2013 Annual Report

SMOLT COLLECTION AND TRANSPORTATION AT LOWER GRANITE DAM ON THE SNAKE RIVER, WASHINGTON

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Summary

The 2013 fish collection season at Lower Granite Dam was characterized by low flow conditions, above average water temperatures, court mandated summer spill, moderate debris levels, above average summer water temperatures, a relatively low number of fish transported, and relatively high descaling rates late in the season. With the continued release of unclipped supplementation Chinook and steelhead above Lower Granite Dam, it is no longer possible to accurately distinguish wild Chinook, steelhead, and sockeye/kokanee in the sample. Consequently, numbers in the report tables designate fish as clipped and unclipped. A total of 3,894,569 juvenile salmonids were collected at Lower Granite Dam during the 2013 season. Of these 3,211,877 were transported to release sites below Bonneville Dam, 3,170,685 by barge and 41,192 by truck. An additional 678,827 smolts were bypassed back to the river during the season.

Introduction

Lower Granite Dam is located on the Snake River, approximately 107.5 miles upstream from the confluence with the Columbia River. Lower Granite is the first of eight dams that migratory juvenile salmonids in the Snake River and its tributaries encounter on their way to the ocean. It has one of the four juvenile fish collection and transportation facilities operated by the Corps of Engineers on the Snake and Columbia Rivers. Most of the juveniles that are collected are transported in barges and trucks to release locations below Bonneville Dam on the Columbia River. From there, they complete the remaining 140-mile journey to the ocean on their own. Other smolts are bypassed to the river by way of spill, turbine passage, or for research purposes to continue their passage to the ocean on their own.

River Conditions

Flows in the Snake River during the 2013 season were well below average. Flows were the second lowest in the last five years during April and May, the lowest in the last five years during June, July, August and September and the second highest in the last five years in October. Flows for entire the juvenile fish collection period running from March 26 through October 31 averaged 41.7 kcfs. Flows exceeded the Biological Opinion target of 100 kcfs on only 8 dates during 2013 and never came close to reaching the 200 kcfs mark. River flows for the last few days of March were between 27.2 and 39.2 kcfs – well below the norm. Flows in April averaged 56.4 kcfs and ranged between 42.0 kcfs and 75.2 kcfs. In May, river flows averaged 82.2 kcfs and ranged between 54.1 kcfs and 137.5 kcfs. The peak flow of the season occurred on May 15 when flows reached 137.5 kcfs. River flows in June averaged 56.3 kcfs and ranged between 40.5 kcfs and 74.4 kcfs. River flows in July averaged 33.3 kcfs and ranged between 21.4 and 52.0 kcfs. August flows averaged 22.1 kcfs and ranged from 17.7 kcfs to 26.3 kcfs. River flows were only slightly lower in September averaging 20.4 kcfs and ranging from 15.6 to 25.3 kcfs. Daily flows in October averaged 23.3 kcfs and ranged up to 34.4 kcfs. The season's low flow date

occurred on October 28 and was 13.7 kcfs. The flow on October 31, the last day of the collection season, was 18.1 kcfs.

During 2013 flows exceeded 80 kcfs on only 13 days, 90 kcfs on 10 days, 100 kcfs on eight days, 110 kcfs on five days, 120 kcfs on 3 days, and 130 kcfs on 2 days. The 2013 peak flow day of 137.5 kcfs occurred on May 15 – earlier than normal. By extreme contrast during 2012 flows exceeded 80 kcfs on 92 days, 90 kcfs on 70 days, 100 kcfs on 49 days, 110 kcfs on 27 days, 120 kcfs on 20 days, 130 kcfs on 12 days, 140 kcfs on 6 days, and 150 kcfs or greater on 4 days. Flows in 2011 exceeded the Biological opinion target of 100 kcfs on 79 dates and reached the 200 kcfs level on four dates.

As directed in the 2013 Corps Fish Passage Plan, and consistent with guidance provided by the Technical Management Team, the juvenile fish transportation season will have a variable start date, based on the expected river flows. During years when the average spring seasonal flow is expected to equal or exceed 65 kcfs, transportation operations at Lower Granite will begin between April 21 and May 1 as determined by TMT. Transportation at Little Goose and Lower Monumental Dams will begin in a staggered fashion, with the start dates determined by TMT. In years when the average spring seasonal flows are expected to be below 65 kcfs, transportation operations will begin on April 3 at Lower Granite, Little Goose, and Lower Monumental Dams. Prior to the start of transportation at a given dam, all fish will be bypassed back to the river unless needed for an approved study.

Projected Snake River spring seasonal average river flows above 65 kcfs at the beginning of the 2013 season were cause for the Corps to forgo general April barge transport operations at the hydroelectric projects on the Snake River. A Fish Operations Plan (FOP) ordered by the Court and a regional agreement led to spill operations similar to recent years. Spring spill operations at Lower Granite began on April 4 and continued on a continuous basis through the month of August. Water was spilled in excess of powerhouse capacity and at or above the 20 kcfs court-ordered spill on all but two of the 78 days of the spring migration period (from April 4 – June 20) and averaged 20.8 kcfs. With the exception of three dates, spill met or exceeded the summer (June 21 – August 31) Biop target of 18 kcfs until July 21 when greatly reduced flows reduced the amount of water available for spill. With the exception of only one day (July 24) from July 21 through August 31 spill levels were consistently below the 18.0 Biop level. Summer spill averaged 14.7 kcfs compared to 19.2 kcfs during 2012.

As in 2011 and 2012, formalized spring and summer testing of the RSW did not take place during 2013. Rather, the RSW was operated as an integral part of the normal April 4 through August 31 spill period. Spring spill (from April 4 through June 20) was authorized at the 20 kcfs level. Summer spill (from June 21 through August 31) was authorized at the 18 kcfs level with approximately 6 kcfs directed through the RSW and 12 kcfs as training spill.

Table 1: Comparison of average monthly river flow and spill at Lower Granite Dam, 2009-2013.

Month	2009	2010	2011	2012	2013	'09-12 Avg.
Flow (kcfs)						
April*	79.61	39.21	103.56	114.51	52.59	84.22
May	116.45	66.59	140.61	107.14	82.19	107.70
June	116.02	128.17	173.86	90.31	56.32	127.09
July	52.15	49.78	96.77	46.49	33.31	61.30
August	32.85	30.56	39.78	27.28	22.08	32.61
September	23.47	24.17	36.33	22.82	20.43	26.70
October	22.30	19.96	28.04	19.36	23.30	22.42
Spill (kcfs)						
April[1]	16.34	13.74	30.62	29.91	15.57	22.65
May	33.25	20.45	51.49	29.54	21.45	33.68
June	30.26	46.89	63.74	32.38	19.70	43.32
July	18.68	18.78	27.37	21.37	16.71	21.55
August	18.63	16.67	26.04	14.33	11.52	18.92
September	0.27	0.27	0.44	0.27	1.99	0.31
October	0.00	0.00	0.01	0.00	0.00	0.00

* Includes March 26-31

Water temperatures in the Snake River during 2013 were above the 2009-2012 average during April, May, June, July, September, and October. Due to low flows and comparatively cold Dworshak mitigation water, the water temperatures in August were actually cooler than normal averaging 65.4°F. The water temperature at the start of the season on March 26 was 43.7°F. Water temperatures increased to 50°F on April 30 and remained in the low to mid 50 degree range until the first of June. Temperatures then began to increase rapidly – reaching 60°F on June 9. Temperatures through June remained in the low 60°F range and the temperature did not hit 65°F until July 2. On July 7 the temperature reached 68.2°F and then things slightly cooled off and remained in the mid-60°F range until early September. The temperature then increased to the season high temperature of 69.4° F on September 14 and very slowly declined through the rest of the month. The temperature finally dropped below 60°F on October 7 - following cool ambient air temperatures and several rains. The temperature on October 31 (the last day of the collection season) was 53.1 °F. Average monthly temperatures during 2013 were as follows: April (47.6°F), May (52.6°F), June (59.7°F), July (66.3°F), August (65.4°F), September (67.6°F), and October (57.5°F). The fish facility water temperature met or exceeded 68°F on 15 days in 2013 compared to eight days in 2012 and one day in 2011.

Facility Modifications

The following modifications and work were made to the Lower Granite Juvenile Fish Facility and barges prior to the 2013 season:

1. Refurbished the sample diversion slide gates per PSMFC guidelines.
2. Had the problem fish counters repaired by Smith Root.
3. Sealed the base of the tank partition to the floor in the sample holding tank.
4. Repaired/replaced problem pneumatic gate valves on the raceways.
5. Repaired the highly eroded concrete on the floor of the separator upwell (powerhouse mechanical crew).
6. Installed a drain on the 42-inch pipe from the 8th floor gallery to allow full pipe dewatering for post season ROV inspections (powerhouse mechanical crew).
7. Replaced the 24-inch knife gate valve on the separator.
8. Evaluated the oxygen monitoring system on the barges and ordered a replacement system to be installed late FY 2013.
9. Replaced copper fittings and injectors on Cat engines on Barge 8106.
10. Replaced the hatch covers on Barge 8107 in attempt to stop leaks into barge hull void.
11. Repaired the seals on the sample holding tank anesthetizing bins.
12. Refurbished all the oxygen probes for the Point Four and YSI systems.
13. Cleaned up the counter tunnel wire connections in the separator control room.

Fish Collection

Migration and Collection

The juvenile fish bypass gallery was watered up on March 18 at 0800 hours. Unlike some previous years, when we normally went to primary bypass before putting fish through the separator, during 2013 water was put over the separator bars on March 18 and fish were diverted out through the bypass pipe to mid river (secondary bypass). This was done to alleviate any chance of stranding juvenile fish or lamprey on the separator inclined screen. On March 25 at 0700 hours formal fish sampling (only) activities began. With the exception of sample fish, and fish collected for research barging operations, all fish were bypassed back to the river until 0700 hours on April 27 when raceway loading for general transportation began.

An estimated 3,894,569 juvenile salmonids were collected at Lower Granite Dam during the 2013 operating season. The 2013 species collection included: 1,362,720 clipped yearling chinook, 502,542 unclipped yearling chinook, 173,989 clipped subyearling fall chinook, 319,566 unclipped subyearling chinook, 1,058,688 clipped steelhead, 386,214 unclipped steelhead, 27,395 clipped sockeye/kokanee, 15,377 unclipped sockeye/kokanee and 48,078 coho (Table 2). Fewer fish were collected for all species groups in 2013 compared to 2012 except for coho and clipped sockeye. Clipped sockeye had the highest number of fish collected in the last five years while

clipped and unclipped subyearling fall Chinook had the lowest collection in the last five years. Clipped and unclipped yearling Chinook, clipped and unclipped steelhead and unclipped sockeye/kokanee all had the second lowest collection in the last five years. Daily collection and river flow information is provided in Appendix 1, Table 1.

The peak collection day was May 13, the second latest in the last five years and 17 days later than in 2012 (Table 3). Clipped yearling Chinook collection peaked May 8, the third earliest peak collection day in the last five years. Unclipped yearling Chinook collection peaked May 13, the latest peak collection day in the last five years. Clipped subyearling fall Chinook collection peaked June 9, the second latest peak collection day in the last five years. Unclipped subyearling fall Chinook collection peaked June 9 the same day as clipped subyearling fall Chinook, and that is the latest day in the last five years. Clipped and unclipped steelhead collection peaked May 13, the second latest peak collection day in the last five years. Clipped sockeye collection peaked May 16, the third earliest peak collection day in the last five years. Unclipped sockeye collection peaked May 17, the earliest peak collection day in the last five years. Coho collection peaked May 14, the second earliest peak collection day in the last five years. Clipped sockeye (13,000) and coho (9,400) collections were their highest in the last five years on their peak collection day. Lower Granite did not have 90% of the total subyearling fall Chinook collection for the season until August 1 in 2013 compared to July 11 in 2012, July 16 in 2011, July 14 in 2010 and July 2 in 2009. All species groups' peak collections occurred before the peak flow date of May 15 except for clipped and unclipped sockeye/kokanee and clipped and unclipped subyearling fall Chinook.

Table 2. Annual collection, bypass, and transport at Lower Granite Dam, 2009-2013.

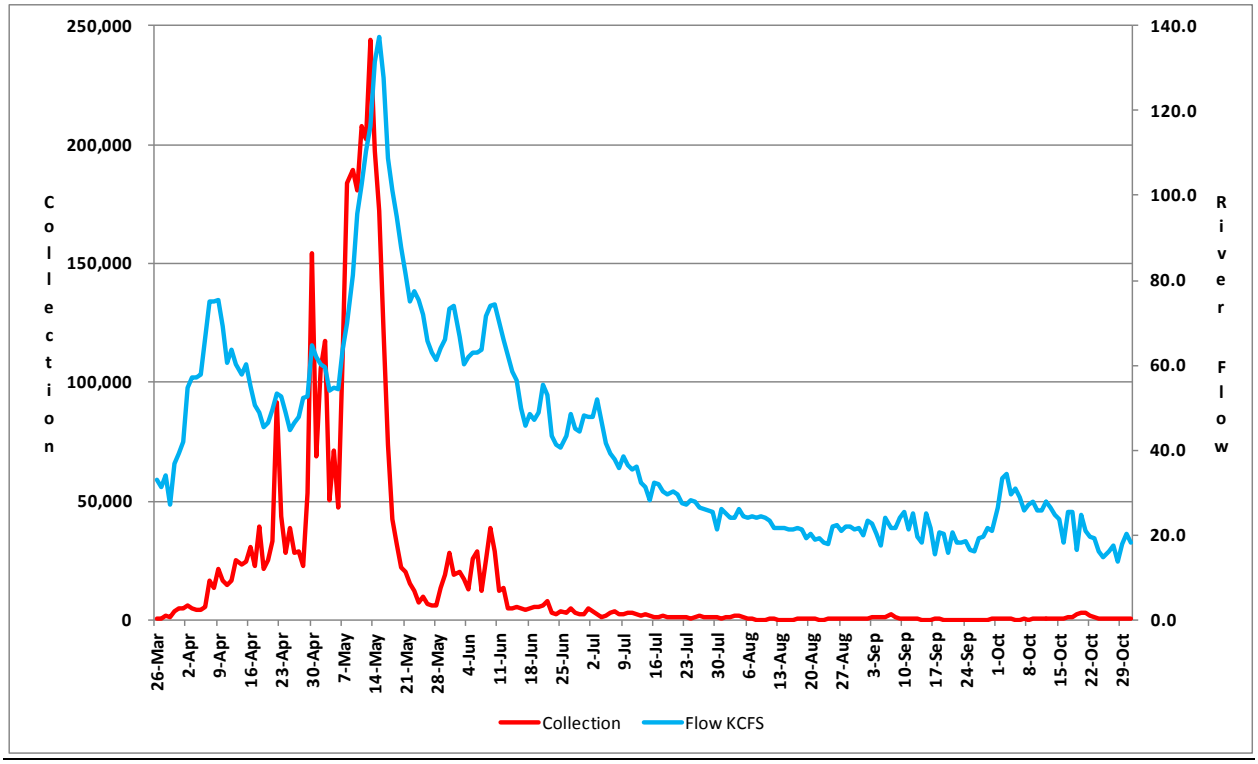
Year	Yearling Chinook Clipped	Yearling Chinook Unclipped	Subyearling[1] Chinook Clipped	Subyearling[1] Chinook Unclipped	Steelhead Clipped	Steelhead Unclipped	Sockeye/Kokanee[2] Clipped	Sockeye/Kokanee[2] Unclpd	Coho All	Total
Collection										
2009	1,836,874	515,775	260,431	450,943	2,673,278	756,926	17,767	15,734	65,933	6,593,661
2010	1,193,654	428,713	176,115	454,408	1,008,668	349,497	1,925	3,932	28,365	3,645,277
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
Bypass										
2009	606,548	241,406	207	20,069	1,254,742	333,032	30	7,038	1,951	2,465,023
2010	161,676	30,184	33	6,880	31,194	17,151	0	11	0	247,129
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	1,119,950	283,525	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
Truck										
2009	2	10	329	6,069	1	7	27	22	233	6,700
2010	16	6	72	16,403	2	14	0	64	17	16,594
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
Barge										
2009	1,227,039	273,887	258,128	422,152	1,418,158	423,803	17,650	8,519	63,607	4,112,943
2010	1,030,557	398,227	175,667	429,964	977,239	332,244	1,922	3,850	28,337	3,378,007
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
Total Transported										
2009	1,227,041	273,897	258,457	428,221	1,418,159	423,810	17,677	8,541	63,840	4,119,643
2010	1,030,573	398,233	175,739	446,367	977,241	332,258	1,922	3,914	28,354	3,394,601
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
Morts										
Facilit	1,679	561	279	818	233	66	9	23	60	3,728
Res/Sa	25	27	38	0	41	6	0	0	0	137

Note: 'Res/Sac' refers to research sacrificed fish and incidental research mortalities (handling and/or tagging). These fish were taken from the general collection only. Additional sacrificed research fish taken from the Sort-By-Code tank are summarized in the research section of this report.

Table 3. Annual peak collection days at Lower Granite Dam, 2009-2013.

Year	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Total
	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	All	
2009	May 15 (112,000)	April 26 (29,000)	May 29 (13,600)	May 30 (21,600)	April 24 (182,000)	April 24 (68,400)	May 20 (3,200)	May 21 (1,200)	May 21 (8,200)	24 April (322,800)
2010	April 28 (73,800)	April 28 (25,200)	June 5 (23,700)	June 5 (40,200)	May 21 (81,800)	May 21 (23,600)	June 6 (400)	May 21 (800)	May 20 (4,800)	May 21 (183,000)
2011	May 12 (165,200)	May 12 (33,800)	June 19 (12,550)	May 28 (25,600)	April 3 (160,139)	May 12 (48,000)	May 25 (4,800)	May 22 (2,300)	May 12 (5,200)	May 12 (375,600)
2012	April 26 (135,000)	April 26 (69,400)	June 4 (15,000)	June 5 (20,800)	April 26 (119,000)	April 26 (37,400)	May 9 (200)	May 18 (5,200)	May 18 (6,300)	April 26[2] (362,200)
2013	8 May 129,641	13 May 37,800	June 9 20,100	9 June 16,225	13 May 89,200	13 May 42,400	16 May 13,000	17 May 4,600	14 May 9,400	13 May 244,000

Figure 1. Daily juvenile salmonid collection, all species combined, versus daily average river flow KCFS at Lower Granite Dam, 2013.



Adult Fallbacks

During 2013 a total of 6,265 adult salmonids were removed from the Lower Granite separator during the March 26 to October 31 time period. This is similar to 2012 when a total of 6,124 adult salmonids were removed from the Lower Granite separator during the same time period. The 2013 totals included 1,160 clipped adult Chinook, 963 unclipped adult Chinook, 1,058 clipped jack Chinook, 768 unclipped jack Chinook, 1,242 clipped steelhead, 1,058 unclipped steelhead, 11 coho and 5 sockeye (included in the total in Table 4). Unclipped steelhead were the most abundant adult salmonid removed from the separator and made up 19.8% of the total salmonid fallbacks followed by clipped adult Chinook (18.5%). The number of fallbacks for all species groups increased over 2012 levels except for clipped and unclipped steelhead, which were down significantly compared to the 2009-2012 average. More clipped and unclipped Chinook jacks were removed from the separator this season than in the last five years while clipped and unclipped adult Chinook were the second highest in the last five years (Table 4). The majority of the Chinook were removed from the separator during September and October (fall Chinook). The largest number of clipped steelhead fallbacks occurred in October and unclipped steelhead fallbacks were highest in May (Table 5).

Table 4: Annual totals of adult Chinook, steelhead and coho released into the river from the juvenile fish wet separator at Lower Granite Dam, 2009-2013.

	Adult Chinook		Jack Chinook		Steelhead		Coho	
	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	All	Totals
2009	1,903	1,495	1,024	617	4,311	2,971	4	12,326[1]
2010	779	523	226	129	2,683	2,527	15	6,893[2]
2011	1,069	673	794	453	2,920	3,410	17	9,340[3]
2012	581	383	716	496	1,683	2,256	6	6,124[4]
2013	1,160	963	1,058	768	1,242	1,058	11	6,265[5]
09-12 avg.	1,083	769	690	424	2,899	2,791	11	8,671

1 Includes one sockeye

2Includes eleven sockeye

3 Includes four sockeye

4 Includes three sockeye

5 Includes five sockeye

All adult and jack fallback salmonids were superficially examined for external condition before being released from the separator and 96.1% of the salmonids released from the separator were classified as either in good or fair condition compared to 89.8% in 2012, 87.1% in 2011, 87.8% in 2010, and 95.2% in 2009 (Table 6).

Adult fallbacks that passed through the separator bars were not counted by the separator technicians and are not included in tables 4-6. These fish either passed into raceways to be transported or were bypassed before April 27, and were not counted. After April 27, if they entered the raceways they were transported. If these fish entered the sample system they were counted as incidental fish per Smolt Monitoring Program guidelines and bypassed. A total of 139 salmonid fallbacks were counted in the daily samples including 53 clipped Chinook jacks, 15 clipped Chinook minijacks, 56 unclipped Chinook jacks, eight unclipped Chinook minijacks, two clipped steelhead, three unclipped steelhead and two sockeye. This compares to 204 salmonid fallbacks counted in daily samples in 2012, 107 in 2011, 221 in 2010, 323 in 2009 and 1,587 in 2008. The decrease in adult and jack salmonids observed in the sample since 2008 is due to the installation of separator bars that are spaced closer together that lay over the regular separator bars. These bars effectively keep most of the Chinook jack and minijack fallbacks out of the sample tank. This season these narrower spaced bars were installed on September 25. It is necessary to remove fallbacks from the sample tank before they are anesthetized with MS-222 because of the sport fishery above and below LGR and the recommended 21 day waiting period prior to human consumption.

Table 5. Monthly totals of adult salmonids released from the juvenile fish separator at Lower Granite Dam, 2013.

	Adult Chinook		Jack Chinook		Steelhead		Coho	Totals
	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	All	
Month								
April[1]	0	0	0	0	70	244	0	314
May	35	32	5	2	350	420	0	844
June	14	14	4	3	21	39	0	95
July	15	19	5	1	6	11	0	62[2]
August	5	12	2	1	65	69	1	155
September	137	161	105	76	269	172	6	926
October	954	725	937	685	461	103	4	3,869
Totals	1,160	963	1,058	768	1,242	1,058	11	6,265

[1] Includes March 26-March 31
[2] Includes 5 sockeye

Table 6. Condition of adult salmonids released from the juvenile fish separator at Lower Granite Dam, 2013.

	Adult Chinook		Jack Chinook		Steelhead		Coho	
	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	All	Totals
Good	1,104	912	1,029	754	978	772	10	5,564[2]
Fair	40	34	15	11	163	191	1	455
Poor	8	11	9	3	68	76	0	175
Dead	8	6	5	0	33	19	0	71
Total[1]	1,160	963	1,058	768	1,242	1,058	11	6,265

[1] Includes March 26-March 31.
[2] Includes five sockeye.

Sampling

Sampling at the juvenile fish facility 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 due to the need to collect

fish for the overflow weir and 14-inch orifice evaluations. From March 26 to August 16 fish were sampled every day and when the sample rate was raised to 100% on August 16, through the end of the season, fish were sampled every other day. Each day's collection was kept separate in the sample tank and on the day of transport, each day's collection was sampled separately. The sample rate was lowered to 50% on September 6-10 and from 25-50% on October 18-31 due to increasing fish numbers – mainly subyearling fall Chinook.

During 2013 the smolt monitoring staff sampled 100,673 smolts, 2.6% of the total collection compared to 96,491 smolts (1.7%) in 2012, 79,426 smolts (1.3%) in 2011, 66,295 (1.8%) in 2010 and 70,866 smolts (1.1%) in 2009 (Table 7). This is the highest percent of the total collection sampled in the last five years. The sample rate was raised above FPC guidelines 21 times to accommodate fish needs for the overflow weir/14 inch orifice evaluation study. As a result the smolt monitors handled an estimated additional 27,634 fish. Without adjusting sample rates for research needs the smolt monitors would have sampled approximately 73,039 fish or 1.9% of the collection. The total number of smolts sampled in 2013 by species included: 15,308 clipped yearling Chinook, 6,776 unclipped yearling Chinook, 10,130 clipped subyearling fall Chinook, 49,313 unclipped subyearling fall Chinook, 13,878 clipped steelhead, 4,497 unclipped steelhead, 157 clipped sockeye, 244 unclipped sockeye/kokanee and 370 coho (Table 8).

Table 7. Annual percentage of total juvenile salmonids collected that were sampled at Lower Granite Dam, 2009-2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	All	Total
2009	0.7	0.8	2.5	5.4	0.6	0.8	0.8	1.8	1.7	1.1
2010	0.8	0.8	2.3	8.3	0.8	0.9	1.6	3.1	1.0	1.8
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
09-12	0.7	0.8	2.7	7.7	0.7	0.8	1.0	1.9	1.4	1.4

Table 8. Weekly sample rates in percent and sample totals at Lower Granite Dam, 2013.

Week Ending	Weekly Rate (%)	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Totals
		Clipped	Unclp'd	Clipped	Unclp'd	Clipped	Unclp'd	Clipped	Unclp'd	All	
3/28	10.0	186	73	0	1	1	14	0	1	1	277
4/04	--	1,382	586	0	2	172	54	0	1	2	2,199
4/11	--	935	624	0	9	233	175	0	0	1	1,977
4/18	--	716	611	0	5	1,578	425	0	0	1	3,336
4/25	--	1,554	1,043	0	6	3,866	349	0	1	2	6,821
5/02	--	3,619	1,202	0	5	2,065	303	0	0	21	7,215
5/09	--	4,064	818	0	3	1,240	456	0	2	40	6,623
5/16	0.5	2,261	950	8	48	2,055	1,025	82	17	177	6,623
5/23	--	215	316	43	159	714	466	67	79	61	2,120
5/30	--	216	279	1,039	1,970	1,125	702	1	11	20	5,363
6/06	--	140	118	3,234	4,030	464	264	5	7	32	8,294
6/13	--	8	26	2,427	2,054	205	98	1	0	4	4,823
6/20	10.0	10	15	1,591	1,696	49	81	1	2	2	3,447
6/27	--	1	5	592	1,500	30	23	0	2	0	2,153
7/04	10.0	0	2	394	1,442	61	17	0	0	2	1,918
7/11	10.0	1	0	219	1,692	5	5	0	1	0	1,923
7/18	--	0	0	63	1,455	3	0	0	0	0	1,521
7/25	25.0	0	1	48	1,696	2	1	0	0	0	1,748
8/01	25.0	0	1	69	1,840	2	0	0	2	0	1,914
8/08	25.0	0	2	51	1,508	1	2	0	1	1	1,566
8/15	50.0	0	0	21	770	0	0	0	1	0	792
8/22	--	0	1	37	1,846	0	0	0	5	1	1,890
8/29	100.0	0	0	41	1,907	0	0	0	5	1	1,954
9/05	100.0	0	9	42	4,784	0	3	0	0	0	4,838
9/12	--	0	3	39	3,416	2	4	0	2	0	3,466
9/19	100.0	0	0	21	1,401	1	3	0	0	0	1,426
9/26	100.0	0	3	5	561	2	3	0	4	0	578
10/03	100.0	0	4	8	1,680	0	0	0	34	1	1,727
10/10	100.0	0	17	17	1,742	0	6	0	30	0	1,812
10/17	100.0	0	45	55	4,490	2	14	0	30	0	4,636
10/24	--	0	11	46	4,144	0	3	0	4	0	4,208
10/31	--	0	11	20	1,451	0	1	0	2	0	1,485
Total		15,308	6,776	10,130	49,313	13,878	4,497	157	244	370	100,673

Transportation

An estimated 3,211,877 juvenile salmonids (82.5% of fish collected) were transported from Lower Granite in 2013. This is considerably higher than during 2012 when an estimated 2,674,880 juvenile salmonids (46.0% of fish collected) were transported from Lower Granite and during 2011 when 61.4% of the fish were transported. In 2013 the low flows reduced the number of fish bypassed by spill before barge transportation operations began. The numbers of fish and the percentages transported of each species group in 2013 were: 1,176,085 clipped yearling Chinook (86.3%), 378,627 unclipped yearling Chinook (75.3%), 161,460 clipped subyearling fall Chinook (92.8%), 317,263 unclipped subyearling fall Chinook (99.3%), 754,422 clipped steelhead (71.3%), 333,526 unclipped steelhead (86.4%), 27,386 clipped sockeye (100.0%), 15,300 unclipped sockeye/kokanee (99.5%) and 47,808 coho (99.4%). All species groups had a higher percentage of fish transported in 2013 compared to 2012 except for clipped subyearling fall Chinook, unclipped subyearling fall Chinook and unclipped sockeye.

During 2013 fish barging operations began slightly earlier than in recent years. Only one research barge (transport evaluation) was sent out prior to the initiation of normal barging operations. That barge departed Lower Granite on April 26. With the exception of the fish collected for the April 26 research trip, all fish other than sample fish were returned to the river by way of secondary bypass (bypass through the outfall pipe to the river). Fish were collected for numerous other studies after general collection began but this had no effect on the general operation of the facility. After normal collection activities began, these fish were handled as part of the regular collection and diverted to the upstream raceways for marking operations. General every-other-day fish barging operations at Lower Granite began on April 28. Every day barging of fish at Lower Granite began on May 2 and continued unimpeded through June 3. Every-other-day barging of fish at Lower Granite then resumed and continued unimpeded through August 16.

Every day fish barging from Little Goose began on May 3 and from Lower Monumental on May 8. The smaller 4000 series fish barges (direct loaded at Little Goose) were taken off line on May 28 but the larger 8000 series barges remained on line for every day barging at Lower Granite, Little Goose, and Lower Monumental through June 3 due to relatively high numbers of subyearling Chinook being collected. On June 4 every other day barging at the above three collector facilities began and continued without interruption through August 16. Traditionally fish barging operations at McNary do not begin until river conditions are “no longer spring like”. As during 2012 in 2013 fish barging operations did not take place at McNary Dam. The Region made the decision to suspend fish barging operations from McNary during 2013 and barge transport operations from that site will no longer take place.

Every other day trucking operations began on August 18 and continued until October 31. Unlike recent years, it was necessary to use the semi at Lower Granite on a fairly frequent basis during 2013. Some of this was due to the cessation of the fall transport study by NOAA-fisheries which in recent years had diverted quite a few would be transported fish from the sample and marked them for in-river release. This increased the number of fish transported well past the midi-tankers capacity on several occasions. In all a total of 11 trips were made with the semi during 2013. Due to a manpower shortage and high fish collection numbers, Lower Granite

personnel transported fish from Little Goose on September 5, 7, 9 and October 1 and 7.

Because of large numbers of predacious birds around the Bonneville release pipe outfall, Lower Granite trucked fish to Dalton Point on October 3, 5, and 7. After the installation of a propane canon at the Bonneville pipe outfall on October 8 (loaned from Little Goose), Lower Granite resumed fish releases at the Bonneville outfall on October 9 and October 11. Due to maintenance related issues at Bonneville, the adult bypass pipe was taken out of service after October 12. From October 13 through the remainder of the season on October 31 all trucked fish were released at Dalton Point.

An estimated 3,170,685 (98.7%) of the total juvenile salmonids transported from Lower Granite Dam were transported by barge compared to 2,659,998 (99.4%) in 2012, 3,859,265 (99.6%) in 2011, 3,378,007 (99.5%) in 2010, and 4,111,943 (99.8%) in 2009 (Table 2). The number of fish barged and the percentages of the total transported by species group in 2013 were: 1,176,085 clipped yearling Chinook (100.0%), 378,497 unclipped yearling Chinook (99.9%), 161,004 clipped subyearling Chinook (99.7%), 276,789 unclipped subyearling Chinook (87.2%), 754,419 clipped steelhead (100.0%), 333,510 unclipped steelhead (100.0%), 27,386 clipped sockeye/kokanee (100.0%), 15,188 unclipped sockeye/kokanee (99.3%) and 47,807 coho (100.0%).

As per previous years, fish collected at Little Goose Dam and Lower Monumental Dam were also loaded onto fish barges that originated from Lower Granite Dam during the 2013 season. This year no fish were barged from McNary Dam. The total number of fish barged from the two other sites during the 2013 season was: Little Goose Dam (2,573,039) and Lower Monumental Dam (1,095,459).

Approximately 41,192 juvenile salmonids, 1.3% of the fish transported from Lower Granite in 2013, were transported by truck (Table 2). The number of fish trucked and the percentage of the total transported by species group were: 0 clipped yearling Chinook (0.0%), 130 unclipped yearling Chinook (<0.1%), 456 clipped subyearling Chinook (0.3%), 40,474 unclipped subyearling Chinook (12.8%), 3 clipped steelhead (<0.1%), 16 unclipped steelhead (<0.1%), 0 clipped sockeye/kokanee (0.0%), 112 unclipped sockeye/kokanee (0.7%), and 1 coho (<0.1%). In addition, another 8,269 juveniles were transported by truck when Lower Granite combined fish trucking operations to help Little Goose from September 5 - 9 and again on October 1 and 7.

The physical operation of the transport barges and transport trucks went reasonably well during the 2013 season. There were a couple of operational towboat problems that slightly delayed the release of fish at the designated site but no serious mechanical problems developed with barges or trucks. The tug Umatilla with the loaded fish barge 8105 had an engine failure on the afternoon of June 8. The tug Cascades was diverted to John Day Dam to pick up the Umatilla's loaded barge. The fish should have been released on the evening of June 8 but due to the breakdown were released at 1300 hours on June 9. On the trip that departed Lower Granite on July 7, the towboat Liberty developed problems with the starboard engine. The towboat's engine was successfully repaired at Pasco, WA on the return trip to Lower Granite following fish release.

The area of biggest concern with the fish barges remains the rubber plungers in the fish holding tanks on the 4000 and 8000 series barges which are mechanically lifted to release the fish. The plungers are wearing out and beginning to deteriorate from sunlight and exposure to extreme summer heat. A recent examination of the plungers by fish facility personnel and LGR engineers showed there was some cracking and leaching of material on many of them. Six rubber plungers were replaced on the barges during 2013. In addition, the project developed a prototype metal plunger as a replacement to the rubber plungers. This plunger was deployed during 2013 on an 8000 series barge and proved reliable. The project plans on fabricating additional plungers based on this design prior to beginning fish barge activities in 2014. It is estimated that as many as 19 plungers will need to be replaced on the barge fleet. A big advantage to the new plunger is that it is fabricated from metal with only the bottom portion serving as a rubber seal/gasket. The rubber seal can be replaced on the metal plungers – saving a considerable amount of money and hopefully preventing the futher need for expensive contracts to manufacture all rubber plungers.

In recent years the oxygen monitoring systems on the fish barges have often caused as many problems (usually minor) as any of the mechanical systems. Problems are typically of a single hold nature and involve a probe in a particular hold not reading correctly or giving fluctuating readings. Because the existing Point Four systems were aging and starting to cause problems, the systems on all 4000 and 8000 series barges were replaced with a new Point Four oxygen monitoring system in the fall of 2013. The new system is easier to calibrate and should provide many years of service for barging operations. The project also retains numerous YSI portable oxygen monitoring units which are kept on the barges as a backup to the Point Four systems should problems develop.

There were very few problems with the Lower Granite fish trucks during the 2013 season. As previously mentioned, the NOAA-Fisheries late season transport evaluation study was not funded in 2013 and consequently more fish were trucked from Lower Granite than in recent years. The higher fish numbers resulted in the semi being used on eleven trips at Lower Granite which is considerably more than in recent years. Nevertheless, fish numbers remained low enough that the project was able to use the pickup mounted midi-tankers on most of the transport trips. The maintenance staff had no problems with either the 1-ton pickup or the 300 gallon mini-tanker. Care was taken to add enough river ice to the midi-tanker to keep the water temperature at an acceptable level for the trip to Bonneville and in general very little tempering was required at the release site.

The only real problem with the semi trailer was with the refrigeration system. The refrigeration system runs on the trailer Lower Granite used (trailer #8) but the drivers had problems maintaining and/or lowering the water temperature during hot summer and early fall transport trips. This problem needs to be addressed and especially so if future fish transportation plans from the collector sites eventually include earlier fish trucking operations and less fish barging during the late summer season.

Bypass

The fish facility was placed in secondary bypass mode (fish routed over the separator and through the long outfall pipe to mid-river) when the system was first watered up on March 18. Biological technicians were on duty 24/7 the same day to monitor the system. This was done to prevent lamprey and juvenile salmonids from possibly being stranded on the inclined screen. Collection for lab sampling began at 0700 hours on March 25. All fish, except those collected and transported for research purposes, were bypassed to the river until the evening of April 22 when an estimated 15,000 juveniles were diverted to a raceway for NOAA fisheries transport research marking operations. Approximately 15,000 juveniles were again diverted to a raceway for NOAA for transport marking operations on the evening of April 25. Raceway collection for general transport operations began at 0700 hours on April 27.

When the separator inclined screen becomes highly clogged with small debris brush cleaning is ineffective and it is necessary to dewater the screen in order to clean it. There were a total of six cleaning events during 2013 with an average duration of 30 minutes per cleaning. During these cleaning events no estimate was made of the number of fish bypassed because the fish are bypassed before encountering the sampling system (Primary Bypass). Following the end of fish sampling, the facility was placed into secondary bypass on October 31 at 0700 hours to prevent juvenile fish and lamprey from becoming impinged on the separator inclined screen and also so that fish could be routed through the PIT-tag interrogation system. Fish were routed through the secondary bypass until the afternoon of December 5 when the collection gallery and juvenile fish system were dewatered for the winter due to very cold temperatures and concerns with freezing pipes and valves.

In 2013, 678,827 smolts (17.4% of those collected) were bypassed from the LGR Juvenile Fish Facility compared to 3,133,048 in 2012, 2,429,798 in 2011, 247,129 in 2010, and 2,465,023 in 2009 (Table 2). The number and collection percentage of smolts bypassed by species group in 2013 included: 184,931 clipped yearling Chinook (13.6%), 123,327 unclipped yearling Chinook (24.5%), 12,212 clipped subyearling fall Chinook (7.0%), 1,485 unclipped subyearling fall Chinook (0.5%), 303,992 clipped steelhead (28.7%), 52,616 unclipped steelhead (13.6%), 0 clipped sockeye/kokanee (0.0%), 54 unclipped sockeye/kokanee (0.4%) and 210 coho (0.4%). An estimated 615,528 juvenile salmonids, 15.8% of the total collection, were bypassed from March 26 to April 27 before the start of general transport operations (this figure includes both facility and research bypassed fish). By contrast during 2012 an estimated 3,088,372 juvenile salmonids, 53.1% of the total collection, were bypassed from March 26 to May 1, before the start of the general transport season. During 2011 27.1% of the total collection (1,709,591 smolts) was bypassed from March 26 to May 1.

As part of five research studies, 76,796 smolts were bypassed from LGR during 2013. The National Marine Fisheries Service (NMFS) Survival Study PIT-tagged and bypassed 36,507 smolts: 11,545 unclipped yearling Chinook, 17,424 clipped steelhead and 7,538 unclipped steelhead. The USGS, USFWS, Pacific Northwest National Laboratory (PNNL) and NMFS "Investigating passage of ESA-listed fall Chinook salmon at Lower Granite Dam during winter when the fish bypass system is not operated" study bypassed 14 non-target smolts and 40 previously PIT-tagged holdover subyearling fall Chinook from the SBC tanks. The Idaho Fish

and Game Genetic Stock Index study bypassed 690 unclipped, non-CWT yearling chinook and 271 unclipped, non-fin eroded and non-CWT steelhead. The NMFS study to monitor the behavior and survival of wild spring/summer Chinook salmon in the Snake River basin bypassed 154 previously PIT-tagged unclipped yearling Chinook and 35 non-target fish. Blue Leaf Environmental, Biomark and UC Davis bypassed 36,948 fish into Unit #5 gatewells or directly into the collection channel including 11,253 clipped yearling Chinook, 12,212 clipped subyearling fall Chinook, 12,058 clipped steelhead and 1,425 lamprey. Another 50 fish were rejected for their study and bypassed including 42 clipped yearling Chinook, six clipped steelhead and two lamprey. From the SBC part of their study they bypassed 141 fish including 36 clipped yearling Chinook, 22 unclipped yearling Chinook, 82 clipped steelhead and one unclipped steelhead before the start of general transportation. They also bypassed 1,946 (852 clipped yearling Chinook and 1,094 clipped steelhead) of their PIT-tagged fish from the SBC tanks that were released into the gatewells and subsequently recaptured in the SBC tanks before the start of general transport and technically these fish were collected twice and bypassed twice from LGR.

Incidental Species

An estimated 33,464 non-salmonid incidental fish entered the fish facility during 2013 (Table 9). This is 18.5% more than the estimated 28,236 incidental fish that entered the fish facility in 2012. The incidental species collection in some recent years was 39,698 in 2011, 41,723 in 2010, and 20,902 in 2009 . During 2013, suckers were the most abundant incidental species with 9,380 collected, which is a 112.6% increase over the 2012 total of 4,413. Siberian prawns were the second most abundant incidental species with 6,634 collected compared to 3,831 in 2012. This was the seventh season that the invasive Siberian prawns were euthanized, per WDFW instructions, rather than released to the river. Sand rollers were the third most abundant incidental species with 6,197 collected compared to 4,390 in 2012. Pacific lamprey were the fourth most abundant incidental species with 4,878 collected compared to 5,557 in 2012. Pacific lamprey ammocoete numbers continued to decline in the collection this year with a total collection of 132 compared to 1,453 in 2012 and 6,165 in 2011. This is the third season that the smolt monitors have identified the life history stage of the lamprey in the sample.

Table 9. Estimated collection of incidental fish species at LGR, 2013.

Common Name	*Scientific Name*	Separator	Expanded Sample	Collection
Pacific Lamprey (Adult)	*Entosphenus tridentatus*		6	6
Pacific Lamprey (Juvenile)	*E. tridentatus*		4,878	4,878
Pacific Lamprey (Ammocoete)	*E. tridentatus*		132	132
American Shad (Adult)	*Alosa sapidissima*	8	9	17
American Shad (Juvenile)	*A. sapidissima*		42	42
Banded Killifish	*Fundulus diaphanous*		0	0
Smallmouth Bass	*Micropterus dolomieui*	6	439	445
Largemouth Bass	*Micropterus salmoides*		14	14
Bull Trout	*Salvelinus Malma*		0	0
Bullhead (misc.)	*Amierus sp.*		133	133
Common carp	*Cyprinus carpio*	14	72	86
Channel catfish	*Ictalurus punctatus*	25	300	325
Catfish, Flathead	*Pylodictis olivaris*	1		1
Chiselmouth	*Acrocheilus alutaceus*		213	213
Crappie (misc)	*Pomoxis sp.*	4	63	67
Cutthroat Trout	*Oncorhynchus clarkia*		0	0
Kokanee	*Oncorhynchus nerka*		3	3
Longnose dace	*Rhinichthys cataractae*		11	11
Northern Pikeminnow	*Ptychocheilus oregonensis*	7	26	33
Peamouth	*Mylocheilus caurinus*	42	1,466	1,508
Rainbow Trout	*Oncorhynchus mykiss*		426	426
Redside shiner	*Richardsonius balteatus*		0	0
Sand Roller	*Percopsis transmontana*		6,197	6,197
Sculpin	*Cottus sp.*		160	160
Siberian Prawn	*Exopalaemon modestus*		6,634	6,634
Speckled Dace	*Rhinichthys osculus*		0	0
Sucker (misc.)	*Catostomus sp.*	891	8,489	9,380
Sunfish (misc.)	*Lepomis sp.*		943	943
Whitefish	*Prosopium sp.*	49	1,730	1,779
White sturgeon	*Acipenser transmontanus*	19	0	19
Yellow perch	*Perca flavescens*		0	0
Walleye	*Stizostedion vitreum*		0	0
Warmouth	*Lepomis gulosis*		12	12
Total		1,066	32,398	33,464

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. The smolt monitors relate that fish with scale loss less than 20% typically take more time to recover from

exposure to MS-222 than fish with no scale loss. Since 2009, descaling information reflects the changes in condition sampling that occurred in 2009.

Per the Lower Granite smolt monitors the 2013 descaling rate for all species combined was 2.7% compared to 2.6% in 2012 and 2.1% for the 2009-2012 average (Table 10). All species groups descaling rates were higher than the 2009-2012 average. The weekly decaling rates began the season at low levels and stayed at low levels (<2%) through April. In May, weekly descaling rates increased and were highest during the spring migration at 5.1% the week ending May 23, the highest weekly rate in May in the last five years. During June and July when small subyearling fall Chinook dominated the collection, weekly descaling rates were low, similar to previous years. However, during August, September and October weekly descaling rates increased to their highest levels of the season and peaked at 6.8% for the weeks ending September 26 and October 3 (Table 11).

In 2013, descaling rates were higher than average for most of the year and increased significantly during mid-August and remained high through early October. On September 3 Unit #1 was taken out of service for annual maintenance but descaling rates remained high. It was returned to service September 13, earlier than scheduled due to adult ladder fish passage concerns and the need to get adult fish through the fish ladder at LGR. At this time its priority was changed to first on last off to provide adult ladder attraction flow. Trash racks were raked during early September but not much debris was found. From August 10 through September 17, during the powerhouse roof repair (0930-2300 hours) Unit #5 was run for station power only (5 kcfs) and the rest of the water was spilled or stored. When not doing the powerhouse roof repair other units were run and this swapping of Units twice a day could have contributed to the increased descaling rates during August and September. During April, May and June Blue Leaf Environmental did a study on the prototype overflow weir/14 inch orifice which required them to collect fish at the fish facility, hold them overnight, PIT-tag them the next day and then release them directly into the gatewells the following day. Many of these fish were observed in the sample a second time and it is possible that two trips through the system may have contributed to the higher rates of descaling observed this season. Collectively, all of these issues may have contributed to the higher than average descaling rates observed at LGR in 2013.

Table 10. Annual full-sample descaling rates (>20%) by species at LGR, 2009-2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total
2009	2.2	0.7	1.5	1.7	1.2	1.0	1.5	7.4	2.4	1.6
2010	1.4	0.7	0.5	2.4	2.5	1.7	0.0	11.2	0.7	2.0
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
09-12 Ave.	2.3	0.9	1.4	2.4	2.2	1.8	1.4	6.5	1.9	2.1

Table 11. Weekly descaling rates in percent for fish sampled at LGR, 2013

	Yearling Chinook		Subyearling Chinook		Steelhead		Sock/Kokanee		Coho	
Week	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip	All	Total
3/28	1.64	1.37	---	---	0.00	0.00	---	0.00	0.00	1.47
4/04	1.61	1.37	---	0.00	0.00	1.85	---	0.00	0.00	1.42
4/11	1.30	0.97	---	0.00	0.86	1.15	---	---	0.00	1.13
4/18	1.98	2.00	---	---	1.40	0.95	---	---	0.00	1.57
4/25	2.00	1.25	---	---	0.88	1.43	---	0.00	0.00	1.22
5/02	3.30	1.84	---	---	1.75	1.65	---	---	0.00	2.53
5/09	3.32	1.60	---	---	3.23	1.54	---	0.00	0.00	2.94
5/16	4.38	1.59	0.00	0.00	5.32	2.83	1.22	0.00	0.56	3.85
5/23	7.91	1.93	4.76	2.03	7.45	2.36	2.99	10.13	9.84	5.14
5/30	7.41	3.27	5.02	2.81	4.45	3.13	0.00	9.09	5.00	3.86
6/06	2.29	1.87	1.91	1.51	1.74	4.98	0.00	0.00	0.00	1.80
6/13	0.00	0.00	1.53	0.90	2.46	6.12	0.00	---	0.00	1.38
6/20	11.11	0.00	1.40	1.68	0.00	3.70	0.00	0.00	0.00	1.59
6/27	0.00	0.00	0.17	0.67	0.00	4.55	---	0.00	---	0.56
7/04	---	0.00	1.80	0.35	0.00	5.88	---	---	50.00	0.74
7/11	0.00	---	0.93	0.18	0.00	0.00	---	0.00	---	0.26
7/18	---	---	1.59	0.21	0.00	---	---	---	---	0.27
7/25	---	100.00	0.00	0.77	0.00	0.00	---	---	---	0.81
8/01	---	0.00	0.00	0.87	0.00	---	---	0.00	---	0.84
8/08	---	0.00	2.00	1.55	0.00	0.00	---	---	100.0	1.62
8/15	---	---	0.00	3.02	---	---	---	0.00	---	2.94
8/22	---	0.00	8.33	5.46	---	---	---	0.00	0.00	5.49
8/29	---	---	7.32	5.41	---	---	---	50.00	0.00	5.54
9/05	---	0.00	2.38	3.94	---	0.00	---	---	---	3.92
9/12	---	0.00	5.13	4.59	0.00	0.00	---	100.0	---	4.61
9/19	---	---	0.00	5.90	0.00	0.00	---	---	---	5.79
9/26	---	0.00	0.00	6.95	0.00	0.00	---	0.00	---	6.75
10/03	---	0.00	0.00	6.89	---	---	---	3.33	---	6.78
10/10	---	0.00	0.00	4.21	---	0.00	---	7.14	---	4.16
10/17	---	0.00	3.77	4.05	0.00	0.00	---	7.14	---	4.01
10/24	---	0.00	0.00	2.72	---	0.00	---	0.00	---	2.67
10/31	---	0.00	0.00	2.34	---	0.00	---	0.00	---	2.29
#Dsc'd	470	108	195	1,434	359	110	3	17	10	2,706
#Smpl'd	15,195	6,715	9,940	48,597	13,848	4,487	155	229	367	99,533
%Dsc'd	3.09%	1.61%	1.96%	2.95%	2.59%	2.45%	1.94%	7.42%	2.72%	2.72%

Other Injuries and Disease

In addition to standard length, weight and descaling data recorded for individual smolts in the daily subsample, the smolt monitors also examined smolts for visible injuries and symptoms of disease. With the exception of descaling and columnaris, signs of visible injuries or disease are only recorded from the detailed subsample. Injuries in 2009-2013 cannot be directly compared to injuries prior to 2009 due to the changes in the condition sampling program. A total of 25,641 smolts were examined in the detailed subsample during 2013 compared to 27,413 in 2012, 30,720 smolts in 2011, 25,825 in 2010 and 25,217 in 2009. This season a total of 5,285 (20.6%) smolts were recorded as having head, body, predator caused injury or symptoms of disease compared to 4,908 (17.9%) in 2012, 4,105 (13.4%) in 2011, 3,189 (12.3%) in 2010 and 2,944 (11.7%) in 2009. The actual proportion of injured smolts is less than the rates shown because some fish have more than one visible injury.

Head injuries that were associated with dam passage include generic head injuries, eye injuries, opercle injuries and "pop" or bulging eye. Since 2009 mandible and maxillary injuries are not recorded separately from the generic head injury category. Head injuries were recorded on 0.5% of the smolts examined in the detailed subsample in 2013 compared to 0.6% in 2012, 0.5% in 2011, 0.5% in 2010 and 0.6% in 2009. Injuries to the opercula comprised the majority of head injuries (40.2%) followed by eye injuries (35.2%) and generic head injuries (12.3%). Unclipped sockeye had the highest occurrence of head injuries at 1.1% (2 of 188) followed by clipped steelhead at 0.9% (31 of 3,434).

The body injuries associated with dam passage that were recorded by the smolt monitors this season included a generic body injury category and a generic fin injury category. Non-dam passage injuries of body deformity, pink fins and fin discoloration (a distinct line of color differentiation on the caudal fin that may be associated with cold water disease and/or stress) are still recorded while lesions, lacerations and bloated body are not recorded separately. Pink fin is thought to be stress or anesthetic related and may or may not be caused by dam passage. Body injuries were observed on 6.4% of the smolts examined in the detailed subsample in 2013 compared to 5.2% in 2012, 4.3% in 2011, 4.7% in 2010 and 7.4% in 2009. The majority of body injuries observed were pink fin (43.1%) followed by discolored fin (27.5%) and fin injuries (19.6%). Unclipped subyearling fall Chinook exhibited the highest percent of body injuries at 9.4% (1,219 of 12,931) followed by clipped subyearling fall Chinook at 5.3% (113 of 2,122). The rate of body injuries on subyearling fall Chinook during May, June and July was 2.8% (193 of 6,939) compared to 13.3% (1,078 of 8,112) during August, September and October.

Diseases with external symptoms included fungus, columnaris, fin hemorrhage, bacterial kidney disease and parasites. External symptoms of disease were observed on 4.2% of the smolts examined in the detailed subsample this year compared to 4.4% in 2012, 2.1% in 2011, 3.5% in 2010 and 2.8% in 2009. Columnaris comprised the majority of the disease symptoms (56.6%) followed by fin hemorrhages (26.3%) and parasites (9.4%). Symptoms of disease were highest on unclipped subyearling fall Chinook (80.9%), which exhibit the majority of the signs of columnaris. The disease rate on subyearling fall Chinook during May, June and July was 1.1% (75 of 6,939) compared to 10.1% (823 of 8,112) during August, September and October.

The disease columnaris, caused by the bacterium *Flavobacterium columnare*, mainly infects summer and fall migrants because it becomes more virulent when water temperatures exceed 60º F. Warren Groberg, Fish Pathologist for Oregon Department of Fish and Wildlife, visited the LGR Juvenile Fish Facility September 30, 1998 and provided information on external symptoms characteristic of columnaris. Groberg explained that the snout injuries (loss of protective skin tissue) and yellowish blemishes without broken skin were symptoms of *F. columnare* infection. Based on this information, the smolt monitors have classified fish exhibiting these symptoms as infected with columnaris. They do not classify a fish as being infected with columnaris unless there is some tissue loss on the snout or body. Fish with just the red mouth edges are probably infected with columnaris but are not classified as infected unless it involves some tissue loss.

The smolt monitors have recorded the incidence of columnaris since 1996 and since 1999 they have recorded columnaris symptoms based on the entire sample. The columnaris infection rate for the entire sample of subyearling fall Chinook in 2013 was 1.4% (796 of 58,510) compared to 2.1% (1,119 of 53,799) in 2012, 1.1% (440 of 39,375) in 2011, 1.3% (550 of 41,116) in 2010 and 1.0% (313 of 30,223) in 2009. The 2013 columnaris rate is lower than the 1.5% observed for the 2009-2012 average. In most years we do not see our first incidence of columnaris until July, after the majority of subyearling fall Chinook have already passed the project. The columnaris rate on subyearling fall Chinook during May, June and July was 0.09% (25 of 28,437) compared to 2.56% (771 of 30,073) during August, September and October.

Injuries associated with predators include wounds inflicted by other fish, birds, and lamprey. Predator wounds were observed on 0.9% of the smolts examined in the detailed subsample compared to 1.0% in 2012, 0.8% in 2011, 0.8% in 2010 and 1.0% in 2009. Predator marks were highest on clipped sockeye at 4.0% (3 of 75), clipped steelhead at 2.0% (69 of 3,434) and unclipped steelhead at 1.85% (31 of 1,677). 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 (70.6%) compared to 24.4% caused by fish and 5.0% caused by lamprey. Although clipped sockeye exhibited the highest percentage of predator marks by number examined, clipped steelhead and unclipped subyearling fall Chinook had the largest percentage of total predation marks at 31.2% and 24.9% respectively. Normally, the larger clipped and unclipped steelhead smolts have the most predation marks due to bird bites.

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. The overall facility mortality rate this year was 0.10% compared to 0.08% in 2012, 0.09% in 2011, 0.08% in 2010 and 0.12% in 2009 (Table 12). In all, 3,728 facility mortalities were recorded from a total collection of 3,894,569 smolts. The number of facility mortalities and the mortality percentage by species group included: 1,679 clipped yearling Chinook (0.12%), 561 unclipped yearling

Chinook (0.11%), 279 clipped subyearling fall Chinook (0.16%), 818 unclipped subyearling fall Chinook (0.26%), 233 clipped steelhead (0.02%), 66 unclipped steelhead (0.02%), nine clipped sockeye (0.03%), 23 unclipped sockeye/kokanee (0.15%) and 60 coho (0.12%). Facility mortality rates for all species groups were higher than in 2012 except for clipped and unclipped subyearling fall Chinook and unclipped sockeye/kokanee. All species group mortality rates were higher than those observed for the 2009-2012 average except for clipped and unclipped subyearling fall Chinook, clipped sockeye and unclipped sockeye/kokanee.

The facility mortality rate is probably skewed slightly due to an equipment problem discovered June 3 in the sample holding tank. A gap in the bottom of the divider screen allowed fish to become entrained in the space that separates the two sides of the screen. The sides are bolted together to make up the divider screen that separates the two halves of the sample tank. Once in the space between the two screens the fish had no way to escape. These fish were called sample mortalities when they might better have been considered equipment mortalities in the sample tank. The smolt monitors recovered 280 dead fish including eight clipped yearling Chinook, eight unclipped yearling Chinook, 125 clipped subyearling fall Chinook, 131 unclipped subyearling fall Chinook, three clipped steelhead, two unclipped steelhead, one clipped sockeye and two coho. The facility mortality rate would have been 0.09% instead of 0.10% if these mortalities were not included. Weekly facility mortality rates were low during April and May, increased slightly during June and July and did not increase over 1% until the week ending August 29, peaked the week ending September 26 at 2.60% and decreased to the end of the season (Table 13). This trend is similar to what has been observed in previous years.

Table 12. Annual facility mortality in percent at Lower Granite Dam, 2009-2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	All	Total
2009	0.12	0.08	0.68	0.58	0.01	0.01	0.34	0.99	0.22	0.12
2010	0.09	0.06	0.19	0.25	0.02	0.02	0.16	0.18	0.04	0.08
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
09-12	0.09	0.05	0.36	0.37	0.01	0.01	0.18	0.79	0.10	0.09

Sample mortalities include dead fish removed from the sample tank prior to sampling and those from the sorting trough in the sample lab. In 2013, 974 sample mortalities were recorded from a total of 100,673 sampled fish, a mortality rate of 0.97% compared to 858 of 96,491 (0.89%) in 2012, 908 of 79,426 (1.14%) in 2011, 501 of 66,295 (0.76%) in 2010 and 511 of 70,866 (0.72%) in 2009 (Table 14). The number of sample mortalities and percent mortality by species group included: 113 clipped yearling Chinook (0.74%), 61 unclipped yearling Chinook (0.90%), 190 clipped subyearling fall Chinook (1.88%), 550 unclipped subyearling fall Chinook (1.12%), 30 clipped steelhead (0.22%), 10 unclipped steelhead (0.22%), two clipped sockeye (1.27%), 15 unclipped sockeye/kokanee (6.15%) and three coho (0.81%). All species groups sample mortality rates were higher than the 2009-2012 average except for unclipped subyearling

fall Chinook, clipped steelhead and unclipped sockeye/kokanee. The smolt monitors feel the sample mortality rate is skewed due to the equipment design problem discovered June 3 in the sample tank and noted in the facility mortality paragraph. The sample mortality rate would have been 0.69% for the season instead of 0.97% if these fish had not died due to being entrained in the sample holding tank divider screen.

Barge mortalities are salmonids removed from barge holds after the barges depart Lower Granite. In previous years, barge mortalities include mortalities from fish loaded at Lower Granite, Lower Monumental and McNary Dam into barges originating from Lower Granite. No fish were barged from McNary Dam in 2013 and probably will not be in future years due to a regional consensus to stop barge transport at McNary. The total number of smolts barged in 2013 included 3,170,685 fish from LGR, 2,573,039 from LGS and 1,095,459 fish from LMN. The barge mortality rate of 0.06% (4,282 of 6,839,183) is higher than the 0.05% (3,897 of 7,952,371) observed for the 2009-2012 average and is the highest barge mortality rate in the last five years. The barge riders observed and reported a great deal of debris loaded onto the barges from LGS at times, with many of the mortalities from the holds loaded with LGS fish, however we have no way to accurately separate out or assign mortalities between LGR and LGS. Barge mortalities by species included: 2,410 clipped yearling Chinook, 576 unclipped yearling Chinook, 272 subyearling fall Chinook, 637 clipped steelhead, 225 unclipped steelhead, 24 clipped sockeye, one unclipped sockeye/kokanee and 137 coho.

Table 13. Weekly facility mortality in percent by species group at LGR, 2013.

Week Ending	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Total
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	
3/28	0.16%	0.00%	---	0.00%	0.00%	0.00%	---	0.00%	0.00%	0.11%
4/04	0.10%	0.03%	---	0.00%	0.03%	0.00%	---	0.00%	0.00%	0.07%
4/11	0.03%	0.04%	---	0.45%	0.00%	0.01%	---	---	0.00%	0.03%
4/18	0.02%	0.03%	---	0.00%	0.00%	0.01%	---	---	0.00%	0.01%
4/25	0.01%	0.02%	---	0.42%	0.00%	0.00%	---	0.00%	0.00%	0.01%
5/02	0.04%	0.05%	---	0.33%	0.01%	0.00%	---	---	0.00%	0.03%
5/09	0.07%	0.07%	---	0.00%	0.02%	0.01%	---	0.25%	0.00%	0.05%
5/16	0.26%	0.21%	0.13%	0.16%	0.04%	0.02%	0.00%	0.00%	0.15%	0.14%
5/23	0.04%	0.05%	0.40%	0.13%	0.01%	0.00%	0.06%	0.05%	0.04%	0.04%
5/30	0.07%	0.12%	0.17%	0.22%	0.02%	0.01%	0.00%	0.65%	0.34%	0.12%
6/06	0.31%	0.41%	0.28%	0.25%	0.08%	0.06%	2.00%	0.00%	0.34%	0.25%
6/13	0.44%	0.15%	0.06%	0.08%	0.14%	0.04%	0.00%	---	0.00%	0.07%
6/20	1.00%	0.00%	0.13%	0.21%	1.02%	0.25%	0.00%	0.00%	0.00%	0.19%
6/27	0.00%	0.00%	0.04%	0.12%	0.00%	0.24%	---	0.00%	---	0.09%
7/04	---	0.00%	0.15%	0.15%	0.00%	0.59%	---	---	0.00%	0.15%
7/11	0.00	---	0.46%	0.40%	0.00%	0.00%	---	0.00%	---	0.40%
7/18	---	---	0.00%	0.24%	10.0%	---	---	---	---	0.25%
7/25	---	0.00%	0.00%	0.29%	0.00%	0.00%	---	---	---	0.29%
8/01	---	0.00%	0.00%	0.23%	12.50%	---	---	0.00%	---	0.24%
8/08	---	0.00%	0.49%	0.56%	0.00%	0.00%	---	25.00%	0.00%	0.57%
8/15	---	---	0.00%	0.84%	---	---	---	0.00%	---	0.82%
8/22	---	0.00	2.70%	0.69%	---	---	---	20.00%	0.00%	0.78%
8/29	---	---	0.00%	1.21%	---	---	---	20.00%	0.00%	1.23%
9/05	---	11.11%	0.00%	0.88%	---	0.00%	---	---	---	0.89%
9/12	---	---	0.00%	0.78%	0.00%	0.00%	---	25.00%	---	0.78%
9/19	---	---	0.00%	2.00%	0.00%	0.00%	---	---	---	1.96%
9/26	---	0.00%	0.00%	2.50%	0.00%	0.00%	---	25.00%	---	2.60%
10/03	---	0.00%	0.00%	1.55%	---	---	---	11.76%	100.0%	1.80%
10/10	---	0.00%	0.00%	0.40%	---	0.00%	---	6.67%	---	0.50%
10/17	---	0.00%	3.64%	0.45%	0.00%	0.00%	---	6.67%	---	0.52%
10/24	---	0.00%	0.00%	0.18%	---	0.00%	---	8.33%	---	0.19%
10/31	---	0.00%	0.00%	0.06%	---	0.00%	---	25.00%	---	0.09%
# morts	1,679	561	279	818	233	66	9	23	60	3,728
# collected	1,362,720	502,542	173,989	319,566	1,058,688	386,214	27,395	15,377	48,078	3,894,569
% mortality	0.12%	0.11%	0.16%	0.26%	0.02%	0.02%	0.03%	0.15%	0.12%	0.10%

--- no fish sampled

Table 14. Annual sample mortality in percent at LGR, 2009-2013.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip	All	Total
2009	0.77	0.61	1.10	1.05	0.18	0.05	2.19	6.92	0.90	0.72
2010	0.48	0.32	0.90	1.02	0.21	0.06	0.00	3.33	0.34	0.76
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
09-12	0.73	0.58	1.11	1.20	0.24	0.16	0.93	7.77	0.62	0.89

The mortality rate for all fish trucked from LGR in 2013 was 0.24% (98 of 41,192) compared to 0.28% for the 2009-2012 average. This is the lowest truck mortality rate in the last five years and also was the seventh consecutive year of no early season trucking from LGR. Every other day trucking began August 18 and ended October 31, the last day of the 2013 season. The truck mortality number and percent by species included: one unclipped yearling Chinook (0.77%), 93 unclipped subyearling fall Chinook (0.23%) and four unclipped sockeye/kokanee (3.57%). On September 5-9 (three trips), October 1 and October 7 the Lower Granite truck transported the Little Goose Fish Facility smolts. The smolts transported from LGS were not used to calculate trucking mortalities in order to have a direct comparison between years. Trucks originating from LGR transported 8,387 smolts from the LGS fish facility and these included: 1 unclipped yearling Chinook, 120 clipped subyearling fall Chinook, 8,259 unclipped subyearling fall Chinook, one unclipped steelhead, two clipped sockeye and four unclipped sockeye/kokanee. If the LGS transported fish are used to calculate trucking mortality the overall rate would be 0.20% instead of 0.24%. The truck drivers noted that they thought most of the mortalities that occurred during the September trips with the Little Goose fish were from the Little Goose fish because of the large amount of debris that was loaded onto the trucks at LGS.

Gas Bubble Trauma Monitoring

The smolt monitoring personnel conducted once a week examinations from April 9 through May 28. Up to 100 smolts were dip netted from the separator and examined for symptoms of Gas Bubble Trauma (GBT). GBT staff examined 744 smolts including 288 clipped yearling Chinook, 133 unclipped yearling Chinook, 256 clipped steelhead and 67 unclipped steelhead. Fifty-five PIT-tagged smolts were handled, not examined and returned to the separator including 24 clipped yearling Chinook, one unclipped yearling Chinook, 27 clipped steelhead and three unclipped steelhead. Prior to April 27 smolts examined for GBT were released in the sample recovery tank and bypassed. Smolts examined for GBT from April 27 on were returned to the raceways and transported. A total of 300 examined smolts were bypassed including 145 clipped yearling Chinook, 68 unclipped yearling Chinook, 79 clipped steelhead and eight unclipped steelhead. A total of 444 examined smolts were transported including 143 clipped yearling Chinook, 65 unclipped yearling Chinook, 177 clipped steelhead and 59 unclipped steelhead. No fish were observed with symptoms of gas bubble trauma at Lower Granite Dam this season.

Gatewell Dipping

Some of the ESBS fish screens in use at Lower Granite were found to be damaged during the 2012 season and the project was able to procure replacement screens from John Day Dam. There were some differences in the screen design and the replacement screens were slightly modified. Before using the screens in all slots it was necessary to do some preliminary testing. Initially a fish screen from John Day Dam was put into slot c of Unit #6 (6c). The John Day fish screen has 1/16 inch spacing compared to 1/8 inch spacing on the LGR fish screens. Because of this and due to concerns with the harmonics of the John Day screen modifications were done to the top three rows of perf plates behind the screen (bigger holes). COE and SMP personnel dipped all three gatewell slots on May 9, May 16 and May 23 to evaluate descaling on the spring run salmonids. The goal was to look at 100 smolts from each gatewell on each day. In gatewell slot 6a, 296 fish were examined with nine descaled for a descaling rate of 3.04%. In gatewell slot 6b, 310 fish were examined with 14 descaled for a descaling rate of 4.52%. In gatewell slot 6c, 200 fish were examined with four descaled for a descaling rate of 2.00%. To analyze further, data in gatewell slot 6a and 6b were added together since both of these slots had LGR fish screens and compared to slot 6c data with the modified John Day fish screen. The overall descaling rate for slots 6a and 6b combined was 3.80% compared to 2.00% in slot 6c. Gatewell 4c was dipped on May 23 for a direct comparison between the two types of fish screens in the same slot in different turbine units but only five fish were captured and none were descaled.

Since the results of the gatewell dipping descaling data from Unit #6 did not show an increase in descaling in slot 6C with the modified John Day fish screen for spring run fish we installed the modified John Day fish screens in the b and c slots of Unit #3 to evaluate descaling on subyearling fall Chinook. All three slots in Unit #3 were dipped on June 27, July 2 and July 18 with the goal to examine 35 fish in each slot. We had a more difficult time catching the required number of fish in each of the slots and especially in slot 3c. In gatewell slot 3a, 96 fish were examined with five descaled for a descaling rate of 5.21%. In gatewell slot 3b, 92 fish were examined with two descaled for a descaling rate of 2.17%. In gatewell slot 3c, 18 fish were examined with none descaled. To analyze further, data in gatewell slot 3b and 3c were added together since both of these slots had modified John Day fish screens and compared to slot 3a data with the LGR fish screen. The overall descaling rate for slots 3b and 3c combined was 1.82% compared to 5.21% in slot 3a. All three gatewell slots in Unit #2 were dipped on July 2 and July 18 to allow for a direct comparison between the b and c slots, with and without the John Day fish screens. In gatewell slot 2b, 56 fish were examined with two descaled for a descaling rate of 3.57% while the descaling rate in slot 3b was 2.17%. In gatewell slot 2c, 40 fish were examined for descaling with one descaled for a descaling rate of 2.50% while the descaling rate in slot 3c was 0.00%. To analyze further, data in slots b and c were combined for Unit 2 with LGR fish screens and for Unit 3 with John Day fish screens. The overall descaling rate for slots 2b and 2c combined was 3.13% compared to 1.82%. In general, the data seems to show that descaling is less in the gatewell slots with the John Day fish screens.

Research

During 2013 twelve entities conducted eight research projects that impacted an estimated 458,554 smolts at Lower Granite. By comparision 548,206 smolts were impacted by research projects in 2012, 602,405 in 2011, 546,340 in 2010, and 750,823 smolts in 2009. The 458,554 smolts taken from the collection included 160,191 clipped yearling Chinook, 42,260 unclipped yearling Chinook, 45,839 clipped subyearling fall Chinook, 54,010 unclipped subyearling fall Chinook, 122,966 clipped steelhead, 27,965 unclipped steelhead, 1,030 clipped sockeye, 717 unclipped sockeye/kokanee, 1,996 coho and 1,580 lamprey. In addition, the University of Idaho, Nez Perce Tribe (NPT) and Columbia River Intertribal Fisheries Commission (CRITFC) continued a study on adult steelhead fallbacks which impacted 377 clipped, 21 fin eroded and 561 unclipped steelhead kelts.

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

NMFS marking crews handled 378,783 smolts for this study. These fish are part of the long term transportation evaluation study and were tagged throughout the spring and summer migration from April 26 to June 15. The NMFS crew PIT-tagged and transported 35,342 smolts; 12,561 unclipped yearling Chinook, 7,955 clipped steelhead and 14,826 unclipped steelhead. Unclipped yearling Chinook less than 124 mm fork length were used for this study to target wild Chinook and unclipped steelhead tagged do not include fin eroded fish, to target wild steelhead. Tagged fish were held over night prior to being loaded onto barges for transport. This year 343,420 smolts were handled, not tagged and transported. These included 148,761 clipped yearling Chinook, 16,423 unclipped yearling Chinook, 33,052 clipped subyearling fall Chinook, 52,366 unclipped subyearling fall Chinook, 85,317 clipped steelhead, 3,782 unclipped steelhead, 1,027 clipped sockeye, 716 unclipped sockeye/kokanee and 1,976 coho. Twenty-one smolts died before they were tagged and included: 17 clipped yearling Chinook, three unclipped yearling Chinook and one clipped steelhead. All of the smolts handled and tagged for this study were collected in the east raceways and tagged in the NMFS marking trailer adjacent to the east raceways.

NMFS-Study to Estimate Juvenile Salmonid Reach Survival

This is a long term study conducted to evaluate the in-river survival of juvenile salmonids bypassed into the tailrace at LGR. This study was done in conjunction with the NMFS Transportation Evaluation study from April 26 to June 15 and NMFS personnel handled 36,548 smolts for this study. This year 36,507 fish were PIT-tagged and bypassed and included: 11,545 unclipped yearling Chinook, 17,424 clipped steelhead and 7,538 unclipped steelhead. Forty-one fish died after being PIT-tagged including 27 unclipped yearling Chinook, eight clipped steelhead and six unclipped steelhead.

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

This study is done to monitor the migration behavior and survival of wild spring/summer Chinook salmon in the Snake River basin. The specific goals are to characterize the migration timing and estimate parr-to-smolt survival to LGR of different wild Chinook populations as they

migrate from their natal rearing areas and determine migration patterns and what environmental factors influence those patterns. Fish were PIT-tagged during the summer of 2012 in natal streams and were diverted to the SBC tanks at LGR. From April 8 to June 11. NMFS personnel handled 189 salmonids for this study and bypassed 154 target PIT-tagged, unclipped yearling Chinook. Another 14 non- PIT-tagged fish were handled and bypassed including five clipped yearling Chinook, two unclipped yearling Chinook, one clipped subyearling fall Chinook, five clipped steelhead and one unclipped steelhead. Twenty-one previously PIT-tagged non-target fish were handled and bypassed including four clipped yearling Chinook, eight unclipped yearling Chinook, one clipped subyearling fall Chinook, one unclipped subyearling fall Chinook, two clipped steelhead, four unclipped steelhead and one unclipped sockeye.

Blue Leaf Environmental/Biomark/UC Davis LGR Juvenile Fish Collection Channel Prototype Overflow Weir and Enlarged Orifice Biological Evaluation

During the winter of 2012-2013 a broad crested overflow weir and 14-inch diameter orifice were installed in gatewell 5A of the juvenile fish collection channel in order to test whether these structural modifications would reduce passage delays and increase survival of fish through the upper portion of the LGR Juvenile Bypass System (JBS). The goal of the study is to assess the biological and debris passage characteristics associated with each style of passage structure (unmodified 10-inch orifice, 14-inch orifice, and "broad crested" overflow weir). Due to concerns with the outflow hitting a support beam, the 14 inch orifice was modified with a 20 degree mitered bend to direct flows more downward into the collection channel on April 22. Results of this study will be used to determine which type of structure warrants installation in the future Lower Granite facility upgrade.

The juvenile salmonids used for this study came either from the PSMFC sample or the NMFS marking trailer. From either collection source the fish were held overnight, PIT-tagged the following day, held overnight again, and released into gatewell 5A, 5B or directly into the orifice gallery channel. Lamprey used in this study came from the raceways at Lower Granite, Little Goose, and Lower Monumental. Most were obtained from the raceway head boxes at Lower Granite. From April 15 to June 22 this study impacted 41,873 fish including 37,989 given to the researchers directly and another 3,884 fish that were collected incidentally to their research in the SBC tanks. A total of 12,247 fish were released into Gatewell 5b (unmodified 10 inch orifice) including 3,946 clipped yearling Chinook, 3,900 clipped subyearling fall Chinook, 4,090 clipped steelhead and 311 lamprey. A total of 11,649 fish were released directly into the collection channel including 3,501 clipped yearling Chinook, 3,746 clipped subyearling fall Chinook, 3,809 clipped steelhead and 593 lamprey. A total of 6,906 fish were released into Gatewell 5a (overflow weir) including 1,979 clipped yearling Chinook, 2,727 clipped subyearling fall Chinook, 2,097 clipped steelhead and 103 lamprey. A total of 6,146 fish were released into Gatewell 5a (14 inch orifice) including 1,827 clipped yearling Chinook, 1,839 clipped subyearling fall Chinook, 2,062 clipped steelhead and 418 lamprey. Forty-two clipped yearling Chinook, six clipped steelhead and two lamprey were rejected and released to the tailrace. A total of 746 fish were rejected and transported including 63 clipped yearling Chinook, 542 clipped subyearling fall Chinook and 141 clipped steelhead. One hundred and fifty lamprey were released directly to the separator. A total of 47 fish died before being PIT-tagged including four clipped yearling Chinook, ten clipped subyearling Chinook and 33 clipped steelhead. A total of 48 fish died after being PIT-tagged including 27 clipped yearling Chinook

and 21 clipped subyearling fall Chinook.

The second part of this study entailed recapturing some of the fish released into the JBS in the SBC tanks and examining them for injuries, descaling etc. that could be attributed to passage through the JBS. A total of 13,507 target fish were recaptured in the SBC tanks including 4,109 clipped yearling Chinook, 4,584 clipped subyearling fall Chinook, 4,742 clipped steelhead, one unclipped steelhead and 71 lamprey. A total of 3,884 fish were incidentally caught in the SBC tanks while sampling for their study fish including 1,572 clipped yearling Chinook, 293 unclipped yearling Chinook, 504 clipped subyearling fall Chinook, 78 unclipped subyearling fall Chinook, 1,192 clipped steelhead, 215 unclipped steelhead, seven clipped sockeye, three unclipped sockeye/kokanee and 20 coho. Of the 3,884 fish incidentally caught in the SBC tanks, 1,386 were previously PIT-tagged fish for other research purposes and these included 516 clipped yearling Chinook, 52 unclipped yearling Chinook, 415 clipped subyearling fall Chinook, three unclipped subyearling fall Chinook, 374 clipped steelhead, 25 unclipped steelhead and one coho.

United States Fish and Wildlife Service (USFWS), United States Geological Service (USGS), Battelle, University of Washington and National Marine Fisheries Service (NMFS) –Holdover Fall Chinook Study

This study is part of the regional discovery based research titled "Investigating passage of ESA-listed fall Chinook salmon at Lower Granite Dam during winter when the fish bypass system is not operated". This is a cooperative study of the survival and prevalence of the reservoir-type life history of juvenile fall Chinook salmon in the Snake River and the passage of subyearlings and reservoir-type fish through the lower Snake River. This part of the study collected PIT-tagged yearling fall Chinook holdovers from the 2012 release of Dworshak hatchery fish in the SBC tanks at LGR during their April and May out-migration. This season, NMFS personnel sampled and bypassed 40 yearling fall Chinook holdovers. There were 10 not PIT-tagged bycatch fish bypassed from the SBC tanks including six clipped yearling Chinook, three unclipped yearling Chinook and one clipped steelhead. Four non target, previously PIT-tagged fish were bypassed including one clipped yearling Chinook, one unclipped yearling Chinook and two clipped steelhead.

Idaho Fish and Game (IDFG)-Genetic Stock Identification

The goal of this study is to develop fine-scale genetic profiles for natural origin salmon and steelhead, develop genetic stock identification (GSI) techniques to estimate stock-specific escapement over LGR, 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 was to enumerate and characterize the natural production of spring/summer Chinook salmon and steelhead above LGR with regards to age composition and genetic stock identification. Scales, fork lengths and genetic samples were taken from fish in the sample from March 26 to July 5. IDFG and NMFS personnel handled 4,935 smolts during this study. A scale sample and a fin clip was taken from 1,807 non-fin eroded, unclipped steelhead, 140 non-CWT, unclipped yearling Chinook and 60 non-CWT, unclipped subyearling fall Chinook. A fin clip only was taken from 1,345 non-CWT, unclipped yearling Chinook and 1,583 non-CWT, unclipped subyearling fall Chinook. From March 26 to April 27, IDFG sampled 271 unclipped steelhead without fin erosion and 690 unclipped yearling

Chinook without a CWT that were bypassed to the river along with the rest of the sample fish. After April 27 the IDFG study fish were transported along with the rest of the sample fish including 795 unclipped yearling Chinook without a CWT, 1,643 unclipped subyearling fall Chinook without a CWT and 1,536 unclipped steelhead without dorsal fin erosion. This season SMP personnel asked IDFG to scan all unclipped steelhead for a CWT. Only one of 1,808 unclipped steelhead had a CWT that could not be identified as a hatchery fish by dorsal fin erosion.

Univ. 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

The goal of this research project is to study the physiology and endocrinology of steelhead kelts to evaluate the feasibility and success of several strategies for rehabilitating and handling of adult steelhead kelts captured at LGR. This project is a collaborative study to investigate approaches to increase adult steelhead returns by utilizing the kelt life stage. Steelhead kelts were diverted from the separator by COE technicians from April 7 to June 20. NPT/CRITFC personnel impacted 959 steelhead kelts during this study including 377 clipped, 21 unclipped, fin eroded and 561 unclipped steelhead kelts. Kelts that were PIT-tagged, genetic sampled and returned to the tailrace included 366 clipped, 20 unclipped fin eroded and 441 unclipped steelhead kelts. Another 113 kelts including one unclipped fin eroded and 112 unclipped steelhead kelts were collected for transport to Dworshak National Fish Hatchery. Four clipped and two unclipped steelhead kelts were handled and bypassed. Seven clipped and six unclipped steelhead kelts died in the tank before handling by NPT/CRITFC personnel. Also, 18 smolts were incidentally sent to the kelt tanks including three clipped and three unclipped yearling Chinook and ten clipped and two unclipped steelhead. The smolts were all collected after the start of general transport so they were put into a raceway to be transported. NPT/CRITFC personnel gave Battelle researchers 151 clipped, six fin eroded and 165 unclipped steelhead kelts after they were done sampling the kelts for Battelle to acoustic tag and release to the river. Since these fish were sampled by both groups they are included in the above totals and separately in the Battelle research summary.

Battelle-Steelhead Kelt Passage Distributions and FCRPS Survival and Return Rates for Fish Tagged above and at LGR

The goal of this study is to estimate steelhead kelt (*Oncorhyncus mykiss*) returns to LGR by passage route and estimate reach survival to the estuary. Results should help managers assess the efficiency and effectiveness of available routes for passing kelts through FCRPS dams. From April 12 to June 17 Battelle researchers acoustic tagged and released to the river 319 steelhead kelts including 148 clipped, six fin eroded and 165 unclipped steelhead kelts. These fish were first sampled by NPT/CRITFC researchers and then given to Battelle for acoustic tagging. Three clipped steelhead kelts died after sampling by Battelle.

Facility Operations and Maintenance

Turbine Operations

During 2013, turbine units 1-6 were unavailable for service a total of 11,327.8 hours per the Ombil status hours database. Given a possible 52,560 operating hours for all six units over the course of a 365 day year this computes to an overall unit availability factor of 78.4%. The 2013 availability factor on a per unit basis was: turbine unit 1 (89.8%), turbine unit 2 (79.1%), turbine unit 3 (89.3%), turbine unit 4 (84.8%), turbine unit 5 (60.0%), and turbine unit 6 (67.8%). The biggest outage factor for all the units was the extensive powerhouse roof repair work which took place in August and September and resulted in minimal generation during that time period. Some other major outage items on a per unit basis are as follows: Unit 1 was out of service 242.15 hours for annual maintenance and 73.67 hours for vibration testing. Unit 2 was out of service 1,345.47 hours for a six-year overhaul. Unit 3 shows 582.35 hours of outage for annual maintenance. Unit 4 was out of service 583.00 hours of annual maintenance and 189.15 hours for governor problems. Unit 5 had 2,411.12 hours of outages for cavitation repair and a combined total of 610.37 hours for annual maintenance. Unit 6 (limited Ombil entries) was out of service from June 24 through December 31 for cavitation repair followed by annual maintenance.

The majority of fish-related outages were due to fish screen installation and removal activities and video inspections of the VBSs and ESBSs. To determine the outage hours the Ombil Data base was queried for the 1 January to 31 December 2013 time period. Unit 1 had a total of 157.9 hours of fish-related outages. The biggest factors were moving an ESBS to unit 2B and VBS repair work in the B-South slot. Unit 2 had a total of 38.8 hours of fish-related outages and the biggest factor was 20.1 hours related to ESBS problems in slot 2B. Unit 3 had a total of 72.9 hours of fish-related outages and ESBS problems in April were the biggest factor followed by ESBS slot troubles in slot 3B later in the season. Turbine unit 4 had a total of only 23.1 hours of fish-related outages. The biggest listed factor was ESBS installation in March. Per Ombil unit 5 had only 12.3 hours of fish outages and VBS inspection/slip ring cleaning was the biggest factor listed. Unit 6 is said to have had 533.7 hours of fish-related outages with ESBS removal between 11 April and 2 May accounting for nearly all the hours.

Other items that accounted for the Ombil fish-related outages during 2013 including monthly VBS inspections, gatewell dipping to determine if modified ESBSs from John Day Dam descaled fish at a greater rate than the standard ESBSs, moving ESBSs from one slot to another, and correcting ESBS scrub brush problems. Trash rack raking on the units took place in late February and a total of 29.0 Ombil-listed hours of raking took place (these hours were not included in fish-related outages).

Forebay Debris/Trashracks

Forebay debris during the 2013 season was relatively light due to lower than average flow conditions. Initial trash rack raking operations were completed February 25-28, 2013. A debris spill to clear debris from the forebay was authorized and took place on March 12. During most of the season forebay debris levels were moderate and debris drifted back and forth with the wind. Due to concerns with elevated descaling rates in the lab during August the Unit 2 and Unit 5 trashracks were raked on August 27 and a fair amount of "Christmas Tree Like" debris was removed from the trash rack in front of gatewell slot 5B. Due to continued high descaling rates, it was recommended that the powerhouse also pursue raking the trash racks on units 1, 3, and 4 before the completion of the powerhouse roof repairs. Additional trash raking operations took place on September 10 and the trashracks on units 1, 3, and 4 were raked. Some light debris was removed with the highest concentration found in front of gatewell slot 4B. No further trash rack raking took place during 2013.

Removable Spillway Weir

The removable spillway weir was operated as an integral part of the spring spill program beginning at 0001 hours on April 4 and running through 2400 hours on June 20. The spill level during this time period was a mandated 20 kcfs 24 hours per day. From 0001 hours on June 21 through 2400 hours on August 31 the RSW was operated as part of the summer spill program. The spill level during this time period was a mandated 18 kcfs 24 hours per day dependent on flow conditions and unit operation.

Extended-length Submersible Bar Screens (ESBSs)

All operating turbine units were equipped with ESBSs during the 2013 fish passage season. Winter maintenance of the screens by the powerhouse mechanics was ongoing in late February and early March. A physical inspection of the screens was conducted by fish facility personnel in mid March - immediately prior to installation. No significant problems of any kind were detected. Installation of fish screens in all operating units (Units 1,2,3,4,6) was completed on March 18-20. The screens were then operated throughout the 2013 season according to established protocols. Due to very cold weather conditions, the last of the screens were raised for the season on December 4-5.

During routine examination of the fish screens in September and October of 2012 it was determined that Lower Granite's ESBSs were bent in several units. Damaged fish screens were found in slots 1C, 2B, and 5C. Lower Granite was eventually able to acquire replacement ESBS screens from John Day Dam. The John Day screens were slightly different from the ESBSs in long-term use at Lower Granite due to having 1/16 inch spacing compared to 1/8 inch spacing on the standard screens in use at Lower Granite. Because of this and due to concerns with the harmonics of the John Day screens, the existing holes in the top three rows of perf plates behind the John Day screens were enlarged. Concerns developed regarding the use of John Day screens at Lower Granite and their possible impact on fish condition. As a result testing was conducted

in 2013 (see Gatewell Dipping section).

Every attempt was made to conduct video inspections of the ESBSs during the course of the fish season as outlined in the Fish Passage Plan. While it is possible to get a good view of the VBSs with the existing video equipment, it is more difficult to get an accurate assessment of the ESBSs due to the limited amount of screen area detectable on the camera. Video inspections took place April 19-20, May 17-18, June 14-15, August 23, and October 25-26. No problems with the ESBSs were detected on these inspections. (Per the Fish Passage Plan, it is not necessary to conduct video inspections during July and September.)

Operation of the standard ESBSs was relatively trouble-free during the 2013 season at Lower Granite (probably due to 2013 being a low flow year with reduced debris). Nevertheless there were a couple of ESBS issues that developed. On April 3 a failed transducer on the ESBS in slot 3B caused a unit outage of approximately one day. On May 20 a failed fish screen in slot 2B caused an outage of approximately one day which was resolved by replacing the failed screen with a replacement screen from unit 1.

All ESBSs at Lower Granite are equipped with a brush cleaning system which can be adjusted for various cleaning cycles. Lower Granite's scrub brushes can be individually set to clean the screens at the following interval times: 15 minutes, 1 hour, 2 hours, and 4 hours. During most of 2013 the brush cleaning times on all ESBSs were set for one cycle every hour. There were relatively few issues with the scrub brushes during 2013.

Vertical Barrier Screens (VBSs)

New vertical barrier screens (VBSs) were installed in all turbine units during 1996. These screens have panels of plastic mesh on the front and 25% open area perforated plate on the back. In April of 2005, three experimental VBSs were installed in unit 4 and these screens remained in place during the entire 2013 fish season. Minor problems (missing rivets or loose straps) have been detected on VBS video inspections in recent years but a tight schedule for the mechanical crew has made correcting these minor problems difficult. VBSs were video inspected in conjunction with ESBSs during the 2013 fish passage season. There were a few minor items found but nothing of real concern until the October 25-26 video inspection when a large tear was found in a VBS in slot 1B about 50 feet down. The tear was quickly repaired by the mechanical crew during the October 29 – November 1 time period.

Gatewells

Gatewells were inspected during adult fishway inspections throughout the 2013 season for debris buildup, oil, dead fish, unusual concentrations of live fish, or anything else out of the ordinary. As in previous years, extended length bar screens and modified vertical barrier screens noticeably increased the turbulence in the gatewells. This caused debris to tumble around in the gatewells and exit through the orifices, rather than accumulate on the gatewell surfaces. Another factor in the lack of gatewell surface debris buildup was that gatewell drawdown with ESBSs

was greater than with the earlier 20 foot traveling screens, putting the orifice closer to the surface, especially under minimum operating pool conditions. As was the case from 1998 - 2012, constant debris movement through the orifices prevented the need for extensive gatewell cleaning during 2013. In addition, since 2013 was a relatively low flow year, there was not as much debris moving through the system as in some recent years.

Some larger debris was removed from individual gatewell surfaces with a small hand dipping basket when it appeared that it might cause problems with movement through the collection gallery orifices. This operation first took place during initial water-up in late March and continued throughout the season as circumstances warranted. Gatewell trash dipping took place only when the units were shut down for maintenance or were off line due to lack of water for generation. During nearly all of the 2013 collection season, surface debris coverage on the gatewells easily averaged less than 1%.

Orifices and Collection Channel

The Lower Granite juvenile collection channel was watered up on March 18, 2013 to accommodate fish screen installations. Bulkhead (downstream) slot orifices were operated in the usual manner during 2013 with at least one orifice per gatewell slot opened to divert fish into the collection channel. Based on gatewell dipping results from 2007, an orifice from slot 5B was also left open during the entire 2013 fish collection season to ensure fish moved out of it safely. Orifices from the other fish screen slots were operated when hydraulic conditions in the gallery permitted.

A prototype broad crested weir and a prototype 14-inch orifice were installed in gatewell slot 5A during the winter of 2012-2013 and tested during the spring/summer of 2013. Biological evaluation of these structures were conducted from April 15 – June 30, 2013 by personnel from UC Davis, Biomark, and Blue Leaf Environmental. Due to problems with the outflow hitting a support beam, the 14-inch orifice was modified on April 22 and fitted with a 20-degree mitered bend which deflected the outflow downward into the collection channel flow. In addition, the north makeup water valve in the collection channel was closed during testing and the south makeup water valve was adjusted to maintain the channel elevation at between 727 and 728 feet which also helped prevent outflow from the orifice from striking the support beam.

The air backflush orifice cleaning system continued to work reasonably well during 2013 and there were no significant maintenance issues of any kind. Due to the variability of the debris moving through the system, fish facility personnel maintained a rigorous schedule of backflushing orifices every three hours around the clock from late March through the cessation of fish collection activities on the last of October. After that time, orifice flushing activities were slightly reduced but still maintained on a regular basis to ensure no orifices were plugged and impeding fish passage. This operation continued until the last of the fish screens were pulled on December 4-5. *Note: The fish screens were removed earlier than normal in 2013 due to very cold weather conditions developing earlier than normal. As soon as possible, the orifices in the collection gallery were also closed. The fish facility was beginning to freeze up and continued operations would likely have resulted in severe frost damage.*

Primary Dewatering Structure

Lower Granite's primary dewatering structure consists of an inclined screen of stainless steel mesh, supported by heavy bar screen, just upstream from the porosity control perforated plate for the separator. There is no mechanical cleaning device on this screen. It is cleaned with a long handled brush or scraper at periods ranging from every hour to once or twice per day dependent on the amount of debris moving through the system. Debris buildup is usually not a problem. Exceptions are during periods of high wind when tumbleweed and other plant materials are blown into the river or during periods of high river flow when an excessive amount of small woody debris, such as wood chips or pine needles, is in the river. Debris spills can also dislodge fine material which can pass into the juvenile fish system and cause problems. In addition small invertebrates in the river can also plug the screen and make cleaning very difficult. During mid to late May 2013, debris levels across the separator were quite high at times resulting in the need to manually clean the screen on a twice hourly basis to prevent clogging.

When the inclined screen on the separator system becomes severely clogged with debris, it is necessary to go into primary bypass mode by closing the dewatering valve below the screen and opening the 72-inch bypass valve. This takes pressure off the top of the inclined screen and allows debris to either float off or be brushed off. Typically it takes about 20 - 30 minutes of time to go through the entire cleaning procedure during which time fish are bypassed back to the river through the pipe at the base of the separator (primary bypass). During 2013 it was necessary to dewater the separator on six different occasions to clean the inclined screen due to debris impingement. Cleaning events took place on May 15 (twice), May 16, May 17 (twice) and on September 15. Cleaning was done with a combination of power-washing and brushing the loose debris up the screen where it could be placed in trash baskets for removal. Cleaning the inclined screen is often a compromise as drawing the water down on the screen far enough to clean it results in a loss of water to the fish facilities. Consequently, cleaning is nearly always a hurry up event in attempt to clean enough to solve the problem and at the same time avoid a fish loss.

Due to continued concerns with cleaning the inclined screen (and two separator technician injuries associated with hand brushing the screen during 2013) an air-burst cleaning system is being installed during the 2013-2014 winter outage period. The air supply will be from an accumulator tank which will be charged with the existing facility air compressors. Two air burst panels will be utilized and a sustained air burst of several seconds should be possible. Hopefully this will greatly reduce the need to dewater the inclined screen for cleaning purposes. In addition, a new primary dewaterer upstream of the facility will be installed during the Phase 1 fish facility construction which will be equipped with cleaning systems which should greatly reduce the need for hand cleaning by maintenance and separator personnel.

Separator

The separator at Lower Granite is a single stage separator and currently has no provision for size separation of juvenile fish. The separator continued to function well for the most part during the 2013 season. Fluctuating water levels in the collection gallery caused very frequent adjustment of the 42-inch control valve early in the season. Some of this was due to the testing of the 14-inch orifice and the prototype weir in the collection gallery. The south shore makeup water valve in the gallery is set to control the gallery within a certain range and did not always adjust properly in relation to the operation of these structures and this was reflected downstream at the separator. Later in the season the south shore makeup water valve became clogged with debris and was manually locked out for the duration of the season. Water levels in the gallery then varied with the forebay elevation and required frequent adjustment of the gallery orifices to keep the gallery at the proper level. This also resulted in the need to adjust the 42-inch separator valve on a frequent basis.

While 2013 was a relatively light debris year, there were still a few periods of time when high levels of debris became an issue at the separator. The increasing debris gradually plugged the inclined screen resulting in the need to adjust the 42-inch dewatering valve to reduce the water flow off the inclined screen and into the separator. Debris also became an issue after it passed through the separator bars and reached the separator exits. When debris became an issue the separator exits and bar screen dewaterer were checked on an hourly basis by the separator technicians. Descaling of juvenile fish became quite severe during late August and September of 2013 and the JFF staff became very concerned that some descaling might be taking place in the separator system. Consequently the water level was lowered in the separator on several occasions and the separator bin area checked to see if debris had built up to any extent. A few sticks were removed each time but nothing to the extent that would have caused the descaling in the lab being seen at the time.

As has been the case during recent years, during 2013 small Chinook jacks caused some problems by falling through the separator bars and ending up in the sample. This is especially problematic because the jacks tend to thrash around quite a bit while being anesthetized and can potentially injure the much smaller juvenile fish in the anesthetizing bins. In addition, jacks could potentially be caught by anglers soon after release and should not be consumed early on due to the possible latent effects of MS-222. In order to prevent jacks from entering the sample, an additional set of separator bars with a smaller spacing were place on top of the existing separator bars on the morning of September 25. These bars were removed after the end of fish collection and sampling activities after the system had been switched back to secondary bypass mode. The additional bars measure 1 inch in diameter, are constructed of rigid wall aluminum tubing, and are spaced approximately 1 1/16 to 1 1/8 inches apart. They are built in three full length panels and secured in place overlaying the existing separator bars. These bars were effective in keeping nearly all the jacks out of the sample in 2013 and generally required little maintenance. The only item of real concern was that on occasion some debris did become entrained between the jack bars and regular bars. This required the short term removal of a section of jack bars to remove the debris.

As in recent seasons the separator was also operated in the standard mode (water over the

bars) to monitor for late season PIT-tagged juveniles passing through the system in November and December of 2013. (Unlike some other sites, Lower Granite does not have a full flow bypass with PIT-tag detection for juvenile fish. PIT-tag detection of juveniles normally ceases with the end of separation activities on the last of October.) No sampling or handling of juvenile fish took place during the extended separator operations. They were simply routed through the separator and out the long bypass pipe back to the river (secondary bypass) until the afternoon of December 5 when the juvenile collection system was dewatered for the season due to very cold temperatures and the high possibility of frost damage at the JFF. The JFF maintenance crew kept electric/diesel heaters available for use at the separator and other exposed pipe areas during November and early December. Separator personnel started the heaters whenever overnight temperatures dropped to the mid 20F and concerns developed with pipes freezing. Due to colder than normal temperatures, the diesel heaters were run on several occasions during November and early December.

Sample System/PIT Tag System

The sample system at Lower Granite consists of two slide gates located in the bottom of the separator exit flumes a few feet downstream of the separator, a large slide gate which separates PIT-tagged fish from sample fish, a PIT-tag tank and routing system to a holding tank or the river, a sample tank with four operational 4-inch counter tunnel exits, an enclosed pipe that carries fish from the sample tank to a sample holding tank which is divided into two equal halves (each with two pre-anesthetizing chambers). The two primary slide gates, which are controlled by a touch pad calibrated to within 0.001%, also act as PIT-tag diversion gates. The system has the capability to send PIT-tagged fish that exit the separator during a sample either to the sample or to the river. Most of the time, the system is set so the sample overrides the PIT-tag diversion system, sending PIT-tagged fish to the sample instead of being diverted back to the river. During 2013 this occurred from startup on March 25 until 0700 hours on July 16 when the system was switched over to “divert during sample mode”. (In this mode the sample is over-ridden to allow PIT-tagged fish to be diverted while a sample is in progress.) The system was operated in divert during sample mode until the end of normal separator operations on October 31.

At the start of the season on March 25 the sample gates were set to divert 10% of the fish to the sample while the remaining fish were diverted back to the river through the bypass outfall pipe. Sample rates varied between 0.5% and 10% during the peak of the fish collection season depending on fish numbers and the need to supply sample fish for the evaluation of the overflow weir and 14-inch orifice in the collection gallery. The slide gates were set to divert fish to the sample tank four to six times per hour during the course of the season until August 16 when the system was switched to a 100% sample rate due to lower fish numbers and also in order to help facilitate truck loading operations. The sample rate remained at 100% until 0700 hours on September 5 when the sample rate was lowered to 50% due to an increase in collection numbers. The sample rate remained at 50% until September 10 when the rate was increased back to 100% at 0700 hours due to a decrease in fish collection numbers. Sample rates remained at that level through the duration of September and then bounced around between 25% and 100% for the duration of the season. The sample rate on October 31, the last day of the collection season, was 50%. During the course of the season, the sample system only needed minor adjustments in air

pressure and gate timing by Pacific States Marine Fisheries Commission personnel.

A new slide gate system with PIT-tag detection capabilities was added to the flume leading to the upstream raceways and bypass outfall pipe during the 2007 winter outage period. This system was installed by NOAA-Fisheries and PSMFC personnel in March of 2007. The system now has four modes: 1) bypass marking, 2) bypass, 3) general collection, and 4) marking. When the system is in bypass marking mode all fish are diverted to the raceways for marking purposes except sort by code fish which are bypassed back to the river. When the system is in bypass mode all fish are diverted through the bypass outfall pipe (secondary bypass) to the river. When the system is in general collection mode, fish are diverted down the flume to the east raceways for normal collection and marking activities. And finally when the system is set for marking mode, previously PIT-tagged fish (sort by code) are diverted to raceway 10 through an additional pipe to avoid being handled again. Untagged fish are routed down the flume for normal marking activities. This system continued to work well during 2013.

Cooling Water Strainers

In accordance with District policy the turbine unit cooling water strainers were inspected for juvenile lamprey on a monthly basis during 2013. An attempt was made to inspect all unit strainers each month but this was not always possible due to some units being tagged out for maintenance. During 2013 May was the highest month for lamprey entrainment with a total of 135 dead lamprey removed from the strainers. April also had a relatively high entrainment rate with a total of 78 juvenile lamprey. August through November were the low months with no lamprey found in the strainers during that entire time period. For the entire 12-month period, a total of 353 dead juvenile lamprey were removed from the cooling water strainers at Lower Granite over a combined possible entrainment run time of 15,219.5 hours.

Barge/Truck Loading Operations

It has long been the policy at Lower Granite to try and load as many fish as possible directly onto fish barges to avoid raceway loading/holding. Direct loading of smolts onto waiting fish barges (rather than into raceways) is felt to be highly beneficial to the fish by eliminating secondary handling and related stress factors. An estimated 33.9% of the smolts (approximately 1,073,950 smolts out of 3,171,062 smolts barged from Lower Granite) were direct loaded into barges during 2013. By comparison direct barge loading percentages for some recent years were 2012 (12.4%), 2011 (43.4%), 2010 (44.4%), and 2009 (32.5%).

Truck loading operations at Lower Granite went relatively well during 2013. As per recent years, there was no early season trucking. Trucking operations began immediately after fish barging ended and ran from August 18 until October 31. NOAA-Fisheries did not conduct the late season transport evaluation during 2013 and this increased the number of fish transported from recent years as NOAA had frequently marked a relatively high number of fish for return back to the river as well as transport. Consequently, it was necessary to use the semi on more days during 2013 than might have been expected. Fish were diverted from the lab directly onto

the waiting midi-tanker or semi reducing fish handling operations.

Recommendations

1. Install a generator to power the fish facility during electrical outages.
2. Dependent on the initiation of the Phase 1 fish facility upgrade, refurbish the existing separator.
3. Install an airburst cleaning system underneath the inclined screen to help in debris removal.
4. Replace the cracked barge fish hold plungers with new prototype metal plungers.
5. Install ballast material in the voids of fish barges 4394 and 4382 to avoid the need to add/remove river water for ballast.
6. Paint the hulls on the 8000 series fish barges as soon as funding becomes available.
7. Refurbish the concrete on the raceway interiors with a new sac-rub finish (pending a new JFF).
10. Replace the aging lab chiller system with an improved system.
11. Install or remove push knees (as needed) on the fish barges and explore a new bumper system to use in place of the present cable and tire system.
12. Cover the upstream raceways to provide shading for juvenile fish.
13. Consider the purchase of a 1,000 gallon (well insulated) fish tank that could be mounted on a flatbed truck and used for fish transport as this would reduce the need for the rental semi tractors.

Acknowledgements

A total of 21 people were employed in various capacities at the Lower Granite Juvenile Fish Facility during 2013. Corps of Engineers biologists in charge of collection and transportation activities were Mike Halter (project fishery biologist) and Ches Brooks (assistant project fishery biologist). Corps technicians assigned to the barges were: John Dammann, Gene Sprofera, Robert Traufer, and Dan Caldwell. Corps separator technicians were: Robert Horal, Mike Casten, Cady Tyron, and Joel Dirks. The Corps maintenance staff consisted of Jeremy Krewer (term) and Robert Enzi. Raymond Cooper served as the engineering equipment operator leader. Mike Knapp served as the heavy mobile equipment operator. Truck transportation operations to below Bonneville Dam were shared by Raymond Cooper, Mike Knapp, and Robert Enzi.

Washington Department of Fish and Wildlife (WDF&W) Biologists in charge of COE Transport Oversight Contract activities and Smolt Monitoring Program activities were Shawn Rapp (Task Order Biologist), Fred Mensik (SMP Supervisory Biologist), and Alan Martin (SMP Biologist). The WDF&W also employed Bill Fitzgerald, Sarah Smith, and Ann Blachly as sample technicians and Jeremy Wright as an anesthetist.

APPENDIX TABLES

Appendix Table 1. Daily Collection and Bypass Numbers at Lower Granite Dam, 2013.

Appendix Table 2. Percent Daily Descaling and Daily Facility Mortality Numbers at Lower Granite Dam, 2013.

Appendix Table 3. Daily Number of Fish Trucked and Barged from Lower Granite Dam, 2013.

Appendix Table 4. Daily Number of Adult Fallbacks and Fallback Mortality at Lower Granite Dam, 2013.