FISH PASSAGE CENTER

1827 NE 44th Ave., Suite 240, Portland, OR 97213
Phone: (503) 230-4099 Fax: (503) 230-7559
http://www.fpc.org/
e-mail us at fpcstaff@fpc.org

MEMORANDUM

TO: Ed Bowles, ODFW

FROM: FPC Staff

DATE: April 21, 2008

RE: Effects of spring spill at the lower Snake River collector projects in 2007 on juvenile salmonids

In response to your request, FPC staff has conducted a preliminary analysis of the responses of juvenile salmonids to the 2007 spring spill program at the lower Snake River collector projects (LGR, LGS, and LMN). As you are aware, 2007 was an unusual year in that it was the first time that spring spill had been provided at the collector projects in a relatively low-flow year. Under previous operational strategies, spring spill was not provided under similar flow conditions. Therefore, the data from 2007 provides a level of contrast previously unavailable on the effects of spill versus no-spill during relatively low flow conditions at the lower Snake River collector projects. Per your request, this analysis focuses on the responses of juvenile salmonids to spill during the May 15-31 period identified in the Draft Biological Opinion when voluntary spill is to be terminated when flows are greater than 65 kcfs.

Methods

As noted by other researchers (Ferguson 2007), the May 15-31 period in 2007 was similar to the May 15-31 period in 2001 in terms of flow levels at the Snake River collector projects (Table 1). Average water temperatures measured at the Little Goose tailrace were also similar between 2001 and 2007, with 2007 only slightly warmer. The main difference between 2001 and 2007 during the May 15-31 time period is that an average 28% spill was provided at the collector projects in 2007 versus an average 0% spill in 2001 (Table 1). Due to this contrast in spill levels, under similar flow and temperature conditions, comparing the responses of juvenile salmonids

migrating during this time period in 2001 and 2007 provides information on the effects of spill versus no-spill during the May 15-31 time period.

Table 1. Environmental conditions at Little Goose Dam (LGS) and average percent spill across the three Snake River collector dams (LGR, LGS, LMN) during May 15-31, 2001 and 2007.

Variable	Dates	Location	2001	2007
Avg. flow	May 15-31	LGS	71	74
Avg. temp	May 15-31	LGS	55.2	55.6
Avg. % spill	May 15-31	LGR, LGS, LMN	0%	28%

To examine the effects of spill versus no-spill on juvenile salmonids migrating during May 15-31, this analysis focuses on the migration (travel time) and survival rates of PIT-tagged Snake River Basin yearling spring/summer Chinook, steelhead, sockeye, and subyearling fall Chinook. During both 2001 and 2007, PIT-tagged yearling Chinook and steelhead were released from the Snake River trap (near Lewiston, Idaho). PIT-tagged sockeye were also released from the Redfish Lake Creek trap (Redfish Lake, Idaho) and PIT-tagged wild subyearling fall Chinook were released from seining efforts in the Snake River upstream of Lewiston, Idaho. For yearling Chinook, steelhead, and sockeye, hatchery and wild fish were combined while subyearling fall Chinook were exclusively wild fish.

We examined the fish travel time and survival from release to Lower Monumental Dam, the last collector project on the lower Snake River. To align the timing of releases with timing past the collector projects during the May 15-31 period, we examined the detection dates for PIT-tagged fish at the three collector projects. Because spill is generally believed to reduce migration delay and therefore affects migration timing, we used the data from 2007 (the spill year) to develop date ranges for release cohorts. These date ranges represented time periods for released fish that primarily migrated past the collector projects during the May 15-31 time period in 2007 (Table 2). The date ranges were May 5-24 for yearling Chinook, May 10-23 for steelhead, May 3-17 for sockeye, and May 1-8 for subyearling Chinook (Table 2).

We calculated the average fish travel time from release to Lower Monumental Dam for each of the four species. The average fish travel times in 2007 for the release date ranges selected were 8.4 days for yearling Chinook, 7.7 days for steelhead, 12.7 days for sockeye, and 39.2 days for subyearling Chinook (Table 2). By adding these average travel times from 2007 to the release date ranges, it is apparent that the ranges reasonably capture the May 15-31 period of migration past the collector projects in 2007. For example, sockeye released on May 3 and May 17, with an average travel time to Lower Monumental Dam of 12.7 days, would be expected to arrive at Lower Monumental on May 16 and May 30, respectively. Similar results are apparent for yearling Chinook and steelhead. But because of ongoing rearing, very few subyearling fall Chinook appeared to migrate all the way to Lower Monumental Dam during the May 15-31 period in 2007. However, some fish released during May 1-8 were detected migrating past Lower Granite Dam during May 15-31 and therefore could be affected by spill/no-spill decisions at Lower Granite during late May.

We applied these same date ranges to releases made in 2001 to examine how the absence of spill affected fish travel time. Average fish travel times for fish released during the same date ranges in 2001 were 29.5 days for yearling Chinook, 20.5 days for steelhead, 20.8 days for sockeye, and 81.7 days for subyearling Chinook (Table 2). The ratio of the 2001:2007 average fish travel times was 3.5 for yearling Chinook, 2.7 for steelhead, 1.6 for sockeye, and 2.1 for subyearling Chinook. These ratios indicate that average travel times were much longer in 2001 compared to 2007 for all species released during the same time periods.

We applied the Cormack-Jolly-Seber methodology to estimate survival rates from release to Lower Monumental Dam for these same release date cohorts. In 2007, survival estimates from release to Lower Monumental Dam were 1.00 for yearling Chinook, 0.91 for steelhead, and 0.34 for sockeye (Table 3). In 2001, survival estimates were 0.44 for steelhead and 0.22 for sockeye (Table 3). Too few yearling Chinook were released during the May 5-24 period in 2001 to estimate survival to Lower Monumental Dam. Similarly, too few subyearling Chinook were released during May 1-8 to estimate survival to Lower Monumental Dam in either 2001 or 2007. The ratio of the 2007:2001 survival estimates was 2.07 for steelhead and 1.55 for sockeye. These ratios indicate that survival rates were much higher in 2007 than 2001 for steelhead and sockeye released during the same time periods.

Table 2. Average fish travel time (FTT, days) from release to Lower Monumental Dam of hatchery and wild yearling Chinook, hatchery and wild Steelhead, hatchery and wild sockeye, and wild subyearling Chinook. Release dates were aligned to correspond with observed arrival dates of May 15-31 at the Snake River collector dams in 2007.

			Release-to-LMN average FTT		
Species group	Release dates	Release location	2001	2007	2001:2007 Ratio
H&W yearling Chinook	May 5-24	Snake River Trap	29.5	8.4	3.5
H&W steelhead	May 10-23	Snake River Trap	20.5	7.7	2.7
H&W sockeye	May 3-17	Redfish Lake Creek Trap	20.8	12.7	1.6
W subyearling Chinook	May 1-8	Snake River	81.7	39.2	2.1

Table 3. Survival estimates from release to Lower Monumental Dam of hatchery and wild yearling Chinook, hatchery and wild steelhead, and hatchery and wild sockeye. The ratio of the 2007:2001 survival estimates is also presented for steelhead and sockeye. Release dates were aligned to correspond with observed arrival dates of May 15-31 at the Snake River collector dams in 2007. Due to few releases and subsequent detections of PIT-tagged fish, survival estimates could not be calculated for yearling Chinook in 2001 or subyearling Chinook in either year.

Species group	Release dates	Release location	Release-to-LMN survival 2001	2007	2007:2001 ratio
H&W yearling Chinook	May 5-24	Snake River Trap	-	1.00*	-
H&W steelhead	May 10-23	Snake River Trap	0.44	0.91	2.07
H&W sockeye	May 3-17	Redfish Lake Creek Trap	0.22	0.34	1.55
W subyearling Chinook	May 1-8	Snake River	-	-	-

* Statistical model-based survival estimate > 1.

Discussion

This analysis indicates that spill/no-spill operations during the May 15-31 period appear to affect the average fish travel time of each of the four species examined, with spill reducing average fish travel time from release to Lower Monumental Dam. Spill/no-spill operations also appeared to affect survival estimates for steelhead and sockeye release timing cohorts. With spill in 2007, estimated yearling Chinook survival was high, and while it was not possible to develop an estimate for the same release cohort in 2001, it is unlikely that survival in 2001 would have been as high as 2007 for yearling Chinook.

While flow and temperature conditions past the collector projects were similar during May 15-31 in 2001 and 2007, flow levels during the early portion of May were not. In 2001, flows were lower during the first half of May than they were during 2007. These flow differences may have influenced the survival and travel times of some of the early releases within the release cohort periods. However, it is likely that most of the later releases experienced similar flow conditions between the two years. While conditions were not identical during the entire month of May, conditions were similar during the second half of May when most of the release cohorts were passing or attempting to pass the collector projects.

References:

Ferguson, J.W. 2007. Memorandum to Bruce Suzumoto. Subject: Preliminary survival estimates for passage during the spring migration of juvenile salmonids through Snake and Columbia River reservoirs and dams, 2007.