FISH PASSAGE CENTER

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MEMORANDUM

TO: Tom Lorz, CRITFC

FROM: Michele Dehart

DATE: September 18, 2012

RE: Juvenile Migration Characteristics of the 2012 B Run Steelhead Return

We have compiled the following in response to your data request for information on the juvenile migration characteristics associated with the lower than expected 2012 adult return of B run steelhead. We have focused on presenting the juvenile migration conditions that occurred in 2010, since most B run steelhead returning in 2012 would have migrated as juveniles in 2010.

Flow and Spill in 2010

Steelhead adults that are from the B run generally spend two years in the ocean before returning to spawn. This means they would have migrated to the sea as juveniles during the spring of 2010. Snowpack and runoff volume throughout the Columbia Basin was considerably below average in 2010. Storage reservoirs failed to meet the Biological Opinion spring target elevations as a result of aggressive reservoir drafting during the winter, which drew the reservoirs down to below flood control elevations. The combined results of reservoirs failing to meet their Biological Opinion target elevations, and the low run off volume, resulted in flows that were much below the Biological Opinion targets for the Snake and Columbia Rivers for most of the spring migration period.

In spite of the below average runoff, near average precipitation occurred. The spring seasonal average flows were increased by an extremely large rain event in June. However, very few late migrating juvenile fish from the spring migration benefited from these high flows, since most fish had passed before the rain began (Figure 1). Migration flows during the April and May period of the spring migration in the Snake River were lower than observed during the recent low flow years, 2004 and 2007.

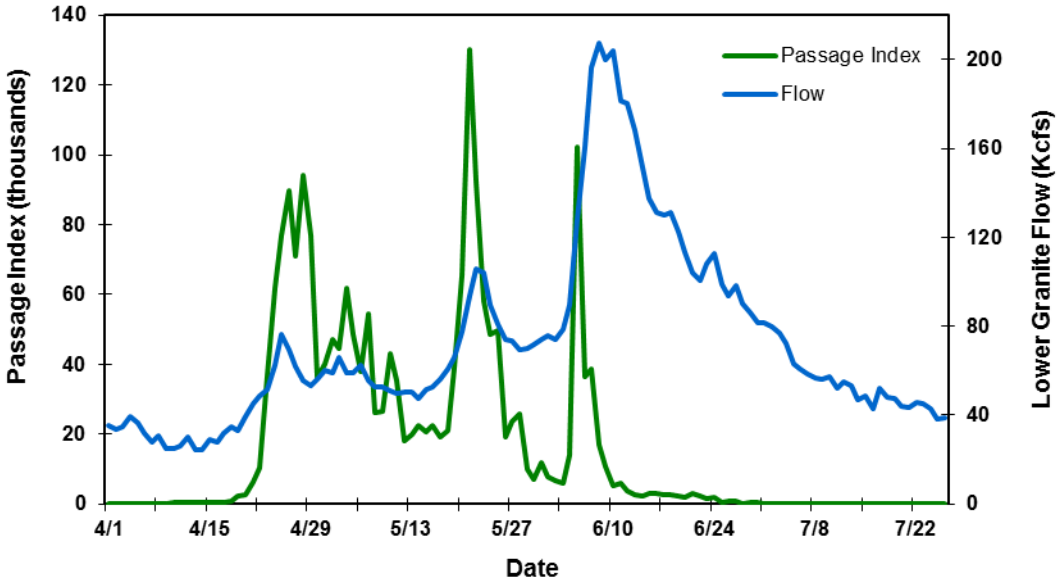

Figure 1. Daily flows and migration timing of Snake River steelhead at Lower Granite Dam in 2010.

Spill for fish passage in the Columbia Basin was implemented according to the Court Order as part of ongoing litigation. Low flows during most of the spring migration period and the requirement to maintain one unit operation at projects in the Snake and Columbia Rivers, precluded the implementation of the Federal Court Ordered spill operations during most of this period. However, low spring flows in the Snake River also resulted in higher spill proportions, particularly at Lower Snake River dams. So, while flows were very low during this time period and spill was restricted due to the requirement to operate one turbine unit at each dam, the proportion of spill that occurred was considerably high.

Hatchery Releases:

For migration year 2010, the hatchery release total for the Snake River Zone was approximately 8.12 million, of which 7.89 million (97.2%) were released above Lower Granite Dam. The 2010 release total was the lowest since 1986. An estimated 700,000 to 900,000 summer steelhead juveniles were lost prior to release at Dworshak NFH due to disease. Steelhead produced at Dworshak NFH are B-run, which would mostly return in 2012.

Table 1 below provides hatchery release totals of A-run and B-run steelhead to the Snake River Zone (above Lower Granite Dam) over the past five years (2008-2012). Release totals for migration year 2012 are still preliminary, as not all of these releases have been finalized in the FPC Hatchery Database. At approximately 0.40, the hatchery release for migration year 2010 had the smallest proportion of B-run steelhead among the five years we analyzed. The average proportion B-run for migration years 2008, 2009, 2011, and 2012 is 0.46. If the loss from Dworshak NFH hadn't occurred, the 2010 release total would have been 45-46% B-run, assuming a loss of 700,000 and 900,000, respectively.

Each year, Dworshak NFH produces the majority of B-run steelhead that are released above Lower Granite Dam (Table 2). For migration year 2010, the proportion of the total B-run steelhead that were produced at Dworshak NFH was 0.39, whereas that for 2008, 2009, 2011, and 2012 ranged from 0.49-0.54 (Table 2). If the loss from Dworshak NFH hadn't occurred, Dworshak NFH would have contributed 50-52% of the overall B-run steelhead release total for 2010, assuming a loss of 700,000 and 900,000, respectively.

Table 1. Total hatchery release of A-run and B-Run steelhead to the Snake River Zone, above Lower Granite Dam, in migration years 2008-2012.

Migration Year	Run	Release Total	Proportion
2008	A	4,866,228	0.54
	B	4,160,428	0.46
2009	A	4,846,680	0.57
	B	3,645,238	0.43
2010	**A**	**4,717,400**	**0.60**
	B	**3,169,703**	**0.40**
2011	A	4,784,108	0.52
	B	4,444,335	0.48
2012	A	4,869,673	0.54
	B	4,066,247	0.46

Table 2. Annual hatchery release total for B-Run steelhead to the Snake River Zone, above Lower Granite Dam by rearing hatchery, in migration years 2008-2012.

Migration Year	Hatchery	Release Total	Proportion
2008	Clearwater Hatchery	819,264	0.20
	Dworshak NFH	**2,254,407**	**0.54**
	Hagerman NFH	179,034	0.04
	Magic Valley Hatchery	907,723	0.22
2009	Clearwater Hatchery	835,636	0.23
	Dworshak NFH	**1,798,874**	**0.49**
	Hagerman NFH	171,094	0.05
	Magic Valley Hatchery	839,634	0.23
2010	Clearwater Hatchery	854,960	0.27
	Dworshak NFH	**1,234,563**	**0.39**
	Hagerman NFH	120,918	0.04
	Magic Valley Hatchery	959,262	0.30
2011	Clearwater Hatchery	1117,487	0.25
	Dworshak NFH	**2,265,405**	**0.51**
	Hagerman NFH	158,577	0.04
	Magic Valley Hatchery	902,866	0.20
2012	Clearwater Hatchery	730,036	0.18
	Dworshak NFH	**2,171,846**	**0.53**
	Hagerman NFH	196,144	0.05
	Magic Valley Hatchery	968,221	0.24

Juvenile Timing:

Based on SMP data, timing of steelhead juveniles to LGR was later in 2010, particularly for the latter half of the run. The 10%, 50%, and 90% dates for 2010 at LGR were April 26, May 11, and June 5, respectively. The current 10-year average arrival dates are April 25, May 9, and May 25, respectively.

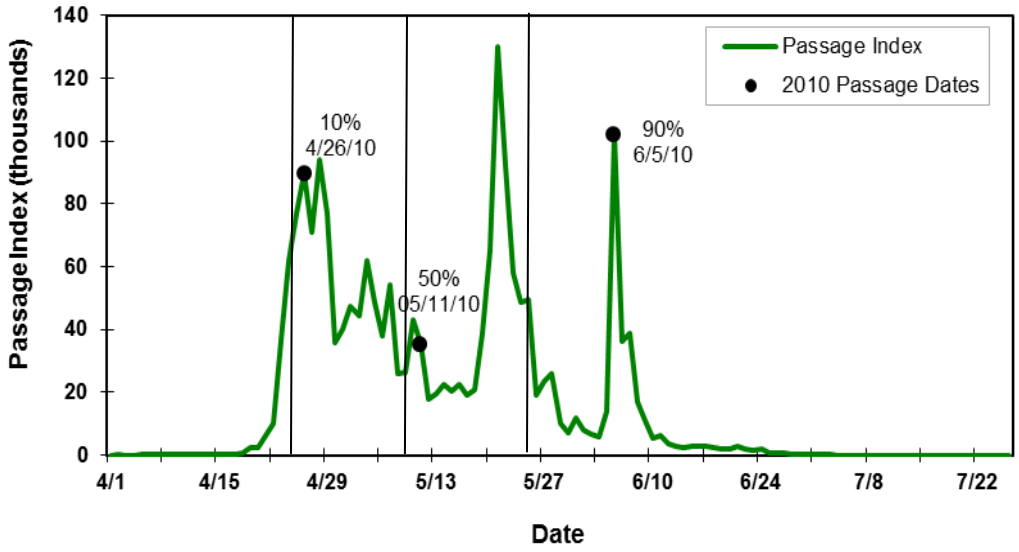

Figure 2. Migration timing and 10%, 50%, and 90% passage dates of Snake River steelhead at Lower Granite Dam in 2010. Vertical lines represent 10-year average 10%, 50%, and 90% passage dates of April 25, May 9, and May 25, respectively.

Juvenile Travel Time and Survivals:

As pointed out above, the in-river migration conditions in this low flow year (2010) were enhanced by the fact that spill made up a large proportion of the flow past each project. Travel time estimates (Table 3) were faster than would have been predicted based on the data available from other low flow years when spill was not provided at transport collection sites (CSS 2010). This meant that less delay occurred in the forebays of dams during the downstream migration.

Juvenile survival estimates (Table 3) were also higher than expected based on data collected during other low flow periods (CSS 2010).

Table 3. Median Fish Travel Time (FTT) and Survival ($\hat{S}$) of combined hatchery and wild steelhead for various river reaches for fish migrating in 2010 and 2011.

A) LGR-MCN Reach.

MY	Release dates	Median FTT	$\hat{S}$	Var($\hat{S}$)	WTT	avg Spill	temp. C
2010	4/17-4/23	8.7	0.859	0.00521	14.7	46.5	10.8
2010	4/24-4/30	8.4	0.776	0.00078	14.7	45.3	11.2
2010	5/1-5/7	9.0	0.709	0.00387	16.3	46.4	10.7
2010	5/8-5/14	8.0	0.832	0.00523	13.5	41.9	11.7
2010	5/15-5/21	5.7	0.917	0.04209	10.2	35.7	12.9
2010	5/22-5/28	6.9	0.750	0.00680	11.7	40.6	12.3
2011	4/17-4/23	8.5	0.727	0.0006	9.2	39.5	9.0
2011	4/24-4/30	8.0	0.728	0.0017	9.9	40.6	9.8
2011	5/1-5/7	6.8	0.742	0.0057	9.1	39.1	10.7
2011	5/8-5/14	5.2	0.674	0.0033	6.1	50.4	11.5
2011	5/15-5/21	4.4	0.786	0.0071	5.2	53.8	11.3

B) MCN-BON Reach.

MY	Release dates	Median FTT	$\hat{S}$	Var($\hat{S}$)	WTT	avg Spill	temp. C
2010	4/27-5/17	5.4	0.773	0.0022	8.7	40.5	12.0
2010	5/18-6/7	4.2	0.685	0.0052	6.3	38.8	13.7
2011	4/27-5/17	4.3	0.743	0.0266	5.0	40.1	11.1

C) RIS-MCN Reach.

MY	Release dates	Median FTT	$\hat{S}$	Var($\hat{S}$)	WTT	avg Spill	temp. C_a
2010	4/21-5/4	8.6	0.604	0.0085	8.0	26.8	10.8
2010	5/05-5/18	8.3	0.499	0.0055	6.8	24.8	12.4
2011	4/21-5/4	7.4	0.568	0.0113	5.9	23.3	9.7
2011	5/05-5/18	5.5	0.739	0.0105	4.3	45.3	11.3
2011	5/19-6/01	4.2	0.632	0.0131	3.2	61.4	11.8

Juvenile Transportation:

In 2010 a mixed strategy of transport and spill was implemented. Approximately 39% of hatchery steelhead and 42% of wild steelhead were transported from the three Snake River transport projects.

Ocean Conditions:

NOAA Fisheries Northwest Fisheries Science Center has been assembling information on ocean indices for the last 14 years. These data are used annually to describe the ocean conditions that are experienced by growing salmon during their years in the ocean. Of particular importance to future survival are the condition experienced during early ocean entry. In 2010 the ocean conditions that existed when B run steelhead were primarily entering the ocean were particularly poor. Ocean indicators were mixed for 2010, with a very warm spring that was followed by a cooling trend in August (Peterson et al. 2011). Rank scores for 2010 were compared to the 14 years of information. The 2010 year was ranked 10 out of the 14 for the years for which data are available. The lower the number in the 14 year record the better the ocean ecosystem conditions were for salmon growth and survival. (http://www.nwfsc.noaa.gov/research/divisions/fed/oeip/g-forecast.cfm).

Summary

The 2010 juvenile migration was characterized by the release of fewer hatchery B run steelhead due to a disease outbreak at Dworshak Hatchery. Juveniles released from Dworshak hatchery normally contribute over 50% of the B-run steelhead that are released above Lower Granite Dam. The second half of the juvenile migration was very delayed due to the low flows that occurred. In spite of this the surviving juveniles, however, passed through the Snake and Columbia rivers relatively quickly and with high survival rate, likely as a result of the high spill proportion that occurred at the low flows. A mixed strategy of transportation and spill was implemented during the spring migration.

The juveniles then entered the ocean and were presented with ocean conditions for survival that ranked 10th of those that had occurred in the past 14 years. It is possible that had

the juveniles not had the high survival through the hydrosystem that occurred in 2010, fewer migrants would have made it to the ocean, and the return of adult B Run steelhead may have been even less than observed this year.

Peterson, W.T., C.A. Morgan, E. Casillas, J. O. Peterson, J.L. Fisher and J.W. Ferguson. Ocean Ecosystem Indicators of Salmon Marine Survival in the Northern California Current. January 2011. http://www.nwfsc.noaa.gov/research/divisions/fed/oeip/documents/oeip-archive-2010-peterson.et.al.2011.pdf.

Tuomikoski, J., J. McCann, T. Berggren, H. Schaller, P. Wilson, S. Haeseker, J. Fryer, C. Petrosky, E. Tinus, T. Dalton, and R. Elke. 2010. Comparative Survival Study (CSS) of PIT tagged Spring/Summer Chinook and Summer Steelhead, 2010 Annual Report. Project No. 199602000. http://www.fpc.org/documents/CSS/2010%20CSS%20Annual%20Report--Final.pdf.

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DATA REQUEST FORM

Request Taken By: M. Filardo **Date:** Sept 13, 2012

Data Requested By:
Name: Tom Lorz, CRITFC **Phone:**
Address: **Fax:**
Email: ✓

Data Requested:
Juvenile migration conditions for Snake River ST migrants in 2010

Data Format: **Hardcopy** ☐ **Text** ☐ **Excel** ☐

Delivery: **Mail** ☐ **Email** ☑ **Fax** ☐ **Phone** ☐

Comments:

Data Compiled By: MF, BC **Date:** 9/18/12

Request # 54