



# FISH PASSAGE CENTER

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January 2, 2013

Mr. Bill Brignon  
U.S. Fish and Wildlife Service  
Columbia River Fisheries Program Office  
1211 SE Cardinal Court, Suite 100  
Vancouver, WA. 98683

Dear Bill-

In response to your request, the Fish Passage Center staff has updated the Columbia Gorge Complex Hatchery Report to include summaries of the 2012 out-migration for USFWS hatcheries of the Columbia Gorge Complex, including: 1) Carson NFH, 2) Spring Creek NFH, 3) Little White Salmon NFH, 4) Willard NFH, and 5) Warm Springs NFH. Data that are summarized in this report include: 1) juvenile timing to Bonneville Dam (BON), 2) juvenile fish travel time to BON, and 3) estimates of smolt-to-adult return rates (SARs) from release to BON. Also provided are data to describe some of the out-migration conditions these fish may have experienced over the years. These analyses are based on PIT-tagged Chinook released at each of these hatcheries over the years.

## **Carson NFH (1997-2012):**

Since 1997, the Fish Passage Center has been PIT-tagging spring Chinook from the Carson National Fish Hatchery facility as part of the Smolt Monitoring Program (SMP) and Comparative Survival Study (CSS). For purposes of these studies data are collected on either juvenile life stage, or both the juvenile and adult life stages. The SMP provides information for in-season management of the hydrosystem and post-season analyses to the federal, state, and tribal fishery agencies.

Under the Smolt Monitoring Program, information is collected on the timing and migration speed from the release at the hatchery to Bonneville Dam. Table 1 provides estimates of minimum, median, and maximum travel times from each year's release to Bonneville Dam. Also provided are estimates of the 95% confidence limits around the estimated median travel time.

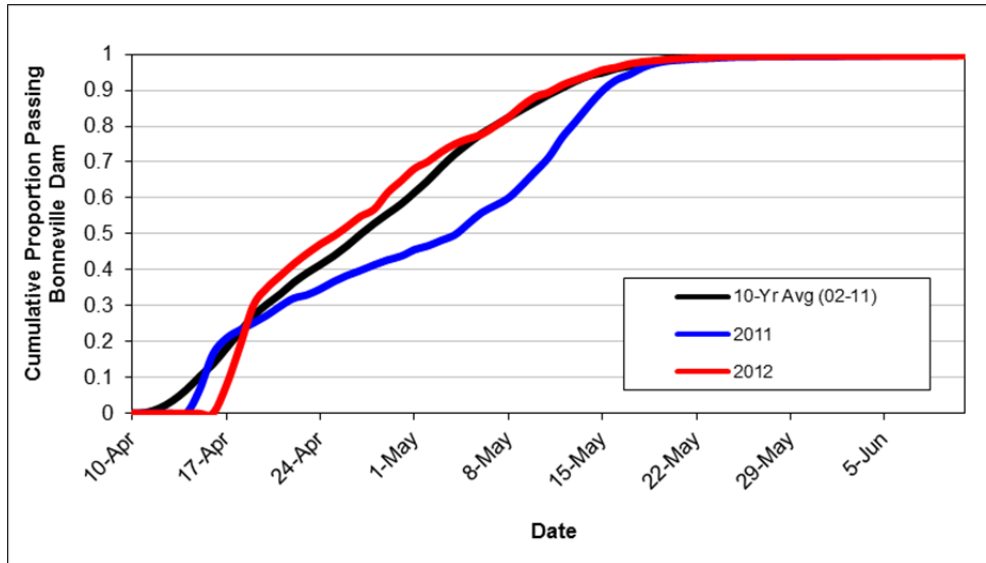
Table 2 presents the estimated 10%, 50%, and 90% passage dates of Carson NFH spring Chinook juveniles at Bonneville Dam for each of the years of tagging. Finally, Figure 1 is provided as an illustration of how the arrival timing of the 2012 smolt release relates to last year's release, as well as the 10-year average arrival timing (2002-2011).

**Table 1.** Carson National Fish Hatchery Spring Chinook Travel Times to Bonneville Dam

Release Date	Migration Year	Travel Time (Days)			Confidence Limits 95%		Bonneville Flow (kcfs)
		Min	Med	Max	Lower	Upper	
17-Apr	1997	0.66	16.5	33.7	14.6	17.1	
20-Apr	1998	1.7	10.0	38.5	9.6	10.7	
20-Apr	1999	0.8	8.7	94.3	7.8	9.5	198.5
20-Apr	2000	0.9	11.6	41.2	10.7	12.6	192.5
19-Apr	2001	1.6	18.5	130.3	18.3	18.7	127.8
17-Apr	2002	0.7	15.6	76.7	15.5	15.7	132.1
16-Apr	2003	1.2	12.5	42.5	11.6	13	111.8
15-Apr	2004	0.9	10.4	65.9	9.6	10.6	143.8
15-Apr	2005	1.5	11.5	29.3	10.7	11.6	146.7
10-Apr	2006	0.7	7.4	44.3	6.7	8.4	226.2
12-Apr	2007	0.9	17.6	41.6	15.7	18.6	215.7
11-Apr	2008	0.9	17.5	98.3	16.2	18.6	158.4
13-Apr	2009	0.7	22.5	101.4	21.5	23.5	164.4
13-Apr	2010	0.8	21	113.4	20.6	21.5	134.3
14-Apr	2011	0.8	20.3	99.2	18.9	21.1	252.5
16-Apr	2012	0.6	7.8	74.2	7.5	8.7	293.9

**Table 2.** Estimated 10%, 50%, and 90% passage dates of Carson NFH spring Chinook at Bonneville Dam.

Migration Year	Release Date	10% Passage Date	50% Passage Date	90% Passage Date
1997	17-Apr	22-Apr	4-May	13-May
1998	20-Apr	24-Apr	29-Apr	7-May
1999	20-Apr	22-Apr	29-Apr	10-May
2000	20-Apr	22-Apr	1-May	15-May
2001	19-Apr	26-Apr	7-May	14-May
2002	17-Apr	20-Apr	3-May	13-May
2003	16-Apr	19-Apr	27-Apr	10-May
2004	15-Apr	17-Apr	25-Apr	5-May
2005	15-Apr	18-Apr	26-Apr	6-May
2006	10-Apr	12-Apr	18-Apr	6-May
2007	12-Apr	15-Apr	30-Apr	12-May
2008	11-Apr	14-Apr	26-Apr	12-May
2009	13-Apr	15-Apr	5-May	18-May
2010	13-Apr	16-Apr	2-May	13-May
2011	14-Apr	16-Apr	5-May	16-May
2012	16-Apr	18-Apr	26-Apr	12-May



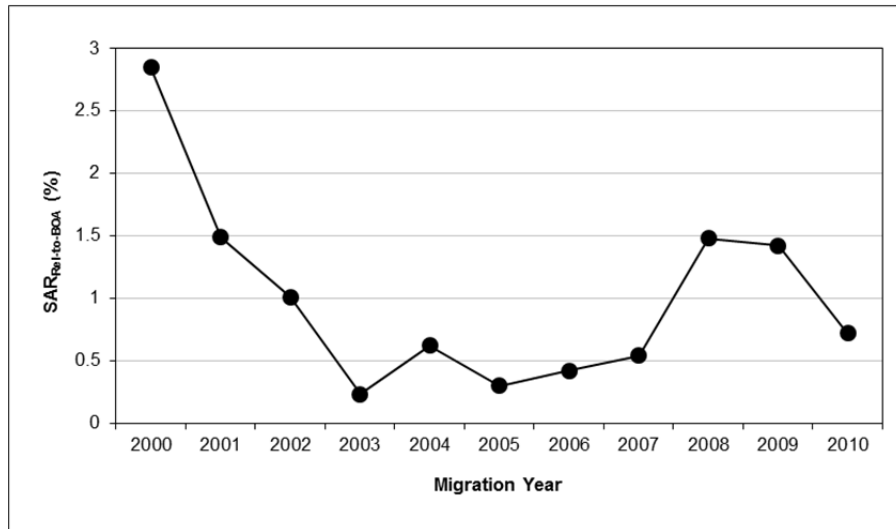
**Figure 1.** Cumulative passage timing of Carson NFH spring Chinook to Bonneville Dam.

Finally, Table 3 contains estimates of SARs for release to BON (without jacks). These SAR estimates were taken from Chapter 4 of the 2012 CSS Annual Report, which can be downloaded from the FPC webpage <http://www.fpc.org/documents/CSS.html>. Figure 2 is provided to illustrate the time series of the SAR estimates over the years of available data for Carson NFH spring Chinook.

**Table 3.** Carson NFH Spring Chinook SARs (without jacks) from CSS, as presented in 2011 CSS Annual Report

Migration Year	Release Date(s)	PIT-Tags Released	Overall SAR <sub>Rel-to-BOA</sub>	Non-Parametric CI	
				90% LL	90% UL
2000	20-Apr	14,992	2.85	2.62	3.07
2001	19-Apr	14,978	1.49	1.32	1.65
2002	17-Apr	14,983	1.01	0.88	1.14
2003	16-Apr	14,983	0.23	0.17	0.29
2004	15-Apr	14,973	0.62	0.51	0.73
2005	15-Apr	14,958	0.30	0.23	0.37
2006	10-Apr	14,971	0.42	0.33	0.51
2007	12-Apr	14,943	0.54	0.43	0.63
2008	11-Apr	14,884	1.48	1.32	1.65
2009	13-Apr	14,975	1.42	1.32	1.63
2010 <sup>A</sup>	13-Apr	14,947	0.72	0.72	0.95

<sup>A</sup> Migration year 2010 is incomplete with Age 2-salt adult returns through 9/10/2012



**Figure 2.** Overall SAR<sub>Rel-to-BOA</sub> for Carson NFH spring Chinook (2000-2010). Migration year 2010 is incomplete for yearling Chinook, with Age 2-salt adult returns through 9/10/2012.

### Spring Creek NFH (2008-2012):

Migration year 2012 is the fifth year that PIT-tagging has occurred for fall Chinook juveniles released from Spring Creek National Fish Hatchery. During these five years, Spring Creek NFH conducted separate PIT-tag releases in March (2008 only), April, and May. Below is a summary of some of the information that was gathered from these PIT-tag releases.

Table 4 provides estimates of minimum, median, and maximum travel times from each year's release to Bonneville Dam. Also provided are estimates of the 95% confidence limits around the estimated median travel time. Table 5 presents the estimated 10%, 50%, and 90% passage dates of Spring Creek NFH fall Chinook juveniles at Bonneville Dam for each of the years of tagging. Separate passage dates were estimated for each of the monthly releases. Finally, Figures 3 and 4 are provided as illustrations of the arrival timing of the 2008-2012 April and May smolt releases, respectively.

**Table 4.** Spring Creek NFH Fall Chinook Travel Times to Bonneville Dam

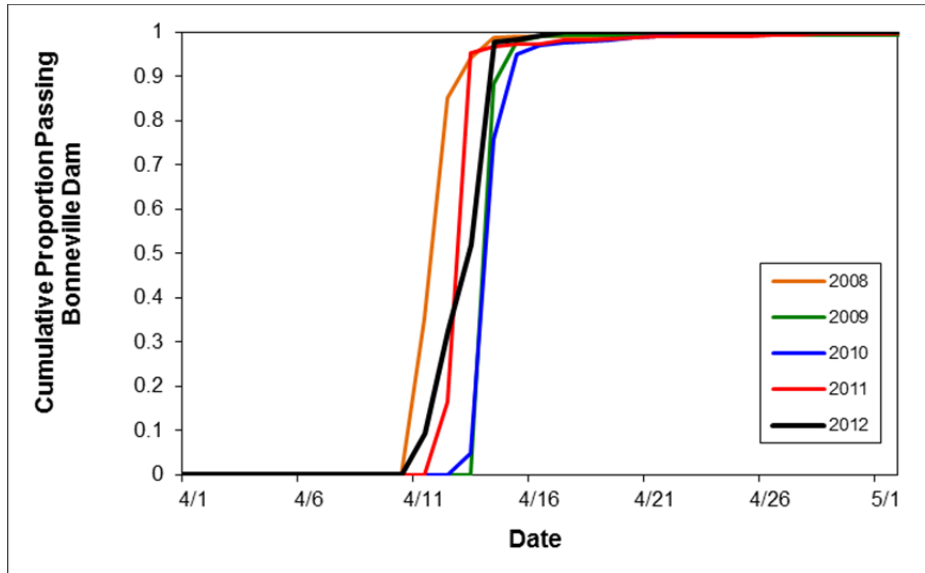
Release Month	Migration Year	Release Date	Travel Time (Days)			95% Confidence Limits		Bonneville Flow (kcfs)
			Min	Med	Max	Lower	Upper	
March	2008	Mar. 5-6	1.2	2.7	104.9	2.6	2.7	145.3
April	2008	Apr. 10	1.1	1.8	22.7	1.7	1.8	130.7
	2009	Apr. 13	0.6	1.2	61.8	1.1	1.4	207.8
	2010	Apr. 12	1.3	2.4	30.5	2.4	2.4	96.9
	2011	Apr 12	0.3	0.6	19.9	0.6	0.6	294.3
	2012	Apr 11 & 13	0.3	0.7	23.6	0.7	0.7	272.0
May	2008	May 2	0.7	1.8	25.8	1.7	1.9	191.7
	2009	May 1	0.6	1.6	52.0	1.5	1.7	224.4
	2010	May 10	0.6	2.1	41.7	1.9	2.4	158.6
	2011	May 4	0.5	1.4	8.3	1.1	1.5	248.3
	2012	Apr 30 <sup>A</sup>	0.3	0.5	23.6	0.5	0.6	372.2

<sup>A</sup> Although this release actually occurred in April of 2012, it is being summarized with the May releases since it was originally intended for release in May.

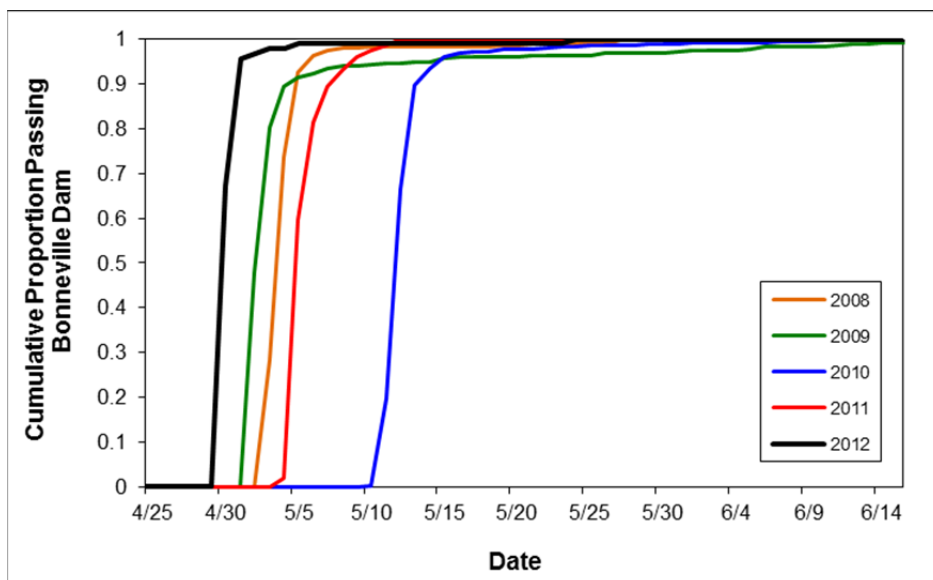
**Table 5.** Estimated 10%, 50%, and 90% passage dates of Spring Creek NFH fall Chinook at Bonneville Dam.

Release Month	Migration Year	Release Date	10% Passage Date	50% Passage Date	90% Passage Date
March	2008	5 & 6-Mar	7-Mar	8-Mar	9-Mar
April	2008	10-Apr	11-Apr	12-Apr	13-Apr
	2009	13-Apr	14-Apr	14-Apr	15-Apr
	2010	12-Apr	14-Apr	14-Apr	15-Apr
	2011	12-Apr	12-Apr	13-Apr	13-Apr
	2012	Apr 11 & 13	12-Apr	14-Apr	14-Apr
May	2008	2-May	3-May	4-May	5-May
	2009	1-May	2-May	2-May	5-May
	2010	10-May	11-May	12-May	14-May
	2011	4-May	5-May	5-May	8-May
	2012	30-Apr <sup>A</sup>	30-Apr	30-Apr	1-May

<sup>A</sup> Although this release actually occurred in April of 2012, it is being summarized with the May releases since it was originally intended for release in May.



**Figure 3.** Cumulative passage timing of Spring Creek NFH fall Chinook to Bonneville Dam (April Releases).



**Figure 4.** Cumulative passage timing of Spring Creek NFH fall Chinook to Bonneville Dam (May Releases).

Finally, Table 6 contains estimates of SARs for release to BON (without jacks) for migration years 2008-2010. These SAR estimates were derived using the same methodology as the estimates for Carson NFH for the 2012 CSS Annual Report.

**Table 6.** Spring Creek NFH Fall Chinook SARs (without jacks) (release to BON).

Release Month	Migration Year	Release Date(s)	PIT-Tags Released	Overall SAR <sub>Rel-to-BOA</sub>	Non-Parametric CI	
					90% LL	90% UL
March	2008	3/5-3/6	7,447	0.27	0.188	0.39
April	2008	4/10	3,953	0.63	0.44	0.88
	2009	4/13	8,686	0.06	0.02	0.12
	2010 <sup>A</sup>	4/12	8,962	0.25	0.17	0.35
May	2008	5/2	2,677	0.52	0.32	0.82
	2009	5/1	5,950	0.22	0.13	0.35
	2010 <sup>A</sup>	5/10	5,971	0.20	0.12	0.33

<sup>A</sup> Migration year 2010 is incomplete with Age 2-salt adult returns through 12/30/2012

### Little White Salmon NFH (2008-2012):

Migration year 2012 is the fifth year where spring and fall Chinook juveniles were PIT-tagged and released from Little White Salmon National Fish Hatchery. During this time, all spring Chinook releases occurred in April while fall Chinook releases occurred in late June or early July. Below is a summary of some of the information that was gathered from these PIT-tag releases.

Table 7 provides estimates of minimum, median, and maximum travel times from each year's release to Bonneville Dam. Also provided are estimates of the 95% confidence limits around the estimated median travel time. Table 8 presents the estimated 10%, 50%, and 90%

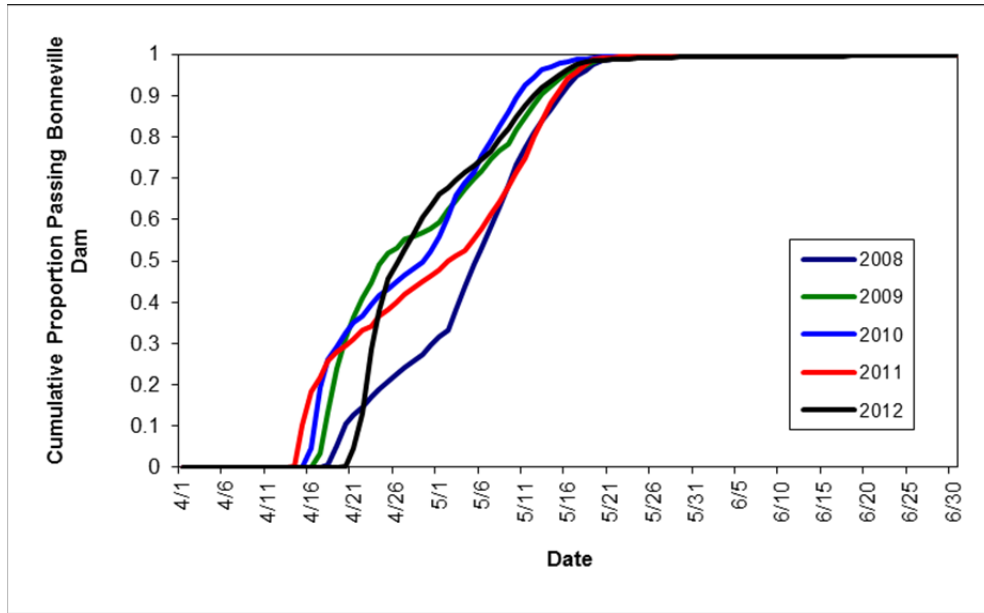
passage dates of Little White Salmon NFH spring Chinook and fall Chinook juveniles at Bonneville Dam for each of the years of tagging. Finally, Figures 5 and 6 are provided as illustrations of the arrival timing of the 2008-2012 spring Chinook and fall Chinook smolt releases, respectively.

**Table 7.** Little White Salmon NFH Spring and Fall Chinook Travel Times to Bonneville Dam

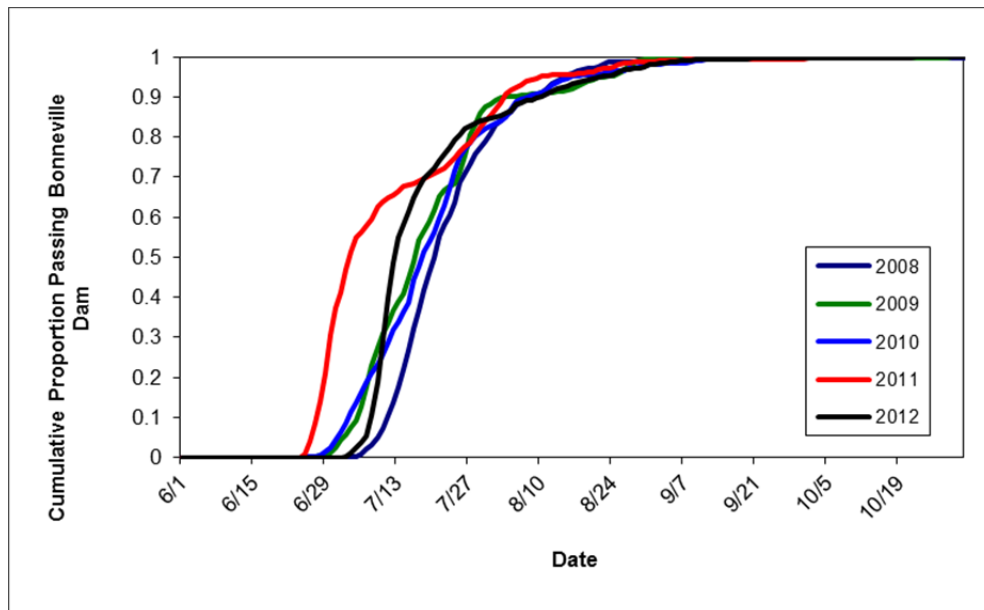
Species	Migration Year	Release Date	Travel Time (Days)			95% Confidence Limits		Bonneville
			Min	Med	Max	Lower	Upper	Flow (kcfs)
SpCH	2008	17-Apr	0.3	20.7	94.4	20.4	21.0	176.1
	2009	16-Apr	0.7	8.6	40.8	7.7	9.8	244.9
	2010	15-Apr	0.8	16.6	49.0	16.2	17.0	140.4
	2011	13-Apr	0.9	19.2	108.1	16.5	21.4	255.6
	2012	19-Apr	0.5	9.6	127.2	9.0	9.7	340.2
FaCH	2008	3-Jul	1.1	16.1	139.5	15.6	16.7	225.3
	2009	18-Jun	9.4	28.4	154.2	27.7	28.8	199.8
	2010	24-Jun	0.9	22.5	123.9	22.4	23.1	234.4
	2011	23-Jun	1.7	12.4	126.2	11.5	13.6	419.4
	2012	3-Jul	0.5	9.9	127.2	9.6	10.6	325.4

**Table 8.** Estimated 10%, 50%, and 90% passage dates of Little White Salmon NFH spring and fall Chinook at Bonneville Dam.

Species	Migration Year	Release Date	10% Passage Date	50% Passage Date	90% Passage Date
SpCH	2008	17-Apr	20-Apr	6-May	16-May
	2009	16-Apr	18-Apr	25-Apr	13-May
	2010	15-Apr	17-Apr	30-Apr	11-May
	2011	13-Apr	15-Apr	3-May	15-May
	2012	19-Apr	22-Apr	27-Apr	12-May
FaCH	2008	3-Jul	11-Jul	21-Jul	9-Aug
	2009	18-Jun	6-Jul	17-Jul	4-Aug
	2010	24-Jun	4-Jul	18-Jul	8-Aug
	2011	23-Jun	28-Jun	4-Jul	3-Aug
	2012	3-Jul	8-Jul	13-Jul	10-Aug



**Figure 5.** Cumulative passage timing of Little White Salmon NFH spring Chinook to Bonneville Dam.



**Figure 6.** Cumulative passage timing of Little White Salmon NFH fall Chinook to Bonneville Dam.

Finally, Table 9 contains estimates of SARs for release to BON (without jacks) for migration years 2008 through 2010. These SAR estimates were derived using the same methodology as the estimates for Carson NFH for the 2012 CSS Annual Report.



**Table 9.** Little White Salmon NFH Spring and Fall Chinook SARs (without jacks) (release to BON)

Species	Migration Year	Release Date	Pit-Tags Released	Overall SAR <sub>Rel-to-BOA</sub>	Non-Parametric CI	
					90% LL	90% LL
SpCH	2008	17-Apr	14,941	1.87	1.69	2.06
	2009 <sup>A</sup>	16-Apr	7,492	1.16	0.97	1.39
	2010 <sup>B</sup>	15-Apr	7,467	0.31	0.21	0.44
FaCH	2008	3-Jul	24,886	1.00	0.90	1.11
	2009 <sup>A</sup>	18-Jun	24,947	0.39	0.33	0.46
	2010 <sup>B</sup>	24-Jun	24,953	0.29	0.23	0.35

<sup>A</sup> SAR estimates are for adults detected at Bonneville Dam through 12/31/2012 and, thus, may be incomplete.

<sup>B</sup> Migration year 2010 is incomplete with only Age 2-salt adult returns through 12/31/2012

### Willard NFH (2009-2012):

The FPC staff identified four years (2009-2012) where spring Chinook juveniles were PIT-tagged and released from Willard National Fish Hatchery. During this time, spring Chinook releases occurred in April. Below is a summary of some of the information that was gathered from these PIT-tag releases.

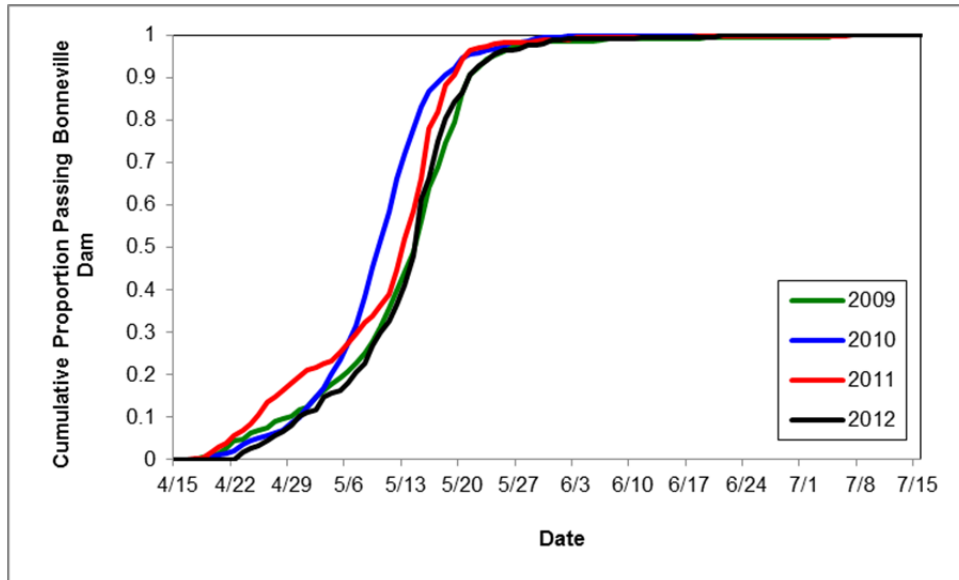
Table 10 provides estimates of minimum, median, and maximum travel times from each year's release to Bonneville Dam. Also provided are estimates of the 95% confidence limits around the estimated median travel time. Table 11 presents the estimated 10%, 50%, and 90% passage dates of Willard NFH spring Chinook juveniles at Bonneville Dam for each of the years of tagging. Finally, Figure 7 is provided as an illustration of the arrival timing to Bonneville Dam of the 2009-2012 spring Chinook smolt releases.

**Table 10.** Willard NFH Spring Chinook Travel Times to Bonneville Dam

Migration Year	Release Date	Travel Time (Days)			95% Confidence Limits		Bonneville Flow (kcfs)
		Min	Med	Max	Lower	Upper	
2009	16-Apr	1.6	28.9	80.4	27.9	29.5	236.7
2010	15-Apr	3.4	26.0	58.0	25.5	26.3	149.4
2011	14-Apr	2.8	28.7	84.2	28.4	29.4	252.8
2012	19-Apr	3.9	25.9	63.4	25.5	26.5	345.7

**Table 11.** Estimated 10%, 50%, and 90% passage dates of Willard NFH spring Chinook at Bonneville Dam.

Migration Year	Release Date	10% Passage Date	50% Passage Date	90% Passage Date
2009	16-Apr	29-Apr	16-May	21-May
2010	15-Apr	1-May	10-May	18-May
2011	14-Apr	25-Apr	13-May	19-May
2012	19-Apr	30-Apr	15-May	21-May



**Figure 7.** Cumulative passage timing of Willard NFH spring Chinook to Bonneville Dam.

Finally, Table 12 contains estimates of SARs for release to BON (without jacks) for migration years 2009 and 2010. These SAR estimates were derived using the same methodology as the estimates for Carson NFH for the 2012 CSS Annual Report.

**Table12.** Willard NFH Spring Chinook SARs (without jacks) (release to BON)

Migration Year	Release Date	PIT-Tags Released	Overall SAR <sub>Rel-to-BOA</sub>	Non-Parametric CI	
				90% LL	90% LL
2009	4/16	7,498	0.69	0.54	0.87
2010 <sup>A</sup>	4/15	7,453	0.39	0.28	0.53

<sup>A</sup> Migration year 2010 is incomplete with Age 2-salt adult returns through 12/31/2012

**Warm Springs NFH (2002, 2007-2012):**

The FPC staff identified seven total years (2002, 2007-2012) where spring Chinook juveniles were PIT-tagged and released from Warm Springs National Fish Hatchery. During this time, spring Chinook releases typically occurred in April. Below is a summary of some of the information that was gathered from these PIT-tag releases.

Table 13 provides estimates of minimum, median, and maximum travel times from each year’s release to Bonneville Dam. Also provided are estimates of the 95% confidence limits around the estimated median travel time. PIT-tags released for migration year 2002 were assigned a release date of April 7<sup>th</sup>, even though the volitional release began on March 26<sup>th</sup>. For each of migration years 2007, 2008, and 2009, Warm Springs NFH conducted volitional releases of spring Chinook in October and November of the previous year. These early volitional releases potentially allowed for some PIT-tagged juveniles to leave the hatchery prior to the spring. Another volitional release was done in mid-March to mid-April, which allowed for the

remaining spring Chinook juveniles to leave the hatchery. Given the nature of releases in these migration years, the PIT-tagged fish were assigned a meaningless release date in PTAGIS. Therefore, it was not possible to estimate travel time to BON based on the release date from PTAGIS. Releases in 2010 were assigned two different “release dates” of April 1<sup>st</sup> and April 15<sup>th</sup>. These release dates are based on the date that PIT-tagged fish were forced out of the ponds, after a volitional release that began on March 24<sup>th</sup>. For migration year 2011, the release date from PTAGIS corresponds to the start date of the entire volitional release, which was April 4<sup>th</sup>. Finally, in the 2012 release was also a volitional release that began on April 2<sup>nd</sup> and ended on April 26<sup>th</sup>. For all the years in this analysis, we estimated travel times to BON based on the start date of the spring volitional releases (Table 13). For migration year 2007-2009 releases, any PIT-tagged fish that were detected at BON prior to this spring start date were removed from the travel time analysis. In all, this resulted in zero removals for 2007, one removal for 2008, and two removals for 2009.

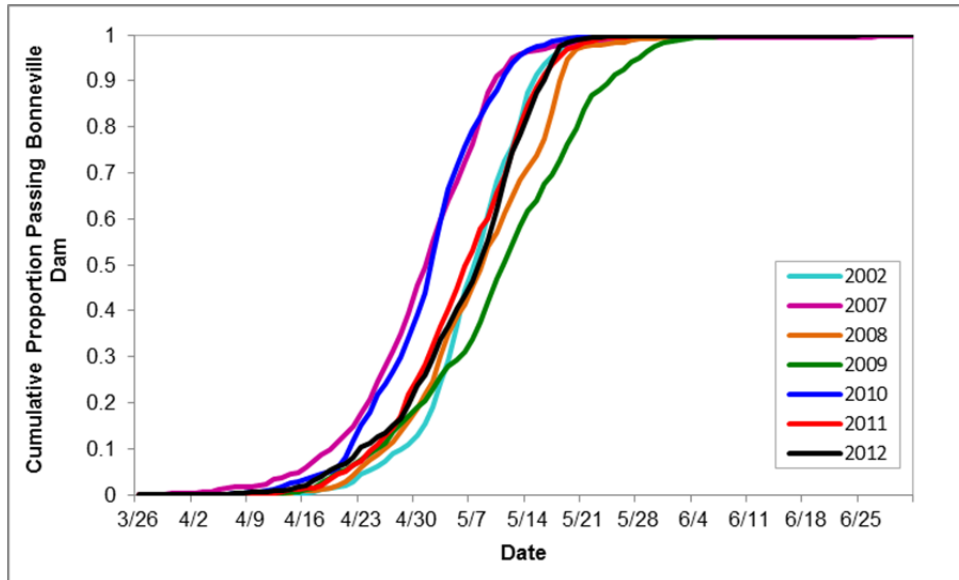
Table 14 presents the estimated 10%, 50%, and 90% passage dates of Warm Springs NFH spring Chinook juveniles at Bonneville Dam for each of the years of tagging. Finally, Figure 8 is provided as an illustration of the arrival timing of the 2002, 2007-2012 spring Chinook smolt releases.

**Table 13.** Warm Springs NFH Spring Chinook Travel Times to Bonneville Dam

Migration Year	Spring Release Dates	Travel Time (Days)			95% Confidence Limits	
		Min	Med	Max	Lower	Upper
2002	Mar. 26-Apr. 18	18.1	42.8	67.5	41.9	43.9
2007	Mar. 21-Apr. 18	7.8	42.6	160.5	41.9	43.3
2008	Mar. 23-Apr. 23	19.8	48.2	70.1	47.8	48.9
2009	Mar. 26-Apr. 20	9.9	47.0	80.5	46.1	47.6
2010	Mar. 24-Apr 21	7.9	40.4	68.8	39.9	40.7
2011	Apr. 4-Apr. 27	4.8	32.5	54.0	31.7	33.5
2012	Apr. 2-Apr. 26	5.2	37.2	84.3	36.3	37.7

**Table 14.** Estimated 10%, 50%, and 90% passage dates of Warm Springs NFH spring Chinook at Bonneville Dam.

Migration Year	Spring Release Dates	10% Passage Date	50% Passage Date	90% Passage Date
2002	Mar. 26-Apr. 18	29-Apr	8-May	15-May
2007	Mar. 21-Apr. 18	20-Apr	2-May	10-May
2008	Mar. 23-Apr. 23	26-Apr	9-May	18-May
2009	Mar. 26-Apr. 20	25-Apr	11-May	25-May
2010	Mar. 24-Apr 21	22-Apr	2-May	11-May
2011	Apr. 4-Apr. 27	25-Apr	7-May	16-May
2012	Apr. 2-Apr. 26	23-Apr	8-May	16-May



**Figure 8.** Cumulative passage timing of Warm Springs NFH spring Chinook to Bonneville Dam.

Finally, Table 15 contains estimates of SARs for release to BON (without jacks) for migration years 2002 and 2007-2010. With exception to migration year 2002, these SAR estimates were taken from Chapter 4 of the 2012 CSS Report, which can be downloaded from the FPC webpage <http://www.fpc.org/documents/CSS.html>. The SAR estimate for migration year 2002 was derived using the same methodology as the 2012 CSS Report.

**Table 15.** Warm Springs NFH Spring Chinook SARs (without jacks) (release to BON).

Migration Year	Spring Release Dates	PIT-Tags Released	Overall SAR <sub>Rel-to-BOA</sub>	Non-Parametric CI	
				90% LL	90% LL
2002	Mar. 26-Apr. 18	3,998	0.95	0.71	1.24
2007	Mar. 21-Apr. 18	19,698	0.30	0.30	0.44
2008	Mar. 23-Apr. 23	19,936	0.84	0.73	0.94
2009	Mar. 26-Apr. 20	19,924	0.65	0.56	0.74
2010 <sup>A</sup>	Mar. 24-Apr 21	14,907	0.20	0.14	0.26

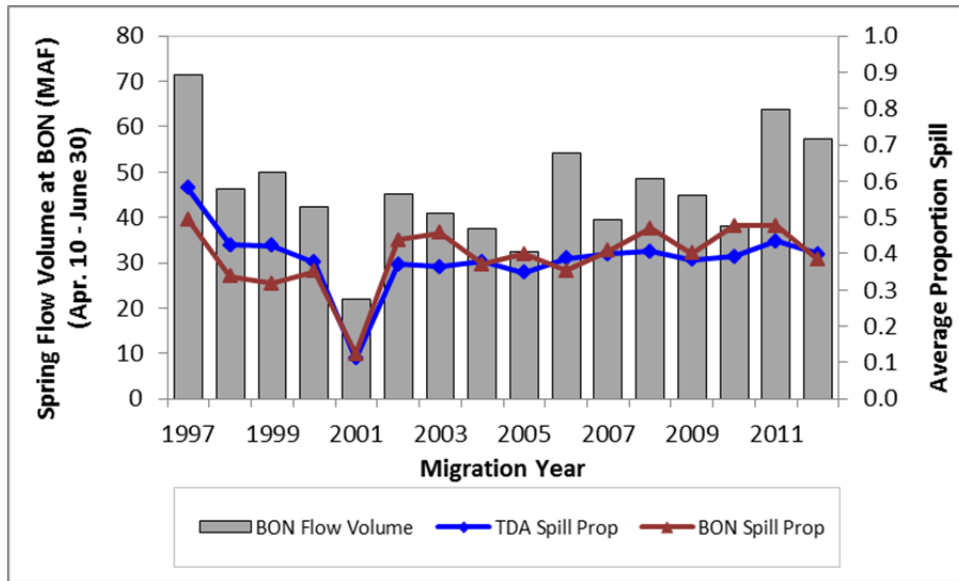
<sup>A</sup> Migration year 2010 is incomplete with Age 2-salt adult returns through 9/10/2012

### Outmigration Conditions in Lower Columbia River:

Most of the PIT-tag releases from Columbia Gorge Complex hatcheries are of spring migrants; with the exception of fall Chinook brights that are released in June and/or July from Little White Salmon NFH. Hatchery Chinook that are released from Carson, Spring Creek, Little White Salmon, and Willard hatcheries only have one FCRPS project (BON) to pass during their out-migration to the ocean. Hatchery Chinook released from Warm Springs NFH have to pass two FCRPS projects (TDA and BON) during their outmigration.

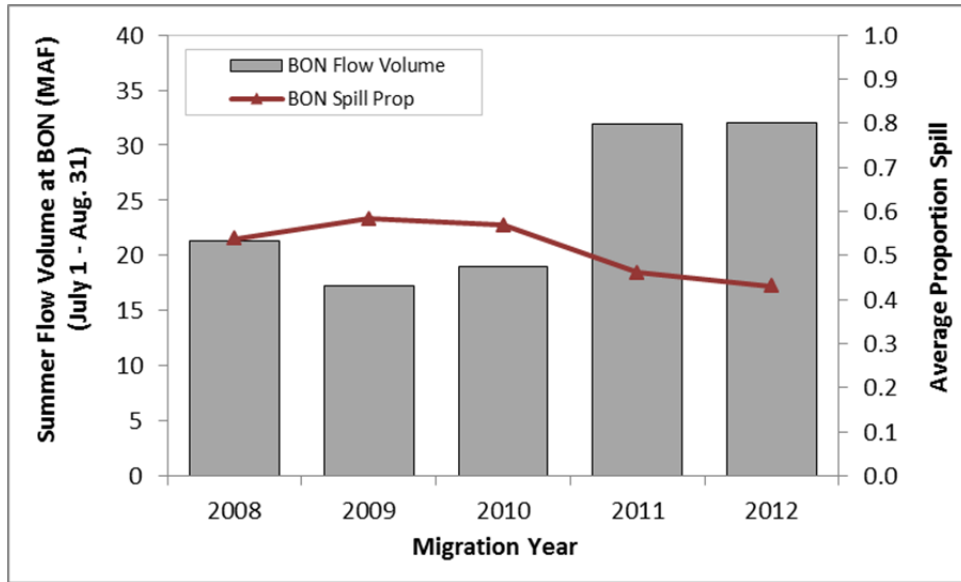
Figure 9 is provided below to illustrate the out-migration conditions that the spring migrants may have experienced in the Lower Columbia River during their out-migration. This figure provides the total flow volume in the Lower Columbia River (as measured at Bonneville

Dam), along with the average spring spill proportions at Bonneville and The Dalles dams during the spring period (Apr. 10-June 30).



**Figure 9.** Total spring flow volume in the Lower Columbia River (at Bonneville Dam) and average spill proportion at The Dalles and Bonneville dams. Spring period in the Lower Columbia River is April 10-June 30.

Figure 10 is provided to illustrate the out-migration conditions that the summer migrants (i.e., fall Chinook brights from LWSH) may have experienced in the Lower Columbia River during the summer period (July 1-Aug. 31). This figure starts with migration year 2008, since this is when PIT-tagging efforts for Little White Salmon NFH fall Chinook brights began. Since hatchery Chinook released from Little White Salmon NFH only have to pass Bonneville Dam, Figure 9 provides the total flow volume in the Lower Columbia River (as measured at Bonneville Dam), along with the average spring spill proportion at Bonneville Dam during the summer period (July 1-August 31).



**Figure 10.** Total summer flow volume in the Lower Columbia River (at Bonneville Dam) and average spill proportion at Bonneville Dam. Summer period in the Lower Columbia River is July 1-August 31.

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.

Sincerely,

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