



FISH PASSAGE CENTER

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MEMORANDUM

TO: Michael Clark, USFWS

FROM: Gabe Scheer

DATE: June 13, 2018

RE: 2017 Columbia Gorge Complex Hatchery Report

The Fish Passage Center staff has updated the Columbia Gorge Complex Hatchery Report to include summaries of the 2015 and 2016 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 fish travel time to BON, (2) juvenile timing to Bonneville Dam (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 (1997–2017)

Since 1997, the Fish Passage Center has been PIT-tagging spring Chinook from the Carson National Fish Hatchery facility as part of the Comparative Survival Study (CSS). The CSS is a multi-year program that estimates survival rates over different life stages for Chinook, steelhead, and sockeye juveniles produced in major hatcheries throughout the Columbia River Basin. We would like to share with you an update of some of the information we developed under the CSS for the Chinook used from the Carson NFH facility in 2016 and 2017 as well as past years.

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

Release Date	Migration Year	Travel Time (Days)			95% Confidence Limits	
		Min	Med	Max	Lower	Upper
17-Apr	1997	0.7	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
20-Apr	2000	0.9	11.6	41.2	10.7	12.6
19-Apr	2001	1.6	18.5	130.3	18.3	18.7
17-Apr	2002	0.7	15.6	76.7	15.5	15.7
16-Apr	2003	1.2	12.5	42.5	11.6	13.0
15-Apr	2004	0.9	10.4	65.9	9.6	10.6
15-Apr	2005	1.5	11.5	29.3	10.7	11.6
10-Apr	2006	0.7	7.4	44.3	6.7	8.4
12-Apr	2007	0.9	17.6	41.6	15.7	18.6
11-Apr	2008	0.9	17.5	98.3	16.2	18.6
13-Apr	2009	0.7	22.5	101.4	21.5	23.5
13-Apr	2010	0.8	21.0	113.4	20.6	21.5
14-Apr	2011	0.8	20.3	99.2	18.9	21.1
16-Apr	2012	0.6	7.8	74.2	7.5	8.7
17-Apr	2013	1.4	14.6	69.7	14.5	14.7
16-Apr	2014	1.6	17.6	57.4	16.5	18.5
15-Apr	2015	1.2	16.8	47.3	16.6	16.8
12-Apr	2016	0.9	8.9	44.5	8.5	9.8
10-Apr	2017	0.9	9.5	45.3	8.5	10.8

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. Figure 1 is provided as an illustration of how the arrival timing of the 2017 smolt release related to the previous year’s release, as well as the 10-year average arrival timing (2007–2016).

Table 2. Estimated 10%, 50%, and 90% passage dates of PIT-tagged 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
2013	17-Apr	26-Apr	1-May	11-May
2014	16-Apr	20-Apr	3-May	14-May
2015	15-Apr	20-Apr	1-May	6-May
2016	12-Apr	14-Apr	21-Apr	1-May
2017	10-Apr	12-Apr	19-Apr	3-May

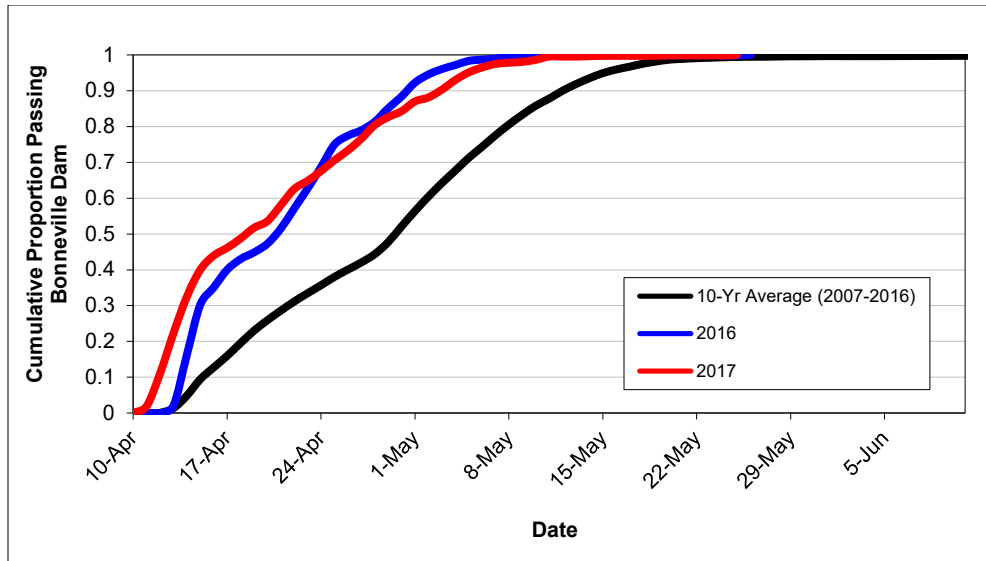


Figure 1. Cumulative passage timing of PIT-tagged Carson NFH spring Chinook to Bonneville Dam.

Table 3 contains estimates of SARs for release to BON (without jacks). These SAR estimates were taken from Appendix B of the 2017 CSS Annual Report, which can be downloaded from the FPC webpage 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.

Migration Year	Release Date(s)	PIT-Tags Released	Overall SAR _{Rel-to-BOA}	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	13-Apr	14,941	0.75	0.64	0.86
2011	14-Apr	14,953	0.33	0.26	0.42
2012	16-Apr	14,941	0.54	0.44	0.64
2013	17-Apr	14,907	1.05	0.92	1.19
2014 ^A	16-Apr	14,906	0.56	0.46	0.66
2015	15-Apr	14,997	0.39	0.31	0.48

^A Migration year 2015 is incomplete with Age 2-salt adult returns through 6/24/2017.

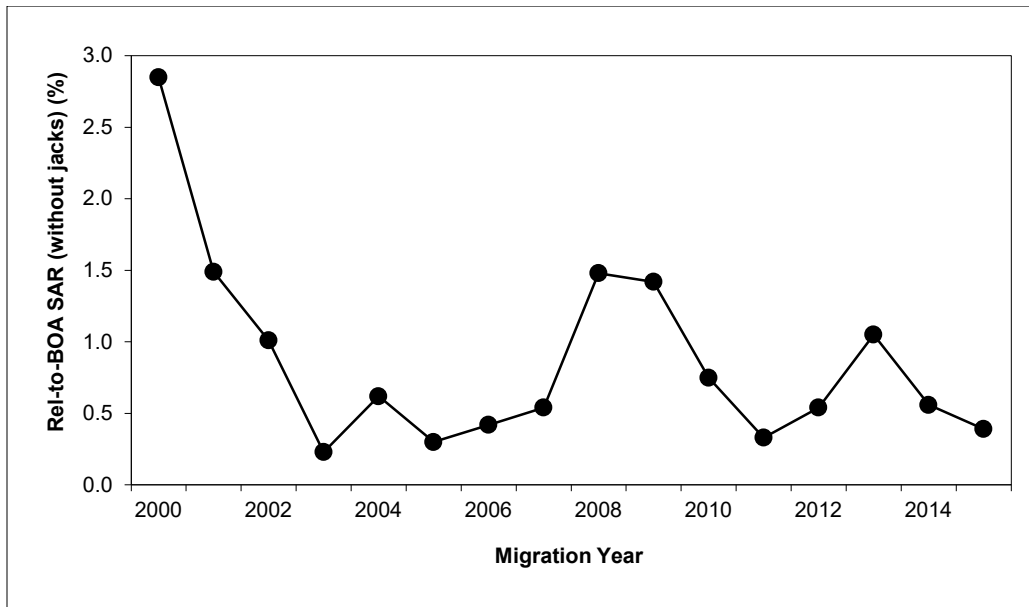


Figure 2. Overall SAR_{Rel-to-BOA} (without jacks) for Carson NFH spring Chinook. Migration year 2015 is incomplete for yearling Chinook, with Age 2-salt adult returns through 6/24/2017.

Spring Creek NFH (2008–2017)

Spring Creek National Fish Hatchery began PIT-tagging a portion of the fall Chinook releases in 2008. Over the years, Spring Creek NFH conducted separate PIT-tag releases in March (2008 only), April (2008–2017), and May (2008–2017). 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. Figures 3 and 4 are provided as illustrations of the arrival timing of the 2017 releases in April (Figure 3) and May (Figure 4) compared to the respective releases in 2016 and the current 9-year averages (2008–2016).

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

Release Month	Migration Year	Release Date	Travel Time (Days)			95% Confidence Limits	
			Min	Med	Max	Lower	Upper
March	2008	Mar. 5-6	1.2	2.7	104.9	2.6	2.7
April	2008	Apr. 10	1.1	1.8	22.7	1.7	1.8
	2009	Apr. 13	0.6	1.2	61.8	1.1	1.4
	2010	Apr. 12	1.3	2.4	30.5	2.4	2.4
	2011	Apr 12	0.3	0.6	19.9	0.6	0.6
	2012	Apr 11 & 13	0.3	0.7	23.6	0.7	0.7
	2013	Apr. 11	0.6	0.8	13.5	0.8	0.8
	2014	Apr. 11	0.6	0.8	15.9	0.8	0.8
	2015	Apr. 13	0.9	1.8	23.8	1.8	1.8
	2016	Apr. 11	0.6	0.9	6.7	0.8	0.9
2017	Apr. 10	0.4	0.6	11.7	0.6	0.6	
May	2008	May 2	0.7	1.8	25.8	1.7	1.9
	2009	May 1	0.6	1.6	52.0	1.5	1.7
	2010	May 10	0.6	2.1	41.7	1.9	2.4
	2011	May 4	0.5	1.4	8.3	1.1	1.5
	2012	Apr 30 ^A	0.3	0.5	23.6	0.5	0.6
	2013	May 2	0.8	2.5	37.7	2.1	2.5
	2014	May 6	0.5	1.5	37.4	1.4	1.6
	2015	Apr. 27 ^A	1.4	1.9	54.5	1.9	1.9
	2016	May 9	0.6	1.1	9.5	0.9	1.2
2017	May 8	0.6	1.1	9.5	1.4	1.5	

^A Although these release actually occurred in April, they are being summarized with the May releases since they were originally intended for release in May.

Table 5. Estimated 10%, 50%, and 90% passage dates of PIT-tagged 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	11 & 13-Apr	12-Apr	14-Apr	14-Apr
	2013	11-Apr	12-Apr	12-Apr	12-Apr
	2014	11-Apr	12-Apr	12-Apr	13-Apr
	2015	13-Apr	14-Apr	15-Apr	16-Apr
	2016	11-Apr	12-Apr	12-Apr	12-Apr
	2017	10-Apr	10-Apr	10-Apr	11-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 ^A	30-Apr	30-Apr	1-May
	2013	2-May	4-May	4-May	6-May
	2014	6-May	7-May	7-May	9-May
	2015	27-Apr ^A	29-Apr	29-Apr	30-Apr
	2016	9-May	10-May	10-May	11-May
	2017	8-May	8-May	8-May	9-May

^A Although these releases actually occurred in April, they are being summarized with the May releases since they were originally intended for release in May.

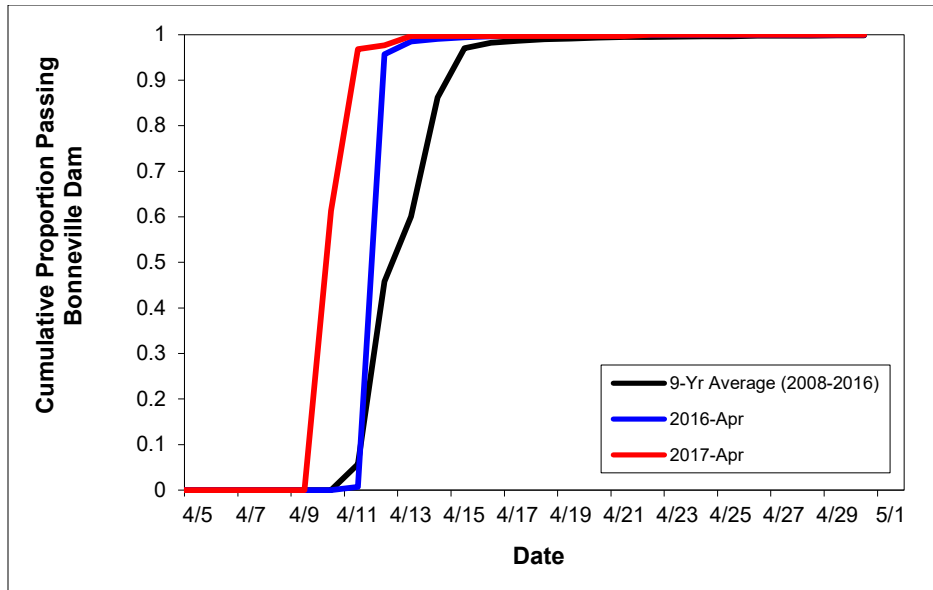


Figure 3. Cumulative passage timing of PIT-tagged Spring Creek NFH fall Chinook to Bonneville Dam (April releases).

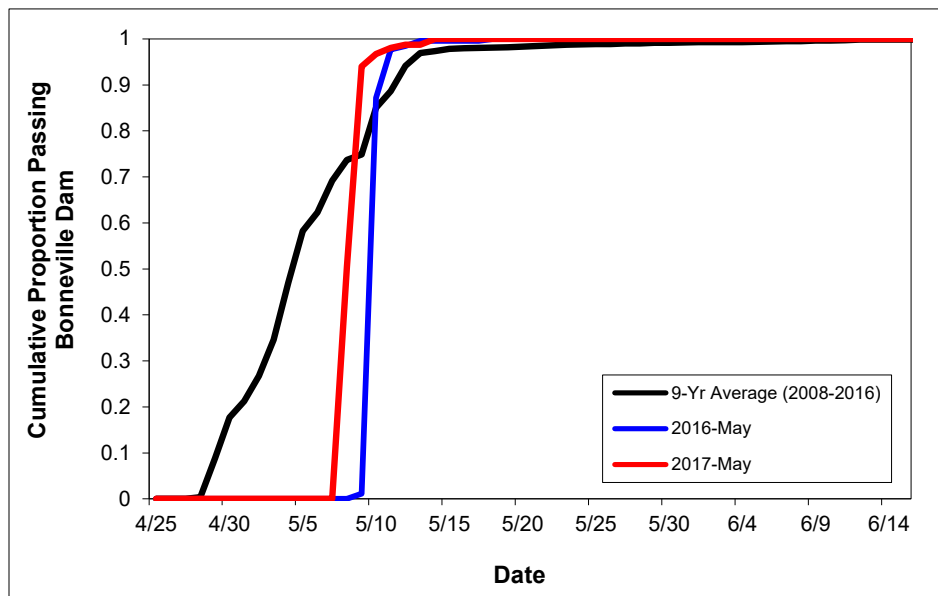


Figure 4. Cumulative passage timing of PIT-tagged Spring Creek NFH fall Chinook to Bonneville Dam (May releases).

Finally, Table 6 contains estimates of SARs for release to BON (without jacks) for migration years 2008–2014. These SAR estimates were taken from Appendix B of the 2017 CSS Annual Report, which can be downloaded from the FPC webpage www.fpc.org/documents/CSS.html. Figure 5 is provided to illustrate the time series of the SAR estimates over the years of available data for Spring Creek NFH fall Chinook.

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 _{Rel-to-BOA}	Non-Parametric CI	
					90% LL	90% UL
March	2008	3/5-3/6	7,447	0.27	0.19	0.39
April	2008	4/10	3,953	0.63	0.53	0.83
	2009	4/13	8,686	0.06	0.02	0.10
	2010	4/12	8,962	0.25	0.16	0.33
	2011	4/12	8,956	0.15	0.08	0.21
	2012	4/11 & 4/13	8,772	0.28	0.19	0.39
	2013 ^A	4/11	8,964	0.56	0.44	0.68
	2014 ^B	4/11	8,873	0.08	0.03	0.14
May	2008	5/2	2,677	0.52	0.30	0.75
	2009	5/1	5,950	0.22	0.13	0.32
	2010	5/10	5,971	0.20	0.12	0.30
	2011	5/4	5,983	0.23	0.13	0.33
	2012 ^C	4/30	5,978	0.23	0.13	0.35
	2013 ^A	5/2	5,976	0.54	0.38	0.69
	2014 ^B	5/6	5,993	0.02	0.00	0.05

^A Migration year 2013 is incomplete with Age 3-salt adult returns through 05/31/2018.

^B Migration year 2014 is incomplete with Age 2-salt adult returns through 05/31/2018.

^C Although this release actually occurred in April, it is being summarized with the May releases since it was originally intended for release in May.

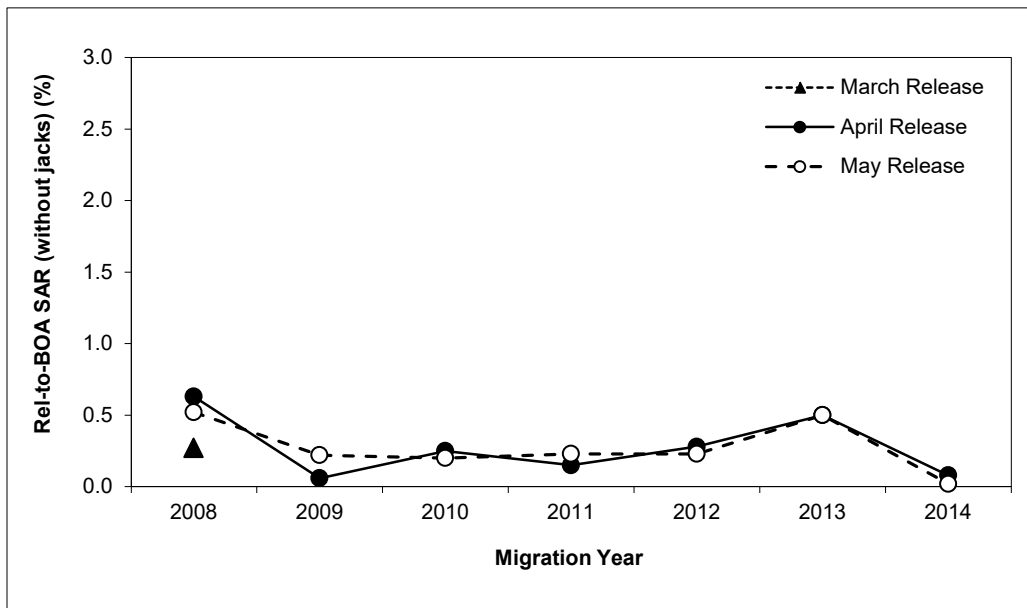


Figure 5. Overall SAR_{Rel-to-BOA} for Spring Creek NFH fall Chinook released in March (closed triangle), April (closed circles) and May (open circles). Migration years 2013 and 2014 are incomplete, with Age 3-salt and 2-salt adult returns through 12/31/2016, respectively.

Little White Salmon NFH (2008–2017)

Little White Salmon National Fish Hatchery began PIT-tagging a portion of their spring and fall Chinook releases in 2008. 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. Figures 6 and 7 are provided as illustrations of the arrival timing of the 2017 spring Chinook (Figure 6) and fall Chinook (Figure 7) releases compared to the respective timing in 2016 and the current 9-year average (2008–2016).

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	
			Min	Med	Max	Lower	Upper
SpCH	2008	17-Apr	0.3	20.7	94.4	20.4	21.0
	2009	16-Apr	0.7	8.6	40.8	7.7	9.8
	2010	15-Apr	0.8	16.6	49.0	16.2	17.0
	2011	13-Apr	0.9	19.2	108.1	16.5	21.4
	2012	19-Apr	0.5	9.6	127.2	9.0	9.7
	2013	18-Apr	0.8	13.1	80.8	12.7	13.5
	2014	17-Apr	0.6	12.2	38.9	11.4	12.6
	2015	16-Apr	0.5	15.5	43.6	14.8	15.6
	2016	14-Apr	0.7	10.6	50.8	9.9	10.8
FaCH	2008	3-Jul	1.1	16.1	139.5	15.6	16.7
	2009	18-Jun	9.4	28.4	154.2	27.7	28.8
	2010	24-Jun	0.9	22.5	123.9	22.4	23.1
	2011	23-Jun	1.7	12.4	126.2	11.5	13.6
	2012	3-Jul	0.5	9.9	127.2	9.6	10.6
	2013	2-Jul	0.6	12.0	143.0	11.6	12.3
	2014	2-Jul	1.3	17.3	137.5	16.5	17.8
	2015	2-Jul	1.6	10.4	44.5	9.9	10.5
	2016	11-Jul	1.8	10.9	50.2	10.7	11.1
2017	5-Jul	0.9	10.5	121.0	10.0	10.6	

Table 8. Estimated 10%, 50%, and 90% passage dates of PIT-tagged 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
	2013	18-Apr	21-Apr	1-May	8-May
	2014	17-Apr	19-Apr	29-Apr	11-May
	2015	16-Apr	19-Apr	1-May	6-May
	2016	14-Apr	16-Apr	24-Apr	2-May
	2017	12-Apr	14-Apr	22-Apr	4-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
	2013	2-Jul	9-Jul	15-Jul	30-Jul
	2014	2-Jul	10-Jul	20-Jul	9-Aug
	2015	2-Jul	9-Jul	12-Jul	18-Jul
	2016	11-Jul	19-Jul	22-Jul	26-Jul
	2017	5-Jul	27-Jul	1-Aug	11-Aug

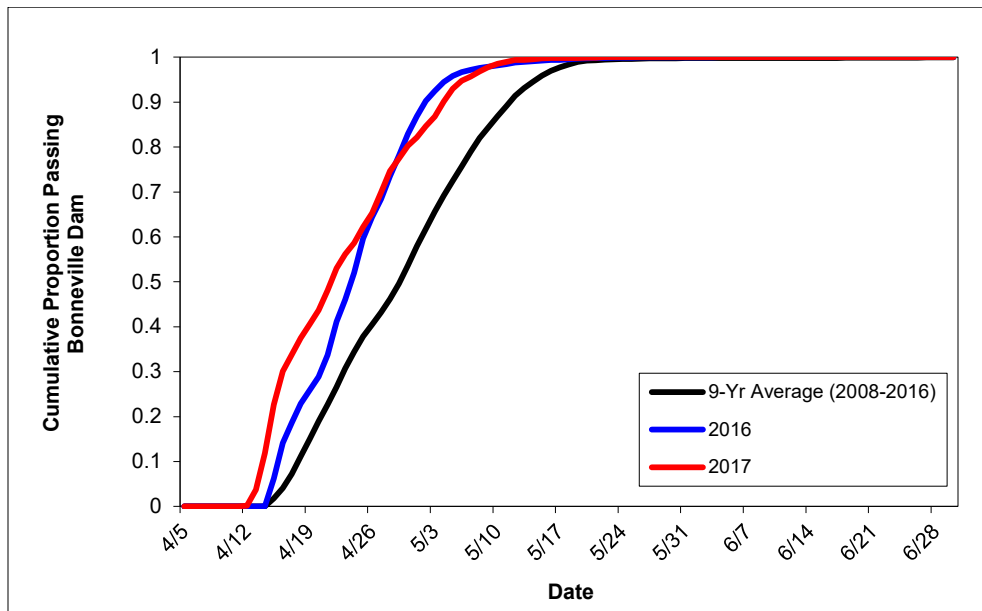


Figure 6. Cumulative passage timing of PIT-tagged Little White Salmon NFH spring Chinook to Bonneville Dam.

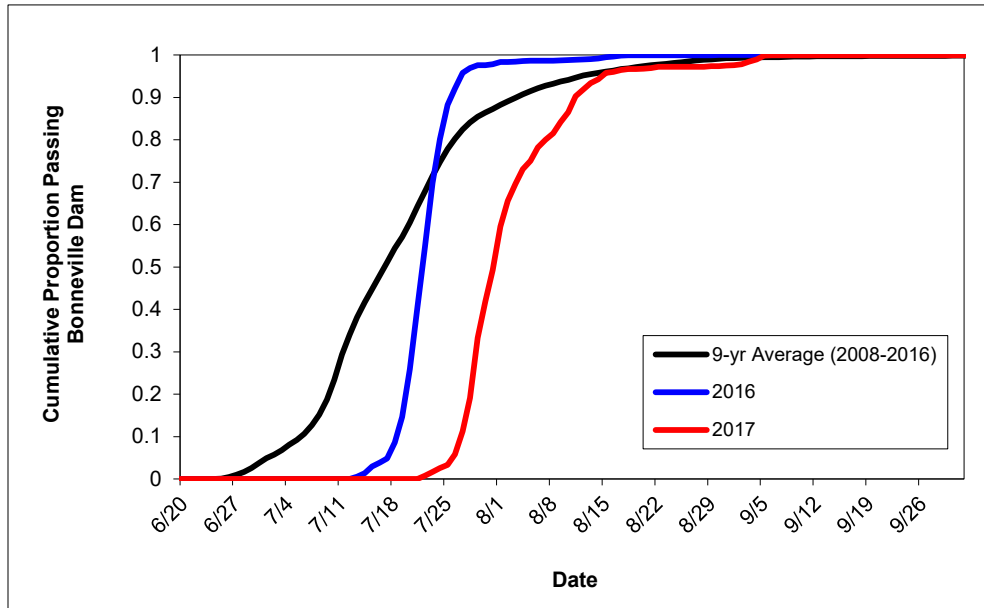


Figure 7. Cumulative passage timing of PIT-tagged Little White Salmon NFH fall Chinook to Bonneville Dam.

Finally, Table 9 contains estimates of SARs for release to BON (without jacks) for migration years 2008 through 2012. The SAR estimates for the spring Chinook were derived using the same methodology as the estimates for the fall Chinook, which were taken from Appendix B of the 2017 CSS Annual Report and can be downloaded from the FPC webpage www.fpc.org/documents/CSS.html. Figure 8 is provided to illustrate the time series of the SAR estimates for the spring Chinook and fall Chinook releases over the years of available data for Little White Salmon NFH.

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 _{Rel-to-BOA}	Non-Parametric CI	
					90% LL	90% UL
SpCH	2008	17-Apr	14,941	1.87	1.69	2.06
	2009	16-Apr	7,492	1.16	0.97	1.39
	2010	15-Apr	7,467	0.36	0.26	0.50
	2011	13-Apr	7,482	0.47	0.35	0.62
	2012	19-Apr	11,959	0.88	0.74	1.03
	2013	18-Apr	10,480	1.53	1.33	1.74
	2014	17-Apr	11,991	0.62	0.50	0.75
	2015	16-Apr	14,945	0.47	0.39	0.58
FaCH	2008	3-Jul	24,886	1.01	0.90	1.11
	2009	18-Jun	24,947	0.50	0.43	0.57
	2010	24-Jun	24,951	1.63	1.50	1.77
	2011	23-Jun	24,638	2.39	2.23	2.54
	2012	3-Jul	24,953	0.49	0.41	0.57
	2013 ^A	2-Jul	14,960	0.86	0.73	0.99
	2014 ^B	2-Jul	14,925	0.05	0.02	0.07

^A Migration year 2013 is incomplete with only Age 3-salt adult returns through 12/31/2017.

^B Migration year 2014 is incomplete with only Age 2-salt adult returns through 12/31/2017.

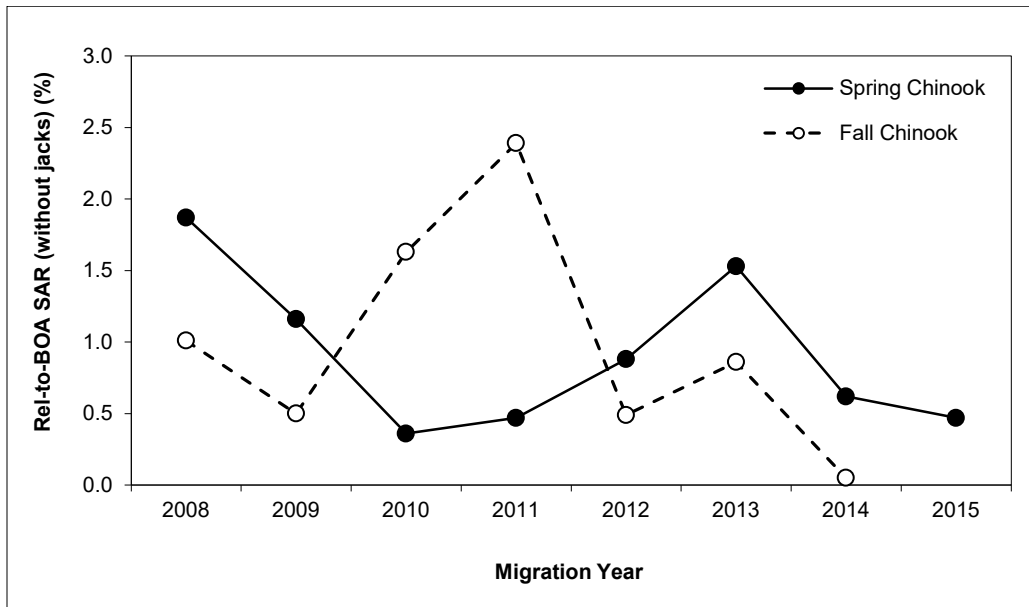


Figure 8. Overall SAR_{Rel-to-BOA} for Little White Salmon NFH spring Chinook (closed circles) and fall Chinook releases (open circles). For fall Chinook, migration years 2013 and 2014 are incomplete, with Age 3-salt and 2-salt returns through 12/31/2017, respectively.

Willard NFH (2009–2017)

The FPC staff identified six years (2009–2014) where spring Chinook juveniles were PIT-tagged and released from Willard National Fish Hatchery. During this time, spring Chinook releases occurred in April. To the best of our knowledge, spring Chinook releases from Willard NFH stopped after 2014. Below is a summary of some of the information that was gathered from the spring Chinook PIT-tag releases in 2009-2014. Willard NFH began releasing fall Chinook juveniles in 2014 and has done so since. PIT-tagging of these fall Chinook releases began in 2015 and continued through 2017. As with the spring Chinook releases, we have summarized some of the information that was gathered from the fall Chinook PIT-tag releases in 2015, 2016, and 2017.

Table 10 provides estimates of minimum, median, and maximum travel times from each year's release of spring Chinook and fall Chinook 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 and fall Chinook juveniles at Bonneville Dam for each of the respective years of tagging. Finally, Figure 9 is provided as an illustration of the arrival timing to Bonneville Dam of the 2015-2017 fall Chinook releases.

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

Species	Migration Year	Release Date	Travel Time (Days)			95% Confidence Limits	
			Min	Med	Max	Lower	Upper
SpCH	2009	16-Apr	1.6	28.9	80.4	27.9	29.5
SpCH	2010	15-Apr	3.4	26.0	58.0	25.5	26.3
SpCH	2011	14-Apr	2.8	28.7	84.2	28.4	29.4
SpCH	2012	19-Apr	3.9	25.9	63.4	25.5	26.5
SpCH	2013	18-Apr	4.4	21.6	66.9	21.4	22.4
SpCH	2014	17-Apr	3.6	23.7	43.5	22.5	24.8
FaCH	2015	1-Jul	5.4	17.8	123.5	17.3	19.1
FaCH	2016	11-Jul	2.6	12.8	114.4	12.7	13.2
FaCH	2017	12-Jul	1.5	9.2	103.1	8.5	9.5

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

Species	Migration Year	Release Date	10% Passage Date	50% Passage Date	90% Passage Date
SpCH	2009	16-Apr	29-Apr	16-May	21-May
SpCH	2010	15-Apr	1-May	10-May	18-May
SpCH	2011	14-Apr	25-Apr	13-May	19-May
SpCH	2012	19-Apr	30-Apr	15-May	21-May
SpCH	2013	18-Apr	2-May	9-May	16-May
SpCH	2014	17-Apr	28-Apr	11-May	17-May
FaCH	2015	1-Jul	13-Jul	19-Jul	31-Jul
FaCH	2016	11-Jul	20-Jul	24-Jul	28-Jul
FaCh	2017	12-Jul	16Jul	22-Jul	30-Jul

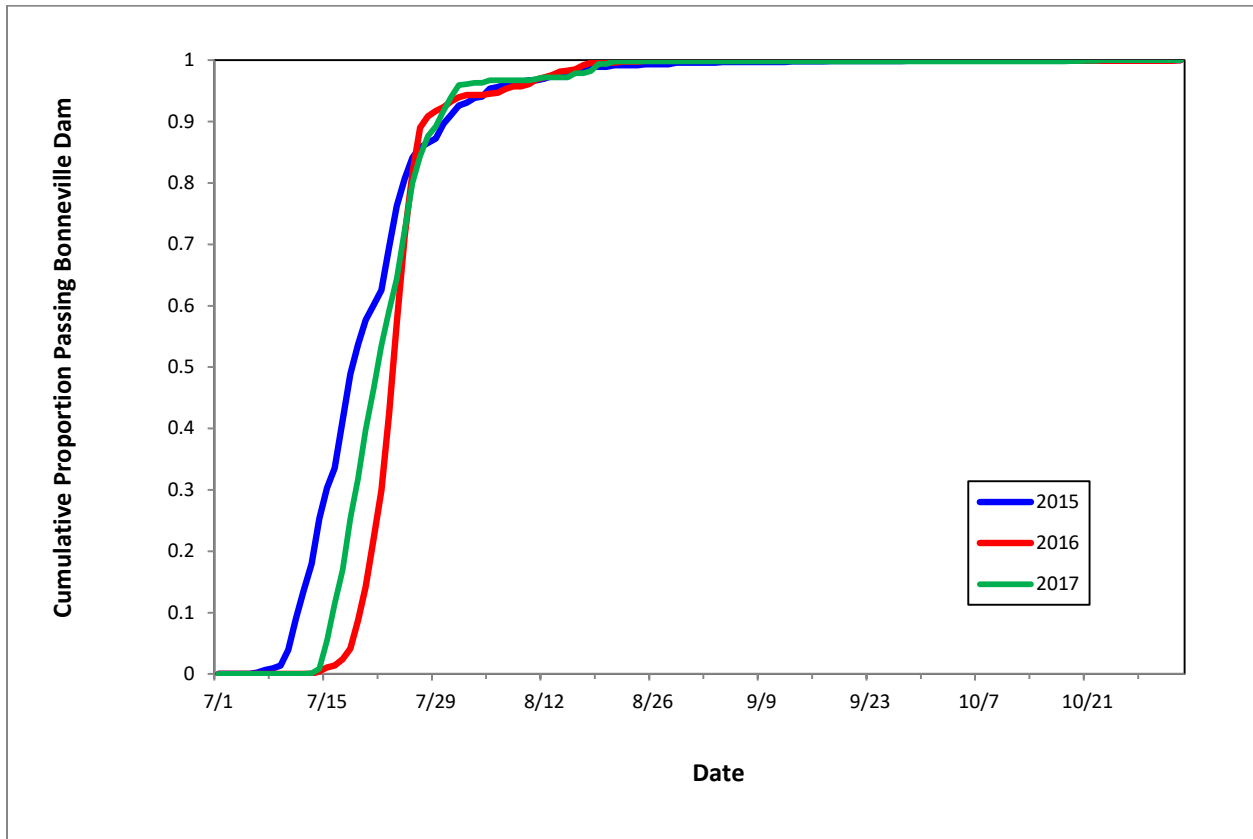


Figure 9. Cumulative passage timing of PIT-tagged Willard NFH fall Chinook to Bonneville Dam.

Table 12 contains estimates of SARs for spring Chinook from release to BON (without jacks) for migration years 2009–2014. Estimates of SARs for the fall Chinook releases are not yet available, as adult returns are not yet available. These SAR estimates were derived using the same methodology as the estimates for the 2017 CSS Annual Report. Figure 10 is provided to illustrate the time series of the SAR estimates for the spring Chinook releases over the years of available data for Willard NFH.

Table 12. Willard NFH Spring Chinook SARs (without jacks) (release to BON).

Migration Year	Release Date	PIT-Tags Released	Overall SAR _{Rel-to-BOA}	Non-Parametric CI	
				90% LL	90% UL
2009	16-Apr	7,498	0.69	0.54	0.87
2010	15-Apr	7,453	0.43	0.31	0.58
2011	14-Apr	7,490	0.25	0.17	0.37
2012	19-Apr	2,960	0.41	0.23	0.66
2013	18-Apr	4,492	0.45	0.30	0.65
2014	17-Apr	2,989	0.54	0.34	0.81

^A Migration year 2014 is incomplete with Age 2-salt adult returns through approximately 5/31/2018.

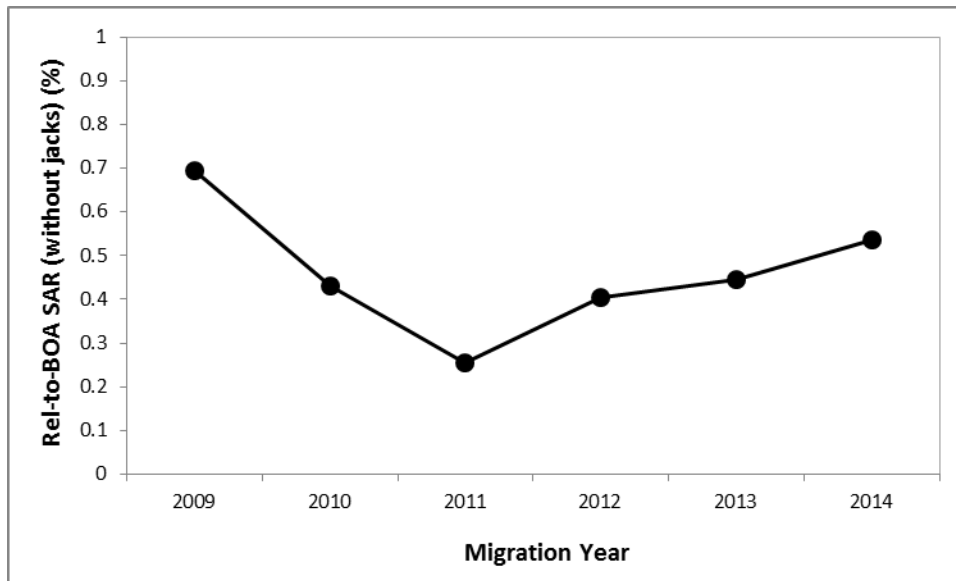


Figure 10. Overall SAR_{Rel-to-BOA} for Willard NFH spring Chinook. Migration year 2014 is incomplete, with Age 2-salt adult returns through approximately 1/1/2016.

Warm Springs NFH (2002, 2007–2017)

The FPC staff identified ten total years (2002, 2007–2017) where spring Chinook juveniles were PIT-tagged and released from Warm Springs National Fish Hatchery. During this time, spring Chinook releases typically occurred in late March or early 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 7th, even though the volitional release began on March 26th. 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 1st and April 15th. 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 24th. For migration years 2011–2017 the release date from PTAGIS corresponds to the start date of each volitional release. 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 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
2013	Apr. 1-Apr. 10	3.6	28.8	90.4	28.5	29.3
2014	Mar. 31-Apr. 3	4.4	30.6	52.2	30.0	31.3
2015	Mar. 30-Mar. 31	3.5	22.6	57.5	21.7	23.5
2016	Mar. 30	3.4	17.3	52.6	16.8	17.8
2017	Mar-30	3.0	28.5	58.7	27.5	30.4

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. Figure 11 is provided as an illustration of the arrival timing of the 2017 release, compared to that in 2016 and the current 10-year average (2007–2016).

Table 14. Estimated 10%, 50%, and 90% passage dates of PIT-tagged 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
2013	Apr. 1-Apr. 10	16-Apr	30-Apr	6-May
2014	Mar. 31-Apr. 3	22-Apr	3-May	14-May
2015	Mar. 30-Mar. 31	11-Apr	24-Apr	2-May
2016	Mar. 30	8-Apr	17-Apr	28-Apr
2017	Mar. 30	5-Apr	27-Apr	10-May

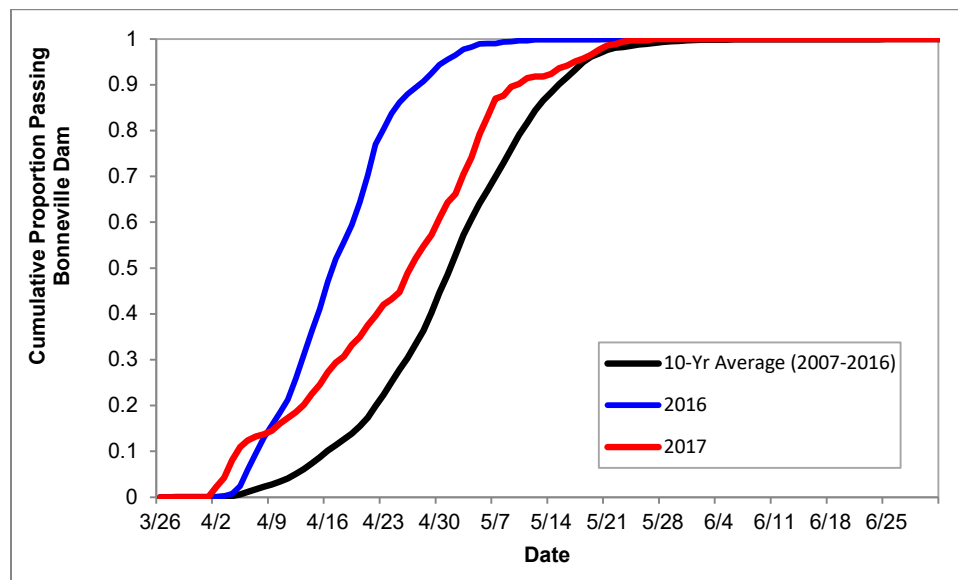


Figure 11. Cumulative passage timing of PIT-tagged Warm Springs NFH spring Chinook to Bonneville Dam.

Table 15 contains estimates of SARs for release to BON (without jacks) for migration years 2002 and 2007–2015. With exception to migration year 2002, these SAR estimates were taken from Appendix B of the 2017 CSS Report, which can be downloaded from the FPC webpage www.fpc.org/documents/CSS.html. The SAR estimate for migration year 2002 was derived using the same methodology as the 2017 CSS Report. Figure 12 is provided to illustrate the time series of the SAR estimates for the spring Chinook releases over the years of available data (excluding 2002) for Warm Springs NFH.

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

Migration Year	Spring Release Dates	PIT-Tags Released	Overall SAR _{Rel-to-BOA}	Non-Parametric CI	
				90% LL	90% UL
2002	Mar. 26-Apr. 18	3,998	0.95	0.71	1.24
2007	Mar. 21-Apr. 18	19,698	0.30	0.24	0.38
2008	Mar. 23-Apr. 23	19,936	0.84	0.73	0.95
2009	Mar. 26-Apr. 20	19,924	0.65	0.56	0.74
2010	Mar. 24-Apr 21	14,907	0.21	0.15	0.27
2011	Apr. 4-Apr. 27	14,924	0.19	0.13	0.25
2012	Apr. 2-Apr. 26	14,806	0.66	0.56	0.77
2013	Apr. 1-Apr. 10	14,877	1.18	1.04	1.32
2014	Mar. 31-Apr. 3	14,818	0.89	0.76	1.01
2015 ^A	Mar 30	14,915	0.36	0.27	0.44

^A Migration year 2015 is incomplete with Age 2-salt adult returns through 9/24/2017.

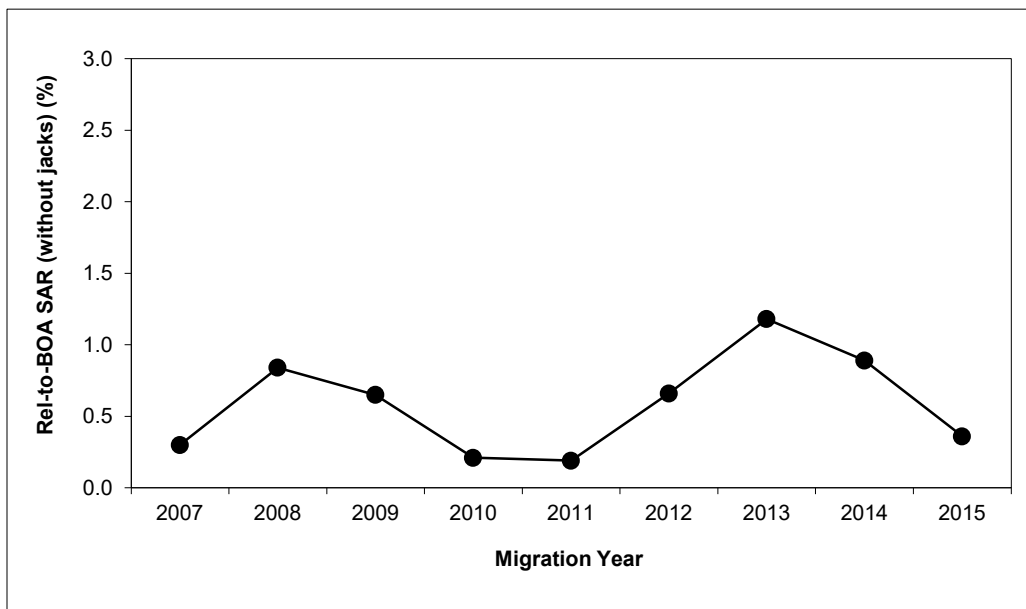


Figure 12. Overall SAR_{Rel-to-BOA} for Warm Springs NFH spring Chinook. Migration year 2015 is incomplete, with Age 2-salt adult returns through 9/24/2017.

Outmigration Conditions in Lower Columbia River

Most of the PIT-tag releases from Columbia Gorge Complex hatcheries are in the spring; with the exception of fall Chinook brights that are released in June and/or July from Little White Salmon NFH and Willard NFH. Hatchery Chinook that are released from Carson, Spring Creek, Little White Salmon, and Willard hatcheries have only 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 13 is provided below to illustrate the out-migration conditions that fish released in the spring may have experienced in the Middle Columbia River during their out-migration. This figure provides the total flow volume in the Middle Columbia River (as measured at Bonneville Dam), along with the average spring spill proportions at Bonneville and The Dalles dams during the spring period (April 10–June 30).

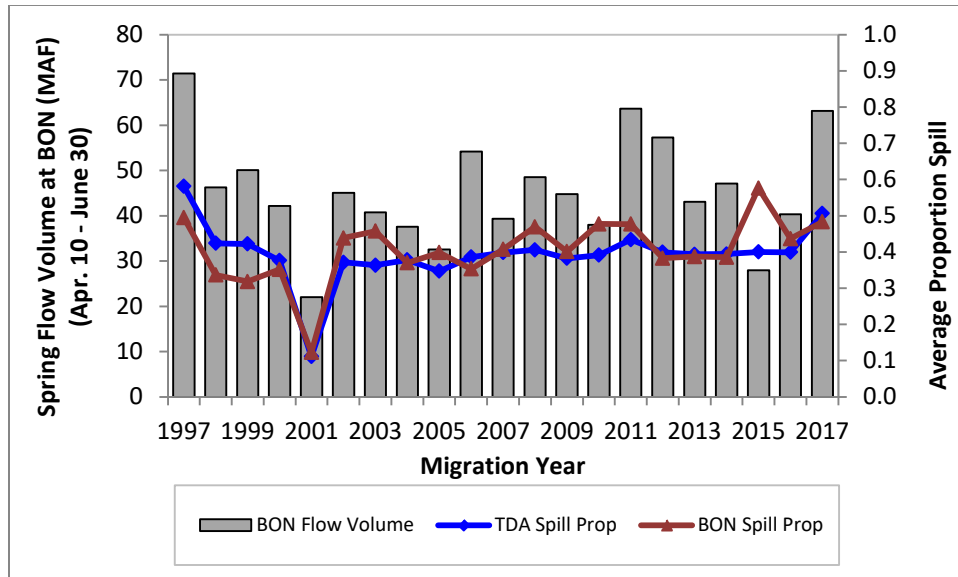


Figure 13. Total spring flow volume in the Middle Columbia River (at Bonneville Dam) and average spill proportion at The Dalles and Bonneville dams. For this figure, the spring period is April 10–June 30.

Figure 14 is provided to illustrate the out-migration conditions that the summer migrants (i.e., fall Chinook brights from Little White Salmon and Willard hatcheries) may have experienced in the Middle 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 and Willard hatcheries have to pass only Bonneville Dam, Figure 14 provides the total flow volume in the Middle 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).

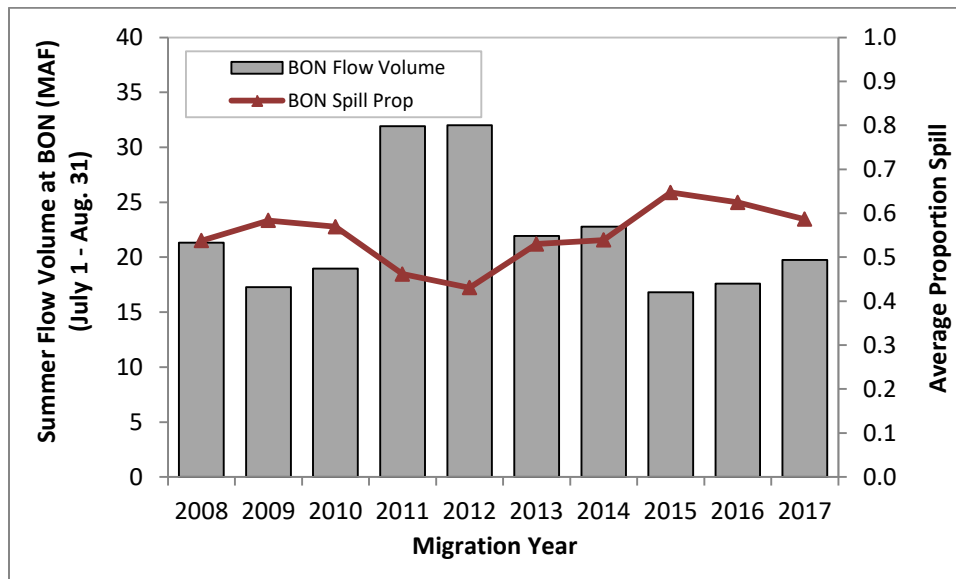


Figure 14. Total summer flow volume in the Middle Columbia River (at Bonneville Dam) and average spill proportion at Bonneville Dam. For this figure, the summer period is July 1–August 31.

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.

- c: Lance Hebdon, IDFG
- Tim Copeland, IDFG
- Bill Tweit, WDFW
- Erik Merrill, NPCC
- Erick Merrill, NPCC
- Tony Grover, NPCC
- Leslie Bach, NPCC
- Jay Hesse, Nez Perce
- Art Martin, ODFW
- Steve Haeseker, USFWS
- Kyle Hansen, USFWS
- FPAC