FISH PASSAGE CENTER

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MEMORANDUM

TO: Rob Lothrop, CRITFC
Bill Tweit, WDFW

Michele DeHart

FROM: Michele DeHart

DATE: April 6, 2004

RE: Transportation of fall chinook smolts and related fall chinook migration and tag data concerning summer spill for fish passage

In response to your request for smolt to adult return rates on transported fall chinook the Fish Passage Center staff reviewed and analyzed the available PIT tag data. We calculated smolt-to-adult returns for transported and non-transported fall chinook from the Snake and Columbia rivers. This analysis of transported versus in-river migrating smolt-to-adult returns is preliminary; NOAA Fisheries staff will conduct the official analysis.

Our review resulted in several observations about fall chinook migrations, in addition to the smolt-to-adult returns, that relate directly to the present discussions regarding summer spill for fish passage. Thus far all of the discussions surrounding summer spill have centered on the BPA SIMPAS model analysis of average conditions with point estimates of juvenile passage data. The data we reviewed, such as actual adult return PIT tag data was not recognized or considered.

We have summarized our conclusions below, followed by a detailed discussion of each point. These data suggest that the benefits of summer spill for fish passage have been underestimated in deliberations thus far and that a decision to eliminate summer spill carries a significant risk of being in error, particularly in regard to impact on returning adults and assumptions regarding the benefits of the transportation. In accord with our normal FPC procedures, copies of this memorandum responding to your data request have been circulated to other CBFWA members and posted on the FPC web site.

- Smolt-to-adult return rates for transported fall chinook indicate that a spread the risk policy such as that implemented for spring chinook should be considered for fall chinook. The adult return data indicates that the best returns occurred when spill occurred at McNary throughout the summer period. The fall chinook SARs on transported fish are disappointing and may not achieve the recovery goals assumed in the 2000 BIOP. This will affect the analysis of impacts of the summer spill program modifications because a spread the risk policy will result in a larger proportion of Snake River fall chinook migrating in-river. The SIMPAS analysis conducted to date did not examine the impacts of discontinuing summer spill with the implementation of a spread the risk policy for transportation.

- PIT tagged adult fall chinook actual returns from 1994 through 2001, that were detected as juveniles, indicate that a large proportion of the fall chinook that survived to return as adults migrated, as juveniles, past Ice Harbor in late July and August and past McNary in August. This indicates that the SIMPAS predictions of impact on adult returns should be regarded with caution because the juvenile passage distribution assumed in BPA's analysis does not reflect actual adult return data and does not provide a robust basis for decisions. Spill may be much more important to adult returns than inferred from juvenile modeling data.
- Review of the data and research results indicates that there is a flow survival and flow travel time relationship for fall chinook. Analysis of alternative management scenarios and mitigation offsets have not considered or utilized this information. Low flow conditions will shift the passage distribution to later in the migration. SIMPAS analysis of average conditions does not capture this effect because it does not vary flow nor does it relate flow to passage distribution. Elimination of spill in August as discussed by BPA will affect a larger proportion of the migration in low flow years than estimated with their model.
- Our review of the data shows that a comprehensive system wide life cycle monitoring program is needed for fall chinook. We have developed an outline of a PIT tagging monitoring program that would assist the agencies and tribes in deliberations of mitigation and protection hydrosystem actions needed for fall chinook.

Fall chinook smolt-to-adult returns

<u>Smolt-to-Adult return rates (SARs) of subyearling fall chinook for comparing in-river versus transportation migration routes based on available regional PIT tag data.</u>

The PIT tag data available for subyearling fall chinook originating in the Snake River basin above Lower Granite Dam consists of wild fall chinook PIT tagged in the mainstem Snake and Clearwater river above Lewiston and hatchery fall chinook PIT tagged for the supplementation releases made at and near the Pittsburg Landing, Captain Johns Rapids, and Big Canyon Creek acclimation ponds over the years 1995 to 2001. Typically, over 95% of the PIT tagged subyearling fall chinook are hatchery fish. Because the goals of these PIT tag studies required keeping the fish in-river, there were low numbers of PIT tagged subyearling chinook routed to transportation until 2001 when NMFS began a multi-year transport evaluation.

Until the NMFS transportation study, most PIT tagged subyearling fall chinook in the Snake River basin have been purposely returned-to-river for in-river survival estimation. Only PIT tagged fish arriving the transportation sites during the standard timed subsamples were being transported. Consequently, prior to 2001 the sample size for this group was very small. Therefore, for this analysis all PIT tagged smolt detected in the raceways or sample rooms, regardless of prior detection at an upstream dam, were combined to create the transportation category. Fish first-time detected at Little Goose Dam and either transported at Little Goose or returned to river and then transported at Lower Monumental Dam were converted to Lower Granite Dam equivalents by dividing by the CJS survival estimate (derived from the Cormack Jolly Seber Model) between Lower Granite tailrace and Little Goose tailrace. Likewise for first-time detected fish at Lower Monumental Dam, the smolt numbers transported were expressed in Lower Granite Dam equivalents. The sum of all PIT tagged smolts from the four transportation sites expressed in Lower Granite Dam equivalents determined the initial juvenile sample size used in the development of smolt to adult return rates.

The in-river PIT tagged subyearling fall chinook with first-time detections at Lower Granite, Little Goose, Lower Monumental, or McNary dams were each divided by the reach survival component to create the total smolts in Lower Granite Dam equivalents. Because the number of PIT tagged smolts with a detection at a transportation site is a known count, and the number of PIT tagged smolts transported or returned-to-river at each sites is a known count, the only estimation required is the expansion to Lower Granite equivalent and this is done similarly for both in-river and transported fish. This make the comparison of the transported category termed T in Figure 1 and the in-river category termed C1 in Figure 1 the most direct comparison between the two modes of migration through the hydro system. With the exception of one year (1998) the SARs for the in-river fish exceeded the survival of transported fish. While this trend was consistent among years, the low sample sizes for transported fish prior to 2001 must be considered. The most conservative conclusion from the present data is that there appears little difference between PIT tagged subyearling chinook transported or bypassed at collector dams.

The in-river PIT tagged subyearling fall chinook that most closely relates to the untagged population is termed C0 in Table 1. This group must be estimated by first determining the population at Lower Granite Dam and then subtracting off all first-time detected fish at Lower Granite, Little Goose, Lower Monumental, and McNary dams, with numbers from each site divided by the appropriate survival component to create a result in Lower Granite Dam equivalents. The highest SAR for the C0 category occurred for migration year 1999 which had no PIT tagged fish overwintering until the following year. The very high flows of 1999 that extended into the mid-July of that year, and associated spill, may have allowed many subyearling chinook to pass undetected that year under good in-river conditions. The SAR of C0 category subyearling fall chinook appears to be higher than the SAR of either transported or bypassed subyearling migrants for the seven years of samples. A caveat to the above conclusion is a methodological issue with the C0 inriver group, which may require additional resolution. We found a possible discrepancy between CJS estimates of collection efficiency, and FGEs reported in the 2000 FCRPS BiOp, which may affect numbers of smolts in the C0 group. The bypass FGE in Table D-2 of the 2000 FCRPS BiOp is 53% at Lower Granite Dam. With any spill at Lower Granite Dam during the last month of the spring spill program, ending June 20, the effective collection efficiency for subyearling chinook for the season would tend to be somewhat lower than the 53% FGE level. However, the CJS model for the aggregate subyearling chinook was greater than 53% in 4 of the 7 years investigated (0.66 in 1995; 0.63 in 1996; 0.41 in 1997; 0.47 in 1998; 0.43 in 1999; 0.56 in 2000; and 0.68 in 2001). This may lead to a bias in C0 estimated numbers of smolts being too low, and therefore, the SARs being too high. However, even if one were to double the C0 smolt, the SAR of C0 category subyearling fall chinook would still appear to be higher than the SARs of the other two categories in each year.

PIT tag detections systems in the Snake River end operation on October 31, and begin again the next spring. Consequently, fish passing during this period are not detected. However, for fall chinook smolts that overwintered and were detected only during the following year at one or more dams as a yearling, the SARs were over 1% in all cases where large enough smolt numbers were present to provide some adult returns (Table 2). Although these SARs are higher than that of their subyearling chinook counterpart, it is difficult to make a direct comparison because the number of smolts overwintering cannot be expanded to Lower Granite equivalents due to the lack of an overwintering estimate of survival. It appears that even after consideration of these holdover migrants little difference may still exist between transport and in-river survival during the following year since the raw SARs shown in Table 2 are fairly similar between categories.

NMFS began a transportation study at McNary Dam in 2001, but also had large numbers of PIT tagged subyearling fall chinook released in 1999 and 2000 for facility survival studies (Table 3). These latter PIT tagged fish were released in the gatewell for the test group and in the tailrace for the control group. Since most gatewell fish were return-to-river, there were only limited numbers of smolts transported. The SARs of the transported smolts were less than that of the in-river migrants, but these results may simply imply that no real difference occurs between the two categories. The partial returns of the full transportation study began in 2001, show that the SARs of the transported and in-river smolts, based on returning jacks and 2-salt adults, are the same. However, 3 and 4-year ocean fish from the 2001 outmigration are yet to return so complete SARs are not possible. But these trends are suggesting that transportation is likely not showing any benefit over in-river migration routes.

So in summary our preliminary review of fall chinook PIT tag data is not showing a benefit from transportation over in-river migration. Given this information it may prove more advantageous to the migrating fall chinook to adopt a spread the risk policy for fall chinook (similar to spring chinook) and adopt improved in-river migration strategies.

Table 1. Smolt-to-adult survival rates (SARs) from LGR-to-LGR for PIT tagged hatchery and wild subyearling fall chinook released in the mainstem Snake and Clearwater rivers above Lewiston, Idaho, within three categories of outmigration status.

Subyearling fall chinook migration year 1995
(includes 90 smolts partially outmigrating in 1996)

category	smolts	adults	SAR
C0	296	24	8.11%
C1	5,021	45	0.90%
T	1,338	10	0.75%
LGR pop.	**category#**	**%categories in pop.**	
7,049	6,655	94.4%	

Subyearling fall chinook migration year 1996
(includes 217 smolts partially outmigrating in 1997)

category	smolts	adults	SAR
C0	794	23	2.90%
C1	9,060	46	0.51%
T	1,105	4	0.36%
LGR pop.	**category#**	**%categories in pop.**	
11,232	10,959	97.6%	

Subyearling fall chinook migration year 1997
(includes 607 smolts partially outmigrating in 1998)

category	smolts	adults	SAR
C0	4,453	21	0.47%
C1	37,754	55	0.15%
T	2,831	4	0.14%
LGR pop.	**category#**	**%categories in pop.**	
45,803	45,038	98.3%	

Subyearling fall chinook migration year 1998
(includes 490 smolts partially outmigrating in 1999)

category	smolts	adults	SAR
C0	3,270	31	0.95%
C1	44,801	83	0.19%
T	2,174	9	0.41%
LGR pop.	**category#**	**%categories in pop.**	
50,400	50,245	99.7%	

Subyearling fall chinook migration year 1999
(no smolts outmigrated in 2000)

category	smolts	adults	SAR
C0	2,479	210	8.47%
C1	19,155	254	1.33%
T	2,428	21	0.86%
LGR pop.	**category#**	**%categories in pop.**	
24,280	24,062	99.1%	

Subyearling fall chinook migration year 2000
(includes 223 smolts partially outmigrating in 2001)

category	smolts	adults	SAR
C0	423	10	2.36%
C1	5,391	35	0.65%
T	919	6	0.65%
LGR pop.	**category#**	**%categories in pop.**	
6,832	6,733	98.6%	

Subyearling fall chinook migration year 2001
(only jacks and 2-salt available, approx 50% of return)
(includes 247 smolts partially outmigrating in 2002)

category	smolts	adults	SAR
C0	2,737	59	2.16%
C1	11,992	40	0.33%
T	30,596	57	0.19%
LGR pop.	**category#**	**%categories in pop.**	
45,621	45,325	99.4%	

Legend for categories (CJS survival estimates are used to convert smolt numbers to LGR equivalents)

C0	Undetected at 4 transport sites, but surviving to MCN tailrace
C1	Detected at one or more of 4 transport sites
T	Transported at one of 4 transport sites regardless of prior detection upstream

Table 2. Smolt-to-adult survival rates (SARs) for fall chinook completely holding over to migrate as yearlings for PIT tagged hatchery and wild subyearling fall chinook released in the mainstem Snake and Clearwater rivers above Lewiston, Idaho, within two categories of outmigration status.

Migration year 1995 fall chinook completely outmigrating in 1996 (66 smolts detected)

category	smolts	adults	SAR
C	54	0	0.0%
T	12	0	0.0%

Migration year 1996 fall chinook completely outmigrating in 1997 (436 smolts detected)

category	smolts	adults	SAR
C	375	5	1.3%
T	61	1	1.6%

Migration year 1997 fall chinook completely outmigrating in 1998 (814 smolts detected)

category	smolts	adults	SAR
C	733	9	1.2%
T	81	0	0.0%

Migration year 1998 fall chinook completely outmigrating in 1999 (862 smolts detected)

category	smolts	adults	SAR
C	817	27	3.3%
T	45	2	4.4%

Migration year 1999 fall chinook had no outmigrants detected in 2000 due to detection of old 400 kHz PIT tags.

Migration year 2000 fall chinook completely outmigrating in 2001 (504 smolts detected)

category	smolts	adults	SAR
C	467	8	1.7%
T	37	0	0.0%

Migration year 2001 fall chinook completely outmigrating in 2002 (1,049 smolts detected) (only jacks and 2-salt available, approx 50% of return)

category	smolts	adults	SAR
C	1,017	48	4.7%
T	32	2	6.3%

Legend for categories (no survival estimates available to convert smolt numbers of fish totally outmigrating as yearlings to LGR equivalents as subyearlings)

C	Detected at any of 7 dams with PIT tag detection capability totally in the year following the migration year
T	Transported at one of 4 transport sites regardless of prior detection upstream in the year following the migration year

Table 3. Smolt-to-adult survival rates (SARs) from McNary-to-Bonneville Dam for subyearling fall chinook PIT tagged and released from McNary Dam within two categories of outmigration status.

Subyearling fall chinook migration year 1999
(tagged fish released for gatewell or tailrace location)

Category	smolts	adults	SAR
C	45,880	83	0.18%
T	2,224	2	0.09%

Subyearling fall chinook migration year 2000
(tagged fish released for gatewell or tailrace location)

category	smolts	adults	SAR
C	48,862	257	0.53%
T	608	0	0.00%

Subyearling fall chinook migration year 2001
(tagged fish released for barge or river location)
(only jacks and 2-salt available, approx 50% of return)

category	smolts	adults	SAR
C	38,594	29	0.08%
T	23,196	18	0.08%

Legend for categories

C	McNary tailrace or river routed PIT tagged smolts
T	Gatewell fish detected on raceway/sample room routes on transportation days or fish routed to barge routed and not subsequently detected at a downstream dam

The importance of spill for fish passage in August
Fall chinook adult returns, migration timing as juveniles

Most of the analyses that have been conducted to date exploring the impact of eliminating spill in July and August have been based on a single set of conditions in the SIMPAS model using point estimates of juvenile data and average juvenile passage distribution data. We considered the available empirical data. We reviewed all of the adult PIT tagged fall chinook that were detected in the hydrosystem as juveniles and determined when they were observed in the hydrosystem as juveniles. This was done in order to understand the importance of spill for fish passage in August at Ice Harbor and in the Lower Columbia River.

The following tables show the proportion of adult PIT tagged fall chinook returns, which passed McNary and Lower Granite Dam in August versus July as juveniles. These tables show that a significant proportion of returning adults may pass the projects in August. In addition, with an average 15-day travel time from Lower Granite to Ice Harbor, the returning adult, juvenile data indicates that a large proportion of Snake River juvenile fall chinook that survive to adult pass through the lower Columbia River in August.

The adult data raises serious questions about the reliance upon the SIMPAS juvenile model analysis to predict impacts of changing summer spill for fish passage from the BiOp operations when the empirical data seems to suggest a more dramatic potential effect of terminating spill.

Table 4. Juvenile Passage Timing, at Lower Granite Dam of PIT tagged fall chinook, which survived to return as adults (see separately attached plots)

Year Juvenile Migration	Transported 6/20-7/31	Transported 8/1-8/31	In-River 6/20-7/31	In-River 8/1-8/31
1995	16.67%	16.67%	16.67%	36.67%
1996	0.00%	50.00%	12.20%	43.90%
1997	50.00%	0.00%	45.95%	21.62%
1998	80.00%	0.00%	38.00%	28.00%
1999	26.32%	68.42%	30.98%	26.63%
2000	0.00%	33.33%	39.13%	21.74%
2001	33.33%	17.95%	44.83%	31.03%

Table 5. Juvenile Passage Timing, at McNary Dam of PIT tagged fall chinook, which survived to return as adults (see separately attached plots)

Year Juvenile Migration	Transported 7/1-7/31	Transported 8/1-8/31	In-River 7/1-7/31	In-River 8/1-8/31
1995	0.00%	0.00%	10.53%	10.53%
1996	0.00%	0.00%	0.00%	50.00%
1997	0.00%	0.00%	38.46%	46.15%
1998	0.00%	50.00%	53.85%	46.15%
1999	0.00%	100.00%	17.07%	70.73%
2000	0.00%	0.00%	37.50%	37.50%
2001	50.00%	0.00%	16.67%	16.67%

The above data indicates that a significant proportion of returning adults may pass projects in August as juveniles. From the Table below, it is interesting to note that during years when a high percentage of returning adults passed McNary Dam as juveniles during August, spill and flow levels during August were also high in the Lower Columbia River. For example, in 1999, 70.73% of returning PIT tagged adults passed McNary dam in August as juveniles. Spill during August of 1999 was high across all Lower Columbia Projects (see table below), and McNary spilled throughout all of August. August flows were the highest (on average) between the years of 1995 and 2001 at McNary Dam.

	Bonneville August Spill Volume (Kaf)	The Dalles August Spill Volume (Kaf)	John Day August Spill Volume (Kaf)	McNary August Spill Volume (Kaf)	McNary August Average Flow (Kcfs)
1995	5059	4670	253	0	138.2
1996	5594	6143	2350	2072	183.3
1997	6563	7621	2533	2862	198.4
1998	5276	4096	2659	317	142.1
1999	5403	7876	3678	3382	208.5
2000	5464	3351	3067	320	140.4
2001	2396	2025	0	0	96.8

Flow and passage distribution and predicted impacts

Elimination of summer spill could be especially detrimental to fall chinook during low flow years, when the subyearling migration is shifted later into the summer. Because BPA did not analyze this scenario, their estimated adult impacts would be underestimated. Juvenile fall chinook passage data shows that passage distribution is affected by flow. The agencies and tribes recent comments on the BPA summer spill analysis (State, Federal and Tribal Fishery Agencies Joint Technical Staff Memorandum, 2/20/04) illustrated the shift in passage timing relative to migration flow level. The BPA summer spill analysis using SIMPAS was done only for average flow conditions. However, the SIMPAS predicted impacts of eliminating summer spill will be highly influenced by the passage timing distribution utilized in the analysis. The following analysis utilizing the SIMPAS model incorporates a passage distribution that could be expected based upon historical data under low flow conditions. This illustrates the range of potential adult impacts that could be expected.

1) Reach Survival Estimates Using SIMPAS

Reach	BiOp Operation	No Spill Operation	Difference
IHR to Bon	26.4%	15.9%	**12.0%**
MCN to Bon	30.0%	19.8%	**11.6%**
JDA to Bon	44.6%	32.0%	**13.0%**
Tda to Bon	69.4%	56.2%	**14.0%**
Bon to Tailrace	82.4%	74.6%	**8.2%**

In our analysis a 4% increase in pool mortality is assumed. The 2000 BiOp assumed a 5% percent increase in pool survival if the RSW and other aggressive non-breach options were implemented. Therefore if spill, a primary route of passage, is removed it should result in a 4% increase especially under low flow conditions that occur in August. BPA in their SIMPAS analysis assumed 1% at JDA and IHR and 0.5% at Bonn and TDA, and no change at McNary. Other differences are sluiceway guidance at Bonneville Powerhouse II; we used 33% based on radio tag data, while 46% was used by BPA based on hydro acoustic, research results; we decreased survival through the sluiceway when no spill was present from 98% to 96.5%; nighttime spill at Bonneville was set at 125 kcfs in the BPA analysis where as we set it at closer to 145 kcfs; also we used NMFS information of 89% survival fro McNary bypass, BPA used 97%. We also included the assumption that transported fish survival is a constant through both operations. There are small changes in numbers throughout the model depending on which recent reports were used to update parameters.

2) Population Estimates for ESA Listed Fish Only

For estimating impacts to ESA listed fish, we assumed that 1.1 million fish collected at LWG and 50.9% are wild and that the FGE is .534. This results in a starting population at LWG of 1.05 million juveniles.

Using SIMPAS, fish were routed through the collection systems and removed for transportation, resulting in an estimated 8% of the juveniles survival to IHR with a spill operation and 7.0% under a no spill operation. This results in an estimated population between 83,535 and 80,713 would be the extreme difference on population respectively, depending on run timing of those fish.

3) Juvenile Run Time Estimate for Snake River Fish

Using migration timing data from the FPC, the range of SARs is 8% to 43%. (Attachment 1) With the assistance of FPC an estimate of between 8% and 25% of fish would still be above Bonneville after August 1. (Also Attachment 1)

4) Overall Impact to ESA Listed Fish

Using the above numbers and assuming an SAR of .1 (Bowes, 2004) the potential range of adult equivalent mortalities is **46 - 192 adults**. A portion of this number are fish that are passed McNary but have not passed Bonneville dam before August 1. BPA did not account for these fish, nor did they account for extra mortality for transported fish. For additional information on SAR assumptions refer to Bowes, 2004. Adult impacts due to fallback through turbines and bypass systems versus fallbacking through spillways have also not been incorporated into this analysis. Assuming that BPA correctly estimated that adult return for listed Snake River Species to be 2396 then a range of 46 to 192 listed adults would equate to a percent of 1.2% to 8% of this population.

Lastly Option C, which is now the federal proposal, includes a spill evaluation at Bonneville Dam of testing 50 kcfs spill 24 hours versus the BiOp operation. This equates to roughly a 1.8% survival reduction for Bonneville passage. No analysis on this impact to inriver migrants has been completed.

Recommended system wide fall chinook life cycle smolt-to-adult return monitoring program.

Our review shows that there is inadequate fall chinook smolt to adult return and life cycle data available to assess recovery and assessment of hydrosystem measures. We have proposed a marking program that encompasses stocks throughout the Columbia Basin. The rationale is to monitor survival rates to assess, protection, recovery, restoration measures.

Our review of the available PIT tag data on fall chinook surviving to adult and review of the juvenile data which was utilized to model predicted impact on adult returns of fall chinook clearly show that a systemwide smolt to adult return life-cycle evaluation program needs to be put into place in 2004. The following is an outline for a proposed fall chinook evaluation.

The evaluation is proposed over a six year time period, evaluating the Biological opinion flow and spill measures against the Bonneville Power Administration no spill measures including no summer spill in the Snake River and no spill for fish passage in August in the lower Columbia River. PIT tagging efforts need to be in place in 2004 to evaluate and monitor the action agencies no summer spill operation for 2004 through 2006. Then, when transmission issues are resolved, implementation of BiOp summer spill and flow measures and, in addition, spill at the Snake River Projects, and at McNary will be evaluated in 2007 through 2009.

Objectives:

- Estimates of smolt-to-adult return rates for transported versus in river migrating fall chinook during the action agencies no spill option.
- Estimates of smolt-to-adult return rates for transported versus in-river migrating fall chinook during the BiOp summer flow, spill, with spill at the Snake River projects and McNary Dam, evaluation period.
- Juvenile fall chinook reach survival estimates throughout both periods.
- Juvenile fall chinook passage distribution and passage timing at Snake River and Lower Columbia River projects for both evaluation periods.

Approximate numbers of PIT tagged Chinook Salmon Required to Estimate Juvenile to Adult Survival in the Snake/Columbia River Basin.

PIT tag quotas vary depending on where fishes are released or captured tagged and released in the basin. Normally, the further upstream or distance traveled in the river system will relate to greater mortality by the time it reaches the sampling site. In addition, subyearling chinook are more vulnerable to predation and other factors that tend to reduce juvenile survival through the hydrosystem. Tables are listed below for the different reaches that have hatcheries or wild salmon groups where representative groups of fish could be PIT tagged in the Columbia River basin.

From McNary Dam to Bonneville Dam, marking subyearling fall chinook (URBs) would require that an estimate could be completed at Bonneville Dam where possible. The key elements would be survival as juvenile fish to Bonneville and return as adult fish back to Bonneville Dam. Survival to adult fish would vary by year, but numbers normally be considered from 0.5% to 2% as a base return. Since there is no transportation involved, there is no requirement to achieve a minimum/maximum number of fish going the different routes of passage at a dam. The Bonneville and John Day Dam estimate for detection at the respective sampling site is set at 28% and 32%. The collection efficiency of the bypass system is simply the (1-spill proportion) times FGE, given the assumption of a 1:1 spill effectiveness.

Marking sites tentatively considered in this section of river are: Umatilla River hatchery and acclimation ponds, Klickitat Hatchery and Little White Salmon Hatchery. For wild subyearling fall chinook, the Deschutes River and John Day River would provide groups to assess survival from the upper end of this Reach to the Bonneville pool release groups.

Table. Estimated Number of PIT tagged fall chinook required to complete SARs for the Individual River basins (McNary Dam to Bonneville Dam Reach)

Hatchery	**# Juvenile chin PIT tagged**	**# Juvenile Chin at Bonneville Dam**
Umatilla	35,000	10,500
Thornhollow Pond (Umat)	35,000	10,500
Total Umatilla	**70,000**	**21,000**
Klickitat	50,000	20,000
Little White Salmon	40,000	20,000
Wild Fall Chinook		
Deschutes R	50,000	20,000
John Day R	Potential mark group	20,300

Note that SARs for the individual groups should equal about 200 adult fish per release area spread among 1 to 4 adult return years. In initial years the Wild fall chinook would be marked to assess migration timing to assure that they arrive at the dams when spill and best passage conditions exist in the hydro-system.

PIT tag quota for two major release groups of subyearling fall chinook from the Mid-Columbia or Hanford Reach have been calculated in past years to achieve detection rates at McNary Dam to achieve transportation/inriver groups of test fish. The hatchery of choice would be Priest Rapids Hatchery with the wild component from Hanford Reach. These groups will provide transport and inriver survival through the hydrosystem.

Table. Estimated number of subyearling fall chinook required to calculate SARS for the individual release groups of hatchery and wild fall chinook in the Mid-Columbia River. [Priest Rapids and Hanford Reach]

	# of Chin-PIT tagged	**# Inriver below McNary Dam**	**# of Trans. Required**
Hatchery Chinook			
Priest Rapids	150,000	43,000	43,000
Wild Chinook			
Hanford Reach	185,000	33,700	52,000

With no transportation required for these two groups, i.e., fish were placed directly back to the river at McNary Dam, about 80,000 fish from each release group (Priest Rapids and Hanford) could be PIT tagged to achieve SARs for the inriver migrants.

Table. Estimated number of subyearling fall chinook required to calculate SARS for the individual release groups of hatchery fall chinook in the Snake River Basin Recommended offset for elimination of spill

Hatchery	# of Chin-PIT tagged	# Inriver below LGR Dam	# of Trans. Required
Snake/Clearwater Acclim Ponds	350,000	80,000	32,000

These groups of subyearling fall chinook would be used to evaluate smolt-to-adult survival rates (SARs) for transported and inriver migrants. In addition, this will provide information on inriver survival and timing through the hydrosystem.

CC: FPAC
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Attachment 1

McNary Percent passage data is presented in Table 1. Also included is the proportion of fish in transit between McNary and Bonneville dams if spill were shut off either July 15 or August 1. We calculated wild origin subyearling chinook timing based on PIT-tag detections at McNary. Then used an average of 8 days travel time McNary to Bonneville Dam. Looking back at McNary to those fish that passed 8 days prior to the proposed shut off date provided the begin percent passage. Subtracting the begin percent from the end percent (the percent passage on the shutoff date) yielded the percent in transit. To calculate percent in transit between McNary and John Day and John Day and Bonneville I would recommend apportioning half of the in transit percentage to each reach.

Using passage timing of Wild Origin subyearling chinook in the Snake River basin we used Lower Monumental detections to develop passage timing expressed as a percent of all annual detections (excluding holdover fish). We then moved back 3 d at Lower Monumental to extrapolate the data for IHR (Table 2). In other words, a passage percentage of 11% at Ice Harbor on 7/15 would have passed Lower Monumental on 7/12 or 3 days earlier based on assumed 3 day travel time.

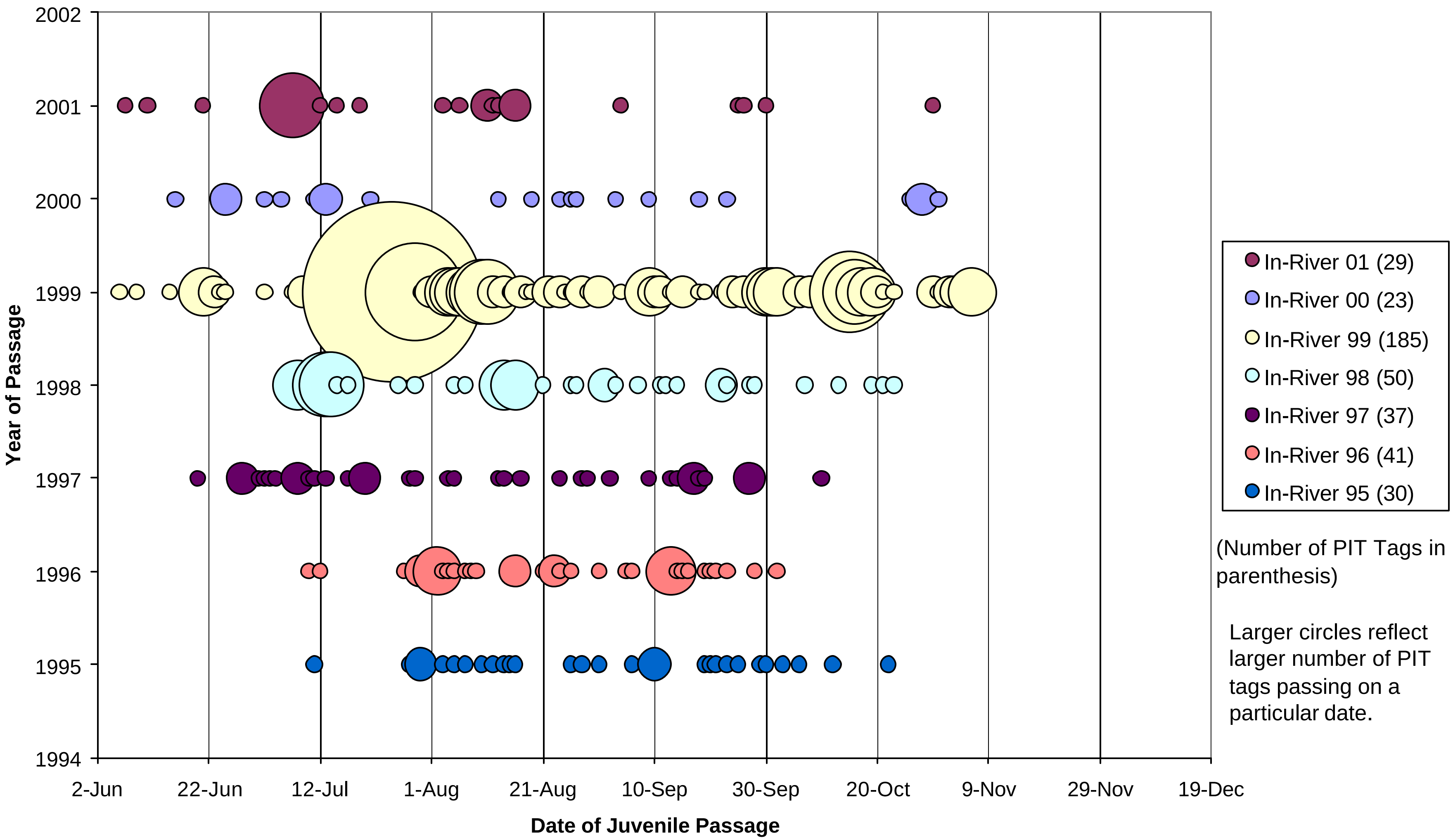
Table 1. Percent of Snake Origin Wild Subyearling chinook affected by End of Spill Operations in Lower Columbia.

	McNary Passage Percent		Percent Pop In Transit (between MCN and BON) at End of Spill	
Date	**7/15**	**8/1**	**If 7/15**	**If 8/1**
1998	41%	87%	13	25
1999	41%	60%	7	8
2000	79%	92%	13	8
2001	10%	57%	1	23
2002	52%	94%	22	16
2003	56%	85%	10	11

Table 2. Passage Timing at Ice Harbor dams for Wild Subyearling chinook based on 3-day Travel Time from LMN to IHR.

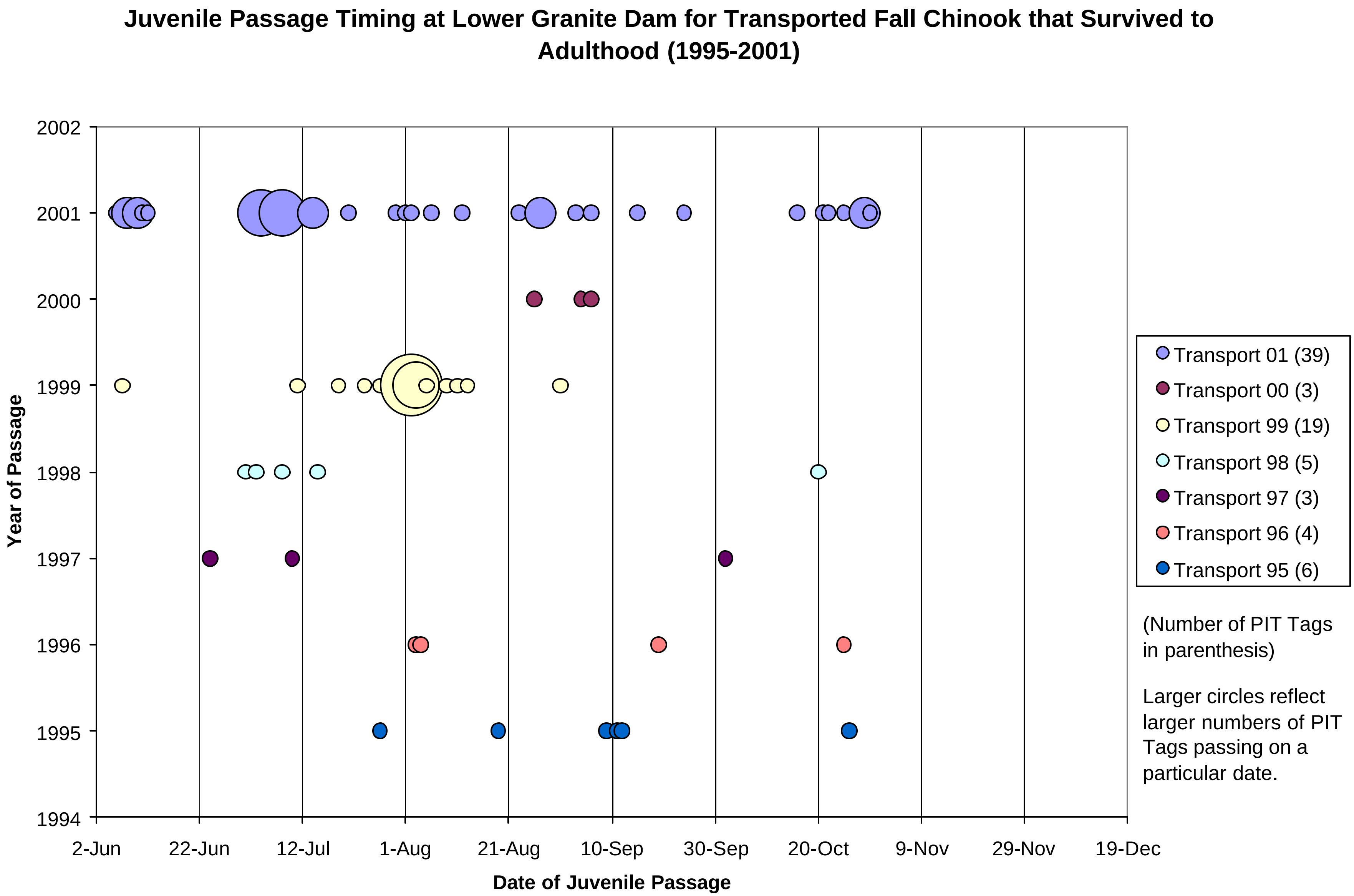
Date	**7/15**	**8/1**
1994	11%	41%
1995	5%	36%
1996	16%	53%
1997	44%	56%
1998	17%	82%
1999	47%	69%
2000	64%	76%
2001	7%	64%
2002	30%	89%
2003	55%	80%

Juvenile Passage Timing at Lower Granite Dam for In-River Fall Chinook that Survived to Adulthood (1995-2001)



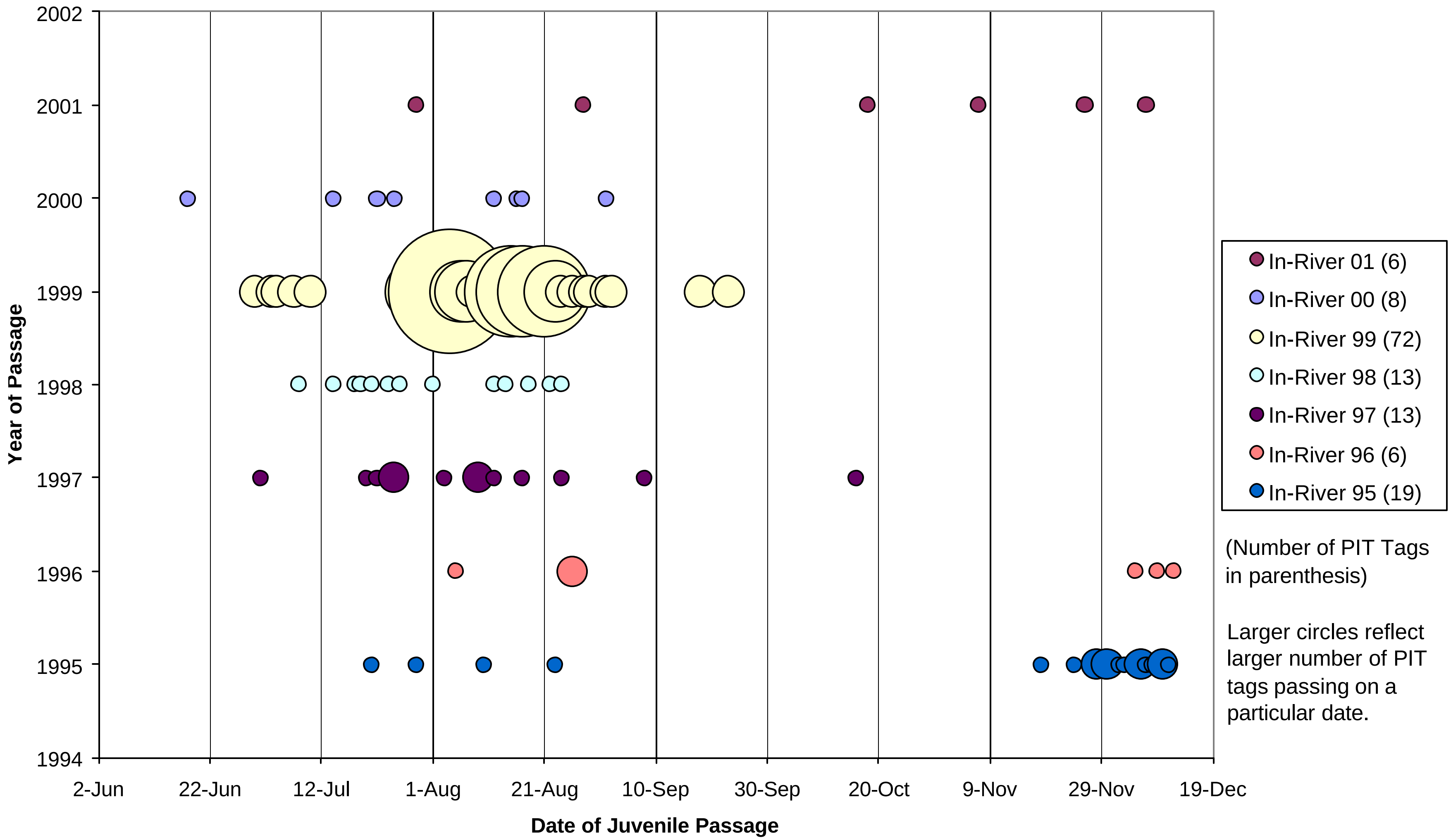
(Number of PIT Tags in parenthesis)

Larger circles reflect larger number of PIT tags passing on a particular date.



Juvenile Passage Timing at Lower Granite Dam for Transported Fall Chinook that Survived to Adulthood (1995-2001)
2002
2001
2000
1999
1998
1997
1996
1995
1994
Year of Passage
2-Jun
22-Jun
12-Jul
1-Aug
21-Aug
10-Sep
30-Sep
20-Oct
9-Nov
29-Nov
19-Dec
Date of Juvenile Passage
Transport 01 (39)
Transport 00 (3)
Transport 99 (19)
Transport 98 (5)
Transport 97 (3)
Transport 96 (4)
Transport 95 (6)
(Number of PIT Tags in parenthesis)
Larger circles reflect larger numbers of PIT Tags passing on a particular date.

Juvenile Passage Timing at McNary Dam for In-River Fall Chinook that Survived to Adulthood (1995-2001)



Juvenile Passage Timing at McNary Dam for Transported Fall Chinook that Survived to Adulthood (1995-2001)