FISH PASSAGE CENTER

847 NE 19th Avenue, #250, Portland, OR 97232
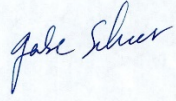Phone: (503) 833-3900   Fax: (503) 232-1259
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MEMORANDUM

TO: Andrew Gibbs, ODFW

FROM: Gabe Scheer

DATE: June 13, 2018

RE: 2017 Lookingglass Hatchery Report

The Fish Passage Center has been marking fish from the Lookingglass Fish Hatchery facility over the last several years as part of the Comparative Survival Study (CSS). The CSS is a multi-year program that estimates survival rates over different life stages for spring and summer Chinook produced in major hatcheries. 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 Lookingglass Hatchery facilities (Imnaha and Catherine Creek Acclimation Ponds).

With the marking efforts over the past several years, data on the timing and migration speed from release to Lower Granite Dam are also available. 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.

The tables below provide estimates of minimum, median, and maximum travel times from release to Lower Granite Dam for the Imnaha River (Table 1) and Catherine Creek Acclimation Pond (Table 2) releases. In 2012–2015, two release sites were used for the Imnaha River releases. The release sites were the Imnaha Weir (IMNAHW) and the Imnaha River (IMNAHR). Travel times for the Imnaha River releases (Table 1) are for both of these release sites combined and are estimated based on the release date. There were also two release sites and strategies used for Catherine Creek releases in 2012. These two release types were a volitional release from Catherine Creek Acclimation Pond (CATHEP) and a direct stream release into Catherine Creek (CATHEC). For the CATHEP release, travel times were estimated as the date of arrival at LGR minus the date of detection at the acclimation pond detection site (CCP). For the direct release (CATHEC), travel times were estimated as the date of arrival at LGR

minus the release date. In all other years, releases into Catherine Creek were volitional and made only from the CATHEP site. For years 2001–2011 and 2013–2014, travel times were estimated as the date of arrival at LGR minus the date of detection at the acclimation pond detection site (CCP). Unfortunately, the CCP detection site was discontinued in 2015. Therefore, travel times for 2015-2017 were estimates as the date of arrival at LGR minus the median release date for this volitional release. The median release dates for the 2015, 2016, and 2017 releases were April 1st, April 3rd, and April 6th respectively. Tables 1 and 2 also provide the 95% confidence limits around the estimated median travel times.

Table 1. Imnaha River – Spring/summer Chinook Travel Time to Lower Granite Dam.

Release Date(s)	Migration Year	Travel Time (Days)			95% Confidence Limits	
		Min	Med	Max	Lower	Upper
Apr-7	1997	9.1	28.1	79.7	27.9	28.7
Apr-6	1998	8.3	26.2	60.8	26.0	26.3
3/16, 4/5	1999	5.1	54.7	175.6	54.4	54.9
22-Mar	2000	15.7	42.8	66.3	42.5	43.1
21-Mar	2001	8.8	42.1	93.0	41.7	42.2
21-Mar	2002	8.2	45.2	66.0	44.9	45.4
1-Apr	2003	7.2	34.6	76.6	34.5	34.7
26-Mar	2004	9.9	38.5	84.4	38.5	38.6
3/26, 3/29	2005	9.3	36.1	78.7	35.9	36.3
3/21, 3/30	2006	6.3	40.6	74.2	40.2	41.0
3/21, 3/31	2007	17.0	41.3	103.5	41.2	41.4
25-Mar	2008	17.4	43.8	163.0	43.7	43.9
30-Mar	2009	13.8	44.6	69.3	44.6	44.8
1-Apr	2010	17.1	41.6	79.5	40.4	41.8
30-Mar	2011	5.7	40.7	66.7	40.6	40.8
30-Mar	2012	1.4	28.6	75.8	28.5	28.7
30-Mar	2013	6.5	38.5	50.7	38.0	38.6
1-Apr	2014	9.3	34.4	57.6	34.3	34.5
4/1-4/15[A]	2015	9.2	27.3	53.2	26.4	27.7
4/1-4/8[A]	2016	3.5	24.0	48.8	23.8	24.3
4/-4/10[A]	2017	2.4	28.4	52.2	28.2	28.8

[A] Due to the volitional nature of release, travel time was estimated as the date of arrival at LGR minus the median release date.

Table 2. Catherine Creek – Spring Chinook Travel Time to Lower Granite Dam.

Release Date(s)	Migration Year	Travel Time (Days)			95% Confidence Intervals	
		Min	Median	Max	Lower	Upper
4/2	2001[A]	8.3	28.2	62.8	28.1	28.3
4/1-4/2	2002[A]	12.7	33.9	75.5	33.6	34.2
3/12, 3/23, 3/31	2003[A]	8.2	32.3	74.4	31.6	33.0
3/15, 3/30	2004[A]	11.1	37.5	98.8	37.1	38.4
3/14, 4/4	2005[A]	14.1	34.0	72.7	33.2	34.6
3/27	2006[A]	11.6	31.1	78.8	30.4	31.6
3/26	2007[A]	15.9	30.2	59.5	29.5	30.6
3/24	2008[A]	11.5	28.1	102.8	27.9	28.4
3/16, 3/24	2009[A]	15.5	38.4	101.0	38.0	39.1
3/29	2010[A]	15.0	32.2	64.3	31.5	32.8
3/21,3/30,4/5	2011[A]	11.3	38.8	95.0	38.1	39.4
3/22-4/14; 4/16	2012[B]	9.8	30.8	61.3	30.5	31.2
3/21-4/14	2013[A]	17.5	34.3	54.2	33.7	34.5
3/21-4/15	2014[A]	12.0	33.3	62.4	32.5	34.2
3/19-4/15	2015[C]	0.6	35.0	55.3	34.2	35.3
3/23-4/14	2016[C]	0.9	24.1	57.6	23.8	24.4
3/20-4/14	2017[C]	8.2	37.7	73.3	37.2	38.3

[A] Travel time was estimated as the date of arrival at LGR minus the date of detection at the Catherine Creek Acclimation Pond detection site (CCP)

[B] Travel time was estimated for two release strategies: (1) the date of arrival at LGR minus the date of detection at the CCP detection site for fish released volitionally at the acclimation facility, and (2) date of arrival at LGR minus the release date for fish released directly into Catherine Creek.

[C] Due to the discontinuation of the CCP detection site, travel time was estimated as the date of arrival at LGR minus the median release date for this volitional release.

As with previous years' reports, we are providing you with tables that present the estimated 10%, 50%, and 90% passage dates at Lower Granite Dam for the yearling spring Chinook juveniles that are released from each of these sites (Table 3 for Imnaha River and Table 4 for Catherine Creek). We are also providing two figures to illustrate the 2016 passage timing for Lookingglass Hatchery yearling spring Chinook released for the CSS study. The first of these figures illustrates the passage timing of the 2017 releases to the Imnaha River, compared to those in 2016 and the current 10-year average (2007–2016) (Figure 1). The second is a comparison of the passage timing of the 2017 release from Catherine Creek Acclimation Pond, compared to that in 2016 and the current 10-year average (2007–2016) (Figure 2).

Table 3. Imnaha River – Estimated 10%, 50%, and 90% passage dates at Lower Granite Dam.

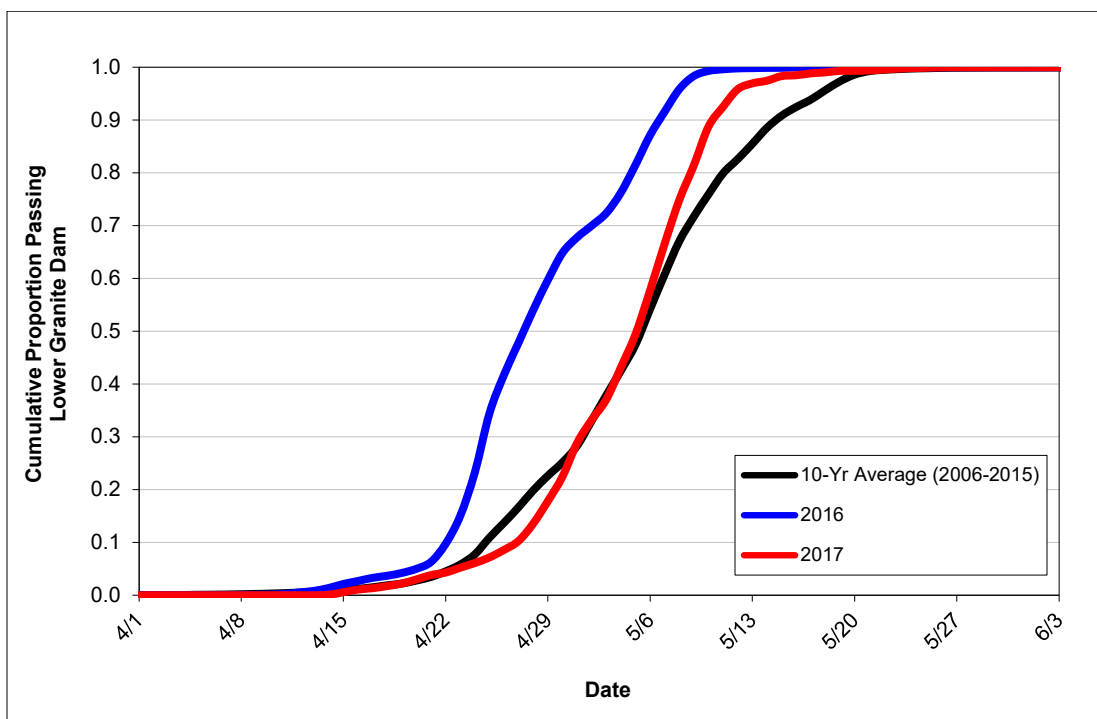| Migration Year	Release Date(s)	10% Passage Date	50% Passage Date	90% Passage Date
1997	7-Apr	26-Apr	6-May	15-May
1998	6-Apr	24-Apr	2-May	9-May
1999	3/16, 4/5	30-Apr	11-May	21-May
2000	22-Mar	24-Apr	4-May	12-May
2001	21-Mar	26-Apr	2-May	15-May
2002	21-Mar	16-Apr	4-May	17-May
2003	1-Apr	24-Apr	5-May	16-May
2004	26-Mar	24-Apr	4-May	9-May
2005	3/26,3/29	25-Apr	2-May	8-May
2006	3/21,3/30	22-Apr	2-May	13-May
2007	3/21,3/31	24-Apr	2-May	11-May
2008	25-Mar	30-Apr	8-May	16-May
2009	30-Mar	30-Apr	14-May	19-May
2010	1-Apr	30-Apr	11-May	20-May
2011	30-Mar	2-May	10-May	15-May
2012	30-Mar	21-Apr	27-Apr	8-May
2013	30-Mar	30-Apr	7-May	11-May
2014	1-Apr	26-Apr	6-May	10-May
2015	4/1-4/15	28-Apr	6-May	11-May
2016	4/1-4/8	23-Apr	28-Apr	7-May
2017	4/3-4/10	27-Apr	6-May	11-May

Figure 1. Imnaha Acclimation Pond – Cumulative passage timing to Lower Granite Dam.

Table 4. Catherine Creek Releases – Estimated 10%, 50%, and 90% passage dates at Lower Granite Dam.

| Migration Year	Release Date(s)	10% Passage Date	50% Passage Date	90% Passage Date
2001	4/2	4-May	15-May	22-May
2002	4/1-4/2	5-May	17-May	21-May
2003	3/12,3/23,3/31	13-Apr	29-Apr	15-May
2004	3/15,3/30	21-Apr	4-May	16-May
2005	3/14,4/4	26-Apr	5-May	10-May
2006	3/27	30-Apr	7-May	19-May
2007	3/26	2-May	10-May	15-May
2008	3/24	5-May	13-May	20-May
2009	3/16,3/24	2-May	15-May	23-May
2010	3/29	1-May	13-May	20-May
2011	3/21,3/30,4/5	5-May	11-May	31-May
2012	3/22-4/14, 4/16	25-Apr	5-May	18-May
2013	3/21-4/14	2-May	10-May	18-May
2014	3/21-4/15	24-Apr	5-May	18-May
2015	3/19-4/15	23-Apr	6-May	14-May
2016	3/23-4/14	18-Apr	26-Apr	9-May
2017	4/10	27-Apr	9-May	24-May
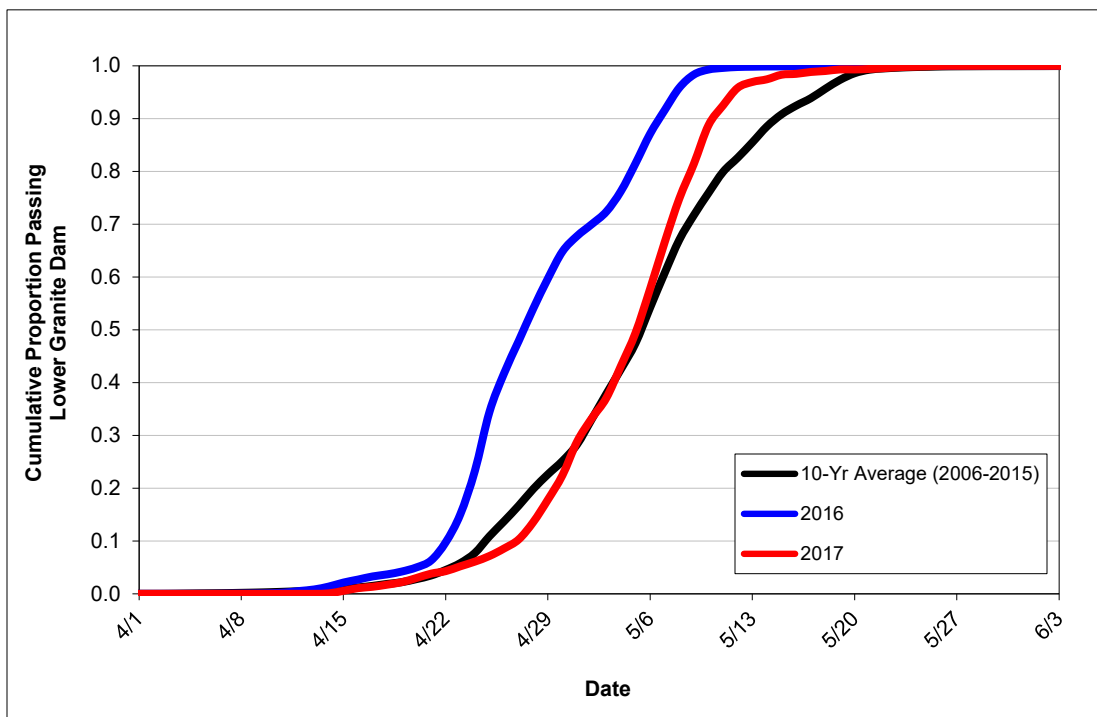
Figure 2. Catherine Creek Releases – Cumulative passage timing to Lower Granite Dam.

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 over the years. 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.
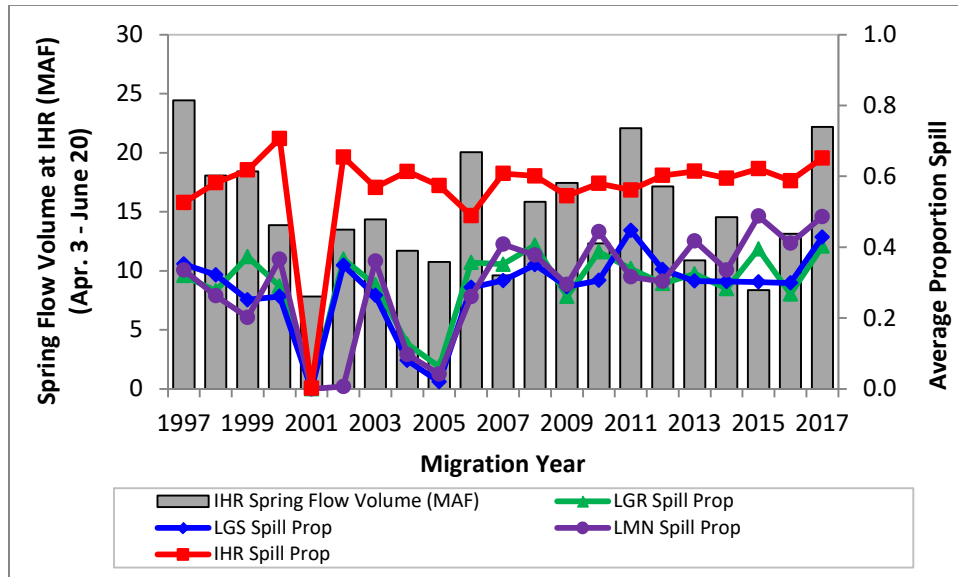

Figure 3. Total spring flow volume in the Snake River (at Ice Harbor Dam) and average spill proportion at Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams. Spring period in the Snake River is April 3–June 20.
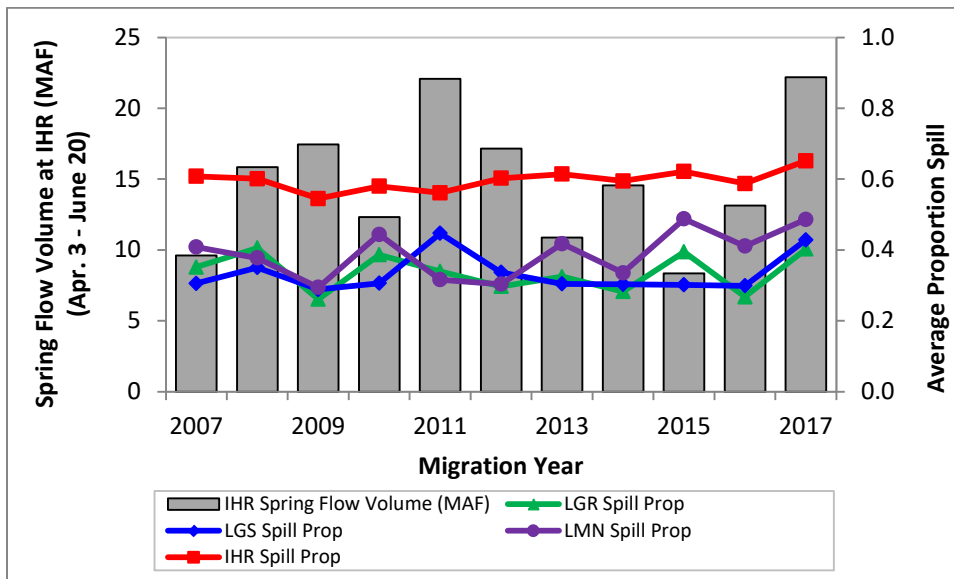
Figure 4. Total spring flow volume in the Middle Columbia River (at Bonneville Dam) and average spill proportion at McNary, John Day, The Dalles, and Bonnevile dams. Spring period in the Lower Columbia River is April 10–June 30.

Finally, the tables below contain estimates calculated by the CSS for the Imnaha River (Tables 5-6) and Catherine Creek (Tables 7-8) releases. The estimates provided include: (1) juvenile survival in the hydrosystem between Lower Granite and Bonneville dams (Tables 5 & 7), (2) the proportion of the juvenile population destined for transportation (Table 5 & 7), and (3) the smolt-to-adult survival (SAR) for several passage categories (Tables 6 & 8). Those passage categories are SAR(T), SAR(C_0), and Overall SARs, where SAR(T) represents smolts transported from Lower Granite, Little Goose, or Lower Monumental Dam, SAR(C_0) represents smolts migrating in-river (undetected at Snake River transportation collector sites), and Overall SAR is the estimated SAR for the overall hatchery release. All of these SAR estimates are for the LGR-to-GRA reach and jacks are excluded. The data presented in Tables 5-8 were taken from various chapters and appendices of the 2017 CSS Annual Report and past reports, which can be downloaded from the FPC webpage www.fpc.org/documents/CSS.html. Finally, Figure 5 is a time series of the Overall SAR (without jacks) over the years of available data for the two Lookingglass Hatchery release sites.

Table 5. Lookingglass Hatchery (Imnaha River Release) spring/summer Chinook juvenile survivals and estimated proportion transported (with 90% confidence intervals) from CSS.

Release Date(s)	Migration Year[A]	Juvenile Survival (LGR-BON)	Proportion Transported[B]
Apr-7	1997	0.31 (0.20-0.49)	0.52
Apr-6	1998	0.53 (0.46-0.62)	0.85
3/16, 4/05	1999	0.54 (0.42-0.75)	0.78
22-Mar	2000	0.57 (0.43-0.83)	0.69
21-Mar	2001	0.37 (0.27-0.61)	0.98
21-Mar	2002	0.50 (0.41-0.66)	0.66
1-Apr	2003	0.70 (0.62-0.80)	0.55
26-Mar	2004	0.56 (0.44-0.73)	0.89
3/26, 3/29	2005	0.58 (0.47-0.78)	0.86
3/21, 3/30	2006	0.50 (0.42-0.59)	0.67 (0.65-0.68)
3/21, 3/31	2007	0.69 (0.56-0.88)	0.23 (0.22-0.23)
25-Mar	2008	0.59 (0.51-0.68)	0.54 (0.53-0.55)
30-Mar	2009	0.51 (0.43-0.61)	0.50 (0.49-0.52)
1-Apr	2010	0.83 (0.69-0.99)	0.26 (0.25-0.28)
30-Mar	2011	0.55 (0.44-0.74)	0.56 (0.55-0.58)
30-Mar	2012	0.64 (0.58-0.72)	0.30 (0.30-0.32)
30-Mar	2013	0.77 (0.63-0.96)	0.34 (0.32-0.35)
1-Apr	2014	0.70 (0.57-0.86)	0.54 (0.53-0.56)
4/1-4/15	2015	0.38 (0.30-0.50)	0.27 (0.25-0.29)
4/3-4/10	2016	0.47 (0.40-0.56)	0.34 (0.32-0.34)

[A] Estimates for migration years 2006 through 2016 reflect use of new methodology developed for random pre-assignment of "monitor mode" and "return-to-river mode" operations. See 2017 CSS Annual Report for details.
[B] Confidence interval for proportion transported not available for migration years 1997-2005.

Table 6. Lookingglass Hatchery (Imnaha River Release) spring/summer Chinook TIR, SAR by study category (T vs. C_0) and Overall SAR (with 90% confidence intervals). SAR estimates are for LGR-to-GRA reach and are without jacks.

Release Date(s)	Migration Year	TIR	SAR(T) %	SAR(C_0) %	Overall SAR %
Apr-7	1997	1.36 (0.83-2.37)	1.16 (0.77-1.60)	0.86 (0.53-1.22)	0.98 (0.76-1.23)
Apr-6	1998	1.55 (0.93-3.15)	0.85 (0.65-1.09)	0.55 (0.28-0.83)	0.80 (0.63-1.00)
3/16, 4/05	1999	1.89 (1.40-2.51)	2.69 (2.28-3.08)	1.43 (1.08-1.82)	2.41 (2.09-2.74)
22-Mar	2000	1.29 (1.06-1.58)	3.11 (2.77-3.44)	2.41 (2.01-2.83)	2.89 (2.63-3.16)
21-Mar	2001	10.8 (4.9-39.8)	0.62 (0.49-0.78)	0.06[A] (0.01-0.11)	0.61 (0.48-0.77)
21-Mar	2002	1.75 (1.07-3.03)	0.79 (0.56-1.04)	0.45 (0.29-0.63)	0.68 (0.52-0.85)
1-Apr	2003	1.21 (0.80-1.86)	0.58 (0.40-0.75)	0.48 (0.34-0.62)	0.53 (0.42-0.65)
26-Mar	2004	1.64 (0.54-5.32)	0.38 (0.26-0.49)	0.23 (0.07-0.48)	0.36 (0.25-0.46)
3/26, 3/29	2005	1.77 (0.91-3.93)	0.28 (0.18-0.40)	0.16[B] (0.08-0.26)	0.27 (0.17-0.37)
3/21, 3/30	2006[C]	0.62 (0.42-0.89)	0.77 (0.58-0.97)	1.25 (0.93-1.61)	0.80 (0.64-0.96)
3/21, 3/31	2007[C]	1.70 (1.05-2.50)	1.07 (0.73-1.43)	0.63 (0.48-0.79)	0.67 (0.53-0.80)
25-Mar	2008[C]	1.45 (1.10-1.92)	1.92 (1.61-2.23)	1.32 (1.02-1.65)	1.76 (1.55-1.97)
30-Mar	2009[C]	1.83 (1.31-2.53)	1.39 (1.10-1.67)	0.76 (0.57-0.97)	1.04 (0.85-1.21)
1-Apr	2010[C]	1.27 (0.82-1.80)	0.95 (0.65-1.27)	0.75 (0.61-0.91)	0.78 (0.62-0.94)
30-Mar	2011[C]	0.83 (0.37-1.76)	0.26 (0.13-0.38)	0.31 (0.16-0.47)	0.24 (0.15-0.33)
30-Mar	2012[C]	1.06 (0.38-2.61)	0.20 (0.07-0.33)	0.18 (0.10-0.30)	0.18 (0.11-0.25)
30-Mar	2013[C]	1.27 (0.77-1.90)	0.63 (0.40-0.86)	0.50 (0.38-0.63)	0.52 (0.40-0.64)
1-Apr	2014[C,D]	2.28 (1.27-4.49)	0.50 (0.35-0.66)	0.23 (0.13-0.34)	0.42 (0.31-0.54)
4/1-4/15	2015	7.47 (3.34-21.85)	0.45 (0.24-0.67)	0.06 (0.02-0.10)	0.15 (0.09-0.21)

[A] Assumed SAR(C_0) same as SAR(C_1) for 2001.
[B] In-river SAR is combination of groups C_1 and C_0.
[C] 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 2017 CSS Annual Report for details.
[D] Migration year 2015 is incomplete with Age 2-salt adult returns through 7/22/2017.

Table 7. Lookingglass Hatchery (Catherine Creek AP Release) spring Chinook juvenile survivals and estimated proportion transported (with 90% confidence intervals) from CSS.

Release Date(s)	Migration Year[A]	Juvenile Survival (LGR-BON)	Proportion Transported[B]
4/2	2001	0.25 (0.18-0.37)	0.96
4/1-4/02	2002	0.65 (0.44-1.06)	0.71
3/12,3/23,3/31	2003	0.62 (0.51-0.74)	0.55
3/15, 3/30	2004	0.48 (0.34-0.72)	0.90
3/14, 4/04	2005	0.51 (0.37-0.80)	0.86
3/27	2006	0.49 (0.39-0.62)	0.68 (0.65-0.71)
3/26	2007	0.72 (0.54-1.07)	0.47 (0.45-0.49)
3/24	2008	0.70 (0.53-0.95)	0.60 (0.58-0.62)
3/16,3/24	2009	0.61 (0.47-0.84)	0.56 (0.54-0.58)
3/29	2010	0.68 (0.56-0.88)	0.29 (0.27-0.31)
3/21,3/30,4/5	2011	0.57 (0.43-0.77)	0.54 (0.51-0.56)
3/22-4/14, 4/16	2012	0.57 (0.47-0.70)	0.46 (0.44-0.48)
3/21-4/14	2013	0.88 (0.65-1.20)	0.52 (0.49-0.55)
3/21-4/15	2014	0.64 (0.53-0.79)	0.52 (0.50-0.55)
3/19-4/15	2015	0.52 (0.31-0.62)	0.02 (0.02-0.03)
3/23-4/14	2016	0.44 (0.37-0.60)	0.28 (0.27-0.29)

[A] Estimates for migration years 2006 through 2016 reflect use of new methodology developed for random pre-assignment of "monitor mode" and "return-to-river mode" operations. See 2017 CSS Annual Report for details.
[B] Confidence interval for proportion transported not available for migration years 1997-2005.

Table 8. Lookingglass Hatchery (Catherine Creek AP Release) spring Chinook TIR, SAR by study category (T vs. C_0) and Overall SAR (with 90% confidence intervals). SAR estimates are for LGR-to-GRA reach and are without jacks.

Release Date(s)	Migration Year	TIR	SAR(T) %	SAR(C_0) %	Overall SAR %
4/2	2001	5.33 (0.00-13.6)	0.23 (0.12-0.35)	0.04[A] (0.00-0.09)	0.22 (0.12-0.34)
4/1-4/02	2002	1.81 (1.02-3.43)	0.89 (0.59-1.20)	0.49 (0.28-0.74)	0.77 (0.56-1.00)
3/12,3/23,3/31	2003	1.45 (0.65-3.79)	0.36 (0.20-0.56)	0.25 (0.10-0.41)	0.31 (0.20-0.43)
3/15, 3/30	2004	1.94 (0.00-2.57)	0.38 (0.21-0.57)	0.20 (0.00-0.60)	0.36 (0.20-0.54)
3/14, 4/04	2005	2.48 (1.02-10.6)	0.44 (0.24-0.65)	0.18[B] (0.04-0.35)	0.40 (0.22-0.60)
3/27	2006[C]	0.48 (0.25-0.88)	0.45 (0.24-0.67)	0.93 (0.55-1.33)	0.49 (0.32-0.69)
3/26	2007[C]	1.35 (0.65-2.71)	0.50 (0.27-0.76)	0.37 (0.20-0.55)	0.43 (0.27-0.59)
3/24	2008[C]	1.41 (1.06-1.92)	2.58 (2.15-3.02)	1.83 (1.39-2.27)	2.13 (1.83-2.44)
3/16,3/24	2009[C]	1.35 (0.94-1.95)	1.76 (1.37-2.17)	1.30 (0.96-1.67)	1.54 (1.26-1.83)
3/29	2010[C]	1.51 (0.94-2.32)	1.18 (0.77-1.63)	0.78 (0.58-0.98)	0.88 (0.68-1.10)
3/21,3/30,4/5	2011[C]	1.15 (0.57-2.58)	0.52 (0.30-0.78)	0.45 (0.21-0.71)	0.48 (0.32-0.65)
3/22-4/14, 4/16	2012[C]	0.66 (0.27-1.21)	0.55 (0.27-0.90)	0.89 (0.55-1.29)	0.69 (0.46-0.91)
3/21-4/14	2013[C]	1.58 (0.97-2.63)	1.63 (1.11-2.16)	1.03 (0.66-1.43)	1.37 (1.01-1.76)
3/21-4/15	2014[C,D,E]	---	0.60 (0.34-0.86)	0.10 (0.00-0.26)	0.44 (0.26-0.62)
3/23-4/14	2015	2.11 (0.66-4.54)	0.71 (0.27-1.27)	0.34 (0.20-0.50)	0.41 (0.25-0.60)

[A] Assumed SAR(C_0) same as SAR(C_1) for 2001.
[B] In-river SAR is combination of groups C_1 and C_0.
[C] 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.
[D] Migration year 2015 is incomplete with Age 2-salt adult returns through 6/24/2017.
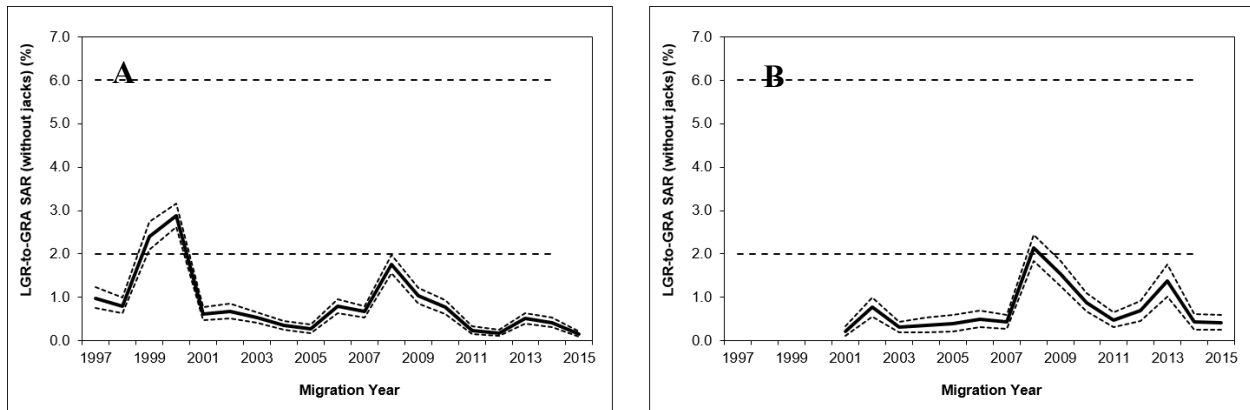[E] Too few adults in Transport and/or C_0 group to estimate TIR.

Figure 5. Overall SAR$_{LGR-to-GRA}$ (without jacks) for Lookingglass Hatchery Chinook released into the Imnaha River (A) (1997–2015) and from the Catherine Creek AP (B) (2001-2015) (with 90% confidence intervals). The NPCC 2-6% SAR objectives for listed wild populations are shown for reference. Migration year 2015 is incomplete with Age 2-salt adult returns through 6/24/2017.

We hope that the information we have provided regarding the use and application of information from the marked groups at the hatchery 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.