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MEMORANDUM

TO: Scott Harden, All Sports LLC

FROM: Michele DeHart

DATE: November 21, 2007

RE: Data Request

In response to your data request regarding the 2007 low returns of fall Chinook at Bonneville Dam and McNary and the above average returns of adult fall Chinook at Lower Granite Dam, the FPC staff summarized historical passage data, passage management and production data for your review. The following summary is not a comprehensive life cycle analysis of these populations of fall Chinook, but simply a summary of juvenile migration factors that could have affected the current adult returns. We have compared passage data and passage conditions, as well as hatchery production and the differences that have occurred from year to year for Bonneville Pool (Spring Creek Hatchery), Hanford Reach and Snake River fall Chinook. We have not addressed harvest because we do not maintain harvest data.

Adult returns in any given year are the result of several cohorts of returning adults and their survival represents the cumulative effect of a myriad of factors throughout the life cycle of these populations. As previously stated we have not attempted a complete life cycle analysis, nor have we attempted to single out the importance of individual variables. We have, however, summarized the juvenile hydrosystem passage and return data to display the differences in conditions that occurred without offering a definitive conclusion regarding a single most important factor that resulted in the disparity between fall Chinook returns to Lower Granite Dam relative to McNary and Bonneville dams. We have documented that changes have occurred in juvenile fish passage and hatchery production in recent years. The following summary is separated into categories that data and analysis have shown to affect adult returns:

- Flow conditions for juvenile migrants
- Spill for juvenile fish passage at Columbia and Snake rivers hydroelectric projects

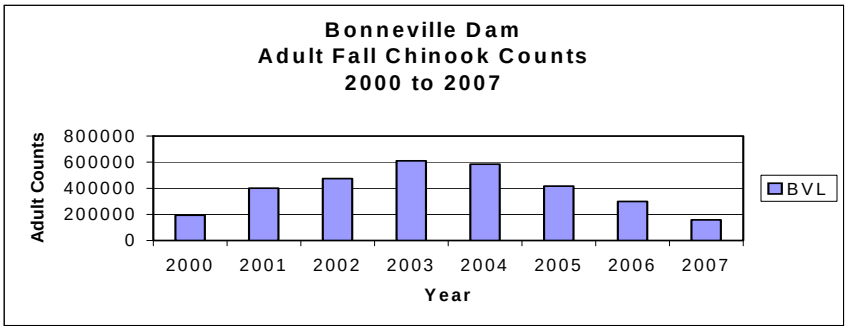
- Hatchery production releases

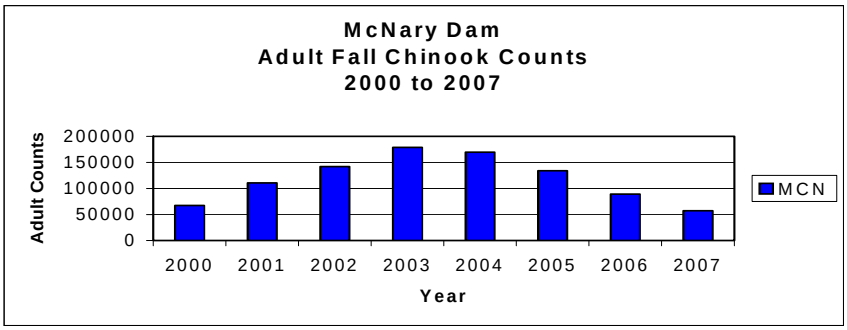
Columbia and Snake River Fall Chinook returns in 2007

Fall Chinook migrating past Bonneville Dam continued to exhibit a downward trend in abundance that began after adult returns peaked in 2003. The 2007 Fall Chinook returns to Bonneville Dam were 157,443 as of November 14, 2007. This return is 53% of the 2006 return and 43.5% of the ten year average. The Fall Chinook returns at McNary Dam showed a similar pattern with 2007 equaling 64% of the 2006 return, and 52 % of the ten year average.

On the other hand, fall Chinook returns to Lower Granite Dam on the Snake River showed a different trend. Prior to 2007 the trend in abundance to the Snake River was similar to that observed for the return to the Columbia River. However, in 2007 counts at Lower Granite Dam did not decrease and were 127% of the 2006 counts and 132% of the ten year average.

The following graphs of adult fall Chinook returns show the trends since 2000.





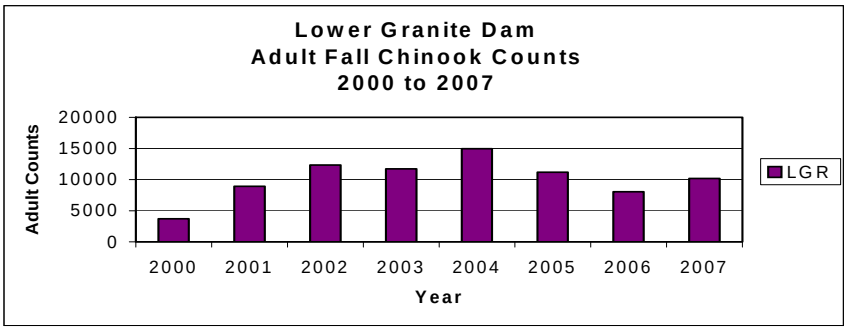


Figure 1. Adult Fall Chinook ladder counts at (a) Bonneville, (b) McNary and (c) Lower Granite dams for 2000 to 2007.

The majority of fall Chinook adults returning in 2007 would have primarily migrated in 2003 and 2004 for Hanford Reach stocks and 2004 and 2005 for Snake River stocks, with 2003 contributing a small percentage. The Spring Creek Hatchery stock would have primarily migrated primarily in 2004 and 2005, similar to the Snake River stocks. The intent of this memo is to characterize the migration conditions that had occurred in these years and compare them to the recent historic conditions in an attempt to identify factors that might have been different for Hanford reach, Snake River and Spring Creek Hatchery migrants.

Summary

Based on the attached analyses and compilation of information, it is difficult to identify one factor as the cause for the decline of Hanford Reach and Spring Creek Hatchery stocks while Snake River stocks increased. Although recognizing that this is not the definitive answer to your question, we have summarized what we do know about the groups comprising the 2007 adult fall Chinook return.

- The first year of a planned summer spill program in the Snake River occurred in 2005. In 2005, there was no planned spring spill program because of low river flows. A short period of unplanned spill occurred during a peak flow period. Hatchery releases of fall Chinook occurred early in 2005 and coincidentally benefited from the peak flows and spill period. However, early hatchery releases migrated coincident with unplanned Snake River spill events due to peak flows. Consequently, a significant portion of the migration in 2005 in the Snake River migrated under spill conditions.

- Spill for Snake River fall Chinook juvenile migrants has increased significantly over the past few years, with the addition of voluntary summer spill since 2005. Furthermore, with the addition of voluntary summer spill, a higher proportion of Snake River subyearling fall Chinook pass LGR during times of spill.

- A smaller proportion of the fall Chinook originating above Lower Granite Dam have been transported since 2005 compared to previous years. Recent analyses (FPC Annual Report 2005) showed the improvement in survival for subyearling Chinook passing in spill. These two facts together result from increased spill; increased in-river population (lower transport proportion), and improved survival. The combination of these would increase the in-river population surviving to below Bonneville Dam, and could provide one source of the increased adult returns seen in 2007.

- Hatchery releases of Snake River fall Chinook were at their highest in 2005. However, the 2004 hatchery release was significantly less than observed in recent past years. Since these two out migration years comprise most of the adult return to Lower Granite in 2007, it is difficult to assess the affect that differences in numbers of fall Chinook released from hatcheries above Lower Granite in 2004 and 2005 had on the 2007 adult return.

- Fall Chinook originating in the Hanford reach experienced poor downstream flow conditions during the summer period for the two primary migration groups (2003 and 2004), which may have contributed to the 2007 adult return.

- Hatchery releases of fall Chinook in the Mid-Columbia in 2003 and 2004 were comparable to past years.

- Other factors, such as entrapments due to the operation of the hydrosystem, may have affected the juvenile migrants during 2003 and 2004. These outmigration years were prior to the Hanford Reach agreement for the operation of the hydrosystem.

- Despite increased releases of tule fall Chinook from Spring Creek Hatchery in recent years, a smaller proportion of juveniles are passing Bonneville Dam during periods of spill, which may be contributing to the lower adult returns seen in recent years.

A. Snake River Juvenile Fall Chinook Migration conditions

1. Flow

The development of the Columbia and Snake rivers hydrosystem changed a free flowing river system into a series of slow moving reservoirs with dams as obstacles to fish passage. Flow objectives are a measure contained in the Biological Opinion to aid the juvenile migration in passing through the hydrosystem. Increases in river flow decrease the amount of time that juvenile salmonids spend in the hydrosystem and improves their overall survival to adulthood.

The majority of the 2007 adult PIT tags were recovered from juveniles that migrated downstream in 2004 and 2005. The following table (Table 1) shows the spring and summer flows that occurred in the Snake River over the past 13 years. Both spring and summer flows in the Snake River were below the Biological Opinion flow objectives for 2004 and 2005.

	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Spring Objective	**95.0**	**100.0**	**100**	**90.0**	**100.0**	96.3	85.0	97.0	**89.1**	85.0	85.0	**100.0**	85.0
Spring Average	**101.1**	**138.3**	**162.5**	**115.6**	**117.0**	85.1	47.5	83.4	**90.0**	70.1	66.3	**125.3**	61.5
Summer Objective	**52.0**	53.5	**55.0**	**50.6**	**54.0**	51.3	50.0	51.0	50.7	50.0	50.0	54.5	50.0
Summer Average	**55.3**	52.7	**66.3**	**53.2**	**56.0**	39.6	25.4	41.2	32.3	33.2	33.4	37.6	28.8

Table 1. Spring and Summer Biological Opinion flow objectives at Lower Granite Dam from 1995 to 2007 as well as actual average seasonal flows at each project. Values in bold indicate that the seasonal flow objective was met.

2. Spill

Spill is provided as a mechanism to get fish past a hydroelectric project via the route associated with the least project mortality. In addition, spill decreases the amount of time that fish spend in

the hydrosystem by decreasing the delay associated with hydroproject passage. Early indications of transportation studies for fall Chinook in the Snake River suggest that transportation neither harms nor enhances juvenile survival of fall Chinook. Consequently, spill in the Snake River is provided to enhance in-river migration conditions for fall Chinook. Analyses of spill effects on juvenile fall Chinook (FPC, Subyearling Chinook Survival in Lower Granite Dam to McNary Dam reach 1998 to 2006) have shown the benefit of spill to in-river survival of subyearling Chinook, especially fish originating in the Snake River above Lower Granite Dam.

A summer spill program for fall Chinook was not implemented until the Court order of 2005. The following figure (Figure 2) show the total spill that has occurred during the Biological Opinion summer spill period of June 21 to August 31 in the Snake River since 2001. As you can see from the graph, very little summer spill occurred at the transport projects prior to the Court Ordered spill program in 2005. Spill that did occur prior to 2005 at the transport collector projects was a function of "involuntary spill", which is water that is spilled because the flow exceeds the hydraulic capacity of a project or because there is a lack of market for the energy produced.

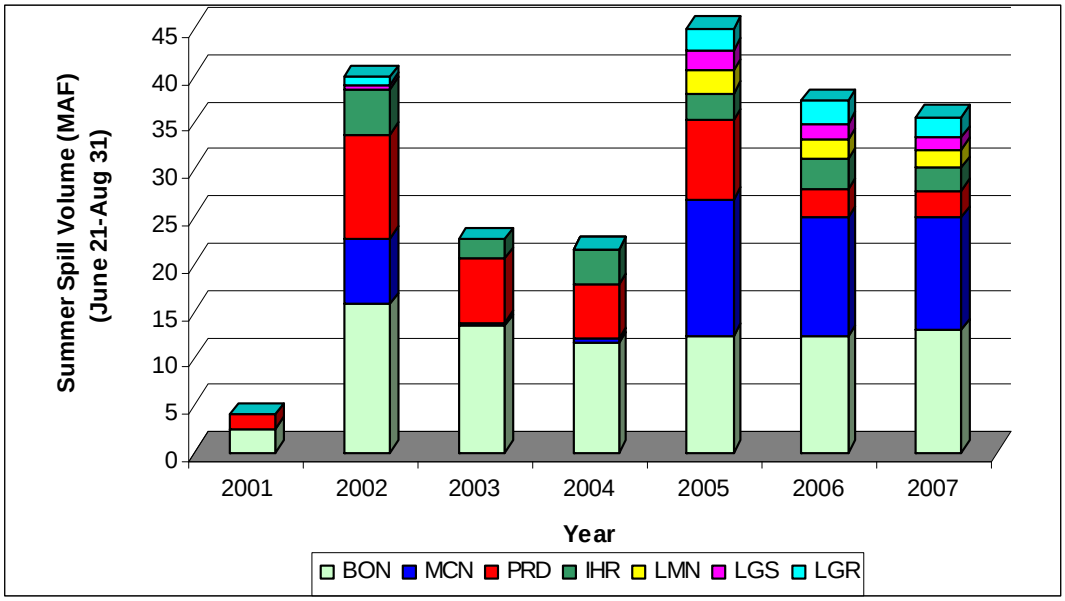


Figure 2. Total summer (June 21-August 31) spill volumes (MAF) at Bonneville (BON), McNary (MCN), Priest Rapids (PRD), Ice Harbor (IHR), Lower Monumental (LMN), Little Goose (LGS), and Lower Granite (LGR) dams from 2001 to 2007.

However, the amount of spill that occurred during the summer spill program does not by itself tell the whole picture. Since the initiation of the fall Chinook supplementation Program in the late 1990's the hatchery releases have overwhelmed the natural fish and display a different pattern of migration. The following figure (Figure 3) shows the passage distribution of fall Chinook at Lower Granite Dam since 2001. The cumulative distribution appears to occur earlier throughout the time period as more and earlier supplementation hatchery releases have occurred above Lower Granite Dam.

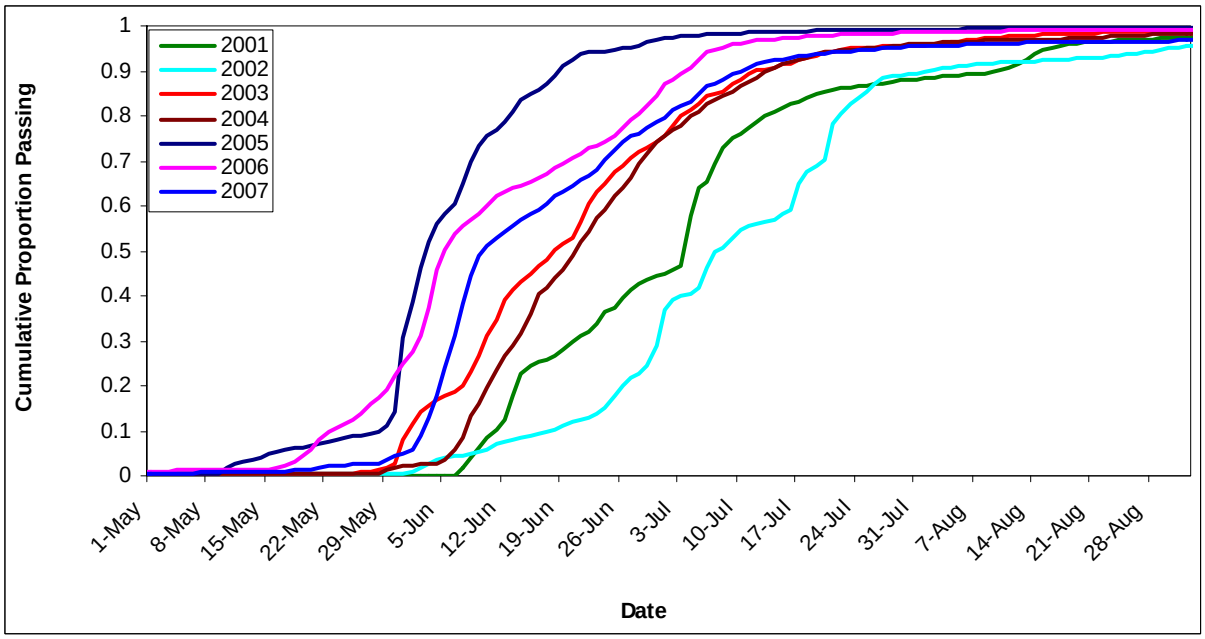


Figure 3. Subyearling fall Chinook passage index distribution timing at Lower Granite Dam (2001-2007).

Because of this shift in timing it is important to also consider the spill that occurred prior to the start of the summer spill period. The following figure (Figure 4) shows the spill that occurred in the system between June 1 and June 21. This spill would have occurred as a result of the spring spill program or involuntary spill.

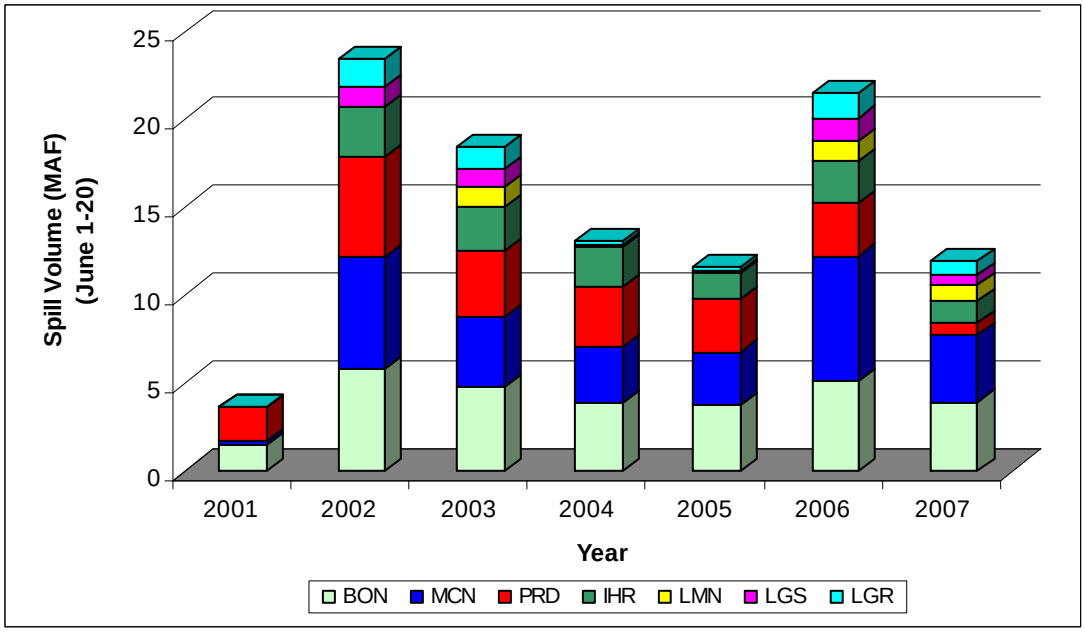


Figure 4. Total spill volume (MAF) at Bonneville (BON), McNary (MCN), Priest Rapids (PRD), Ice Harbor (IHR), Lower Monumental (LMN), Little Goose (LGS), and Lower Granite (LGR) dams from June 1 to June 21 (2001 to 2007).

An important factor to consider is that in 2005 there was no planned spill at the fish transportation projects, however, involuntary spill did occur during May. This, coupled with the fact that hatcheries released fish approximately two weeks early because of decreasing river flows, resulted in a relatively high proportion of juvenile migrants passing in-river during periods of spill. Given the variability in involuntary spill at Snake River projects over the years, the proportion of the subyearling fall Chinook population that would have migrated past LGR during spill for migration years 2001 to 2007 (Table 2) was estimated. These estimates are based on the daily passage indices and the daily average spill volumes at LGR. Of the migration years that would be returning to LGR in 2007 (MY 2002-2007), migration years 2005, 2006, and 2007 had the highest percent of subyearling Chinook passing LGR during spill and the highest average percent spill during times of fish passage (Table 2). This is mostly due to the addition of voluntary summer spill during these years. It is worth noting that the percent of subyearling Chinook juveniles passing LGR during spill in 2005 may have been more similar to that seen in 2001, had there not been involuntary spill in May and early June and voluntary spill in the summer.

Table 2. Percent of subyearling Chinook passing Lower Granite Dam during spill and average percent spill when fish are passing during spill (2001-2007).

Migration Year	Percent Passing LGR During Spill	Average Percent Spill When Fish Passing LGR Through Spill
2001	0.45	11.65
2002	48.75	32.68
2003	53.89	28.47
2004	16.65	20.58
2005	66.62	43.91
2006	99.17	42.91
2007	96.87	42.63

As a result of summer spill, a smaller proportion of subyearling Chinook were transported in recent years (Table 3). In 2006 the lowest proportion of subyearlings were transported in any of the recent years. While 2005 was lower than other years, it was still a relatively high proportion transported, due to the lack of planned spring spill in that year. As stated earlier with the increase in spill there has been an increase in reach survival in subyearling Chinook. So the combination of decreased transportation, and increased in-river survival could yield overall increases in the numbers of juvenile subyearling Chinook surviving to ocean entry. This is one possible source of increased adult returns in 2007.

Table 3. Comparison of the 2006 estimate of the proportion of Snake River Basin smolt population in Lower Granite Dam forebay that are "destined for transportation" and the corresponding estimates from 1999 to 2005.

Species-age group	Transport Proportion							
	2006	2005	2004	2003	2002	2001	2000	1999
Subyearling Chinook	0.521 (H) 0. 562(W)	0.809	0.972	0.895	0.929	0.962	0.93	0.870

3. Hatchery production releases

Over the past seven years, production releases of Snake River fall Chinook (above LGR) have ranged from 1.93 to 4.25 million (Figure 5). Migration years 2005 and 2006 had the highest production releases of Snake River fall Chinook (above LGR) over the past 7 years, with 4.25 million released in 2005 and 3.83 million released in 2006, while 2004 had one of the lowest hatchery releases. Juveniles from the 2004 and 2005 releases would be making the largest contribution to the adult returns. However, without smolt to adult return rates for each cohort it is impossible to assess at this time what contribution the increased hatchery release may be making to the 2007 return.

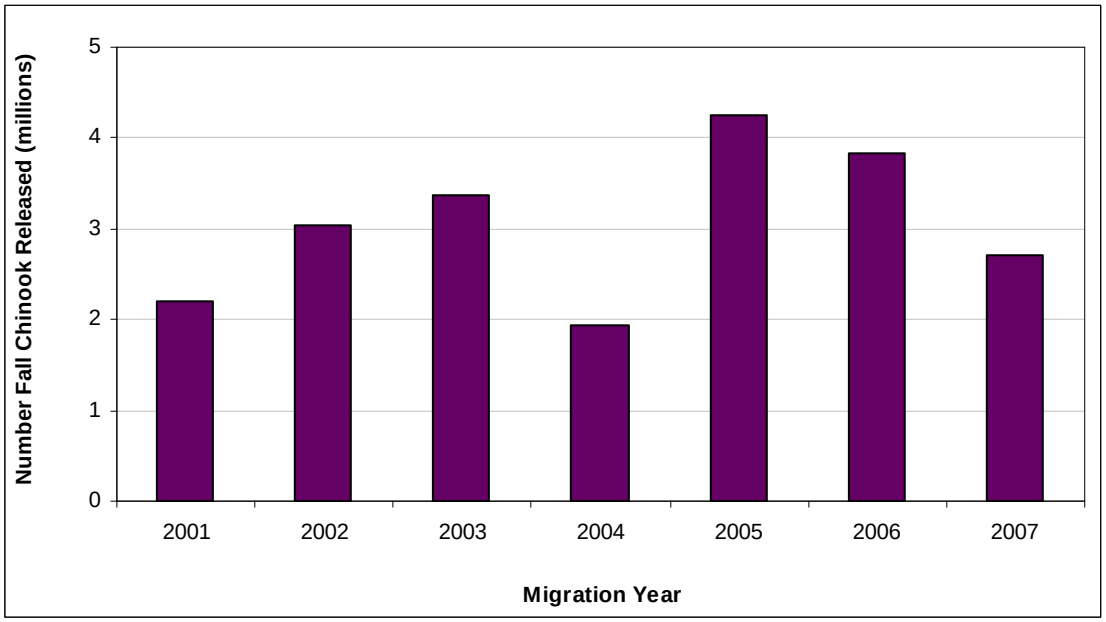


Figure 5. Production releases of fall Chinook to the Snake above LGR.

B. Hanford Reach juvenile fall Chinook migration conditions

A summary of the Hanford Reach fall Chinook population by age from 1997 through 2006 is provided in Table 4. From this table it can be seen that between the years 1997 and 2006, the majority of returning URB fall Chinook adults in the Hanford reach are age 4 and age 5. Although the 2007 age class breakdown is not yet available, it can be assumed based on Table 4, that the majority of Hanford URB adults returning in 2007 were age 4 and age 5. Returning age 4 and age 5 adults in 2007 would have spawned in 2002 and 2003 and would have out-migrated in 2003 and 2004.

Table 4. Annual Hanford Reach URB fall Chinook escapement by age (%), 1997 - 2006[1].

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
2006	6.0	7.4	34.3	51.0	1.1	0.2
2005	0.9	10.9	55.2	31.9	1.1	
2004	1.3	13.6	20.7	61.8	2.2	
2003	1.4	5.1	54.8	38.6	0.1	
2002	1.2	16.2	60.5	22.1	0.1	
2001	5.8	21.0	50.9	21.0	1.3	
2000	3.2	7.4	36.1	53.3	0.0	
1999	3.2	12.3	65.8	17.5	1.3	
1998	1.8	18.6	13.1	65.6	1.0	
1997	1.1	2.9	64.0	31.8	0.2	
Mean	**2.2**	**12.0**	**46.8**	**38.2**	**0.8**	

1. Flow

Mid and Lower Columbia flow conditions during the 2003 and 2004 out-migration are presented in Table 5. From Table 5, the 2003 out-migration year appeared to be a slightly better flow year than 2004 during the spring Biological Opinion flow period. At McNary Dam and Priest Rapids Dam, flows just exceeded the Spring Biological Opinion targets in 2003. In 2004, flows averaged just under the Spring Biological Opinion targets. In both 2003 and 2004, summer flows were significantly below the Summer Biological Opinion objectives. In fact, the summer flows during 2003 and 2004 were the lowest in the 13 years presented, with the exception of the 2001 drought year.

It appears that average spring flows were not exceptionally low during either the 2003 or 2004 out-migration years. Average spring flows in 2004 were less than the Biological Opinion flow targets in both the middle and lower Columbia River, however average spring flows in 2004 were not excessively below the flow spring target. Summer flows during both the 2003 and 2004 out-migration years were significantly below the Summer Biological Opinion objectives and the lowest in the 13 years presented, with the exception of the 2001 drought year. Based on all of this information, it appears that excessively lows summer flows below the Hanford Reach during the out-migration years of 2003 and 2004 may have contributed to low adult returns seen in 2007.

[1] Table from Assessment of Losses of Juvenile Fall Chinook in the Hanford Reach of the Columbia River in relation to Flow Fluctuations, Hoffarth, P., et.al. June 30, 2007.

Table 5. Spring and Summer Biological Opinion flow objectives at McNary Dam, and Priest Rapids Dam (spring only) from 1995 to 2007 as well as actual average seasonal flows at each project. Values in bold indicate that the seasonal flow objective was met.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
McNary													
Spring Objective	**249.0**	**260.0**	**260.0**	**228.0**	**260.0**	260.0	220.0	**246.0**	**220.0**	220.0	220.0	**260.0**	**237.0**
Spring Average	**253.0**	**357.1**	**463.5**	**287.8**	**303.6**	243.4	123.9	**269.3**	**231.4**	203.2	195.7	**325.4**	**239.2**
Summer Objective	200.0	**200.0**	**200.0**	200.0	**200.0**	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0
Summer Average	164.7	**214.5**	**236.6**	169.7	**228.2**	153.6	90.9	190.9	135.5	133.7	165.1	166.5	166.3
Priest Rapids													
Spring Objective	*Na*	*Na*	*Na*	*Na*	**135.0**	**135.0**	135.0	**135.0**	**135.0**	135.0	135.0	**135.0**	**135.0**
Spring Average	*Na*	*Na*	*Na*	*Na*	**169.6**	**158.1**	76.7	**180.6**	**141.4**	126.7	122.7	**191.3**	**168.6**

2. Spill

Figure 6 displays the percentage of Hanford Wild Chinook passing McNary during McNary spill and the average percentage spill at McNary experienced by fish passing McNary during spill. Figure 6 shows that over the years of 2003 and 2004 at least 70% of Hanford Wild Chinook passed McNary Dam during periods of spill between April 1 and August 31; in 2005, all (100%) of Wild Hanford Chinook passing McNary Dam by August 31st passed during spill at McNary. Figure 6 also shows that the percentage of spill experienced by fish passing McNary Dam during period of spill has increased in the latest years.

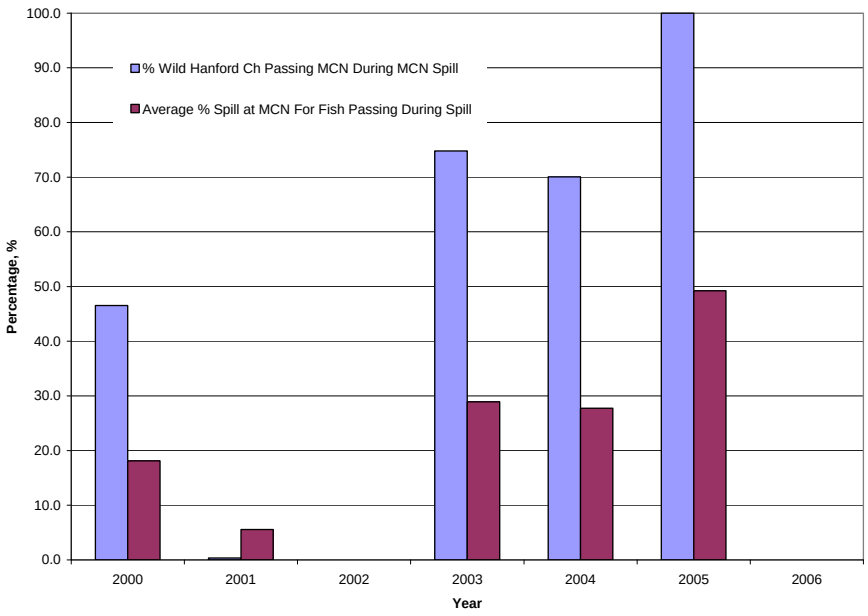


Figure 6. Percentage of Hanford Wild Chinook passing McNary Dam during spill and the average percentage spill at McNary experienced by fish passing McNary during Spill, between April 1 and August 31. Note: No passage data were available during 2002 and 2006.

During the years of 2003 and 2004 at least 70% of Hanford Wild Chinook passed McNary Dam during periods of spill between April 1 and August 31. From this information, it does not appear that spill conditions below the Hanford Reach can easily explain why the Hanford fall Chinook that out-migrated during the years of 2003 and 2004 did not return well in 2007.

3. Hatchery production Releases

The majority of fall Chinook released into the Mid-Columbia (McNary Dam to Chief Joseph Dam) are released from Priest Rapids Hatchery, Ringold Hatchery, and several hatcheries on the Yakima River. Over the past seven years, releases of fall Chinook from these hatcheries have been fairly consistent, ranging from 10.91 to 12.2 million, with the exception of 2006 (Figure 7). Due to disease, Ringold Hatchery was only able to release a small fraction of their fall Chinook juveniles in 2006. This resulted in the smallest total release (8.88 million) of fall Chinook to the Mid-Columbia since 1993.

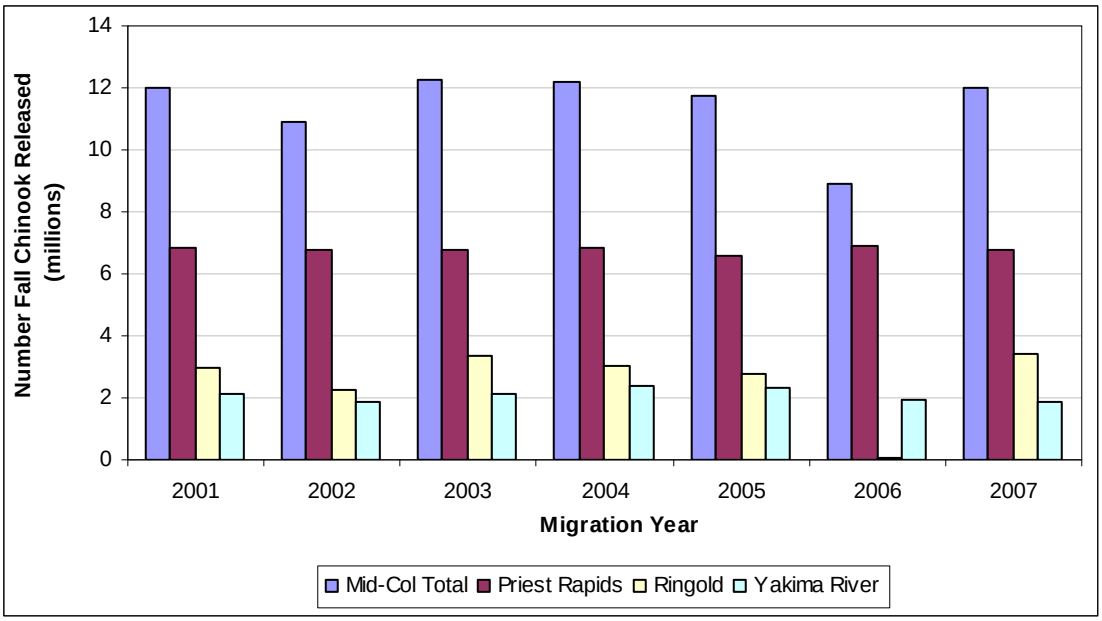


Figure 7. Production releases of fall Chinook to the Mid-Columbia (Priest Rapids Hatchery, Ringold Hatchery, and Yakima River Releases) (2001 to 2007).

4. Other Factors for Hanford Reach Fall Chinook

Table 6 shows fall Chinook escapement in the Hanford Reach from 1964 through 2006. Table 6 shows that adult fall Chinook escapement in the Hanford Reach in 2002 and 2003 was very good. In fact, adult fall Chinook escapement in the Hanford Reach in 2003 was the highest recorded between 1964 and 2006. Table 7 shows a calculation of the 2002-2007 fall Chinook salmon fry production estimate for the Hanford Reach of the Columbia River by year of emergence. Again, both the emergence years of 2003 and 2004 (spawning years of 2002 and 2003) appear to be good fry years, with emergence year 2004 (spawning year 2003) especially high.

Table 6. Escapement estimates for fall Chinook in the Hanford Reach, 1964 - 2006[2].

Year	Adult	Jack	Total		Year	Adult		Year	Adult
2006	47,095	4,606	51,701		1990	40,117		1974	25,847
2005	64,355	7,612	71,967		1989	65,913		1973	33,044
2004	79,464	8,231	87,695		1988	74,034		1972	26,749
2003	89,322	11,533	100,855		1987	88,762		1971	31,398
2002	69,342	15,167	84,509		1986	72,559		1970	26,730
2001	44,140	15,708	59,848		1985	65,796		1969	34,939
2000	36,027	11,993	48,020		1984	41,982		1968	24,067
1999	27,012	2,800	29,812		1983	36,022		1967	23,188
1998	29,410	5,983	35,393		1982	20,543		1966	28,079
1997	34,007	9,486	43,493		1981	15,115		1965	24,360
1996	37,548	5,701	43,249		1980	21,861		1964	24,048
1995	38,381	16,827	55,208		1979	23,558			
1994	48,857	14,246	63,103		1978	20,578			
1993	30,650	6,697	37,347		1977	31,527			
1992	29,449	12,503	41,952		1976	21,140			
1991	31,971	20,225	52,196		1975	22,242			

Table 7. Calculation of the 2002-2007 fall Chinook salmon fry production estimate for the Hanford Reach of the Columbia River by year of emergence.

	2007	2006	2005	2004	2003	2002
Fall Chinook Salmon fry Production (Mean of two estimates in Table 3[3])	19,407,569	28,509,720	30,358,531	38,971,487	23,580,149	16,538,513

The following discussion addresses the river conditions that Hanford fall Chinook returning in 2007 experienced while rearing and out-migrating in 2003 and 2004.

In 1999, an Interim Protection Program was developed and implemented on a trial basis in an attempt to safeguard rearing juvenile fall Chinook salmon in the Hanford Reach. In 1999, the program set operational constraints on flow fluctuations in the Hanford Reach during the fall Chinook salmon emergence and rearing period. From 1999 to 2003 the Hanford Reach Stranding Policy Group met annually to develop and refine an interim protection plan to protect emergent and rearing juvenile fall Chinook salmon in the Hanford Reach. In 2004, a comprehensive plan to enhance fall Chinook survival was established by Grant County PUD and approved by WDFW and NOAA Fisheries. The Hanford Reach Fall Chinook Protection

[2] Table from Assessment of Losses of Juvenile Fall Chinook in the Hanford Reach of the Columbia River in relation to Flow Fluctuations, Hoffarth, P., et.al. June 30, 2007.

[3] Table derived from Table 3 in Assessment of Losses of Juvenile Fall Chinook in the Hanford Reach of the Columbia River in relation to Flow Fluctuations, Hoffarth, P., et.al. June 30, 2007.

Program Agreement (HRFCPP) included all protection measures covered under the Vernita Bar Agreement and included additional provisions to improve survival of juvenile fall Chinook after emergence. Parties to the agreement included GCPUD, BPA, NOAA Fisheries, WDFW, USFWS, Confederated Tribes of the Yakama Indian Nation, and the Colville Confederated Tribes. It is also important to note that out-migration year 2003 was before the 2004 comprehensive plan to enhance fall Chinook survival.

According to "Assessment of Losses of Juvenile Fall Chinook in the Hanford Reach of the Columbia River in Relation to Flow Fluctuations" by Hoffarth, P., et.al June 30, 2007, escapement data (Table 8) suggests that the effects of flow fluctuations on the population of fall Chinook fry inhabiting the Hanford Reach over the past several years was greatest in 2003, with a high percentage of entrapments having Chinook present during emergence and a high number of Chinook per entrapment. It should be pointed out that entrapment monitoring did not begin until well after the estimated emergence in all years and this was especially true for the 2004 field season.

Table 8. Comparison of overall entrapments with Chinook and mean number of Chinook per entrapment in the Hanford reach, 2003-2007. Weekly time periods varied from year to year[4].

Entrapments w/ Chinook (%)				Chinook per Entrapment			
2007	2005	2004	2003	2007	2005	2004	2003
5%	18%	12%	18%	2.3	13.4	7.1	35.5

From the above information (Table 8), it appears that the fall Chinook salmon fry that emerged in 2003 had a high percentage of entrapments having Chinook present during emergence and a high number of Chinook per entrapment. Compared to 2003, fall Chinook emerging in 2004 had a smaller percentage of entrapments with Chinook and far fewer Chinook per entrapment.

From this simple analysis, it does appear to be a possibility that increased entrapments in the Hanford Reach containing Chinook and increased numbers of Chinook per entrapment in migration year 2003 may have contributed to a reduced adult return in 2007. Also, out-migration year 2003 was before the 2004 comprehensive plan to enhance fall Chinook survival. The out-migrants from 2003 would be age-5 Chinook; it will be interesting to compare the 2007 age-class breakdown to other years when this information is available.

C. Spring Creek hatchery Juvenile Fall Chinook migration conditions

The Spring Creek Hatchery returns (Figure 8) show the same pattern as the adult return as a whole presented previously in Figure 1. Based on past years' data the Spring Creek Hatchery return in 2007 would come primarily from juveniles that migrated in 2004 and 2005.

[4] Table derived from Table 32 in Assessment of Losses of Juvenile Fall Chinook in the Hanford Reach of the Columbia River in relation to Flow Fluctuations, Hoffarth, P., et.al. June 30, 2007.

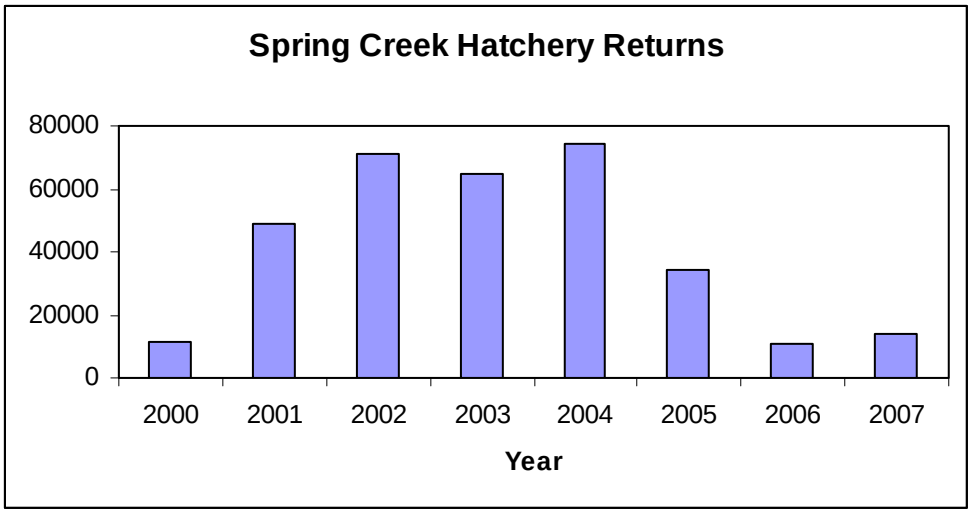


Figure 8. Spring Creek Hatchery returns by year.

1. Flow

The flow experienced by the Spring Creek Hatchery release at Bonneville Dam would be similar to the spring flows observed for spring of 2004 and 2005. The spring flows did not achieve the Biological Opinion flow objectives in either year, but the average floes were not that much less than the objectives.

2. Spill

Spring Creek hatchery releases millions of tule fall Chinook juveniles into the Bonneville Pool, typically in March, April, and May of each year. The March release typically represents approximately 50% of the overall release from Spring Creek Hatchery and accounts for approximately 46% of the adult returns. Prior to 2004, spill was provided at Bonneville Dam for the March release from the hatchery. In March 2004, the U.S. Fish and Wildlife Service (FWS) released over 220,000 subyearling fall Chinook from Spring Creek NFH with coded wire tags (CWT) to evaluate smolt-to-adult return rates (SAR) back to the hatchery under two operations at Bonneville Dam. Tagged fish were released in two groups: one group released during four days of spill operation at Bonneville Dam and one group released during four days of corner collector operation at Bonneville Dam.

In past years (2002-2004), the vast majority (75-94%) of Spring Creek fall Chinook migrated past Bonneville Dam during periods of full spill (Table 9). However, in more recent years (2005-2007), spill has not been provided for the March release (Figure 8). During these years, only corner collector operation has been provided for the March releases. It is worth noting that, even though there was a higher total spill volume in March 2007 (Figure 8), the higher spill volume occurred well after the March Spring Creek releases passed Bonneville Dam.

Table 9. Percent of tule fall Chinook from Spring Creek Hatchery that passed Bonneville Dam during times of full spill (2001-2007).

Migration Year	Total Spring Creek Release	Percent Passing Bonneville Dam During Spill
2001	10,569,810	50.3
2002	16,117,906	94.7
2003	15,079,904	100.0
2004	14,653,529	75.1
2005	14,533,488	49.4
2006	15,239,054	50.2
2007	15,472,563	49.8

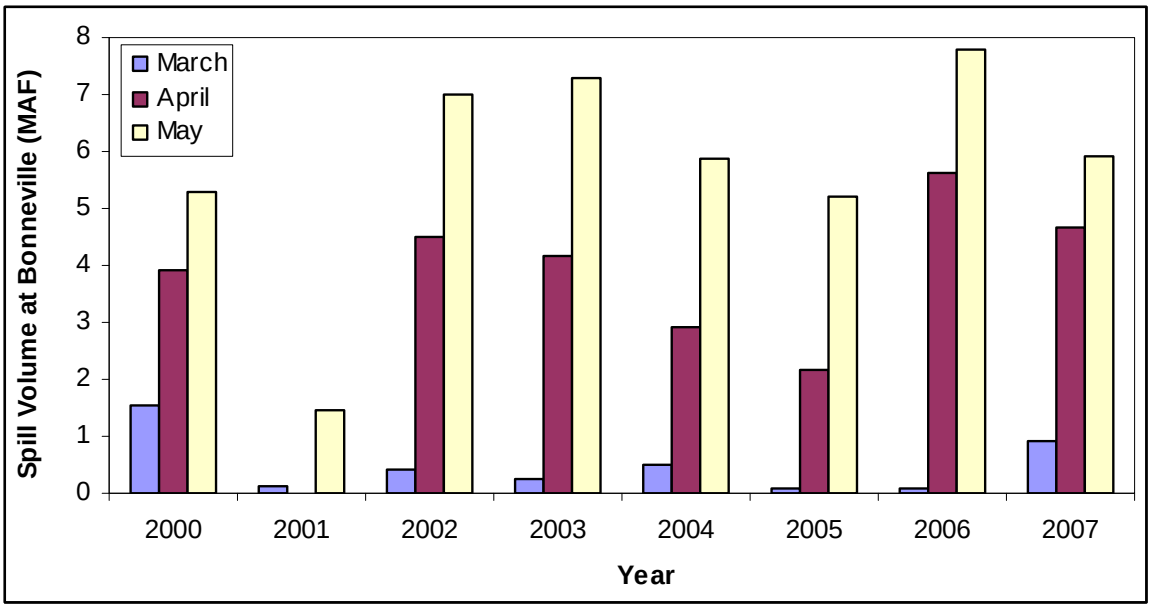


Figure 8. Monthly (March, April, and May) spill volume at Bonneville Dam during months of Spring Creek Hatchery releases of fall Chinook (2000-2007).

3. Production

A significant portion of the total fall Chinook production releases into the Columbia River Basin occurs from Spring Creek Hatchery in the Bonneville Dam pool. Spring Creek Hatchery releases fall Chinook tules in March, April, and May of each year. Over the past seven years, these releases have ranged from 10.57 million in 2001 to 16.12 million in 2002 (Figure 8). Recent years (2005-2007) have seen a slight increase in the total fall Chinook released from Spring Creek Hatchery

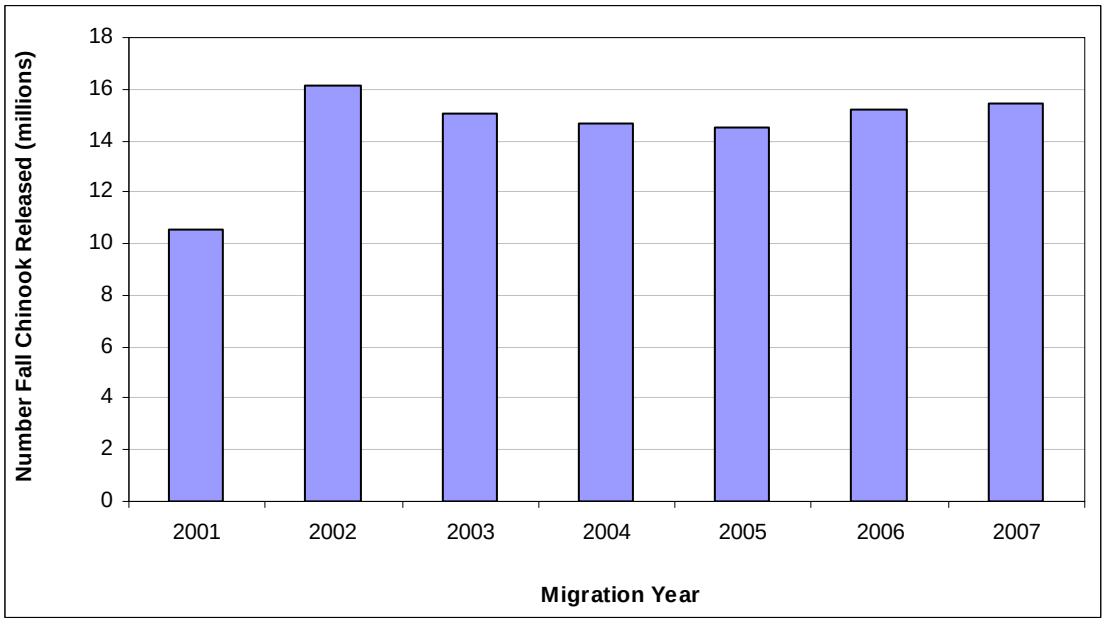


Figure 9. Production releases of fall Chinook to the Bonneville Pool (Spring Creek Hatchery) (2001 to 2007).

In summary, we cannot positively identify any one factor that at this time can explain the 2007 trends in the return of adult fall Chinook to the Columbia Basin. We have tempted to identify the factors that characterized the juvenile migration conditions for these years to determine if any particular differences in migration conditions could be established. As more information becomes available for the cohorts identified and as more adult data becomes available under varying migration conditions, better explanations may be possible.

To end on a positive note, the 2007 fall Chinook jack return to Bonneville Dam and to Lower Granite Dam have far exceeded the ten year averages. In fact, the jack count at Lower Granite Dam is almost double the ten year average. The higher jack return from the 2006 juvenile fall Chinook migration may be an early indication of good out-migration conditions occurring in 2006, particularly in the Snake River.