2013 Juvenile Fish Collection and Bypass Report
Little Goose Dam Juvenile Fish Facility

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Introduction

This report summarizes activities and results associated with the collection, transportation and bypass of out-migrating juvenile steelhead *Oncorhynchus mykiss*; chinook salmon *Oncorhynchus tschawytscha*; sockeye salmon *Oncorhynchus nerka*; and coho salmon *Oncorhynchus kisutch* at Little Goose Dam (LGS) in 2013. The data represented in this report was collected from April 1 through October 31, 2013 by the United States Army Corps of Engineers (USACE) and Oregon Department of Fish and Wildlife (ODFW) Smolt Monitoring Program (SMP) and transportation biologists and technicians.

Little Goose Lock and Dam (LGS), located at river mile (RM) 70.3, is the third of four hydroelectric dams impounding the lower Snake River. Little Goose Dam is 2,655 feet long and impounds Lake Bryan, a 10,025 acre reservoir with normal operating elevations ranging from 633-638 feet above mean sea level (msl). Lower Monumental Dam impounds the Snake River below LGS, forming Lake Herbert G. West, creating tailwater elevations at LGS ranging from 537-544 feet msl. LGS is comprised of five major components; the powerhouse, navigation lock, earthen embankment, spillway and adult and juvenile fish passage facilities.

The juvenile fish collection and bypass system at LGS extends from the upstream face of the dam downstream to the Juvenile Fish Facility (JFF) and tailwater area. System components include 18 extended length submersible bar screens (ESBS), 18 vertical barrier screens (VBS), 36 gatewell orifices, a collection channel, a dewatering structure, and a corrugated flume, which routes fish diverted from the forebay to the JFF. The JFF consists of a fish separator, routing flumes, fish holding raceways, a sampling and marking laboratory, truck and barge loading facilities, and a passive integrated transponder (PIT) tag detection and diversion system.

The objective of the transport program is to improve survival of out-migrating smolts, resulting in increased adult salmon and steelhead returns. Operating parameters are set forth annually in the Fish Passage Plan (FPP) and Fish Operations Plan (FOP).

River Conditions

River Flows

Below average winter and spring precipitation preceded a hot and dry summer for the 2013 water year resulted in below average monthly flows. For the month of June, the average daily flows were 45.3% of the five year average (Table 1). During the fish passage season, the average daily flow past LGS was 41.2 kcfs. The maximum average daily flow of 131.1 kcfs occurred on May 15 and the minimum average daily flow of 12.5 kcfs occurred on September 22 (Figure 1).

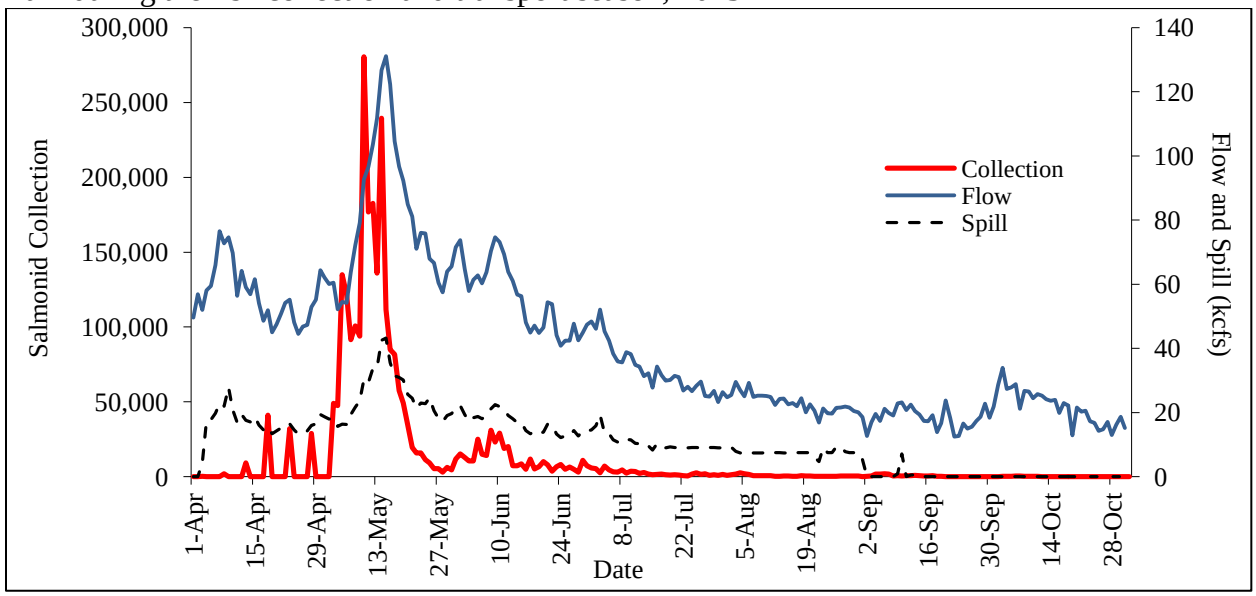
Spill to aid juvenile fish passage occurred from April 3 through August 31, 2013, in accordance with the 2013 Fish Operation Plan (FOP). The designated spill target was 30% of total flow from April 1 through August 31. Spill averaged 31.1% of total flow during this period. Flows decreased to below 33 kcfs on July 17. In accordance with the FPP, July 17 through August 31, spill was kept at a constant rate of 9.3 or 7.5 kcfs, whichever came closest to the target rate of 30% of the total flow. The temporary spillway weir was in service April 3 to August 1.

Table 1. Comparisons of average monthly flow and spill in kcfs at Little Goose Dam JFF 2008-2013.

Month	2008	2009	2010	2011	2012	2013	2008-2012 Average
				Flow (kcfs)			
Apr	52.67	84.50	40.28	103.34	113.60	56.68	78.88
May	110.90	111.04	64.83	133.19	102.07	79.99	104.41
Jun	124.86	109.48	124.58	163.98	87.38	55.41	122.06
Jul	57.39	50.43	49.51	93.50	46.35	33.44	59.44
Aug	35.79	32.02	29.81	42.07	28.38	23.16	33.33
Sep	22.70	21.84	22.62	33.61	21.09	18.37	24.37
Oct	19.64	21.26	18.97	26.58	18.09	21.75	20.91
				Spill (kcfs)			
Apr	13.26	24.48	11.41	30.08	36.99	16.30	23.24
May	23.39	31.13	19.40	81.37	32.28	24.75	37.51
Jun	13.98	30.88	40.91	73.32	31.86	16.62	38.19
Jul	9.50	15.09	14.83	28.54	17.89	10.57	17.17
Aug	8.54	10.11	9.40	14.00	9.52	7.64	10.31
Sep	0.34	0.20	0.18	0.39	0.18	0.50	0.26
Oct	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The average daily river temperature during the fish passage season was 60.2°F. Average monthly water temperatures were within the range of the five year average temperatures for each month. The maximum river temperature of 68.7°F, recorded on July 14 and 15 was below the five year average maximum of 69.9°F and earlier than we've seen in recent years. The 2013 minimum river temperature of 44.5°F was recorded on April 2, and was slightly below the five year average of 44.9°F. As per the Water Management Plan, river temperatures were tempered by scheduled water releases from Dworshak Reservoir. Supplemental flow from Dworshak Reservoir averaged 10.6 kcfs at 43.8°F for the month of July, and 8.7 kcfs at 46.4°F for the month of August (Columbia River Dart). Temperatures recorded daily in the LGS JFF averaged 67.3°F during July and 67.5°F during August.

Figure 1. Total river flow, spill, and number of juvenile salmonids collected at Little Goose Dam during the fish collection and transport season, 2013



In accordance with the FCRPS BIOP, Minimum Operating Pool (MOP) operations to enhance lotic conditions and improve fish migration were placed into effect during the juvenile fish passage season from April through August. To improve navigational safety during low flows, forebay elevations were increased from MOP elevations (633-634 feet MSL), to MOP +1 (634-635 feet MSL) from July 17 through the end of MOP restrictions on August 31. All deviations from the FPP and FOP were coordinated through the Technical Management Team (TMT), as necessary, to meet real-time operational requirements.

Total Dissolved Gas data are automatically collected and transmitted to the Columbia River Operational and Hydromet Management System (CROHMS) hourly to provide information for spill and gas saturation management. The USACE Reservoir Control Center (RCC) coordinates efforts to maintain dissolved gas saturation levels in accordance with the Washington State TDG Level Variance Standard of 120% saturation in the project tailwater or 115% in the forebay of the next project downstream as measured over 12 consecutive hours. In 2013, TDG was monitored in the forebay from April 1 through August 31 and in the tailwater year around.

The average daily TDG level in the LGS forebay, from April 1 through August 31, was 110.7% saturation. The minimum daily average TDG saturation of 103.6% occurred on April 2. The maximum average TDG saturation of 116.8% occurred on May 6 and July 4. The 115% saturation variance standard was exceeded May 5-7 and July 1-5. The TDG saturation averaged 116.5% during both intervals.

The TDG level in the tailrace averaged 110.9% saturation from April 1 through the end of the spill to aid fish passage on August 31. TDG levels ranged from an average of 102.2% on April 2 to an average of 116.3% on May 13. The 120% saturation variance in the tailrace was not exceeded during the 2013 spill for fish passage season. Forebay TDG levels at Lower Monumental Dam (LMN) averaged 110.4% from April 1 through August 31, ranging from an average of 102.8% on April 2, to an average of 117.2% on May 12. The LMN forebay saturation level exceeded the 115% variance from May 11 through May 13, averaging 116.7% saturation during that interval (USACE via Columbia River Dart).

Water clarity was measured during adult fish passage facility inspections. Measurements were taken in the adult fish ladder using a Secchi disc lowered to a maximum depth of just over 6 feet. The fish ladder water supply is gravity fed from the forebay and is representative of river conditions. Turbidity was highest from April 9-30 and May 14-28 ranging between 2.8 and 3.4 feet.

Fish Migration, Bypass, Collection and Transportation

The juvenile fish bypass and collection facility was placed into primary bypass operations on March 19. Fish collection for transport began on May 2 and ended on October 31 and primary bypass operations resumed from October 31 to December 16. A total of 2,713,850 smolts were collected during the 2013 season (Table 2). Of those, 2,598,836 were transported, 113,450 were bypassed, and 1,564 were facility mortalities.

Prior to the start of transportation, the collection facility was switched from primary to secondary bypass for condition sampling and gas bubble trauma monitoring every fifth day. An estimated total of 113,308 smolts were collected during these 24 hour sampling periods on April

2-3, 7-8, 12-13, 17-18, 22-23 and 27-28. All fish were bypassed back to the river. The number of fish passing through the primary bypass system on non-sampling days could not be determined.

An estimated 2,600,542 smolts were collected for transport in 2013, of which 2,598,836 were transported (Table 2). Daily barging and direct loading operations occurred from May 3 to June 3, alternate day barging occurred from June 5 to August 16. Transportation by truck began on August 16 and ended on October 31. Juvenile salmonids collected for transport were directly loaded into barge holds and truck tanks or were held in raceways and wet lab tanks prior to loading and transport. The maximum holding time prior to transport ranged from 24 to 48 hours. Barge transport time from Little Goose to the mid channel release point below Bonneville Dam was approximately two days. Barging accounted for approximately 99% of the smolts transported.

Table 2. Annual collection, bypass, and transport activity at Little Goose Dam JFF, 2009-2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho		Sockeye		
Year	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip	Total
Collection											
2009	1,315,352	404,911	333,313	519,124	1,935,602	582,074	4,389	55,155	19,992	13,678	5,183,590
2010	643,785	229,253	287,702	578,905	807,718	277,394	2,740	34,177	1,291	7,594	2,870,559
2011	1,125,551	323,791	232,116	508,188	868,702	263,726	0	41,631	3,487	20,869	3,388,061
2012	1,067,044	431,462	268,235	399,054	658,540	312,732	775	52,541	252	25,583	3,216,218
2013	768,720	257,791	155,896	297,206	864,292	310,421	50	36,839	15,952	6,683	2,713,850
Bypass[1]											
2009	531,880	220,144	2,180	7,121	1,160,734	299,337	0	2,825	1	5,825	2,230,047
2010	57,967	23,228	3	325	46,365	12,601	0	0	0	0	140,489
2011	56,672	46,496	1	92	216,725	21,908	0	401	0	5,227	347,522
2012	242,353	145,896	1	125	227,179	60,328	0	1,601	0	691	678,174
2013	24,036	22,662	5	343	56,575	9,627	0	200	0	2	113,450
Truck											
2009	0	2	123	2,753	3	4	0	300	1	18	3,204
2010	11	15	79	10,452	7	11	0	19	1	10	10,605
2011	1	16	59	10,680	8	22	0	277	2	77	11,142
2012	1	0	133	6,306	17	26	0	7	0	106	6,596
2013	0	0	638	25,106	13	18	0	4	2	16	25,797
Barge											
2009	782,309	184,253	328,224	505,511	774,611	282,643	4,408	51,964	19,975	7,793	2,941,691
2010	585,585	205,930	285,364	564,261	761,183	264,706	2,740	34,156	1,289	7,583	2,712,797
2011	1,067,450	276,919	230,973	494,558	651,617	241,734	0	40,943	3,480	15,416	3,023,090
2012	824,116	285,393	267,834	391,916	431,232	252,302	775	50,931	252	24,775	2,529,526
2013	744,193	235,046	155,117	271,046	807,600	300,745	50	36,635	15,950	6,657	2,573,039
Total Transport											
2009	782,309	184,255	328,347	508,264	774,614	282,647	4,388	52,284	19,976	7,811	2,944,895
2010	585,596	205,945	285,443	574,713	761,190	264,717	2,740	34,175	1,290	7,593	2,723,402
2011	1,067,451	276,935	231,032	505,238	651,625	241,756	0	41,220	3,482	15,493	3,034,232
2012	824,117	285,393	267,967	398,222	431,249	252,328	775	50,938	252	24,881	2,536,122
2013	744,193	235,046	155,755	296,152	807,613	300,763	50	36,639	15,952	6,673	2,598,836

[1] Bypass counts include fish provided for research, but don't include NOAA sort by code PIT tagged salmon or divert during sample pit tagged salmon.

Trucking mostly occurred every other day as scheduled, however due to poor fish health coupled with warm water temperatures and high collection counts, fish were transported daily from September 11 through 15. Transportation by truck to the release sites at the Bonneville

Juvenile Fish Facility Flume or the Dalton Point Boat ramp took approximately six hours. Trucked Fish were transported in a saline solution of 1 to 2 mg/L of sodium chloride to reduce stress and treat presumed Columnaris disease.

An additional 151 juvenile fish were bypassed during transportation operations these included 51 chinook and two sockeye, due to their small size and 97 subyearling chinook and one clipped steelhead due to disease or poor condition. Fish collection, bypass and transport fish numbers are provided in Appendix Table 3.

The maximum daily estimated collection of 280,443 fish occurred on May 10 and accounted for 10.3% of the total season collection (Table 3). The composition of the collection for that date was: clipped chinook 55.7%, clipped steelhead 21.1%, unclipped yearling chinook 15.7%, unclipped steelhead 6.3%, unclipped coho 1.1%, and chinook fry <0.1%.

Table 3. Annual peak salmonid collection days and count by species group at Little Goose Dam JFF, 2009-2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye		Coho	
Year	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip		Season
2009	May 23 (65,408)	April 28 (23,601)	June 04 (25,720)	June 04 (37,214)	April 27 (180,448)	April 26 (57,600)	May 20, 23 (3,200)	May 7, 8, 23 (1,000)	May 23 (7,800)	April 27 (288,500)
2010	May 20 (71,700)	May 2 (21,200)	June 12 (33,456)	June 12 (46,507)	May 20 (96,600)	May 20 (29,800)	May 29 (300)	May 20 (2,200)	May 20 (4,000)	May 20 (222,600)
2011	May 13 (121,429)	May 13 (28,802)	June 04 (16,859)	June 04 (39,613)	May 18 (58,203)	May 18 (27,400)	May 22 (700)	May 12 (1,406)	May 20 (4,400)	May 13 (225,048)
2012	April 30 (176,464)	April 30 (76,835)	June 16 (25,750)	June 04 (23,025)	April 30 (104,051)	April 30 (29,612)	May 29 (150)	May 23 (3,000)	May 19 (4,200)	April 30 (389,763)
2013	May 10 (156,233)	May 10 (44,008)	June 10 (15,290)	June 08 (14,452)	May 14 (107,846)	May 14 (46,209)	May 17 (4,600)	May 19 (2,400)	May 14 (5,200)	May 10 (280,443)

Adult Fallbacks

Fallbacks are adult salmonids that have migrated above the dam and have "fallen back" into the downstream juvenile fish collection and bypass system. Fallbacks collected at the separator were usually too large to pass between the separator bars and were released back to the river. Fallbacks were identified by species and fin clip and assessed for condition prior to being released.

Table 4. Total Annual Adult Salmonid Fallbacks at Little Goose Dam JFF, 2009-2013.

Year	Adult Chinook	Jack/mini Chinook	Clip Steelhead	Unclip Steelhead	Sockeye	Coho	Total
2009	1,192	1,372	2,997	2,131	11	35	7,738
2010	976	780	1,758	1,881	22	9	5,426
2011	1,683	1,020	1,996	1,549	17	14	6,280*
2012	1,064	1,077	1,215	1,399	9	21	4,785
2013	1,341	1,050	1,469	1061	15	2	4,938

*2011 total includes 1 Pink Salmonid.

A total of 4,938 adult salmon and steelhead fallbacks occurred in 2013 (Table 3). Of these 4,894 were bypassed from the separator. The remaining 44 were small chinook Jacks that passed through the separator bars and were collected in the sample and released back to the river. Daily numbers of adult fallbacks and fallback mortalities can be found in Appendix Table 4.

There were 1,086 steelhead fallbacks in April, May and June (Table 5). Of these there were 342 clipped and 508 unclipped which were classified as out-migrating kelts. Due to their post spawned condition, kelts collected during this period accounted for the majority of fish in fair (98%), poor (97%) and dead (100%) condition. Table 6 lists the numbers of fish by species and condition categories.

Table 4. Monthly totals of fallbacks bypassed from separator at Little Goose Dam, 2013.

Month	Adult Chinook	Jack Chinook	Clip Steelhead	Unclip Steelhead	Sockeye	Coho	Total
April	0	0	39	53	0	0	92
May	37	19	368	511	0	0	935
June	33	14	34	81	0	0	162
July	62	19	17	14	8	0	120
August	39	37	68	60	1	0	205
September	370	172	648	263	3	0	1,456
October	800	789	295	79	3	2	1,968
Total	1,341	1,050	1,469	1,061	15	2	4,938

Table 5. Condition of adult salmonids released at Little Goose Dam, 2013.

Fish	Chinook		Chinook Jack		Steelhead		Sockeye		Coho	
Condition[1]	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip		Total
Good	600	648	449	541	1,352	887	4	11	2	4,494
Fair	33	46	37	19	72	88	0	0	0	235
Poor	6	7	2	1	31	65	0	0	0	112
Dead	1	0	0	1	14	21	0	0	0	37
Total	640	701	488	562	1,469	1,061	4	11	2	4,938

[1] Condition ratings for live fish were determined subjectively based on the presence/absence and severity of fungus, headburn, fin wear, and other injuries.
Note: Table 6 does not separate post spawned "kelt" steelhead from pre-spawned healthier steelhead.

Other fish of particular interest that were bypassed back to the river from the separator included 6 bull trout, 13 adult pacific lamprey, and 16 white sturgeon. The 13 adult pacific lamprey were transported to one mile above the dam and released. In addition, another 15 adult lamprey collected in the sample were also transported and released above the dam.

Separator Efficiency

Separator efficiency is a measure of how effectively fish entering the facility are separated by size. Due to the spacing of the separator sorter bars, smaller fish, primarily salmon smolts, should pass through the "A" side and larger fish, primarily steelhead, should pass through "B" side of the separator into the respective sample and transport holding areas. Table 4 gives efficiency, expressed as the percentage of each group, passing through the desired side of the separator, for 2009-2013. Efficiency rates are based on expanded sample counts.

Separator efficiency was highest for clipped steelhead with 82.1% entering on the B-side. Only one clipped coho was sampled, giving an A-side efficiency rating of 100%. Separator efficiency was lowest for unclipped coho salmon at 23.7% entering on the A-side. Separator efficiency was lower than in recent years for unclipped subyearling Chinook, with 48.8% entering the A side (Table 7).

Table 7. Annual juvenile salmonid separator efficiency (%) at Little Goose Dam JFF, 2009-2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho		Sockeye	
Year	Clip A-side	Unclip A-side	Clip A-side	Unclip A-side	Clip B-side	Unclip B-side	Clip A-side	Unclip A-side	Clip A-side	Unclip A-side
2009	66.0	61.7	52.4	52.3	89.8	68.0	21.0	26.5	19.9	20.8
2010	69.8	68.3	57.4	54.8	87.8	69.4	15.1	28.0	12.8	43.1
2011	73.7	70.1	58.0	57.7	77.3	67.4	-----	32.9	22.6	38.3
2012	75.1	72.3	59.1	59.9	83.7	64.8	40.6	42.1	00.0	37.7
2013	71.5	71.2	53.8	48.8	82.1	62.1	100.0	23.7	64.5	52.4

Note: Counts do not include sample mortalities.

Sampling

The fish sampling system was operated without incident throughout the 2013 season. Sampling procedures followed the smolt monitoring guidelines developed by the Fish Passage Center and the USACE. Data were used for management of facility and fish transport operations. Data were also transmitted daily to the FPC electronic database in support of the SMP.

Sample rates were set by USACE project biologists. To obtain the target sample of 300 to 500 smolts, sample rates were varied between 0.25% and 100% as fish migration numbers fluctuated. The percentage of each species sampled was dependent on the timing of migration and the overall sample rate in effect at that time (Table 8).

Table 8. Annual percentage of total juvenile salmonids collected that were sampled at Little Goose Dam JFF, 2009-2013[1].

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye		Coho	
Year	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip		Total
2009	0.7	0.8	2.7	6.3	0.5	0.7	19.9	20.8	2.5	1.4
2010	0.9	1.0	1.7	6.3	0.8	0.9	1.9	1.1	0.9	2.1
2011	0.6	0.8	2.8	6.9	0.7	0.8	2.3	1.8	1.7	1.8
2012	0.5	0.7	3.0	8.0	0.8	0.9	2.4	1.5	0.9	1.8
2013	0.6	0.8	5.1	15.4	0.8	1.0	0.7	1.5	0.8	2.6

[1]All other research fish and sample mortality are included in percentages

All sample fish were examined to determine species and clip type. In addition, chinook salmon age class was determined as subyearling or yearling. All yearling chinook salmon in the sample were examined for spring, holdover, or Lyons Ferry Hatchery fall Chinook salmon characteristics. All unclipped yearling and subyearling chinook salmon, coho, and sockeye salmon were scanned for coded wire tags. chinook, sockeye and coho fry were defined by length, under 60 mm, and were bypassed for continued growth. All adipose clipped salmonids were further examined for ventral fin clips. None of the 2013 hatchery releases above LGS were marked with elastomer eye tags.

Fish condition data were collected daily on a random subsample of 100 fish of the dominant species. Condition metrics included weight, length, descaling, injury, disease, predation, and "other" monitored conditions including pink fin, fin hemorrhage, fin discoloration, pop eyes, and eye hemorrhage. Injury and descaling data were used by managers to assess passage conditions at the dam where data were collected. All additional, or "non-condition", sample fish were examined for fresh descaling greater than 20%.

Pound counts (fish per pound) taken during condition sampling were provided to the USACE on a daily basis from May 3 through October 31. Additional weights were also taken on non-condition salmonids if the target number of 25 per group was not present in the condition sample. During transport, when the sample rate was set below 100%, weights were also recorded on all non-salmonid species.

Table 9. Weekly sample as percent of collection total and sample totals at LGS JFF, 2013.

Week Ending	Weekly % Sampled (%)	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye		Coho	Totals[1]
		Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip		
4-Apr	14.9	6	24	0	0	1	4	0	0	0	35
11-Apr	9.8	58	58	0	0	63	18	0	0	0	197
18-Apr	2.9	312	277	0	0	661	211	0	0	0	1,461
25-Apr	1.3	121	60	0	0	221	20	0	0	0	422
2-May	0.9	112	82	0	1	46	6	0	0	1	248
9-May	0.5	1,308	357	0	0	1,357	365	0	0	16	3,403
16-May	0.5	2,287	708	1	6	2,151	798	3	1	95	6,050
23-May	0.8	314	203	3	127	687	360	90	41	81	1,906
30-May	4.4	195	162	58	347	621	547	15	23	35	2,003
6-Jun	4.8	154	91	1,463	2,283	535	302	0	6	52	4,886
13-Jun	2.5	21	18	1,663	1,517	230	85	0	4	9	3,547
20-Jun	4.8	19	5	1,110	1,174	115	153	0	1	5	2,582
27-Jun	6.5	7	5	860	1,726	120	43	0	1	1	2,763
4-Jul	10.2	6	8	1,051	3,012	153	37	0	1	4	4,272
11-Jul	11.7	0	1	437	2,332	31	14	0	0	0	2,815
18-Jul	18.5	0	0	202	2,031	12	2	0	1	0	2,248
25-Jul	35.3	0	0	186	3,011	11	3	0	1	0	3,212
1-Aug	33.1	0	1	142	2,959	4	0	0	0	0	3,106
8-Aug	22.8	0	1	109	2,353	3	1	0	0	0	2,467
15-Aug	45.3	0	0	88	1,568	3	3	0	1	0	1,663
22-Aug	94.3	0	0	164	2,606	2	1	0	3	0	2,776
29-Aug	100.0	0	0	71	2,529	3	4	0	2	0	2,609
5-Sep	80.7	0	0	89	4,274	0	1	0	2	0	4,366
12-Sep	50.9	0	0	50	3,405	3	2	1	2	1	3,464
19-Sep	100.0	0	0	78	3,836	4	4	0	2	0	3,924
26-Sep	99.6	0	0	6	241	0	2	0	0	0	249
3-Oct	100.0	0	0	19	455	1	1	0	1	0	477
10-Oct	99.8	0	0	86	2,420	0	1	0	2	1	2,510
17-Oct	100.0	0	0	23	678	0	0	0	2	0	703
24-Oct	100.0	0	0	15	542	0	1	0	1	0	559
31-Oct	99.8	0	0	18	386	2	3	0	0	2	411
Total Sampled		4,920	2,061	7,992	45,819	7,040	2,992	109	98	303	71,334
Total Collection		768,720	257,791	155,896	297,206	864,292	310,421	15,952	6,683	36,889	2,713,850
% of Sample		6.9	2.9	11.2	64.2	9.9	4.2	0.2	0.1	0.4	100.0
% of Coll.		0.6	0.8	5.1	15.4	0.8	1.0	0.7	1.5	0.8	2.6

[1]All research fish, GBT fish and sample mortality included in species group/clip type numbers.

Note: Little Goose JFF was in primary bypass mode, going to secondary bypass for 24 hour condition sampling on April 2,7,12, 17, 22, and 27. Collection for transport with daily 24 hour sampling began on May 2 at 0700 hours and will end October 31 at 0700 hours

A total of 71,344 juvenile salmonids entered the sample tanks or were examined for GBT in 2013 (Table 9). This total includes sample mortality. Prior to the start of the transportation season, twenty-four hour sampling to monitor fish condition occurred on April 3, 8, 13, 18, 23 and 28. During this period a total of 2,363 fish were sampled.

Fish Condition

Fish condition was monitored daily by SMP biologists and biological aids. The primary purpose for condition monitoring was to identify juvenile salmonids that were descaled or had other significant injuries incurred during passage at Little Goose Dam.

Descaling

All live smolts in the sample were examined for descaling. A smolt was considered descaled if more than 20% of the scales were missing from either side of the fish. Only descaling that appeared fresh enough to have occurred at LGS was recorded. Prior to 2009, all descaling, old or new, was recorded.

A total of 68,957 smolts were examined for descaling in 2013. The overall rate of descaling was 0.9%, which is similar to rates observed in previous years (Table 10). The descaling rates for each species and fin clip group were similar to previous years, with the exception of clipped sockeye, which had a higher rate than has been observed over the past few years. This was likely due, in part, to a relatively small sample size for the species.

Table 10. Annual descaling rates (%) for salmonids examined at Little Goose Dam JFF, 2009-2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye		Coho	
Year	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip		Totals
2009	0.7	0.7	0.3	0.3	0.5	0.8	0.0	0.4	0.2	0.4
2010	0.5	0.3	0.3	0.3	0.3	0.2	0.0	0.0	0.6	0.3
2011	0.5	0.5	0.3	0.5	0.2	0.1	0.0	0.6	0.3	0.4
2012	1.0	0.6	0.5	09	0.8	1.4	0.0	1.9	0.6	0.9
2013	0.7	1.0	0.8	1.0	0.6	0.8	0.9	1.1	0.7	0.9

Note: GBT sample numbers not included in descaling rate calculations.

Of the 68,957 smolts examined for descaling in 2013, 33.8% or 23,293 smolts were examined as part of condition subsampling. During condition subsampling, fish with descaling equal to or greater than 20% were differentiated into two categories; descaling associated with dam passage and descaling with bite marks indicative of predation attempts by birds, fish, or mammals. Recording fish as “descaled with predation” did not necessarily signify that the descaling was caused by the attempted predation, merely that the fish was descaled and that predation marks were also present on that fish. The rate of descaling observed in the condition subsample was 1.2% or 273 descaled smolts. Of the 273 descaled smolts observed in the condition subsample, descaling presumably associated with dam passage was 49.8% of the condition descale total and the rate of descaling with predation marks present was 50.2% of the condition descale total.

In addition to descaling of 20% or greater, for fish in the condition subsample, we also recorded partial descaling. Partial descaling was considered scale loss above background levels of approximately 5% scale loss but below the 20% threshold for descaling. The rate of partial descaling was 3.1% of the 23,293 smolts examined for condition in 2013.

Overall weekly descaling rates per species and clip types are referenced in Table 11. Note in 2009, descaling associated with predatory attempts were not included in the total descaling rate, while in 2010 through 2013, it was included. The average weekly descaling rate ranged from 0.4% to 5.9% (Table 11). Weekly descaling rates were variable and high throughout the month of April though sample sizes were small. Increased descaling was observed during May and June, and as in previous years, appeared to coincide with peak migrations and increased river discharge. Much of the increased descaling observed in mid-June through July was associated with increasing prevalence of predator bite marks. Descaling rates increased again from mid-September through the end of the season. The prevalence of presumed Columnaris disease and predator bite marks both increased during this time period. Both factors likely contributed to some degree to the increased descaling observed in the fall of this year.

Table 11. Weekly descaling rates (%) for salmonids examined at Little Goose Dam JFF, 2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye		Coho	
Week Ending	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip		Total[1]
4-Apr	16.67	4.35	-----	-----	0.00	0.00	-----	-----	-----	5.88
11-Apr	0.00	7.50	-----	-----	0.00	0.00	-----	-----	-----	3.16
18-Apr	0.85	1.35	-----	-----	0.00	0.00	-----	-----	-----	0.40
25-Apr	0.00	0.00	-----	-----	1.50	0.00	-----	-----	-----	0.94
2-May	0.00	2.00	-----	-----	0.00	0.00	-----	-----	0.00	0.70
9-May	0.65	1.23	-----	-----	0.86	0.84	-----	-----	0.00	0.81
16-May	0.80	0.43	0.00	0.00	0.24	0.13	0.00	0.00	0.00	0.45
23-May	0.69	1.06	33.33	0.83	0.94	1.16	0.00	0.00	1.23	0.95
30-May	0.57	0.00	0.00	0.00	1.19	0.75	6.67	4.35	2.86	0.79
6-Jun	0.00	0.00	0.42	0.27	0.58	0.68	-----	0.00	0.00	0.36
13-Jun	4.76	6.25	0.25	0.27	1.45	0.00	-----	0.00	0.00	0.38
20-Jun	0.00	0.00	0.65	0.61	0.00	4.31	-----	-----	0.00	0.77
27-Jun	0.00	0.00	0.48	0.77	0.00	0.00	-----	0.00	0.00	0.63
4-Jul	0.00	0.00	0.78	0.58	2.14	10.34	-----	0.00	0.00	0.75
11-Jul	-----	-----	1.67	0.36	0.00	0.00	-----	-----	-----	0.55
18-Jul	-----	-----	1.59	0.93	10.00	0.00	-----	0.00	-----	1.03
25-Jul	-----	-----	2.29	0.86	0.00	0.00	-----	0.00	-----	0.94
1-Aug	-----	-----	1.48	0.70	0.00	-----	-----	-----	-----	0.74
8-Aug	-----	0.00	1.87	0.35	0.00	0.00	-----	-----	-----	0.42
15-Aug	-----	-----	0.00	0.38	0.00	0.00	-----	-----	-----	0.36
22-Aug	-----	-----	0.00	0.42	0.00	0.00	-----	0.00	-----	0.40
29-Aug	-----	-----	0.00	0.44	0.00	0.00	-----	0.00	-----	0.43
5-Sep	-----	-----	2.30	0.61	-----	-----	-----	0.00	-----	0.65
12-Sep	-----	-----	2.08	1.10	0.00	-----	0.00	0.00	0.00	1.12
19-Sep	-----	-----	5.13	2.02	0.00	-----	-----	0.00	-----	2.08
26-Sep	-----	-----	0.00	1.73	-----	-----	-----	-----	-----	1.67
3-Oct	-----	-----	5.26	3.76	0.00	-----	-----	0.00	-----	3.80
10-Oct	-----	-----	9.30	3.55	-----	-----	-----	0.00	0.00	3.74
17-Oct	-----	-----	0.00	4.03	-----	-----	-----	0.00	-----	3.88
24-Oct	-----	-----	0.00	3.92	-----	0.00	-----	0.00	-----	3.80
31-Oct	-----	-----	0.00	3.92	-----	0.00	-----	-----	0.00	3.41
Total Exam	4,494	1,841	7,786	44,853	6,628	2,851	109	92	303	68,957
% Desc	0.73	0.98	0.82	1.03	0.63	0.77	0.92	1.09	0.66	0.94
Median	0.28	0.43	0.65	0.70	0.00	0.00	0.00	0.00	0.00	0.79

[1] Descaling figures do not include sample mortalities or fish examined for GBT.
[2] "-----" means species group not present in sample during this week.

Injuries

A total of 23,293 smolts from the condition subsample were examined for injuries in 2013. Of the fish examined, 12.1% or 2,814 individual smolts were observed with one, or more than one, injury to their body (Table 12). A total of 2,840 individual injuries were observed this year. The vast majority of injuries involved injury to the fin at 94.5% of the total followed by operculum injury (2.6%), head and body injury (1.1% each) and, eye injury (0.6%) (Table 12). The highest rates of injury were observed in subyearling Chinook salmon followed by yearling Chinook salmon.

Prior to 2009, we recorded injuries based solely on the presence of an injury, with no attempt made to determine the age or origin of the injury. From 2009 to date, only fresh injuries presumed to have occurred during passage through Little Goose Dam have been recorded. From 2003 through 2008, minor scale loss and abrasions were included in the body injury category greatly inflating the reported injury rate (Table 12).

Table 12. Annual injury rates (%) for salmonids examined at Little Goose Dam, 2003-2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye		Coho	
Years	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip		Total
2009	0.2	0.3	0.2	0.2	0.3	0.3	0.0	1.2	0.3	0.2
2010	1.1	0.5	0.1	0.3	1.5	0.3	0.0	4.8	0.0	0.5
2011	0.7	1.4	0.6	1.7	1.9	1.8	0.0	3.6	0.9	1.5
2012	2.5	2.7	4.9	6.0	2.0	3.3	0.0	1.8	2.7	4.6
2013	3.4	4.3	8.9	17.0	1.8	1.6	0.0	3.2	2.9	12.1

Disease

Data on the presence of disease symptoms were collected from fish in the condition subsample to provide relative information about fish health. Disease classifications included fungus, presumed Columnaris, presumed BKD, body parasites, deformity, and other disease such as cysts or tumors. A total of 1,029 smolts were observed with one or more symptoms of disease in 2013 for an overall disease rate of 4.4% of the total subsample (Table 13). Presumed Columnaris was the most prevalent sign of disease at 60.7% of the 1,039 individual disease observations this year followed by body parasites (27.3%), deformity (6.0%), fungus (5.5%), other (0.3%) and, presumed BKD (0.2%). The highest percentage of disease was observed in unclipped steelhead followed by unclipped subyearling Chinook salmon. Body parasitism and presumed Columnaris disease were the most frequent signs of disease observed in unclipped steelhead and unclipped subyearling Chinook respectively.

Predation Marks

We recorded bite marks from the condition subsample which were indicative of predation attempts by bird, fish, lamprey, and other mammalian predators such as mink and otter. We observed a total of 603 smolts with one or more predatory wounds for an overall predation attempt rate of 2.6% of the total condition subsample. The majority of marks observed in the subsample were caused by lamprey parasitism at 42.1% of the total 604 individual bite marks recorded, followed by bird bites (30.5%), and fish bites (27.5%). We did not observe any mammalian bite marks this year. Unclipped sockeye sustained the highest rate of predatory

attempts, which were predominately a result of fish bites, followed by unclipped steelhead, where bite marks were largely due to predation attempts by birds (Table 13).

Table 13. Percent of fish examined that were injured, had predation marks or had signs of disease by species and clip type at Little Goose Dam, 2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho		Sockeye		
	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip	Total[1]
Injuries											
Head	0.0	0.4	<0.1	0.18	<0.1	0.0	0.0	0.0	0.0	1.6	0.1
Eye	0.4	0.3	<0.1	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	<0.1
Operculum	0.4	0.6	0.3	0.1	1.0	0.5	0.0	0.0	0.0	1.6	0.3
Body	0.0	0.1	<0.1	0.2	0.1	0.3	0.0	0.7	0.0	0.0	0.1
Fin	2.7	2.9	8.6	16.7	0.6	0.8	0.0	2.2	0.0	0.0	11.5
Total Injury	3.4	4.3	8.9	17.0	1.8	1.6	0.0	2.9	0.0	3.2	12.1
Disease											
Fungus	0.3	0.5	<0.1	0.2	0.7	0.3	0.0	0.7	1.1	1.6	0.2
Columnaris	0.0	0.0	1.0	4.2	<0.1	0.3	0.0	0.0	0.0	0.0	2.7
BKD	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	<0.1
Parasites	0.4	0.1	1.5	1.0	0.9	6.2	0.0	0.0	1.1	0.0	1.2
Deformity	0.3	0.0	0.2	0.3	0.2	0.2	0.0	0.7	0.0	0.0	0.3
Disease Other	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	<0.1
Total Disease	1.0	0.6	2.7	5.6	1.9	6.9	0.0	1.4	2.2	1.6	4.4
Predation											
Bird	1.0	1.0	0.1	0.5	1.8	2.6	0.0	1.4	2.2	1.6	0.8
Fish	0.6	0.6	0.8	0.8	0.5	0.5	0.0	0.0	3.2	1.6	0.7
Lamprey	0.1	0.1	0.3	1.7	0.2	0.2	0.0	0.0	0.0	0.0	1.1
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Predation	1.7	1.8	1.3	2.9	2.5	3.2	0.0	1.4	5.4	3.2	2.6
Other Condition											
Pop Eye	0.0	0.3	0.0	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.4
Fin Hemorrhage	3.0	4.3	14.6	22.9	2.2	2.1	0.0	0.7	0.0	3.2	16.3
Pink Fin	4.6	6.3	20.7	48.9	10.0	14.8	0.0	0.0	0.0	3.2	34.5
Fin Discoloration	0.7	0.4	3.3	6.7	<0.1	0.3	0.0	0.0	0.0	0.0	4.5
Eye Hemorrhage	0.2	0.1	0.2	<0.1	0.0	<0.1	0.0	0.0	0.0	0.0	<0.1
Total Other	8.1	10.4	31.5	59.2	11.8	16.6	0.0	0.7	0.0	6.4	42.7
Total sample size	1,582	792	2,604	14,200	2,607	1,213	1	138	93	63	23,293

[1] Overall disease and injury rates are less than the sum of the individual categories because some individual fish had more than one injury or disease.

The overall rate of bird bite marks in 2013 decreased slightly from last year and was similar to 2011 and 2010 (Table 14). The highest prevalence of bird bite marks was observed on unclipped steelhead. Of the 184 total bird bites observed this season, most occurred in May (70 bite marks) followed by October (64 bite marks). These results are typical of bird bite activity observed in previous years.

Other Miscellaneous Conditions

The Other Miscellaneous Conditions category included popeye (exopthalmos), hemorrhaged fin, pink fin, discolored fin, and hemorrhaged eye. We recorded a total of 9,941 smolts with one or more miscellaneous condition for an overall miscellaneous condition rate of 42.7% of the total condition subsample (Table 13). A total of 12,923 individual observations of

miscellaneous conditions were found, as many smolts that we examined had multiple conditions in this group. For example, pink and hemorrhaged fins often occurred on the same individual fish though in different fins. Pink fins constituted the majority of the conditions in this category at 62.3% of the miscellaneous conditions total followed by hemorrhaged fin(s) (29.4%), fin discoloration (8.2%), eye hemorrhage (0.2%), and exopthalmos (0.07%). Subyearling Chinook salmon presented the highest rates in this condition category, due to the high incidence of pink fin(s), hemorrhaged fin(s) and fin discoloration observed in the species.

Table 14. Annual bird bite rates (%) for salmonids examined at Little Goose Dam, 2008-2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye		Coho	
Year	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip		Total
2008	0.8	0.5	0.0	0.4	4.4	3.2	1.9	0.6	1.7	1.2
2009	0.9	0.4	0.3	0.3	2.5	2.9	0.0	0.4	1.0	0.9
2010	0.8	0.0	0.5	0.2	3.0	2.7	0.0	0.0	0.7	0.7
2011	0.8	0.3	0.1	0.5	2.4	2.3	0.0	1.8	0.0	0.7
2012	0.7	0.5	0.1	0.5	3.9	3.8	0.0	0.0	0.0	1.0
2013	1.0	1.0	0.1	0.5	1.8	2.6	2.2	1.6	1.4	0.8

Mortality

Mortality at the JFF included fish that entered the JFF system dead as well as those that died at the facility. Each mortality was recorded by the location the fish was removed. These included the separator, sample, and raceways. Raceways included barge holds, wet lab tanks and routing flumes. Total facility mortality was low this year at 0.06% from a total collection of 2,713,850 smolts (Table 15). The average weekly total facility mortality rate ranged from 0.0% to 4.8%. The minimum rates of 0.0% occurred frequently during the months of April and May when the number of mortalities represented a small proportion of the total collection. Increased mortality rates occurred later in the season when collection numbers decreased and descaling, disease, predation and injury rates increased. The maximum weekly mortality rate of 4.8% occurred during the week ending September 26 from a total weekly collection of 293 fish. In September and October, fish displayed an outbreak of presumed Columnaris disease and increased descaling. A thorough check of the forebay for debris, including trash raking was conducted. The JFF was investigated as well. All points of concern were clean of any debris. Daily mortality rates are provided in Appendix Table 2.

Table 15. Annual total facility mortality as a percentage of total collection at LGS JFF 2008-2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye		Coho		Pacific lamprey	
Year	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip		Total	Ammocoete	Macropthalmia
2008	0.2	0.2	0.2	0.3	<0.1	<0.1	<0.1	0.6	<0.1	0.1	-----	-----
2009	<0.1	0.1	0.8	0.7	<0.1	<0.1	<0.1	0.3	<0.1	0.2	-----	-----
2010	<0.1	<0.1	0.8	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	-----	-----
2011	0.1	0.1	0.5	0.6	<0.1	<0.1	0.1	0.7	<0.1	0.2	0.7	0.2
2012	<0.1	<0.1	0.1	0.2	<0.1	<0.1	0.0	<0.1	0.0	<0.1	0.5	0.3
2013	<0.1	<0.1	0.1	0.2	<0.1	<0.1	0.0	0.1	0.0	<0.1	0.2	<0.1

Note: Mortality rate for collected fish includes sample, raceway, and separator mortalities. Lamprey numbers are not included in totals.

Beginning in 2011, all SMP sites were directed to report juvenile lamprey collections in more detail. Lamprey numbers are not included in the overall salmonid mortality data in this

report, but have been added to the mortality table for future years' comparisons (Tables 14). The Pacific lamprey ammocoete total mortality rate in 2013 was 0.2% from a total collection count of 525 lamprey ammocoetes. The total mortality rate for Pacific lamprey macropthalmia this year was 0.05% from a collection total of 55,075 macropthalmia. We did not observe any notable peak in total facility mortality for either life stage of juvenile Pacific lamprey in 2013.

Incidental Species

The total incidental fish collection was determined by using the sample rate to expand the number of incidental fish in the sample and adding the number of incidental fish removed from the separator to the expanded sample count.

Incidental species were counted individually, except when handling large numbers of juvenile fish, such as American shad or Siberian prawn. When the number of juvenile fish was too large to practically count each individual, a weekly fish per pound calculation was obtained for these species; the result was then multiplied by the weight of the sampled species to obtain an estimated count. All sampled incidental fish were returned to the river except for Siberian prawn. For the sixth consecutive season, we euthanized all Siberian prawn that occurred in the sample per the directive issued by Washington Department of Fish and Wildlife on July24, 2007. With the exception of the 1,123 of frozen prawn given to the USGS for research, all Siberian prawn from the sample were frozen and returned to the river at the end of the fish passage season

When the sample rate was less than 100%, incidental species were inadvertently collected and transported along with the smolts. Therefore, when the sample rate was below 100%, incidental fish species were weighed and the average weight was applied to the expanded sample count to determine their contribution to transport loading densities.

Incidental collections totaled 122,055 fish in 2013. This included an expanded sample count of 118,705 fish and crustaceans and 3,350 fish from the separator. Incidental collection counts were higher in 2013 than in the previous two years, but lower than the number collected in either 2009 or 2010 (Table 16). The majority of the incidental catch this year consisted of Pacific lamprey macropthalmia at 45.1% of the total. Numbers of Pacific lamprey macropthalmia were up substantially from collection numbers observed in 2011 and 2012, though the numbers of Pacific lamprey ammocoetes decreased this year and were the lowest counts observed of the past four years. In 2013, Siberian prawn made up 36.9% of the incidental species collection and. Siberian prawn collections in 2013 were nearly double the 2012 collection and nearly triple the 2011 collection (Table 8).

Adult Pacific lamprey collections totaled 28 lamprey in 2013, 15 from the sample and 13 from the separator. Two individual lamprey were collected from the sample and expanded on July 23 at a sample rate of 50% and July 27 at a rate of 25%. All other adult lamprey were collected at a rate of 100%. The first adult Pacific lamprey of the season was collected May 23, the last on October 9. Upriver adult migrants were most frequently observed falling back into the collection system from June through September. For the third consecutive year, USACE transported all Pacific adult lamprey captured at the facility to above the dam, releasing them at Little Goose Landing. In addition, to avoid exposure to sampling anesthesia, any adult lamprey found in the sample tanks were removed by the USACE prior to SMP sampling.

Table 16. Numbers of incidental species collected at Little Goose Dam JFF, 2009-2013

Common Name	Scientific Name	2009	2010	2011	2012	2013
American shad	*Alosa sapidissima*	25,388	18,803	2,122	14,614	6,678
Banded Killifish	*Fundus diaphanous*	17	213	14	61	117
Bass-Smallmouth	*Micropterus dolomieu*	5,092	4,150	3,691	2,442	1,279
Bass-Largemouth	*M. salmoides*	32	3	7	6	2
Bullhead	*Amierus sp.*	374	323	390	511	291
Bull trout	*Salvelinus confluentus*	5	9	7	2	6
Channel Catfish	*Ictalurus punctatus*	618	369	235	353	381
Chiselmouth	*Acrocheilus alutaceus*	15	14	72	2	6
Common carp	*Cyprinus carpio*	145	722	294	139	96
Crappie	*Pomoxis sp.*	1,076	318	86	687	1,139
Dace	*Rhinichthys sp.*	10	29	24	12	3
Goldfish	*Carassius auratus*	0	1	0	0	0
Kokanee	*Oncorhynchus nerka*	14	0	55	0	0
Lamprey Adult-Pacific	*Entosphenus tridentatus*	125	11	63	32	28
Lamprey Ammocoete-Pacific	*E. tridentatus*	5,126	1,650	6,584[1]	1,903	525
Lamprey Macropthalmia-Pacific	*E. tridentatus*	88,415	57,802	11,108	4,749	55,077
Mountain Whitefish	*Prosopium williamsoni*	1,940	5,614	3,850	697	324
Northerrn Pikeminnow	*Ptychocheilus oregonensis*	565	73	72	52	41
Peamouth	*Mylocheilus caurinus*	2,798	6,057	7,631	1,077	1,292
Rainbow Trout	*O. mykiss*	17	99	12	2	0
Redside Shiner	*Richardsonius balteatus*	0	0	0	0	0
Sandroller	*Percopsis transmontana*	4,124	24,260	7,591	2,452	6,241
Sculpin	*Cottus sp.*	3,733	2,062	996	1,732	1,239
Siberian Prawn	*Exopalaemon modestus*	6,327	38,676	15,743	23,183	45,015
Sucker	*Catostomus sp.*	2,413	1,820	1,760	882	1,353
Sunfish[2]	*Lepomis sp.*	585	239	218	602	865
Tadpole Madtom	*Noturus gyrinus*	1	2	0	8	8
Walleye	*Stizostedion vitreum*	19	20	8	7	9
White Sturgeon	*Acipenser transmontanus*	5	11	12	15	16
Yellow Perch	*Perca flavescens*	46	14	55	43	17
Other		311	11	2	0	7
Total		149,336	163,375	62,702	56,265	122,055

Note- Numbers include expanded sample counts and separator releases

[1] Of the 6,584 ammocoetes collected in 2011, approximately 1,806 fish were not identified to species but were called Pacific lamprey based on the species composition of the sample.

[2] Sunfish include bluegill/pumpkinseed and warmouth.

Research

ODFW and USACE personnel provide various types of research assistance during the fish passage season. Typically, ODFW provides research specimens that are collected on site via the sample. The summaries below describe each research or monitoring project.

Gas Bubble Trauma Monitoring

Biological technicians from the Washington Department of Fish and Wildlife (WDFW) examined juvenile salmonids for the presence of gas bubble trauma (GBT). When fish numbers permitted, a maximum of 100 fish were sampled. Sampling occurred weekly from April 7 to August 5, 2013. Sampling was designed to determine the relative proportion of migrating

juvenile salmonids passing the dam that exhibited symptoms of GBT in the unpaired fins and eye.

A total of 1,917 smolts were handled by WDFW GBT personnel in 2013. Fish with PIT tags were not examined for GBT, resulting in a GBT sample size of 1,877 smolts. Of the smolts examined, 39.2% were subyearling Chinook salmon, 32.7% were yearling Chinook salmon and 28.1% were steelhead smolts. The total GBT rate for the 2013 season was 0.2%, identical to last year's rate. No mortality occurred during GBT sampling in 2013.

The majority of the GBT sample this year consisted of clipped smolts, with a trauma rate of 0.1% of 981 clipped fish examined, compared to unclipped smolts, with a trauma rate of 0.3% of 896 unclipped fish examined. Unclipped subyearling Chinook and clipped yearling Chinook exhibited the highest rates of gas trauma this year with a rate of 0.2% and 0.05% respectively.

Positive signs of gas bubble trauma were first detected on May 13 at a rate of 1.0% from 100 fish examined. Trauma was again observed in mid-summer on July 2, July 23 and July 30. Sample sizes remained at 100 smolts, with trauma rates of 1% for each of the three July sampling dates. All four individual cases of gas bubble trauma in 2013 were mild (1-5% bubble coverage of body region) and were detected in the smolt anal fin.

BiOp Performance Testing- Subyearling Chinook salmon- Batelle Pacific Northwest National laboratory (PNNL).

In order to assess compliance with the BiOp Juvenile Salmon Performance Standard, Batelle researchers utilized acoustic telemetry to estimate passage survival of juvenile subyearling Chinook salmon. Hydrophones were deployed on the upstream face of Little Goose Dam, monitoring all major routes of potential passage through the project. In addition, monitoring occurred pre and post passage, approximately two kilometers from the dam. This was the second year of the two year study and concluded mid-August.

BiOp Performance Testing- Kelt- (PNNL)

To assess compliance with the BiOp Juvenile Summer-run Salmon Performance Standard, the PNNL conducted this passage survival study, monitoring passage efficiency and survival of downriver migrating steelhead kelts. Researchers utilized existing telemetry equipment previously installed at Little Goose. This was the second year of a two year study.

Passage Evaluation- Adult Pacific Lamprey- University of California Davis (UC Davis) and University of Idaho (U of I)

This study involved monitoring passage success of adult Pacific lamprey through all four of the Lower Snake River hydro-projects; passage success was also monitored at McNary Dam. Study lamprey were tagged off site with half duplex (HD) PIT- tags. Researchers were granted access to each projects' PIT-tag detection systems to download lamprey passage data.

Pacific Lamprey and Adult Salmon Passage-Video Surveillance- UC Davis and U of I.

During the winter/spring of 2012/2013, new lamprey specific orifices (16" x 2.5") were installed in the 10 vertical slot weirs (628-637) located just below the fish ladder exit. In addition, lamprey passage plates were fabricated and installed over a portion of diffuser 3 – 5 and 13 gratings (weirs 539 -542 and 627. The plates were installed at the fish passage orifices to

reduce water upwelling forces resulting in more efficient lamprey passage. Researchers employed two underwater video cameras to observe lamprey behavior with regard to passage through the orifices and to ascertain chinook, steelhead and sockeye delay and interaction behavior.

Lower Granite Dam Prototype Weir Evaluation- UC Davis, Biomark and Blue Leaf Environmental

During the winter of 2012, Lower Granite Dam (LGR) modified orifice gallery opening 5A, enlarging it to a 14 inch orifice. In addition a prototype weir was installed, which decreases turbulence and water velocity as flows exit into the juvenile collection channel. This study evaluated the weir passage efficiency in orifice opening 5A for PIT tagged hatchery yearling Chinook, hatchery steelhead and Pacific macropthalmia lamprey. Macropthalmia were collected from the Little Goose Dam SMP sample for this study beginning May 23. However, collections were suspended May 29 due to low sample numbers. A total of four Pacific macropthalmia lamprey were given to researchers from the SMP sample in 2013

Siberian Prawn Studies in the Lower Snake River- United States Geological Survey (USGS)

Beginning in late September of 2013, USGS researchers requested Siberian Prawn collections from the SMP sampling sites at Lower Granite, Little Goose and Lower Monumental Dams. Prawn studies included calculating size distribution and sex. Once a week beginning September 23, ODFW biologists collected, froze and retained all prawn in the sample for researchers to claim at the end of the season. An estimated total of 1,123 Siberian prawns were collected from the SMP sample at Little Goose this year.

Miscellaneous Monitoring

Zebra Mussel Monitoring

As in previous years Little Goose monitored the facility for zebra mussel *Dreissena polymorpha* infestation. The zebra mussel monitor is a piece of substrate suspended in the adult fish ladder near the ladder exit. No zebra mussels were observed during the 2013 season.

Turbine Strainers

Turbine unit strainers were monitored for the third consecutive year at Little Goose Dam. Strainers are located in the piping associated with the intake water valve to each of the six turbine units. Strainers were flushed weekly to remove fish trapped, particularly juvenile lamprey. Results were reported throughout the season to TMT and in the USACE and ODFW weekly report.

Avian Predation Monitoring

Avian activity has been monitored and recorded at Little Goose Dam by the USACE and ODFW for many years to assist with the management of reducing bird predation of juvenile smolts. New protocols involving documenting bird behavior were established by the Portland District Bonneville Dam Fisheries Field Unit and implemented in 2012 and continued through the 2013 season. Six specific zones were established to document bird locations. We recorded

specific bird behavior including loafing/resting (on land or water), flyby, scavenging and predating.

Gulls (*Larus spp.*) continued to be the predominant bird species and numbers were more abundant throughout the entire 2013 season. The peak period recorded between May 2 and May 20 averaged 95 gulls per day more than doubled that recorded 2012 which averaged 41 gulls per day during the same period. This peak period occurred during APHIS hazing activities and gull numbers approached 250 on May 15th. Gulls appeared to be more persistent foragers in 2013. The increase in gulls may be attributed in part, to the low flow year.

Double Crested Cormorants (*Phalacrocorax auritus)* numbers also increased to a mean total of 1021 from 516 recorded in 2012 (April 1 to August 31). The majority of cormorants were counted within the area one half mile upstream and downstream of the dam. Cormorants do not forage in fast currents that are present in the tailrace during the spring freshet. The low flows in 2013appeared to be advantageous for cormorant foraging.

American White Pelicans (*Pelecanus erythrorhynchos*) were again observed in 2013. In general, pelicans were observed in the tailrace from mid April to mid August but were most predominant in May and June. When pelicans were present most surveys counted between 1 and 4 birds with the occasion count reaching 6 to 7. A peak count of 20 was recorded on May 19. The total mean count of 91 in 2013 was similar to the 2012 total mean count of 85.

Other piscivorous bird species observed during the 2013 season that was not viewed to be a significant predator on salmonids included Caspian Terns (*Sterna caspia*),Western Grebes (*Aechmophorus occidentalis*), Osprey (Pandion haliaetus**)** and Bald Eagle (Haliaeetus leucocephalus).

Facility Operations & Maintenance

The juvenile fish bypass system was inspected at a minimum twice daily during the fish passage season. The juvenile bypass system and the collection facility were not heavily impacted by debris, equipment and components for the most part, met operational reliability and overall excellence in operations helped make 2013 an exceptional year for safe fish passage.

Forebay Debris/Trashracks

Accumulation of forebay debris was much less than in the previous several years, a direct result of a low flow water year. We estimated the water surface area covered by debris and the location of that debris in the forebay daily during inspections. Moderate accumulations of woody debris were present in the forebay from March through May. Debris tapered off as expected through August as most was passed downstream via the surface bypass spillway weir (surface spill). Debris increased again in September due to increased pool elevations that resulted from the termination of MOP restrictions. There were no emergency spills to remove debris during the fish passage season. Trashracks were rake to remove debris in February, May, June and September. An estimate total of thirty yards of debris was removed of which most was from turbine unit 1 trashrack 1A.

Spillway Weir

The spillway weir (SW) was placed into operation on April 3 in the low crest (618 ft. msl) position. Problems did arise during installation of the weir due to woody debris interfering with bulkhead placement. Spill was required on April 2 from 0732 to 0812 hours to remove debris to complete the installation. On May 31, the weir was changed to the high crest (622 ft. msl) position. On August 6, river discharge dropped below 35 kcfs and the weir was removed from service to "smooth-out" flows for the remainder of the passage season. There were no debris blockages during the operation of the weir. Spill was again required on December 9, to remove debris so divers could measure the structure in support of design for a new adjustable spillway weir.

Turbine Operation

Efforts were made to operate all turbine units within 1% limitation of best efficiency from April 1 to October 31. Best efficiency operations provide greatest fish passage survival through operating turbines. Deviations outside the 1% criteria are reportable if it occurs for more than 15 minutes in duration and/or there are 5 or more periods of at least 5 minutes during a single calendar day. In 2013, there were no reportable 1% violations.

There were numerous scheduled and unscheduled turbine unit outages during the fish passage season. Short term outages, less than 24 hours in duration were required to perform minor maintenance repairs, fish passage inspections and debris removal. Long term outages, greater than 24 hours are listed below.

Unit # 1
1. Forced outage starting 6 May, 24 hour duration for D.C. short.
2. Forced outage starting 9 May, 25 hour duration for low spring pressure on XJ breaker.
3. Forced outage starting 20 June, 32 hour duration for governor problems.
4. Planned outage starting 9 September, 106 hour duration for T1 doble testing.
5. Planned outage starting 1 October, 469 hour duration for Exciter replacement.

Unit # 2
1. Forced outage starting 6 May, 24 hour duration for D.C. short.
2. Planned outage starting 8 July, 1,322 hour duration for 6 year overhaul.
3. Planned outage starting 9 September, 106 hour s duration for T1 doble testing.
4. Planned outage starting 9 October, 2,722 hour duration for annual and field grounding problems.
5. Planned outage starting 25 November, 880 hour duration to January 1 2014 for Exciter replacement.

Unit # 3
1. Forced outage starting 23 April, 70 hour duration for Exciter problems.
2. Forced outage starting 11 May, 48 hour duration for Exciter problems.
3. Planned outage starting 9 September, 106 hour duration for T1 doble testing.
4. Planned outage starting 28 October, 390 hour duration for annual maintenance.

Unit # 4
1. Forced outage starting 28 April, 246 hour duration for Exciter problems.
2. Planned outage starting 9 September, 106 hour duration for T1 doble testing.
3. Planned outage starting 7 October, 412 hour duration for annual maintenance.

Unit # 5
1. Forced outage starting 13 May, 70 hour duration for Exciter problems.
2. Planned outage starting 16 September, 562 hour duration for annual maintenance.
3. Forced outage starting 14 October, 26 hour duration for oil catcher pump problems.

Unit # 6
1. Forced outage starting 1 April, 61 hours duration for no fish screens installed.
2. Planned outage starting 19 August, 489 hours duration for Annual and T1 doble testing.

Extended-Length Submersible Bar Screens (ESBS)

All ESBS performed satisfactorily with only one notable exception. ESBS 3B was observed not working on October 16. It was replaced October 17 and the turbine unit placed back in service. Drawdown inspections across trashracks and ESBS/VBS were performed according to the FPP. All drawdown inspections were measured within criteria throughout the season. Video inspections and manual operation inspections showed all screens in good operating condition throughout the fish passage season.

Vertical Barrier Screens (VBS)

Inspections of all VBS were performed by underwater video camera in May and turbine unit 2 VBS on July 31. All inspections showed VBS in good operating condition.

Gatewells

Gatewells were checked for debris and oil contamination daily. As needed, debris was removed using a dip basket or grappling hook. In 2013, the occasional oil films were observed on the water surface in several gatewells similar to previous years. Most oil films appeared to be organic (animal or vegetative) in appearance while some appeared to be petroleum base and may have been produced, in part, from rain-washed oil/grease residue associated with mechanical equipment and vehicles.

Orifices and Collection Channel

The collection channel was operated throughout the season with 18 to 22 open orifices depending on forebay elevations. Orifices were inspected and/or back-flushed two to five times per day. All orifice operations were manually performed throughout the year.

The collection channel was dewatered and removed from service on December 17. Fish salvage operations during the dewatering included releasing unharmed back to the river 90 adult steelhead, five juvenile lamprey (macropthalmia) two sculpins and one chiselmouth. One dead juvenile chinook was removed.

Primary Dewaterer/Primary Bypass Pipe

The primary dewatering structure and components functioned adequately throughout the season. Inspection of the primary dewaterer and manual operation of the cleaning brushes was

performed daily. As in past years, the excess water was diverted to the adult fish channel pump chamber throughout the season to improve adult fish attraction and migration.

Bypass Flume/Pipe

The primary bypass flume functioned satisfactorily in 2013. During winter maintenance 2010, the flume outfall was relocated from near shore to mid channel. The relocation extended the release site approximately 400 feet north into the river mid-channel. This new section of outfall is made of 36 inch corrugated metal pipe. The new point of release allows bypassed fish to migrate downstream with improved guidance. The flume was inspected during the winter maintenance period and observed in overall good condition and found free of obstructions and rough edges.

Separator

The separator was operated similar to previous years. The water level was kept about one to two inches above the downstream end of the B-side separator bars. In some years, the facility is placed in primary bypass mode for short periods during the transport season in order to clean debris out of the separator. In 2013, debris accumulations within the separator were minimal and all debris was removed without changes in facility operation. During the winter maintenance period, the interior and exterior surfaces of the separator were cleaned and refurbished.

Sample System/PIT Tag System

The PIT tag detection and diversion systems at the lower Snake and Columbia River dams are maintained and operated by the Pacific States Marine Fisheries Commission. PIT tagged salmonids have been monitored for movement and behavior in the Columbia and Snake Rivers since 1987. At Little Goose Dam, there are 11 PIT tag monitors located throughout the JFF.

In previous years, the state of the Divert During Sample (DDS) system was manually changed by USACE project biologists and technicians based upon fish passage and sample rates. However, the DDS system was upgraded during the winter maintenance period in 2012/2013 to allow for automatic changes of state per entry of the sample rate, while still retaining the ability to override the automation and change the system manually.

At low sample rates ($\leq$20%), when large numbers of fish are passing through the system, the DDS setting is deactivated. When the DDS is deactivated, the PIT tag slide gate will not open when the sampling system is engaged. This setting helps avoid potential sample bias caused by diverting large numbers of untagged fish along with the targeted PIT tagged fish during a sampling event. At sample rates greater than or equal to 20%, (low numbers of fish passing through system), the potential for sample bias is lower and the DDS system is activated. An automated log of state changes to the system, trouble reports and power outages affecting the PIT tag interrogation equipment in 2013 can be obtained at www.ptagis.org.

DDS settings for the A and B side sample tanks followed recommendations for most of the season. Minor deviations typically occur daily at approximately 0700 as a result of equipment operation as the facility prepares for a new 24 hour sampling period. In addition, minor deviations occur as a result of split sample changes, separator cleanouts and/or power outages.

There were three deviations in 2013 for unknown reason or cause. Two deviations occurred on the A side sample tank. These occurred on July 14/15 and 15/16 with a sample rate setting of 20%. On both occasions the DDS setting was changed from automatic (on) to manual OFF. The first deviation lasted approximately 35 minutes and the second, a string of switch events for 5 minutes. These deviations were determined negligible for 20% is the gate trigger for the DDS setting. The third deviation occurred on the B side sample tank when the log shows an extensive string of state changes on April 2/3 with a sample setting of 15%. This string of changes totaled 45 minutes in deviation. However, we presume PIT tag diversions were not affected significantly, as the total sample count for April 3 was only 45 fish, including 5 Pacific lamprey macropthalmia. Moreover, the facility was operating in secondary bypass and all non sampled fish were routed back to the river.

Pit Tag Detections

The passive integrated transponder (PIT) tag detection system records data on PIT tagged salmonids as they pass through the juvenile collection system. The PTAGIS database categorized all PIT tag detections based upon species, race, and clip type/rearing disposition. An additional "orphan" category was used for detections of PIT tags for which the database contained no record of tagging and release. Data were categorized based upon exit monitor detections: 1) to the river, 2) to transport holding areas, 3) to the smolt monitoring sample, and 4) unknown. This last category included final detections of PIT tagged fish at locations that did not constitute an exit.

From April 1 through October 31, a total of 110,688 PIT tagged fish were detected within the juvenile collection/bypass system: 54,228 chinook smolts, 50,449 steelhead smolts, 5,096 sockeye smolts, 882 coho smolts, and 33 Pacific lamprey. Of the total number of detections, 66% or 72,904 smolts were routed to the river, 34% or 37,698 smolts were routed to transport areas, and 0.1% or 86 smolts had unknown disposition, as they were last detected at locations that did not constitute an exit from the facility. PIT tagged smolts in the subsample were treated as the other fish in the sample and were either routed back to the river, if the facility was operating in secondary bypass mode, or routed to a transport holding area when the facility operated in collection mode. Approximately 1% or 729 PIT tagged smolts were routed to the sample this year. Prior to the start of the transportation season, all PIT tagged fish were routed back to the river. Approximately 37% or 26,706 of the PIT tagged fish detected in 2013 were detected prior to the start of collection for transportation.

Barge and Truck Loading Operations

Barge loading and transport operations occurred from May 2 through August 16. All fish loading and barge operations at LGS were performed satisfactorily.

Truck loading and transport operations occurred on alternate days from August 18 to October 31. Due to high numbers of fish collected, Lower Granite Fish Facility trucked Little Goose Fish on Sept 5, 7 and 9 using the 3500 tanker. This "piggyback" operation delayed transport time for those fish transported from Lower Granite by approximately one hour. No problems were reported regarding piggyback operations. Fish transported by truck from Little Goose were transported in a mild saline solution of 1 to 2 mg/L to reduce stress and treat columnaris disease.

Avian Predation Deterrence

Springtime gull predation on juvenile salmon and steelhead at Little Goose has been significantly reduced since 1999 when the USDA Animal and Plant Health Inspection Service (APHIS) began bird hazing activities. Prior to 1999, 150 to 200 birds were common sight in the tailrace area during the smolt migration. On some days, up to 400 gulls were observed during the peak period in May. In 2013, APHIS bird hazing activities at Little Goose took place from April 1 through June 14. Additional hazing by project personnel using bird scare products including propane scare cannons, bird bangers and bird screamers continued intermittently through the remainder of the fish passage season. The water cannon located at the bypass outfall was used continuously throughout the season. Little Goose continued to use passive bird deterrent devices that included needle strips, bird wires and visual scare devices.

Facility Modifications

Several modifications were made prior to, during and after the 2013 season.

1. PSMFC installed an automated electronic DDS mode change to prevent sampling and diversion errors – February 2013
2. PSMFC updated PIT-tag hardware.
3. Replaced two staff gauges
4. Installed a new 6" fish release knife gate valve on the sort by code holding tank exit.
5. Installed new flooring in technician control building

Recommendations

1. Continue to write revisions and updates to the operations maintenance manual pertaining to new equipment and facility collection and transport procedures
2. Repair the trash/shear boom.
3. Install a new log boom between the floating guide wall and the trash/shear boom
4. Repair the emergency fish bypass/drain pipe outfall section. Install air and vaccumn release valves to prevent back blow of the drain system.
5. Continue to rebuild orifice valve cylinders.
6. Replace all 72 in-line air control hand valves associated with the orifice valves and back-flushing operations.
7. Replace all 36 orifice push button electronic valve operators with manual 2-way valves.
8. Continue to remove scale and rough edges in the facility flumes, tanks, and transition areas

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