clips; .3k PITs.

Clearwater Hatchery Total **331,982**

Dworshak NFH										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	9/21/2004	9/21/2004	70,191	78.7	Selway River	Clearwater River M F	2003	100% ad clip; Rel = McGruder Corridor; Surplus prod.
Spring Chinook Yearling Subtotal					70,191					
CO		1 UN	4/27/2005	4/27/2005	287,863	15.3	Clear Creek	Clearwater River M F	2003	150k CWT only 61-26-81..85; 2k PIT tag; no fin clips.
Coho Yearling Subtotal					287,863					
ST		SU	4/12/2005	4/12/2005	72,406	8.4	Newsome Creek	S Fk Clearwater River	2004	No fin clips; no tags/marks.
ST		SU	4/13/2005	4/13/2005	79,320	6.9	American River	S Fk Clearwater River	2004	No fin clips; no tags.
Summer Steelhead Subtotal					151,726					
Dworshak NFH Total					509,780					
Eagle Creek NFH										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CO		1 UN	3/7/2005	3/7/2005	287,793	16.0	Potlatch River	Clearwater River M F	2003	50k CWT only 61-26-; 50k ad+CWT 61-26-46; 1.0k PITs.
CO		1 UN	3/9/2005	3/9/2005	46,912	14.8	Clear Creek	Clearwater River M F	2003	% Mark - Pending.
CO		1 UN	3/9/2005	3/9/2005	193,732	15.9	Clearwater River	Snake River	2003	Rel at RM 16.5; 50k ad+CWT61-26-81; 50kCWT only 61-26-87; 1k PITs.
Eagle Creek NFH Total					528,437					
Hagerman NFH										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
ST		SU	3/28/2005	4/7/2005	156,219	4.4	Hazard Creek/Little Salmon R	Little Salmon River	2004	No fin clips; .3k PIT.
ST		SU	4/7/2005	4/7/2005	44,795	4.1	Hazard Creek/Little Salmon R	Little Salmon River	2004	No fin clips.
Hagerman NFH Total					201,014					
Lookingglass Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	3/11/2005	3/20/2005	95,541	22.8	Lostine Accim Pond	Wallowa River	2003	100% ad+CWT + 51.8k VIE (L Elast Red) tag; 5k PIT tag.
CH		1 SP	3/28/2005	4/1/2005	69,278	23.2	Lostine Accim Pond	Wallowa River	2003	100% ad+CWT 9-36-45; Cap. Brd -18.4k; Endemic - 50.8k VIE (L Elast Red) tag; 5k PIT tag.
Lookingglass Hatchery Total					164,819					

Lyons Ferry Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 FA	5/23/2005	5/27/2005	505,087	52.0	Cpt John Acclim Pond	Snake River	2004	100k ad+CWT 61-1-54; 100k CWT 61-1-54 only; 300k unmarked; 3.5k PITs.
CH		0 FA	5/30/2005	5/31/2005	510,226	55.0	Big Canyon (Clearwater River)	Clearwater River M F	2004	100k ad+CWT 61-25-4; 100k CWT 61-25-4 only; 300k unmarked; 2.5k PITs.
Fall Chinook Subyearling Subtotal					1,015,313					
CH		1 FA	4/4/2005	4/5/2005	139,509	10.3	Big Canyon Acclim.Pd (Grande Ronde)	Clearwater River M F	2003	100% ad+CWT; 5k PIT tag.
CH		1 FA	4/13/2005	4/14/2005	150,706	9.7	Pittsburg Landing Acclim Pond	Snake River	2003	100% ad+CWT 61-1-46; 49; 5k PIT tag.
Fall Chinook Yearling Subtotal					290,215					
Lyons Ferry Hatchery Total					1,305,528					

McCall Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SU	3/14/2005	3/16/2005	105,230	25.7	Johnson Cr Idaho	South Fork Salmon River	2003	No fin clips; 100% VI (L. Red) +CWT 10-64-76; 10- 65-76; 12k PITs.
McCall Hatchery Total					105,230					

Nez Perce Tribal Hatchery

CH		0 FA	5/7/2005	5/7/2005	869,300	115.4	Nez Perce Tribal Hatchery	Clearwater River M F	2004	Early rel - flooded hatchery; 207k ad+CWT 61-1-8; 61-26-70; 334k CWT only 61-26-69; 72; 327k Unmark/unclip.
Fall Chinook Subyearling Subtotal					869,300					
CH		0 SP	6/15/2004	6/22/2004	309,555	75.6	Meadow Creek - SELW	Selway River	2003	100% CWT 61-26-50; 74; 61-1-4; 10k PIT tag; no fin clips.
CH		0 SP	8/6/2004	8/9/2004	146,962	36.0	Lolo Creek	Clearwater River M F	2003	100% CWT 61-26-73; No fin clips.
CH		0 SP	5/7/2005	5/7/2005	391,920	69.7	Nez Perce Tribal Hatchery	Clearwater River M F	2004	Rel = flood at hat; orig rel Meadow Crk; 100% CWT 61-26-51; 78; 9.9k PITs.
Spring Chinook Subyearling Subtotal					848,437					
CH			10/1/2004	10/31/2004	75,000	29.0	Newsome Creek	S Fk Clearwater River	2003	100% CWT; no fin clips.
Spring Chinook Yearling Subtotal					75,000					
Nez Perce Tribal Hatchery Total					1,792,737					

Rapid River Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	9/8/2004	10/1/2004	183,923	56.3	Selway River	Clearwater River M F	2003	100% ad clip; Rel = Magruder Corridor; Surplus prod.
Rapid River Hatchery Total					183,923					
Umatilla Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 FA	5/23/2005	5/24/2005	397,704	50.4	Pittsburg Landing Acclim Pond	Snake River	2004	100% ad clip; 169k ad+CWT 7-53-36; 2.5k PITs.
Umatilla Hatchery Total					397,704					
Nez Perce Tribe Total					5,521,154					

Oregon Department of Fish and Wildlife

Irrigon Hatchery Complex										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
ST		SU	4/11/2005	4/11/2005	152,048	4.4	L Sheep Acclim Pond	Imnaha River	2004	130k ad clip only; 25k adLV+CWT 9-41-3.
ST		SU	4/11/2005	4/12/2005	396,943	4.2	Wallowa Acclim Pond	Wallowa River	2004	100% ad clip; 150k adRV orLV+CWT 9-41-4..6; 8..10.
ST		SU	4/11/2005	4/13/2005	136,553	4.6	Big Sheep Creek	Imnaha River	2004	65k ad only; 45k no mark/clips; 45k adLV+CWT 9-40-20.
ST		SU	4/11/2005	4/14/2005	87,924	4.5	Big Canyon Acclim.Pd (Grande Ronde)	Grande Ronde River	2004	100% ad clip; 25k adLV+CWT 9-41-12.
ST		SU	4/30/2005	4/30/2005	145,818	4.6	Wallowa Acclim Pond	Wallowa River	2004	100% ad clip; 25kadLVorRV+CWT 9-41- 7; 11.
ST		SU	5/2/2005	5/3/2005	82,205	4.6	Big Canyon Acclim.Pd (Grande Ronde)	Grande Ronde River	2004	100% ad clip; 25k adLV+CWT 9-41-13.
Irrigon Hatchery Total					1,001,491					
Lookingglass Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	3/29/2005	4/8/2005	435,186	24.5	Imnaha Acclim Pond	Imnaha River	2003	100% ad clip; 213k ad+CWT 9-40-32..34; 21k PIT tag; 145k dir str - 3/29.
Lookingglass Hatchery Total					435,186					
Oak Springs Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
ST		SU	3/1/2005	3/2/2005	32,069	5.8	Hood River	Hood River	2004	100% ad clip; Rel = below Powerdale Dam.
Summer Steelhead Subtotal					32,069					
ST		WI	3/29/2005	3/29/2005	1,961	8.9	E Fk Hood River	Hood River	2004	100% adRV clip.
Winter Steelhead Subtotal					1,961					
Oak Springs Hatchery Total					34,030					

Round Butte Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	4/4/2005	5/31/2005	312,928	9.1	Bel. Pelton Ladder	Deschutes River	2003	100% ad+CWT; 95% emig by 4/30.

Spring Chinook Yearling Subtotal **312,928**

ST-SU			4/4/2005	4/5/2005	156,939	3.6	Bel. Pelton Ladder	Deschutes River	2004	100% adLM clip.
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Summer Steelhead Subtotal **156,939**

Round Butte Hatchery Total **469,867**

Umatilla Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 FA	5/9/2005	5/13/2005	400,000	40.0	Hells Canyon Dam	Snake River	2004	100% ad clip.

Umatilla Hatchery Total **400,000**

ODFW Total	2,340,574
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U.S. Fish and Wildlife Service**Carson Hatchery**

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	4/15/2005	4/15/2005	1,470,134	14.5	Carson Hatchery	Wind River	2003	100% ad clip; 75k CWT 5-38-37; 5-37-29; 5-33-10; 15k PIT tag.

Carson Hatchery Total **1,470,134**

Dworshak Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	9/22/2004	9/22/2004	66,150	24.5	Powell Acclim Pond	Lochsa River	2003	100% ad clip.
CH		1 SP	9/23/2004	9/23/2004	64,263	24.5	Crooked R Acclim Pond	S Fk Clearwater River	2003	Surplus fish; ad clip only.
CH		1 SP	4/4/2005	4/6/2005	1,072,359	19.2	Dworshak Hatchery	Clearwater River M F	2003	100% ad clip; 130k ad+CWT 5-8-64; 73; 52k PITs.
Spring Chinook Yearling Subtotal					1,202,772					
ST		SU	4/11/2005	4/15/2005	282,362	5.5	Kooskia Hatchery	Clearwater River M F	2004	18k undipped; 264k ad clip.
ST		SU	4/11/2005	4/15/2005	317,032	6.0	Redhouse (SFk ClearH20 R)	S Fk Clearwater River	2004	14k undipped; 303k ad clip.
ST		SU	4/18/2005	4/22/2005	1,122,064	6.0	Dworshak Hatchery	Clearwater River M F	2004	54k undip; remainder ad clip; 130k ad+CWT; 1.5k PITs.

Summer Steelhead Subtotal **1,721,458**

Dworshak Hatchery Total **2,924,230**

Entiat Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH1-SP			4/15/2005	4/15/2005	401,240	17.2	Entiat Hatchery	Entiat River	2003	100% ad clip; 200k ad+CWT 5-12-64; 65; 5-41-21; 35; 3k PIT tag.
Entiat Hatchery Total					401,240					
Hagerman Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
ST		SU	4/6/2005	4/11/2005	91,263	4.4	Little Salmon River	Salmon River (ID)	2004	100% ad clip; .3k PITs; Rel = Stinky Spr.
ST		SU	4/11/2005	4/29/2005	747,462	4.3	Sawtooth Hatchery	Salmon River (ID)	2004	Dir. Rel = Weir; 100% ad clip; 80k ad+CWT; .3k PITs.
ST		SU	5/2/2005	5/10/2005	100,150	4.7	East Fk Salmon River	Salmon River (ID)	2004	100% ad clip; .3k PITs.
ST		SU	5/4/2005	5/9/2005	139,384	4.7	Yankee Fk (Salmon R)	Salmon River (ID)	2004	No fin clips; .3k PITs.
Hagerman Hatchery Total					1,078,259					
Kooskia Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	4/1/2005	4/1/2005	620,000	18.0	Kooskia Hatchery	Clearwater River M F	2003	100% ad clip; 105k ad+CWT; 1.5k ISS - PIT tag.
Kooskia Hatchery Total					620,000					
Leavenworth Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 SP	5/5/2005	5/5/2005	486,185	168.1	Leavenworth Hatchery	Wenatchee River	2004	100% ad clip; 200k ad+CWT; excess rel due to hatch modif.
Spring Chinook Subyearling Subtotal					486,185					
CH		1 SP	4/15/2005	4/15/2005	1,476,046	18.4	Leavenworth Hatchery	Wenatchee River	2003	100% ad clip; 800k CWT; 15k PIT tag.
Spring Chinook Yearling Subtotal					1,476,046					
Leavenworth Hatchery Total					1,962,231					
Little White Salmon Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 FA	6/23/2005	6/23/2005	1,459,873	79.3	Little White Salmon Hatchery	Little White Salmon River	2004	1.24 mil ad clip; 200k ad+CWT 5-1-4-5-9; 200k CWT only 5-25-81.
CH		0 FA	6/29/2005	6/29/2005	443,000	90.0	Willard Hatchery	Little White Salmon River	2004	100% ad clip.
Fall Chinook Subyearling Subtotal					1,902,873					
CH		1 SP	4/19/2005	4/19/2005	779,716	13.8	Little White Salmon Hatchery	Little White Salmon River	2003	100% ad clip; 150k ad+CWT.
Spring Chinook Yearling Subtotal					779,716					
Little White Salmon Hatchery Total					2,682,589					

Spring Creek Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 FA	3/2/2005	3/2/2005	7,348,976	183.5	Spring Creek Hatchery	L Col R (D/s McN Dam)	2004	100% ad clip except for 152k CWT only; 5-22-64...67.
CH		0 FA	4/15/2005	4/15/2005	3,915,785	121.7	Spring Creek Hatchery	L Col R (D/s McN Dam)	2004	100% ad clip; 150k ad+CWT 5-17-94; 150k CWT only 5-17-96.
CH		0 FA	4/27/2005	5/4/2005	3,268,727	64.6	Spring Creek Hatchery	L Col R (D/s McN Dam)	2004	100% ad clip; 300k ad+CWT 5-15-78; -17-95.

Spring Creek Hatchery Total **14,533,488**

Warm Springs Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	10/13/2004	11/17/2004	48,430	25.0	Warm Springs Hatchery	Deschutes River	2003	Estim. 10% Passage in fall; 100% ad+CWT 5-20-77...82; & 87...96.
CH		1 SP	3/16/2005	4/13/2005	738,480	22.0	Warm Springs Hatchery	Deschutes River	2003	100% ad+CWT 5-20-72...96.

Warm Springs Hatchery Total **786,910**

Winthrop Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	4/15/2005	4/15/2005	384,603	15.7	Winthrop Hatchery	Methow River	2003	100% CWT; no fin clips; 3.6k PIT tags.
CH		1 SP	4/15/2005	4/15/2005	165,611	17.2	Winthrop Hatchery	Methow River	2003	100% ad+CWT.

Spring Chinook Yearling Subtotal **550,214**

ST		SU	4/22/2005	4/29/2005	110,368	8.2	Winthrop Hatchery	Methow River	2004	100% ad clip; 49.9k PIT tags; 50% force out 4/22.
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Summer Steelhead Subtotal **110,368**

Winthrop Hatchery Total **660,582**

U.S. Fish and Wildlife Service Total	27,119,663
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Umatilla Tribe**Bonneville Hatchery**

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH1-FA			2/14/2005	2/16/2005	226,150	11.3	Umatilla River	Umatilla River	2003	dir stream rel - Reith Br (RM 48); 26.7k ad+CWT 9-40-54; 215k BWT only.
CH1-FA			3/8/2005	3/11/2005	211,315	11.4	Umatilla River	Umatilla River	2003	dir str rel = RM 48; Reith Br; 25k ad+CWT 9-40-53; 185k BWT only.

Bonneville Hatchery Total **437,465**

Cascade Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CO	1	UN	2/16/2005	2/17/2005	249,880	16.9	Pendelton Acclim Pond	Umatilla River	2003	Rel = Reith Br near Apd.; 38% ad clip; 39.7% CWT 9-40-48.
CO	1	UN	3/14/2005	3/21/2005	797,884	15.9	Pendelton Acclim Pond	Umatilla River	2003	Rel = Reith Br near Apd; 25k ad+CWT 9-40-49; 3k PITs.

Cascade Hatchery Total **1,047,764**

Little White Salmon Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH1-SP			3/14/2005	3/15/2005	205,395	17.9	Imeques Acclim Pond	Umatilla River	2003	100% ad clip; 40k adRV+CWT 5-15-97; .3k PIT tag; acclim = 48 hr.
CH1-SP			4/4/2005	4/5/2005	250,374	16.1	Walla Walla River	Walla Walla River	2003	100% ad clip; 1k PIT tag; 50k ad+CWT 5-15-70.

Little White Salmon Hatchery Total **455,769**

Lookingglass Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH	1	SP	3/8/2005	3/14/2005	105,369	21.0	Grande Ronde Acclim Pond	Grande Ronde River	2003	100% CWT only; no fin clips; ~1k Captive Brd w/ad+CWT.
CH	1	SP	3/14/2005	3/27/2005	130,544	25.2	Catherine Cr Acclim Pond	Grande Ronde River	2003	100% ad+CWT; 60kVIE (L Elast gm) tag; 70k Captive Brd.
CH	1	SP	3/18/2005	3/29/2005	98,023	22.1	Lookingglass Hatchery	Grande Ronde River	2003	100% ad clip; 66k ad+CWT 9-38-24; 5k PIT tag.
CH	1	SP	4/4/2005	4/7/2005	59,036	24.9	Catherine Cr Acclim Pond	Grande Ronde River	2003	100% ad+CWT 7-7-54+ VIE (L Elast green) tag.

Lookingglass Hatchery Total **392,972**

Lower Herman Creek Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CO	1	UN	2/14/2005	2/17/2005	512,152	18.1	Pendelton Acclim Pond	Umatilla River	2003	Early rel (Reith Br near Pend APD; 50k ad+CWT 9-37-35

Lower Herman Creek Hatchery Total **512,152**

Umatilla Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH	0	FA	5/12/2005	5/13/2005	603,323	76.8	Umatilla River	Umatilla River	2004	100% ad+CWT 7-14- 39...42; .6k PITs; Rel = RM 48.5; Reith Brdg.
Fall Chinook Subyearling Subtotal					603,323					
CH	1	SP	3/2/2005	3/8/2005	584,775	13.3	Imeques Acclim Pond	Umatilla River	2003	100% ad clip; 120k adRV+CWT 9-40- 61...63; 9-41-1; 2; 9-38- 61; 1.8k PITs.
Spring Chinook Yearling Subtotal					584,775					

ST	SU	4/22/2005	4/28/2005	54,252	4.3	Pendelton Acclim Pond	Umatilla River	2004	100% ad clip; 32k adLV+CWT 9-41-20; .3k PITs.
ST	SU	4/22/2005	4/28/2005	101,446	4.3	Thornhollow Acclim Pond	Umatilla River	2004	100% ad clip; 58k adLV+CWT 9-41-18; 19; .6k PITs.
Summer Steelhead Subtotal				155,698					
Umatilla Hatchery Total				1,343,796					
Umatilla Tribe Total				4,189,918					

Warm Springs Tribe

Oak Springs Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
ST		SU	3/24/2005	5/6/2005	56,529	5.0	Blackberry Acclim Pond	Hood River	2004	100% adRM clip; 3-15k rel on 3/31; 4/18; 5/5; Truck Hood mouth - 5.9k.
Summer Steelhead Subtotal				56,529						
ST		WI	4/7/2005	5/12/2005	37,533	5.0	Parkdale Acclim Pond	Hood River	2004	100% adRV clip; 2 rel groups.
ST		WI	4/8/2005	5/2/2005	38,920	7.6	E Fk Irrig Dist Sand Trap	Hood River	2004	100% adRV clip; .5k PITs rel - Mouth Hood 5/16.
Winter Steelhead Subtotal				76,453						
Oak Springs Hatchery Total				132,982						

Parkdale Pond										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	4/22/2005	4/22/2005	29,819	13.7	Parkdale Acclim Pond	Hood River	2003	100% adLV+CWT 9-40- 10.
Parkdale Pond Total				29,819						

Round Butte Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	3/17/2005	5/3/2005	43,235	12.0	Blackberry Acclim Pond	Hood River	2003	100% adRM; CWT 9-40- 46; 47; 1/2 rel = 4/7; 1/2 rel = 5/3.
CH		1 SP	3/27/2005	5/3/2005	40,047	12.0	Jones Creek Acclim Pond	Hood River	2003	100% adRm clip; 1/2 rel = 4/7; 1/2 rel = 5/3; CWT 9- 40-46; 47.
Round Butte Hatchery Total				83,282						
Warm Springs Tribe Total				246,083						

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Co-Op Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	4/18/2005	4/25/2005	37,065	15.0	O'Reilly Pond	Methow River	2003	MSRF coop; 100% CWT 63-25-64; No fin clips.
Spring Chinook Yearling Subtotal				37,065						
CO		1 NO	2/2/2004	3/25/2004	90,000	1188.0	Salmon Creek (WA)	Columbia River	2003	Unmarked fry rel by Dist 5 Firefighters.
Coho Yearling Subtotal				90,000						
ST		SU	4/23/2005	5/7/2005	20,865	7.0	O'Reilly Pond	Methow River	2004	HxW Cross; No fin clips; 100% VI tag (R Yellow elast).
Summer Steelhead Subtotal				20,865						
Co-Op Hatchery Total				147,930						

Eastbank Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 SP	3/21/2005	3/25/2005	14,629	192.0	Chiwawa Hatchery	Wenatchee River	2004	100% ad clip.
Spring Chinook Subyearling Subtotal					14,629					
CH		0 SU	6/27/2005	6/27/2005	364,453	25.0	Turtle Rock Hatchery	Mid-Columbia River	2004	Accelerated Group; 200k ad+CWT 63-25-78.
CH		0 SU	6/27/2005	6/27/2005	411,707	38.0	Turtle Rock Hatchery	Mid-Columbia River	2004	Production Group; 200k ad+CWT 63-27-81.
Summer Chinook Subyearling Subtotal					776,160					
CH		1 SP	4/18/2005	5/18/2005	222,131	9.6	Chiwawa Hatchery	Wenatchee River	2003	100% ad+CWT 63-18-94; 63-22-72; 70k dir str rel - 5/2. Captive Brood Progeny; Unmarked/unclipped.
CH		1 SP	5/2/2005	5/2/2005	1,946	8.0	White River	Wenatchee River	2003	
CH		1 SP	5/6/2005	5/6/2005	4,432	7.0	Nason Creek	Wenatchee River	2003	
Spring Chinook Yearling Subtotal					228,509					
CH		1 SU	4/15/2005	5/11/2005	579,019	15.7	Similkameen Acclim Pd	Okanogan River	2003	100% ad+CWT 63-25-79.
CH		1 SU	4/25/2005	4/25/2005	653,764	12.0	Dryden Acclim Pond	Wenatchee River	2003	100% ad+CWT 63-25-81.
CH		1 SU	5/2/2005	5/2/2005	215,366	7.8	Turtle Rock Hatchery	Mid-Columbia River	2003	100% ad+CWT 63-25-77.
Summer Chinook Yearling Subtotal					1,448,149					
SO		1 UN	6/15/2004	6/15/2004	32,755	97.7	White River	Wenatchee River	2003	100% ad+CWT 63-22-70; late spring rel.
SO		1 UN	8/25/2004	8/25/2004	104,879	26.0	Lake Wenatchee	Wenatchee River	2003	100% ad+CWT 63-24-70; late summer rel; ave length = 118 mm.
SO		1 UN	11/3/2004	11/3/2004	102,825	11.3	Lake Wenatchee	Wenatchee River	2003	100% ad+CWT 63-24-69; fall rel; ave length = 157 mm
Sockeye Yearling Subtotal					240,459					
ST		SU	4/18/2005	5/28/2005	100,875	6.0	Above Rock Island Dam	Mid-Columbia River	2004	PUD Study fish; 25kad only; Rel=below Wells&Rocky R. dams; 79.8k ad+PIT tag. HxW Cross; 40.6k ad+CWT 63-23-97; 113.7k w/ad clip; 100% VI tag (L Green Elast). WxW cross; No fin clips; 100% VI tag (R. Pink elast.). HxH Cross; 100% ad+CWT 63-26-76; 100% VI tag (L. Red Elast.).
ST		SU	5/2/2005	5/3/2005	153,959	6.0	Chiwawa Hatchery	Wenatchee River	2004	
ST		SU	5/4/2005	5/4/2005	100,519	5.8	Nason Creek	Wenatchee River	2004	
ST		SU	5/5/2005	5/5/2005	39,635	5.6	Wenatchee River	Wenatchee River	2004	
Summer Steelhead Subtotal					394,988					
Eastbank Hatchery Total					3,102,894					
Klickitat Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 FA	6/13/2005	6/20/2005	4,090,940	66.0	Klickitat Hatchery	Klickitat River	2004	1.9 mil rel = June 13-15; 602k ad+CWT 63-29-68; 69; 63-27-98;; remainder no fin clips.
Fall Chinook Subyearling Subtotal					4,090,940					
CH		0 SP	5/17/2005	5/17/2005	269,800	68.0	Upper Klickitat River	Klickitat River	2004	100% ad clip; 10k PITs.
Spring Chinook Subyearling Subtotal					269,800					

CH	1 SP	3/1/2005	3/7/2005	628,196	14.5	Klickitat Hatchery	Klickitat River	2003	100% ad clip; 200k ad+CWT63-24-65; 66.	
Spring Chinook Yearling Subtotal				628,196						
CO	1 NO	5/9/2005	5/13/2005	1,000,175	16.0	Klickitat Hatchery	Klickitat River	2003	100% ad clip; 45k ad+CWT 63-22-69.	
Coho Yearling Subtotal				1,000,175						
Klickitat Hatchery Total				5,989,111						
Lyons Ferry Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH	0	FA	5/16/2005	5/30/2005	121,000	40.0	Cpt John Acclim Pond	Snake River	2004	NOAA Fisheries transp stdy; 100% PIT tag; rel = 12k/day@ 5da/wk. 10km below Apd.
CH	0	FA	5/23/2005	5/23/2005	234,030	59.0	Cpt John Acclim Pond	Snake River	2004	100% unmarked; Rel = Snake R below Cpt Johns near Couse Cr.
CH	0	FA	5/24/2005	5/25/2005	482,460	61.4	Grande Ronde River	Grande Ronde River	2004	192k ad+CWT 63-27-82; 223k unmrk/untag; rel = near OR/WA border.
CH	0	FA	5/26/2005	5/26/2005	200,191	49.0	Cpt John Acclim Pond	Snake River	2004	100% ad+CWT 61-1-55; 3.5k PITs; rel = dir stream rel at Couse Cr.
CH	0	FA	5/27/2005	5/27/2005	200,171	51.0	Lyons Ferry Hatchery	Snake River	2004	100% ad+CWT 63-27-87; 1.5k PITs.
Fall Chinook Subyearling Subtotal				1,237,852						
CH	1	FA	3/28/2005	3/30/2005	453,200	9.4	Lyons Ferry Hatchery	Snake River	2003	225k ad+CWT 63-17-69; - 23-68 +VI tag (L Red); 225k CWT 63-17-70+VI tag (L. Red).
Fall Chinook Yearling Subtotal				453,200						
ST		SU	3/25/2005	3/31/2005	150,442	6.4	Cottonwood Acclim Pond	Grande Ronde River	2004	100% ad clip; 38k adLV+CWT 63-26-77.
ST		SU	3/29/2005	3/31/2005	61,238	4.8	Curl Lake Acclim Pond	Tucannon River	2004	Rel = Camp Wooten br; 100% CWT 63-11-86+ VI tag (R Green); 10k PITs; no fin clips.
ST		SU	3/29/2005	3/31/2005	55,706	5.5	Baileysburg Bridge	Touchet River	2004	Wild Parentage; 100% CWT 63-11-85+VI tag (L Green); 10k PITs.
ST		SU	4/1/2005	4/10/2005	86,270	4.7	Dayton Acclim Pond	Touchet River	2004	100% ad clip; 19k adLV+CWT 63-23-67.
ST		SU	4/4/2005	4/7/2005	63,036	4.5	Lyons Ferry Hatchery	Snake River	2004	100% ad clip; 20k adLV+CWT 63-23-64.
ST		SU	4/4/2005	4/7/2005	104,027	4.5	Walla Walla River	Walla Walla River	2004	100% ad clip; 20k adLV+CWT 63-23-66; rel = rkm56.
ST		SU	4/4/2005	4/7/2005	102,029	4.6	Tucannon River	Tucannon River	2004	Rel = Westergreen Br; 100% ad clip; 20k adLV+CWT 63-23-65.
Summer Steelhead Subtotal				622,748						
Lyons Ferry Hatchery Total				2,313,800						
Methow Hatchery										
CH	0	SP	4/25/2005	4/30/2005	42,252	75.0	Methow Hatchery	Methow River	2004	100% CWT 63-26-94; no fin clips.
CH	0	SP	4/25/2005	5/2/2005	3,643	75.0	Twisp River	Methow River	2004	100% CWT 63-15-8; no fin clips.
Spring Chinook Subyearling Subtotal				45,895						

CH	1 SP	4/18/2005	4/24/2005	48,831	15.0	Methow Hatchery	Methow River	2003	100% CWT only 63-25-68; No fin clips.	
CH	1 SP	4/18/2005	4/25/2005	127,614	15.0	Chewuch Acclim Pond	Methow River	2003	100% CWT only 63-25-66; 69; No fin clips.	
CH	1 SP	4/18/2005	4/25/2005	99,933	15.0	Twisp Acclim Pond	Methow River	2003	100% CWT only 63-25-65; 67; 63-24-99; No fin clips.	
Spring Chinook Yearling Subtotal				276,378						
CH	1 SU	4/19/2005	4/25/2005	354,699	13.0	Carlton Acclim Pond	Methow River	2003	100% ad+CWT 63-27-76; 77.	
Summer Chinook Yearling Subtotal				354,699						
Methow Hatchery Total				676,972						
Priest Rapids Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH	0	FA	6/9/2005	6/18/2005	6,599,838	48.3	Priest Rapids Hatchery	Mid-Columbia River	2004	200k ad+CWT 63-30-76; 3k PITs.
Priest Rapids Hatchery Total				6,599,838						
Ringold Springs Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH	0	FA	6/14/2005	6/16/2005	2,800,055	65.0	Ringold Springs Hatchery	Mid-Columbia River	2004	200k ad+CWT 7-12-63.
Fall Chinook Subyearling Subtotal				2,800,055						
CH	1 SP	3/7/2005	3/15/2005	418,593	14.2	Ringold Springs Hatchery	Mid-Columbia River	2003	100% ad clip; 50k ad+CWT 63-24-85.	
Spring Chinook Yearling Subtotal				418,593						
ST		SU	4/11/2005	4/14/2005	80,520	5.7	Ringold Springs Hatchery	Mid-Columbia River	2004	100% adRV clip; 94.9k PITs.
Summer Steelhead Subtotal				80,520						
Ringold Springs Hatchery Total				3,299,168						
Skamania Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
ST-SU			5/3/2005	5/11/2005	100,725	5.1	Klickitat River	Klickitat River	2004	100% ad clip; Rel = Rm 10-22 (5-sites).
ST-SU			5/9/2005	5/10/2005	21,809	5.1	White Salmon River	White Salmon River	2004	100% ad clip; Rel = old USFWS raceways.
Summer Steelhead Subtotal				122,534						
ST-WI			4/18/2005	4/18/2005	19,951	4.6	Salmon Creek (WA)	Columbia River	2004	100% ad clip.
ST-WI			4/26/2005	5/1/2005	20,428	5.2	White Salmon River	White Salmon River	2004	100% ad clip; rel = Old USFWS raceways.
Winter Steelhead Subtotal				40,379						
Skamania Hatchery Total				162,913						
Tucannon Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH	1	SP	3/28/2005	4/15/2005	71,154	14.5	Curl Lake Acclim Pond	Tucannon River	2003	100% CWT 63-24-82+Elast Tag (R Red); No fin clips.
CH	1	SP	3/28/2005	4/15/2005	130,064	14.5	Curl Lake Acclim Pond	Tucannon River	2003	100% CWT 63-27-78; no fin clips; Captive Brood Stock.
Tucannon Hatchery Total				201,218						

Washougal Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CO-NO			3/21/2005	3/25/2005	2,499,530	22.0	Klickitat River	Klickitat River	2003	55k ad+CWT 63-11-84; remainder unmark/unclip.

Washougal Hatchery Total **2,499,530**

Wells Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 SU	5/18/2005	5/18/2005	230,649	37.0	Wells Hatchery	Mid-Columbia River	2004	100% ad+CWT 63-22-86; 3k PITs.
CH		0 SU	6/13/2005	6/13/2005	240,474	28.0	Wells Hatchery	Mid-Columbia River	2004	100% ad+CWT 63-22-85; 3k PITs.

Summer Chinook Subyearling Subtotal **471,123**

CH		1 SU	4/25/2005	5/11/2005	313,509	10.5	Wells Hatchery	Mid-Columbia River	2003	100% ad+CWT 63-25-80.
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Summer Chinook Yearling Subtotal **313,509**

ST		SU	4/25/2005	5/11/2005	82,280	5.4	Chewuch River	Methow River	2004	HxW Cross; 100% ad clip.
ST		SU	4/25/2005	5/11/2005	86,041	5.4	Methow River	Methow River	2004	HxH Cross; 100% ad clip; rel = Mazama.
ST		SU	4/25/2005	5/11/2005	96,420	5.4	Twisp River	Methow River	2004	No fin clips; 100% VI tag (R Yellow elast).
ST		SU	4/25/2005	5/11/2005	68,940	6.6	Similkameen Acclim Pd	Okanogan River	2004	HxH Cross; 100% ad clip; rel = near Similk APd.
ST		SU	4/25/2005	5/11/2005	10,000	8.0	Omak Creek	Okanogan River	2004	HxW Cross; 100% ad clip.

Summer Steelhead Subtotal **343,681**

Wells Hatchery Total **1,128,313**

WDFW Total	26,121,687
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Yakama Tribe**Cascade Hatchery**

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CO-UN			3/14/2005	3/14/2005	52,500	13.0	Yakama River	Yakima River	2003	Rel = Boone Pd; 100% LV clip; 1.5k PITs.
CO-UN			3/15/2005	3/18/2005	52,500	13.0	Lost Creek Acclim Pond	Yakima River	2003	100% LV clip; 1.5k PITs.

Cascade Hatchery Total **105,000**

Cle Elem Hatchery

Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		1 SP	3/9/2005	4/27/2005	273,377	25.0	Clark Flat Acclim Pond	Yakima River	2003	100% ad+CWT 61-1-26;27;36;37;40; 41; +VI (L & Rt Red Elast) tag; 13.3k PITs.
CH		1 SP	3/9/2005	4/27/2005	267,711	25.0	Easton Pond	Yakima River	2003	100% ad+CWT 61-1-28;29;32..35; + VI (L&Rt Green Elast) tag; 13.3k PITs.
CH		1 SP	3/9/2005	4/27/2005	283,604	25.0	Jack Creek Acclim Pond	Yakima River	2003	100% ad+CWT 61-1-30;31;38;39;42; 43; + VI (L/Rt Orange Elast) tag; 13.3k PITs.

Cle Elem Hatchery Total **824,692**

Eagle Creek Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CO		1 UN	3/14/2005	3/21/2005	261,207	13.0	Yakama River	Yakima River	2003	Rel = Holmes Pond; 90% ad clip; 1.5k PITs.
CO		1 UN	3/14/2005	3/22/2005	239,494	13.0	Stiles Pond	Yakima River	2003	90% ad clip; 1.5k PITs.
Eagle Creek Hatchery Total					500,701					
Leavenworth Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CO		1 UN	4/14/2005	4/14/2005	139,533	17.0	Leavenworth Hatchery	Wenatchee River	2003	100% CWT; no clips; long/short term acclim study.
CO		1 UN	4/14/2005	4/14/2005	639,615	17.0	Leavenworth Hatchery	Wenatchee River	2003	100% CWT; No fin clips; 16k PIT tag.
CO		1 UN	4/15/2005	4/29/2005	60,779	15.0	Wenatchee River	Wenatchee River	2003	Rel = Beaver Cr (4/25) & Coulter Cr (4/15); 100% CWT; No fin clips.
CO		1 UN	4/25/2005	5/15/2005	70,822	15.0	Maher Creek Acclim. Pond	Wenatchee River	2003	100% CWT; No fin clips; 7k PIT tag.
CO		1 UN	4/27/2005	5/15/2005	67,951	15.0	Butcher Creek Acclim. Pond	Wenatchee River	2003	100% CWT; No fin clips; 7k PIT tag.
Leavenworth Hatchery Total					978,700					
Little White Salmon Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 FA	5/10/2005	6/1/2005	1,660,000	109.0	Prosser Acclim Pond	Yakima River	2004	10% ad+CWT.
Little White Salmon Hatchery Total					1,660,000					
Prosser Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 FA	4/25/2005	5/9/2005	537,660	78.2	Prosser Acclim Pond	Yakima River	2004	4k PITs; 183k RV clip; 265k LV clip.
Prosser Total					537,660					
Winthrop Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CO		1 UN	4/20/2005	4/29/2005	283,695	16.7	Winthrop Hatchery	Methow River	2003	100% CWT; No fin clips; 50% back channel acclim.
Winthrop Hatchery					283,695					
Yakama Hatchery										
Species	Age	Race	RelStart	RelEnd	NumRel	Size	ReleaseSite	RiverName	Brood	Comments
CH		0 FA	3/15/2005	3/15/2005	72,000	105.0	Union Gap (Yakama R)	Yakima River	2004	Marks Pending; rel = (Edler Pd).
CH		0 FA	3/25/2005	3/25/2005	37,000	85.0	Stiles Pond	Yakima River	2004	2k PITs.
CH		0 FA	4/28/2005	4/30/2005	42,559	70.0	Marion Drain	Yakima River	2004	2k PITs.
Yakama Hatchery Total					151,559					
Yakama Tribe Total					5,042,007					
Above BONNEVILLE Dam Total					83,062,191					

APPENDIX H

Transportation Proportion Tables

Proportion of Lower Granite Dam forebay population destined to be transported in 2005

Model to estimate proportion:

In the transportation proportion estimation procedure, the population of N smolts in Lower Granite Dam forebay is partitioned into $X1$ fish destined to be transported and $X2$ fish destined to migrate in-river. The proportion of fish in the transportation category is $Pt = X1/N$ and the proportion of fish in the in-river category is $(1-Pt)=X2/N$. Below is the derivation of model for springtime migrants with three transportation dams – the procedure for summertime migrants is similar with the addition of a fourth transportation dam (McNary Dam).

The number of fish, $x2$, estimated to remain in-river below last transportation site for springtime migrants:

$$x2 = (((N*s1-t1)*s2-t2)*s3-t3) = N*s1*s2*s3 - t1*s2*s3 - t2*s3 - t3$$

where $s1$ =survival from origin in Lower Granite Dam forebay to Lower Granite Dam tailrace
 $s2$ =survival from Lower Granite Dam tailrace to Little Goose Dam tailrace
 $s3$ =survival from Little Goose Dam tailrace to Lower Monumental Dam tailrace
 $t1$ =fish removed at Lower Granite Dam for transportation
 $t2$ =fish removed at Little Goose Dam for transportation
 $t3$ =fish removed at Lower Monumental Dam for transportation

To index $x2$ back to the starting population in Lower Granite Dam, $X2$, requires dividing by the survival estimate $s1*s2*s3$ from Lower Granite Dam forebay to Lower Monumental Dam tailrace.

$$X = x2/(s1*s2*s3) = N - t1/s1 - t2/(s1*s2) - t3/(s1*s2*s3)$$

The number of fish in the starting population destined to be transported then becomes

$$X1 = N-X2 = t1/s1 + t2/(s1*s2) + t3/(s1*s2*s3)$$

The proportion of fish in the starting population destined to be transported is

$$Pt = X1/N = t1/(N*s1) + t2/(N*(s1*s2)) + t3/(N*(s1*s2*s3))$$

The number of fish surviving to the tailrace of each dam is given by the following series of equations:

Lower Granite	$N1 = N*s1$
Little Goose	$N2 = (N1-t1)*s2 = N1*(1-t1/N1)*s2$
Lower Monumental	$N3 = (N2-t2)*s3 = N2*(1-t2/N2)*s3 = N1*(1-t1/N1)*s2*(1-t2/N2)*s3$

Substituting these equalities into the equation for Pt gives

$$Pt = t1/N1 + (1-t1/N1)*t2/N2 + (1-t1/N1)*(1-t2/N2)*t3/N3$$

Letting $P1=t1/N1$, $P2=t2/N2$, and $P3=t3/N3$ the equation for proportion of transport fish in Lower Granite Dam forebay destined for transportation becomes:

$$Pt = P1 + (1-P1)*P2 + (1-P1)*(1-P2)*P3$$

With McNary Dam transportation added the equation becomes:

$$P_t = P_1 + (1-P_1)*P_2 + (1-P_1)*(1-P_2)*P_3 + (1-P_1)*(1-P_2)*(1-P_3)*P_4$$

where $P(J)$ = transport number / population number
= (transport proportion * collection) / (collection / collection efficiency)
= transport proportion * collection efficiency

The site-specific transport proportions $P(J)$ are based on data from the run-at-large at each dam. These P_1 , P_2 , P_3 , and P_4 proportions are computed using facility collection, transport, and population estimates for Lower Granite ($J=1$), Little Goose ($J=2$), Lower Monumental ($J=3$), and McNary ($J=4$) dams, respectively, and are presented in Table H-1 through Table H-3 for yearling Chinook, steelhead, and subyearling Chinook, respectively. In 2005 there was no spring time transportation at McNary Dam. However, transportation did occur in the summer time, beginning June 25. The estimate of proportion of Snake River subyearling Chinook "destined for transport" are presented both with and without McNary Dam considered in the model. This allows direct comparison with past years when only three transportation sites are used during the springtime, and a comparison of the amount of transportation added by McNary Dam for subyearling Chinook originating above Lower Granite Dam in 2005. For subyearling Chinook originating in the Mid-Columbia River basin, the transportation proportion is simply estimated by P_4 above, and is presented in Table H-3.

The 2005 collection efficiency is estimated using the CSJ mark-recapture model on PIT tagged yearling Chinook and steelhead released from the Salmon, Snake and Imnaha River traps in 2005. The 2005 collection efficiency for subyearling Chinook was based on estimated FGE's derived from the 2005 release of PIT tagged subyearling Chinook at Snake River basin fall Chinook acclimation ponds and wild marked fish in the Snake River by USFWS.

TABLE H- 1. Yearling Chinook model input data for 2005.

Site	Facility Collection	Estimated Population	Spill Proportion	Estimated Collection Efficiency	Collection Transport Proportion	P(J)
LGR (J=1)	5,539,597	7,700,000	0.024	0.72	0.947	0.685
LGS (J=2)	2,451,041	3,100,000	0.010	0.78	0.822	0.642
LMN (J=3)	670,864	1,700,000	0.051	0.40	0.782	0.315

TABLE H- 2. Steelhead model input data for 2005.

Site	Facility Collection	Estimated Population	Spill Proportion	Estimated Collection Efficiency	Collection Transport Proportion	P(J)
LGR (J=1)	5,590,788	8,300,000	0.058	0.68	0.919	0.622
LGS (J=2)	2,857,094	3,200,000	0.022	0.89	0.797	0.707
LMN (J=3)	614,133	1,100,000	0.091	0.55	0.747	0.414

The estimated percent of smolts arriving Lower Granite Dam forebay that were destined for transportation in 2005, excluding McNary Dam transportation, was approximately 92% for yearling Chinook, 94% of steelhead, and 81% for subyearling Chinook (Table H-4). For smolts originating in the Mid-Columbia River basin, the estimated percent of smolts arriving McNary Dam forebay that were transported was approximately 25% for subyearling Chinook.

TABLE H- 3. Subyearling Chinook model input data for 2005.

Site	Facility Collection	Estimated Population	Spill Proportion	Estimated Collection Efficiency	Collection Transport Proportion	P(J)
LGR (j=1)	1,580,219	4,500,000	0.099	0.35	0.984	0.345
LGS (j=2)	1,196,986	2,400,000	0.070	0.51	0.955	0.483
LMN (j=3)	177,812	700,000	0.144	0.26	0.955	0.248
MCN (j=4)	4,169,117	11,600,000	0.391	0.36	0.696	0.250

TABLE H- 4. Estimated proportion destined for transportation in 2005.

Species- age group	Transport Proportion		
	Origin Snake R Basin above Lower Granite Dam		Origin Mid-Columbia R Basin
	Without McNary Dam transport	With McNary Dam transport	With McNary Dam transport
Yearling Chinook	0.92	N/A	N/A
Steelhead	0.94	N/A	N/A
Subyearling Chinook	N/A	0.809	0.250

Model without McNary Dam: $P_t = P_1 + (1-P_1)*P_2 + (1-P_1)*(1-P_2)*P_3$

Model with McNary Dam: $P_t = P_1 + (1-P_1)*P_2 + (1-P_1)*(1-P_2)*P_3 + (1-P_1)*(1-P_2)*(1-P_3)*P_4$

Model for Mid-Columbia R Basin fish: $P_t = P_4$

The proportion of smolts transported in 2005 was very similar to 2004 and 2001 when low flows and lack of spill translated into high collection at Snake River dams and therefore higher proportions transported.

TABLE H- 5. Comparison of the 2005 estimate of the proportion of Snake River Basin smolt population in Lower Granite Dam forebay that are "destined for transportation" and the corresponding estimates from 1999 to 2004. For yearling Chinook and steelhead, the results exclude transport at McNary Dam.

Species- age group	Transport Proportion ¹						
	2005	2004	2003	2002	2001	2000	1999 ²
Yearling Chinook	0.92	0.870	0.629	0.683	0.980	0.71	0.777 (H) 0.862 (W)
Steelhead	0.94	0.964	0.670	0.677	0.986	0.81	0.825
Subyearling Chinook	0.809	0.972	0.895	0.929	0.962	0.93	0.870

¹ In years 2000-2005, 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.

² Note: Past years annual reports for 2000-2004 included a typographical error which reversed Hatchery (H) and Wild (W) proportions. The proportions for (H) (W) are correct in this table.

APPENDIX I

2005 System Operational Requests (SOR)

SOR #	Date	Subject	Response of Action Agencies
#2005-22	12/06/2005	Snake River Zero Nighttime and Weekend Flow	
#2005-21	12/06/2005	To provide the best spawning and incubation conditions possible below Bonneville Dam to: <ul style="list-style-type: none"> ? protect the natural spawning chum and fall Chinook salmon at the Ives/Pierce Island Complex, Multnomah Falls, and to partly influence the condition at the I-205 seeps; ? and to better assure meeting the April 10 upper rule curve for the spring out-migration of listed fish.. 	
#2005-20	11/08/2005	Ice/Trash sluiceway at the Dalles Dam.	
#2005-19	10/18/2005	Tailwater elavation at Bonneville Dam to protect natural spawning of chum and fall chinook salmon.	Implemented
#2005-18	07/12/2005	Dworshak Operations	Implemented
#2005-17	07/05/2005	Dworshak Operations	Implemented
#2005-16	06/28/2005	Libby Summer Operations	Partially Implemented
#2005-15	06/02/2005	Actions required at Lower Granite Dam	
#2005-14	05/24/2005	Spring Spill Operations at John Day Dam	Partially Implemented
#2005-13	05/11/2005	Spill at Lower Monumental Dam	Partially Implemented
#2005-12 amended	05/17/2005	Adjustment for decreased spill volumes at The Dalles Dam	Implemented
#2005-11	05/10/2005	Spring Dworshak Operations	Partially Implemented
#2005-10	05/03/2005	Priest Rapids Flows	Implemented

#2005-09	05/03/2005	Spring Dworshak Operations	Partially Implemented
#2005-08	04/26/2005	Lower Columbia Flow Shaping	Partially Implemented
#2005-07	04/19/2005	Priest Rapids Flows	Implemented
#2005-06	04/19/2005	Ice Harbor Dam Spill	Unknown
#2005-05	04/14/2005	Bonneville Project Spill	Partially Implemented
#2005-04	04/05/2005	Fishery operations at the Bonneville Project	Partially Implemented
#2005-03	04/01/2005	Fishery operations at the Bonneville Project	Implemented
#2005-02	03/01/2005	Fishery operations at the Bonneville Project	Partially Implemented
#2005-01	01/12/2005	Operations at Dworshak Reservoir	NOT Implemented

SYSTEM OPERATIONAL REQUEST: #2005-22

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	Colonel Gregg F. Martin	COE-NWD
	James D. Barton	COE-Water Management
	Cathy Hlebechuk	COE-RCC
	Witt Anderson	COE-P
	Col. Thomas E. O'Donovan	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: Russ Kiefer, Chairperson, Salmon Managers

DATE: December 6, 2005

SUBJECT: Snake River Zero Nighttime and Weekend Flow

SPECIFICATIONS:

The fishery agencies and tribes recommend following the guidelines they developed in 2003 regarding the implementation of zero flow at Snake River projects.

JUSTIFICATION:

The COE LWG water Control Manual states on page 8-2,

“From December to February, “zero” minimum project discharge is permitted on a limited basis. Under an agreement between the Corps of Engineers and the fishery agencies, zero river flow is allowed for water storage during low power demand periods (at night and on weekends) when there are few, if any, actively migrating anadromous fish present in the Snake River... Water stored under zero river flow conditions may maximize power production from the Columbia River basin system, but zero river flow operations are not recommended at Lower Granite when fish are actively migrating in the Snake River.”

In the Winter 2003/2004, the Salmon Managers proposed the following criteria to define what is meant by “few” migrating adults.

1. The number of adults migrating per day is defined as the number of upstream counts minus the number of downstream counts.
2. A three-day moving average will be used to determine if the few migrating adult criterion has been met.
3. “Wild” and “total” returns will be calculated separately. Only one of the categories is necessary to show that more than a few adults are migrating.
4. The run to date is defined as the cumulative number of adult steelhead in the “wild” and “total” categories passing Lower Granite Dam since June 1st of the return year.

The few migrating adult criterion trigger will be defined on a sliding scale outlined in the following table. The table applies to both “wild” and “total” categories of returning adult steelhead.

Run to date>#	Run to date≤ #	Few criteria< #
0	30,000	10
30,000	60,000	20
60,000	100,000	35
100,000	150,000	50
150,000	200,000	65
200,000	250,000	80
250,000		100

As of December 2, 2005, 149,490 total steelhead and 34,220 wild steelhead had passed Lower Granite Dam since June 1, 2005. Using the above table proposed by the Salmon Managers, “few” fish would be defined as less than 50 fish over a three day moving average using the total steelhead number and less than 20 fish using the wild steelhead number. The three-day average total steelhead count at Lower Granite over 11/3, 12/1, and 12/2 was 82 fish and the wild fish three-day average was 25 fish. In either case, the three-day average of fish exceeds the definition of “few” and the salmon managers would not recommend operating to zero nighttime or weekend flow. The salmon managers recommend using the proposed criterion for implementing zero nighttime and weekend flow this year.

SYSTEM OPERATIONAL REQUEST: #2005-21

The following Federal and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	Colonel Gregg F. Martin	COE-NWD
	James D. Barton	COE-Water Management
	Cathy Hlebechuk	COE-RCC
	Witt Anderson	COE-P
	Col. Thomas E. O'Donovan	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Steve Oliver	BPA-VP Operation Supply

FROM: Tom Lorz, Vice Chair, Salmon Managers

DATE: December 6, 2005

SUBJECT: To provide the best spawning and incubation conditions possible below Bonneville Dam to:

- protect the natural spawning chum and fall Chinook salmon at the Ives/Pierce Island Complex, Multnomah Falls, and to partly influence the condition at the I-205 seeps;
- and to better assure meeting the April 10 upper rule curve for the spring out-migration of listed fish.

SPECIFICATIONS:

1. If the Salmon Managers determine that significant superimposition is occurring and that the population size of spawning chum at the Ives Island complex warrants additional spawning habitat based on the ongoing field monitoring programs, and consideration of other salmon flow needs, beginning on or about December 1, 2005 (dependent on in-season field monitoring) increase instantaneous tailwater elevation up to 13.5 feet (range from 13.3-13.7) at Bonneville Dam.
2. If the tailwater is increased to the 13.2-13.7 range in December, then beginning on or about January 1, 2006 (dependent on the cessation of spawning), provide a minimum

- instantaneous tailrace elevation of 13.0 feet (range 12.8-13.2) at Bonneville Dam through incubation and emergence.
3. Maintain Grand Coulee Dam at upper rule curve elevations throughout the winter and spring, except as needed to achieve the Bonneville tailwater elevation, as described above, subject to the regular check-ins shown under number 4 below.
 4. Check in regularly to review the present operations, the difference between observed flows and those needed to achieve the tailwater elevations determined above, and the probability of being on upper rule curve on April 10, 2006. It is the intention to maximize the probability of achieving spring flow targets by being at upper rule curve on April 10.

JUSTIFICATION:

The Ives/Pierce Islands Complex below Bonneville Dam represents a limited and critical natural spawning area for ESA listed Columbia River chum and unlisted Lower Columbia River bright fall Chinook. Mainstem chum salmon spawning numbers have been trending downwards the past three years, especially in the Ives Island area (TMT 10-19-05). The NMFS 2004 Biological Opinion (BiOp) recognizes that access to spawning habitat in the Ives/Pierce area and Hardy and Hamilton creeks is primarily a function of the water surface elevation. More so, the BiOp and experience over the last 5 years recognizes that managing water levels to a tailwater gage height rather than a flow level is preferable.

The provision of a minimum 11.5-foot tailwater elevation at Bonneville Dam will provide access to a limited area of mainstem spawning habitat for chum salmon and allow unrestricted access to Hardy and Hamilton creeks. However, the issue of superimposition of redds has been a concern over the last few years of restricting chum spawning to the 11.5 foot tailwater elevation. The Salmon Managers may use the weekly counts coupled with a GIS analysis to determine when, and if, redds start to superimpose (the time of most concern is expected to begin approximately December 1). If superimposition is an issue the Salmon Managers will request to operate based on our past modeling efforts and on site knowledge of the area and impacts to other salmon flow needs, to a tailwater operation of 13.5 feet. Past habitat and flow modeling efforts conducted by the USGS and USFWS showed that at a tailwater of 13.5 ft water begins to flow through a second channel adjacent to the north shore of Ives Island. This was confirmed during USGS flows tests in 2004. This channel is dry at 11.5 ft, but at 13.5 ft provides chum salmon spawning habitat as evidenced by its use in 1998 and 1999 under higher flows in those years. Based on USGS's work at 13.5 ft in 2004, water velocities in much of the primary spawning area below the mouth of Hamilton Creek are near, or exceed, the suitability criterion for chum salmon. Therefore, an elevation of 13.5 ft should discourage additional spawning in this area and promote spawning in the channel on the north side of Ives Island as intended by this operation. Even if the some of the redds associated with the 13.5 operation are subsequently dewatered, the net effect should be increased overall production.

A review of the past ten years' of flow information has indicated that in 7 of ten years the operation could proceed without incident if Grand Coulee is operated to upper rule curve, except to draft to meet the chum elevations, and still meet the April 10 elevation. In 2002, the 13.5-foot tailwater had to be reduced to 13.0 feet on December 12th, however the 13.0-foot tailwater could

be maintained until April 10th. In 2005 some redds would have been dewatered, but it was not necessary to drop all the way down to the 11.5 foot elevation (had to reduce the tailwater down to 12.0 feet in mid February). In 2001, the tailwater at Bonneville would have had to drop to 11.5 feet in approximately mid December, however the 11.5-foot elevation could have been met all the way through emergence and the reservoir would have reached to the April 10 elevation.

Managers should consider a balance between flood control, power drafts, and the ability to achieve spring flow objectives and reservoir refill. With unstable water years and water supply forecasts, the April 10 objective may not be met if operators use all of their flexibility for power operations early in the season. Based on the past several years, chum operations by themselves; do not appear to impact refill.

SYSTEM OPERATIONAL REQUEST: #2005-20

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	Colonel Gregg F. Martin	COE-NWD
	James D. Barton	COE-Water Management
	Cathy Hlebechuk	COE-RCC
	Witt Anderson	COE-P
	Col. Thomas E. O'Donovan	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Steve Oliver	BPA-PG-5

FROM: Russ Kiefer, Chairperson, Salmon Managers

DATE: November 8, 2005

SUBJECT: Ice/Trash Sluiceway at The Dalles Dam

SPECIFICATIONS: Immediately restart the Ice/Trash Sluiceway at The Dalles Dam and continue operation through the end of November. Operate the Ice/Trash Sluiceway at The Dalles Dam 24 hrs/day.

JUSTIFICATION:

According to the February 2005 Fish Passage Plan, the primary juvenile passage period at The Dalles Dam is April through November. There are some indicators that adult returns from late migrating fall chinook may contribute a great proportion of returning adults (NOAA Technical Memo, NMFS-NWFSC-63, February 2005). Consequently, it is important to provide this non-turbine passage route, with lower associated mortality, for these late migrating juveniles.

SYSTEM OPERATIONAL REQUEST: #2005-19

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	Colonel Gregg F. Martin	COE-NWD
	James D. Barton	COE-Water Management
	Cindy Henriksen	COE-RCC
	Witt Anderson	COE-P
	Col. Thomas E. O'Donovan	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: **Russell B. Kiefer, Chairperson, Salmon Managers**

DATE: **October 18, 2005**

SUBJECT: Tailwater elevation at Bonneville Dam to protect natural spawning of chum and fall chinook salmon at the Ives/Pierce Island Complex, Multnomah Falls, and partly influence the I-205 seeps.

SPECIFICATIONS: As required by the 2004 NMFS Biological Opinion, beginning when chum are present and continuing until further notice, provide a minimum instantaneous tailrace elevation of 11.5 feet at Bonneville Dam. On average it is anticipated that daily average flows will not exceed 125 Kcfs.

JUSTIFICATION: The Ives/Pierce Islands Complex below Bonneville Dam represents a limited natural spawning area for ESA listed Columbia River chum and unlisted Lower Columbia River bright fall chinook. The NMFS 2004 Biological Opinion (BiOp) recognizes that access to spawning habitat in the Ives/Pierce area and Hardy and Hamilton creeks is primarily a function of the water surface elevation. More so, the BiOp and experience over the last 5 years recognizes that managing water levels to a tailwater gage height rather than a flow level is preferable.

Over the last ten days the flow below Bonneville has varied 90.2 and 120 Kcfs, with project tailwater elevations fluctuating between 9.3 and 11.3 feet. These variable flows and tailwater elevations are not consistently adequate to provide spawning area for chum salmon at the Ives/Pierce Islands Complex and Multnomah Falls. Additionally, these flows and tailwater elevations limit access to both Hardy and Hamilton creeks and spawning effectiveness at the I-205 seeps. The provision of a minimum 11.5-foot tailwater elevation at Bonneville Dam will provide access to a limited area of mainstem spawning habitat for chum salmon and allow unrestricted access to Hardy and Hamilton creeks.

SYSTEM OPERATIONAL REQUEST: #2005-18

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, the Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, NOAA Fisheries, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
	James D. Barton	COE-Water Management
	Cindy Henriksen	COE-RCC
	Witt Anderson	COE-P
	Col. Richard Hobernicht	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: July 12, 2005

SUBJECT: Dworshak Operations

SPECIFICATIONS:

- Increase outflows to 14 Kcfs immediately at Dworshak and continue for a period of one week (through 7/19). Continue target of 46-48°F outflow water temperature over specified time.

JUSTIFICATION:

Juvenile Fall Chinook Passage Timing

Subyearling Chinook continue to pass Snake River projects in relatively good numbers. Based on preliminary analysis of PIT-tag data collection of subyearling chinook at Snake River SMP sites is low compared to other recent years due to spill. This makes analysis of timing data more tentative at this point. The passage of juvenile fall chinook is progressing, with wild marked fish from the Snake River being detected daily at Lower Granite.

Travel Time Survival of juvenile fall chinook

In the compilation of travel time and survival data by NOAA Fisheries "Travel Time/Survival White Paper" (March 2000), NOAA Fisheries concludes that "Estimated survival

probability from release points in the Snake River Basin to Lower Granite Dam was significantly correlated with flow, water temperature and turbidity". NOAA Fisheries also concludes that the high correlation among variables precludes the determination of effects of these variables individually. A flow travel time relationship has been established for subyearling chinook migrants. The flow travel time relationship has been confirmed consistently in various studies and monitoring programs. Recent information (Connor, 2003) has shown statistically significant relations between flow, temperature and survival for sub-yearling fall chinook.

Historical passage timing and distribution of fall chinook data shows that 90% of the wild chinook passage at Lower Granite occurs prior to August 30 and 97% of hatchery sub-yearling fall chinook of Clearwater and Snake River origin pass Lower Granite Dam prior to August 30. This data set is primarily comprised of Snake River origin fish. The limited data available for the Clearwater population indicates they pass Lower Granite Dam at a later date.

Water Temperature

An extensive literature review was compiled for the Environmental Protection Agency entitled, "A Review and Synthesis of Effects of Alterations to the Water Temperature Regime on Freshwater Life Stages of Salmonids with Special Reference to Chinook Salmon". This review establishes water temperature as an important factor in all life stages of salmon. The review documents the detrimental effects of elevated water temperatures on all life stages of salmon, both juvenile and adult. The literature review has identified a water temperature of 21°C as the incipient lethal temperature for adult salmon. Washington State water quality standards for temperature in the mainstem Snake is 20°C. The maximum recommended water temperature in the NMFS BIOP at Lower Granite Dam is 20°C

Temperatures in the Lower Granite Dam Tailrace are approaching the 20°C water quality standard. Over the last two days, temperatures in the Lower Granite tailrace have been 19.8 °C. Increased cool water releases are warranted at this time due to an already warm river condition during a period of time when increased air temperatures are expected.

Flows

The BIOP summer flow objective for Lower Granite Dam in 2005 is 50 Kcfs. Flows at Lower Granite from June 21 through July 11 have averaged 46.3 Kcfs, slightly below the NOAA Biological Opinion target. Flows have been generally decreasing, averaging only 37.3 Kcfs over the last three days. Wild sub-yearling fall chinook salmon spend from 20 to 42 days in Lower Granite Reservoir primarily during the months of July and August. Migration conditions for wild subyearling Snake River fall chinook are improved by both flow and temperature. Higher summer flows generally decrease temperature, depending on the proportion of cool Dworshak water to warmer Upper Snake water.

SYSTEM OPERATIONAL REQUEST: #2005-17

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, the Washington Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
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	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: July 5, 2005

SUBJECT: Dworshak Operations

SPECIFICATIONS:

- Continue outflows of 7 Kcfs at Dworshak through July 10th, 2005, however, after July 7th, 2005 increase outflows at Dworshak to 10 Kcfs if temperatures at Lower Granite exceed 67 °F (19.4°C) on a 24-hr rolling average. On July 11th, 2005 increase outflows to 10 Kcfs until further notice. Continue to target 46-48°F outflow water temperature over the specified time.

JUSTIFICATION:

Juvenile Fall Chinook Passage Timing

Subyearling Chinook continue to pass Snake River projects in relatively good numbers. Based on preliminary analysis of PIT-tag data collection of subyearling chinook at Snake River SMP sites is low compared to other recent years due to spill. This makes analysis of timing data more tentative at this point. The passage of juvenile fall chinook is progressing, with wild marked fish from the Snake River being detected daily at Lower Granite.

Travel Time Survival of juvenile fall chinook

In the compilation of travel time and survival data by NOAA Fisheries "Travel Time/Survival White Paper" (March 2000), NOAA Fisheries concludes that "Estimated survival probability from release points in the Snake River Basin to Lower Granite Dam was significantly correlated with flow, water temperature and turbidity". NOAA Fisheries also concludes that the high correlation among variables precludes the determination of effects of these variables individually. A flow travel time relationship has been established for sub-yearling chinook migrants. The flow travel time relationship has been confirmed consistently in various studies and monitoring programs. Recent information (Connor, 2003) has shown statistically significant relations between flow, temperature and survival for sub-yearling fall chinook.

Historical passage timing and distribution of fall chinook data shows that 90% of the wild chinook passage at Lower Granite occurs prior to August 30 and 97% of hatchery sub-yearling fall chinook of Clearwater and Snake River origin pass Lower Granite Dam prior to August 30. This data set is primarily comprised of Snake River origin fish. The limited data available for the Clearwater population indicates they pass Lower Granite Dam at a later date.

Water Temperature

An extensive literature review was compiled for the Environmental Protection Agency entitled, "A Review and Synthesis of Effects of Alterations to the Water Temperature Regime on Freshwater Life Stages of Salmonids with Special Reference to Chinook Salmon". This review establishes water temperature as an important factor in all life stages of salmon. The review documents the detrimental effects of elevated water temperatures on all life stages of salmon, both juvenile and adult. The literature review has identified a water temperature of 21°C as the incipient lethal temperature for adult salmon. Washington State water quality standards for temperature in the mainstem Snake is 20°C. The maximum recommended water temperature in the NMFS BIOP at Lower Granite Dam is 20°C

The tailrace temperature at Lower Granite Dam is currently at a day average temperature of slightly less than 19 °C on July 4th, 2005.

Additional temperature considerations include growth of wild fall chinook in the Lower Clearwater River and needs of the Dworshak National Fish Hatchery.

Flows

The BIOP summer flow objective for Lower Granite Dam in 2004 is 50 Kcfs. Flows at Lower Granite from June 21 through July 4 have averaged 48.7 Kcfs, slightly below the NOAA Biological Opinion target. Migrating wild sub-yearling fall chinook salmon spend from 20 to 42 days in Lower Granite Reservoir primarily during the months of July and August. Migration conditions for wild subyearling Snake River fall chinook are improved by both flow and temperature. Higher summer flows generally decrease temperature, depending on the proportion of cool Dworshak water to warmer Upper Snake water.

SYSTEM OPERATIONAL REQUEST: #2005-16

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, and the Columbia River Inter-Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
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	Cindy Henriksen	COE-RCC
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	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: June 28, 2005

SUBJECT: Libby Summer Operations

SPECIFICATIONS:

- Maintain stable outflows from Libby while drafting to 2439 feet by August 31st, 2005.

JUSTIFICATION:

The 2004 FCRPS Biological Opinion calls for a 20-foot summer draft from Libby to elevation 2439 feet by August 31st. Given the projections for low summer flow levels in 2005, it is desirable to utilize the full volume of augmentation water by August 31 with stable flows through the summer months of 2005 to both assist in meeting flow objectives in the Lower Columbia River and to avoid a double peak of flows in the Kootenai River. It is also our understanding that most water released at Libby Dam after August 31st will not likely pass through Kootenai Lake and so will not be available to benefit juvenile salmon.

The draft by the end of August will benefit in-river migrating listed fall Chinook from the Snake River as well as other subyearling Chinook from Mid-Columbia, the Hanford Reach and Lower Columbia Rivers. Due to the Judge Redden order summer spill is occurring in the Snake River and McNary Dam until August 31st, which will result in

substantial increases the proportion of listed Snake River fall Chinook migrating in-river through the Lower Columbia reach.

While it is too soon to calculate with precision the exact proportion of fish migrating in-river since spill began June 20, it is likely that at least 50% of the fish passing Lower Granite Dam after that date will be destined to remain in-river and pass into the Lower Columbia. In comparison, we estimated that between 90% and 98% of subyearling chinook originating above Lower Granite Dam were destined for transport the previous five years.

USFWS marking of wild fall Chinook is still ongoing in the Snake River above Lower Granite Dam, with approximately 9,400 these listed subyearling Chinook marked by June 23. To date roughly 9% of those fish have been detected at Lower Granite or Little Goose dams. In 2004, 30% of the USFWS marks were detected at Lower Granite prior to the end of sampling at the dam. In addition, wild subyearling Chinook marking in the Clearwater River is just beginning with 793 fish marked to date. By June 27 only seven of these marks had been detected at Lower Granite Dam. All indications are that these fish will be migrating through the Snake River and the Lower Columbia through July and August as in past years. Flow augmentation from Libby will benefit these wild stocks of fish.

In addition Hanford Reach fall Chinook, Mid-Columbia summer and fall chinook, and other subyearling Chinook originating from Lower Columbia tributaries will benefit from increased flows that result from this requested operation.

Because the Judge Redden order calls for spilling all flows above 50 Kcfs at McNary Dam beginning July 1, any increased flow at that project as a result of the Libby augmentation will result in increased spill volume and therefore spillway passage at McNary Dam. Based on 2004 juvenile salmon radio telemetry studies, McNary turbine survival was very low at 77%. Thus, increasing spill passage should provide a direct survival benefit at McNary for summer migrants.

SYSTEM OPERATIONAL REQUEST: #2005-15

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

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	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: June 2, 2005

SUBJECT: Actions required at Lower Granite Dam when head differentials across VBS reach 1.5 feet.

SPECIFICATIONS: According to FPP, page LWG-10, paragraph 8, "When a head differential of 1.5' is reached, the respective turbine unit should be operated at a reduced loading, not more than 110 MW...clean VBSs as soon as possible...". The Salmon Managers recommend that the COE operate to these specifications. We also recommend that the Project follow up with video monitoring of the VBSs after raking trashracks to ensure they are clear of debris.

JUSTIFICATION: Juvenile fish facility mortality for subyearling Chinook at Lower Granite was 1.1% on June 2nd. Smolt monitoring personnel report that the mortalities showed high levels of descaling. That indicates fish are likely being injured due to high debris levels in trash racks or screens. The Project completed trashrack raking on Units 2, 3, and 4 on June 1 and completed the other two Units (5 and 6) by the end of the day on June 2.

We are concerned that after the trashracks have been raked that debris can accumulate downstream on the VBSs. We therefore recommend the COE closely monitor the debris levels on the screens and clean them if necessary.

The COE should reduce loading of Turbines as a first step when the head differentials reach the criteria of 1.5 feet. Then the operators should proceed with trashrack raking rather than continue high loading while trashracks are being cleaned. The reduction in loading is a precaution to reduce impingement of fish on the screens.

SYSTEM OPERATIONAL REQUEST: #2005-14

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
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	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: May 24, 2005

SUBJECT: Spring Spill Operations at John Day Dam

SPECIFICATIONS: Provide at least 120 Kcfs hourly spill at John Day Dam (and higher if possible to achieve the 60% nighttime and 40% daytime spill percentage) for fish passage through spill, and operate at flat flows if necessary to achieve this objective. This request is in response to The Dalles Dam not achieving the required Biological Opinion 40% spill.

JUSTIFICATION:

We understand that there is great difficulty managing hydro projects to achieve multiple objectives and goals, and wanted to clarify the intended objectives of SOR #2005-12. In SOR #2005-12 the Fishery Managers requested that spill be increased at John Day Dam during daytime hours to provide benefits to fish survival in response to the project constraints that limit the volume of spill that can be provided at The Dalles Dam, and try to recover some of the additional fish "take" associated with that limited operation. The request for daytime spill at John Day Dam was intended to provide the best fish operation given current fish passage numbers and present configuration of the hydrosystem.

We recognize that the John Day Dam project is unique in that gas often exceeds the 120% level when spill volumes are between 86 and 120 Kcfs. In reviewing the record of hourly flow, spill and total dissolved gas levels over the past several days, it is apparent that spill flows in excess of 140 Kcfs often yield lower total dissolved gas levels than spill flows of 85 Kcfs. Fish passage and survival at the project is a function of the percentage of the total flow that passes through spill. Increasing the proportion spilled increases the number of fish passing through spill, increasing overall survival. It was noted that on May 22, 2005 from midnight to

0700 hours that spill volumes were 140 Kcfs and TDG was between 118 and 119%. However, in spite of the TDG being below the 120% waiver, spill was decreased to less than or equal to 90 Kcfs for the next 37 hours. This operational decision did not best meet our biological objectives. The biological objectives of the Fishery Managers are better met when spill is provided in excess of the 120 Kcfs. If necessary, the daily flows could be flattened to better achieve this objective of balancing flow, spill passage and TDG levels of 120%.

While we recognize that the COE views this as an experimental spill operation, it should be noted that thus far (as of 0900 hours on 5/24/05) spill volume at The Dalles has been approximately 810 KAF less than it would have been at 40% of daily average, while the operation at John Day Dam (since 5/20/05) has resulted in only an additional 31.4 KAF spill above the 60% nighttime spill.

Spring migrating fish will continue to pass through the Lower Columbia River through June. We recognize that the Action Agencies regard this operation as a seven-day event, based on discussions at the last TMT meeting; however, the Fishery Managers view it as their responsibility to recommend the implementation of the operation that provides the most benefit to the migrating salmonids. An operation that continues through the first few weeks of June will provide this protection to the remainder of the migration (up to 90% passage) that has been affected by the reduced spill at The Dalles Dam resulting in additional "take" of listed species.

Historic daily proportions average of 1985-04. Curve scaled to one half projected 2005 index, using NOAA estimated collection, and 45% spill.

Historic daily proportions average of 1985-04. Curve scaled to one half projected 2005 index, using NOAA estimated collection, and 45% spill.

TOTAL DISSOLVED GAS REPORT FOR JOHN DAY T.
starting at 0011 21 may 2005

DATE	TIME	GAS %	Spill Q	Total Q					
21-May	100	119.6	80	252.2					
21-May	200	119.4	80.1	229					
21-May	300	119.4	79.9	223.1					
21-May	400	119.4	79.9	202.4					
21-May	500	119.5	79.9	219.2					
21-May	600	119.5	79.9	241.1					
21-May	700	112.1	33.7	293.3					
21-May	800	109	0	286					
21-May	900	108.9	0	283.3					
21-May	1000	109.2	0	283.5					
21-May	1100	109.2	0	284.9					
21-May	1200	109.3	0	286.5					
21-May	1300	109.5	0	273.5					
21-May	1400	109.5	0	269.5					
21-May	1500	109.5	0	278					
21-May	1600	109.5	0	279.2					
21-May	1700	109.7	0	282.4					
21-May	1800	109.6	0	282.7					
21-May	1900	109.6	1.3	280.9					
21-May	2000	119.2	129.5	323.1					
21-May	2100	119.5	139.7	330.8					
21-May	2200	112.5	69.7	265.4					
21-May	2300	118.7	139.9	299.7					
22-May	0	118.4	139.9	264.5					
22-May	100	118.8	139.9	257.6					
22-May	200	118.6	139.9	261.6					
22-May	300	118.7	139.9	264					
22-May	400	118.6	139.9	264.8					
22-May	500	118.6	139.9	269.1					
22-May	600	118.9	139.4	270.7					
22-May	700	119.4	80.8	253.2					
22-May	800	119.7	80	266.9					
22-May	900	119.7	80	274.1					
22-May	1000	119.8	80	276.4					
22-May	1100	120.2	88.1	283.7					
22-May	1200	120.2	90	276.5					
22-May	1300	120.2	90	262.4					
22-May	1400	120.2	90	259.3					
22-May	1500	120	90.1	256.1					
22-May	1600	120.1	90.1	257.4					
22-May	1700	120	90.1	255.9					
22-May	1800	120.1	90.1	261.9					
22-May	1900	120	90.1	257.9					
22-May	2000	115.6	69.2	247.5					
22-May	2100	119.6	80.3	285.4					
22-May	2200	119.7	80.7	275.4					
22-May	2300	119	68.9	233.3					
23-May	0	118.9	68.9	224.4					
23-May	100	118.9	68.9	224.2					
23-May	200	118.9	68.9	229.1					
23-May	300	119	68.9	227.6					
23-May	400	119	68.9	226.9					
23-May	500	119	68.9	230.2					
23-May	600	119	68.9	228.3					
23-May	700	119.4	79	275					
23-May	800	119.8	79.7	283.4					
23-May	900	119.9	79.7	275.3					
23-May	1000	119.9	79.7	276.9					
23-May	1100	119.8	79.7	277.5					
23-May	1200	119.9	79.8	293					
23-May	1300	120.6	88.7	306					
23-May	1400	120.2	79.7	287					
23-May	1500	120	80	272.9					
23-May	1600	120.4	85.1	271.9					
23-May	1700	120.4	85.1	292.5					
23-May	1800	120.3	85.1	291.9					
23-May	1900	120.4	85.6	289.2					
23-May	2000	120	153	296.1					
23-May	2100	120.1	153.9	294.6					
23-May	2200		153.6	280.7					
23-May	2300		144.1	244.7					
23-May	0		124.6	207.5					
23-May	1200	119.9	79.8	293					
23-May	1300	120.6	88.7	306					
23-May	1400	120.2	79.7	287					
23-May	1500	120	80	272.9					
23-May	1600	120.4	85.1	271.9					
23-May	1700	120.4	85.1	292.5					
23-May	1800	120.3	85.1	291.9					
23-May	1900	120.4	85.6	289.2					
23-May	2000	120	153	296.1					
23-May	2100	120.1	153.9	294.6					
23-May	2200	120	153.6	280.7					
23-May	2300	119.4	144.1	244.7					
24-May	0	118.4	124.6	207.5					
24-May	100	119	86.6	176.9					
24-May	200	119.4	85.7	176.1					
24-May	300	119.6	85.7	180.1					
24-May	400	119.4	85.7	173.4					
24-May	500	119.1	85.7	166.4					
24-May	600	119.4	85.6	192.3					
24-May	700	119.6	85.7	246.3					
24-May	800	119.8	85.7	252.8					
24-May	900	119.8	85.7	240.7					

SYSTEM OPERATIONAL REQUEST: #2005-13

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

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	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: May 12, 2005

SUBJECT: Spill at Lower Monumental Dam

Objective: Improve migration conditions for fish that will not be transported at Lower Monumental Dam.

SPECIFICATIONS:

Begin immediately to implement bulk spill to the gas cap 24 hours per day at Lower Monumental Dam. Return to collection and holding for transport when holding criteria can be met.

JUSTIFICATION:

The Lower Monumental project has been collecting and bypassing fish since May 9, because fish transportation barges have been filled to capacity with the collections from Lower Granite and Little Goose. Spill is accepted as the safest and most effective route of passage through the projects. In 2004 bulk spill was tested at Lower Monumental and resulted in high survival rates. Spill is provided as an alternative to and in addition to powerhouse passage at

projects where transportation is not available. The attached plot summarizes PIT tagged wild Chinook and steelhead at Lower Monumental Dam. Passage at Lower Monumental has increased with increasing flows. Passage indices at Lower Granite Dam increased dramatically on May 5th and have continued at high daily levels through May 10th. The medium travel time of Chinook and steelhead between Lower Granite and Lower Monumental dams has been between 5.5 and 7.8 days. This indicates that significant passage will continue to occur at Lower Monumental for the next several days.

Wild PIT Tagged Chinook and Steelhead Observed at Lower Monumental Dam May 1st - May 11th, 2005

SYSTEM OPERATIONAL REQUEST: #2005-12

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

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FROM: David A. Wills, Chairperson, Salmon Managers

DATE: May 17, 2005

SUBJECT: Compensation for decreased spill volumes at The Dalles

SPECIFICATIONS:

- Provide compensation for the spill that is not occurring at The Dalles Dam due to restricted spill gate operations.
- The compensation should be in the form of spill volume equal to what would have been provided if The Dalles Dam were fully operational.
- Spill is to be implemented as daytime spill at John Day Dam as 40% of instantaneous flow for the next seven days.

JUSTIFICATION:

Spill at The Dalles Dam is restricted due to the inability to operate spill gates at all but two spillbays. All other spillbays are operated with a fixed opening and, consequently, only have the ability to pass a fixed volume of spill. At the recent high flows the volume spill has averaged far below the 40% Biological Opinion spill level (ranging from 31% to 34% over the past several days). The fishery agencies and tribes are requesting compensation for this decreased spill volume and for the additional mortality incurred from fish passing The Dalles Dam by increasing spill (and therefore survival) at other FCRPS projects. Daytime spill equal to 40% of instantaneous flow at John Day Dam is recommended to compensate for the reduction in spill volume at The Dalles Dam based on fish movement and total dissolved gas levels. The

following graphs suggest that presently it is less than midway through the migration of juveniles into the Lower Columbia River. Also, based on historic passage timing and current year data it appears that the peak daily passage of yearling chinook and steelhead are passing lower river projects now and that this will continue for two to three more weeks. Presently, total dissolved gas levels are below the TDG waiver levels in both the tailrace of John Day Dam and in the forebay of The Dalles Dam. It is not anticipated that this operation will increase the TDG levels above the state waivers.

It is estimated that thus far (April 10 to May 16) the fixed gate settings at The Dalles Dam have resulted in a reduction of approximately 430 Kcf of spill volume. At present flows it is anticipated that this volume would provide about 4 to 5 days of daytime spill at John Day Dam. Additional volume, subsequent to May 16, will likely be available due to The Dalles Dam spilling less than 40% daily average flow after May 16. It is anticipated that spill less than 40% will occur whenever daily average flows are near, or above, 200 Kcfs. Based on current information it is anticipated that flows in the near future will continue to provide spill levels less than 40% at The Dalles. This water, and the anticipated water, can be used to continue daytime spill at John Day Dam for the next seven days. The fishery agencies and tribes would like the operation to continue for at least the next seven days to provide uninterrupted passage benefits to presently migrating stocks of fish. At the end of the seven-day period volumes can be reassessed and additional adjustments can be made.

SYSTEM OPERATIONAL REQUEST: #2005-11

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
	James D. Barton	COE-Water Management
	Cindy Henriksen	COE-RCC
	Witt Anderson	COE-P
	Col. Richard Hobernicht	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: May 10, 2005

SUBJECT: Spring Dworshak Operations

SPECIFICATIONS:

- Pass inflows at Dworshak Dam to the 110% TDG level in the Dworshak tailrace for a period of one week, outflows at Dworshak should not drop below 12 Kcfs during this period.
- Assure refill of Dworshak reservoir by June 30th.
- This request is for this coming week, anticipate further requests as new information based on fish numbers and water supply forecast becomes available.

JUSTIFICATION:

The Smolt Monitoring Program passage index data and PIT tag detection data indicate that wild and hatchery stocks from all upstream tributaries are passing Lower Granite Dam at the present time, and that the recent increase in flows has resulted in increased passage through the Snake River reservoirs. The request to pass inflow at Dworshak is based upon these passage data and the anticipated continuation of higher natural flows from recent and anticipated continuing of rain events in the Upper Snake Basin. Daily passage of wild and hatchery spring chinook yearling migrants at Lower Granite Dam have increased from a daily total of 129,000 on May 4, to 351,000 on May 9. Daily steelhead passage at Lower Granite has increased from 59,000 on May 4, to 439,000 on May 9. The attached graphs of the passage index at Lower Granite display the increase in passage that has occurred during the past week. This increase in daily passage of

steelhead and yearling chinook has occurred with an increase of daily average flows from 49 kcfs to 77 Kcfs at Lower Granite over the period of May 4, through May 9. The attached graphs of the cumulative passage index graph for steelhead and for chinook at Lower Granite Dam show the present passage compared to the historic passage distribution. These graphs indicate that this is the historic period of peak passage for spring migrants.

In addition, the attached graphic shows the wild PIT tagged spring chinook and steelhead that which have been detected at Lower Granite Dam over the past week. Passage of wild PIT tagged steelhead and chinook at Lower Granite has increased with increased flow. The wild PIT tagged steelhead and Chinook passing Lower Granite represent releases from all upstream Oregon and Idaho tributaries. PIT tags have been detected from PIT tag releases groups from tributaries of the Salmon River, Imnaha River, Snake River, Grande Ronde River, the Lemhi River, the Lostine River, Minanm River, Clearwater River encompassing all of the Snake River ESUs. These data indicate that wild populations of steelhead and chinook are presently migrating in significant numbers through the upper Snake River. The following table shows the daily passage of wild PIT tagged chinook and steelhead detections at Lower Granite Dam.

Date	Wild Yearling Chinook PIT Tagged	Wild Steelhead PIT Tagged
May 1	904	549
May 2	490	242
May 3	533	126
May 4	832	203
May 5	1394	524
May 6	1154	464
May 7	696	530
May 8	997	576
May 9	771	899
May 10	256	331

The above data clearly indicates that wild and hatchery stocks comprise the migration through the Snake River.

The request to pass inflow at Dworshak without decreasing outflows to below 12 kcfs is intended to provide flows for this peak segment of the outmigration while maintaining the June 30 refill target for Dworshak Dam, which will provide flow augmentation for summer fall chinook migrants.

Historic daily proportions average of 1985-04. Curve scaled to projected 2005 index, using NOAA estimated collection no spill

PIT Tagged Wild Chinook and Wild Steelhead Passage at Lower Granite Dam for the 2005 Migration (as of May 10th)

SYSTEM OPERATIONAL REQUEST: #2005-10

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
	James D. Barton	COE-Water Management
	Cindy Henriksen	COE-RCC
	Witt Anderson	COE-P
	Col. Richard Hobernicht	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: May 3, 2005

SUBJECT: Priest Rapids Flows to Improve Migration Conditions in the Middle Columbia River

SPECIFICATIONS:

- Increase flows at Grand Coulee Dam to provide 135 Kcfs at Priest Rapids Dam beginning May 4, 2005 and continue through the month of May. Do not draft Grand Coulee below elevation 1240 feet and assure refill to elevations 1280-1285 feet by late June.

JUSTIFICATION:

The Passage Index for combined yearling chinook at Rock Island Dam on May 2nd, 2005 was 408; the combined steelhead passage index over the same day was 451. Based on historic passage information, both combined yearling chinook and steelhead numbers are expected to continue to increase over the next few weeks. The flow target of 135 Kcfs is the seasonal flow objective listed in the NMFS 2000 Biological Opinion, and in the 2004 Updated Proposed Action.

Historic and Realtime Passage Index at Rock Island Dam For Yearling Chinook

Historic daily proportions average of 1985-04. Curve scaled to projected 2005 index, using NOAA estimated population, and a 1% FGE.

Historic and Realtime Passage Index at Rock Island Dam For Steelhead

Historic daily proportions average of 1985-04. Curve scaled to projected 2005 index, using NOAA estimated population, and a 2% FGE.

SYSTEM OPERATIONAL REQUEST: #2005-9

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
	James D. Barton	COE-Water Management
	Cindy Henriksen	COE-RCC
	Witt Anderson	COE-P
	Col. Richard Hobernicht	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: May 3, 2005

SUBJECT: Spring Dworshak Operations to Provide Improved Migration Conditions in the Snake River

SPECIFICATIONS:

- Increase Outflows at Dworshak Dam to full powerhouse capacity along with spill to the 110% TDG level in the Dworshak tailrace for a period of one week (approximately 14 Kcfs day average flow). We estimate this operation will use 174 Kaf of reservoir water from Dworshak reservoir, above the 1.5 Kcfs minimum outflow.
- Assure refill of Dworshak reservoir by June 30th.
- This request is for this coming week, anticipate further requests as new information based on fish numbers and water supply forecast becomes available.

JUSTIFICATION:

Increased outflows at Dworshak Dam will aid in the passage of yearling chinook and steelhead in the Lower Snake River. The passage indices of combined yearling chinook have increased dramatically at Lower Granite Dam over the last week. The passage index at Lower Granite for combined yearling chinook for 5-2-05 was 412,325. Passage indices for steelhead have also been increasing over the last week at Lower Granite Dam, with a daily passage index of 228,980 on 5-2-05. Based on historic timing, peak passage of yearling chinook and steelhead should be occurring over the next few weeks (see figures for cumulative passage timing).

Historic daily proportions average of 1985-04. Curve scaled to projected 2005 index, using NOAA estimated collection no spill

SYSTEM OPERATIONAL REQUEST: #2005-8

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Washington Department of Fish and Wildlife, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
	James D. Barton	COE-Water Management
	Cindy Henriksen	COE-RCC
	Witt Anderson	COE-P
	Col. Richard Hobernicht	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: April 26, 2005

SUBJECT: Lower Columbia Flow Shaping

SPECIFICATIONS: Flat load flow through Lower Columbia projects as much as possible to improve fish passage conditions for migrating juvenile salmonids.

JUSTIFICATION:

Over the past few days it has come to the attention of the Salmon Managers' that daily load factoring has resulted in decreasing amounts spill at some of the lower Columbia Rivers projects where spill is provided on a 12 hour, rather than a 24 hour basis. This results in spill levels that are much lower than expected. The Biological Opinion calls for project minimum flows through the powerhouse of 50 Kcfs at both McNary and John Day Dam. The Biological Opinion also calls for spill to the 120% gas cap (approximately 170 Kcfs) during nighttime hours at McNary Dam and 60% of flow to be passed at John Day Dam also during nighttime hours. The projects are at times being operated at much higher daytime flows, and decreased nighttime flows. This peaking operation, together with the project minimum of 50 Kcfs, has resulted in very low spill volumes (as low as 31 Kcfs with TDG averages of 111 to 112% in the tailrace) during spill hours at McNary Dam and as low as 46% of instantaneous flow at John Day Dam. These conditions do not provide as much protection as assumed in the Biological Opinion. In addition, the present situation at The Dalles Dam, where only spill gates one and two can be used

to modify spill in response to changing river conditions, suggests that spill volumes would best be achieved under flat loading of the project.

We understand that 2005 is a low flow year, and the possibility of achieving the Biological Opinion spill levels is compromised due to the requirement for project minimum operations. However, the extent of this inability to achieve the intent of the Biological Opinion is exacerbated by the present peaking operation of the river flow. Therefore, we request that the Action Agencies take all steps necessary to limit day/night flow fluctuations to assure safe passage of fish via spill protection levels as close as possible to those assumed in the Biological Opinion.

SYSTEM OPERATIONAL REQUEST: #2005-7

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
	James D. Barton	COE-Water Management
	Cindy Henriksen	COE-RCC
	Witt Anderson	COE-P
	Col. Richard Hobernicht	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: April 19, 2005

SUBJECT: Priest Rapids Flows

SPECIFICATIONS:

- Increase flows at Grand Coulee Dam to begin providing 95-105 Kcfs at Priest Rapids Dam beginning April 22nd, 2005.

JUSTIFICATION:

The Passage Index for combined yearling chinook at Rock Island Dam on April 17th and 18th, 2005 was 151 and 833; the combined steelhead passage index over the same days were 1 and 12. Based on historic passage information, steelhead numbers are expected to continue to increase over the next week. Also, steelhead respond well to increasing flows, so providing flows will likely improve numbers as well.

SYSTEM OPERATIONAL REQUEST: #2005-6

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
	James D. Barton	COE-Water Management
	Cindy Henriksen	COE-RCC
	Witt Anderson	COE-P
	Col. Richard Hobernicht	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: April 19, 2005

SUBJECT: Ice Harbor Dam Spill

SPECIFICATIONS:

- 1) It is requested that the COE please provide requests for input on operations to all Technical Management Team Salmon Manager members and the tribes, as far in advance as possible in writing, to assure adequate time for coordination and response.
- 2) To the extent possible piggyback transducer installation at Ice Harbor Dam with the proposed spill outage at Ice Harbor Dam scheduled for Wednesday, April 20, 2005.
- 3) Compensate for any spill not provided at Ice Harbor during this outage by providing that volume at McNary Dam as spill during daytime hours.

JUSTIFICATION: It was brought to the Salmon Managers' attention this morning that the COE notified two Fish Passage Advisory Committee members via telephone call of an upcoming spill outage and altered operations at Ice Harbor Dam. The outage is scheduled for 8 daytime hours beginning tomorrow Wednesday, April 20, 2005. During this time equipment for the hose release mechanisms will be removed. It is requested that the reduction in the daily spill volume

due to this operation be compensated for by spilling during daytime hours at McNary Dam. A second project manipulation is expected to occur on Saturday and Sunday, April 23 and 24, 2005. Spill will be concentrated and limited to three bays at a time to facilitate the installation of transducer equipment. The transducer equipment should have been installed during the in-water work window, prior to the juvenile salmon migration season. To insure a minimum disruption to the juvenile fish migration from the proposed operation of only three spill bays, it is requested that as much as possible transducer installation be accomplished during the spill outage planned for April 20, 2005.

SYSTEM OPERATIONAL REQUEST: #2005-5

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
	James D. Barton	COE-Water Management
	Cindy Henriksen	COE-RCC
	Witt Anderson	COE-P
	Col. Richard Hobernicht	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: April 14, 2005

SUBJECT: Bonneville Project Spill

SPECIFICATIONS: Beginning April 15, 2005 at 1800 hours, spill 50 Kcfs hourly at Bonneville Dam. Begin operating the Bonneville Corner Collector on April 15, no later than 1600 hours. Flatten daily load following at the project to the extent possible to moderate tailwater elevation fluctuations. Avoiding daily tailwater fluctuations should effectively increase tailwater elevations from the minimums observed during low load time periods, providing better conditions for emerging juvenile chum salmon.

Increase Bonneville spill to full Biological Opinion levels (75 Kcfs during daytime hours and spill to the 120% TDG gas cap during nighttime hours) on April 19 at 1800 hours.¹

JUSTIFICATION: Initiation of Biological Opinion spill at Bonneville Dam has been delayed from the normal April 10 planning date because of below normal flows and inadequate water depth to protect emergent chum fry below Bonneville Dam. The initial reduced Bonneville spill request is based upon dissolved gas levels occurring at the sensitive, Multnomah Falls chum redd

¹ CRITFC and the Nez Perce Tribe do not oppose this SOR, but want to see a higher spill volume, 120 kcfs daytime at Bonneville Dam, as outlined in their 2005 River Operations Plan.

site, which has minimum coverage at present tailwater elevations. ODFW, USFWS and FPC staff measured dissolved gas levels at the Multnomah chum redd sites at 9:00 to 9:30 a.m. on April 14. Dissolved gas levels ranged from 101.3 to 103.9 with 1.5 ft depth compensation. Based upon these measurements the agencies and tribes recommend the beginning of spill at Bonneville to benefit downstream migrating salmon and steelhead. It is anticipated that by next Tuesday a very high percentage of chum will have emerged and Bonneville spill levels will no longer need to be restricted, but moderating load following to increase minimum tailwater may need to continue to protect the remaining emergent fry.

SYSTEM OPERATIONAL REQUEST: #2005-4

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
	James D. Barton	COE-Water Management
	Cindy Henriksen	COE-RCC
	Witt Anderson	COE-P
	Col. Richard Hobernicht	COE-Portland District
	Karen Durham-Aguilera	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: April 5, 2005

Re: Ice Harbor and Lower Columbia Spill¹

SPECIFICATIONS:

1. Ice Harbor Dam: Begin spill immediately to the amount specified in the Biological Opinion with the bulk spill pattern.
2. McNary Dam: Begin spill on April 10th, 2005 to the amount specified in the Biological Opinion.
3. John Day Dam: Begin spill on April 10th, 2005 to the amount specified in the Biological Opinion.
4. The Dalles Dam: Begin spill on April 11th, 2005 to the amount specified in the Biological Opinion.

^{1 1} CRITFC and the Nez Perce Tribe do not oppose this SOR but want to see higher spill volumes, as outlined in their 2005 River Operations Plan.

5. Bonneville Spill: The commencement of spill at Bonneville Dam is being considered by the agencies and tribes. ODFW will monitor dissolved gas at chum emergence sites downstream. The agencies and tribes will consider additional data prior to requesting spill at Bonneville. The agencies and tribes anticipate that start of spill will be requested for April 15.

JUSTIFICATION:

The passage of juvenile fish into the Lower Columbia River is presently occurring. McNary Dam sampling is occurring on alternate days and has shown the presence of juvenile yearling chinook, and steelhead. At John Day Dam passage indices of yearling chinook have been over 2000 the first 3 days of sampling. Historic information for passage timing at John Day Dam indicates that the presence of Umatilla and John Day stocks is expected during the early part of April based on the historic passage. If spill is not initiated early enough during the migration season there is a higher likelihood that these stocks will pass under no spill conditions.

Passage indices for yearling chinook have been steadily increasing at Bonneville Dam over the past few days. Presently, ESA listed chum salmon continue to emerge from redds below Bonneville Dam and are expected to emerge until the last week of April. At present flows there is the potential of increasing total dissolved gas levels over the redds where salmon have not yet emerged. Consequently, the recommended spill conditions at Bonneville Dam have been changed to address this concern. Changes to the Bonneville recommendation will be made following emergence, or as river conditions improve.

SYSTEM OPERATIONAL REQUEST: #2005-3

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO: B. G. Grisoli COE-NWD
James D. Barton COE-Water Management
Cindy Henriksen COE-RCC
Witt Anderson COE-P
LTC Charles S. Markham COE-Portland District
LTC Randy L. Glaeser COE-Walla Walla District
J. William McDonald USBR-Boise Regional Director
Stephen J. Wright BPA-Administrator
Greg Delwiche BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: April 1, 2005

SUBJECT: Lower Snake and John Day Operations¹

SPECIFICATIONS: The Salmon Managers listed above are requesting the following operations for reservoir drafts in the Lower Snake river and at John Day.

1. Draft Ice Harbor Pool to MOP +1 on the evening of Monday, April 4th;
2. Draft Lower Granite pool to MOP +1 beginning the evening of Monday April 11, 2005;
3. Draft Little Goose pool to MOP +1 beginning the evening of April 12th;
4. Draft Lower Monumental Pool to MOP beginning the evening of April 13th;
5. Draft John Day Pool evenly over a three-day period to MIP beginning the evening of April 15th.

Grand Coulee Dam should be operated as planned before this request (steady draft of several 1/10ths of a foot per day, 3-30-05 STP). It is anticipated that the combination of

¹ CRITFC and the Nez Perce Tribe agree with the intent of this SOR; however, would like all Snake projects drafted to MOP, as outlined in their 2005 River Operations Plan.

all of the requested drafts will increase flows at Bonneville Dam relative to that planned (163-173 Kcfs at Bonneville Dam between April 10th to April 20th, 3-30-05 STP). If Grand Coulee decreases planned drafts (STP 3-30-05) as a result of these increases in flow, then an overall increase in flow at Bonneville Dam will not be accomplished.

JUSTIFICATION:

Fish collection at the Snake River Traps has been increasing. With the recent freshet in Snake River tributaries collection of yearling chinook at the Salmon River Trap reached 3,700, while collection at Grande Ronde and Imnaha traps also increased this past week. However, collection at the Snake River Trap at Lewiston remains low as well as at Lower Granite Dam. Passage indices at Lower Granite averaged 210 per day for yearling chinook and 280 per day for steelhead since sampling began March 26. These numbers are relatively quite low. Many of the chinook appear to be holdover fish indicating that active migrant chinook from tributaries have yet to reach the dam in significant numbers.

The intent of this operation is to delay the drafts of pools by one week to benefit a greater number of fish. In addition to benefiting juvenile fish through the Snake and Columbia rivers, these drafts will benefit chum below Bonneville Dam and facilitate the beginning of spring spill at Bonneville Dam.

SYSTEM OPERATIONAL REQUEST: #2005-2

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, NOAA Fisheries, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter-Tribal Fish Commission.

TO: B. G. Grisoli	COE-NWD
James D. Barton	COE-Water Management
Cindy Henriksen	COE-RCC
Witt Anderson	COE-P
LTC Charles S. Markham	COE-Portland District
LTC Randy L. Glaeser	COE-Walla Walla District
J. William McDonald	USBR-Boise Regional Director
Stephen J. Wright	BPA-Administrator
Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: March 1, 2005

SPECIFICATIONS: The Salmon Managers listed above are requesting the following fishery operations at the Bonneville Project following the March 2 Spring Creek Hatchery tule fall Chinook release:

1. No operation of unscreened units at Bonneville Powerhouse I or II and follow the turbine operating priority in the Fish Passage Plan;
2. Operate Powerhouse II as first priority. Fully load PH II before operating PH I;
3. Operate turbine units within 1% of peak efficiency;
4. Operate juvenile and adult facilities according to criteria;
5. Beginning on the morning of March 3, operate the corner collector (B2CC) for a period of 5 days, to the morning of March 8. Provide a sixth day, to the morning of March 9, of B2CC operation and tailwater compensation if there are sufficient numbers of hatchery fish still passing the project. Presence of low hundreds of fish per day passage will be interpreted as "sufficient" for the provision of an additional day of protection. This assessment will be based on fish passage index numbers for the sample ending the morning of Tuesday March 8.
6. Concurrent with the operation of the B2CC, operate the Bonneville Project to maintain a minimum 12.5-foot project tailwater elevation. Based on last year's B2CC operation,

which produced TDG readings approaching 108%, a 12.5 foot minimum project tailwater should be sufficient to maintain a maximum level of 105 % TDG (factored for depth compensation) at the chum redds in the Ives Island complex, and on the Oregon shore to the Multnomah area.

7. We request that the Action Agencies use the flexibility in the system to accomplish this while maintaining the target elevation of 1255 feet at Grand Coulee by March 31 to accommodate drum gate maintenance planned by the Bureau of Reclamation.

JUSTIFICATION:

We recognize that we are entering a water runoff season with a lower than normal runoff forecast. With this in mind, this SOR is requesting flow and duration at levels well below what is normally requested by the salmon managers for full protection of the March release group at Spring Creek Hatchery. Because Grand Coulee must achieve a target elevation of 1255 by March 31, we believe that achieving some measure of fish protection by shaping the water that will be released for drum gate maintenance is appropriate and implementable.

Spring Creek Hatchery is scheduled to release 7.37 million tule fall Chinook by mid-day March 2, 2005. This represents one-half of the total production for brood year 2004. The overall importance of this stock to ocean and Columbia River commercial, sport and tribal fisheries has been previously documented in the requests for a total dissolved gas waivers submitted to the Oregon Department of Environmental Quality and Washington Department of Ecology. The Spring Creek Hatchery fall Chinook are an important buffer to ESA listed stocks present in ocean and Columbia River mixed stock fisheries. Because of the accelerated growth of the fish and increasing fish health concerns with the March release group, as well as the April and May groups, postponing the release is not an option. Releasing the fish on March 2 will allow the densities of the remaining fish to be reduced, better maintaining hatchery rearing protocols and ultimately better fish health.

In order to protect the most sensitive developmental stages of juvenile fall Chinook and chum salmon that are incubating downstream from Bonneville Dam in the Ives/Pierce Islands area and along the Oregon shore across from the Ives/Pierce areas, the total dissolved gas supersaturation levels over the redds should not exceed 105%, when factored for depth compensation. At the same time, the fishery agencies and tribes wish to provide adequate spill protection for the Spring Creek Hatchery release. To ensure the protection of incubating juvenile fall Chinook and chum salmon, while providing some protection for the Spring Creek Hatchery release, a minimum tailwater elevation of 12.5 feet should produce a total dissolved gas supersaturation level at, or below, 108%. This would mean that the TDG (with depth compensation) for the highest elevation (11.5 tailwater) chum redd on the Oregon shore below Bonneville Dam would be below 105%. The flow from PH II is preferred because it provides a buffer between the more highly saturated spillway/B2CC flow and the Ives/Pierce Islands area on the Washington shore. A field crew will be on the river measuring the TDG levels at the chum redd sites. If gas levels exceed those predicted and endanger the chum redds, the Corps will be notified to cease the B2CC operation.

If this SOR cannot be implemented as requested, please provide a written response to the Fish Passage Advisory Committee documenting the rationale for the actions taken.

SYSTEM OPERATIONAL REQUEST: #2005-1

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: U.S. Fish & Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, National Marine Fisheries Service, Nez Perce Tribe, Shoshone-Bannock Tribes, and the Columbia River Inter Tribal Fish Commission.

TO:	B. G. Grisoli	COE-NWD
	Acting Division Chief	COE-Water Management
	Cindy Henriksen	COE-RCC
	Witt Anderson	COE-P
	LTC Charles S. Markham	COE-Portland District
	LTC Randy L. Glaeser	COE-Walla Walla District
	J. William McDonald	USBR-Boise Regional Director
	Stephen J. Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: David A. Wills, Chairperson, Salmon Managers

DATE: January 12, 2005

SUBJECT: Operations at Dworshak Reservoir

SPECIFICATIONS: Maintain Dworshak Reservoir to the highest elevation possible within the flood control rule curves. Do not evacuate 50 Ksfd (99.2 Kaf) as planned by the COE over the next week for power operations. Continue to release minimum discharges (1.5 Kcfs) until further notice.

JUSTIFICATION:

The current COE April-July Water Supply Forecast at Dworshak is 1914 Kaf (approximately 70% of average), which equates to an end of January flood control elevation of 1557.4 feet. The January Final April-July Water Supply Forecast issued by the RFC is 1960 Kaf (74% of average). The RFC forecast assumes future January precipitation to be 85% of average and 100% of average beyond January. As of January 10th, 2005 precipitation over the month of January at Lewiston, Idaho has been 19% of average. With precipitation not expected to occur in any significant amount over the next week to ten days, it can be anticipated that the Water Supply Forecast at Dworshak Dam will decrease. Given these forecasts, Dworshak will remain below

its required seasonal flood control elevation, requiring no additional drafts to achieve that objective.

To summarize, the below average nature of the current Water Supply Forecasts at Dworshak Dam, the uncertainty of precipitation into the near future, and the fact that the current reservoir elevation is about seven feet below the flood control rule curve, the evacuation of 50 Ksfd this early in the season would be a risk to achieving BIOP spring flow objectives and elevation targets.

SYSTEM OPERATIONAL REQUEST #2005-FWS / IDFG-2

TO: Colonel (P) Gregg Martin	COE-NWD
Jim Barton	COE-NWD-NP-Water Management
Cindy Henriksen	COE-NWD-NP-WM-RCC
Rudd Turner	COE-NWD-CM-F Fish Management
Col. Debra Lewis	COE-Seattle District
Steven Wright	BPA-Administrator
Greg Delwiche	BPA- KE-4

FROM: Susan Martin, Supervisor, U.S. Fish and Wildlife Service

Russ Kiefer for Virgil Moore, Fisheries Bureau Chief, Idaho Department of Fish and Game

SUBJECT: Request for winter water level operations on Lake Pend Oreille, Idaho during winter 2005 and 2006, to increase egg to fry survival of kokanee, the primary forage base for listed bull trout.

DATE: October 17, 2005

SPECIFICATIONS:

- 1) By November 15, 2005, draw Lake Pend Oreille down to an elevation no lower than 2055 feet to enhance kokanee spawning. During the winter of 2005-2006, maintain the lake level at an elevation at or above 2055 feet to prevent harm to kokanee redds by dessication or disturbance by wave action.
- 2) The Corps of Engineers is to hold Lake Pend Oreille as high as possible (up to 2059) through October 31st and minimize as much as possible the need to spill in order to reach elevation 2055 by mid November.
- 3) The goal is to reach the winter elevation by November 15th but can be extended up to November 20th to minimize the need to spill.

JUSTIFICATION:

In Lake Pend Oreille, bull trout heavily use kokanee as forage. Elsewhere, when forage became limiting and introduced lake trout were present, the bull trout populations have been severely depressed and lake trout have become the dominant char. Examples of this negative population interaction include Flathead Lake, Montana and Priest Lake, Idaho. Kokanee population levels in Lake Pend Oreille have become depressed to the extent that in the absence of significant habitat manipulation and concurrent management actions leading to a reduction in the lake trout population, the bull trout population is at risk. The effect of lake level on kokanee spawning success is being evaluated as a tool to benefit the kokanee population.

This recommendation is part of a study of lake level operations intended to determine the effectiveness of variable lake level management as a tool in the maintenance of the kokanee population. Findings to date indicate that kokanee egg-to-fry survival has increased from a mean of 2.8% in years of full drawdown, to a mean of 6.6% in years when the lake was held higher (Figure 1). Recent monitoring by Idaho Department of Fish and Game indicates a spawning population of about 100,000 female kokanee will spawn this fall. A higher lake level, with its associated expansion of spawning areas, would be expected to benefit the population during the 2005 spawning season. Information from an independent scientific review panel also recommended holding the lake at 2055 feet for 2 to 3 years in a row followed by a drawdown to 2051 feet to enhance the kokanee population. Based on this information, the Fish and Wildlife Service and the Idaho Department of Fish and Game request that the water surface elevation of Lake Pend Oreille be maintained at 2055 feet during the winter of 2005 – 2006 to evaluate the efficacy of higher lake levels on kokanee spawning and as an attempt to provide a forage base for the lake's bull trout population.

The Action Agencies use Lake Pend Oreille to provide fall flow augmentation to enhance listed Chum Salmon spawning conditions below Bonneville Dam. Current hydrologic modeling indicates that the Action Agencies will be able to initiate the chum spawning operation beginning the first week of November while implementing this System Operation Request. Implementing Specification number 2 of this System Operation Request helps ensure the likelihood of initiating the Chum Salmon spawning operation in early November while also providing for the identified needs of resident fish in Lake Pend Oreille.

The lake level during the winter of 2006-2007 will be determined at a later date following a review of information available at that time.

Figure 1. Survival rate of kokanee eggs in Lake Pend Oreille during years when the winter lake level was held higher (dots) and during years of a full drawdown (diamonds).

SYSTEM OPERATIONAL REQUEST: #2005, FWS-1

TO:	Brig. Gen. Grisoli	COE-NWD
	William Branch	COE-Water Management
	Cindy Henriksen	COE-RCC
	Witt Anderson	COE-P
	Col. Debra Lewis	COE-Seattle District
	J. William McDonald	USBR-Boise Regional Director
	Steven Wright	BPA-Administrator
	Greg Delwiche	BPA-PG-5

FROM: Susan Martin, Supervisor, Upper Columbia Fish and Wildlife Office

DATE: May 13, 2005

SUBJECT: Libby Dam Releases for Sturgeon and Bull Trout Augmentation
Flows

SPECIFICATIONS:

Based on the May final April-August volume runoff forecast of 5.189 million acre-feet we are within a tier 2 operations year for Kootenai River white sturgeon as defined in the Fish and Wildlife Service's December 2000 Biological Opinion on operations of the Federal Columbia River Power System. The minimum recommended release volume for sturgeon conservation under current circumstances is 800 thousand acre-feet, and we now recommend the following procedures for discharge of at least this minimum volume from Libby Dam:

Thursday May 19th at about 6:00 am, increase flow at Libby Dam to 15,000 cfs (Kcfs): Ascending limb of hydrograph; USGS will conduct suspended sediment sampling and ADCP on May 20 and 21 (Friday and Saturday)

Saturday May 21st at about 6:00 am, increase flow at Libby Dam to 20Kcfs: Ascending limb of hydrograph; USGS will conduct suspended sediment sampling and ADCP on May 22 and 23 (Sunday and Monday)

Monday May 23rd at about 6:00 am, increase flow at Libby Dam to 25Kcfs: Peak of hydrograph; USGS will conduct suspended sediment sampling and ADCP on May 24 and 25 (Tuesday, Wednesday), and multi-beam bathymetric mapping in the braided reach from May 24 through 28th (Tuesday through Saturday)

Saturday May 28th at about 6:00 am, reduce flow at Libby Dam to 20Kcfs: Weekend low power demand

Sunday May 29th at about 6:00 am, reduce flow at Libby Dam to 15K cfs: Weekend low power demand

Monday May 30th maintain flow at Libby Dam at 15Kcfs, Memorial Day Holiday

Tuesday May 31st at about 6:00 am, increase flow at Libby Dam to 20Kcfs: Restart the descending limb of hydrograph; USGS will conduct suspended sediment sampling and ADCP on June 1 and 2 (Wednesday and Thursday)

Thursday June 2nd at about 6:00 am; reduce flow at Libby Dam to 15Kcfs: Descending limb of hydrograph; USGS will conduct suspended sediment sampling and ADCP on June 3 and 4 (Friday and Saturday)

Continue discharging at this rate through approximately June 14 to utilize the minimum tiered volume of 800 thousand acre-feet. However, this discharge rate may be continued beyond June 14 if you elect to provide sturgeon flow in addition to the minimum recommended.

When it is clarified whether Lake Kooncanusa will be drafted to elevation 2439 by the end of August or by the end of September and releases from Libby Dam beginning June 15 are defined, we may provide additional recommendations. However in the absence of this clarification, beginning approximately June 15, 2005 we recommend that at least the tiered bull trout minimum flow of 7,000 cfs from the Fish and Wildlife Service December 2000 Biological Opinion be maintained through September.

Further, since Libby operations are anticipated to be constrained by having only 4 turbines (with maximum release capacity of slightly more the 20,000 cfs) in operation for much of this spring and summer, we recommend timely releases of additional water as necessary in excess of these recommended sturgeon or bull trout minimum flows to preclude any amount of forced spill this year.

This is a tier 2 water year as defined in the December 2000 Jeopardy Biological Opinion on the operations of Libby Dam. Based on these specifications the figure below illustrates how the Fish and Wildlife Service recommends this tiered sturgeon volume of water be shaped from Libby Dam through approximately June 14. Note that this illustration also depicts potential summer operations based on the current volume runoff forecast and NOAA Fisheries' Final Remand Biological Opinion of November 2004.

JUSTIFICATION:

This operational request is intended to provide flows sufficient to allow U. S. Geological Survey (USGS) to gather basic field measurements necessary to expand their flow and sediment transport modeling throughout the “braided reach” of the Kootenai River, immediately upstream of Bonners Ferry, Idaho. Preliminary findings have indicated that this is the reach of the Kootenai River which has been most altered since the commencement of operations of Libby Dam. It is shallower for several reasons; backwater effects from Kootenay Lake operations are diminished, peak flows have been directly curtailed by operations of Libby Dam, and there is increased deposition of coarse materials. In addition, channel instability in this reach has been increased. This reach has suitable substrate for sturgeon spawning and incubation, and because of its relatively high gradient, water velocities are believed generally suitable as well. The findings of this work are important for defining both the evolving habitat strategies, and spill tests to provide for sturgeon needs. Both of these general approaches are intended to allow the sturgeon to again naturally reproduce in its habitat.

Secondly, efforts are underway to capture as many gravid female sturgeon as possible. This is both a pilot study to assess survival of sturgeon eggs and free embryos at water velocities believed to minimize predation within suitable rocky substrates, and to provide opportunity for additional sturgeon reproduction, in excess of the capacity of the hatcheries. All eggs in excess of the needs of the two hatcheries will be fertilized, and then immediately released at predetermined sites in the Kootenai River Canyon and within the braided reach.

We acknowledge that some female sturgeon may be spawned, and their eggs released during the high discharges recommended before June 4. Thus, monitoring of early life stages of these individual fish may not be feasible because of the flows recommended for the USGS studies. However, subsequent fertilized egg releases by the Kootenai Tribe will be monitored by Idaho Department of Fish and Game for production of free embryos and larvae.

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APPENDIX J

Joint Technical Staff Letters

State, Federal and Tribal Fishery Agencies Joint Technical Staff

*Columbia River Inter-Tribal Fish Commission
Idaho Department of Fish and Game
Nez Perce Tribe
Oregon Department of Fish and Wildlife
Shoshone-Bannock Tribes
US Fish and Wildlife Service*

November 4, 2005

Dr. Chris Toole
NOAA Fisheries Service
1201 NE Lloyd Blvd
Suite 1100
Portland, OR 97232

Dear Dr. Toole,

At the October 18, 2005 meeting of the Fish Passage Advisory Committee (FPAC), NOAA Fisheries Service provided an update on the effort to construct a revised passage model. We thank NOAA Fisheries for meeting with us and, after reflecting on the discussion that took place, we wanted to express some of our thoughts and concerns on the efforts that have occurred to-date on this topic.

As you recall, a meeting was held by NOAA Fisheries Service on August 10, 2005 to organize other fishery management agencies input into the NOAA Fisheries effort to develop a new passage model. There were several representatives from NOAA Fisheries, as well as agency technical representatives from USFWS, IDFG, ODFW, WDFW, and CRITFC present. At that meeting, NOAA Fisheries staff described their desire to develop a new model to replace the SIMPAS model. NOAA Fisheries staff explained that they were developing this new model in response to the regional criticism of the SIMPAS model. NOAA Fisheries staff requested technical input to their model development from the other fishery agencies' technical staffs.

The context in which this model would be used, and the fundamental question of whether such a model is the appropriate method for making decisions about future management actions, are of serious concern to us. The new model concept outlined to us on August 10 incorporates many of the elements of SIMPAS and CRISP, although both of those models have been extensively criticized and have serious shortcomings in their use in hydrosystem management decisions. Because the revised version of SIMPAS is arguably more complex than CRISP, and CRISP has been denounced because of its over-complexity (Carpenter et al. 1998), this effort may be misguided. It does not appear to us that the development of revised versions of SIMPAS

will overcome the significant issues of model complexity, system complexity, data gaps, and environmental variability, present in both the SIMPAS and CRISP models.

At the meeting on August 10, NOAA Fisheries staff also expressed the various applications they intended to use this model for. The fishery and tribal agencies technical staff voiced strong disagreement as to NOAA's intended uses for the model, as well as the context of their participation in the model development. Some of the technical concerns voiced include:

- How this model could integrate with the needs for overall life-cycle analyses;
- The model output is only focused on juvenile fish direct survival, with little analysis of effects of passage routes on adult return rates;
- The model cannot accurately measure incremental changes in system survival related to small operational changes at individual dams;
- Most of the data to be used in the model was collected from studies that were not designed from a life history perspective (i.e., short-term project-specific survival estimates designed to evaluate alternative management actions or passage routes for example often size distribution of fish was limited by tag size, making the marked fish not representative of run-at-large);
- Uncertainty as to how this modeling effort would be integrated with the technical needs and goals identified by the Technical Recovery Teams;
- Uncertainty on how technical disagreements and disputes surrounding the model are to be resolved.

It appears that NOAA Fisheries has already decided major aspects of the model development without the other fishery and tribal agencies' input. The invitation to work on the model did not include agency participation in developing the goals of the analysis, developing the uses for the model, determining whether such a model was the necessary or appropriate approach to take, or defining the management questions that the model could support for NOAA Fisheries. At the FPAC meeting you recognized that the failure to have these sorts of discussions was a shortcoming of the effort to-date. The present approach used to improve the NOAA Fisheries passage model is not our vision of collaboration on the research and management issues that need to be addressed for FCRPS operations relative to salmon recovery. We believe a collaborative approach for addressing the management and research needs for the FCRPS would be a more productive endeavor for the Region to recover salmon populations.

From our perspective, there are several examples of how collaboration can result in effective research and monitoring programs in the Region. The ongoing Comparative Survival Study (CSS) is an excellent example of effective collaboration among USFWS, CRITFC, IDFG, ODFW, and WDFW to study the effectiveness of transportation on spring Chinook and steelhead. The CSS group also organized a formally facilitated workshop to examine the issue of delayed mortality, which we believe resulted in improved understanding of this important factor. A proposal developed in 2005 for conducting a fall Chinook transportation evaluation was a collaborative effort among the USFWS, WDFW, ODFW, IDFG, and CRITFC. However, the Corps rejected this proposal for funding in FY 2005. Subsequent collaboration between these agencies, the Corps, NOAA Fisheries and BPA is occurring to attempt to develop an experimental design for Snake River Fall Chinook with respect to FCRPS operations that will

address many of the parties' management issues. Each of these efforts began with discussions to identify the important management and research questions, followed by discussions on what approach would be most appropriate for addressing these questions.

Our concern is that the present process of system passage model development employed by NOAA Fisheries, combined with the intended application of the model, will only lead to continued disagreement and discord when the model is completed. We strongly recommend that NOAA Fisheries engage the other fishery agencies in a true collaborative effort for the system passage model development that will appropriately address, among other things, the concerns expressed above. We are encouraged with our recent discussions with you and staff and your willingness to work with us to address these issues and encourage further progress along those lines.

We believe the approach should first identify the critical management questions, and then develop a model to analyze alternative actions or hypothesis. We also believe the juvenile passage model must be linked to a life cycle model to provide a more complete perspective for alternative actions analysis. Specifically, we recommend a formally facilitated workshop process similar to the Comparative Survival Study workshop on delayed mortality be adopted, where a weight-of-evidence approach to developing hypotheses for further testing was employed. The weight-of-evidence approach has been extremely successful when varied views are represented among a group. There may be better approaches for addressing the important research questions than developing another passage model. We hope to provide some suggestions on alternative approaches in our future discussions. We suggest that NOAA Fisheries consider the workshop approach to engage the other co-managers in a more collaborative fashion. We look forward to working with NOAA Fisheries to develop a more meaningful process that will lead to agreed upon alternatives and actions to consider in the analytical process the will better meet our respective needs.

Sincerely,

Ron Boyce, ODFW

Tom Lorz, CRITFC

Russ Kiefer, IDFG

Dave Statler, Nez Perce Tribe

David Wills, USFWS

Keith Kutchins, Shoshone Bannock Tribe

CITATION

Carpenter, S., J. Collie, S. Saila, and C. Walters. 1998. Conclusions and Recommendations from the PATH Weight of Evidence Workshop. Vancouver, BC Canada. C. Peters, I. Parnell, D. Marmorek, R. Gregory, and T. Eppel, eds. October 21, 1998

State, Federal and Tribal Fishery Agencies Joint Technical Staff

*Columbia River Inter-Tribal Fish Commission
Idaho Department of Fish and Game
Nez Perce Tribe
Shoshone-Bannock Tribes
US Fish and Wildlife Service
Washington Department of Fish and Wildlife*

March 31, 2005

Marvin Shutters
US Army Corps of Engineers
Walla Walla District
201 N. 3rd St.
Walla Walla, WA 99362-1876

Dear Mr. Shutters:

RE: Study Design Changes at LGR, LGS, LMN 2005

In response to the March 23, 2005 conference call, during which the COE laid out some proposed changes to 2005 research in the Snake River, the Joint Technical Staff of the Agencies and Tribes have developed their own recommendations. We have attached the COE outline of proposed changes for reference. The COE has stated that over 70% of the money available for Spring survival studies is not recoverable, making the no study option undesirable because of the amount of money that would be lost in the case of several planned RT studies in the Snake River. Since survival studies appear imminent, it makes sense to use the opportunity to acquire new information about operating the Lower Snake projects differently during these low flow years.

In our view, the primary purpose of AFEP research is to advance scientific understanding of the effects of the FCRPS on fish. More specifically, we look to the AFEP research to help resolve key uncertainties and suggest management options that mitigate for the operation and presence of the FCRPS. The operation and presence of the FCRPS is especially harmful to juvenile fish survival during low flow years when spill operations are ceased and transportation is maximized (e.g., 2001). Because juvenile fish survival was so poor due to the flows and operations in 2001, we felt that it would be prudent to conduct research on alternative operations that could improve survival, rather than ignoring the hard lessons that we learned. Obviously, the 2001 operations were not successful in providing acceptable in-river survival rates.

In 2001 we learned that in-river survival rates were 25 to 30% for spring Chinook compared to 50 to 60% in the years 1998-2000 and 2002 (FPC 2001 Annual Report, CSS 2003 Annual Report). While steelhead survival in 2001 was 4% compared to 40% in 2000 (FPC 2001 Annual Report). While some of the low survival may be due to slow migration rates caused by low flows in the Snake River reservoirs, it is likely that mortality due to forebay delay and

turbine passage were important contributing factors. Forebay mortality can be significant, as demonstrated by radio telemetry studies in recent years. No-spill operations also force in-river migrants through the turbines, which is the passage route with the lowest survival rates. In addition to demonstrating the detrimental effects of no-spill operations in a low flow year, the 2001 migration year demonstrated that survival was higher in the lower Columbia when spill was provided (FPC 2001 Annual Report). Because 2005 is likely to be a low-flow year similar to 2001, it would be prudent to conduct research on operations that could improve in-river and overall survival rates rather than conducting research on the same operations and re-learning the lessons that were learned in 2001. Conducting research on the same operations as 2001 will not advance scientific understanding, nor will it suggest management options that could improve in-river and overall survival rates.

The recommendations described below are limited to and in light of the very low flow year that is predicted for the Lower Snake River. Because of the Action Agencies UPA which prescribes no-spill operations and maximizing transportation in the Snake River when the projected seal average flows are below 70 kcfs, the 2005 studies that were planned to test spill operations and passage may need to be altered. Presently the forecast is for flows in the range of 45 kcfs for the spring. Our recommendations are presented with this low flow year in mind.

In a low flow year, we have significant concern about forebay delay and mortality (both forebay and turbine) associated with no-spill operations. It would be useful to determine if spill can mitigate for these effects. The effects of the provision of spill during a low-flow year is an important uncertainty that needs to be resolved. During the conference call, the COE proposed single-treatment studies of a no-spill conditions at Lower Granite, Little Goose, and Lower Monumental. While evaluating no-spill operations would provide information about the length of delay and associated mortality without spill, it would be better to compare no-spill operations to spill operations under the same flow conditions, thereby providing a reference operation for comparison. This low-flow year provides an important opportunity to increase our scientific and management understanding of the effects of spill on in-river survival. Historically, there have been several years of low-flow conditions without spill in the Snake River and in each the survival rates have been poor. Therefore it would be helpful to understand what effects spill may have in affecting survival rates during these conditions.

At Lower Granite Dam we would recommend a 2-treatment study design comparing RSW spill operation versus a no-spill operations. We would recommend a minimum 3-day period for each block so that sufficient time is available for test conditions to set up properly. That would mean 6 days per paired treatment. We would recommend 5 or more repetitions for examination of seasonal effects, or a minimum 30-day study. Start date would depend upon fish availability, but we recommend starting as early as April 10.

At Little Goose Dam we would recommend a similar study to that proposed above for Lower Granite. At Little Goose, we would like to use a 2-treatment study design comparing spill operations versus no-spill operations. Again, use a minimum 3-day period for each block so that sufficient time is available for test conditions to set up properly. That would mean 6 days per paired treatment. We would recommend 5 or more repetitions for examination of seasonal effects, or a minimum 30-day study. Start date would depend upon timing of study at Lower Granite Dam.

Lower Monumental Dam we would agree to use the COE "Option 1" described in attached COE study outline. This option consisted of evaluating large-gate opening spill in spillway 8 during three weeks in May.

Given the collection efficiencies at the Snake River dams and our proposal to evaluate spill operations for 15 days at Lower Granite and Little Goose Dams and 21 days at Lower Monumental Dam, we believe that there is little risk to the populations at large compared to the Action Agencies UPA specifications of no-spill operations and maximized transportation for this year. However, there are considerable potential benefits, both in terms of increased survival and scientific understanding, to evaluating spill operations during this low-flow year. We hope that the COE will take advantage of this opportunity to advance the scientific and management understanding during this low-flow year, rather than subjecting the fish to the same operations that occurred in 2001. Conducting the research that the fishery co-managers have suggested will help accomplish this.

Sincerely,

Dave Statler, NPT

Dave Wills, USFWS

Keith Kutchins, SBT

Cindy LeFleur, WDFW

Bob Heinith, CRITFC

Russ Kiefer, IDFG

State, Federal and Tribal Fishery Agencies Joint Technical Staff

MEMORANDUM

TO: Cindy Henriksen, COE

FROM: Dave Wills, FPAC Chairman

DATE: March 23, 2005

Subsequent to recent discussions at the Technical Management Team and review of the March 15 Q-Adjust model output, the agencies and tribes are considering alternative operations, and flow scenarios. We are requesting that the COE conduct the following analysis to facilitate operations discussions.

- Re-run the Q-adjust model with the new runoff volume forecast. At the last TMT meeting COE staff indicated that the March 15 Q-adjust run was not accurate because of change in runoff volume forecast.

Based upon the March 15 Q-adjust output, very low flow periods are predicted for the first half of April and the last half of June. The early April period is significant for chum salmon below Bonneville and the late June period is significant for juvenile fall chinook passage in the mid-and lower Columbia River.

Based upon the , March 15 Q adjust run, the agencies and tribes are requesting the following modifications to the Q-Adjust run to attempt to improve the flows in these two periods.

- Re-run the Q-Adjust model with Grand Coulee only filling to 1285 by June 30, therefore improving the late June period flow in the mid and lower Columbia River. In the early April period drawdown John Day pool to MIP, and then draft Snake River pools to MOP and increase Dworshak outflows to 5 kcfs.

State, Federal and Tribal Fishery Agencies Joint Technical Staff

*Columbia River Inter-Tribal Fish Commission
Idaho Department of Fish and Game
Nez Perce Tribe
Oregon Department of Fish and Wildlife
Shoshone-Bannock Tribes
US Fish and Wildlife Service
Washington Department of Fish and Wildlife*

Rebecca Kalamasz
US Army Corps of Engineers
Walla Walla District
201 N. 3rd St.
Walla Walla, WA 99362-1876

Dear Ms. Kalamasz:

At the request of the TMT, FPAC has reviewed the proposed "Ice Harbor Special Spill Injury Test Summary" for 2005 and has the following comments. We have several concerns with the basis for and the operational impacts of the proposed study, especially given the low flow conditions expected for 2005 and the commensurate detrimental effects on fish survival.

First, we find little technical basis for conducting the proposed study. Radio telemetry studies conducted at Ice Harbor in 2004 showed high survival for spring and summer migrants passing through the existing spillway, which was not surprising given that the spillway passage routes have consistently demonstrated the highest survival rates among all passage routes. The draft report by Normandeau and Skalski summarizing Ice Harbor balloon tag studies conducted in 2003 and 2004 showed absolutely no effect of tailrace elevations on either survival or the proportion of injured fish. However, the results of the report strongly suggest that velocities at the end of the hose and spill volume are the primary factors affecting survival and injury rates, not tailrace or forebay elevation. That is, the location of the hose release and/or the spillway volume determine the survival and injury rates, a concern on the reliability of balloon tag studies that we have repeatedly expressed at SRWG meetings. The effects of hose release location on survival have also been demonstrated at Ice Harbor using PIT tags (Eppard et al. study). Given these technical shortcomings, the unreliability of balloon tag studies, and the demonstrated high survival rates at the Ice Harbor spillway using volitionally-passed radio tag fish, we find little technical basis for conducting the proposed study.

Second, we have not received a full study proposal for review, nor have we received any analyses supporting the hypothesis that tailrace elevations affect spillway survival. Various COE representatives have voiced the hypothesis that tailrace conditions affect spillway survival, but written data summaries, though promised to be forthcoming, have not materialized. In addition,

it appears that the concerns of our SRWG representatives may have been misconstrued in regard to this study and therefore we are taking this opportunity to clarify our concerns and our lack of support.

Third, the proposed study will significantly affect operations in the spring and runs contrary to our best professional judgment as to the best operations for fish. While this study may have originally been proposed to occur prior to the spring fish migration season, delays in the RSW installation have pushed the onset of the proposed study into spring spill operation period. This will result in a delay of the onset of spill, which we find unacceptable. Especially with the low flow conditions expected for 2005, we want to provide the best fish migration conditions possible, and this includes starting spill at Ice Harbor on April 3, as specified in the COE Fish Passage Plan. To date we have not seen compelling evidence to support the study hypothesis and justify this use of water resources.

In summary, we find the proposed study unnecessary, with potential detrimental effects on fish survival. Therefore we request that the COE not implement the study, and maintain the April 3 spill start date at Ice Harbor. In 2005, which the region agrees will be a critical water year, the initiation of MOP will have greater benefit if used for fish passage than if utilized for this study when there are many unaddressed technical issues. We ask the COE to address our concerns, beginning with the analysis that was used as support for originally conducting this study. There is ample time to deal with the technical issues this year regarding the underlying needs for this study. The state and tribal fishery co-managers will be developing their recommendations for the implementation of MOP.

Sincerely,

Dave Statler, NPT

David Ward, ODFW

Keith Kutchins, SBT

Bob Heinith, CRITFC

Cindy LeFleur, WDFW

Dave Wills, USFWS

Russ Kiefer, IDFG

Cc: Marvin Shuttters, COE
Mark Smith, COE
Cindy Henriksen, COE

State, Federal and Tribal Fishery Agencies Joint Technical Staff

*Columbia River Inter-Tribal Fish Commission
Idaho Department of Fish and Game
Nez Perce Tribe
Oregon Department of Fish and Wildlife
Shoshone-Bannock Tribes
US Fish and Wildlife Service
Washington Department of Fish and Wildlife*

February 15, 2005

Marvin Shutters
US Army Corps of Engineers
Walla Walla District
201 N. 3rd St.
Walla Walla, WA 99362-1876

Dear Mr. Shutters:

On December 14, 2004 the Salmon Managers representing the Columbia River Inter-Tribal Fish Commission, Idaho Department of Fish and Game, Nez Perce Tribe, Oregon Department of Fish and Wildlife, Shoshone-Bannock Tribe, Washington Department of Fish and Wildlife, and US Fish and Wildlife Service sent a letter to the Corps of Engineers (COE) and the Bonneville Power Administration (BPA) explaining our rationale for recommending testing, in 2005, the effectiveness of Removable Spillway Weirs (RSWs) in passing summer out-migrants at both Lower Granite Dam (LGR) and Ice Harbor Dam (IHR). At subsequent regional meetings, Salmon Managers have verbally outlined in general terms our thoughts on the treatments that should be tested. Recently, representatives of the COE and BPA have asked if we could provide specific treatments we would recommend to be tested. The specific treatments that should be tested are dependent upon the hydraulic modeling work that will be conducted at Vicksburg from February 7-11. However, the following is an outline of our recommendations with as much detail as is possible until the modeling work is conducted and evaluated. These recommendations are also based upon COE researchers' determination that only a two-treatment block design is realistically doable at each dam per season (spring and summer).

Overall, we believe the RSW spill levels selected should be at a level that is estimated to provide comparable, or better, spillway passage and survival as obtained with current bulk spill at BiOp levels. Proposed test spill levels should be discussed and approved at the technical level in the Corp's SRWG process and the Regional Forum (TMT).

Ice Harbor

Spring Evaluation

Implement a two-treatment random block study design. One treatment would be Spill Volumes directed in the BiOp using the Bulk spill pattern. The other treatment would be RSW with training spill. The amount of training spill is still uncertain until the hydraulic modeling work is completed to determine what level of training spill will provide adequate tailrace egress. The amount of training spill selected should be at a level that is estimated to provide at least as high spillway passage and survival as can be obtained with bulk spill at volumes directed in the BiOp. Proposed test spill levels should be discussed and approved at the technical level in the Corp's SRWG process and the Regional Forum (TMT).

Summer Evaluation

Use the same methods to determine the two treatments as described above for the Spring test.

Lower Granite

Spring Evaluation

Constant RSW and training spill operation, with the treatments being in-out operation of the Behavioral Guidance System (BGS). RSW and training spill amounts should be at the same level (if possible) as selected for the test at IHR. Selecting the same spill levels at both projects would provide information on whether an RSW can be expected to perform similarly at multiple lower Snake River Projects for spring migrants.

Summer Evaluation

Implement a two-treatment random block study design. The first treatment should once again be RSW and training spill amounts at the same level as selected for the IHR summer test (if possible). This would provide information on whether RSWs can be expected to perform similarly at multiple lower Snake River Projects for summer migrants. The second treatment would consist of the same total volume of spill used in the first treatment, but using a more conventional bulk style pattern. The specific bulk spill pattern to test would be determined based upon the results of the Vicksburg hydraulic model testing. The BGS would be left in either the deployed position or the stored location. Currently the stored position would seem to make more sense, however the Salmon Managers do not have strong opinions on this aspect of the study design, only that the BGS should not be moved during the evaluation. The Salmon Managers envision these tests starting in late June and continuing through most of July.

Before IHR tests are finalized, we should consider and discuss the possibility of adjusting the RSW + training spill levels at IHR to match the projected RSW + training spill capacity at LGR during its summer RSW test. This would be to secure a test that is as comparable as possible between the projects during the summer season. Although this water year is beginning to shape up as one of the lower flow years, it would be easier to establish similar spill levels under these low flow summer conditions.

Sincerely,

Dave Statler, NPT

Ron Boyce, ODFW

Keith Kutchins, SBT

Bob Heinith, CRITFC

Cindy LeFleur, WDFW

Dave Wills, USFWS

Russ Kiefer, IDFG

State, Federal and Tribal Fishery Agencies Joint Technical Staff

*Columbia River Inter-Tribal Fish Commission
Idaho Department of Fish and Game
Nez Perce Tribe
Oregon Department of Fish and Wildlife
Shoshone-Bannock Tribes
US Fish and Wildlife Service
Washington Department of Fish and Wildlife*

February 8, 2005

John Kranda
US Army Corps of Engineers
PO Box 2870
Portland, OR 97208-2870

Dana Knudtson
US Army Corps of Engineers
201 N. 3rd Ave.
Walla Walla, WA 99362

Dear Mr. Kranda and Ms. Knudtson:

This letter is to reiterate our desire to maintain the Removable Spillway Weir (RSW) installation schedule agreed upon by the System Configuration Team (SCT) last summer, and to ask for an explanation of the Corps of Engineers' (COE's) rationale for recommending changing the agreed upon schedule. The agreed upon schedule was supported by all SCT representatives except for the COE's, and the COE's representatives stated that they only needed time to internally deliberate on whether this schedule was both feasible and cost effective. This schedule already represents a considerable compromise on the part of the Salmon Manager members of SCT. As previously discussed, we believe that installing a RSW at Little Goose Dam (LGO) would provide greater biological benefits, and was (and still is) our preference for the next RSW installation. However, in order to reach a consensus agreement, the Salmon Managers agreed to allow the COE to decide whether to install the next RSW at LGO or Lower Monumental Dam (LMO), **as long as there was consensus agreement to complete RSW installation at all lower Snake River Projects as soon as reasonably possible.**

The Salmon Managers compromised on this issue to demonstrate, per your request, regional support for accelerated RSW installation to COE management and other policy makers. The COE's SCT representatives also requested that the Salmon Managers document our rationale and this agreement in a letter (sent August 13, 2004) to communicate SCT's position to the COE's upper management. We never received a response from the COE to our August 13, 2004 letter. However, in subsequent SCT meetings, the COE's representatives stated that only

one RSW could be built per year, and the remaining Snake River RSW installation schedule would be LMO in 2007 and LGO in 2008. This schedule was also outlined in the National Oceanic and Atmospheric Administration's 2004 Federal Columbia River Power System Biological Opinion (BiOp) and the Action Agencies Updated Proposed Action (UPA). We therefore assumed that the COE was in agreement with the rest of SCT to finish RSW installation in the Snake River as soon as reasonably possible, and concurrently conduct the necessary feasibility and design work to seamlessly begin installation in the lower Columbia River Projects immediately following completion of the Snake River system. However, recent actions and statements by the COE's SCT representative gives us concern that the regional SCT agreement on the RSW installation schedule may no longer exist.

To reiterate critical points from our August 13, 2004 letter, we stated our desire to move beyond the issue of whether the next RSW should be installed at LGO or LMO by agreeing to install RSWs at both projects as soon as reasonably practical, hopefully by April 1, 2007. This schedule reflected both technical and policy input. We stated that our overall goal was (and still is) to more effectively provide spillway passage when information indicates this passage route could improve juvenile in-river survival and/or adult return rates. We stated that our desire for an expedited installation schedule for RSWs in the lower Snake River should not be interpreted as indicating a lower priority in the lower Columbia River. Rather, because of the size and complexity of lower Columbia projects, it will likely take several years to determine how to best configure RSWs, training spill, and biological guidance systems to provide desired results. We specifically requested that feasibility studies for lower Columbia projects be initiated early so that installation could be phased in immediately after completion of all Snake River projects. We also included information providing more detailed supporting rationale and background for our position, which we request you review again for decision consideration. Please add to your decision consideration the new information indicating that wild Snake River chinook salmon that outmigrated via spillways in 2002 (including the RSW at Lower Granite Dam) returned at a significantly higher rate than their transported cohorts (Draft 2003 CSS Annual Report).

In addition, please add to your decision the importance of conducting RSW passage studies for summer migrants in 2005 at Lower Granite and Ice Harbor. If RSWs do not work for summer migrants, current decisions to go forward with installation of RSWs at other dams may have to be modified.

The COE's SCT representatives are now proposing to delay RSW installation at LGO and begin installation at McNary Dam (MCN) in 2008. We are disappointed that apparently the COE has decided not to fulfill the consensus RSW installation schedule agreed to last summer. The only reasons given by the COE's SCT representatives for proposing this change have been the MCN reach survival estimates and the 2004 BiOp gap analysis. All SCT members representing Salmon Management Agencies are aware of and understand the MCN reach survival estimates and the BiOp gap analysis, and we still support the Snake River installation schedule agreed to last summer. We are also disappointed that we must spend additional time and resources rehashing this issue that we thought had been resolved last summer with a consensus agreement. To help us determine future action on this issue, we request that the COE provide written responses to our August 13, 2004 letter and the following questions:

- 1) Since we stated our unanimous desire for an accelerated RSW schedule in the summer of 2004, and the COE's SCT representatives have stated that only one RSW can be built per year, please provide detailed explanation on why the COE is not building an RSW now for installation in spring 2006.
- 2) The Salmon Manager SCT representatives unanimously stated our belief that installing the next RSW at LGO would provide the greatest biological benefits, and that the only additional information necessary for determining which bay to install a RSW in at LGO was forebay fish distribution and modeling of attraction spill patterns for suitable tailrace egress conditions. On what basis did the COE decide that the next RSW should be installed at LMO?
- 3) What information does the COE believe justifies reopening the debate on whether the next Snake River RSW should be at LGO or LMO relative to previous discussions that led to the consensus compromise reached last summer?
- 4) What level of assurance can the COE provide the Salmon Managers that using another year to determine the appropriate design and configuration for surface bypass technology at MCN would not be desirable or necessary?
- 5) Was the COE's SCT representatives' only concern last summer with the consensus schedule the feasibility and cost effectiveness of meeting our desired April 1, 2007 completion date?
- 6) Since the August 13, 2004 letter from the Salmon Managers stated our understanding that the COE was in support of the consensus RSW installation schedule, why did the COE not endeavor to correct this misconception if this was not the case?
- 7) Since this installation schedule is clearly identified as being followed in both the 2004 BiOp and UPA, does the COE believe this schedule can be changed without regional consensus?
- 8) If we cannot resolve this issue at the February 17, 2005 SCT meeting, are there any reasons why we should not elevate this issue to IT as soon as possible for resolution?

SCT representatives worked hard to achieve consensus on this issue. Our understanding was that the COE was in agreement with this consensus RSW installation schedule, and only needed to deliberate on feasibility and cost effectiveness relative to meeting the desired April, 2007 date for completion of all Snake River projects. The current COE proposal to move ahead with MCN RSW installation before completion in the lower Snake does not comport with prior deliberation parameters, which we thought the COE would use to support or modify the consensus agreement. These include the 2004 BiOp, and the 2004 UPA. Without a regional agreement to complete Snake River RSW installation as soon as reasonably possible, the COE does not currently have our support for RSW installation at LMO before LGO. To facilitate discussions at the February 17, 2005 SCT meeting, we request the COE provide an estimate of how much Columbia River Fish Mitigation funding would need to be reallocated in order to install a RSW at LGO by April 1, 2007. We anticipate that the COE's response to our questions and this letter will help facilitate getting back on track with a reasonable discussion about RSW installation. A COE response to the Salmon Managers by February 11, 2005 would be most helpful in focusing our discussion on February 17.

Sincerely,

Dave Statler, NPT

Ron Boyce, ODFW

Keith Kutchins, SBT

Bob Heinith, CRITFC

Cindy LeFleur, WDFW

Dave Wills, USFWS

Russ Kiefer, IDFG

State, Federal and Tribal Fishery Agencies Joint Technical Staff

*Columbia River Inter-Tribal Fish Commission
Idaho Department of Fish and Game
Nez Perce Tribe
Oregon Department of Fish and Wildlife
Shoshone-Bannock Tribes
US Fish and Wildlife Service
Washington Department of Fish and Wildlife*

February 10, 2005

Mr. Witt Anderson
Chief District Support Team
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Scott Dunmire
USACE, Environmental Analysis Section
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Paul Ocker
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Corps of Engineers, Northwestern Division
PO Box 2870
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Gentlemen:

As you know the representatives of the undersigned state, federal, tribal fishery agencies have been working with the Corps of Engineers and NOAA fisheries Science Center staff, since June of 2004 to reach agreement on a fall Chinook transportation and passage evaluation. The fishery agencies expended considerable effort in developing a proposed fall Chinook evaluation. They recognize that the management of fall Chinook passage is a critical near-term issue affecting the operation of federal hydrosystem and the well being of Snake River fall Chinook. Available data indicate that the present passage strategy of maximizing transportation of juveniles may not be prudent. We believe that a key to resolving these critical management issues is the establishment of a collaborative process between the fishery co-managers and the federal operating agencies. In order to avoid controversy and contention in future fall Chinook passage and mitigation implementation decisions, the fishery co-managers must be full and active participants in the design, implementation, analysis and reporting of fall Chinook

evaluations. To date, we believe that this has not occurred. The Corps of Engineers process for addressing the fall Chinook evaluation has thus far been frustrating, and disappointing. In our view, the COE process has not provided an adequate role for the fishery co-managers.

The COE unilaterally selected a group of consultants, and unilaterally developed questions to pose to those consultants regarding the fall Chinook evaluation and the review of the two proposals (one by tribal, state, and USFWS co-managers, the other by the NOAA Science Center). A collaborative process would have resulted in the development of questions and selection of consultants with the co-managers. We have attached our technical comments on the NOAA third revised proposed fall Chinook evaluation and the COE consultants review. Our comments can be summarized into the following three points.

- The consultants report indicates some misunderstanding on portions of the agencies' and tribes' proposal.
- The NOAA proposal is inadequate to address the prevailing management questions. The agencies and tribes are not in agreement with the NOAA proposal.
- The COE process has thus far not included adequate collaboration with the fishery co-managers.

Given the lack of adequate collaboration with the state and tribes, the failure to reach agreement with the co-managers on an evaluation, and the remaining short time frame, we recommend that the COE fund the following actions in 2005 in order to resolve these issues.

Fund a Fall Chinook Technical Workshop

In earlier correspondence, the agencies and tribes recommended that the COE fund a Technical Workshop examining various hypothesis based upon a weight-of-evidence approach, and facilitated by a contractor agreed upon by the co-managers to address the issues surrounding fall Chinook passage management, development and evaluation of hypotheses, study design options, and analytical methods. This approach will bring together the researchers, their data, their hypotheses and an open technical exchange bringing all of the data together and the evidence for various hypotheses. This will be necessary to define future research directions.

Establish and fund a Technical Fall Chinook Collaborative Committee

Establish and fund a Technical Collaborative Fall Chinook Committee comprised of representatives of the fishery co-managers. This committee in 2005 would be tasked with developing an agreed upon study design and implementation plan for a fall Chinook evaluation in 2006, addressing the recognized analytical and methodology issues and the results of the previously discussed fall Chinook workshop.

Sincerely,

Dave Statler, NPT

Ron Boyce, ODFW

Keith Kutchins, SBT

Bob Heinith, CRITFC

Cindy LeFleur, WDFW

Dave Wills, USFWS

Russ Kiefer, IDFG

Fishery Co-Manager Technical Comments Regarding

1. “A Review of Two Transportation Proposals” By J. Skalski, M. Schiewe and A. Giorgi, January 11, 2005 2. NOAA Revised Fall Chinook Evaluation Proposal

Following are: First, fishery co-manager comments on the Skalski, Giorgi and Schiewe review of the proposals and response to the three questions developed by the COE; Second, fishery co-manager comments on the revised NOAA fall Chinook evaluation proposal.

Comments on “A Review of Two Transportation Proposals”

The COE, BOR and BPA engaged three consultants to review the two proposals for the fall Chinook transportation evaluation. The stated intent of the COE was to obtain the review of the two proposals by “outside independent consultants”. In addition the COE unilaterally developed specific questions for the consultants’ response. The ad-hoc process implemented by the COE for evaluating the two proposals is significantly flawed and therefore limits the application of the consultant’s review of the two proposals. The three reviewers were selected unilaterally by the COE, BPA and BOR without discussion or agreement of the fishery management agencies and tribes. Each of these consultants has a long-term contractual and or professional association with NOAA fisheries. The questions posed by the COE are subject to various interpretations as to whether they are strictly technical study design questions or management questions. In a truly collaborative approach, both the development of the questions and the selection of consultants would have been accomplished through discussion and agreement with the state, tribal and federal fishery agencies. In a recent letter to Witt Anderson, COE, the agencies and tribes recommended a collaborative, structured, disciplined, scientific, weight-of-evidence approach to identifying hypothesis regarding fall Chinook passage management (attached). A weight-of-evidence approach is effective because it has demonstrated that it can provide a foundation for development of future research projects.

Specific Comments

Page 3, paragraph 1- The report states that the review is based on several considerations, first technical forums such as AFEP meetings and the NOAA/Northwest Power and Conservation Council Summer Flow Symposium. The state, tribal and federal fishery managers advised the NPCC that the Summer Flow Symposium devised and implemented by NOAA and the NPCC was inadequate to address fall Chinook passage requirements (letter attached). For instance, due to the short planning timeframe and competing commitments, CRITFC was unable to participate in the NPCC workshop. The agencies and tribes have discussed the inadequate collaboration of the AFEP process.

Page 4, Section III - In Section III, the reviewers misinterpreted the study design of the Joint agencies and tribes, USFWS/Nez Perce proposal. They refer to a Nez Perce Study component and a CSS component as two separate activities. This is incorrect. A careful reading of the joint agencies’ and tribes’ proposal indicates one release protocol, which we refer to as the Nez Perce approach. This release strategy is currently being utilized by the Nez Perce in ongoing subbasin

SAR studies. This approach establishes the two study categories at the time of tagging – one group to mimic the run-at-large under the current transportation program and the other group to mimic what the run-at-large would experience if all collected fish were bypassed instead of transported. There would be equal numbers of smolts PIT tagged in each study category. The mimic-bypass category would also be used in the estimation of in-river reach survivals. In years without spill, these two groups would provide a test of whether higher SARs would occur if collected fish are transported or simply bypassed at each collector dam. Both release groups will include fish that have passed collector dams undetected. In years with spill, there would be more fish undetected passing the collector dam for each study category. The overall SAR from initial smolt release to adult return indexed at Bonneville and Lower Granite Dam adult ladders for the two study categories would be the most basic parameter computed. For this SAR estimate, it doesn't matter whether the fish outmigrate as subyearlings or yearlings or at times when the PIT tag detectors at the dams are not operated. The reviewers mistakenly reported that the joint agencies' and tribes' approach would compare SARs of transported versus non-detected fish.

The primary analysis will center on estimation of T/I's and SAR, and we will base inferences on effectiveness of transportation and flow on these metrics. Secondary to that analysis, if critical assumptions are met, the joint agencies and tribes, USFWS/Nez Perce proposal included an analytical activity that would partition the mimic-transport and mimic-bypass categories into study groups T_0 , C_0 , and C_1 . The separation by code technology will be utilized to direct those marks to transportation, while the bypass group will be bypassed to the river. The bypassed mark group is analyzed utilizing the CJS methodology to estimate the population size arriving Lower Granite Dam and estimate the various reach survivals needed to convert detection data to Lower Granite Dam equivalents, and finally to estimate the parameter D. Difficulties in obtaining unbiased estimates of reach survival and D when an unknown proportion of the population may overwinter in downstream reaches were acknowledged. The agencies and tribes proposed that in implementing a collaborative technical approach they could develop an agreed upon analytical method for addressing the over-wintering effect. The smolts in the mimic-transport category that actually were detected and transported would be divided by corresponding reach survival needed to convert the data to Lower Granite Dam equivalents and create the T_0 group. The smolts in the mimic-bypass category that actually were detected and returned-to-river would be divided by corresponding reach survival needed to convert the data to Lower Granite Dam equivalents and create the C_1 group. The mimic-bypass category fish would also provide the estimate of the number of PIT tagged smolts not detected at any collector dam (Lower Granite, Little Goose, Lower Monumental, and McNary dams) and population size arriving Lower Granite Dam, which together would be used to create half of the C_0 group. Since the two study categories (mimic-transport and mimic-bypass) would contain the same number of smolts released and be thoroughly mixed within the production release at the hatchery or acclimation pond, it was planned to double the estimated number of smolts estimated in the C_0 group from the mimic-bypass category fish to account for fish in both the mimic-transport and mimic-bypass categories that pass the collected dams undetected, thus creating a larger overall C_0 group. If overwinter proportions of the population were non-negligible and a method to properly adjust for them was not possible, it was realized that these partitions to three study groups in Lower Granite Dam equivalents would not be possible. In that case a simpler approach using comparisons of T/Is and SARs across years may be required. The joint agencies' and tribes' proposal does not consider each hatchery release as a single release group and then use the electronics at the dams to route

detected fish into transport and return-to-river groups as is done in the CSS. Instead the proposal is to work within the framework of the Nez Perce release strategy to attempt to further partition the study fish into route of passage groups. This is an unfortunate mis-interpretation of the reviewers.

In Section IV the reviewers failed to comprehend the actual joint agencies and tribes proposed analysis, mistakenly reporting that the proposed analysis included a complicated censoring of recapture data that would produce wildly askew estimates, which Skalski et al. constructed in Table 1 to illustrate their point. The joint agencies and tribes proposed analytical methodology is simply the standard CJS method in which only marks that are detected in the same year as they are released, as sub-yearlings are utilized in the CJS methodology. Marks that are detected as sub-yearlings and detected at a downstream site the following year are only utilized as sub-yearlings to the site to where they were last detected in the same year as they were released. The example created by Skalski et al. in Table 1 makes it apparent that the reviewers failed to understand this simple concept. In the following discussion we illustrate in Tables 2 and 3 that the agencies and tribes methodology results in estimates that differ little from the standard CJS estimates, contrary to the misguided conclusions of the reviewers.

Skalski et al. provided an example that completely misrepresents the agencies and tribes proposal without actually explaining the “censoring” method that they used to construct their example. In order to understand the Skalski et al example we constructed the number of fish in each capture history that would be required to produce the Skalski example results Table 1 also showing the number of fish that would be included under varying overwintering survival scenarios. Table 2 shows the relatively small numbers of fish that are affected in each capture history. Based upon fish in each capture history in Table 2, the agencies and tribes proposed methodology is applied, producing survival estimates under assumed varying over wintering survival rates. Table 3 presents the resulting survivals and illustrates that applying the proposed agencies and tribe’s methodology produces resulting survivals nearly identical to the standard CJS method presented by Skalski et al. The only difference in the agencies and tribes method from the standard CJS method was due to the considering fish detected as yearlings as “removals” at the last location seen as a subyearling. But by not having the ability to apply a corresponding “removals” on the undetected fish will cause a bias relative to simply handling these fish as last detected as a subyearling but still returned-to-river for estimation purposes. The latter approach provides the reviewers “Standard CJS” when residualism occurs. But as we showed in Table 2, the bias impact of considering these fish as “removals” was fairly negligible in practice. This is because the number of fish that actually will be seen in the following year is relatively small compared to the remaining fish seen migrating out as subyearling smolts (tallies for affected capture histories are shown in Table 2 in bold type), the effect of our planned adjustment was also small.

This treatment of the mark recoveries is an analytical step which can be carried out or not, if it is found to bias the survival estimate it would be excluded from the analysis. However, based on the CJS with censoring results presented by the reviewers as their interpretation of our adjustment, it is obvious that the reviewers erroneously thought we were doing something different in our proposal (see Table 1). They show major impacts of their censoring method even when applied to a case when no residualism is present. In our analysis, if residualism is not

present, then there would not be any fish detected as a yearling, and so no adjustment would have ever been made.

Table 1. Results of CJS with Censoring as shown in the Skalski Review Team Document.

Parameter	Actual Value ¹	No Residualism Case ¹ (Review Team Table 3)		Residualism Case ¹ (Review Team Table 4)	
		Standard CJS	Censored CJS	Standard CJS	Censored CJS
$S_1 \cdot (1-R_1)$	0.95	0.9500 (0.0065)	0.5273 (0.0016)	0.7600 (0.0071)	0.3726 (0.0015)
$S_2 \cdot (1-R_2)$	0.95	0.9500 (0.0118)	1 (n/a)	0.8550 (0.0152)	1 (n/a)
P_1	0.25	0.2500 (0.0022)	0.9504 (0.0022)	0.2500 (0.0028)	0.5099 (0.0026)
P_2	0.25	0.2500 (0.0030)	0.5839 (0.0025)	0.2500 (0.0042)	0.6672 (0.0030)
$S_3 \cdot P_3 \cdot (1-R_3)_{\text{Lambda}}$	0.2375	0.2375 (0.0028)	1 (n/a)	0.1663 (0.0029)	1 (n/a)

¹ Residual level is $R_1 = R_2 = R_3 = 0$.

² Residual level modeled is $R_1 = 20\%$ above LGR, $R_2 = 10\%$ between LGR and LGS, and $R_3 = 30\%$ between LGS and LMN. Subyearling Chinook reach survivals set at 95%; collection efficiencies set at 25% for both subyearlings and yearling Chinook.

Table 2. Tallies by capture history code entered into the MARK program to estimate reach survivals and collection efficiencies. Data for capture histories affected by “removal” adjustment are shown in bold type. Standard CJS method.

Capture History	No Residualism ²	Residualism at level of Skalski's example ¹			
		No OW survival ³	20% OW survival ³	50% OW survival ³	80% OW survival ³
1100			-95	-238	-380
1110			-61	-152	-244
1010			-183	-457	-731
1111	1340	675	675	675	675
1011	4019	2026	2026	2026	2026
1101	4019	2026	2026	2026	2026
1001	12057	6077	6077	6077	6077
1110	4301	3386	3325	3234	3142
1010	12903	10158	9975	9701	9427
1100	14090	12913	12818	12675	12533
1000	47271	62739	62739	62739	62739

¹ Residual level modeled is $R_1 = 20\%$ above LGR, $R_2 = 10\%$ between LGR and LGS, and $R_3 = 30\%$ between LGS and LMN. Subyearling Chinook reach survivals set at 95%; collection efficiencies set at 25% for both subyearlings and yearling Chinook.

² Residual level is $R_1 = R_2 = R_3 = 0$.

³ Percent of overwintering (OW) survival assumed in making adjusted reach survival estimates.

Table 3. Survival and collection efficiency estimates for standard CJS method with “removal” adjustment for residualism under varying levels of overwinter survival.

Parameter	No Residualism ²	Residualism at level of Skalski’s example ¹			
		No OW survival ³	20% OW survival ³	50% OW survival ³	80% OW survival ³
$S_1 \cdot (1-R_1)$	0.94998 (0.00648)	0.76000 (0.00709)	0.75715 (0.00704)	0.75286 (0.00698)	0.74860 (0.00692)
$S_2 \cdot (1-R_2)$	0.95000 (0.01176)	0.85500 (0.01523)	0.84962 (0.01508)	0.84150 (0.01484)	0.83318 (0.01460)
P_1	0.25001 (0.00220)	0.25000 (0.00278)	0.25094 (0.00278)	0.25237 (0.00279)	0.25381 (0.00280)
P_2	0.25001 (0.00296)	0.25000 (0.00417)	0.25285 (0.00419)	0.25723 (0.00424)	0.26178 (0.00428)
$S_3 \cdot P_3 \cdot (1-R_3)$	0.23751 (0.00283)	0.16627 (0.00292)	0.16880 (0.00296)	0.17274 (0.00302)	0.17688 (0.00309)

¹ Residual level modeled is $R_1 = 20\%$ above LGR, $R_2 = 10\%$ between LGR and LGS, and $R_3 = 30\%$ between LGS and LMN. Subyearling Chinook reach survivals set at 95%; collection efficiencies set at 25% for both subyearlings and yearling Chinook.

² Residual level is $R_1 = R_2 = R_3 = 0$.

³ Percent of overwintering (OW) survival assumed in making adjusted reach survival estimates.

Page 17, Section V - In Section V of the review, the authors comment that both proposals do not lay out an experimental design for incorporating years of spill and no-spill conditions. That is true, but since we do not know for sure whether spill will be provided by 2007 or the magnitude of the spill when it is provided, it appears somewhat premature to devise a multi-year experimental design for this initial proposal submittal. As more information will be forthcoming this year, we felt that development of a regionally approved design would need to be pursued over the next year. The initial intent was simply to develop the best design for implementation in 2005 under the no-spill condition expected for that year. The reviewers pose important questions regarding type of experimental design, replication, constraints of flow, and power operations that need to be considered in setting up a regionally approved approach to addressing management questions of how transportation, bypass, and spill may be tweaked to provide overall improvements in fall Chinook survival through the hydrosystem and returns as adults. The agencies and tribes have proposed a formal collaborative process to address and reach agreement on these issues.

The reviewers discuss the need to incorporate harvest information in the SAR estimation since fall Chinook harvest in the ocean and lower Columbia River may be sizeable before the returning adults even arrive and pass Bonneville Dam. They suggest double tagging with CWTs and PIT tags to investigate harvest benefits. They also present the concern for straying of fall Chinook into Lyons Ferry Hatchery since fish released from Big Canyon Creek and Captain John Rapids acclimation ponds were reared there, and recommend terminal monitoring at that site in addition any upstream adult traps at the various acclimation ponds being used in the study. The inclusion of harvest data into the calculation of SARs should be discussed and agreed upon through the US V Oregon process and parties the Lower Snake River Compensation Plan activities which both

conduct index marking with use of CWTs and the monitoring of the adult traps at the appropriate hatcheries and acclimation ponds.

Lastly, the reviewers question whether jacks should be omitted from the calculation of SARs. In the USFWS/Nez Perce proposal jacks were not excluded in the SAR calculations, and in particular, both the jacks from smolts that outmigrated as subyearlings and the mini-jack to jack sized fish that return in the fall from the smolts that outmigrated as yearlings in the spring should be included. Many of these latter fish are potentially of jack size when returning after upwards of 4 to 6 months in salt water. Therefore, it seems prudent to consider grouping the returning adults by combined “freshwater.saltwater” age as 0.1 and 1.0 age returns; 0.2 and 1.1 age returns; 0.3 and 1.2 age returns; 0.4 and 1.3 age returns; etc. The jack and mini-jack data should be considered since there is some indication that yearling out-migrants have a greater proportion of return as mini-jacks. The data should be considered since it does have implications for long-term production and management programs.

Comments on NOAA revised proposal

Subsequent to the original submittal of the joint agencies’ and tribes’ proposal and the NOAA proposal in August of 2004, NOAA submitted an additional proposal in October of 2004, and revisions of their August proposal in November of 2004 and again in December of 2004. The most recent revised NOAA proposal closely resembles the original August proposal submittal by the agencies and tribes for a fall Chinook evaluation. Like the agencies and tribes original proposal, the third-edition NOAA proposal has proposed marking two groups of subyearling Chinook, one group to be transported and one to be bypassed, and releasing them upstream of Lower Granite Dam. The result would be estimates of Smolt-to-Adult (SAR) returns for transported juvenile fall Chinook and bypassed juvenile fall Chinook. At this point the twice-revised NOAA proposal has been modified to resemble the original joint agencies and tribes proposal. We are disappointed that the agencies and tribes were not provided the opportunity to revise their original August proposal, as NOAA was given the opportunity to revise their proposal. Although NOAA has made an attempt to adopt the Joint agencies and tribe’s proposal into their own proposal, there are several aspects of the NOAA proposal that remain problematic. Specifically, a collaborative process that provides a central role for the fishery agencies and tribal co-managers for implementation, analysis and reporting of the results and conclusions that provides a central role for the fishery agencies and tribal co-managers is not included in the proposal. It is clear from the review and discussion of proposals that the Corps of Engineers and the state, tribal co-managers have very different views on the definition of collaboration. The joint agencies and tribes expectations regarding true collaboration and a meaningful role for the tribal, state and federal salmon managers are outlined in the letter preceding these comments.

The NOAA proposal has a large part of its discussion devoted to a manuscript in press by William Connor et al., which places significant emphasis upon overwintering fall Chinook based upon scale pattern analyses. The fishery agencies and tribes recognize that there are several fall Chinook out migration strategies. It is important to configure the system so that the hydro system operation does not select against the sub-yearling out migrants. However the NOAA proposal does not address questions that have been raised regarding the apparent disconnect between results of PIT tag studies that have been done in the Snake River and results of this scale study. Some of these questions were presented at the SRWG meeting in Walla Walla, but have

subsequently been ignored by NOAA and the COE. These summaries of the Connor et al. scale data have shown that there is large year-to-year variability in the estimated proportion of subyearling migrants for both hatchery and wild fish (Figures 1 and 2). The patterns over time in the scale estimates are dissimilar to the patterns based upon PIT tag detections for fish released in the upper and lower Snake River (Figure 3). In addition, the scale analysis methodology has not been validated using fish with known detection histories. These questions should precipitate significant caution regarding potential management or research implications of the Connor et al. analyses. Further, the emphasis on the overwintering fish may be misplaced since the vast majority of the fall Chinook juvenile population, both presently and historically, out-migrate as sub-yearlings. It has been estimated that 98% of wild fall Chinook from the Snake River and 47% from the Clearwater River migrate as subyearlings according to PIT-tag studies conducted by William Connor, USFWS (Connor et al. 2002). In the manuscript by Connor et al. and cited by NOAA, scale analysis indicated that on average 59% of wild fall Chinook juveniles out-migrate as sub-yearlings. Although the scale data indicate complexity in out-migration strategy it reaffirms the importance of the sub-yearling outmigration strategy. The results from this scale analysis and past PIT tag studies by Connor display an apparent disconnect (Figures 4 and 5). These apparently conflicting results could be the result of several things including the present passage management program causing large mortality rates on sub-yearling migrants, or that the Connor et al. juvenile PIT tag results do not represent the Snake River fall Chinook ESU. At this time, there is not sufficient data to understand the effects of hydrosystem operations on the proportion of the overall Snake River fall Chinook ESU that migrate as yearlings or the relative importance of yearling migrants for achieving recovery goals for the ESU. However, continued scale sampling and comparisons with PIT tag results, as was put forth in both proposals, should help to inform the scientific understanding of these issues.

Figure 1. Percentage of wild fall Chinook adults collected at Lower Granite Dam that were estimated to have migrated to the ocean as subyearlings based upon scale pattern analyses (data from Connor et al. *in press*).

Figure 2. Percentage of hatchery fall Chinook adults collected at Lower Granite Dam that were estimated to have migrated to the ocean as subyearlings based upon scale pattern analyses (data from Connor et al. *in press*).

Figure 3. Percentage of wild fall Chinook adults collected at Lower Granite Dam that were estimated to have migrated to the ocean as subyearlings based upon scale pattern analyses (data from Connor et al. *in press*) and the estimated percentage of subyearling migrants based on PIT tag detections for fall Chinook released in the upper and lower portions of the free-flowing Snake River (data from Connor et al. 2002) over subyearling outmigration years 1994 through 2000.

Figure 4. Percentage of wild fall Chinook adults collected at Lower Granite Dam that were estimated to have migrated to the ocean as subyearlings based upon scale pattern analyses (data from Connor et al. *in press*) versus the estimated percentage of subyearling migrants based on PIT tag detections for fall Chinook released in the upper portion of the free-flowing Snake River (data from Connor et al. 2002) for brood years 1994-1997 and 1999.

Figure 5. Percentage of wild fall Chinook adults collected at Lower Granite Dam that were estimated to have migrated to the ocean as subyearlings based upon scale pattern analyses (data from Connor et al. *in press*) versus the estimated percentage of subyearling migrants based on PIT tag detections for fall Chinook released in the lower portion of the free-flowing Snake River (data from Connor et al. 2002) for brood years 1994-1997 and 1999.

Specific Comments

1. **The study is inappropriately limited to non-representative groups of hatchery fish.**
 The NOAA test groups do not represent present hatchery production or wild migrants. The primary comparison in the NOAA proposal will be SARs between PIT tagged fish in two study groups – “transport strategy” and “in-river strategy” groups. These two groups are the same as the “mimic-transport” and “mimic-bypass” groups planned in the USFWS proposal. The type of hatchery fall Chinook used within these two study groups differed between proposals. NOAA plans to have hatchery fish reared to smaller size to try to mimic the smaller-sized wild fall Chinook, while USFWS planned to utilize the full size range of production fish to provide inferences to the major production of fall Chinook in the Snake River basin above Lower Granite Dam. The cited Conner unpublished data (2004) looked at two size groups of fish from Lyons Ferry released in June of 1997 and concluded that the smaller fish had higher SARs, but is this simply a one-year result, or does this indicate a general trend in survival versus hatchery size. Since the NOAA proposal is heavily weighted toward the notion of smaller hatchery fish being more like wild fish with regards to in-river timing and survival, but there is little evidence that the size effect carries over into SARs.

2. **The NOAA proposal places emphasis on the issue of over-wintering fall Chinook, but does not propose to investigate the actual proportion that hold over, or the cause of the hold over. NOAA seems to be proceeding with the unvalidated assumption that the overwintering proportion of the total population is significant.** The added complexity raised by nature of some fall Chinook subyearling holding over to yearlings before completing their seaward migration is raised in the NOAA proposal. Reading of scales on returning adults from the run-at-large collected at Lower Granite Dam by Conner over 6 years (1998-2003) showed 41% of wild and 51% of hatchery fall Chinook returns had scales with a ocean entry check indicative of yearling entry. These findings have caused great consternation on how to proceed with fall Chinook studies. If, as the Conner report suggests, the holdover proportions may be large, then use of the CJS methods for estimating population size at Lower Granite Dam and reach survival through the hydrosystem would be adversely impacted. If the holdover proportion is negligible in some year and only high when summer flows are lower than usual, then it would be important for any proposal to attempt to quantify the holdover proportion. In the USFWS proposal, we planned to use the “mimic-bypass” group to obtain the survival components for use in estimating a Lower Granite Dam population, converting detections at Little Goose, Lower Monumental, and McNary dams to Lower Granite Dam equivalents for partitioning the Lower Granite population into study groups C_0 , C_1 , and T_0 , and computing D . If a significant holdover proportion occurs between the dams, then the CJS method would not provide valid estimates for use in these estimations. So it is imperative that the magnitude of residualism is investigated in future fall Chinook studies.
3. **Although NOAA states they will compute reach survival estimates, and state that overwintering could bias the estimate, they do not explain how they will address that bias.** In the “Background” section of the NOAA proposal, they state that they will compute reach survival estimates from release to Lower Granite Dam and to dams downstream, but they do not discuss that the estimates may have severe bias if a significant level of residualism occurs in a given year. They discuss the problem of estimating a population size at Lower Granite Dam and estimating the number of fish never detected at a collector dam when residualism occurs, but they fail to tie this problem to the lack of unbiased reach survival estimates. However, in the “Approach” section they do not make any further mention of computing reach survival estimates, so it is unclear what they are proposing to do regarding estimation of in-river reach survival.
4. **The NOAA proposal infers that non-listed fish do not require evaluation.** In the NOAA proposal, they finally acknowledge the “value of determining the effects of hydropower system operations on hatchery production fish released either at hatcheries or acclimations sites.” They also state that they could expand the design to include production hatchery fall Chinook, but only if additional funding, tags, and fish were available. In their “Collaboration” section, they reiterate the value of including hatchery fall Chinook releases from the Nez Perce tribal and IDFG/IPC facilities, however, it appears that expanded studies to cover hatchery production would need to be funded outside the COE process by other entities. It appears that the COE may have an issue with studying non-listed fish, and resolution of this issue may be required before the COE would add hatchery production fish in the future.

ATTACHMENT #1 (Letter to Witt Anderson)

State, Federal and Tribal Fishery Agencies Joint Technical Staff

***Columbia River Inter-tribal Fish Commission
Idaho Department of Fish and Game
Nez Perce Tribe
Oregon Department of Fish and Wildlife
Shoshone-Bannock Tribes
US Fish and Wildlife Service
Washington Department of Fish and Wildlife***

September 8, 2004

Mr. Witt Anderson
Chief District Support Team
Department of the Army
Corps of Engineers, Northwestern Division
PO Box 2870
Portland, Oregon 97208-2870

Dear Mr. Anderson:

Thank you for your August 4, 2004 response to the state, federal and tribal salmon managers regarding our June 29, 2004 request to implement a spread-the-risk policy for fall chinook.

We appreciate your stated commitment to a strong collaborative approach to the management questions surrounding fall chinook passage management options. The agencies and tribes have developed and submitted a joint collaborative proposal for a fall chinook transportation and in-river migration evaluation study for FY 2005 through the Corps of Engineers Anadromous Fish Evaluation Program (AFEP) research process, with US Fish and Wildlife Service as the project leader. We believe that our collaborative proposal will produce results critical for future management decisions regarding fall chinook passage management.

Our joint proposal is an important first step towards determining future fall chinook passage management strategies that maximize smolt-to-adult survival in an effort to achieve recovery of this stock. However, as stated in our June 29, 2004 letter, there is a need to assess the current management paradigm given data collected to date. While research has been conducted on some aspects of fall chinook passage and life history, there are many facets to fall chinook passage that must be considered in fall chinook passage management decisions. All of the various available information should be brought together to begin to provide a common base of understanding and

a framework for development of future research that will lead to appropriate management decisions.

We concur with you that a meeting to vet the existing data on fall chinook between all regional managers would be beneficial. To best accomplish this task, the agencies and tribes are requesting that the Corps of Engineers work with the Fish Passage Center to fund, organize, and implement a fall chinook workshop facilitated by ESSA this winter. The Fish Passage Center and the US Fish and Wildlife Service implemented a similar workshop addressing the comparative survival of juvenile spring chinook migrants during February 2004. The workshop was very successful and provided a synthesis of available spring chinook passage and survival information. Through this synthesis, the participants formed a common basis of understanding that was useful for both interpreting historical data as well as outlining critical research needs for the future. We are convinced that a similar workshop organized and implemented in the same way will be extremely helpful in providing a basis for research and management of fall chinook passage. Please contact Michele DeHart at the Fish Passage Center, 503-230-4288 or Howard Schaller at the USFWS, 360-604-2500 to discuss the comparative survival workshop. We look forward to working with the Corps of Engineers on this critical resource management issue.

Sincerely,

Russ Kiefer, IDFG

Bob Heinith, CRITFC

Dave Statler, NPT

Cindy LeFleur, WDFW

Ron Boyce, ODFW

Dave Wills, USFWS

Keith Kutchins, SBT

State, Federal and Tribal Fishery Agencies Joint Technical Staff

*Columbia River Inter-tribal Fish Commission
Idaho Department of Fish and Game
Nez Perce Tribe
Oregon Department of Fish and Wildlife
Shoshone-Bannock Tribes
US Fish and Wildlife Service
Washington Department of Fish and Wildlife*

October 18, 2004

Ms. Judi Danielson, Chair
Northwest Power and Conservation Council
450 West State
PO Box 83720
Boise, ID 83720-0062

Mr. Doug Marker
Northwest Power and Conservation Council
Fish and Wildlife Division Director
851 SW 6th Ave., Suite 1100
Portland, OR 97204-1348

Dear Ms. Danielson and Mr. Marker:

Re: November 9-10 Flow-Survival Symposium

It is our understanding that the Northwest Power and Conservation Council (Council) and NOAA Fisheries are planning a symposium for November 9 and 10, 2004 to examine how changes in operations of Libby and Hungry Horse dams may affect flow and survival in the mainstem Columbia below Chief Joseph Dam. We concur with the need for federal, state, and tribal scientists to explore the biological implications of changes in Libby and Hungry Horse operations during summer as anticipated in the Council's 2003 Mainstem Amendments to the Columbia Basin Fish and Wildlife Program (Program) and as discussed in the July 19, 2004 letter from NOAA Fisheries to the Council. We are concerned, however, about the Council organizing and structuring this symposium without the formal involvement of all of the regional fish managers with vested interest in this issue.

A strong body of work from the regional fish managers and the National Research Council exists on the topic of flow, survival and incremental water withdrawals in the Columbia River Basin State, Federal, and Tribal Anadromous Fish Managers Comments on the Northwest Power Planning Council Draft Mainstem Amendments as they Relate to Flow/Survival Relationships for Salmon and Steelhead, January 2003; The effects of mainstem flow and water velocity on salmon and steelhead populations of the Columbia River, Presentation to the National Research Council, IDF&G, ODFW, USFWS, FPC, March 2003; and Managing the Columbia River: Instream Flows, Water Withdrawals, and Salmon Survival, Committee on Water Resources Management, Instream Flows, and Salmon Survival in the Columbia River Basin, National Research Council, 2004). These works should be the starting point for framing the workshop (we have attached the former two documents and the web link for the latter document for your record. Link to NAS report: <http://www.ecy.wa.gov/programs/wr/cr/crinsr.html>).

The Council should formally consult with the affected fishery managers on the objectives, specific questions, analytical methods, and format of the symposium. The current list of questions posed for the symposium is extremely narrow in scope, and appears to be directed at addressing the questions based on an incremental analysis of the effects of flow on juvenile salmonid survival utilizing SIMPAS and other models. We believe an examination of these issues using only these deterministic single life cycle models is not sufficient, as these models are inadequate to address the complexities and uncertainties of the effects of summer flow on the entire life cycle survival of anadromous fish below Libby and Hungry Horse dams. Applying this approach, which is parallel to the contested method used by the Council, NOAA Fisheries, and Action Agencies to evaluate effects of summer spill reductions, will only promote additional controversy, resulting in a lack of regional support of findings from the symposium. The Council should strive to avoid creating additional controversy by facilitating a broader technical scope. Also, failing to include in the rigorous evaluation of changes in Libby and Hungry Horse operations the effects on resident fish above and below projects leaves out a decisive element needed for a comprehensive evaluation as is anticipated in the Council's Program.

Based on our review of the announcement for the symposium, it appears that symposium participants will be asked to share their responses on the questions that will be summarized in a briefing document developed by the Council. We recommend that the symposium be patterned after a decision analysis framework using a "weight of evidence" approach whereby the strengths and weakness of the various factors affecting survival including flow are evaluated for each life stage of fish below the projects. We specifically recommend that the format used in the Comparative Survival Study workshop conducted February 11-13, 2004, be followed to provide a scientifically sound basis for assessing effects of changes in Libby/Hungry Horse project operations on fish.

We stand ready to assist the Council in planning and conducting this important symposium that will increase the region's collective understanding of the implications of the Council's Program on fish and hope that our recommendations are useful in formulating the symposium. We agree that changes to the operations of Libby and Hungry Horse reservoirs need to be comprehensively examined to make sure that the modified operations proposed under the Council's program do not increase the risk to Columbia River anadromous or resident fish,

particularly pursuant to ongoing FCRPS consultation and expectations for further recovery planning. Flow augmentation is an extremely important component of anadromous fish recovery and restoration. Any changes to operations of Libby and Hungry Horse need to be comprehensively evaluated for compatibility with the NOAA Fisheries and USFWS BIOPs and to assure that the modified operations do not impede the progress towards recovery, achieving biological objectives and restoring sustainable fisheries.

Sincerely, STFA

Dave Statler, NPT

for Bill Tweit, WDFW

Ron Boyce, ODFW

Howard Schaller, USFWS

Keith Kutchins, SBT

for Sharon Kiefer, IDFG

Rob Lothrop , CRITFC

Cc: Bob Lohn NOAA Fisheries

State, Federal and Tribal Fishery Agencies Joint Technical Staff

Columbia River Inter-Tribal Fish Commission
Idaho Department of Fish and Game
Nez Perce Tribe
NOAA Fisheries
Oregon Department of Fish and Wildlife
Shoshone-Bannock Tribes
US Fish and Wildlife Service
Washington Department of Fish and Wildlife

February 8, 2005

Cathy Hlebechuk
US Army Corps of Engineers
PO Box 2870
Portland, OR 97208-2870

Dear Ms Hlebechuk:

The fishery agencies and tribes are concerned about the action agencies' use of perceived flexibility in operations at Dworshak reservoir to enhance revenue through hydropower production. The COE presented their proposal at the January 19 Technical Management Team (TMT) meeting. The COE action to draft Dworshak was based upon their Extended Streamflow Prediction model (ESP) and was applied before any review of the methodology with the fishery co-managers. After considering the COE proposal we have concluded that drafting Dworshak reservoir based upon the ESP model study as presented by the COE will increase the risk of meeting spring flow objectives in the Snake River this year. We recommend that the COE, in recognition of the decreasing water supply forecasts, and predictions of low streamflows operate Dworshak and other reservoirs to conserve water for spring and summer out-migrating salmon and steelhead.

The extended stream flow prediction (ESP) was developed to predict stream flow over periods ranging from one week to an entire season. These periods are typically beyond the National Weather Service (NWS) ability to predict the weather. The ESP uses short-term forecasts and historical precipitation, temperature, and evaporation over the rest of the simulated period. The ESP assumes that past meteorological conditions are representative of what may occur for the simulated period¹.

¹ Information taken from "Review of Extended Stream Flow Prediction of the National Weather Service River Forecast System" by Joseph A Pica of Portland State Universities Civil Engineering Department
http://www.nwrfc.noaa.gov/nwrfc/papers/esp_review/esp_review.html.

Joseph Pica, Portland State University, used ESP to simulate the April-July forecast at Dworshak Dam using each year of metrological data from 1950 to 1988 and compared these forecasts to the actual observed data. Pica states “for Dworshak inflow, the historical simulations at lower volumes are higher than the observed data, while simulations at the highest volumes are slightly lower than the observed data.” In short, Pica found that the ESP over-predicted April-July water supply at Dworshak Dam in lower water years. Therefore, caution should be had in applying the ESP to lower volume water years at Dworshak Dam as the ESP may predict a higher runoff volume than actual observed runoff, leading to increased risk to spring flows and out migration conditions.

Past years provide some examples of use of the ESP to draft Dworshak for hydropower, and the resulting reductions in early spring flows. The COE used the ESP model to implement flexibility in Dworshak operations in 2004. The COE announced that they had operational flexibility at the February 18th, 2004 TMT Meeting. The amount of flexibility was not stated, however over 101 Kaf was released from Dworshak between 2-18-04 and 3-2-04. The March 31st Flood Control elevations were 1538.3 feet for system flood control and 1547.2 feet for local flood control. At the end of March, Dworshak was at an elevation of 1530.1 feet, 8.2 feet and 111.9 Kaf below system flood control and 17.1 feet and 236 Kaf below local flood control. The COE did meet the April 10th FC elevation but had to refill 14.7 feet between March 31st and April 10th, 11.4 feet of that refill came after April 3rd – the beginning of the Spring Biological Opinion flow period on the lower Snake river. According to the RFC, the observed April-July inflow at Dworshak was 90% of average. In 2004, the ESP was used to determine some flexibility at Dworshak. In the end, Dworshak was well below the end of March FC elevations and had to refill aggressively over the start of April to meet the BIOP required April 10th elevation. As a result, the flexibility determined through ESP and then used late in February 2004 by the COE came at the cost of reduced early spring flows for juvenile out migrants.

In 2005, the COE has again utilized the ESP and concluded that they have some operational flexibility at Dworshak Dam. In the presentation at the 1-19-05 TMT, the COE used the ESP predicted water supply volumes over forty-four water years of differing conditions to predict flexibility at Dworshak. According to the plot “Additional Volume Available” in this presentation, at the 25th percentile water year (of the 44 years), approximately 50 Ksfd (or 100 Kaf) would be available to use with flexibility.

All available data indicate that the water supply forecast is decreasing through the winter. The RFC January Final (Apr-Jul) WSF at Dworshak was 1960 Kaf (74% of average); the February Early-Bird (Apr-July) forecast is down 140 Kaf to 1820 Kaf (69% of average). The February Early Bird included the actual precipitation through January 24th, assumed precipitation to be 50% of average from the 24th to the end of the month, assumed future precipitation to be normal, and did include snow. Additionally, according to the Natural Resources Conservation Service (NRCS), snowpack for the Clearwater and Salmon basins has dropped from 70% of average on January 1st to 60% of average on January 30th. The COE’s February Final forecast for Dworshak was down to 1642 Kaf (62% of normal).

In conclusion, all indicators are that Dworshak water supply be lower than average in 2005. Additionally, water supply at Dworshak is decreasing. This is likely to result in failure to

meet the NOAA Biological Opinion flow targets at Lower Granite Dam. The ESP forecast, based upon the assumption that the 2005 water year is near the 25th percentile of historical water years, indicates that 50 Ksf of operational flexibility is possible at Dworshak. However, according to the Joseph Pica, study, there is likelihood that ESP will over predict the inflows to Dworshak in lower water years and therefore this method is likely to increase risk for juvenile migrants and exacerbate failure to meet flow targets at Lower Granite dam in a low water year, such as 2005. We recommend and encourage the COE to operate Dworshak and other projects conservatively, maintaining the upper rule curve operation to maintain as much volume as possible for juvenile spring salmon and steelhead migrants. This can help avoid the necessity to refill as much in late March and early April, and reduce the impact to spring migration flows.

If the Corps plans to continue using the ESP as a decision making tool, we would appreciate including the fisheries agencies in a review of the analysis, through the Regional Forum process, prior to making a final operational decision.

Sincerely,

Dave Statler, NPT

Ron Boyce, ODFW

Keith Kutchins, SBT

Kyle Martin, CRITFC

Cindy LeFleur, WDFW

Dave Wills, USFWS

Russ Kiefer, IDFG

Paul Wagner, NOAA Fisheries

State, Federal and Tribal Fishery Agencies Joint Technical Staff

*Columbia River Inter-Tribal Fish Commission
Oregon Department of Fish and Wildlife
US Fish and Wildlife Service*

January 25, 2006

Greg Delwiche
Bonneville Power Administration
905 NE 11th Ave
PO Box 3621
Portland, OR 97208-3621

Dear Mr. Delwiche,

As the Joint Technical Staff of the U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife, and the Columbia River Inter-Tribal Fish Commission, it is our job to provide the best scientific information on effects of the Federal Columbia River Power System (FCRPS) on fisheries resources both to our respective agencies and to the Region as a whole. Many of these evaluations are related to in-season management issues, which require a variety of applied science skills and most importantly, experience with the FCRPS operations, fish biology and ecology, and analytical assessment techniques in order to provide assessment in a timely manner. For the last 23 years, an integral component of our ability to provide the best scientific information has been the scientists at the Fish Passage Center (FPC). Indeed, the FPC was created to primarily serve as an independent technical resource for the state, tribal, and federal fishery management agencies.

There are at least three elements that uniquely distinguish the scientists at the FPC apart from any other groups of individuals currently in existence or any other group of individuals that could be amassed. These are the level of direct and primary FCRPS experience of the scientists at the FPC, their availability and timely response to the technical staff which rely upon them, and the scientific rigor and merit of the analyses they provide to the technical staffs.

Experience

You may be unaware that the eleven professionals at the FPC **have a combined 120 years of direct and primary experience on fisheries and hydrological issues within the FCRPS.** Throughout their 23 years of existence, the scientists at the FPC have provided technical analyses based on their extensive experience to the state, tribal, and federal fisheries management agencies. These are years of experience where the sole and primary focus was the fisheries and hydrological issues associated with the FCRPS. **No other group of individuals has this much direct and primary experience.** These are years of experience spent directly interacting with and providing technical assistance to the state, tribal, and federal technical staffs, and over the 23 years of FPC existence the Joint Technical Staff have developed a high level of

trust and reliance upon the scientists at the FPC. **No other groups of individuals have or could achieve this level of trust and reliability with the state, tribal, and federal technical staffs.** As the FCRPS is a complex system with a complicated history, it has been critical to have the scientists at the FPC as a resource for synthesizing this history and recalling this history when providing technical analyses. Without the historical continuity and knowledge possessed by the FPC scientists, our ability to understand the historical context and provide the best scientific assessments would be severely compromised. **No other group of individuals has the extent or depth of historical knowledge about the FCRPS.** These important components of the experience of the scientists at the FPC cannot be assumed by any other group of individuals and are simply irreplaceable. **Any elimination of or reduction in the scientists at the FPC will result in a substantial loss of historical knowledge and impair our ability to provide the best scientific information to our respective agencies and the Region as a whole.**

Proximity, Availability, and Timely Responses

Because the Portland/Vancouver Metro area is where the vast majority of the FCRPS assessment and management processes occur, and where the fishery management agency technical staffs are located or meet, the location and availability of the scientists at the FPC in Portland has been a critical element of our ability to interact with and obtain technical assistance from FPC staff. FPC scientists have taken the time to attend and participate in all of the major public Regional Forum processes, which primarily take place in the Portland/Vancouver Metro area. Their attendance and participation in these meetings has been essential for assisting and providing analyses to the technical staffs. Most importantly, the FPC scientists are always available for in-person technical assistance and **consistently demonstrate rapid responses to technical requests.** These levels of interaction and participation would not be possible if the FPC was located outside of the Portland area. **Substituting some other group of individuals outside the Portland area to perform the technical assistance role of the FPC scientists would severely erode our ability to provide the best scientific information to our respective agencies and the Region as a whole in a timely manner.** Many of the analyses FPC scientists perform relate to in-season management issues, which require their scientists' collective experience to rapidly deliver rigorous and error-free analyses.

Scientific Rigor and Merit

Consistent with all of the independent reviews of the scientific work conducted by the FPC scientists, we have been highly impressed with the outstanding level of scientific rigor and merit with which the FPC has conducted its work and provided technical assistance to the state, tribal, and federal technical staffs. Indeed, there is no other group in the Region which has had to endure such levels of scrutiny as the FPC staff. Despite this scrutiny, the technical analyses conducted by the scientists at the FPC have consistently proven to be of high scientific rigor and merit. The ISAB has twice reviewed the work conducted by the FPC and found it to be of "high technical quality."

A recent case study that exemplifies the rigor with which the FPC scientists conduct their work can be seen in the analyses of the effects of the 2005 summer spill program. In response to requests to assess effects of the court-ordered spill in Summer 2005, the FPC released and published on their website three memos that consisted of 18 typed pages which clearly described the methods, results, and discussion of their analyses, along with appendices which contained the

data that were utilized in their analysis. The analyses were thoroughly described, along with the important assumptions and qualifications that needed to be considered. The documentation of this work was more than sufficient to allow for any other scientist to duplicate and verify the analyses and results. These documents were very helpful to the state, tribal, and federal technical staff in determining their technical assessment of the summer operations in 2005. This case study exemplifies the high scientific rigor and merit with which the scientists at the FPC conduct their work. **Replacement of the FPC scientists will eliminate the high-quality scientific information that is necessary for the state, tribal, and federal technical staff to provide the best scientific information to their respective agencies and the Region as a whole in a timely manner.**

Additional considerations

With the ongoing remand process and need for constructive collaboration among the regional entities, it seems highly unlikely that state, tribal, and federal technical staff will be able to provide input to their agencies and the Region as a whole without the technical assistance of the FPC scientists. **To achieve meaningful participation by state, tribal and federal scientists in the collaborative efforts towards solutions, at the technical level this will be extremely difficult, if not impossible, without the technical assistance provided by the FPC scientists.** The attached request for FPC technical assistance in evaluating the recently-developed COMPASS model illustrates the continuing and ongoing technical assistance needs by the states and tribes in the remand process.

In summary, the Joint Technical Staff believe that any reduction in, substitution for, or relocation of the scientists at the Fish Passage Center will deleteriously impact the ability of the technical staffs to provide the best scientific information to their respective agencies and the Region as a whole in a timely manner. We respectfully request that the BPA maintains the duties and funding for the Fish Passage Center scientific staff and their capabilities to avoid these impacts.

Sincerely,

Richard Kruger, ODFW

Tom Lorz, CRITFC

Steve Haeseker, PhD, USFWS

January 12, 2006

Michele DeHart
Fish Passage Center
1827 NE 44th Ave, Suite 240
Portland, OR 97213

Dear Michele:

As you know, the National Marine Fisheries Service is collaborating with states, tribes and others in the development of a new Biological Opinion for the Federal Columbia River Power System. For your background information, we have attached a document describing this, which includes a discussion of the collaboration process, jeopardy analysis framework, and initial thinking on the scope of the proposed action.

Looking ahead to the substantive aspects of the collaboration, we believe that technical assistance from the Center will be essential to our meaningful participation in this process. At this time, we are requesting the technical assistance of the Center (provision of data and analyses) with respect to:

- Formulation and technical assessment of performance measure options, e.g. dam specific and system survival measures;
- Identification and technical assessment of project operation and configuration alternatives intended to increase salmon survival;
- Development and application of a new fish passage model to replace SIMPASS;
- Development of a salmon life cycle model to assist in our efforts to partition the human induced causes of salmon mortality;
- Articulation of long-term monitoring and evaluation strategies related to the effects of the FCRPS.

These are broad areas of endeavor and the specific data and analyses needed from the Center will evolve as the states, tribes and federal agencies proceed with the collaboration effort. We ask that you and your staff work with Ed Bowles (ODFW), Guy Norman (WDFW), and Rob Lothrop (CRITFC) to further refine and carry out this request. They will be sharing your technical analyses with the others involved in the collaboration.

Thank you for your consideration of this request.

Sincerely,

Olney Patt, Jr.
Executive Director
Columbia River Inter-
Tribal Fish Commission

Roy Elicker,
Acting Director
Oregon Dept. of
Fish and Wildlife

Jeff Koenings,
Director
Washington Dept. of
Fish and Wildlife

State, Federal and Tribal Fishery Agencies Joint Technical Staff

*Columbia River Inter-tribal Fish Commission
Idaho Department of Fish and Game
Nez Perce Tribe
Oregon Department of Fish and Wildlife
Shoshone-Bannock Tribes
US Fish and Wildlife Service
Washington Department of Fish and Wildlife*

January 13, 2005

William E. Branch
US Army Corps of Engineers
Northwestern Division
North Pacific Water Management Division
Attention: CENWD-CM-WH-N
P.O. Box 2870
Portland, OR 97208-2870

Dear Mr. Branch,

RE : Recommended Early Season Operations at Snake River Transport Sites 2005 for
 inclusion in the 2005 Fish Passage Plan, Appendix B

This memo presents our preferred operations to guide the Action Agencies in establishing early season operations at the Snake River dam collection and transportation sites. The COE has proposed to begin juvenile salmon transportation on April 20, 2005 at Lower Granite (LGR), Little Goose (LGS) and Lower Monumental (LMN) dams based on changes in the 2004 NOAA Biological Opinion, Section 6.2.1.4 (Juvenile Fish Transportation Operations). We understand that the details of this operation are forthcoming in the draft 2005 Fish Passage Plan and Water Management Plan. According to an email sent to Larry Basham from Dave Hurson, the delayed start of transportation would be dependent upon the 2005 April Final Flow Forecast. If the AFFF predicts flows in excess of 70 kcfs for the April-July forecast, then the plan would call for transportation to begin April 20 at all three sites. Our understanding is that LGR, LGS, and LMN would be operated with spill to provide for juvenile fish passage prior to April 20 is as follows: LGR RSW operation 24 hours at 12 Kcfs with 7 Kcfs training spill; LGS night-time 12-hour spill to the gas cap; and LMN 24 hour spill 45% to 50% of total discharge depending upon flow volume forecast.

We have summarized the preferred project operation modes for each site below. In general, we believe each of the three projects should be operated in secondary bypass mode upon startup. Several studies rely on PIT-tag detection at these sites to provide necessary data for analysis. The

Comparative Survival Study (CSS) relies on these detections for reach survival estimates and to classify PIT tagged smolts into their appropriate study group based on their capture histories. In particular, the 2005 proposed fall chinook transportation study relies upon early season detections to gather important information about holdover yearling “reservoir type” fish. For example, 77.2 % of hold-over yearling fall chinook from the 2000 migration of subyearlings were detected in 2001 at LGR before April 20, while at LGS and LMN, the holdover proportions detected was 12.5 % and 8.0%, respectively. Delaying PIT tag monitoring until April 20 would eliminate detection of a major portion of these holdover fish. Other studies rely on detection and bypass of PIT-tagged fish for survival information throughout the season.

If the secondary bypass operation is continued in the future we recommend improvements to the juvenile fish facilities at all three sites that would make operation of the full flow bypasses more tenable. Since full flow bypass is the preferred passage operation for collected fish when transportation is not implemented, it should be followed as a high priority to provide better outfall conditions as well as full flow PIT-tag detection (as is currently available at McNary Dam).

Lower Granite Dam

We believe the juvenile fish facility should begin operation in secondary bypass mode on March 25th, the normal start-up date. There are several reasons for operating the secondary bypass system at Lower Granite Dam. The primary bypass is old and has a sharp-angle bend that may cause injury to fish. Further, the primary bypass outfall discharges its flow next to the shoreline riprap near the fish facility. This release location is poor and could result in additional predation, delay and confusion for the bypassed fish. Operating the secondary bypass would allow PIT-tag detections on all fish that enter the bypass. There are several studies including the CSS that use these data in long-term studies, as well as short reach survival estimates and timing studies that rely on PIT-detections at Lower Granite Dam. The CSS study relies on these early detections since in some years such as 2002, between 10 and 20% of the seasonal detections of PIT tagged hatchery spring chinook (Dworshak, Rapid River, and Catherine Ck releases) and 25% of the season detections of the PIT tagged wild chinook aggregate occurred before April 20 at LGR. The proposed Fall Chinook Transportation Study would also require early season detections of holdover fish, which make up an important component of the study population.

The regular Smolt Monitoring Program sampling should take place during this time period. Lower Granite is a primary site for gathering information on migration timing for various species. Further, the outfall from the secondary bypass is downstream of the barge loading dock and is in a more favorable position than the primary bypass pipe.

Little Goose Dam

Upon startup we believe the LGO facility should be operated in secondary bypass mode for PIT-tag detection. Timed sampling for smolt monitoring during this time period is not required. However, sampling for Gas Bubble Trauma (GBT) is required at this time as part of routine monitoring. Presently, GBT monitoring is conducted one day per week at Little Goose Dam during spring operations when spill typically occurs. (GBT is schedule component of SMP at

LGO and LMN ... if flows are low and/or we pass peak flow period without spill, then GBT sampling could be discontinued). Fish are netted off the separator so a timed sub-sample is necessary. These samples could also be used to gather information on fish condition. The full flow bypass at Little Goose Dam does not have PIT-tag detection capability, and the outfall location is influenced by upstream eddies during some flow conditions. As this is not a primary site for passage index timing data for the Smolt Monitoring Program we would not recommend sampling there unless observations of fish on the separator or at other facility locations indicated it was necessary.

Lower Monumental Dam

We believe that the LMN facility should be operated in secondary bypass mode for PIT-tag detection upon startup as well. Timed sampling for smolt monitoring during this period is not required. However, routine sampling for GBT is required at this site. Presently, GBT monitoring is carried out one day per week at Lower Monumental Dam during spring operations when spill typically occurs. Fish are netted off the separator so a timed sub-sample would be unnecessary. These samples could also be used to gather information on fish condition. As at Little Goose, the full flow bypass at Lower Monumental Dam does not have PIT-tag detection capability and the outfall location is influenced by upstream eddies during most flow conditions. This is not a primary site for passage index timing data for the SMP so we do not recommend sampling here unless fish observations on the separator or at other facility locations indicate it is necessary.

Thank you for considering these requests. We look forward to discussing them at future TMT and/or FPOM meetings.

Sincerely,

Dave Statler, NPT

Ron Boyce, ODFW

Keith Kutchins, SBT

Bob Heinith, CRITFC

Cindy LeFleur, WDFW

Dave Wills, USFWS

Russ Kiefer, IDFG

APPENDIX K

A c r o n y m s

List of Acronyms used in Fish Passage Center Annual Report

APRE	Artificial Production Review and Evaluation
BC Hydro	British Columbia hydro
BOR	Bureau of Reclamation
BPA	Bonneville Power Administration
CJS	Cormack, Jolly, Seber
COE	United States Army Corps of Engineers
CRITFC	Columbia River Inter-Tribal Fish Commission
CSS	Comparative Survival Study
CWT	Coded wire tag
DEQ	Oregon Department of Environmental Quality
DOE	Washington Department of Ecology
ESA	Endangered Species Act
ESP	Extended stream flow prediction model
FCE	Flood control elevation
FPC	Fish Passage Center
FPE	Fish passage efficiency
GBT	Gas bubble trauma
HCC	Hells Canyon Complex
HGMP	Hatchery genetic management plan
IDFG	Idaho Department of Fish and Game
IPC	Idaho Power Company
IT	Implementation Team
Kaf	Thousand acre feet
Maf	Million acre feet
NFH	National Fish Hatchery
NOAA Fisheries	National Oceanic and Atmospheric Administration Fisheries
NPT	Nez Perce Tribe
NTS	Non-treaty storage
NPCC	Northwest Power and Conservation Council
ODFW	Oregon Department of Fish and Wildlife

Opinion	NOAA Fisheries 2000 Biological Opinion
PIT Tag	Passive Integrated Transponder Tag
PSMFC	Pacific States Marine Fisheries Commission
PUD	Public Utility District
RFC	River Forecast Center
RPA	Reasonable and prudent alternative
RSW	Removable spillway weir
RT	Radio tag
SMP	Smolt Monitoring Program
SOR	System Operational Request
SPILLPROP	Spill proportion variable
TAC	Technical Advisory Committee
TDG	Total dissolved gas
TDGS	Total dissolved gas supersaturation
TEMP	Temperature variable (in regressions AVTEMPC is used)
TMT	Technical Management Team
TREATY	Columbia River Treaty
TRVTIME	Smolt Travel Time
TSR	Treaty storage regulation
USFWS	United States Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WSF	Water Supply Forecast
WTT	Water particle transit time
WY	Water year