



# FISH PASSAGE CENTER

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## MEMORANDUM

TO: Mark Drobish, USFWS

FROM: Brandon R. Chockley

DATE: January 4, 2017

RE: 2016 Dworshak National Fish Hatchery Report

The Fish Passage Center has been marking Chinook and steelhead from the Dworshak National Fish Hatchery facility over the last several years as part of the Smolt Monitoring Program (SMP) and the Comparative Survival Study (CSS). The SMP provides information for in-season management of the hydrosystem and post-season analyses to the federal, state, and tribal fishery agencies. The CSS is a multi-year program that estimates survival rates over different life stages for spring and summer Chinook and steelhead produced in major hatcheries. We would like to share with you an update of some of the information we developed under these studies for the spring Chinook and summer steelhead used from Dworshak National Fish Hatchery facility in 2016 and past years.

Under the Smolt Monitoring Program, information is collected on the timing and migration speed from the hatchery to Lower Granite Dam. In addition, as part of the CSS study, juvenile survival estimates are developed for the hydrosystem between Lower Granite and Bonneville Dams, as well as survival to adulthood of different passage histories.

Tables 1 and 2 provide estimates of minimum, median, and maximum travel times for each year's release of spring Chinook (Table 1) and steelhead (Table 2) to Lower Granite Dam. Also provided are estimates of the 95% confidence limits around the estimated median travel times. The annual data presented in Tables 1 (Chinook) and 2 (steelhead) are for all release sites combined. Beginning in 2008, Dworshak NFH began releasing additional PIT-tagged steelhead throughout the Clearwater River Basin. For comparison purposes, travel times for each of the different release sites are provided in Appendix A at the end of this memo (Table A.1).

**Table 1.** Dworshak NFH Spring Chinook Travel Times to Lower Granite Dam

Release Date	Migration Year	Travel Time (Days)			95% Confidence Limits	
		Min	Med	Max	Lower	Upper
4/7	1997	3.2	31.9	97.6	31.0	32.8
3/23-3/26	1998	2.8	28.1	78.2	27.8	28.1
4/7-4/8	1999	4.6	27.7	133.7	27.4	28.2
3/23, 4/5-4/6	2000	3.9	27.3	86.8	27.2	27.3
3/28	2001	3.9	30.4	151.1	30.3	30.4
3/27-3/28	2002	3.4	38.1	77.6	38.1	38.2
3/19-3/20	2003	6.0	49.4	121.4	49.0	49.7
3/31-4/1	2004	6.2	32.2	74.9	32.0	32.4
4/4-4/6	2005	5.6	30.2	76.0	30.2	30.2
3/27-3/29	2006	2.7	35.6	78.7	35.4	35.9
3/28-3/29	2007	4.4	27.8	76.9	27.4	28.4
4/2-4/3	2008	5.6	34.6	88.3	34.5	34.9
3/25-3/26	2009	5.5	43.5	89.2	43.3	43.6
3/31	2010	10.1	27.2	66.2	27.2	27.2
3/23-3/24	2011	2.8	40.0	77.4	39.4	40.2
3/26, 4/1	2012	4.3	31.2	93.6	30.8	31.4
4/1-4/2	2013	4.1	30.4	67.3	30.3	30.4
4/9-4/10	2014	3.1	25.4	62.4	25.4	25.5
3/25-3/26	2015	3.7	29.4	63.8	29.4	29.5
3/23-3/24	2016	2.9	28.6	75.3	27.8	29.2

**Table 2.** Dworshak NFH Steelhead Travel Times to Lower Granite Dam

Release Date(s)	Release Site(s)	Migration Year	Travel Time (Days)			95% Confidence Limits	
			Min	Med	Max	Lower	Upper
4/28-5/2	DWOR	1997	1.2	3.3	64.8	2.7	4.0
4/27-4/30	DWOR	1998	2.3	4.7	48.8	4.5	5.0
4/26-4/30	DWORMS	1999	1.5	6.2	60.1	5.8	6.5
5/3-5/5	DWORMS	2000	1.6	3.5	66.6	3.5	3.5
4/23-4/26	DWORMS	2001	2.5	6.8	110.0	6.7	7.0
4/22-4/25	DWORMS	2002	2.4	5.7	47.4	5.5	6.4
4/24	DWORMS	2003	0.6	7.1	54.8	6.6	7.7
4/29-4/22	DWORMS	2004	2.9	8.8	34.0	8.4	9.3
4/18-4/22	DWORMS	2005	3.4	11.2	60.8	10.4	11.6
4/17-4/21	DWORMS	2006	1.0	10.5	52.7	8.1	12.6
4/16-4/19	DWORMS	2007	1.9	14.6	52.7	13.0	15.8
4/14,4/21-4/24	All Sites	2008	0.5	11.5	56.5	11.1	11.9
4/14-4/17	All Sites	2009	2.5	7.5	64.2	7.48	7.54
4/14-4/22	All Sites	2010	2.4	9.9	66.3	9.7	10.2
3/21-3/31	All Sites	2011	1.7	12.6	100.4	12.4	12.8
4/3-4/12	All Sites	2012	1.5	9.6	64.4	9.4	10.4
4/9-4/17	All Sites	2013	2.4	6.6	61.0	6.4	6.8
4/14-4/23	All Sites	2014	1.7	7.6	61.9	7.5	7.8
4/14-4/22	All Sites	2015	2.8	7.3	49.6	7.1	7.4
4/11-4/20	All Sites	2016	1.5	4.5	47.5	4.5	4.6

As with past years, we are providing you with tables that present the estimated 10%, 50%, and 90% passage dates of yearling spring Chinook (Table 3) and steelhead (Table 4)

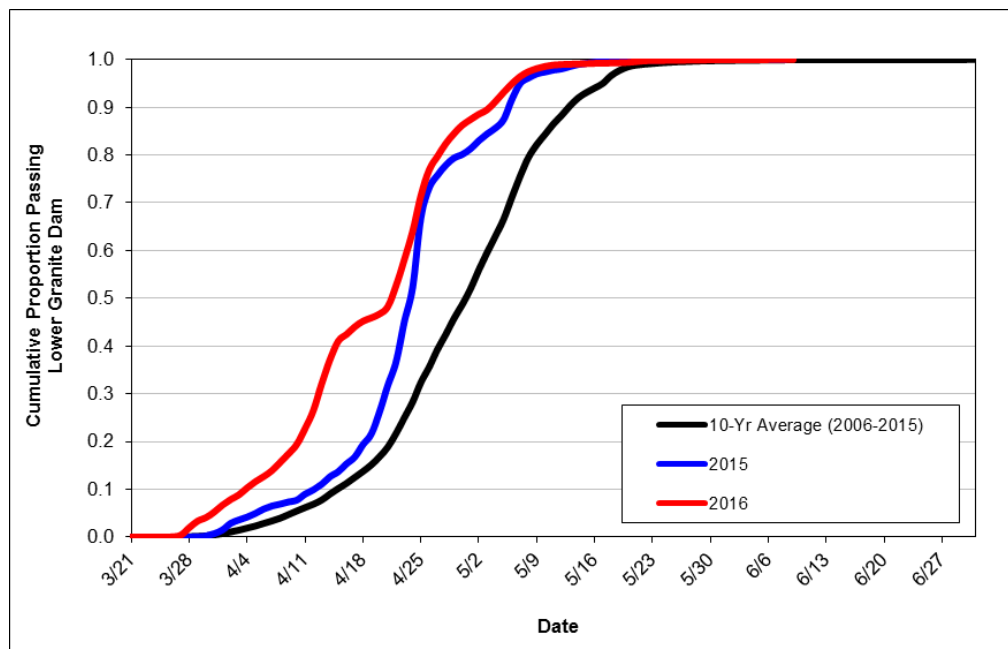
juveniles at Lower Granite Dam for each of the years of tagging. As with the travel time tables, Tables 3 (Chinook) and 4 (steelhead) provide these estimates for all release sites combined. Estimates of steelhead passage dates by release site can be found in Appendix A (Table A.2). Finally, Figures 1 and 2 are provided as illustrations of the cumulative 2016 arrival timing compared to that from 2015 and the current 10-year average (2006–2015) for yearling Chinook (Figure 1) and steelhead (Figure 2).

**Table 3.** Estimated 10%, 50%, and 90% passage dates of Dworshak NFH yearling spring Chinook at Lower Granite Dam.

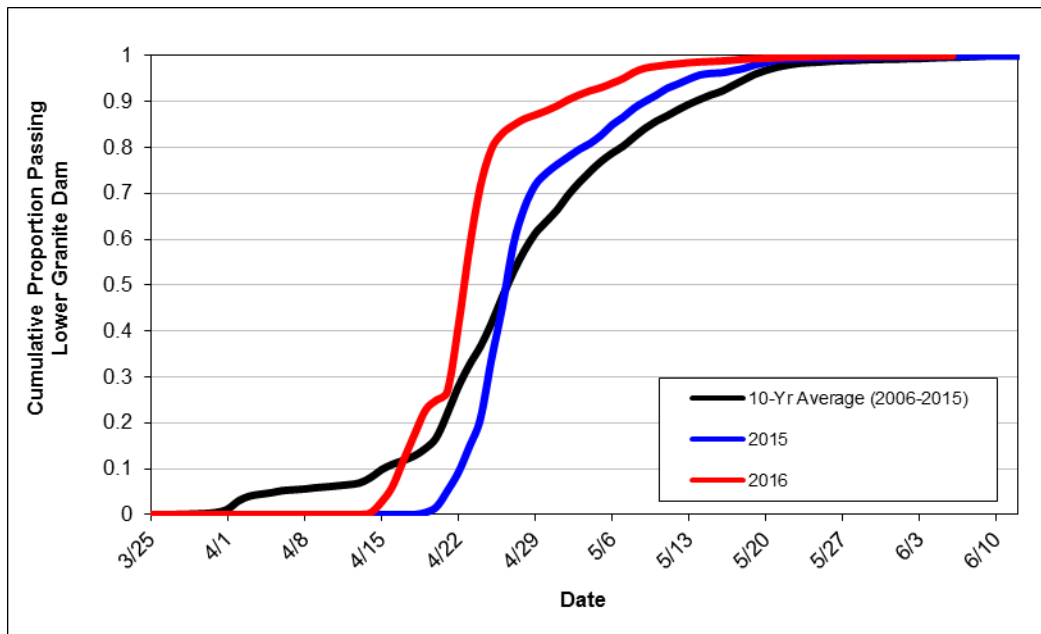
<b>Migration Year</b>	<b>Release Date(s)</b>	<b>10% Passage Date</b>	<b>50% Passage Date</b>	<b>90% Passage Date</b>
1997	4/7	26-Apr	11-May	18-May
1998	3/23-3/26	11-Apr	23-Apr	2-May
1999	4/7-4/8	25-Apr	6-May	21-May
2000	3/23, 4/5-4/6	23-Apr	3-May	12-May
2001	3/28	18-Apr	28-Apr	5-May
2002	3/27-3/28	15-Apr	4-May	15-May
2003	3/19-3/20	23-Apr	8-May	26-May
2004	3/31-4/1	17-Apr	3-May	8-May
2005	4/4-4/6	27-Apr	6-May	10-May
2006	3/27-3/29	8-Apr	2-May	11-May
2007	3/28-3/29	11-Apr	22-Apr	8-May
2008	4/2-4/3	21-Apr	8-May	18-May
2009	3/25-3/26	20-Apr	8-May	19-May
2010	3/31	22-Apr	27-Apr	7-May
2011	3/23-3/24	10-Apr	2-May	11-May
2012	3/26, 4/1	14-Apr	26-Apr	12-May
2013	4/1-4/2	19-Apr	2-May	10-May
2014	4/9-4/10	13-Apr	5-May	17-May
2015	3/25-3/26	14-Apr	24-Apr	6-May
2016	3/23-3/24	4-Apr	22-Apr	4-May

**Table 4.** Estimated 10%, 50%, and 90% passage dates of Dworshak NFH steelhead at Lower Granite Dam.

Migration Year	Release Date(s)	Release Site(s)	10% Passage Date	50% Passage Date	90% Passage Date
1997	4/28-5/2	DWOR	1-May	3-May	15-May
1998	4/27-4/30	DWOR	2-May	3-May	13-May
1999	4/26-4/30	DWORMS	30-Apr	4-May	25-May
2000	5/3-5/5	DWORMS	6-May	7-May	16-May
2001	4/23-4/26	DWORMS	29-Apr	2-May	17-May
2002	4/22-4/25	DWORMS	26-Apr	30-Apr	21-May
2003	4/24	DWORMS	25-Apr	28-Apr	20-May
2004	4/19-4/22	DWORMS	25-Apr	29-Apr	9-May
2005	4/18-4/22	DWORMS	26-Apr	1-May	10-May
2006	4/17-4/22	DWORMS	21-Apr	1-May	18-May
2007	4/16-4/19	DWORMS	22-Apr	1-May	13-May
2008	4/14,4/21-4/24	All Sites	27-Apr	2-May	17-May
2009	4/14-4/17	All Sites	20-Apr	23-Apr	8-May
2010	4/14-4/22	All Sites	25-Apr	1-May	20-May
2011	3/21-3/31	All Sites	1-Apr	6-Apr	14-May
2012	4/3-4/12	All Sites	14-Apr	22-Apr	8-May
2013	4/9-4/17	All Sites	17-Apr	22-Apr	11-May
2014	4/14-4/23	All Sites	22-Apr	28-Apr	15-May
2015	4/14-4/22	All Sites	23-Apr	27-Apr	9-May
2016	4/11-4/20	All Sites	17-Apr	23-Apr	2-May

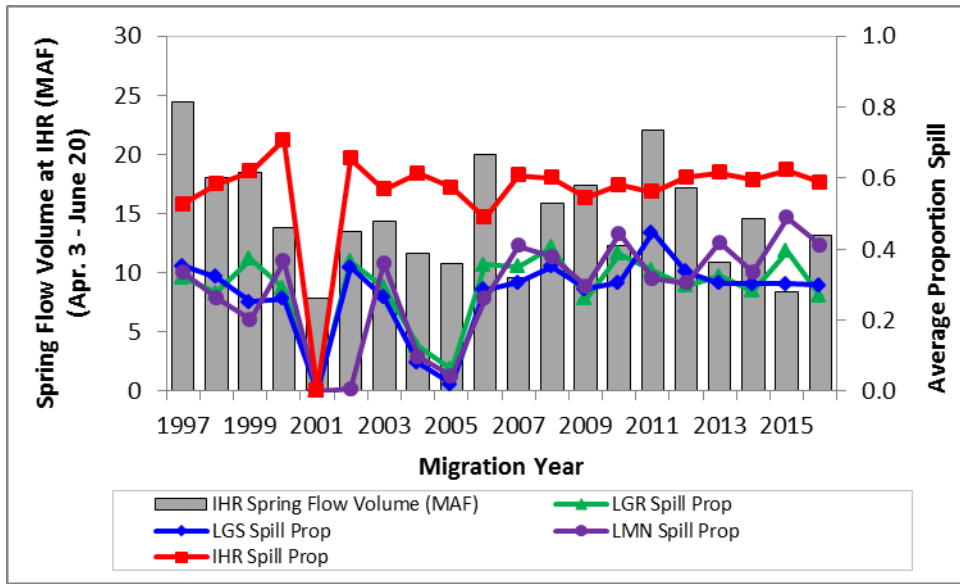


**Figure 1.** Cumulative passage timing of Dworshak NFH yearling spring Chinook to Lower Granite Dam.

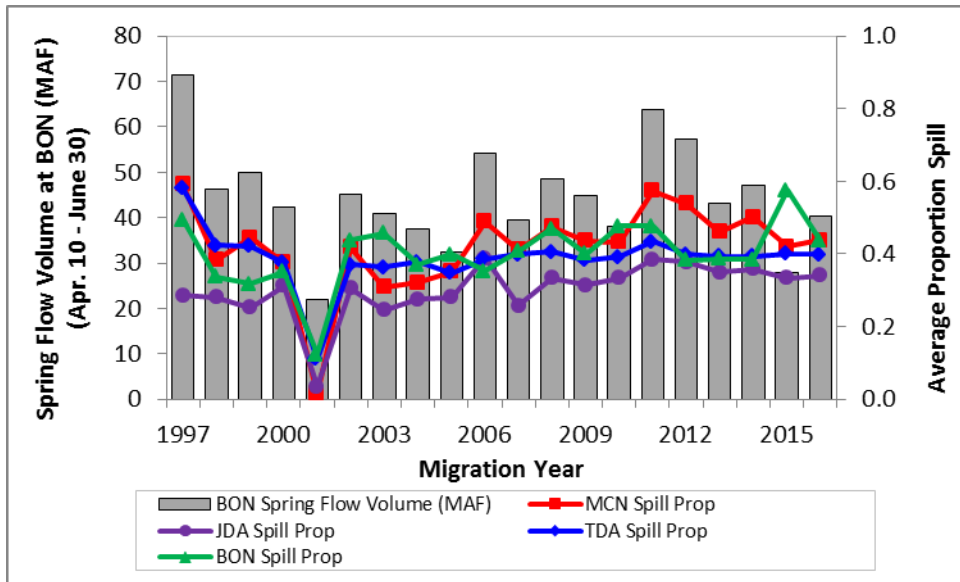


**Figure 2.** Cumulative passage timing of Dworshak NFH steelhead to Lower Granite Dam. Timing plots are collective timing of all release sites for each year.

Figures 3 and 4 are provided below to illustrate the out-migration conditions that these spring migrants may have experienced in the Snake and Middle Columbia rivers. Figure 3 provides the total spring flow volume (April 3–June 20) for the Snake River (as measured at Ice Harbor), along with the average spring spill proportions at each of Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams, for each migration year. Figure 4 provides the total spring flow volume (April 10–June 30) for the Middle Columbia (as measured at Bonneville), along with the average spring spill proportions at each of McNary, John Day, The Dalles, and Bonneville dams, for each migration year.



**Figure 3.** Total spring flow volume in the Snake River (at Ice Harbor Dam) and average spill proportion at Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams. Spring period in the Snake River is April 3–June 20.



**Figure 4.** Total spring flow volume in the Middle Columbia River (at Bonneville Dam) and average spill proportion at McNary, John Day, The Dalles, and Bonneville dams. Spring period in the Lower Columbia River is April 10–June 30.

Tables 5 and 6 contain estimates calculated for Dworshak NFH Chinook by the CSS. The estimates provided include: (1) juvenile survival in the hydrosystem between Lower Granite and Bonneville dams (Table 5), (2) the proportion of the juvenile population destined for transportation (Table 5), and (3) the smolt-to-adult survival (SAR) for several passage categories (Table 6). Those passage categories are SAR(T), SAR(C<sub>0</sub>), and Overall SAR, where SAR(T) represents smolts transported from Lower Granite, Little Goose, or Lower Monumental Dam, SAR(C<sub>0</sub>) represents smolts migrating in river (undetected at Snake River transportation collector sites), and Overall SAR is the estimated SAR for the overall hatchery release (without jacks). All SAR estimates are for the LGR-to-GRA reach and jacks are excluded. The data presented in Tables 5 and 6 were taken from various chapters and appendices of the 2016 CSS Annual Report, which can be downloaded from the FPC webpage [www.fpc.org/documents/CSS.html](http://www.fpc.org/documents/CSS.html). Figure 5 is a time series of the Overall SAR over the years of available data for Dworshak NFH spring Chinook.

**Table 5.** Dworshak NFH spring Chinook juvenile survivals and estimated proportion transported (with 90% confidence intervals) from CSS.

Release Date(s)	Migration Year <sup>A</sup>	Juvenile Survival (LGR-BON)	Proportion Transported <sup>B</sup>
4/7	1997	0.49 (0.31-0.80)	0.48
3/23-3/26	1998	0.51 (0.44-0.58)	0.71
4/7-4/8	1999	0.54 (0.47-0.65)	0.74
3/23, 4/5-4/6	2000	0.48 (0.40-0.65)	0.66
3/28	2001	0.24 (0.20-0.30)	0.98
3/27-3/28	2002	0.62 (0.54-0.72)	0.57
3/19-3/20	2003	0.68 (0.58-0.81)	0.54
3/31-4/1	2004	0.50 (0.40-0.66)	0.84
4/4-4/6	2005	0.51 (0.42-0.58)	0.84
3/27-3/29	2006	0.52 (0.48-0.58)	0.52 (0.52-0.53)
3/28-3/29	2007	0.67 (0.60-0.75)	0.08 (0.08-0.09)
4/2-4/3	2008	0.51 (0.46-0.56)	0.34 (0.33-0.35)
3/25-3/26	2009	0.44 (0.39-0.53)	0.34 (0.33-0.35)
3/31	2010	0.71 (0.65-0.77)	0.19 (0.18-0.19)
3/23-3/24	2011	0.42 (0.31-0.60)	0.35 (0.34-0.35)
3/26, 4/1	2012	0.60 (0.56-0.64)	0.20 (0.20-0.21)
4/1-4/2	2013	0.71 (0.58-0.89)	0.22 (0.21-0.23)
4/9-4/10	2014	0.74 (0.59-1.01)	0.39 (0.38-0.40)
3/25-3/26	2015	0.43 (0.37-0.50)	0.07 (0.07-0.08)

<sup>A</sup> Estimates for migration years 2006 through 2015 reflect use of new methodology developed for random pre-assignment of “monitor mode” and “return-to-river mode” operations. See 2016 CSS Annual Report for details.

<sup>B</sup> Confidence interval for proportion transported not available for migration years 1997-2005.

**Table 6.** Dworshak NFH spring Chinook TIR, SAR by study category (T vs. C<sub>0</sub>), and Overall SARs (with 90% confidence intervals). SAR estimates are for LGR-to-GRA reach and without jacks.

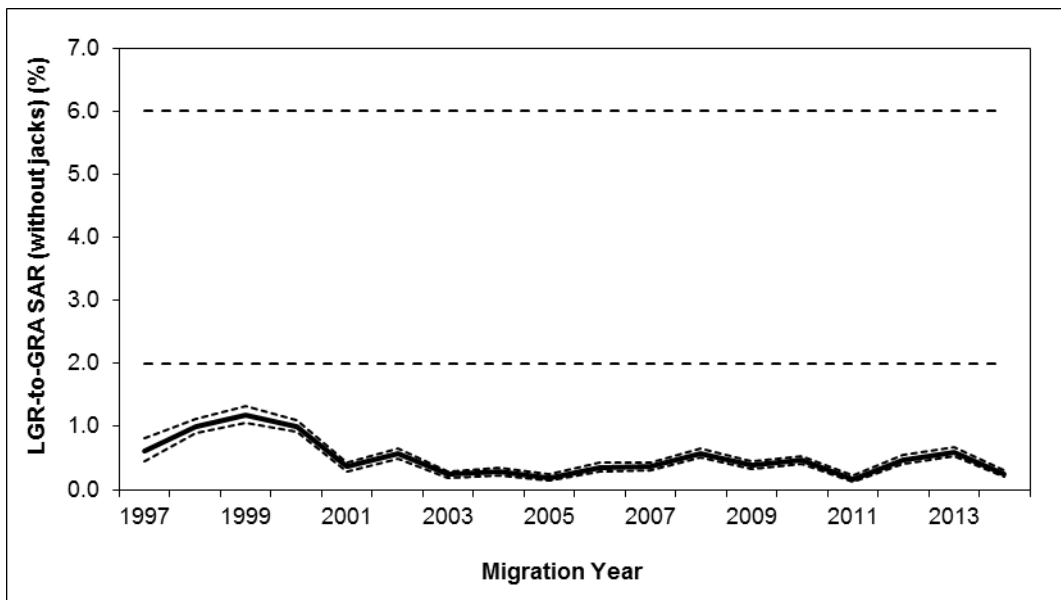
Release Date(s)	Migration Year	TIR	SAR(T) %	SAR(C <sub>0</sub> ) %	Overall SAR %
4/7	1997	1.75 (0.92-3.46)	0.83 (0.52-1.19)	0.47 (0.26-0.72)	0.62 (0.44-0.81)
3/23-3/26	1998	0.72 (0.59-0.88)	0.90 (0.77-1.02)	1.25 (1.08-1.42)	1.00 (0.89-1.11)
4/7-4/8	1999	0.99 (0.81-1.24)	1.18 (1.01-1.35)	1.19 (1.01-1.37)	1.18 (1.05-1.32)
3/23, 4/5-4/6	2000	0.99 (0.82-1.19)	1.00 (0.88-1.12)	1.01 (0.87-1.16)	1.00 (0.92-1.10)
3/28	2001	8.76 (5.04-20.4)	0.36 (0.29-0.43)	0.04 <sup>A</sup> (0.02-0.07)	0.36 (0.29-0.43)
3/27-3/28	2002	1.24 (0.93-1.61)	0.62 (0.49-0.75)	0.50 (0.42-0.58)	0.57 (0.48-0.65)
3/19-3/20	2003	1.21 (0.81-1.75)	0.26 (0.19-0.33)	0.21 (0.16-0.27)	0.24 (0.19-0.29)
3/31-4/1	2004	0.89 (0.59-1.43)	0.28 (0.23-0.35)	0.32 (0.21-0.44)	0.29 (0.23-0.34)
4/4-4/6	2005	1.43 (0.97-2.17)	0.20 (0.16-0.26)	0.14 <sup>B</sup> (0.10-0.19)	0.19 (0.15-0.24)
3/27-3/29	2006 <sup>C</sup>	0.95 (0.69-1.30)	0.36 (0.29-0.44)	0.38 (0.30-0.47)	0.35 (0.29-0.42)
3/28-3/29	2007 <sup>C</sup>	1.84 (1.11-2.81)	0.59 (0.35-0.86)	0.32 (0.27-0.38)	0.36 (0.31-0.42)
4/2-4/3	2008 <sup>C</sup>	1.53 (1.17-1.99)	0.80 (0.64-0.95)	0.52 (0.43-0.61)	0.57 (0.50-0.65)
3/25-3/26	2009 <sup>C</sup>	1.29 (0.92-1.80)	0.49 (0.37-0.61)	0.38 (0.30-0.46)	0.38 (0.32-0.45)
3/31	2010 <sup>C</sup>	0.70 (0.46-1.01)	0.37 (0.24-0.52)	0.52 (0.46-0.59)	0.47 (0.41-0.53)
3/23-3/24	2011 <sup>C</sup>	0.63 (0.32-1.09)	0.13 (0.07-0.20)	0.21 (0.15-0.28)	0.17 (0.13-0.22)
3/26, 4/1	2012 <sup>C</sup>	0.94 (0.63-1.31)	0.50 (0.35-0.66)	0.53 (0.44-0.63)	0.47 (0.41-0.55)
4/1-4/2	2013 <sup>C</sup>	0.90 (0.65-1.17)	0.62 (0.56-0.80)	0.69 (0.61-0.78)	0.59 (0.52-0.67)
4/9-4/10	2014 <sup>C,D</sup>	1.94 (1.32-2.86)	0.36 (0.27-0.45)	0.18 (0.14-0.23)	0.25 (0.20-0.30)

<sup>A</sup> Assumed SAR(C<sub>0</sub>) same as SAR(C<sub>1</sub>) for 2001.

<sup>B</sup> In-river SAR is combination of groups C<sub>1</sub> and C<sub>0</sub>.

<sup>C</sup> Estimates for migration years 2006 through 2014 reflect use of new methodology developed for random pre-assignment of “monitor mode” and “return-to-river mode” operations. See 2016 CSS Annual Report for details.

<sup>D</sup> Migration year 2014 is incomplete with Age 2-salt adult returns through 9/16/2016.



**Figure 5.** Overall SAR (without jacks) for Dworshak NFH spring Chinook (with 90% confidence intervals). The NPCC 2-6% SAR objectives for listed wild populations are shown for reference. Migration year 2014 is incomplete with Age 2-salt adult returns through 9/16/2016.



More representative tagging for Snake River hatchery steelhead began in coordination among CSS, LSRCP, and IPC in migration year 2008. This increased sample size of PIT tags allowed for finer-scale analyses than in previous years. Since this time, the CSS has grouped and analyzed hatchery steelhead by run (A-run or B-run) and release drainage (e.g., Salmon River, Clearwater River, etc.). Therefore, estimates of SARs are not available for individual hatcheries. However, steelhead reared at Dworshak NFH are part of the Clearwater-B group, which also includes hatchery steelhead from Clearwater Hatchery. Estimates of juvenile survival in the hydrosystem, proportion transported, and various SARs for Clearwater-B hatchery steelhead are provided in Tables 7 and 8. All SAR estimates are for the LGR-to-GRA reach. The data presented in Tables 7 and 8 were taken from various chapters and appendices of the 2016 CSS Annual Report, which can be downloaded from the FPC webpage [www.fpc.org/documents/CSS.html](http://www.fpc.org/documents/CSS.html). A time series of the Overall SAR for the Clearwater-B hatchery steelhead group is also provided in Figure 6.

**Table 7.** Hatchery Clearwater-B steelhead juvenile survivals and estimated proportion transported (with 90% confidence intervals) from CSS. The Clearwater-B hatchery steelhead group is comprised of hatchery steelhead reared at Clearwater Hatchery and Dworshak NFH.

Migration Year <sup>A</sup>	Juvenile Survival (LGR-BON)	Proportion Transported
2008	0.47 (0.44-0.51)	0.30 (0.30-0.31)
2009	0.61 (0.55-0.68)	0.22 (0.21-0.22)
2010	0.52 (0.49-0.56)	0.31 (0.30-0.32)
2011	0.48 (0.46-0.50)	0.26 (0.25-0.26)
2012	0.69 (0.64-0.76)	0.14 (0.14-0.15)
2013 <sup>B</sup>	0.54 (0.47-0.64)	0.15 (0.14-0.15)
2014 <sup>B</sup>	0.67 (0.57-0.60)	0.25 (0.24-0.25)
2015	0.55 (0.50-0.60)	0.08 (0.07-0.08)

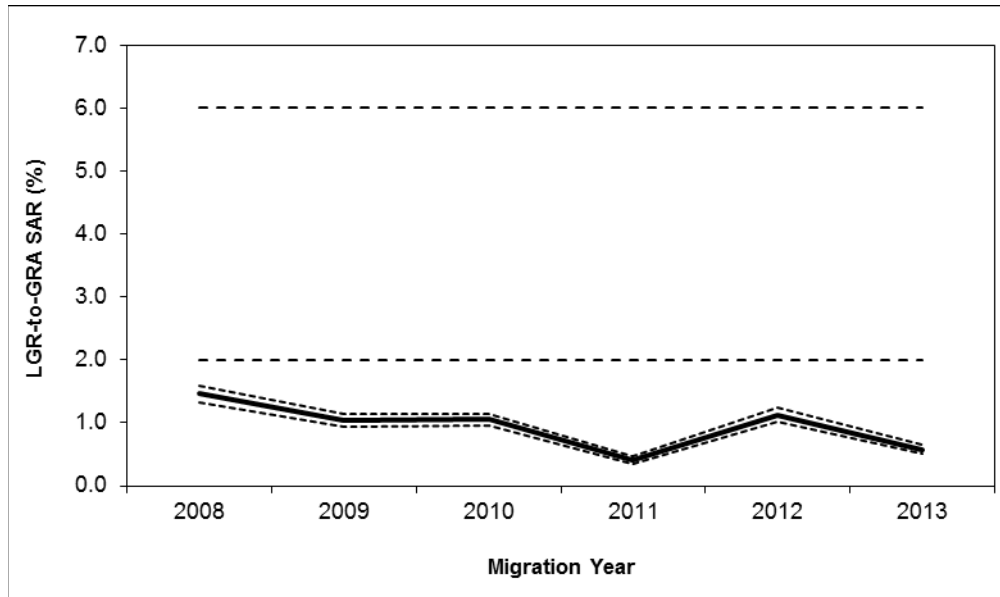
<sup>A</sup> All migration years reflect use of new methodology developed for random pre-assignment of “monitor mode” and “return-to-river mode” operations. See 2016 CSS Annual Report for details.

**Table 8.** Hatchery Clearwater-B steelhead TIR, SAR by study category (T vs. C<sub>0</sub>), and Overall SARs (with 90% confidence intervals) from CSS. The Clearwater-B hatchery steelhead group is comprised of hatchery steelhead reared at Clearwater Hatchery and Dworshak NFH.

Migration Year <sup>A</sup>	TIR	SAR(T) %	SAR(C <sub>0</sub> ) %	Overall SAR %
2008	1.55 (1.28-1.85)	1.96 (1.68-2.23)	1.26 (1.10-1.43)	1.46 (1.33-1.58)
2009	0.74 (0.57-0.97)	0.99 (0.79-1.20)	1.34 (1.12-1.57)	1.04 (0.93-1.14)
2010	0.76 (0.61-0.92)	0.90 (0.73-1.06)	1.18 (1.07-1.31)	1.05 (0.96-1.15)
2011	1.14 (0.78-1.69)	0.47 (0.36-0.60)	0.41 (0.31-0.53)	0.41 (0.35-0.46)
2012	1.05 (0.73-1.46)	1.21 (0.87-1.57)	1.15 (0.94-1.37)	1.12 (1.01-1.24)
2013 <sup>B</sup>	0.82 (0.53-1.19)	0.48 (0.32-0.68)	0.59 (0.51-0.68)	0.57 (0.50-0.65)

<sup>A</sup> All migration years reflect use of new methodology developed for random pre-assignment of “monitor mode” and “return-to-river mode” operations. See 2016 CSS Annual Report for details.

<sup>B</sup> Incomplete adult returns until 3-salt returns (if any) occur after Sept. 16, 2016, at GRA.



**Figure 6.** Overall SAR<sub>LGR-to-GRA</sub> for hatchery Clearwater-B steelhead (with 90% confidence intervals). The NPCC 2-6% SAR objectives for listed wild populations are shown for reference. Migration year 2013 may be incomplete, as Age 3-salt adults returning after through 9/16/2016 are not included.

We hope that the information we have provided regarding the use and application of information from the marked groups over the last several years is of some use to you. If you would like any additional information regarding these releases please feel free to contact us.

- c: Lance Hebdon, IDFG
- Tim Copeland, IDFG
- Brian Leth, IDFG
- Bill Tweit, WDFW
- Stuart Rosenberger, IPC
- Jay Hesse, Nez Perce
- Tom Rien, ODFW
- Steve Haeseker, USFWS
- Kyle Hanson, USFWS
- Erick Merrill, NPCC
- Tony Grover, NPCC
- Leslie Bach, NPCC
- FPAC

## Appendix A

**Table A.1.** Travel times (release to LGR) of PIT-tagged Dworshak NFH steelhead, by release site.

Release Date(s)	Release Site(s)	Migration Year	Travel Time (Days)			95% Confidence Limits	
			Min	Med	Max	Lower	Upper
4/14	CLEARC	2008	3.6	16.4	44.0	15.4	17.4
4/14	CLWRSF		4.5	23.9	56.5	23.6	24.5
4/21-4/24	DWORMS		0.5	8.6	49.5	8.4	8.8
4/15	CLEARC	2009	3.5	8.5	64.2	8.5	8.6
4/15	CLWRSF		3.7	10.6	54.8	10.4	11.2
4/14-4/17	DWORMS		2.5	6.5	54.2	6.5	6.6
4/14	CLWRSF	2010	3.4	11.8	55.5	11.5	12.5
4/19-4/22	DWORMS		2.4	10.1	66.3	9.8	10.4
3/21-3/24	CLEARC	2011	4.0	12.4	100.4	12.1	12.7
3/21-3/24	CLWRSF		4.5	27.8	94.3	23.6	30.9
3/28-3/31	DWORMS		1.7	8.6	85.2	8.2	9.1
4/4-4/6	CLEARC	2012	3.3	12.7	60.4	11.5	14.3
4/3-4/6	CLWRSF		4.5	21.5	64.4	21.1	22.0
4/12	DWORMS		1.5	5.4	55.4	5.3	5.5
4/11	LOLOC		6.6	32.4	64.4	28.7	35.4
4/9-4/10	CLEARC		3.3	6.6	49.6	6.3	7.5
4/10	CLWRSF	2013	3.5	11.8	61.0	11.4	14.7
4/17	DWORMS		3.4	5.0	42.3	4.8	5.3
4/15-4/16	LOLOC		2.4	28.3	51.8	27.4	28.5
4/15	CLEARC		3.3	7.6	40.8	7.4	8.3
4/14-4/15	CLWRSF		3.5	8.8	41.2	8.6	9.3
4/15-4/23	DWORMS	2014	1.7	5.2	47.8	4.9	5.3
4/18-4/21	LOLOC		1.7	19.0	61.9	18.4	19.6
4/14	CLEARC		4.6	8.3	35.2	8.1	8.7
4/17	CLWRSF		4.5	7.6	49.6	7.5	7.8
4/22	DWORMS		2.8	5.7	48.6	5.3	5.9
4/20	LOLOC	2015	4.5	20.4	45.7	18.6	21.0
4/13	CLEARC		2.3	5.5	41.5	5.4	5.6
4/11-4/14	CLWRSF		2.3	6.2	41.6	5.8	6.4
4/20	DWORMS		1.5	3.4	47.5	3.37	3.41
4/19-4/20	LOLOC		3.4	10.0	42.6	8.8	11.7

**Table A.2.** Estimated 10%, 50%, and 90% passage dates of PIT-tagged Dworshak NFH steelhead at Lower Granite Dam, by release site.

<b>Migration Year</b>	<b>Release Date(s)</b>	<b>Release Site(s)</b>	<b>10% Passage Date</b>	<b>50% Passage Date</b>	<b>90% Passage Date</b>
1997	4/28-5/2	DWOR	1-May	3-May	15-May
1998	4/27-4/30	DWOR	2-May	3-May	13-May
1999	4/26-4/30	DWORMS	30-Apr	4-May	25-May
2000	5/3-5/5	DWORMS	6-May	7-May	16-May
2001	4/23-4/26	DWORMS	29-Apr	2-May	17-May
2002	4/22-4/25	DWORMS	26-Apr	30-Apr	21-May
2003	4/24	DWORMS	25-Apr	28-Apr	20-May
2004	4/19-4/22	DWORMS	25-Apr	29-Apr	9-May
2005	4/18-4/22	DWORMS	26-Apr	1-May	10-May
2006	4/17-4/22	DWORMS	21-Apr	1-May	18-May
2007	4/16-4/19	DWORMS	22-Apr	1-May	13-May
2008	4/14	CLEARC	20-Apr	30-Apr	12-May
	4/14	CLWRSF	24-Apr	8-May	19-May
	4/21-4/24	DWORMS	28-Apr	2-May	16-May
2009	4/15	CLEARC	20-Apr	23-Apr	6-May
	4/15	CLWRSF	22-Apr	25-Apr	11-May
	4/14-4/17	DWORMS	6-May	11-May	8-May
2010	4/14	CLWRSF	25-Apr	17-May	27-May
	4/19-4/22	DWORMS	25-Apr	30-Apr	19-May
2011	3/21-3/24	CLEARC	30-Mar	2-Apr	1-Apr
	3/21-3/24	CLWRSF	2-Apr	14-Apr	23-May
	3/28-3/31	DWORMS	1-Apr	6-Apr	11-May
2012	4/4-4/6	CLEARC	12-Apr	22-Apr	30-Apr
	4/3-4/6	CLWRSF	15-Apr	26-Apr	16-May
	4/12	DWORMS	5-Apr	18-Apr	3-May
	4/11	LOLOC	26-Apr	13-May	23-May
2013	4/9-4/10	CLEARC	13-Apr	16-Apr	9-May
	4/10	CLWRSF	16-Apr	21-Apr	12-May
	4/17	DWORMS	21-Apr	22-Apr	6-May
	4/15-4/16	LOLOC	29-Apr	13-May	20-May
2014	4/15	CLEARC	19-Apr	23-Apr	6-May
	4/14-4/15	CLWRSF	20-Apr	23-Apr	7-May
	4/15-4/23	DWORMS	26-Apr	28-Apr	7-May
	4/18-4/21	LOLOC	27-Apr	8-May	26-May
2015	4/14	CLEARC	20-Apr	22-Apr	30-Apr
	4/17	CLWRSF	23-Apr	25-Apr	8-May
	4/22	DWORMS	25-Apr	27-Apr	7-May
	4/20	LOLOC	28-Apr	10-May	21-May
2016	4/13	CLEARC	16-Apr	19-Apr	27-Apr
	4/11-4/14	CLWRSF	16-Apr	19-Apr	1-May
	4/20	DWORMS	22-Apr	23-Apr	27-Apr
	4/19-4/20	LOLOC	25-Apr	29-Apr	15-May