CENWW-OD-EL HOLDREN February, 2016

MEMORANDUM THRU:
Marty Mendiola, Operations Project Manager, Lower Granite Dam

FOR Chief, Operations Division
ATTN: John Bailey / Ann Setter

SUBJECT: Submission of 2015 Juvenile Fish Collection and Bypass Report, Lower Granite Dam Juvenile Fish Facility.

1. Enclosed find the 2015 Juvenile Fish Collection and Bypass Report for Lower Granite Dam as requested.

2. If you have any questions contact Elizabeth Holdren at Lower Granite Dam, (509) 843-1493 ext. 263.

ELIZABETH A. HOLDREN
Supervisory Fisheries Biologist, Lower Granite Dam

Enclosure

2015 Juvenile Fish Collection and Bypass Report
Lower Granite Dam Juvenile Fish Facility

Prepared by

Elizabeth Holdren

U.S. Army Corps of Engineers

and

Shawn Rapp Blue Leaf Environmental

February, 2016

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TRANSPORT OPERATIONS - LOWER GRANITE DAM

Introduction

The 2015 collection season at Lower Granite was characterized by below average flow and spill conditions and low debris. ESBSs (Extra-Length Bar Screens) were installed March 18 through March 23. The bypass system and juvenile collection facility were watered up in secondary bypass mode at 1300 hours March 17. The JFF (Juvenile Fish Facility) was operated in secondary bypass until collection for transport began at 0700 hours May 1. Daily twenty-four hour sampling for fish condition monitoring occurred from March 26 until collection for transport began at 0700 on May 1. Early season transport of Snake River yearling anadromous salmonids as part of the ongoing study to compare in-river verses transported SARs (Smolt Adult Return Ratios) included 17,915 April 16 and 27,145 April 23. Four agencies conducted five research projects at the Lower Granite juvenile collection facility this season.

Collection for transport began at 0700 hours on May 1 and ended at 0700 hours on October 31. The facility was operated in secondary bypass mode October 31 through December 2. Total smolt collection for 2015 season was 2,703,657 fish which is about 59.6% less than 2014 (6,688,226). Of the 2,703,657 fish collected in the 2015 season, 22,432 were trucked, 1,526,694 were barged, and 1,151,740 were bypassed.

Pacific States Marine Fisheries Commission (PSMFC)/Blue Leaf Environmental technicians examined 611 fish for gas bubble trauma (GBT) between April 9 and May 21. Smolts examined prior to May 1 were bypassed to the river and smolts examined after that date were transported. There were no symptoms of GBT observed during the 2015 season.

The passive integrated transponder (PIT) tag system detected 59,108 PIT-tagged fish coming through the JFF during the 2015 season, of these 38,219 were diverted to the river or failed to be detected moving to the raceways, the sample, or the exits.

This season's total collection by species group included: 902,798 clipped yearling Chinook, 247,380 unclipped yearling Chinook, 188,552 clipped subyearling Chinook, 500,858 unclipped subyearling Chinook, 674,434 clipped steelhead, 152,383 unclipped steelhead, 8,350 clipped sockeye, 2,572 unclipped sockeye, and 26,330 coho.

Historically Snake River Basin hatchery salmonids were distinguished from wild salmonids by clipped adipose fins (occasionally pectoral or ventral fins). Before 1998, Idaho Fish and Game (IDFG) was the only agency that released sizeable numbers of unclipped hatchery fish. Starting in 1998, increasing numbers of unclipped hatchery fish were released by state, federal, tribal, or other agencies (FPC). Thus salmonids collected, sampled, bypassed, and transported from Lower Granite facilities are designated as clipped/unclipped not hatchery/wild. Snake River Basin Coho were reintroduced by the tribes and are all of hatchery progeny.

Corps of Engineers personnel included: Supervisory Fisheries Biologist Elizabeth Holdren, Assistant Biologist Ches Brooks, Lead Biological tech Robert Horal, Biological Technicians:

Stephen Hampton, John Walz, Jonathan Ewanyk, John Dammann, Bob Traufer, Dan Caldwell, Geno Sprofera, and truck driver / maintenance personnel: Raymond Cooper, Chuck Krasselt, Jeremy Krewer, Tom Ring. Representing Pacific States Marine Fisheries Commission (PSMFC) were biologists Allan Martin, Jenna Davis, Blue Leaf Environmental was biologists Shawn Rapp and Paul Burke, and Washington Department of Fish and Wildlife (WDF&W) biologist Charles Morrill. PSMFC technicians Jeremy Wright, Dawn Waldal, and Bill Fitzgerald conducted fish sampling, and were responsible for the numerous quality control and data keeping tasks.

Facility Modifications

The following modifications were made to the JFF prior to or during the 2015 fish collection season:

1. Juvenile bypass upgrade Phase 1a is ongoing.
2. Refurbished the sample diversion slide gates per PSMFC guidelines.
3. Replaced sample slide gate guides.
4. Replaced separator exit B flume dewatering air cylinder.
5. Permanently sealed base of sample holding tank floor to the sample holding tank to eliminate potential for lamprey stranding.
6. Repaired/replaced remaining problem pneumatic raceway exit gate valves.
7. Repaired 42” valve guides.
8. Completed plunger and cylinder installation on 8000 series barges (replaced barge hold plungers, shafts, cylinders, and hoses).
9. Fabricated and installed upper raceway jump barrier screens.
10. Installed upstream raceways crowder hoist to facilitate NOAA research.
11. Replaced lower raceway stoplogs.
12. Installed truck loading flume dewatering screen extension walls.
13. Completed permanent fish screen slot orifice closure work.
14. Replaced downstream direct load line switch gate bushing.
15. Replaced barge loading boom cable and winch.

River Conditions

During the 2015 season, the average daily flow did not exceed 100 kcfs. The highest daily average flow for the season was 74.9 kcfs April 2. The lowest daily average flow for the season occurred on October 19 with a flow of 12.8 kcfs. The average flow for the season was 34.2 kcfs. Spill occurred for 152 days from April 3 through midnight on August 31, with a maximum daily average spill of 20.6 kcfs June 17, a minimum daily spill of 3.3 kcfs August 26, and a seasonal average of 16.0 kcfs. The RSW was put into operation when Court ordered spill began April 3. The RSW was taken out of service July 8 to improve tailrace conditions for adult passage. River temperature averaged 61.6^{o} F for the season and ranged from 46.6^{o} F April 7-9 to 71.2^{o} F July 11. A comparison of daily powerhouse flow and spill is shown in Figure 1. Average monthly flow and spill for the 2011-2015 collection seasons are provided in Table 1.

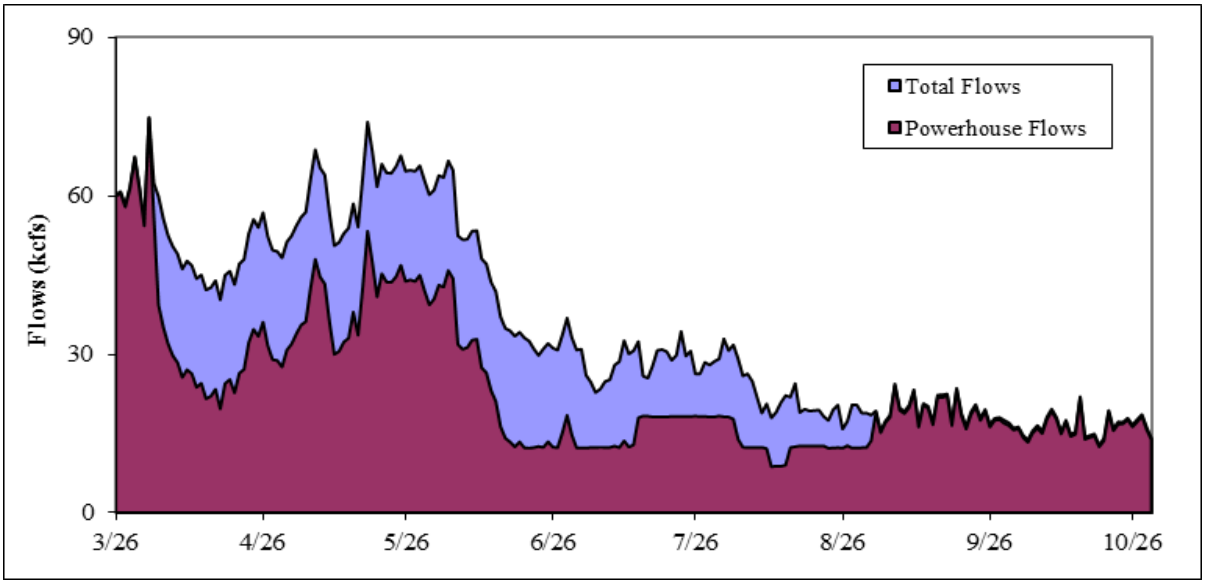

Figure 1. Daily average total flow and powerhouse flow at LWG, 2015.

Table 1. Comparison of average monthly river flow and spill at LWG, 2011-2015.

Flow (kcfs)	2011	2012	2013	2014	2015	2011-14 Ave.
April[1]	103.55	114.50	52.58	73.67	52.11	86.07
May	140.59	107.14	82.19	104.08	60.89	108.50
June	173.86	90.31	56.31	88.09	43.08	102.14
July	96.77	46.49	33.31	46.64	28.47	55.80
August	39.78	27.28	22.08	26.06	21.72	28.80
September	36.32	22.82	20.42	21.54	19.26	25.28
October	28.04	19.36	23.30	18.86	16.36	22.39
Spill (kcfs)						
April[1]	30.62	29.91	15.56	16.79	15.34	23.22
May	51.49	29.53	21.45	31.10	20.30	33.39
June	63.75	32.38	19.71	23.22	19.60	34.76
July	27.37	21.42	16.71	18.77	12.22	21.07
August	26.05	14.33	11.52	14.19	8.75	16.52
September	0.44	0.27	1.99	0.47	0.15	0.79
October	0.01	0.00	0.00	0.00	0.00	0.00

Fish Collection

Migration and Collection

Pre-transport secondary bypass occurred from March 17 through May 1. Fish collection for transportation began at 0700 hours on May 1 and continued until 0700 hours on October 31. An estimated 2,703,657 juvenile salmonids were collected in 2015. This is the lowest number of salmonids collected and transported in the last five years (Table 2) and since the 1984 collection season. Within each species group, the number collected and percent of the total collection was: 902,798 clipped yearling Chinook (33.4%), 247,380 unclipped yearling Chinook (9.1%), 188,552 clipped subyearling Chinook (7.0%), 500,858 unclipped subyearling Chinook (18.5%),

674,434 clipped steelhead (24.9%), 152,383 unclipped steelhead (5.6%), 8350 clipped sockeye/kokanee (0.3%), 2572 unclipped sockeye/kokanee (0.1%), and 26,330 coho (1.0%). Post-season secondary bypass occurred from October 31 through December 2. Daily collection and bypass numbers are provided in Appendix Table 1.

Table 2. Annual collection, bypass, transportation and mortality at LWG, 2011-2015.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total
Collection										
2011	1,993,789	723,152	229,224	518,262	2,114,802	598,520	23,334	54,806	54,717	6,310,606
2012	1,731,454	962,141	256,860	430,048	1,746,004	607,404	552	30,289	47,678	5,812,430
2013	1,362,720	502,542	173,989	319,566	1,058,688	386,214	27,395	15,377	48,078	3,894,569
2014	2,431,937	1,010,410	242,870	415,002	1,856,040	548,219	18,902	112,122	52,724	6,688,226
2015	902,798	247,380	188,552	500,858	674,434	152,383	8,350	2,572	26,330	2,703,657
Bypass										
2011	659,510	350,162	22,184	65,459	1,056,462	219,457	13,591	28,464	14,509	2,429,798
2012	1,024,069	678,689	57	17,163	1,119,949	283,526	0	1,430	8,165	3,133,048
2013	184,931	123,327	12,212	1,485	303,992	52,616	0	54	210	678,827
2014	895,654	605,721	3,013	8,991	920,228	156,884	0	59,640	3,722	2,653,853
2015	512,884	163,586	0	8,366	407,393	55,764	0	160	3,499	1,151,740[1]
Truck										
2011	2	30	52	15,274	3	11	2	89	145	15,608
2012	2	109	145	14,349	6	35	0	207	29	14,882
2013	0	130	456	40,474	3	16	0	112	1	41,192
2014	5	4	486	20,690	0	2	2	64	2	21,255
2015	28	9	145	22,184	28	16	0	7	15	22,432
Barge										
2011	1,332,596	372,515	206,271	435,419	1,058,026	378,986	9,715	25,697	40,040	3,859,265
2012	706,147	282,894	255,814	396,998	625,847	323,764	552	28,535	39,447	2,659,998
2013	1,176,085	378,497	161,004	276,789	754,419	333,510	27,386	15,188	47,807	3,170,685
2014	1,535,098	404,342	238,763	383,774	935,573	391,283	18,889	51,966	48,991	4,008,679
2015	389,616	83,675	188,023	468,810	266,752	96,530	8,091	2,392	22,805	1,526,694
Total Transport										
2011	1,332,598	372,545	206,323	450,693	1,058,029	378,997	9,717	25,786	40,185	3,874,873
2012	706,149	283,003	255,959	411,347	625,853	323,799	552	28,742	39,476	2,674,880
2013	1,176,085	378,627	161,460	317,263	754,422	333,526	27,386	15,300	47,808	3,211,877
2014	1,535,103	404,346	239,249	404,464	935,573	391,285	18,891	52,030	48,993	4,029,934
2015	389,644	83,684	188,168	490,994	266,780	96,546	8,091	2,399	22,820	1,549,126
2015 Mortalities										
Facility	270	94	384	1,473	237	57	253	12	11	2,791
Res/Sac	0	16	0	25	24	16	6	1	0	88

[1] Includes Res/Sac fish

By the end of May, 76.9% of the total yearly collection had arrived. The percent of total collection arriving by the end of June and the end of July was 91.3% and 95.3%, respectively. The remaining 4.7% of juvenile salmonids was collected during August, September, and October. During this time period, 8.0% of subyearling Chinook was collected. The peak daily collection total and date for each species group were: clipped yearling Chinook 64,400 (April 25), unclipped yearling Chinook 28,200 (April 25), clipped subyearling Chinook 24,900 (June 5), unclipped subyearling Chinook 44,100 (June 5), clipped steelhead 64,200 (April 26),

unclipped steelhead 10,200 (May 7), clipped sockeye 1,750 (May 19), unclipped sockeye 400 (May 9), and coho 2,600 (May 7). Total daily collection in 2015 peaked at 150,800 (April 26). Daily collection of all species combined versus total flow is shown graphically in Figure 2. Peak collection date and daily collection total by species group are listed in Table 3.

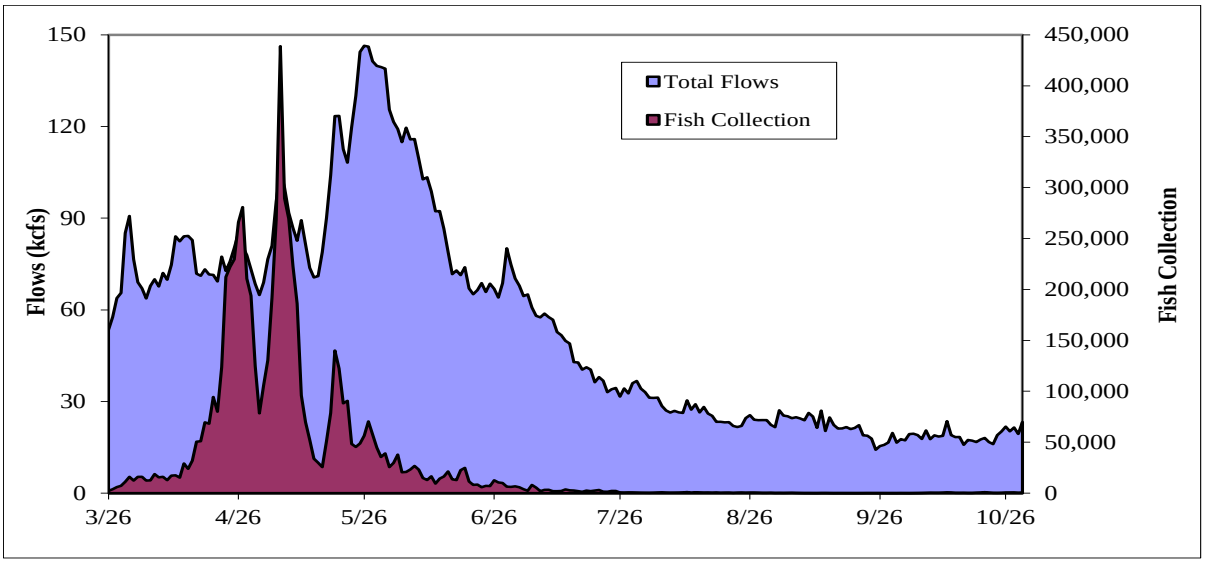

Figure 2. Fish collection and daily average flows at LWG, 2015.

Table 3. Annual peak collection days at LWG, 2011-2015.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total
2011	12-May	12-May	19-Jun	28-May	3-Apr	12-May	25-May	22-May	12-May	12-May
	165,200	33,800	12,550	25,600	160,139	48,000	4,800	2,300	5,200	375,600
2012	26-Apr	26-Apr	4-Jun	5-Jun	26-Apr	26-Apr	9-May	18-May	18-May	26-Apr
	135,000	69,400	15,000	20,800	119,000	37,400	200	5,200	6,300	362,200
2013	8-May	13-May	9-Jun	9-Jun	13-May	13-May	16-May	17-May	14-May	13-May
	129,641	37,800	20,100	16,225	89,200	42,400	13,000	4,600	9,400	244,000
2014	6-May	24-Apr	3-Jun	3-Jun	27-Apr	8-May	18-May	5-May	19-May	6-May
	287,000	48,000	12,900	18,600	126,200	31,000	8,900	10,800	5,600	438,800
2015	25-Apr	25-Apr	5-Jun	5-Jun	26-Apr	7-May	19-May	9-May	7-May	26-Apr
	66,400	28,200	24,900	44,100	64,200	10,200	1,750	400	2,600	150,800

Adult Fallbacks

A total of 4,205 adult salmonids fell back through the juvenile bypass system and were bypassed from the separator between March 26 and October 31, 2015 (Table 4). The total includes: 1,041 adult Chinook salmon, 491 jack Chinook salmon, 1,180 clipped steelhead, 1,472 unclipped steelhead, 16 sockeye, and 5 coho. Steelhead kelts are included in the total though they are not

technically fallbacks. Fallbacks that went through the separator bars entered the raceways and were transported or were sent to the sample system and bypass to the river. These fish were not counted by the separator technician. The total fallback number in 2015 was lowest than the previous 5 year average with the 2011 being the highest followed by 2014. From March 18 to March 25 there were 350 adult steelhead (138 clipped and 212 unclipped) released from the separator that are not included in the 4,205 collection season total. Daily adult fallbacks and fallback mortalities can be found in Appendix Table 4.

Table 4. Annual totals of adult salmonids released from the separator at LWG, 2010-2015.

	Adult Chinook		Jack Chinook		Steelhead		Sockeye	Coho	
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip			Totals
2011	1,069	673	794	453	2,920	3,410	4	17	9,340
2012	581	383	716	496	1,683	2,256	3	6	6,124
2013	1,160	963	1,058	768	1,242	1,058	5	11	6,265
2014	951	992	455	393	2,662	2,546	26	79	8,104
2015	558	483	290	201	1,180	1,472	16	5	4,205
11-14 avg.	940	753	756	528	2,127	2,318	10	28	7,458

Steelhead were the most common adult salmonids species removed from the separator in 2015. April and May accounted for 71.6% of adult steelhead removed from the separator. The remaining 28.4% of steelhead fallbacks were predominantly removed from the separator in August, September, and October. The total number of steelhead fallbacks removed from the separator include out migrating kelts. The majority of Chinook adults and jacks were removed from the separator during September and October (fall Chinook). Sockeye fallbacks were highest in July and Coho fallbacks were highest in October (Table 5).

Table 5. Monthly totals of adult salmonids released from the separator at LWG, 2015.

	Adult Chinook		Jack Chinook		Steelhead		Sockeye	Coho	
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip			Totals
April[1]	1	0	0	0	552	770	0	0	1,323
May	26	16	3	0	201	375	0	0	621
June	29	25	9	5	4	47	0	0	119
July	24	30	15	13	6	15	11	0	114
August	22	25	9	0	96	68	4	0	224
September	124	139	63	59	225	152	1	0	763
October	332	248	191	124	96	45	0	5	1,041
Totals	558	483	290	201	1,180	1,472	16	5	4,205

[1]Includes March 26-31

The condition of adult salmonids was evaluated as they were released from the separator (Table 6). Fallback condition was predominantly good to fair. Condition ratings of the 4,205 adults examined were as follows: 2,752 good (65.4%), 1,044 fair (24.8%), 358 poor (8.5%), and 51 were dead (1.2%). Adult salmonid mortalities included: 5 clipped Chinook, 6 unclipped Chinook, 23 clipped steelhead, and 17 unclipped steelhead. Adult Chinook had the highest percentage of good/fair fish (79.8%) followed by steelhead (55.4%).

Table 6. Condition of adult salmonids released from the separator at LWG, 2015.

	Adult Chinook		Jack Chinook		Steelhead		Sockeye	Coho	
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip			Totals
Good	443	388	258	186	604	864	7	2	2,752
Fair	80	70	28	15	412	428	9	2	1,044
Poor	30	19	4	0	141	163	0	1	358
Dead	5	6	0	0	23	17	0	0	51
Total	558	483	290	201	1,180	1,472	16	5	4,205

Sampling

Consistent with the 2015 Fish Operations Plan (FOP) Appendix B and guidance provided by the Technical Management Team (TMT), the juvenile fish transportation program allows for a variable start date, based on expected river flows. During years when the spring seasonal average river flow in the Snake River is expected to equal or exceed 65 kcfs, transport operations will begin on staggered start dates between April 21 and May 1 at Lower Granite, Little Goose, and Lower Monumental Dams. Prior to a dam's transport start date, all fish collected will be bypassed to the river. In years when the spring seasonal average river flow is expected to be below 65 kcfs, transport operations at Lower Granite Dam will start on April 1. This year TMT put out a system operational request (SOR) for transportation at Lower Granite, Little Goose, and Lower Monumental to begin at 0700 hours on May 1. All fish sampled prior to transport were bypassed to the river with the exception of research fish.

Sampling is diverting and segregating groups of fish in a consistent fashion so that data collected from those segregated groups will accurately represent the sum total of the fish being collected in real time. Sampling is not the act of evaluating those groups. Lower Granite fish sampling began at 0700 hours on March 26 and ended at 0700 hours on October 31. A total of 220 daily samples were processed this season. The sample rate was set at 10% on March 26 and fluctuated throughout the season based on guidelines provided by the Fish Passage Center (FPC) according to daily fish numbers and to accommodate research needs. Fish were sampled daily from March 26 to August 16. Every other day sampling began August 17 at a rate of 50% to minimize fish handling. The sample rate was increases to 100% September 4 in response to a decrease in subyearling Chinook. The sample holding tank was crowded at 0700 every other day to separate day one fish from day two fish. On transport days each day's sample was worked up separately. During 2015 the smolt monitoring staff sampled 52,359 smolts 1.9% of the total collection compared to 80,606 smolts (1.2%) in 2014 (Table 7).

Table 7. Annual percentage of smolts sampled at LWG, 2011-2015.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total
2011	0.6	0.7	2.0	6.9	0.8	0.8	1.1	1.7	1.5	1.3
2012	0.8	0.9	3.8	10.4	0.8	0.9	1.4	2.1	1.2	1.7
2013	1.1	1.3	5.8	15.4	1.3	1.2	0.6	1.6	0.8	2.6
2014	0.6	0.8	2.9	8.5	0.6	0.6	0.8	1.1	0.5	1.2
2015	0.9	1.0	2.1	5.9	0.9	1.1	1.7	1.8	1.2	1.9
11-14 Ave.	0.7	0.9	3.5	9.8	0.8	0.9	0.8	1.4	1.0	1.6

The sample rate was not raised above FPC guidelines to accommodate fish needs for research this season. The total number of smolts sampled in 2015 by species included: 7,941 clipped yearling Chinook, 2,507 unclipped yearling Chinook, 3,978 clipped subyearling fall Chinook, 29,672 unclipped subyearling fall Chinook, 6,003 clipped steelhead,1,747 unclipped steelhead, 144 clipped sockeye, 46 unclipped sockeye/kokanee, and 321 Coho (Table 8).

Table 8. Weekly sample totals at LWG, 2015.

Week	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Ending	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total
26-Mar	356	226	0	2	5	25	0	5	0	619
2-Apr	1,345	469	0	95	275	86	0	3	0	2,273
9-Apr	396	106	0	5	236	30	0	1	0	774
16-Apr	430	185	0	11	504	102	0	0	0	1,232
23-Apr	1,131	353	0	22	586	112	0	0	7	2,211
30-Apr	1,125	360	0	3	1,201	98	0	0	14	2,801
7-May	1,424	266	0	10	865	188	0	5	24	2,782
14-May	1,113	213	0	19	692	295	10	7	72	2,421
21-May	467	221	24	136	676	355	131	9	107	2,126
28-May	116	73	896	1,049	534	281	2	4	68	3,023
4-Jun	4	11	1,388	2,032	157	100	0	0	7	3,699
11-Jun	2	4	536	1,196	140	51	1	0	1	1,931
18-Jun	0	3	325	864	17	3	0	0	0	1,212
25-Jun	0	1	395	2,125	18	1	0	2	0	2,542
2-Jul	0	4	213	1,770	9	1	0	1	1	1,999
9-Jul	0	0	48	966	8	3	0	1	0	1,026
16-Jul	0	0	22	1,046	2	0	0	0	2	1,072
23-Jul	1	3	41	1,528	22	2	0	0	3	1,600
30-Jul	0	0	24	1,600	10	0	0	0	0	1,634
6-Aug	0	0	19	2,434	9	1	0	1	1	2,465
13-Aug	0	0	3	1,148	3	1	0	0	2	1,157
20-Aug	0	0	8	1,047	1	3	0	0	0	1,059
27-Aug	0	0	6	1,233	4	1	0	0	0	1,244
3-Sep	0	0	9	1,341	1	0	0	0	3	1,354
10-Sep	0	1	9	1,506	3	2	0	0	4	1,525
17-Sep	6	0	0	238	4	0	0	0	2	250
24-Sep	5	1	0	78	5	1	0	0	0	90
1-Oct	5	0	2	205	5	0	0	2	0	219
8-Oct	4	1	0	558	1	0	0	2	1	567
15-Oct	1	0	1	1,348	0	0	0	0	1	1,351
22-Oct	5	2	2	2,228	4	1	0	0	1	2,243
29-Oct	4	2	4	1,701	3	3	0	3	0	1,720
31-Oct	1	2	3	128	3	1	0	0	0	138
Total	7,941	2,507	3,978	29,672	6,003	1,747	144	46	321	52,359

Transportation

An estimated 1,549,126 juvenile salmonids (57.3% of fish collected) were transported from Lower Granite Dam in 2015. The number of fish and the percentage of collection that was

transported of each species group included: 389,644 clipped yearling Chinook (43.2%), 83,684 unclipped yearling Chinook (33.8%), 188,168 clipped subyearling fall Chinook (99.8%), 490,994 unclipped subyearling fall Chinook (98.0%), 266,780 clipped steelhead (39.6%), 96,546 unclipped steelhead (63.4%), 8,091 clipped sockeye (96.9%), 2,399 unclipped sockeye/kokanee (93.3%) and 22,820 coho (86.7%). Of these, approximately 1,526,694 were transported by barge and 22,432 by truck. This total includes 45,060 fish transported from Lower Granite by barge (17,915 on April 16 and 27,145 on April 23) as part of the ongoing National Marine Fisheries Service (NMFS) study to compare SAR's of transported versus in-river yearling Chinook. Daily truck and barge transportation numbers are provided in Appendix Table 2.

Every day barging operations occurred from May 2 through May 22. Every-other-day barging occurred May 24 through August 14. Lower Granite transported an estimated 1,481,634 (97.6% of the total collection) juvenile fish by barge from May 2 through August 14. The number of fish barged and the percent barged of the total transport season collection for each species group included: 369,506 clipped yearling Chinook (100.0%), 76,603 unclipped yearling Chinook (96.1%), 188,023 clipped subyearling fall Chinook (99.7%), 468,418 unclipped subyearling fall Chinook (95.1%), 252,369 clipped steelhead (93.9%), 93,551 unclipped steelhead (89.9%), 8,091 clipped sockeye (96.9%), 2,392 unclipped sockeye/kokanee (99.2%) and 22,681 Coho (99.8%). Fish were transported July 16 (a non-scheduled transport day) from Lower Granite to demonstrate fish loading and barge transportation procedures to Judge Simon following regional coordination. Lower Granite transported 4,158 juvenile salmonids by truck July 29 due to Little Goose Dam navigation lock being out of service. Little Goose and Lower Monumental fish were transported by barge on this day. Fish transported for National Marine Fisheries Service are not included in the transport season collection or barge transport totals. New Point Four oxygen monitoring systems were used on 4000 and 8000 series barges this season. YSI portable oxygen monitoring units continue to be kept on barges as backup systems. Fish evacuation plungers were replaced on 8000 series barges during the 2014-2015 maintenance season. Replacement of the 4000 and 2000 series plungers is ongoing. Shafts, cylinders, and hoses for 8000 series fish evacuation plungers were replaced in response to pneumatic actuator coupler failure in the right rear hold of barge 8106 during the 2014 transport season.

There was no early season trucking from Lower Granite this season. Juvenile fish were trucked by midi-tanker or semi-truck from August 16 through October 31. All truck trips were made with the 300 gallon pickup mounted except for August 16 when fish numbers necessitated using the larger capacity semi-truck and trailer. The COE transported 22,432 smolts by truck which is 0.8% of the total juvenile collection. The number of smolts trucked by species included: 28 clipped yearling Chinook, 9 unclipped yearling Chinook, 145 clipped subyearling Chinook, 22,184 unclipped subyearling Chinook, 28 clipped steelhead, 16 unclipped steelhead, 7 unclipped sockeye/kokanee, and 15 coho. Water temperatures and oxygen levels were monitored to ensure acceptable levels. When needed raw river water is added to the midi-tanker to keep the water temperature at an acceptable level for the trip to Bonneville. This was not required in 2015. Very little tempering was required at the release site.

Bypass

The collection facility operated in secondary bypass mode from March 17 through May 1. From 0700 hours March 26 through 0700 hours May 1, prior to collection for transport 1,126,353 fish

were bypassed from the juvenile facility. During the May 1 through October 31 juvenile transport season 25,387 smolts were bypassed from the facility (Table 2). Of the 1,151,652 smolts bypassed (March 26 through October 31) the number bypassed in each species group and percent of those collected in that group was: 512,884 clipped yearling Chinook (56.8%), 163,586 unclipped yearling Chinook, 8,366 unclipped subyearling fall Chinook (1.7%), 407,393 clipped steelhead (60.4%), 55,764 unclipped steelhead (36.6%), 160 unclipped sockeye/kokanee (6.2%), and 3,499 coho (13.3%). These numbers include fish examined for GBT prior to the transport season and fish given for research projects during the transport season. This does not include fish bypassed by the PIT tag diversion system. Juvenile salmonids were bypassed rather than transported for the following purposes this season. May 1, prior to collection for transport 1,126,353 fish were bypassed from the Lower Granite collection facility.

1. Secondary bypass occurred from March 17 through May 1. Sampling occurred March 26 through May 1 for fish condition monitoring (COE). Fish sampled during this period are included in the facility bypass total.
2. GBT inspections during the period of April 9 through May 21 accounted for a total of 611 fish bypassed. Within each species group the number bypassed was: 276 clipped yearling Chinook, 71 unclipped yearling Chinook, 201 clipped steelhead, and 63 unclipped steelhead.
3. As part of three research projects 36,140 fish were collected and bypassed (See; Research Section). These fish are included in the bypass numbers of this report.
4. The PTAGIS database revealed that 59,108 PIT-tagged fish of different species groups were bypassed through the PIT tag system. These fish are not included in the facility bypass total.

According to the PTAGIS database, 59,108 PIT-tagged fish were detected at LWG in 2015. Of these, 38,219 (64.7%) were bypassed to the river through the PIT-tag diversion system, 19,997 (33.8%) were diverted to the raceways, 643 (1.1%) were diverted to the sample tank and 249 (0.4%) were not detected at any of the bypass, raceway or sample exit monitors and their final disposition is unknown. Before May 1, all PIT-tagged fish were bypassed to the river except for those transported on the research barges.

Incidental Species

Non-target fish species that were too large to pass through the separator bars were recorded and bypassed through the adult release flume at the separator. Those that were small enough to pass through the separator bars were either sampled and bypassed, or held in the raceways and transported with the juvenile salmonids. Sample fish from each incidental species were counted and their total numbers were calculated using the sample rate. These numbers were then added with separator counts of the same group to estimate the total collection for each species. An estimated 44,554 non-salmonid incidental fish were collected at the fish facility during the March 26 to October 31 passage period (Table 9). This is a decrease of 8.7% from 2014 season. Siberian prawns were most abundant incidental species with 20,979 collected followed by 5,701 suckers, and 4,516 sandrollers. Siberian Prawns in the sample were euthanized per WDFW instructions rather than released to the river. Pacific lamprey ammocoetes collection was estimated at 325 and lamprey macropthalmia collection was estimated at 785.

Table 9. Estimated collection of incidental fish species at LWG, 2015.

Common Name	*Scientific Name*	Separator	Expanded Sample	Total Collection[1]
American Shad (Adult)	*Alosa sapidissima*	552	1,074	1,626
American Shad (Juvenile)	*A. sapidissima*		255	255
Banded Killifish	*Fundulus diaphanus*			
Bass, Largemouth	*Micropterus salmoides*		2	2
Bass, Smallmouth	*M. dolomieui*	4	2,156	2,160
Bullhead (misc.)	*Amierus sp.*		200	200
Catfish, Channel	*Ictalurus punctatus*	13	248	261
Catfish, Flathead	*Pylodictis olivaris*			
Chiselmouth	*Acrocheilus alutaceus*		72	72
Common Carp	*Cyprinus carpio*	11	14	25
Crappie (misc)	*Pomoxis sp.*	7	448	455
Dace, Longnose	*Rhinichthys cataractae*		13	13
Dace, Speckled	*R. osculus*			
Kokanee	*Oncorhynchus nerka*			
Northern Pikeminnow	*Ptychocheilus oregonensis*	2	6	8
Pacific Lamprey (Adult)	*Entosphenus tridentatus*	11	42	53
Pacific Lamprey (Ammocoete)	*E. tridentatus*		325	325
Pacific Lamprey (Macrophthalmia)	*E. tridentatus*		785	785
Peamouth	*Mylocheilus caurinus*	4	3,961	3,965
Redside Shiner	*Richardsonius balteatus*			
Sand Roller	*Percopsis transmontana*		4,516	4,516
Sculpin	*Cottus sp.*		117	117
Siberian Prawn	*Exopalaemon modestus*		20,979	20,979
Sucker (misc.)	*Catostomus sp.*	534	5,167	5,701
Sunfish (misc.)	*Lepomis sp.*		1,577	1,577
Trout, Bull	*Salvelinus Malma*			
Trout, Cutthroat	*Oncorhynchus clarkii*			
Trout, Rainbow	*O. mykiss*		223	223
Walleye	*Stizostedion vitreum*	1		1
Warmouth	*Lepomis gulosis*		2	2
White Sturgeon	*Acipenser transmontanus*			
Whitefish	*Prosopium sp.*	4	1,228	1,232
Yellow Perch	*Perca flavescens*	1		1
Total		1,144	43,410	44,554

[1]Separator count plus expanded sample count equals estimated total facility collect.

Fish Condition

Descaling

Standard descaling criteria identifies a fish with 20% or greater scale loss on one side of its body. If scale loss is less than 20% on one side the fish is not considered descaled. PSMFC smolt monitoring personnel collected descaling data from all live sample fish (full sample) rather than just a portion (subsample).

The descaling rate for all fish sampled in 2015 was 2.2% which is slightly lower than the 2011-2014 average of 2.3%. The annual descaling rate by species group was: clipped yearling

Chinook 1.6%, unclipped yearling Chinook 1.2%, clipped subyearling Chinook 0.7%, unclipped subyearling Chinook 2.6%, clipped steelhead 2.2%, unclipped steelhead 3.3%, clipped sockeye/kokanee 5.1%, unclipped sockeye/kokanee 0.0%, and coho 0.9%. Annual descaling rates are summarized in Table 10.

Table 10. Annual full-sample descaling rates (>20%) by species at LWG, 2011-2015.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total
2011	2.6	1.1	0.8	2.2	2.5	2.2	1.6	6.2	2.2	2.2
2012	2.8	0.8	1.9	2.9	3.0	2.2	0.0	5.4	1.1	2.6
2013	3.1	1.6	2.0	3.0	2.6	2.5	1.9	7.4	2.7	2.7
2014	0.9	0.6	0.7	1.8	1.3	1.2	0.0	2.6	1.0	1.3
2015	1.6	1.2	0.7	2.6	2.2	3.3	5.1	0.0	0.9	2.2
11-14 Ave.	2.3	1.0	1.5	2.5	2.4	2.1	1.2	4.7	1.8	2.3

The highest weekly descaling rate for all species combined was 9.43% for the week ending October 15. The lowest descaling rates were 0.17% the week June 18 followed by 0.28% the week of June 25, 0.46% the week of July 2 (Table 11). As has been observed in the past, descaling rates increased as sample size decreased during the late August, September, and October. The forebay elevation was raised to 736-737 msl feet during the first week in October resulting in a pulse of debris at the juvenile collection facility. Clipped sockeye collected at the juvenile fish facility the second and third week in May exhibited descaling, caudal fin rot, and fungus. IDFG pathology determined the poor condition of clipped sockeye was due to fish being severely stressed during transportation from the hatchery to their release sites and not related to Lower Granite operations. This probably led to the higher than average descaling on clipped sockeye observed this season. Daily descaling rates are provided in Appendix, Table 3.

Table 11. Weekly descaling rates in percent for fish sampled at LWG, 2015.

Week Ending	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Total
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	
26-Mar	0.85%	1.34%	--	--	0.00%	4.00%	--	0.00%	--	1.15%
2-Apr	2.61%	0.43%	--	--	0.00%	0.00%	--	0.00%	--	1.71%
9-Apr	1.52%	2.86%	--	--	1.70%	0.00%	--	0.00%	--	1.70%
16-Apr	1.40%	1.09%	--	--	1.79%	0.98%	--	--	--	1.48%
23-Apr	0.98%	1.43%	--	--	2.56%	2.70%	--	--	0.00%	1.56%
30-Apr	1.25%	1.11%	--	--	1.59%	3.06%	--	--	0.00%	1.44%
7-May	1.69%	1.13%	--	--	1.97%	3.72%	--	0.00%	0.00%	1.84%
14-May	0.99%	1.42%	--	0.00%	4.07%	4.07%	11.11%	0.00%	0.00%	2.29%
21-May	3.65%	0.45%	0.00%	1.01%	2.68%	3.38%	4.76%	0.00%	0.93%	2.69%
28-May	0.00%	4.11%	0.22%	0.52%	1.88%	4.66%	0.00%	0.00%	1.47%	1.16%
4-Jun	0.00%	9.09%	0.36%	0.31%	1.96%	4.00%	--	--	14.29%	0.55%
11-Jun	0.00%	0.00%	0.56%	1.02%	1.44%	0.00%	0.00%	--	0.00%	0.88%
18-Jun	--	0.00%	0.31%	0.12%	0.00%	0.00%	--	--	--	0.17%
25-Jun	--	0.00%	0.77%	0.19%	0.00%	0.00%	--	0.00%	--	0.28%
2-Jul	--	0.00%	0.48%	0.46%	0.00%	0.00%	--	0.00%	0.00%	0.46%
9-Jul	--	--	0.00%	0.52%	12.50%	0.00%	--	0.00%	--	0.59%
16-Jul	--	--	0.00%	0.69%	0.00%	--	--	--	0.00%	0.67%
23-Jul	0.00%	0.00%	10.00%	1.32%	13.64%	0.00%	--	--	0.00%	1.70%
30-Jul	--	--	0.00%	1.07%	0.00%	--	--	--	--	1.05%
6-Aug	--	--	11.11%	1.49%	11.11%	0.00%	--	--	0.00%	1.59%
13-Aug	--	--	0.00%	2.74%	0.00%	0.00%	--	--	0.00%	2.72%
20-Aug	--	--	12.50%	1.64%	0.00%	0.00%	--	--	--	1.72%
27-Aug	--	--	16.67%	3.59%	0.00%	100.00 %	--	--	--	3.72%
3-Sep	--	--	0.00%	3.98%	0.00%	--	--	--	0.00%	3.94%
10-Sep	--	0.00%	11.11%	7.33%	0.00%	0.00%	--	--	0.00%	7.30%
17-Sep	0.00%	--	--	2.54%	0.00%	--	--	--	0.00%	2.42%
24-Sep	0.00%	0.00%	--	2.78%	0.00%	0.00%	--	--	--	2.38%
1-Oct	0.00%	--	0.00%	8.59%	0.00%	--	--	0.00%	--	8.02%
8-Oct	25.00%	0.00%	--	7.48%	0.00%	--	--	0.00%	0.00%	7.54%
15-Oct	0.00%	--	0.00%	9.46%	--	--	--	--	0.00%	9.43%
22-Oct	0.00%	0.00%	0.00%	4.09%	0.00%	0.00%	--	--	0.00%	4.06%
29-Oct	0.00%	0.00%	50.00%	5.07%	33.33%	0.00%	--	0.00%	--	5.19%
31-Oct	100.00 %	0.00%	0.00%	5.60%	0.00%	0.00%	--	--	--	5.93%
# Descaled	129	30	26	748	131	57	7	0	3	1,131
# Sampled	7,909	2,494	3,950	28,865	5,974	1,743	138	44	320	51,437
% Descaled	1.63%	1.20%	0.66%	2.59%	2.19%	3.27%	5.07%	0.00%	0.94%	2.20%

Injuries and Disease

Injury data was gathered from a sub sample of 100 of the dominant species and not more than 100 each of the non-dominant species. There were 23,974 fish examined for injury and disease in 2015. The body injuries associated with dam passage that were recorded this season included a generic body injury category and a generic fin injury category. Head injuries that were

associated with dam passage include generic head injuries, eye injuries, operculum injuries and "pop" or bulging eye. Fish were also examined for external symptoms of fungus, columnaris, bacterial kidney disease, and parasites.

Body injuries were observed on 8.8% of the smolts examined in the detailed subsample. Blood pooling is defined as the vasodilatation of the capillaries in fins (also referred to as fin pinkness). It seems to be a symptom of anesthetic use during higher water temperatures and is mostly found on subyearling Chinook. Fin hemorrhaging is the discharge of blood outside the body and is a sign of trauma. Of the smolts sampled for body injuries, the most common symptom observed in 2015 was general fin injury (38.2%) followed by blood pooling (37.3%), and discolored fin (17.3%). Unclipped subyearling fall Chinook exhibited the highest percent of body injuries at 13.1% (1,666 of 12,717 fish examined) followed by clipped steelhead at 5.1% (69 of 1,346 fish examined).

Head injuries were recorded on 0.4% of the smolts examined in the detailed subsample. Injuries to the operculum comprised the majority of head injuries (34.8%) followed by eye injuries (28.1%) and general head injuries (23.6%). Clipped sockeye had the highest occurrence of head injuries at 1.6% (2 of 123 fish examined) followed by unclipped yearling Chinook at 0.9% (11 of 1,267 fish examined).

Injuries associated with predators include wounds inflicted by other fish, birds, and lamprey. Predator wounds were observed on 0.7% of the smolts examined. Predator marks caused by birds, characterized by a distinct V-shaped descaling pattern on both sides of a fish were the most common predator mark (56.7%) compared to 37.8% caused by fish and 5.5% caused by lamprey. Predator marks were highest on clipped sockeye at 4.9% (6 of 123 fish examined), unclipped steelhead at 1.9% (21 of 1,121 fish examined), and clipped steelhead at 1.1% (35 of 3,197 fish examined).

External symptoms of disease were observed on 3.6% of the smolts examined in the detailed subsample compared to 3.4% in 2014, 4.2% in 2013, 4.4% in 2012, and 2.1% in 2011. Symptoms of disease were most common on clipped sockeye (14.6%). Fin hemorrhages comprised the majority of the disease symptoms (59.1%) followed by Columnaris (23.0%) and fungus (10.2%).

Fungus was found on 0.4% of all fish examined. Fungus was found on all species and rearing types with the exception of coho and unclipped sockeye. The occurrence of fungus is generally seen early in the season while the water is still relatively cold.

Columnaris is caused by the bacterium *Flavobacterium columnare* that becomes more virulent when water temperatures exceed 60º F. Therefore summer and fall Chinook migrants are more susceptible to infection. Columnaris can be recognized by the presence of yellowish lesions on the belly, damage to the gills, pelvic fins, snout, and caudal fins. SMP at Lower Granite only classify fish as being infected with columnaris if there is some tissue loss on the snout or body (fish with only red mouth edges are not classified as infected). Columnaris was identified at Lower Granite in 1996 and symptoms in sample fish have been recorded since1999. Typically the first incidence of columnaris is observed in July after the majority of subyearling fall Chinook have passed the project. The columnaris infection rate for the entire sample of

subyearling fall Chinook in 2015 was 0.8% (276 of 32,815) compared to 1.8% (736 of 41,386) in 2014, 1.4% (796 of 58,510) in 2013, 2.1% (1,119 of 53,799) in 2012, and 1.1% (440 of 39,375) in 2011.

Mortality

Facility mortality includes fish removed from the barges or trucks before departure, sample mortalities, recovery tank mortalities, separator mortalities and raceway mortalities, including the east raceways, which are used by NMFS for research. Annual facility mortality for all groups combined was 0.1% in 2015 and totaled 2,791 fish (Table 12). All species group mortality rates were lower than those observed for the 2011-2014 average except for unclipped subyearling fall Chinook. Within each species group, the number of facility mortalities and percent of those collected in that group was: 270 clipped yearling chinook (0.03%), 94 unclipped yearling Chinook (0.04%), 384 clipped subyearling fall Chinook (0.20%), 1,473 unclipped subyearling Chinook (0.29%), 237 clipped steelhead (0.04%), 57 unclipped steelhead (0.04%), 253 clipped sockeye (3.03%), 12 unclipped sockeye/kokanee (0.47%), and 11 coho (0.04%).

Table 13. Annual facility mortality in percent by species group at LWG, 2011-2015.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total
2011	0.08	0.04	0.31	0.39	0.01	0.01	0.11	1.01	0.04	0.09
2012	0.07	0.04	0.33	0.36	0.01	0.01	0.00	0.39	0.08	0.08
2013	0.12	0.11	0.16	0.26	0.02	0.02	0.03	0.15	0.12	0.10
2014	0.05	0.03	0.25	0.37	0.01	0.01	0.06	0.40	0.02	0.06
2015	0.03	0.04	0.20	0.29	0.04	0.04	3.03	0.47	0.04	0.10
11-14 Ave.	0.07	0.05	0.27	0.35	0.01	0.01	0.07	0.54	0.06	0.08

Weekly facility mortality rates were low during April and May, increased during June and July but did not increase over 1% until the week ending September 10. The mortality rate increased as the sample size decreased in the middle of September to a maximum weekly mortality rate of 6.67% the week of September 24. Mortality rates decreased to the end of the season (Table 14).

Table 14. Weekly facility mortality in percent by species group at LWG, 2015.

Week	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Ending	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total
26-Mar	0.14%	0.09%	--	5.00%	0.00%	0.00%	--	0.00%	--	0.13%
2-Apr	0.01%	0.02%	--	0.20%	0.01%	0.00%	--	0.00%	--	0.01%
9-Apr	0.00%	0.01%	--	0.18%	0.00%	0.00%	--	0.00%	--	0.00%
16-Apr	0.04%	0.05%	--	0.15%	0.01%	0.00%	--	--	--	0.03%
23-Apr	0.01%	0.02%	--	0.08%	0.01%	0.02%	--	--	0.00%	0.01%
30-Apr	0.00%	0.00%	--	0.00%	0.00%	0.01%	--	--	0.00%	0.00%
7-May	0.05%	0.05%	--	0.00%	0.04%	0.01%	--	0.33%	0.00%	0.04%
14-May	0.05%	0.09%	--	0.52%	0.07%	0.02%	0.50%	0.60%	0.01%	0.06%
21-May	0.08%	0.10%	0.08%	0.40%	0.12%	0.04%	2.89%	0.18%	0.03%	0.28%
28-May	0.48%	0.38%	0.13%	0.17%	0.12%	0.11%	33.00%	0.00%	0.09%	0.18%
4-Jun	0.00%	0.17%	0.16%	0.16%	0.24%	0.08%	--	--	0.86%	0.16%
11-Jun	1.00%	0.00%	0.12%	0.15%	0.15%	0.28%	14.00%	--	0.00%	0.15%
18-Jun	--	0.00%	0.71%	0.43%	1.45%	2.73%	--	--	--	0.53%
25-Jun	--	0.00%	0.51%	0.44%	1.43%	10.00%	--	5.00%	--	0.46%
2-Jul	--	1.67%	0.37%	0.34%	0.77%	0.00%	--	0.00%	5.00%	0.35%
9-Jul	--	--	0.78%	0.55%	0.53%	1.11%	--	0.00%	--	0.57%
16-Jul	--	--	1.62%	0.45%	2.00%	--	--	--	1.00%	0.48%
23-Jul	0.00%	3.33%	0.22%	0.45%	0.38%	5.00%	--	--	0.00%	0.45%
30-Jul	--	--	1.67%	0.25%	0.00%	--	--	--	--	0.27%
6-Aug	--	--	0.91%	0.24%	0.00%	0.00%	--	40.00%	0.00%	0.26%
13-Aug	--	--	0.00%	0.42%	0.00%	0.00%	--	--	0.00%	0.41%
20-Aug	--	--	2.50%	0.38%	0.00%	6.67%	--	--	--	0.42%
27-Aug	--	--	0.00%	0.55%	12.50%	0.00%	--	--	--	0.57%
3-Sep	--	--	0.00%	0.45%	0.00%	--	--	--	0.00%	0.44%
10-Sep	--	0.00%	0.00%	1.20%	0.00%	0.00%	--	--	0.00%	1.18%
17-Sep	0.00%	--	--	0.84%	0.00%	--	--	--	0.00%	0.80%
24-Sep	0.00%	0.00%	--	7.69%	0.00%	0.00%	--	--	--	6.67%
1-Oct	0.00%	--	0.00%	3.41%	0.00%	--	--	0.00%	--	3.20%
8-Oct	0.00%	0.00%	--	1.79%	0.00%	--	--	0.00%	0.00%	1.76%
15-Oct	100.00%	--	0.00%	1.93%	--	--	--	--	0.00%	2.00%
22-Oct	40.00%	0.00%	0.00%	1.17%	25.00%	0.00%	--	--	0.00%	1.29%
29-Oct	0.00%	0.00%	0.00%	1.53%	0.00%	0.00%	--	0.00%	--	1.51%
31-Oct	0.00%	0.00%	0.00%	2.34%	0.00%	0.00%	--	--	--	2.17%
# morts	270	94	384	1,473	237	57	253	12	11	2,791
# collected	902,798	247,380	188,552	500,858	674,434	152,383	8,350	2,572	26,330	2,703,657
% mortality	0.03%	0.04%	0.20%	0.29%	0.04%	0.04%	3.03%	0.47%	0.04%	0.10%

Sample mortalities include dead fish removed from the sample tank prior to sampling and those from the sorting trough in the sample lab. Annual sample mortality for all groups combined was 0.86% in 2015 (Table 15) and totaled 451 fish. The number of sample mortalities and mortality rate by species group was: 32 clipped yearling Chinook (0.40%), 13 unclipped yearling Chinook (0.52%), 28 clipped subyearling fall Chinook (0.70%), 336 unclipped subyearling fall Chinook

(1.13%), 29 clipped steelhead (0.48%), 4 unclipped steelhead (0.23%), 6 clipped sockeye/kokanee (4.17%), unclipped sockeye/kokanee (4.35%), and 1 coho (0.31%). Sample mortality for all groups combined has ranged from a high of 1.14% in 2011 to a low of 0.86% in 2015.

Table 15. Annual sample mortality by species group in percent at LWG, 2010-2015.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total
2011	0.70	0.49	1.37	1.73	0.20	0.20	0.39	8.11	0.25	1.14
2012	0.91	0.72	1.08	1.00	0.36	0.28	0.00	8.51	0.72	0.89
2013	0.74	0.90	1.88	1.12	0.22	0.22	1.27	6.15	0.81	0.97
2014	0.61	0.68	1.38	1.41	0.40	0.46	0.00	4.06	0.35	1.05
2015	0.40	0.52	0.70	1.13	0.48	0.23	4.17	4.35	0.31	0.86
11-14 ave	0.74	0.71	1.45	1.28	0.29	0.28	0.53	6.44	0.50	1.00

Barge mortalities are salmonids removed from barge holds after the barges depart LWG. The total number of smolts barged in 2015 included: 1,526,694 fish from LWG, 1,774,069 from LGS, and 1,067,858 fish from LMN. The barge mortality rate of 0.09% (3,964 of 4,368,621) is greater than observed in 2014 or for the 2011-2014 average and is the highest barge mortality rate in the last five years (Table 17). Barge mortalities by species group included: 563 clipped yearling Chinook, 247 unclipped yearling Chinook, 719 clipped subyearling Chinook, 1,462 unclipped subyearling Chinook, 599 clipped steelhead, 258 unclipped steelhead, 84 clipped sockeye, 19 unclipped sockeye/kokanee, and 13 coho (Table 16). Over 50% of the barge mortalities occurred between June 27 and July 11 when temperature regularly exceeded 70°F.

Table 16. Total barge mortalities from LWG 2011-2015.

	Number of Mortalities	Number Barged	Percent Mortality
2011	5,381	9,311,962	0.06%
2012	3,169	6,412,853	0.05%
2013	4,282	6,839,678	0.06%
2014	3,677	9,894,912	0.04%
2015	3964	4,368,621	0.09%
2011-2014 ave	4,127	8,114,851	0.05%

The mortality rate for fish trucked from LWG in 2015 was 0.14% (31 of 22,432) which is the lowest truck mortality rate in the last five years (Table 17). The truck mortality number and percent by species included: 1 clipped subyearling Chinook (0.69%) and 30 unclipped subyearling Chinook. All trips were made with the 300 gallon pickup truck mounted tank except for the trips on July 29 and August 16 which were made with the larger capacity semi-truck and trailer due to LGO navigation lock being out of service and increased collection of subyearling Chinook, respectively.

Table 17. Annual truck mortality at LWG, 2011-2015.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total
2011	0.00	0.00	0.00	0.30	0.00	0.00	0.00	1.12	0.00	0.30
2012	0.00	0.00	0.00	0.20	0.00	0.00	--	4.35	0.00	0.25
2013	--	0.77	0.00	0.23	0.00	0.00	--	3.57	0.00	0.24
2014	0.00	0.00	0.00	0.18	--	0.00	0.00	1.56	0.00	0.18
2015	0.00	0.00	0.69	0.14	0.00	0.00	--	0.00	0.00	0.14
11-14 Ave.	0.00	0.37	0.00	0.23	0.00	0.00	0.00	3.18	0.00	0.24

Gas Bubble Trauma Monitoring (PSMFC)

Juvenile salmonids were sampled for GBT from April 9 through May 21 in 2015. PSMFC personnel examined up to 100 clipped and unclipped yearling Chinook and steelhead each week for evidence of bubbles in paired and unpaired fins, and in the eye, as per Fish Passage Center GBT protocols. This season 611 fish were sampled for GBT: 276 clipped yearling Chinook, 71 unclipped yearling Chinook, 201 clipped steelhead, and 63 unclipped steelhead. During GBT sampling 13 PIT-tagged smolts were handled, not examined and returned to the separator including: 6 clipped yearling Chinook, 1 unclipped yearling Chinook, 4 clipped steelhead, and 2 unclipped steelhead. An additional 19 fish were handled and released into the separator including 1 clipped yearling Chinook, 1 unclipped yearling Chinook, 4 clipped steelhead, 3 unclipped steelhead, 2 clipped sockeye, 1 unclipped sockeye, and 7 coho. Prior to May 1, smolts examined for GBT were released in the sample recovery tank and bypassed. Smolts examined for GBT after May 1 were returned to the raceways and transported. A total of 309 smolts were bypassed including: 177 clipped yearling Chinook, 58 unclipped yearling Chinook, 62 clipped steelhead, and 12 unclipped steelhead. A total of 303 smolts were transported including: 100 clipped yearling Chinook, 13 unclipped yearling Chinook, 139 clipped steelhead, and 51 unclipped steelhead. Symptoms of GBT were observed on 1 clipped yearling Chinook April 16.

Gatewell Dipping

In 2012 three John Day ESBSs were used to replace LWG damaged fish screens. John Day fish screens have 1/16 inch spacing compared to 1/8 inch spacing on the LWG fish screens and have the top three rows of the perforated plates behind the screens with large holes. In 2013 and 2014 PSMFC and COE personnel performed gatewell slot sampling to evaluate performance of the screens and compare descaling rates. Consistent in both years, the average rate of descaling in the slots with the John Day fish screens (2.1 %) was less than the slots with LWG fish screens (2.5%). Further sampling is required to evaluate John Day screen performance in A gatewell slots. Testing of A gatewell slots is scheduled for spring of 2016.

Research

Four agencies participated in five research projects at Lower Granite juvenile facility that impacted 451,816 which is 16.7% of bypassed and collected smolts combined or 29.2% of the 2015 facility collection for transport. By comparison 471,305 were handled in 2014, 458,554 in 2013, 548,206 in 2012, and 602,405 in 2011. The 451,816 smolts taken from the collection included: 152,574 clipped yearling Chinook, 19,492 unclipped yearling Chinook, 48,868 clipped subyearling Chinook, 77,948 unclipped subyearling Chinook, 116,296 clipped steelhead, 22,552 unclipped steelhead, 4,342 clipped sockeye, 968 unclipped sockeye/kokanee, and 8,776 coho. In addition, the University of Idaho, Nez Perce Tribe (NPT) and Columbia River Intertribal Fisheries Commission (CRITFC) collected 494 clipped and 723 unclipped steelhead kelts from the juvenile facility this season.

National Marine Fisheries Service (NMFS)-Study to Compare the Adult Returns of In-river Migrating versus Barged Juvenile Anadromous Salmonids (Transportation Study)

Smolts were collected in the east raceways and tagged in the NMFS marking trailer at Lower Granite JFF from April 14 to June 13. NMFS handled 414,750 smolts as part of this transportation evaluation study. Of these 22,963 smolts were PIT tagged and transported including 5,071 unclipped yearling Chinook, 7,317 clipped steelhead, and 10,575 unclipped steelhead. There were 391,676 smolts handled that were not selected for tagging as part of this study. All fish were held overnight in raceways prior to transport. There were 111 smolt mortalities including 34 clipped yearling Chinook, 2 unclipped yearling Chinook, 25 clipped subyearling Chinook, 15 unclipped subyearling Chinook, 21 clipped steelhead, 2 unclipped steelhead, and 12 unclipped sockeye. Unclipped yearling Chinook with fork lengths less than 124 mm were targeted. Unclipped steelhead with fin erosion were not PIT tagged.

National Marine Fisheries Service (NMFS)-Study to Estimate Juvenile Salmonid Reach Survival

This Juvenile salmonids in-river survival study was done in conjunction with the NMFS Transportation Evaluation study from April 14 to June 13. NMFS handled 35,448 smolts for this study. Of these, 35,392 fish were PIT-tagged and bypassed. Tagged fish including 5,481 unclipped yearling Chinook, 19,111 clipped yearling Chinook, and 10,800 unclipped steelhead. There were 56 post tagging mortalities including 16 unclipped yearling chinook, 24 clipped steelhead, and 16 unclipped steelhead.

National Marine Fisheries Service (NMFS)-Monitoring the Migrations of Wild Snake River Spring/Summer Chinook

This study to monitor the migration behavior and survival of Snake River Basin wild spring/summer Chinook salmon aims to characterize migration timing and estimate individual wild population parr-to-smolt survival to LWG and the influence of environmental factors on migration patterns. Fish PIT-tagged in natal streams during the summer of 2014 were diverted to the SBC tanks at LWG from April 2 to June 19. A total of 255 fish were impacted by this study. NMFS handled and bypassed 201 unclipped yearling Chinook as part of this study. An additional 45 untagged smolts and 9 non-target PIT-tagged fish were incidentally diverted to the SBC tanks and bypassed.

Idaho Fish and Game (IDFG)-Genetic Stock Identification

The goal of this study is to develop detailed genetic profiles for natural origin salmon and steelhead, develop genetic stock identification (GSI) techniques to estimate stock-specific escapement over LWG, monitor abundance, productivity and distribution of naturally produced adult and juvenile steelhead and salmon and research and monitor stock-specific life history characteristics. The objective of the study is to enumerate and characterize the natural production of spring/summer Chinook salmon and steelhead above LWG with regards to age composition and genetic stock identification. Scales, fork lengths and genetic samples were taken March 26 through June 19 on fish given to IDFG during the daily sample. IDFG personnel handled 1,278 smolts during this study with 168 unclipped steelhead without fin erosion and 323 yearling Chinook without fin erosion bypassed between March 26 and May 1 and the remainder transported.

University of Idaho/Columbia River Intertribal Fisheries Commission (CRITFC)/Nez Perce Tribe (NPT)-Evaluate Reproductive Success of Natural-Origin, Hatchery-Origin, and Kelt Steelhead in the Columbia River Basin

This project studies steelhead kelt physiology and endocrinology to evaluate strategies for rehabilitating and handling steelhead kelts captured at LWG. Steelhead kelts were diverted from the separator by COE technicians to the kelt tanks from March 30 to June 9. NPT/CRITFC personnel handled 1,191 kelts. Of the 1,191 PIT-tagged and genetic sampled kelts 1165 were returned to the tailrace, 17 were transported to Dworshak National Fish Hatchery for acclimation and feeding studies, and 9 were mortalities. Mortalities included 6 clipped and 3 unclipped steelhead kelts.

U.S. Geological Survey (USGS)/U.S. Fish and Wildlife Service (USFWS)-Research, monitoring and evaluation of spawning and early life history of the Snake River fall Chinook salmon ESU

USGS is investigating changes to the food web in LWG and LGO reservoirs to determine the importance of the non-native Siberian prawn and opossum shrimp to juvenile salmon as resources. USGS personnel sampled unclipped subyearling fall Chinook on four sample days from August 11 to September 21. They performed gastric lavages on 85 unclipped subyearling fall Chinook and 60 of these were transported while 25 were sacrificed for stable isotope analysis to provide a time-integrated view of their diet.

Operation and Maintenance

Turbine Operations

Efforts were made to operate all turbine units within one percent of the peak efficiency from April 1 to October 31. Deviations were infrequent and brief or required by BPA (table 18).

Table 18. Lower Granite turbine unit outages, 2015.

Unit	Date OOS	Reason out of service
All Units	Monthly	ESBS/VBS inspection.
All Units	August 10-13	Doble testing
All Units	August 28-29	VBS inspections
All Units	October 30-31	VBS inspections
All Units	Nov 30-Dec 2	ESBS removal
All Units	December 7-9	Unit debris/ice bubbler plugs as part of Phase 1a
Unit 1		
	January 1-March 24	FSS closure, reinforcement bulkhead install, unit debris bubbler plug install
Unit 2		
	January 1-10	Annual Maintenance
	January 22	NERC Testing
	Feb 17-Mar 19	FSS closure, reinforcement bulkhead install, unit debris bubbler plug install
	April 19-20	Air cooler waterline repair
	April 22	ESBS screen cleaner repair
	April 26	VBS repair in slot 2A
	June 11	Replace ESBS in slot 2C
	Nov 9-Dec 3	Annual Maintenance
Unit 3		
	Jan 12-Feb 26	Annual maintenance/overhaul Fish screen slot closure install
	February 17-26	Unit debris/ice bubbler plug install
	March 16	Rake trash
	March 19	Install ESBS
	April 1-2	Tripped ESBS cleaner due to amperage overload in slot 3C
	May 4-5	Debris removal and VBS repair in slot 3B
	May 14-19	Upper guide temperature relay issues
	October 13-Nov 5	Annual Maintenance
	November 6	Relay testing
Unit 4		
	January 22	NERC testing
	March 16	Rake Trash
	March 19	Install ESBS
	April 14-16	Oil sheen in gatewell slot 4C
	May 29	VBS repair in slot 4A
	June 24-Aug 26	Annual Maintenance
	August 28	ESBS screen cleaner issues
Unit 5		
	March 5	
	May 20	Slip-ring cleaning
	March 23	Install ESBS and Rake Trash
	Sep 14-Oct 28	Annual maintenance and fish screen slot closure work
Unit 6		
	January 22	NERC testing
	March 4	Rake Trash
	March 23	Install ESBS and Rake Trash
	April 9	ESBS failed screen cleaner drive motor in gatewell slot 6B
	Aug 12-Sept 22	Annual maintenance

Debris/Trash Racks

Units 1 and 2 trashracks were completed during the fish screen slot closure unit outages. Forebay debris and trashrack raking of units 4, 5, and 6 occurred on March 2 and 3. Units 3 trashracks were raked the week of March 16. Trashrack raking was not required during the 2015 fish passage season.

Extended-length Submersible Bar Screens (ESBSs)

ESBSs were inspected and tested on the week of March 10. The screens were installed from March 18 through March 23. Video inspection took place April 25-26, May 29-30, June 26-27, August 28-29, and October 30-31. No problems with the ESBSs were detected during video inspections. ESBS screen cleaning motors failed in slot 3C April 1-2, slot 6B April 9, slot 2C April 22 and June 11, and slot 4B August 28 as a result of a manufactures flaw. Screen cleaner motor options are being investigated with the intent of replacing the faulty components during the 2015-2016 winter maintenance outage. The brush cleaning cycle was set to operate every two hours this season.

Vertical Barrier Screens (VBSs)

The VBSs were video inspected in conjunction with ESBSs during the 2015 fish passage season. VBS's in slots 2A, 3B, and 4A were repaired after small tears were identified. Screens that had minor flaws but passed inspection are scheduled for repair during the 2015-2016 winter maintenance season.

Gatewells

Gatewells were normally less than 1% covered with debris and did not exceed the 50% debris surface coverage criterion. Turbulence in gatewells with ESBSs causes debris to tumble around and exit through the orifices rather than accumulate on the gatewell surfaces. Surface debris was removed from individual gatewells with a hand dipping basket during initial water-up in late March and continued throughout the season. Occasional oil sheens were dealt with by floating oil absorbent pads in the affected gatewells.

Orifices/Collection Channel

During the 2015 season the number of open orifices varied from 18 to 30 according to forebay level. With the Lower Granite reservoir at minimum operating pool, water discharge through an orifice is reduced. Orifices were cycled and backflushed with air remove debris every three hours from March 17 through December 2 when the channel was dewatered. The automated backflush system was not operational this season. Orifice obstructions were not a problem this season. Orifice lights were checked daily. Orifices with burnt out lights were switched to the other orifice in the slot until the bulb was replaced. Fish screen slot orifices closure were completed during the 2015 season. The south makeup water valve shaft was damaged due to the operator failing to stop when that gate was closing in auto mode. The gate is scheduled for repair prior to 2016 fish passage season.

Primary Dewaterer

Lower Granite's primary dewatering structure is an inclined screen just upstream from the porosity control perforated plate for the separator. Debris is removed from the screen with a long handled brush every half hour to once a shift depending on debris level. When the inclined screen becomes severely clogged the facility is put in primary bypass mode to take pressure off the top of the inclined screen. Debris then either floats off or is brushed off. This cleaning procedure takes about 20-30 minutes to complete. During 2015 it was not necessary to go to primary bypass due to debris accumulating on the incline screen. Facility operation remained in secondary bypass through December 2 to eliminate the potential for subyearling Chinook mortalities on the incline screen.

Wet Separator/Distribution and Sampling Systems

Water levels in the separator also varied with the forebay elevation requiring adjustment in the number of orifices operating and adjustments of the 42-inch valve to maintain proper water level. The separator water levels also fluctuated due the south shore makeup water valve being unable to adjust automatically. Separator personnel manually operated orifice valves to maintain collection channel and separator water levels. North and south makeup water valves are scheduled for repair/replacement during the 2015-2016 winter maintenance season.

Historical PVC separator bar spacing at Lower Granite allow shad, Chinook jacks, and other adults to be collected into the sample, raceways, and barges for transport. Jack bars designed to keep larger fish out of the collection system are positioned on top of the standard separator bars. Debris accumulation between the two sets of bars has the potential to increase descaling. Separator bars will be modified to address these concerns during the 2016 outage.

Barge Loading Operations

Barge loading operations occurred from May 2 through August 14. Both direct loading and loading from the raceways went smoothly this season.

Truck Loading Operations

Juvenile fish were loaded every other day from August 16 through October 31 either into the midi-truck or the semi-truck with no problems this season. Lower Granite transported 4,158 juvenile salmonids by truck July 29 due to Little Goose Dam navigation lock being out of service.

Recommendations

1. Retain 10 inch knife gates from orifice gallery as spares for raceways after they are removed as part of Phase 1.
2. Replace mesh tailscreens with porosity plates to allow lamprey passage.
3. Replace PVC separator bars with stainless steel.
4. Cover upstream raceways to provide shade.
5. Improve flow/elevation in the sample recovery truck loading pipe to eliminate fish being stranded in the pipe.
6. Operate the facility secondary bypass at all times when the collection channel is watered up to prevent fish from becoming stranded on the incline screen until Phase 1a completion.
7. Rebuild motors for pneumatic fish evacuation system on the 2000 barges.
8. Rebuild motors on 2000 series barges.
9. Install bumper system to replace cable and tire system on barges.
10. Paint hulls on 8000 barges.
11. Install ballast material in voids of 4394 and 4382 to eliminate the need to use river water.
12. Replace plungers in 2000 series barges.
13. Purchase a 1000 gallon fish tank and truck, a 3500 gallon tank and semi, and a service truck dedicated to trap and transport truck/barge maintenance.

APPENDIX TABLES

Appendix Table 1. Daily collection and bypass numbers and river conditions at Lower Granite Dam, 2015.

Appendix Table 2. Percent descaling and daily facility mortality numbers at Lower Granite Dam, 2015.

Appendix Table 3. Daily number of fish trucked and barged from Lower Granite Dam, 2015.

Appendix Table 4. Daily number of adult fallbacks and fallback mortality at Lower Granite Dam, 2015.