FISH PASSAGE CENTER

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MEMORANDUM

TO: Bob Heinith

Michele DeHart

FROM: Michele DeHart

DATE: March 12, 2007

RE: Fall Chinook Timing

You requested that the FPC review the graphs (attached) of fall chinook timing in 2006 developed by Billy Connor, USFWS. The graphs were developed based on the PIT tagged fish recaptured for wild Snake and Clearwater River migrants, surrogate Snake and Clearwater river migrants, and production releases for the Snake and Clearwater rivers. The expansion of the PIT tag data was based on daily estimates of detection probability. There are variations in daily detection probabilities estimated dependent on the methods employed for expansion. However, while there might be slight variations in the timing graphs produced, it would not lead to different conclusions regarding overall migration timing.

However, when considering Snake River fall Chinook timing it is important to note the factors that have changed in the Snake River over the past several years that have contributed to the present timing observed for the subyearling migration.

- The run at large is dominated by hatchery supplementation releases.
- Over the past few years' hatchery releases have been earlier and over shorter time frames. These two factors have skewed the population such that it now has significantly earlier timing.
- Runoff volume has been on average less post 2000 than pre 2000.
- The volume of summer flow augmentation from Dworshak has decreased by approximately 200 KAF and is now used in September.
- The operation of Dworshak for flow and temperature control has changed over the time period.
- Temperature of released water from Dworshak has decreased over the time period.
- Spill for summer migrants in the Snake was implemented beginning in 2005. Spill aids passage through the Snake River projects and decreases forebay residence time.

- Brownlee augmentation pre draft agreement ended in 2001.
- Flows below Hells Canyon Dam have been lower post 2000.
- The collective result of the above action has been lower flow at Lower Granite during the summer migration period and colder water temperatures.

Snake River Fish

- Between 1995 and 2006 the proportion of PIT tagged wild and hatchery Snake River fall chinook passing Lower Granite Dam during August decreased steadily. This proportion is based on PIT tag recoveries between May and November of each year.
- 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.
- The subyearling run at large is now dominated by hatchery supplementation releases. Supplementation releases began increasing in the late 1990's, but increased significantly after the 2000 migration year. These releases are generally earlier than the normal timing observed in previous years for wild fish, skewing the distribution earlier.
- Initially the hatchery releases were made in mid to late May and were allowed to exit volitionally through July. However, over the past few years' hatchery releases have been made earlier and over shorter time frames.
- These two factors have contributed to skew the population such that it appears to have significantly earlier timing.

Clearwater River Fish

- As with Snake River hatchery subyearling Chinook, there has been a gradual decline in the proportion of Clearwater River hatchery subyearling Chinook passing Lower Granite Dam in August. The maximum proportion of Clearwater River hatchery subyearling Chinook passing in August occurred in 1996, with 0.45. Over the past three years (2004-2006), no PIT tagged hatchery subyearling Chinook passed Lower Granite Dam from the Clearwater River in August. In 2001 there was an increase in the proportion of Clearwater subyearling Chinook passing Lower Granite Dam in August (to 0.23). This increase in August passage coincided with drought conditions and low flows on the Snake and Clearwater Rivers.
- Clearwater River wild subyearling Chinook show a different pattern of passage timing to Lower Granite Dam than any of the other groups analyzed thus far. From 1998 to 2003 there was an increase in the proportion of wild subyearling Chinook passing Lower Granite Dam in August. In 2004, the proportion passing in August decreased to 0.19, compared to 0.52 in 2003. Following 2004, there has been a decrease in the proportion passing in August. In 2006, the proportion of the estimated PIT-tag population of Clearwater River wild subyearling Chinook passing Lower Granite Dam in August was 0.13.

Flow

- Overall runoff volume above Dworshak and Brownlee reservoirs has on average been less post 2000 than pre 2000. Consequently, flow at Lower Granite during the summer migration period has been lower.
- Other factors affecting flow and temperature are:
  - Brownlee augmentation pre-draft agreement ended in 2001.
  - Approximately 200 KAF of the summer flow augmentation from Dworshak has been shifted to post August 31.
  - The operation of Dworshak for flow and temperature control has changed over the time period.
  - Temperature of released water from Dworshak has decreased as a result of selective withdrawals of colder water (Figure 1 and Table 2).

- Spill for summer migrants in the Snake was implemented beginning in 2005. Spill aids passage through the Snake River projects and decreases forebay residence time.

Table 1. Historic changes in volume runoff, augmentation water and flow.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Dworshak Runoff Volume (MAF)	1.81	3.07	4.64	2.06	3.19	2.68	1.47	3.70	2.30	2.39	1.64	2.68
DWR flow Jul 1-Aug 31	10.62	10.30	15.99	11.57	10.59	11.5	9.15	12.92	10.17	10.55	9.56	10.16
Dwr elev Aug 31	1530	1537	1500	1520	1527	1520	1520	1534*	1534*	1534*	1534*	1532*
Brownlee Runoff Volume (MAF)	6.59	8.27	9.83	8.77	8.02	4.39	2.4	3.24	3.52	3.19	3.61	8.98
HCA Flow June 21-Aug 31	18.5	17.6	25	20	19.3	13.1	9.5	10.6	11.1	10.7	12.1	14.7
Snake Aug (KAF)	425	428	427	422	437	427	427	90	286	285	341	427
LGR Vol Jan-Jul KAF	29.41	42.43	49.48	30.84	36.08	24.6	14.38	23.98	23.81	20.68	19.4	32.19
LGR flow June 21-Aug 31	55.3	52.7	66.3	53.2	56	33.7	25.4	41	62.3	33.2	33.4	37.6

Table 2. Average July temperature (°C) in the Snake and Clearwater Rivers as measured at the Anatone gauge, Lower Granite Dam, Peck gauge, and Dworshak Dam tailwater from 1995-2006.

Migration Year	Anatone Gauge	Lower Granite Dam	Dworshak Dam Tailwater	Peck Gauge
1995	19.18	19.32	12.03	14.55
1996	19.19	19.29	11.40	14.22
1997	19.38	17.83	11.11	12.26
1998	21.23	19.73	9.65	12.40
1999	18.87	18.11	10.67	14.12
2000	20.71	18.91	8.90	12.39
2001	20.71	19.27	9.13	13.57
2002	21.16	18.50	8.56	13.03
2003	21.58	19.03	7.99	12.58
2004	21.22	19.21	7.36	12.19
2005	21.19	19.04	7.13	11.98
	22.36	19.85	6.32	11.49

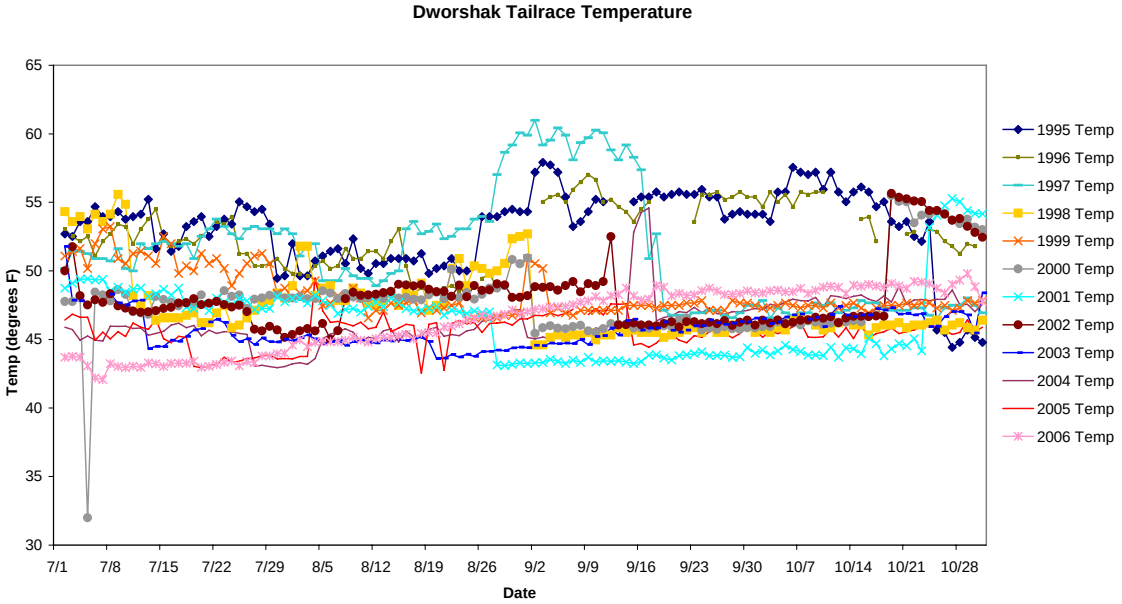

Figure 1. Historic (1995-2006) tailrace temperatures in the Dworshak Dam tailrace.

Conclusions

- It is clear that significant changes have occurred in the Snake and Clearwater rivers relative to hatchery practices and the management of flow, spill and temperature. These changes have significantly altered juvenile passage in the lower Snake River from historic passage. However, the impact that these changes have had on adult production and recovery of these stocks has yet to be determined.
- Wild fish timing has become more similar to hatchery timing over the years, as production releases have increased. Possible mechanisms might include density dependent effects or genetic dilution by wild spawning supplementation returns. The

supplementation program has not addressed this effect nor shown means of evaluating the effects of this change to wild population, either genetic or density/competition related. Both of these effects are common concerns with hatchery supplementation programs in general.

- It is premature to develop long-term conclusions regarding fall chinook from the Snake and Clearwater since data has not yet been collected and evaluated regarding adult returns for fish that passed the Snake River with spill.
- There is a also good chance that the operations at Dworshak that provide cold water instead of providing higher flows out of Dworshak may be causing more Clearwater fish to hold over and begin migrating into the fall months. The question is what is the overall return of adults to the Clearwater under this management scenario of Dworshak and the resulting effects on smolts migration.