

FISH PASSAGE CENTER

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MEMORANDUM

TO: Ron Boyce, ODFW

FROM: Michele DeHart

DATE: August 27, 2008

RE: Passage timing of juvenile subyearling Chinook above Lower Granite Dam

Per your request, the FPC has reviewed passage timing data of juvenile subyearling Chinook to Lower Granite Dam (LGR) in order to determine the proportion of juveniles out-migrating in August, particularly wild juveniles from the Snake and Clearwater Rivers. In the course of our review, it became apparent that the estimation of passage proportion using PIT-tags is likely biased by limitations associated with PIT-tag marking. Also passage timing of the run-at-large or unmarked subyearling Chinook population has been affected by management changes. The earlier timing of the run-at-large in recent years, which is increasingly dominated by hatchery origin fish, creates the impression that the wild fish timing has changed. However both the PIT-tag data and the run-at-large timing data introduce potentially large changes to and even biases in the passage data such that the wild fish run timing appears to be earlier in more recent years. However, the perception that subyearling Chinook timing is earlier must be considered in light of these potential biases so that management actions based on timing data, particularly the timing of wild fish out-migration, are not misinformed.

Limitations of PIT tag data

While PIT-tagged groups of wild subyearling Chinook provide information relative to the request, the subyearling Chinook PIT-tagging efforts have considerable limitations that need to be acknowledged and considered in the interpretation of these data.

- The majority of the available PIT-tag mark groups for wild populations are not designed to represent the entire passage distribution of the unmarked population. Consequently the PIT-tag mark group data presents a conservative representation of fish presence.
- Marking of wild subyearling Chinook is limited by several factors, including: 1) fish size at the time of marking, 2) availability of fish to mark, and 3) the environmental conditions during marking. As fish grow and mature they move from near shore areas and decrease in availability to beach seining techniques used for collection. In addition, as the migration season progresses water temperatures increase. This increase in water temperatures amplifies marking and handling affects and precludes the continuation of tagging. The combination of these factors may bias mark groups to the earlier segments of the passage distribution (i.e., fish that are larger earlier in the migration). Therefore, it is difficult to determine the portion of the run that is represented by the existing wild PIT-tagged subyearling Chinook.
- Detections of wild PIT-tagged subyearling Chinook at LGR in August are inherently dependent on when tagging and release of these individuals occurs. Individuals tagged earlier in the season will typically pass LGR earlier. Again, the available PIT-tag groups may be weighted to the earlier portion of the passage distribution.
- Not all hatchery and supplementation subyearling Chinook are marked. Unmarked supplementation and hatchery juveniles may be included in the wild PIT tag mark groups.

Management Changes

Significant management changes have occurred over the past several years that may influence the passage timing of juvenile subyearling Chinook above Lower Granite Dam. These management changes include:

- During the second half of the 1990's the decision was made to augment the wild Snake River population with supplementation subyearling Chinook. Numbers increased steadily and, beginning in 2000, supplementation fish dominated the juvenile subyearling Chinook migration. Furthermore, over the past six years, the releases of hatchery subyearling Chinook above LGR have occurred earlier and over a shorter period of time.
- The supplementation fish affected the timing and distribution of the run-at-large and possibly the wild population.
- The operation of Dworshak for flow and temperature control has changed over the past 13 years. Volume flow from Dworshak has decreased such that more water is used later in the summer. Temperature of released water has also decreased over the years.
- Spill for summer migrants in the Snake River was implemented beginning in 2005.

August passage of subyearling Chinook at Lower Granite

Review of the available SMP and PIT tag data resulted in the following conclusions regarding August passage of subyearling Chinook juveniles at Lower Granite Dam. However, the considerations discussed above regarding management changes and limitations of present PIT-tagging efforts could in combination underestimate passage in August and could obscure passage of natural/wild produced juveniles in August.

- Based on the Run-at-Large, the proportion of subyearling Chinook migrating past LGR in August has declined over the past 13 years. However, the run timing of subyearling Chinook is dominated by the overwhelming proportion of hatchery subyearlings and their earlier releases in recent years.
- Since 2000, the average August population at LGR has increased, when compared to prior years.
- Due to the domination of earlier hatchery subyearlings, collection counts in August may appear low. However, with lower flows and higher spill proportions at Snake River projects in August, these low collection counts (~300 fish) can equate to substantial numbers of juveniles passing LGR.
- The proportion of wild Snake River subyearling Chinook migrating past LGR in August has decreased over the past 13 years. However, tagging and release of Snake River wild subyearlings has occurred earlier over this same time frame. This earlier tagging could bias the passage timing to an earlier period.
- The proportion of wild Clearwater River subyearling Chinook migrating past LGR in August is larger than that for wild Snake River subyearlings. Although this proportion has decreased over the past 13 years, the average proportion passing in August is about 0.21 in more recent years (2004-2007).

Methods and Results:

Run-At-Large

For the run-at-large subyearling Chinook, FPC staff estimated a daily population index for migration years 1995 through 2007. The daily population index is an expansion of the daily collection counts from the Smolt Monitoring Program (SMP) at LGR and is a function of the daily estimated collection efficiency at that project. Daily collection efficiency estimates were a function of daily flow, spill, and spill percent at LGR. This expansion allowed us to compensate for changes in operations over the years such as the implementation of court ordered summer spill in 2005.

All subyearling Chinook collection counts were used in this analysis (i.e., from the initialization of SMP collection until it's termination each year). Appendix A contains estimates of the monthly proportion of the estimated population passing Lower Granite for the run-at-large subyearling Chinook above LGR.

Over the past 13 years, there has been a decline in the proportion of the run-at-large subyearling Chinook passing Lower Granite Dam in August (Figure 1). The maximum

proportion of run-at-large subyearling Chinook passing in August occurred in 1995 with 0.33. Over the past 10 years, the average proportion passing in August is 0.05. Although the proportion passing in August has declined over the past 13 years, the average August population has increased, particularly since the implementation of supplementation. Prior to supplementation, the average August population at LGS was 32,302 (1995-1999), whereas the average August population for the post-supplementation period was 68,365 (2000-2007).

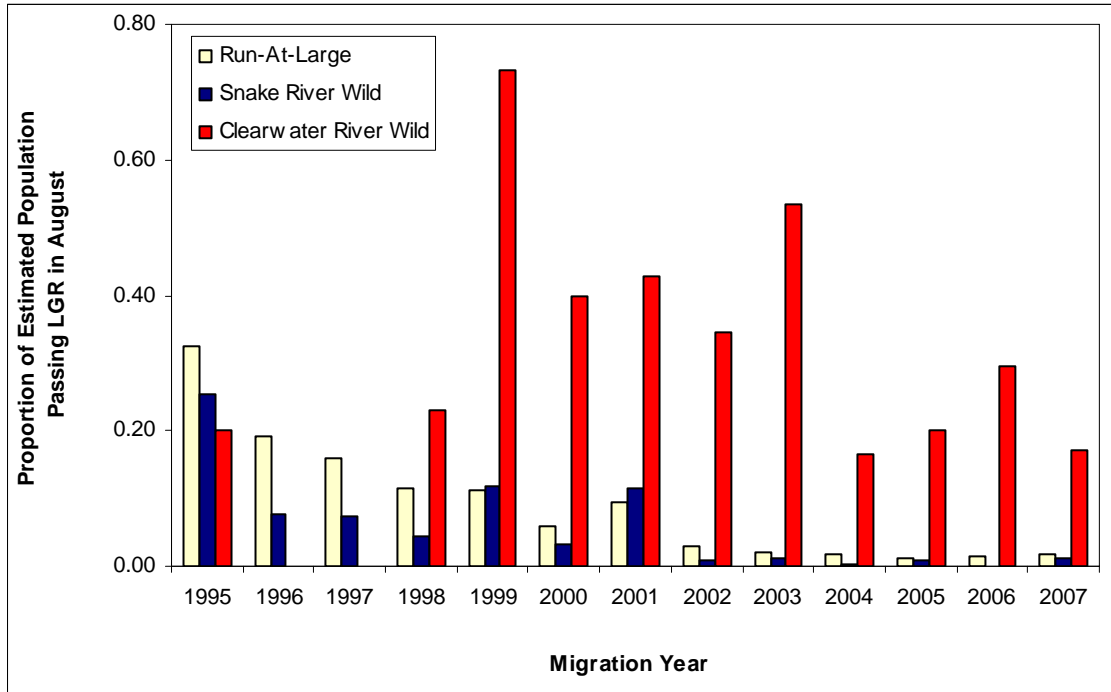


Figure 1. Proportion of estimated population (Snake River Wild, Clearwater River Wild, and Run-at-Large) of subyearling Chinook passing Lower Granite Dam in August. There were no releases of PIT-tagged wild Clearwater River subyearlings in 1996 and 1997.

Table 1. Estimated August population of run-at-large subyearling Chinook juveniles at LGR.

Migration Year	Estimated August Population at LGR
1995	17,232
1996	6,898
1997	31,027
1998	20,401
1999	85,950
2000	105,262
2001	111,659
2002	69,114
2003	72,684
2004	35,118
2005	70,364
2006	45,065
2007	37,652

Wild Subyearling Chinook

To address August passage of wild subyearling Chinook from the Snake River Basin, PIT-tagged wild subyearling Chinook from the Snake and Clearwater Rivers were analyzed from 1995 to 2007. For each migration year, we estimated a Lower Granite PIT-tag population, which was based on the number of detections and estimates of collection efficiency at LGR. Daily collection efficiency estimates were a function of daily flow, spill, and spill percent at LGR. This expansion allowed us to compensate for changes in operations over the years such as the implementation of court ordered summer spill in 2005.

All detections for a given migration year were used in this analysis (i.e., from the initialization of PIT-tag detectors until the time they were turned off for the winter). All individuals that were determined to be holdovers were removed prior to determining the monthly proportion of the estimated PIT-tag population passing each project. Holdovers were defined as subyearling Chinook that were detected the year after their initial migration as yearlings. Appendix A contains estimates of the monthly proportion of the estimated PIT-tag population passing Lower Granite for wild Snake and Clearwater River subyearling Chinook.

Snake River Wild Subyearling Chinook

Over the past 13 years, there has been a decline in the proportion of the estimated PIT-Tag population of Snake River wild subyearling Chinook passing Lower Granite Dam in August (Figure 1). Following a gradual decline from 1995-1998, the proportion of wild subyearling Chinook passing Lower Granite Dam in August increased in 1999. The maximum proportion of wild subyearling Chinook passing in August occurred in 1995 with 0.26.

It is unknown at this point what the proportion of the estimated PIT-tag population passing Lower Granite in August will be for migration year 2008. However, preliminary data indicate that the estimated PIT-tag population passing LGR in August 2008 (267 as of August 26th) is the largest among all the years we analyzed. The next largest August population was in 1995 at 197. Coincidentally, the weighted average release date for 2008 of June 9 is also the latest seen since 1997 and the second latest among the years we analyzed (Table 2). Over the last 10 years, the average release date is around May 26th.

Clearwater River Wild Subyearling Chinook

Clearwater River wild subyearling Chinook show a different pattern of passage timing to Lower Granite Dam than did wild Snake River subyearlings (Figure 1). From 1998 to 2003 there was an increase in the proportion of wild Clearwater River subyearling Chinook passing Lower Granite Dam in August. In 2004, the proportion passing in August decreased to 0.16, compared to 0.53 in 2003. The proportion of the estimated PIT-tag population passing in LGR in August increased again from 2004 to 2006. In 2007, the proportion of the estimated PIT-tag population passing LGR in August decreased to about 0.17.

It is unknown at this point what the proportion of the estimated PIT-tag population passing Lower Granite in August will be for migration year 2008. However, as of August 26, 2008, the

estimated PIT-Tag population passing LGR in August 2008 is 61, which is comparable to that seen in recent years, particularly 2005. The weighted average release date for wild Clearwater River subyearling Chinook has gradually gotten later over the past 11 years (Table 2). Over the last 10 years, the average release date is around July 8th.

Table 2. Weighted average date of release for PIT-tagged wild Snake and Clearwater River subyearling Chinook.

Migration Year	Snake River	Clearwater River
1995	5-Jun	4-Jul
1996	5-Jun	---
1997	14-Jun	---
1998	30-May	19-Jun
1999	4-Jun	21-Jun
2000	24-May	21-Jun
2001	25-May	23-Jun
2002	31-May	13-Jul
2003	19-May	30-Jun
2004	21-May	29-Jun
2005	23-May	30-Jun
2006	23-May	3-Jul
2007	21-May	12-Jul
2008	9-Jun	16-Jul

Conclusions:

Although it appears that the passage timing of subyearling Chinook is occurring earlier and is less significant in August, it is important to consider how recent management changes may be influencing these patterns. For example, during the second half of the 1990's the decision was made to augment the wild Snake River subyearling Chinook population with supplementation fish. Hatchery output of subyearling Chinook increased steadily and, beginning in 2000, supplementation fish dominated the juvenile subyearling Chinook migration above LGR (Figure 2). Therefore, the passage timing and distribution of the run-at-large can be greatly affected by the release schedule of hatchery subyearling Chinook.

The release schedule of hatchery subyearling Chinook above LGR has changed dramatically over the past 13 years, with releases occurring earlier in more recent years (Table 3). For example 1995 through 1998 had releases in the Snake and Clearwater rivers ending well into July and August. These years also had the highest August passage for the run-at-large. However, over the last six years, only a couple of releases to the Clearwater River have ended in July (BCCAP in 2005 and 2006) and no releases to the Snake River have ended in July. In fact, over the last six years, all releases to the Snake River have ended by June 21st. In addition to earlier releases over the past 13 years, there has also been a decrease in the time span of releases. This indicates that long volitional hatchery releases have become less common, while short release spans are the norm in more recent years.

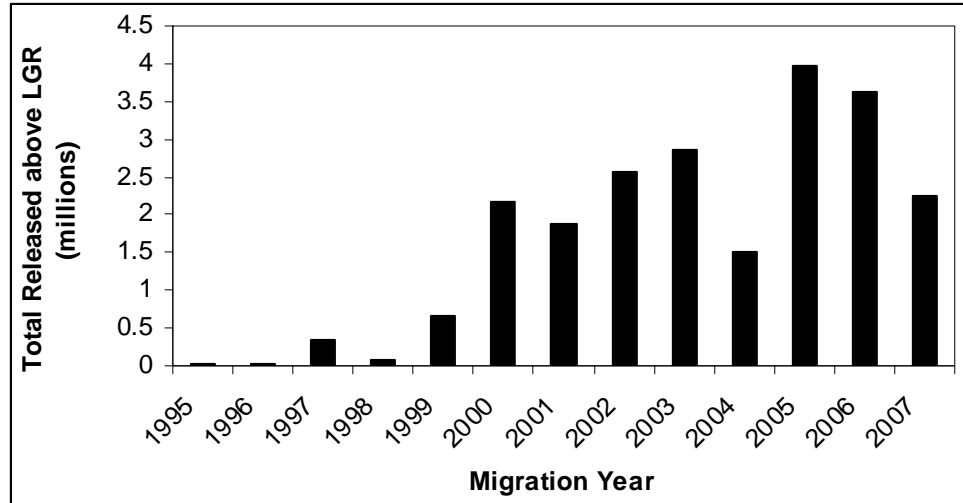


Figure 1. Total releases of hatchery subyearling Chinook above Lower Granite Dam (1995-2007).

Table 3. Release dates of hatchery subyearling Chinook released above Lower Granite Dam (1995-2007).

Migr. Year	Snake River Releases				Clearwater River Releases					
	PLAP	CJRAP	HCD	GRR	BCCAP	NPTH	LAPW	CLWR	CEDFL	LUGL
1995	5/18-8/17									
1996	6/6-7/10							6/6-7/10		
1997	5/28-7/8				6/3-7/8 6/10-6/13					
1998	5/14-7/7				6/2-7/8					
1999		5/30-6/5			6/2-6/3					
2000	5/24-5/26	5/20-5/31 6/15-6/23			5/30-6/1 6/20-6/26					
2001	5/28 6/1-7/6	5/26	5/16-6/19		5/29 5/29-7/4 6/13					
2002	5/27-5/29	5/28 6/20	5/21		5/27-5/28 6/18-6/19					
2003	6/4	5/28 6/9-6/16 6/12	5/1-5/16 5/22		6/3	6/3-6/5 6/19-6/21	5/28-5/31			
2004	5/24 5/31	5/26-6/1	5/28		5/31-6/3	6/4-6/11				
2005	5/23-5/24	5/16-5/30 5/23 5/23-5/27 5/26	4/28 5/13	5/24-5/25	5/30-5/31 6/21-7/8	5/7				
2006	5/24	5/15-6/2 5/26-5/29 5/30	5/2 5/8-5/10	6/19-6/21	5/25-5/26 6/19-7/9	5/17 6/8-6/15	6/13	5/17	6/13	6/13
2007	5/26	5/29	5/8		5/28-5/29	6/11-6/15	5/22-5/23		6/11	6/4

When compared to the run-at-large, a larger proportion of wild subyearling Chinook are passing Lower Granite Dam in August, particularly those from the Clearwater River (Figure 1). Clearwater River subyearling Chinook make up a small portion of overall population of subyearling Chinook above LGR and, therefore, their timing is masked by the supplementation fish. However, their importance should not be ignored.

We are unaware of a sound biological basis for choosing 300 subyearlings as the trigger to end summer spill at the Lower Snake Projects. Based on our analysis of the run-at-large, we found that the population of subyearling Chinook passing LGR in August can be substantial (Maximum 111,659 in 2002, Table 1). Furthermore, since flows are usually lower in August, the set volume of spill at LGR equates to a higher spill proportion during these periods of low flow. For example, when flows are approximately 30 Kcfs and LGR is spilling 18 Kcfs (as specified in the 2008 BiOp), a collection count of 300 fish could equate to as many as 9,000 subyearling Chinook passing the project. Our analysis of wild Snake and Clearwater river Chinook suggests that a substantial portion of the fish passing LGR in August are wild and, therefore, cutting spill in August would likely have a greater impact on these wild stocks.

Appendix A

Proportion of Run-at-large population of subyearling Chinook passing Lower Granite Dam by month of passage (1995-2007).

Migration Year	Month of Lower Granite Passage					
	Apr	May	June	July	August	Sept-Dec
1995	0.003	0.027	0.042	0.436	0.325	0.167
1996	0.057	0.020	0.178	0.482	0.191	0.071
1997	0.003	0.020	0.198	0.537	0.158	0.083
1998	0.024	0.075	0.161	0.555	0.114	0.071
1999	0.006	0.003	0.641	0.191	0.112	0.047
2000	0.005	0.003	0.564	0.302	0.058	0.068
2001	---	0.001	0.447	0.434	0.094	0.026
2002	0.004	0.002	0.349	0.593	0.029	0.024
2003	0.004	0.106	0.710	0.150	0.022	0.009
2004	0.006	0.033	0.727	0.197	0.019	0.019
2005	0.002	0.220	0.683	0.080	0.013	0.002
2006	0.009	0.215	0.566	0.191	0.016	0.003
2007	0.005	0.026	0.676	0.266	0.019	0.008

Proportion of estimated PIT-Tag population of Snake River wild subyearling Chinook passing Lower Granite Dam by month of passage (1995-2007).

Migration Year	Month of Lower Granite Passage				
	May	June	July	August	Sept-Dec
1995	---	0.14	0.51	0.26	0.07
1996	0.04	0.27	0.50	0.16	0.03
1997	0.02	0.38	0.50	0.07	0.03
1998	0.04	0.20	0.70	0.04	0.02
1999	---	0.60	0.28	0.12	---
2000	0.01	0.55	0.35	0.03	0.05
2001	0.01	0.15	0.70	0.11	0.02
2002	---	0.37	0.61	0.01	---
2003	0.06	0.64	0.29	0.01	---
2004	0.01	0.79	0.19	---	0.01
2005	---	0.75	0.23	0.01	---
2006	0.16	0.63	0.20	---	---
2007	0.01	0.57	0.41	0.01	---

Proportion of estimated PIT-Tag population of Clearwater River wild subyearling Chinook passing Lower Granite Dam by month of passage (1995-2007).

Migration Year	Month of Lower Granite Passage				
	May	June	July	August	Sept-Dec
1995	---	---	0.25	0.20	0.56
1998	---	0.01	0.53	0.23	0.23
1999	---	---	0.27	0.73	---
2000	---	---	---	0.40	0.60
2001	---	---	0.28	0.43	0.29
2002	---	---	---	0.35	0.65
2003	---	---	0.11	0.53	0.36
2004	---	---	0.29	0.16	0.55
2005	0.01	0.09	0.55	0.20	0.15
2006	---	0.04	0.49	0.29	0.18
2007	---	0.07	0.27	0.17	0.49



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DATA REQUEST FORM

Request Taken By: Jerry McCann Date: 8/19/2008

Data Requested By:

Name: Ron Boyce Phone: _____
Address: ODFW Fax: _____
Email: _____

Data Requested:

Wild Snake River and Clearwater brook trout
see attached email for questions

Effects of Improved River conditions 2006-07
on Snake River Chinook and Steelhead.

* Request for second item withdrawn due to time constraints (8/27)