2011 Annual Report

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

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Summary

The 2011 fish collection season at Lower Granite Dam was characterized by high flow conditions, court mandated summer spill, high debris levels, below average water temperatures well into the season, and an average number of smolts collected and transported. 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 6,310,606 juvenile salmonids was collected at Lower Granite Dam during the 2011 season. Of these 3,874,873 were transported to release sites below Bonneville Dam, 3,859,265 by barge and 15,608 by truck. An additional 2,429,798 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 2011 season were easily the highest of the last five years (Table 3) and also the highest since 1997 (based on January to July flow figures). Flows for the juvenile fish collection period running from March 26 through November 1 averaged 88.3 kcfs. Flows exceeded the Biological Opinion target of 100 kcfs on 79 dates during 2011 and reached the 200 kcfs level on four dates. River flows for the last few days of March were between 77.6 and 95.7 kcfs – well above the norm. Flows in April averaged 107.8 kcfs and ranged between 81.8 kcfs and 143.0 kcfs. In May, river flows averaged 140.6 kcfs and ranged between 84.1 kcfs and 206.8 kcfs. River flows in June were much higher than May – averaging 173.9 kcfs and ranging between 154.1 kcfs and 212.5 kcfs. The peak average flow of the season occurred on June 9 at 212.5 kcfs. River flows in July averaged 96.8 kcfs and ranged between 52.2 and 172.9 kcfs. August flows averaged 39.8 kcfs and ranged from 32.4 kcfs to 51.9 kcfs. River flows remained relatively high in September and averaged 36.3 kcfs for the month. The season's low flow occurred on October 29 at 19.5 kcfs. Daily flows in October averaged 28.0 kcfs and ranged up to 36.4 kcfs. The flow on November 1, the last day of the collection season, was 26.0 kcfs.

During 2011 flows exceeded 80 kcfs on 114 days, 90 kcfs on 96 days, 100 kcfs on 79 days, 110 kcfs on 68 days, 120 kcfs on 64 days, 130 kcfs on 58 days, 140 kcfs on 54 days, 150 kcfs on 48 days, 160 kcfs on 38 days, 170 kcfs on 27 days, 180 kcfs on 19 days, 190 kcfs on 9 days, 200 kcfs on 4 days and peaked at 212.5 on June 9 (Table 2). By comparison during 2010 flows exceeded 80 kcfs on 34 days, 90 kcfs on 27 days, 100 kcfs on 21 days, 110 kcfs on 17 days, 120 kcfs on 15 days, 130 kcfs on 12 days, 140 kcfs on 10 days, 150 kcfs on 8 days, 160 kcfs on 8 days and peaked at 208.5 on June 6.

As directed in the 2011 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 the Snake River collector dams will have a staggered start of between April 21 and May 1 at Lower Granite, Little Goose, and Lower Monumental Dams. 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 Dam.

Projected Snake River spring seasonal average river flows well above 65 kcfs at the beginning of the 2011 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. Spill operations at Lower Granite began on April 3 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 78 days of the spring migration period (from April 4 – June 20) and averaged 49.4 kcfs. Spill levels met and frequently exceeded the Biop target of 18.6 kcfs on all 72 days of the summer migration period (June 21 – August 31) and averaged 31.3 kcfs.

As in 2010 formalized spring and summer testing of the RSW did not take place during 2011. Rather, the RSW was operated as an integral part of the normal April 3 through August 31 spill period. Spring spill (from April 3 through June 20) was authorized at the 20 kcfs level. Summer spill (from June 21 through August 31) was authorized at the 18.6 kcfs level with approximately 6 kcfs directed through the RSW and 12.6 kcfs as training spill.

Table 3: Comparison of average monthly river flow and spill at Lower Granite Dam, 2007-2011.

Month	2007	2008	2009	2010	2011	'07-10 Avg.
Flow (kcfs)						
April*	48.47	51.12	79.61	39.21	103.56	54.60
May	79.93	114.30	116.45	66.59	140.61	94.32
June	47.01	129.31	116.02	128.17	173.86	105.13
July	31.76	58.76	52.15	49.78	96.77	48.11
August	24.12	37.47	32.85	30.56	39.78	31.25
September	19.53	23.62	23.47	24.17	36.33	22.70
October	19.16	20.18	22.30	19.96	28.04	20.40
Spill (kcfs)						
April[1]	16.99	15.43	16.34	13.74	30.62	15.63
May	19.84	49.85	33.25	20.45	51.49	30.84
June	19.30	57.10	30.26	46.89	63.74	38.39
July	17.02	18.66	18.68	18.78	27.37	18.28
August	12.34	18.44	18.63	16.67	26.04	16.52
September	0.21	0.43	0.27	0.27	0.44	0.30
October	0.15	0.00	0.00	0.00	0.01	0.04

* Includes March 26-31

Water temperatures in the Snake River were very favorable for migrating juvenile salmonids during 2011. Flow augmentation and spill during the heat of the summer kept water temperatures moderated during the heat of the summer in July and August. The facility water temperature was 43.9°F at the beginning of the season on March 26 and remained below 50° until May 5 – over two weeks later than in 2010. Temperatures during the peak of the juvenile migration in late April and early May were in the high 40° to low 50° range. Temperatures stayed in the low to mid 50° through the month of May and into June. Temperatures reached 60°F on July 7 – over a week later that in 2010. (Appendix 1, Table 1). Water temperatures first exceeded 65.0°F (65.3°F) on July 25 – nearly two weeks later than in 2010. Despite high air temperatures for a few days in mid and late August, water temperatures did not reach 70º F during 2011. The peak water temperature of the year was 68.0ºF on August 5 – which is actually 10 days earlier than in 2010. The August 5 peak water temperature compares favorably with some recent years when temperature peaks were: 2010 (68.5°F on August 15), 2009 (69.3°F on July 31), 2008 (67.8 ºF on August 15), 2007 (68.9 ºF on July 6), and 2006 (70.5°F on July 5). After water temperatures peaked in early August, temperatures began to slowly taper off and remained in the mid 60 degree range through the rest of August, and through September. September water temperatures remained surprisingly consistent – starting at 67.1°F on September 1 and ending at 67.5°F on September 30. Water temperatures through the duration of

the season (October 1 – November 1) were on the high side starting at 67.3ºF and ending at 54.9 ºF on November 1. The average daily temperature during this time period was 61.2 ºF.

Facility Modifications

The following modifications and work were made to the Lower Granite Juvenile Fish Facility and barges prior to the 2011 season:

1. Refurbished the sample diversion slide gates per PSMFC guidelines.
2. Built new raceway tailscreens to allow juvenile lamprey to pass out of the raceways.
3. Built a pipe extension to the river to allow juvenile lamprey to pass from the upstream raceways into the river.
4. Cleaned up the counter tunnel wire connections in the separator control room.
5. Repaired separator water leaks in the slide gate area.
6. Checked/repaired damaged mesh in raceway tailscreens.
7. Rebuilt snorkel seals on the raceway loading boom and replaced the flexible hose.
8. Examined by ROV the upstream and downstream ends of the 42-inch underground fish pipe running from the juvenile fish collection gallery to the separator.
9. Repaired the anesthesia tanks on the sample holding tank system.
10. Repaired the leak on the small valve off the separator spool piece.
11. Cut an emergency fish exit in the floor of the barge mooring dock to allow separator technicians to release raceway fish in the event of a water supply emergency.
12. Refurbished the oxygen probes for the fish barges.
13. Replaces some of the twist-lock electrical fittings on the barges with straight fittings.
14. Installed new strainer seals on fish barge 2127.
15. Repaired the broken aerator control valve on fish barge 8106.
16. Serviced the aerator valves on fish barge 4382.
17. Built new raceway stoplogs.

Fish Collection

Migration and Collection

The juvenile fish bypass gallery was watered up on March 21. Fish were bypassed through the 72-inch pipe at the base of the separator (primary bypass) until 0730 hours on March 23 when water was routed over the separator bars due to sockeye/kokanee (probably Dworshak flushed fish) and small Chinook becoming stranded on the inclined screen. Fish thus routed over the separator bars were diverted out the long bypass pipe to mid-river. On March 25, 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 May 1.

Fish barging operations from Lower Granite followed the general pattern of recent years with a few research barge trips taking place prior to the initiation of general fish transportation. Fish were collected 2-3 days before the actual transport date in order to allow marking crews time to mark and handle the fish. The first research barge departed Lower Granite on April 7. Subsequent research barges departed Lower Granite on April 14, April 21, and April 28. When fish were not being collected for research, 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. Collection ended at 0700 hours November 1.

An estimated 6,310,606 juvenile salmonids were collected at Lower Granite Dam during the 2011 operating season. The 2011 species collection included: 1,993,789 clipped yearling chinook, 723,152 unclipped yearling chinook, 229,224 clipped subyearling fall chinook, 518,262 unclipped subyearling chinook, 2,114,802 clipped steelhead, 598,520 unclipped steelhead, 23,334 clipped sockeye/kokanee, 54,806 unclipped sockeye/kokanee and 54,717 coho (Table 8). Fish collection numbers were well above the 2010 collection in every species category. Daily collection and river flow information is provided in Appendix 1, Table 1.

Peak collection dates during 2011 were reasonably close to the norm (Table 9). The peak total daily collection of 375,600 occurred on May 12 – which is only slightly later than the long term average. May 12 was also the peak collection date for clipped yearling Chinook (165,200), unclipped yearling Chinook (33,800), unclipped steelhead (48,000), and coho (5,200). Clipped steelhead peaked very early on April 3 (160,139). Unclipped sockeye (2,300) and clipped sockeye (4,800) peaked on May 22 and May 25, respectively. Unclipped subyearling Chinook (25,600) peaked on May 28 and clipped subyearling Chinook peaked on June 19 (12,550). With the exception of clipped subyearling Chinook, the collection peaked for all species groups before the high flow of the season on June 9. This is similar to 2009 when all species groups peaked before the high flow and 2010 when clipped subyearling Chinook peaked on the high flow day and all other species groups peaked prior to that.

Table 8. Annual collection, bypass, and transport at Lower Granite Dam, 2007-2011.

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										
2007	1,267,755	310,619	59,200	142,039	1,003,671	364,127	13,753	2,186	38,308	3,201,658
2008	1,913,873	484,791	152,792	282,084	1,675,433	490,012	10,424	3,934	68,833	5,082,176
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
Bypass										
2007	335,966	115,143	7,319	37,255	139,532	42,202	1	355	1,432	679,205
2008	326,382	99,567	344	9,040	288,065	89,866	203	249	1,849	815,565
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
Truck										
2007	57	226	189	7,017	6	8	18	1	33	7,555
2008	0	31	62	16,166	6	29	0	851	33	17,178
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
Barge										
2007	929,994	195,037	51,279	102,186	863,756	321,795	13,720	1,820	36,823	2,509,393
2008	1,582,205	384,695	149,429	252,309	1,386,704	399,905	10,204	2,661	66,905	4,235,017
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
Total Transported										
2007	930,051	195,263	51,468	95,169	863,762	321,803	13,738	1,821	36,856	2,516,948
2008	1,582,205	384,726	149,491	268,475	1,386,710	399,934	10,204	3,512	66,938	4,252,195
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
Morts										
Facilit	1,560	325	717	2,032	272	47	26	556	23	5,558
Res/Sa	121	120	0	78	39	19	0	0	0	377

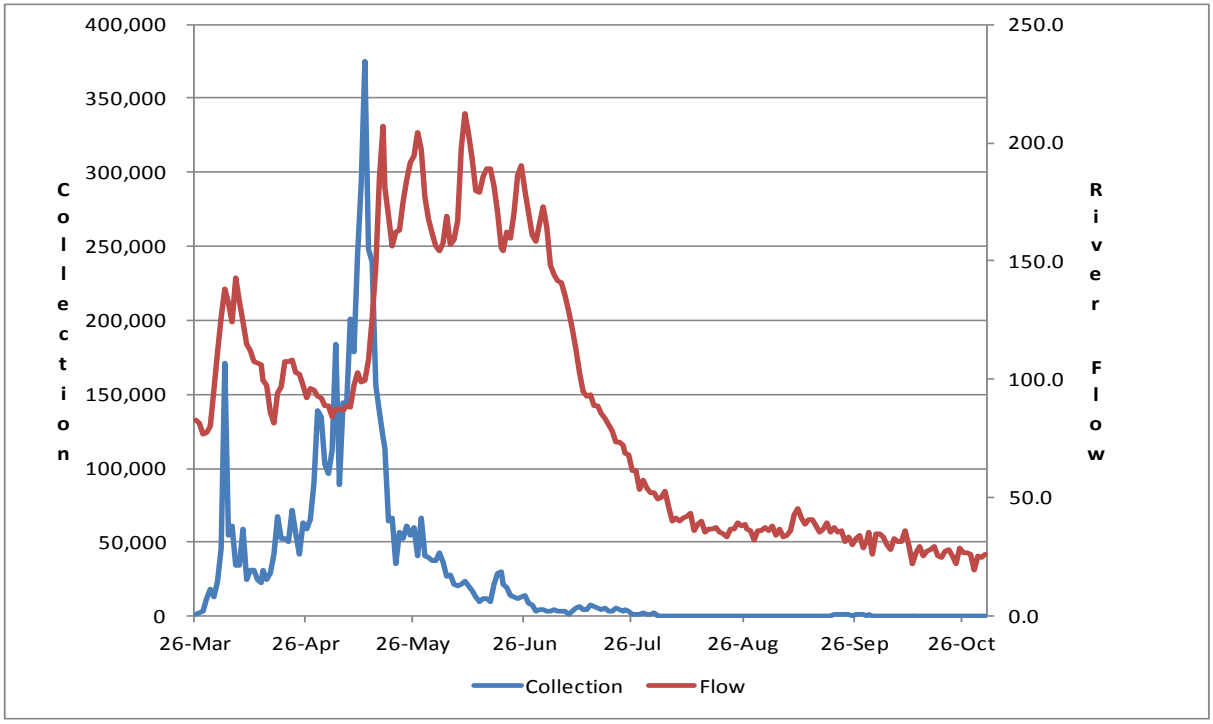
Note: 'Res/Sac' refers to research sacrificed fish and incidental research mortalities (handling and/or tagging). These fish were taken from the general collection only. Additional sacrificed research fish taken from the Sort-By-Code tank are summarized in the research section of this report.

Table 9. Annual peak collection days at Lower Granite Dam, 2007-2011.

Year	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Total
	Clipped	Unclipped	Clipped	Unclipped[1]	Clipped	Unclipped	Clipped	Unclipped	All	
2007	May 4 (149,200)	May 4 (24,800)	June 6 (6,920)	June 5 (9,100)	May 3 (88,800)	May 4 (32,000)	May 15 (2,400)	May 13 (400)	May 14 (6,400)	May 4 (286,600)
2008	May 8 (167,000)	May 8 (39,200)	June 16 (7,900)	July 5 (10,680)	May 6 (92,200)	May 10 (29,000)	May 20 (1,800)	May 10 (400)	May 8 (11,000)	May 8 (305,800)
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)

[1]Includes unmarked (unclipped) hatchery subyearling Chinook from 2007- 2011.

Figure 6. Daily juvenile salmonid collection, all species combined, versus daily average river flow KCFS at Lower Granite Dam, 2011.



Adult Fallbacks

During 2011 a total of 9,340 adult salmonids were removed from the Lower Granite separator through the morning of November 1. This is a significant increase from 2010 when 6,893 were collected through the morning of October 1. The 2011 totals included 1,069 clipped adult Chinook, 673 unclipped adult Chinook, 794 clipped jack Chinook, 453 unclipped jack Chinook, 2,920 clipped steelhead, 3,410 unclipped steelhead, four sockeye and 17 coho. Unclipped steelhead were the most abundant adult salmonid removed from the separator and made up 36.5% of the total salmonid fallbacks followed by clipped steelhead (31.3%). The number of fallbacks for all species groups increased over 2010 levels except for sockeye. Most of the Chinook fallbacks occurred in October. Clipped steelhead fallback numbers were highest in September and October while unclipped steelhead fallback counts were highest in April and May (Table 11).

Table 10: Annual totals of adult Chinook, steelhead and coho released into the river from the juvenile fish wet separator at Lower Granite Dam, 2007-2011.

	Adult Chinook		Jack Chinook		Steelhead		Coho	
	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	All	Totals
2007	138	153	160	120	1,449	943	18	2,981
2008	578	447	720	589	1,885	1,396	25	5,646[1]

2009	1,903	1,495	1,024	617	4,311	2,971	4	12,236[1]
2010	779	523	226	129	2,683	2,527	15	6,893[2]
2011	1,069	673	794	453	2,920	3,410	21	9,340[3]
07-10 avg.	850	655	533	364	2,582	1,959	16	6962[4]

1Includes one sockeye.

2Includes 11 sockeye

3 Includes 4 sockeye in coho total

4 Includes average sockeye totals

All adult and jack fallback salmonids were superficially examined for condition before being released from the separator and 87.1% of the salmonids released from the separator were classified as in either good or fair condition compared to 87.8% in 2010, 95.2% in 2009, 93.8% in 2008, and 83.6% in 2007. (Table 12).

Adult fallbacks that passed through the separator bars are not counted by the separator technicians and are not included in the numbers in these tables. These fallbacks either pass into raceways to be transported and are not counted, while others entered the sample system and were counted as incidental fish. A total of 107 salmonid fallbacks were counted in the daily samples including 60 clipped Chinook jacks, 38 unclipped Chinook jacks, one clipped Chinook minijacks, three unclipped Chinook minijacks, two unclipped steelhead and two unclipped coho. This compares to the 221 salmonid fallbacks that were counted in daily samples in 2010, the 323 in 2009 and 1,587 in 2008. The large decrease in salmonids observed in the sample in the last few years is due to using an additional set of separator bars spaced closer together that lay over the regular separator bars. These bars effectively keep the Chinook jack and minijack fallbacks out of the sample collection tank. (In 2010 we did not use these bars but due to the lower run size of Chinook jacks fewer fell back across the separator.) 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 because of the recommended 21 day waiting period prior to human consumption identified in the Argent Chemical Laboratories MS-222 protocols.

Table 11. Monthly totals of adult salmonids released from the juvenile fish separator at Lower Granite Dam, 2011.

	Adult Chinook		Jack Chinook		Steelhead		Coho	Totals
	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	All	
Month								
April[1]	1	0	0	0	660	881	0	1,542
May	132	32	16	0	605	1,215	0	2,000
June	155	60	68	1	118	585	0	987
July	78	41	22	3	31	39	0	217
August	6	18	5	0	77	73	0	179
September	131	110	127	74	674	431	0	1,547
October[2]	566	412	556	375	755	186	21[3]	2,867
Totals	1,069	673	794	453	2,920	3,410	21	9,340[3]

[1] Includes March 26-March 31
[2] Includes November 1
[3] Includes four sockeye.

Table 12. Condition of adult salmonids released from the juvenile fish separator at Lower Granite Dam, 2011.

	Adult Chinook		Jack Chinook		Steelhead		Coho	
	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	All	Totals
Good	935	578	713	413	1,757	1,879	21[2]	6,296
Fair	111	80	70	33	603	944	0	1,841
Poor	20	12	8	7	497	559	0	1,103
Dead	3	3	3	0	63	28	0	100
Total[1]	1,069	673	794	453	2,920	3,410	21[2]	9,340

[1] Includes March 26-March 31.
[2] Includes 4 sockeye.

Sampling

Sampling at LGR Juvenile Fish Facility (JFF) Lab began at 0700 hours March 26 and ended at 0700 hours on November 1. A total of 221 daily samples were processed by the WDFW smolt monitors 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) and daily numbers (Table 14). The sample system was switched to "divert during sample" mode at 0700 hours on August 2 in order to allow PIT-tagged fish to over-ride the sample and be diverted to the PIT-tag headbox while a sample was going off. After August 15, the last barge trip of the season, smolts were transported by truck every other day. The sample rate was elevated to 100% on August 15. By that time fish collection had decreased to the point that fish could be transported every other day and working up the samples every other day would not impact fish trucks leaving early enough in the morning to reach Bonneville in a timely manner. Each day's collection was kept separated in the sample tank and on the day of transport, each day's collection was sampled separately. Due to increases in collection, the sample rate was dropped to less than 100% on September 23-24 and September 28-30.

During 2011 the smolt monitors sampled 79,426 smolts, 1.3% of the total collection compared to 66,295 (1.8%) in 2010, 70,866 smolts (1.1%) in 2009, 97,421 smolts (1.9%) in 2008, and 71,798 smolts (2.2%) in 2007 (Table 13). The total number of smolts sampled in 2011 by species included: 11,427 clipped yearling Chinook, 4,899 unclipped yearling Chinook, 4,615 clipped subyearling fall Chinook, 35,722 unclipped subyearling fall Chinook, 16,206 clipped steelhead, 4,549 unclipped steelhead, 254 clipped sockeye, 950 unclipped sockeye/kokanee and

804 coho (Table 14).

Table 13. Annual percentage of total juvenile salmonids collected that were sampled at Lower Granite Dam, 2007-2011.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	All	Total
2007	1.0	1.8	9.8	22.0	1.1	1.3	1.3	2.4	1.7	2.2
2008	0.8	1.0	4.9	17.4	0.9	1.1	1.2	28.3	0.7	1.9
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
07-10	0.8	1.0	3.7	10.7	0.8	1.0	1.1	6.1	1.3	1.7

Table 14. Weekly sample rates in percent and sample totals at Lower Granite Dam, 2011.

Week	Weekly Rate	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Ending	(%)	Clipped[2]	Unclp'd	Clipped[2]	Unclp'd[1]	Clipped[2]	Unclp'd[1]	Clipped[2]	Unclp'd[1]	All	Totals
3/31	8.1	510	327	0	9	1,623	138	0	321	21	2,949
4/07	1.4	301	282	0	6	3,408	123	0	83	7	4,210
4/14	1.0	518	580	0	5	959	161	0	29	4	2,256
4/21	0.8	609	477	0	1	1,159	145	0	30	0	2,421
4/28	0.5	894	365	0	3	765	179	0	14	3	2,223
5/05	0.5	1,984	753	0	0	1,281	212	0	40	20	4,290
5/12	0.5	4,035	816	0	1	2,249	698	0	26	76	7,901
5/19	0.5	1,829	564	45	83	2,032	771	3	14	62	5,403
5/26	0.9	456	321	114	368	1,119	670	151	75	95	3,369
6/02	1.0	133	115	565	1,161	507	464	38	22	55	3,060
6/09	1.7	88	78	638	1,041	527	464	25	36	28	2,925
6/16	2.0	25	75	530	776	208	212	14	29	11	1,880
6/23	2.3	18	59	1,279	1,808	112	114	7	18	6	3,421
6/30	2.0	10	27	329	747	83	66	3	12	4	1,281
7/07	6.6	10	17	301	1,130	78	58	2	36	5	1,637
7/14	10.0	4	12	491	2,702	64	42	0	28	16	3,359
7/21	6.4	0	1	171	2,042	13	6	0	21	19	2,273
7/28	10.0	1	0	63	1,804	12	3	6	23	68	1,980
8/04	24.3	0	0	19	1,423	3	0	2	4	134	1,585
8/11	50.0	0	1	6	307	0	2	0	1	8	325
8/18	71.4	0	0	10	970	1	0	2	1	26	1,010

8/25	100.0	0	0	5	921	0	3	0	4	29	962
9/01	100.0	0	0	1	552	0	0	0	0	18	571
9/08	100.0	0	4	4	606	2	1	0	8	9	634
9/15	100.0	1	1	9	2,656	0	3	0	10	22	2,702
9/22		0	0	10	4,034	0	4	0	27	27	4,102
9/29	71.4	0	3	10	4,384	0	2	0	13	16	4,428
10/06	92.9	1	1	3	2,497	0	3	1	5	4	2,515
10/13	100.0	0	2	3	1,205	0	1	0	11	5	1,227
10/20	100.0	0	5	3	742	1	1	0	5	3	760
10/27	100.0	0	11	3	1,038	0	2	0	2	2	1,048
11/01	100.0	0	2	3	710	0	1	0	2	1	719
Total		11,427	4,899	4,615	35,722	16,206	4,549	254	950	804	79,426

[1]Wild Chinook, wild steelhead and wild sockeye/kokanee designated in text as unclipped.
[2]Hatchery Chinook, hatchery steelhead and hatchery sockeye/kokanee designated in text as clipped.

Transportation

An estimated 3,874,873 juvenile salmonids (61.4% of fish collected) were transported from Lower Granite in 2011. This is proportionately much lower than in 2010 when 93.1% of the collected fish were transported. During 2011 large numbers of juveniles passed the dam prior to the beginning of general fish transportation activities on May 1. The numbers of fish and the percentages transported of each species group in 2011 were: 1,332,598 clipped yearling Chinook (66.8%), 372,545 unclipped yearling Chinook (51.5%), 206,323 clipped subyearling fall Chinook (90.0%), 450,693 unclipped subyearling fall Chinook (87.0%), 1,058,029 clipped steelhead (50.0%), 378,997 unclipped steelhead (63.3%), 9,717 clipped sockeye (41.6%), 25,786 unclipped sockeye/kokanee (47.0%) and 40,185 coho (73.4%).

The COE and NMFS transported fish by barge from Lower Granite for research purposes only on April 7, April 14, April 21 and April 28. Fish collection activities for general transport began at 0700 hours on May 1. The first day of general fish barge transport was May 2. Fish were barged fish every day from May 2 to May 15. Smolts were not barged on May 16-May 18 due to high flows and unsafe passage conditions for the towboats and crew. On May 19 every day barging resumed but only until May 22. From May 23 to May 28 fish were not barged due lockage repairs at The Dalles Dam as well as high flows and questionable barge loading conditions. On May 29 every other day barging began and continued through August 15. Every other day trucking began on August 17 and continued until November 1. All truck trips were made with the 300 gallon pickup mounted tank except for September 24, September 28, and September 30 when collection increased and the 3500 gallon tanker truck was used to transport the smolts. Due to repairs to the Little Goose fish facility transport truck, on August 21, August 23, August 25, August 27, August 29 and August 31 the Lower Granite truck picked up and hauled the Little Goose Dam smolts to the Bonneville release site.

During 2011 both the 4000 and 2000 series fish barges were direct-loaded at Little Goose Dam during the month of May. Due to regional concerns over juvenile fish migration times, fish barging operations did not begin at Little Goose until May 6 and not until May 9 at Lower Monumental. Fish barging operations at McNary do not begin until river conditions are "no longer spring like". In 2011 fish barging at McNary began on July 20. Fish barging operations at all sites continued until mid August. The last barge for all sites left Lower Granite on August 15.

An estimated 3,859,265 (99.6%) of the total juvenile salmonids transported were barged from Lower Granite in 2011 compared to 3,378,007 (99.5%) in 2010, 4,111,943 (99.8%) in 2009, 4,235,017 (99.6%) in 2008, and 2,509,393 (99.7%) in 2007 (Table 8). The number of fish barged and the percentages of the total transported by species group were: 1,332,596 clipped yearling Chinook (almost 100%), 372,515 unclipped yearling Chinook (99.9%), 206,271 clipped subyearling Chinook (99.9%), 435,419 unclipped subyearling Chinook (96.6%), 1,058,026 clipped steelhead (almost 100%), 378,986 unclipped steelhead (almost 100%), 9,715 clipped sockeye/kokanee (almost 100%), 25,697 unclipped sockeye/kokanee (99.7%) and 40,040 coho (99.6%).

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 43.4% of the smolts (approximately 1,674,590 smolts out of 3,859,265 smolts barged from Lower Granite) were direct loaded onto fish barges at Lower Granite during the 2011 season. This figure has been both higher and lower in previous years and is dependent on a number of factors. As in 2007-2010, a factor limiting direct loading of barges was the need to divert large numbers of smolts to the upstream raceways to accommodate research marking operations during the peak of the juvenile outmigration. Other factors which limited direct barge loading were: a late start in general barging operations, high river flows in late May and June (which made direct barge loading hazardous), and occasional late arrival times of returning fish barges.

As per previous years, fish collected at Little Goose Dam, Lower Monumental Dam, and McNary Dam were also loaded onto fish barges that originated from Lower Granite Dam during the 2011 season. The total number of fish barged from these other sites during the 2011 season was: Little Goose Dam (3,023,090), Lower Monumental Dam (1,365,734), and McNary Dam (1,063,874).

As in recent seasons, no early season fish trucking activities took place during 2011. Late season trucking operations at Lower Granite began on August 17 and continued every other day through November 1. Due to low fish numbers, trucking operations resumed using the pickup-mounted midi-tanker. All truck trips were made with the 300 gallon pickup mounted tank except for September 24, September 28 and September 30 when collection increased and the 3500 gallon tanker truck was used to transport the smolts. Due to repairs to the Little Goose fish facility transport truck, on August 21, August 23, August 25, August 27, August 29 and August 31 the Lower Granite truck picked up and hauled the Little Goose Dam smolts to the Bonneville release site.

Approximately 15,608 juvenile salmonids, 0.4% of the fish transported from Lower Granite in 2011, were transported by truck (Table 8). In addition, an additional 2,836 juveniles were transported by truck when Lower Granite combined fish trucking operations with Little Goose from August 21-31. During 2010, 16,594 juvenile salmonids, 0.4% of the fish transported from Lower Granite, were transported by truck compared to 6,700 juvenile salmonids in 2009 (0.2%), 17,178 in 2008 (0.4%), 7,555 in 2007 (0.3%), and 6,751 (0.1%) in 2006. A continuing factor in the relatively low percentage of fish transported by truck in 2011 was an extensive late season transport evaluation by NOAA-Fisheries which removed many fish which would have been transported and put them back into the river. The numbers of fish trucked in 2011 and the percentages of the total transported for each species group were: 2 clipped yearling Chinook (<0.1%), 30 unclipped yearling Chinook (<0.1%), 52 clipped subyearling fall Chinook ((<0.1%), 15,272 unclipped subyearling fall Chinook (3.4%), 3 clipped steelhead (<0.1%), 11 unclipped steelhead (<0.1%), 2 clipped sockeye/kokanee (<0.1%), 89 unclipped sockeye/kokanee (0.3%) and 145 coho (0.4%).

The physical operation of the transport barges and transport trucks went reasonably well during the 2011 season. There were no operational problems that prevented the normal transportation and release of fish at the designated release points. (High river flows prevented safe barge loading at Lower Granite on May 16-18 and again on May 23-28.) Nevertheless, as is to be expected of any large-scale operation involving considerable equipment over a lengthy period of time, there were a few minor operational problems. Perhaps the biggest problem was the amount of fine debris in the river which worked into the barge aerators and resulted in the need for barge technicians to clean the aerators much more frequently than usual. This was especially problematic at McNary where the navigation lock was packed with debris on several occasions. Most of the barge equipment-related problems during 2011 were of a minor mechanical or electrical nature. The 2000 series fish barges are quite old and require careful operation to ensure the plungers open properly when releasing fish. There were a few instances where it took several tries to get the barge plungers up to raise to release the fish. The engine oil pressure gauges caused a few problems this season on fish barges 4382 and 8108. There was a problem (corrected) with the air compressor pressure switch on barge 8105. Barge 8105 also experienced some problems with the #2 engine pump alarm going off prematurely. The plungers on the 8000 series fish barges are getting old and beginning to slightly deteriorate (the plunger in the number 5 hold on barge 8105 has about an 9 inch tear near the bottom sealing edge. An examination of the plungers by fish facility personnel showed there was some cracking on several of them. An engineering evaluation by Lower Granite staff indicated they were probably still good for several seasons but need careful monitoring. One of the towboat skippers voiced some concerns with the integrity of the fuel containment barriers on the 2000 barges. These were repaired and repainted during the summer months after these barges returned back to Lower Granite.

The oxygen monitoring system on the fish barges often causes as many problems (usually minor) as any of the mechanical systems. This was again the case during 2011. Problems were usually of a single hold nature and involved a probe in a particular hold not reading correctly or giving fluctuating readings. In most instances this was solved by renovating the probe and changing out the electrolyte. In other cases it was necessary to install another probe or chase down an electrical system problem. The touch pad system on the P4 box on barge 8107 began

sticking during the season and was eventually replaced. In all cases, the portable YSI oxygen/temperature monitoring systems (used as a backup system on each barge) have proven invaluable and allowed for proper monitoring of oxygen and temperature levels whenever there were problems with the main Point Four system.

On July 28 fish barge 8108 struck the wall inside the lock at McNary Dam while enroute to the fish release site below Bonneville Dam. Minor damage was done to the hull. It was buckled beneath the stairs on the port bow and some of the support beams were bent. Damage was not sufficient to impact the duration of the trip and the fish were released per normal operations. No damage was done to the barge fish holds but the contractor was required to make repairs and fix the dent and bent beams. This work was done over the fall and early winter of 2011 and the barge was returned back to Lower Granite with all repair work done on December 26, 2011.

There were very few problems with the Lower Granite fish trucks during the 2011 season. The refrigeration system on the large tanker truck continues to present problems for the drivers. The system runs but the drivers can not measure any cooling during pre-season truck testing. Truck maintenance personnel stationed at McNary report that the refrigeration unit on one trailer has been repaired. There were virtually no problems with the midi-tanker system during the season. Care was taken to add enough ice to keep the temperatures at an acceptable level for the trip to Bonneville and in general very little tempering was required at the release site.

With the exception of the previously mentioned trips, the majority of late season fish transport took place with the pickup-mounted 300 gallon midi-tanker system. NOAA-Fisheries late season transport evaluation study put quite a few fish back into the river that would have normally been transported and kept transport numbers low enough to use the 1-ton pickup and midi-tanker tank for the majority of the trips. All operational aspects of truck transport went smoothly. Lower Granite received a new 1-ton diesel dual rear wheel pickup for fish transport in 2010 which worked very well and was much appreciated by the truck drivers.

Bypass

The LGR collection gallery was watered up on March 21. All fish were initially diverted out the large pipe at the base of the separator (primary bypass). This operation continued until 0730 hours on March 23 when the separator was watered up and put into secondary bypass mode (all fish other than sample fish diverted out to the mid-river release pipe) due to the large number of juvenile salmonids that were becoming impinged on the inclined screen. Activation of the sampling system began at 0700 hours on March 25. At that time, all fish other than those diverted to the sample holding tank were bypassed back to the river through the bypass outfall pipe to the river (secondary bypass). The system was operated in secondary bypass mode with the exception of periods of time when it was necessary to load fish into the upstream raceways to accommodate research marking for index barge trips on April 7, April 14, April 21, and April 28. General fish collection (for transportation) began on May 1 and continued until 0700 hours on November 1 when the facility was placed back into secondary bypass mode (smolts diverted out

the outfall pipe to mid-river) to monitor for late season PIT-tagged juvenile fish. The juvenile fish collection system was operated in the secondary bypass mode continuously until 0700 hours on December 15, when the system was put into primary bypass mode. The system was then operated in primary bypass mode until the morning of December 19 when the juvenile fish collection gallery and collection/transportation facility were dewatered for the season.

There were numerous events during the season that lead to additional fish bypass. Smolts were bypassed for approximately 6 hours during 15 separator cleaning events during May, June and July. These cleanings were necessary to remove debris off the inclined screen (primary dewaterer)which provides water to the holding raceways and lab. During these cleaning events no estimate can be made of the number of fish bypassed because the fish are bypassed before encountering the sampling system (Primary Bypass). In addition, the Lower Granite JFF bypassed fish May 16-May 18 due to high flows and unsafe passage conditions for the towboats and crews. From May 23 to May 28 fish were not barged due to lockage repairs at The Dalles Dam. Fish collection ended at 0700 hours November 1.

In 2011 an estimated 2,429,798 smolts (38.5% of those collected) were bypassed from the LGR Fish Facility compared to 247,129 smolts (6.8%) in 2010 and 2,465,023 (37.4%) in 2009. In 2010, an estimated 247,129 smolts (6.8% of those collected) were bypassed from the LGR Juvenile Fish Facility compared to 2,465,023 fish in 2009. The number and percentage of smolts bypassed by species group in 2011 (percentage of the total number of fish collected that were bypassed) included: 659,510 clipped yearling Chinook (33.1%), 350,162 unclipped yearling Chinook (48.4%), 22,184 clipped subyearling Chinook (9.7%), 65,459 unclipped subyearling Chinook (12.6%), 1,056,462 clipped steelhead (50.0%), 219,457 unclipped steelhead (36.7%), 13,591 clipped sockeye/kokanee (58.2%), 28,464 unclipped sockeye/kokanee (51.9%), and 14,509 coho (26.5%). An estimated 1,709,591 juvenile salmonids, 27.1% of the total collection were bypassed from March 26 to May 1, before the start of the general transport season. In 2010, an estimated 71,789 juvenile salmonids, 2.0% of the total collection were bypassed from March 26 to April 23.

As part of eight research studies, 225,568 smolts were bypassed from LGR. The National Marine Fisheries Service (NMFS) Survival Study PIT-tagged and bypassed 56,149 smolts: 16,046 unclipped yearling Chinook, 22,057 clipped steelhead and 18,046 unclipped steelhead. The NMFS Extra Mortality study PIT-tagged and bypassed 74,842 clipped yearling Chinook smolts and another 40,035 smolts were handled and bypassed. The NMFS Fall Chinook Late Season Transportation Study bypassed six clipped and 5,511 unclipped subyearling fall Chinook. The United States Fish and Wildlife Service (USFWS), NMFS, Nez Perce Tribe (NPT) and United States Geological Survey (USGS) Post Release Performance of Subyearling Fall Chinook Study bypassed 196 previously PIT-tagged target subyearling fall Chinook and 126 non-target smolts. 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 13 non-target smolts and 24 previously PIT-tagged holdover yearling fall Chinook. The Idaho Fish and Game Genetic Stock Index study bypassed 1,239 unclipped, untagged yearling chinook and 548 unclipped and untagged steelhead. The NMFS transportation study bypassed 46,644 smolts including 8,534 clipped yearling Chinook, 523 unclipped yearling Chinook, 4,098 clipped

subyearling fall Chinook, 7,451 unclipped subyearling fall Chinook, 22,409 clipped steelhead, 514 unclipped steelhead, 1,653 clipped sockeye, 870 unclipped sockeye/kokanee and 592 coho. The USGS Bypass Probability study PIT and radio tagged and bypassed 235 unclipped subyearling fall Chinook.

Incidental Species

An estimated 38,698 non-salmonid incidental fish entered the fish facility in 2011 (Table 15). This is 4.9% less than the 41,723 non-salmonid incidental fish that entered the fish facility in 2010, compared to 20,902 in 2009, 35,571 in 2008 and 22,919 in 2007. Whitefish were the most abundant incidental species with 6,625 collected, which is a 23.7% decrease over the 2010 total of 8,688. Pacific lamprey macrophthalmia were the second most abundant incidental species with 6,420 collected compared to 3,554 in 2010. Pacific lamprey ammocetes were the third most abundant incidental species with 6,165 collected compared to 2,493 in 2010. Sucker species were the fourth most abundant incidental species with 5,142 collected compared to 5,152 in 2010. Peamouth were the fifth most abundant incidental species with 4,071 collected compared to 3,637 collected in 2010. Siberian Prawns were the sixth most abundant incidental species with 3,400 collected, which is a 71.0% decrease over the 2010 total of 11,711 This was the fifth season that the invasive species Siberian Prawns were euthanized, per WDFW instructions, rather than released to the river.

Table 15. Estimated collection of incidental fish species at LGR, 2011.

Common Name	*Scientific Name*	Separator	Expanded Sample	Collection
Pacific Lamprey (Adult)	*Entosphenus tridentatus*	10	9	19
Pacific Lamprey (Juvenile)	*E. tridentatus*		6,420	6,420
Pacific Lamprey (Ammocete)	*E. tridentatus*		6,165	6,165
American Shad (Adult)	*Alosa sapidissima*		0	0
American Shad (Juvenile)	*A. sapidissima*		4	4
Banded Killifish	*Fundulus diaphanous*		10	10
Smallmouth Bass	*Micropterus dolomieui*	4	678	682
Largemouth Bass	*Micropterus salmoides*		21	21
Bull Trout	*Salvelinus Malma*		0	0
Bullhead (misc.)	*Amierus sp.*		48	48
Common carp	*Cyprinus carpio*	389	92	481
Channel catfish	*Ictalurus punctatus*	65	106	171
Chiselmouth	*Acrocheilus alutaceus*	1	504	505
Crappie (misc)	*Pomoxis sp.*	7	257	264
Cutthroat Trout	*Oncorhynchus clarkia*		0	0
Kokanee	*Oncorhynchus nerka*		1,608	1,608
Longnose dace	*Rhinichthys cataractae*		35	35
Northern Pikeminnow	*Ptychocheilus oregonensis*	2	125	127
Peamouth	*Mylocheilus caurinus*	11	4,060	4,071
Rainbow Trout	*Oncorhynchus mykiss*		119	119
Redside shiner	*Richardsonius balteatus*		0	0
Sand Roller	*Percopsis transmontana*	1	3,201	3,202
Sculpin	*Cottus sp.*		163	163

Siberian Prawn	*Exopalaemon modestus*		3,400	3,400
Sucker (misc.)	*Catostomus sp.*	1,436	3,706	5,142
Sunfish (misc.)	*Lepomis sp.*		376	376
Whitefish	*Prosopium sp.*	2	6,623	6,625
White sturgeon	*Acipenser transmontanus*	18	0	18
Yellow perch	*Perca flavescens*	5	0	5
Walleye	*Stizostedion vitreum*	1	0	1
Warmouth	*Lepomis gulosis*		16	16
Total		1,952	37,746	38,698

Fish Condition

Descaling

WDFW smolt monitors at Lower Granite began looking at gradations of scale loss in smolts in 1998 to augment the standard descaling data taken from fish sampled. Standard descaling criteria identifies a fish with 20% or greater scale loss on one side of its body as descaled, based on Fish Passage Center guidelines. If scale loss is less than 20% on one side the fish is not considered descaled. Many fish have levels of scale loss that do not fit the standard descaling criteria. Therefore they began noting, in addition to standard descaling, if a smolt was more than 10% but less than 20% descaled or more than 50% descaled. Furthermore, each gradation of scale loss was characterized as patchy or scattered. WDFW observed 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. (This information has not been recorded since 2009 due to a revised touch screen program from the Fish Passage Center.)

The 2011 descaling rate for all species combined was 2.2% compared to 2.0% in 2010 and 1.7% for the 2007-2010 average (Table 16). The weekly decaling rates began the collection season at low levels and increased through mid-June, opposite of what has occurred in previous years. During the end of June, July and August when small subyearling fall Chinook dominated the collection weekly descaling rates were the lowest of the season, similar to previous years. During August, September and October weekly descaling rates increased to their highest levels of the season (Table 17).

Table 16. Annual full-sample descaling rates (>20%) by species at LGR, 2007-2011.

Yearling Chinook	Subyearling Chinook	Steelhead	Sockeye/Kokanee	Coho

	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total
2007	1.4	0.6	0.6	1.8	2.7	2.4	5.6	3.8	4.0	1.8
2008	1.4	0.9	0.6	1.6	2.1	2.0	1.7	3.7	1.6	1.6
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
07-10 Ave.	1.6	0.7	0.8	1.9	2.0	1.8	3.1	5.1	2.4	1.7

Table 17. Weekly descaling rates in percent for fish sampled at LGR, 2011

	Yearling Chinook		Subyearling Chinook		Steelhead		Sock/Kokanee		Coho	
Week	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip	All	Total
3/31	1.38	1.55	---	---	0.37	0.00	---	3.41	0.00	0.93
4/07	3.37	0.36	---	---	1.59	0.82	---	10.45	14.29	1.77
4/14	3.12	1.04	---	---	2.09	0.63	---	0.00	0.00	1.92
4/21	2.64	0.84	---	---	1.47	2.07	---	0.00	---	1.66
4/28	2.70	0.83	---	---	2.89	0.00	---	0.00	0.00	2.22
5/05	3.25	0.80	---	---	1.02	0.47	---	12.90	0.00	2.07
5/12	2.02	0.98	---	---	2.54	1.29	---	0.00	0.00	1.97
5/19	2.10	1.78	0.00	0.00	4.29	2.08	0.00	0.00	4.84	2.87
5/26	4.87	1.88	0.89	0.59	3.85	1.79	0.00	1.39	1.05	2.64
6/02	4.55	0.00	0.54	0.18	4.93	3.03	0.00	0.00	3.64	1.74
6/09	4.55	5.13	1.78	1.61	5.50	3.67	8.00	17.14	0.00	3.11
6/16	4.00	2.67	1.35	1.21	6.76	5.19	7.14	3.70	0.00	2.51
6/23	0.00	0.00	0.16	0.39	5.36	5.26	14.29	23.53	0.00	0.77
6/30	20.00	0.00	0.62	0.55	6.10	12.12	0.00	9.09	0.00	1.74
7/07	0.00	0.00	0.34	1.19	1.28	0.00	0.00	11.11	0.00	1.19
7/14	0.00	0.00	0.82	0.79	1.56	0.00	---	11.11	0.00	0.88
7/21	---	0.00	0.59	0.50	0.00	0.00	---	0.00	5.26	0.54
7/28	0.00	---	0.00	0.45	8.33	0.00	0.00	8.70	1.47	0.61
8/04	---	---	0.00	0.93	0.00	---	0.00	0.00	3.01	1.10
8/11	---	0.00	0.00	1.03	---	0.00	---	0.00	0.00	0.98
8/18	---	---	0.00	0.95	0.00	---	0.00	0.00	7.69	1.11
8/25	---	---	0.00	1.12	---	0.00	---	33.33	0.00	1.18
9/01	---	---	0.00	2.59	---	---	---	---	0.00	2.50
9/08	---	0.00	0.00	4.30	0.00	0.00	---	0.00	0.00	4.11
9/15	0.00	0.00	12.50	6.01	---	0.00	---	20.00	0.00	6.03
9/22	---	---	22.22	4.54	---	0.00	---	25.00	3.70	4.69
9/29	---	0.00	0.00	2.53	---	0.00	---	8.33	6.25	2.56
10/06	0.00	0.00	0.00	2.30	---	0.00	0.00	25.00	0.00	2.33

10/13	---	0.00	0.00	3.21	---	0.00	---	0.00	0.00	3.16
10/20	---	25.00	0.00	3.26	0.00	0.00	---	0.00	0.00	3.32
10/27	---	0.00	0.00	3.32	---	0.00	---	0.00	50.00	3.36
11/01	---	0.00	0.00	2.28	---	0.00	---	0.00	0.00	2.25
#Dsc'd	291	56	35	776	401	99	4	54	18	1,733
#Smpl'd	11,347	4,875	4,552	34,834	16,173	4,540	253	873	802	78,249
%Dsc'd	2.56	1.15	0.77	2.23	2.48	2.18	1.58	6.19	2.24	2.21

Other Injuries and Disease

In addition to standard length, weight and descaling data recorded for individual smolts in the daily subsample, smolts were also examined 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 2009-2011 can not be directly compared to injuries prior to 2009 due to changes to the FPC program. A total of 30,720 smolts were examined in the detailed subsample during 2011 compared to 25,825 in 2010, 25,217 smolts in 2009, 25,624 in 2008 and 19,808 in 2007. This season a total of 4,055 (13.2%) smolts were recorded as having head, body, predator caused injury or symptom of disease compared to 3,189 (12.3%) in 2010, 2,944 (11.7%) in 2009, 3,509 (13.7%) in 2008 and 2,006 (10.1%) in 2007. 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. Mandible and maxillary injuries were not recorded separately from the generic head injury category as in previous years. Head injuries were recorded on 0.5% of the smolts examined in the detailed subsample compared to 0.5% in 2010, 0.6% in 2009, 1.0% in 2008 and 0.9% in 2007. Injuries to the opercula comprised the majority of head injuries (38.5%) followed by eye injuries (32.3%) and eye hemorrhages (18.0%). Of all head injuries, 28.0% were on clipped steelhead, 26.7% were on unclipped subyearling fall Chinook and 17.4% were on clipped yearling Chinook.

The body injuries associated with dam passage that were recorded 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. Body injuries were observed on 4.3% of the smolts examined in the detailed subsample compared to 4.7% in 2010, 7.4% in 2009, 6.8% in 2008 and 4.2% in 2007. The majority of body injuries observed were discolored fins (38.5%) followed by pink fin (27.7%) and fin injuries (19.2%). Of all body injuries, unclipped subyearling fall Chinook had 61.1% of the total body injuries followed by clipped steelhead (13.0%) and clipped yearling Chinook (8.9%).

Diseases with external symptoms included fungus, columnaris, fin hemorrhage, bacterial

kidney disease and parasites. External symptoms of disease were observed on 2.1% of the smolts examined in the detailed subsample compared to 3.5% in 2010, 2.8% in 2009, 5.0% in 2008 and 4.3% in 2007. Symptoms of disease were highest on unclipped subyearling fall Chinook (66.9%) followed by clipped steelhead (11.4%) and clipped yearling Chinook (7.1%). Columnaris comprised the majority of the disease symptoms (43.8%) followed by fungus (20.5%) and fin hemorrhages (18.5%).

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, we have classified fish exhibiting these symptoms as infected with columnaris.

Lower Granite's 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 2011 was 1.1% (440 of 39,375) compared to 1.3% (550 of 41,116) in 2010, 1.0% (313 of 30,223) in 2009, 1.1% (614 of 55,826) in 2008 and 1.6% (566 of 36,577) in 2007. The 2011 columnaris rate is slightly lower than the 1.24% observed for the 2007-2010 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.

Injuries associated with predators include wounds inflicted by other fish, birds, and lamprey. Predator wounds were observed on 0.7% of the smolts examined in the detailed subsample compared to 0.8% in 2010, 1.0% in 2009, 1.0% in 2008 and 0.8% in 2007. Predator marks were highest on clipped steelhead (39.6%), unclipped subyearling fall Chinook (29.7%) and unclipped steelhead (20.3%). 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 (65.3%) compared to 31.2% for predator marks caused by fish. Similar to previous years the larger clipped and unclipped steelhead smolts had the most bird bites.

Mortality

Facility mortality included 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 for 2011 was 0.09% compared to 0.08% in 2010, 0.12% in 2009, 0.13% in 2008 and 0.11% in 2007 (Table 14). In all, 5,558 facility mortalities were recorded from a total collection of 6,310,606 smolts. The number of facility mortalities and the mortality percentage by species group included: 1,560 clipped yearling Chinook (0.08%), 325 unclipped yearling Chinook (0.04%), 717 clipped subyearling fall Chinook (0.31%), 2,032 unclipped subyearling fall Chinook (0.39%), 272 clipped steelhead (0.01%), 47 unclipped steelhead (0.01%), 26 clipped

sockeye (0.11%), 556 unclipped sockeye/kokanee (1.01%) and 23 coho (0.04%). Facility mortality rates for all species groups were lower than in 2010 except for clipped and unclipped subyearling fall Chinook and unclipped sockeye/kokanee. All species group mortality rates were lower than those observed for the 2007-2010 average. Facility mortality rates during the spring migration and the first five weeks of the summer migration did not exceed 0.50% and were lower than average. During August, September and October facility mortality rates were mostly above average and ranged from 0.48% to 4.26%.

Table 18. Annual facility mortality in percent at Lower Granite Dam, 2007-2011.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	Clipped	Unclipped	All	Total
2007	0.07	0.07	0.42	1.08	0.04	0.03	0.10	0.46	0.05	0.11
2008	0.13	0.10	0.55	0.51	0.04	0.04	0.16	4.40	0.07	0.13
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
07-10	0.11	0.08	0.44	0.46	0.03	0.02	0.19	1.31	0.10	0.11

Sample mortalities include dead fish removed from the sample tank prior to sampling and those from the sorting trough in the sample lab. In 2011, a total of 908 sample mortalities were recorded from a total of 79,426 sampled fish (1.14%) compared to 501 sample mortalities from 66,295 (0.76%) smolts in 2010, 511 of 70,866 (0.72%) in 2009, 937 of 97,421 (0.96%) in 2008 and 502 of 71,798 (0.70%) in 2007 (Table 20). The number of mortalities and percent mortality by species group for 2011 included: 80 clipped yearling Chinook (0.70%), 24 unclipped yearling Chinook (0.49%), 63 clipped subyearling fall Chinook (1.37%), 619 unclipped subyearling fall Chinook (1.73%), 33 clipped steelhead (0.20%), nine unclipped steelhead (0.20%), one clipped sockeye (0.39%), 77 unclipped sockeye/kokanee (8.11%) and two coho (0.25%). The overall sample mortality of 1.14% is the highest sample mortality rate in the last five years.

Barge mortalities are salmonids removed from barge holds after the barges depart LGR. Barge mortalities include those from fish loaded at Little Goose, Lower Monumental and McNary into barges originating at LGR. The barge mortality rate of 0.06% (5,381 of 9,311,962) in 2011 is the highest in the last five years (Table II, optional table from smolt monitors). The total number of smolts barged included 3,859,265 fish from LGR, 3,023,090 from Little Goose Dam, 1,365,733 fish from Lower Monumental Dam and 1,063,874 from McNary Dam. Barge

mortalities by species for 2011 include: 2,230 clipped yearling Chinook, 643 unclipped yearling Chinook, 1,313 subyearling fall Chinook, 656 clipped steelhead, 255 unclipped steelhead, one clipped sockeye, 132 unclipped sockeye/kokanee, seven coho and 144 salmonids classified as others because they were seen at release but could not be identified to species (Table II).

Table 19. Weekly facility mortality in percent by species group at LGR, 2011.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Week Ending	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total
31-Mar	0.03%	0.07%	--	3.74%	0.01%	0.00%	--	0.60%	0.41%	0.09%
7-Apr	0.03%	0.01%	--	0.00%	0.00%	0.01%	--	0.50%	0.00%	0.01%
14-Apr	0.03%	0.01%	--	0.40%	0.00%	0.01%	--	0.38%	0.00%	0.02%
21-Apr	0.01%	0.01%	--	0.00%	0.00%	0.00%	--	0.21%	--	0.01%
28-Apr	0.03%	0.02%	--	0.00%	0.02%	0.00%	--	0.79%	0.00%	0.03%
5-May	0.07%	0.05%	--	--	0.01%	0.00%	--	1.41%	0.00%	0.06%
12-May	0.09%	0.08%	--	1.50%	0.01%	0.00%	--	2.90%	0.03%	0.07%
19-May	0.10%	0.04%	0.02%	0.04%	0.01%	0.00%	0.33%	1.96%	0.04%	0.05%
26-May	0.07%	0.02%	0.09%	0.02%	0.01%	0.00%	0.01%	0.22%	0.01%	0.03%
2-Jun	0.26%	0.09%	0.47%	0.44%	0.03%	0.02%	0.45%	2.18%	0.05%	0.30%
9-Jun	0.12%	0.10%	0.31%	0.33%	0.10%	0.03%	0.17%	0.68%	0.11%	0.23%
16-Jun	0.32%	0.11%	0.63%	0.69%	0.12%	0.01%	0.00%	0.69%	0.18%	0.50%
23-Jun	0.14%	0.23%	0.10%	0.10%	0.06%	0.00%	0.62%	0.41%	0.00%	0.10%
30-Jun	0.60%	0.22%	0.24%	0.18%	0.10%	0.15%	0.00%	2.50%	0.50%	0.21%
7-Jul	3.13%	0.55%	0.19%	0.18%	0.00%	0.40%	2.86%	0.65%	0.00%	0.22%
14-Jul	5.00%	1.67%	0.39%	0.28%	0.31%	0.48%	--	3.21%	0.63%	0.34%
21-Jul	--	5.00%	0.35%	0.20%	1.43%	0.00	--	0.67%	0.00%	0.23%
28-Jul	10.00%	--	1.27%	0.81%	1.67%	0.00%	0.00%	0.43%	0.15%	0.81%
4-Aug	--	--	1.09%	1.08%	6.67%	--	0.00%	5.00%	0.15%	1.02%
11-Aug	--	50.00%	8.33%	3.09%	--	0.00%	--	0.00%	6.25%	3.38%
18-Aug	--	--	12.50%	1.14%	0.00%	--	0.00%	0.00%	2.08%	1.27%
25-Aug	--	--	0.00%	3.04%	--	0.00%	--	25.00%	0.00%	3.01%
1-Sep	--	--	0.00%	2.17%	--	--	--	--	0.00%	2.10%
8-Sep	--	0.00%	50.00%	4.13%	0.00%	0.00%	--	0.00%	0.00%	4.26%
15-Sep	0.00%	0.00%	11.11%	3.65%	--	33.33%	--	0.00%	0.00%	3.66%
22-Sep	--	--	10.00%	2.85%	--	0.00%	--	11.11%	0.00%	2.90%
29-Sep	--	16.67%	0.00%	1.65%	--	0.00%	--	5.26%	0.00%	1.67%
6-Oct	0.00%	0.00%	0.00%	0.85%	--	0.00%	0.00%	16.67%	0.00%	0.88%
13-Oct	--	0.00%	0.00%	1.91%	--	0.00%	--	0.00%	0.00%	1.87%
20-Oct	--	20.00%	0.00%	0.67%	0.00%	0.00%	--	0.00%	0.00%	0.79%
27-Oct	--	9.09%	0.00%	0.39%	--	0.00%	--	0.00%	0.00%	0.48%
1-Nov	--	0.00%	0.00%	1.13%	--	0.00%	--	0.00%	0.00%	1.11%
# morts	1,560	325	717	2,032	272	47	26	556	23	5,558
# collected	1,993,789	723,152	229,224	518,262	2,114,802	598,520	23,334	54,806	54,717	6,310,606
% mortality	0.08%	0.04%	0.31%	0.39%	0.01%	0.01%	0.11%	1.01%	0.04%	0.09%

-- no fish sampled

Table 20. Annual sample mortality in percent at LGR, 2007-2011.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip	All	Total
2007	0.38	0.26	0.66	1.16	0.21	0.30	1.12	0.00	0.15	0.70
2008	0.87	0.55	1.24	0.99	0.28	0.23	2.50	13.36	0.39	0.96
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
07-10	0.64	0.43	1.00	1.04	0.22	0.16	1.72	10.98	0.55	0.80

Table II. Total barge mortalities from LGR 2007-2011. (Optional table per Smolt Monitors.)

	Yearling Chinook		Subyearling	Steelhead		Sockeye/Kokanee		Coho	Unknown	
	Clipped	No Clip	Chinook	Clipped	No Clip	Clipped	No Clip	All	Others	Total
2007	465	89	98	308	95	0	1	21		1,077
2008	2,088	369	556	622	173	9	1	12		3,830
2009	1,316	206	1,560	404	103	7	13	8	476	4,093
2010	799	245	889	394	202	26	3	25	362	2,945
2011	2,230	643	1,313	656	255	1	132	7	171	5,408
07-10 ave	1,167	227	776	432	143	11	5	16	209	2,986

Table III. Barge Mortality Percent from LGR, LGS, LMN AND MCN dams 2007-2011. (Optional Table per Smolt Monitors)

Year	Number of Mortalities	Number Barged	Percent Mortality
2007[1]	1,077	5,342,257	0.02%
2008	3,830	9,095,533	0.04%
2009	4,093	8,637,230	0.05%
2010	2,945	7,447,634	0.04%
2011	5,381	9,311,962	0.06%
07-10 ave.	2,986	7,630,615	0.04%

Fish were not barged from McNary Dam during 2007 due to concerns with spill patterns from the temporary spillway weirs.

Table IV. Annual truck mortality at LGR, 2007-2011. (Optional table per Smolt Monitors.)

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	Clipped	No Clip	All	Total

2007	0.00	0.00	1.06	0.83	0.00	0.00	0.00	0.00	0.00	0.79
2008	--	0.00	0.00	0.58	0.00	0.00	--	5.05	0.00	0.80
2009	0.00	10.00	0.00	0.31	0.00	0.00	0.00	9.09	0.00	0.33
2010	0.00	0.00	2.78	0.27	0.00	0.00	--	0.00	0.00	0.28
2011	0.00	0.00	0.00	0.30	0.00	0.00	0.00	1.12	0.00	0.30
07-10 Ave.	0.00	0.37	0.61	0.47	0.00	0.00	0.00	4.80	0.00	0.55

The overall mortality rate for fish trucked from LGR in 2011 was 0.30% (47 of 15,608) compared to 0.28% (47 of 16,594) in 2010, 0.33% (22 of 6,700) in 2009, 0.80% (137 of 17,178) in 2008 and 0.75% (57 of 7,555) in 2007. This was the fifth consecutive year there was no early season trucking from LGR. Every other day (EOD) trucking began August 17 and ended November 1, the last day of the 2011 season. The 2011 trucking mortality numbers and percent by species included: 46 unclipped subyearling fall Chinook (0.30%) and one unclipped sockeye/kokanee (1.12%) (Table IV, optional table from smolt monitors). Due to repairs to the Little Goose fish facility transport truck, on August 21, August 23, August 25, August 27, August 29 and August 31 the Lower Granite truck picked up and hauled the Little Goose Dam smolts to the Bonneville release site. The smolts transported from Little Goose Dam were not used to calculate trucking mortalities.

Gas Bubble Trauma Monitoring

Examinations were conducted once each week, on up to 100 fish from April 12 through June 30. Smolts were collected from the wet separator at LGR. GBT staff examined 1,048 smolts comprised of 218 clipped yearling Chinook, 91 unclipped yearling Chinook, 475 clipped steelhead and 264 unclipped steelhead. Forty-three PIT-tagged smolts were handled, not examined and returned to the separator including 13 clipped yearling Chinook, seven unclipped yearling Chinook, 14 clipped steelhead, six unclipped steelhead, and three unclipped sockeye/kokanee. After examination for GBT, the smolts were placed in raceways and transported after the general transport season began on May 2. No symptoms of gas bubble trauma were observed on smolts examined at Lower Granite Dam this season.

Research

Seven different agencies conducted 11 research projects that impacted 602,405 smolts compared to 546,340 in 2010, 750,823 smolts in 2009, 867,442 smolts in 2008, and 653,552 smolts in 2007. Of the 602,405 smolts taken from the collection in 2011, there were 176,509 clipped yearling Chinook, 49,790 unclipped yearling Chinook, 37,196 clipped subyearling fall Chinook, 70,090 unclipped subyearling fall Chinook, 225,508 clipped steelhead, 32,346 unclipped steelhead, 2,840 clipped sockeye, 5,592 unclipped sockeye/kokanee and 2,534 coho. In addition, the University of Idaho and the Columbia River Intertribal Fisheries Commission (Nez Perce Tribe) continued a study on adult steelhead kelt fallbacks which impacted 558 clipped and 1,347 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 357,014 smolts for this study. These fish are part of an ongoing transportation evaluation study and were tagged throughout the spring and summer migration from April 5 to June 18. The NMFS crew PIT-tagged and transported 25,614 smolts; 11,938 unclipped yearling Chinook, 5,423 clipped steelhead and 8,253 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 for at least 24 hours prior to being loaded onto barges for transport. This year a total of 284,703 smolts were handled, not tagged and transported. These included 77,910 clipped yearling Chinook, 9,145 unclipped yearling Chinook, 32,906 clipped subyearling fall Chinook, 49,157 unclipped subyearling fall Chinook, 108,895 clipped steelhead, 655 unclipped steelhead, 1,187 clipped sockeye, 3,412 unclipped sockeye/kokanee and 1,436 coho. Another 46,644 smolts were handled, not tagged and bypassed. These included 8,534 clipped yearling Chinook, 523 unclipped yearling Chinook, 4,098 clipped subyearling fall Chinook, 7,451 unclipped subyearling fall Chinook, 22,409 clipped steelhead, 514 unclipped steelhead, 1,653 clipped sockeye, 870 unclipped sockeye/kokanee and 592 coho. Fifty-three smolts died before they were tagged including 36 clipped yearling Chinook, one unclipped yearling Chinook, one clipped subyearling fall Chinook, three unclipped subyearling fall Chinook, eight clipped steelhead, one unclipped steelhead and three unclipped sockeye/kokanee. 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 Reach Survival

This is an ongoing study conducted to evaluate the in-river survival of juvenile salmonids bypassed into the tailrace at LGR. This year 56,149 fish were PIT-tagged and bypassed including 16,046 unclipped yearling Chinook, 22,057 clipped steelhead and 18,046 unclipped steelhead. There were 109 fish that died after being tagged including 71 unclipped yearlingChinook, 23 clipped steelhead and 15 unclipped steelhead. This study was done in conjunction with the NMFS Transport Evaluation Study.

NMFS-Extra Mortality Evaluation

This is an ongoing study to evaluate the mortality effects upon fish encountering the collection and bypass facilities at Little Goose, Lower Monumental and Ice Harbor Dams compared to fish that do not encounter these dams. This study was conducted from April 22 to May 12. In previous years clipped yearling Chinook were collected at LGR and divided among three treatment groups. The first treatment group was PIT-tagged, trucked and released below Ice Harbor Dam, the second group was PIT-tagged and trucked for the same period of time as the first group, but released in the tailrace at LGR and the third group was PIT-tagged and bypassed directly into the tailrace at LGR, to evaluate the trucking effects on the first two groups. This season NMFS did not tag a direct tailrace release group. NMFS tagging crews handled 170,453 smolts during this study. Of these 74,842 clipped yearling Chinook were PIT-tagged and bypassed including 45,779 that were trucked for a period of time similar to those released below Ice Harbor Dam and then released into the tailrace at LGR. Another 29,063 clipped yearling Chinook were trucked to and released into the Ice Harbor Dam tailrace. In addition 55,359 fish were handled, not tagged and transported including 10,696 clipped yearling Chinook, 2,893

unclipped yearling Chinook, 14 clipped subyearling fall Chinook, 69 unclipped subyearling fall Chinook, 39,867 clipped steelhead, 367 unclipped steelhead, 1,009 unclipped sockeye/kokanee and 444 coho. Another 40,035 smolts were handled, not tagged and bypassed including 4,029 clipped yearling Chinook, 6,525 unclipped yearling Chinook, 51 unclipped subyearling fall Chinook, 26,763 clipped steelhead, 2,308 unclipped steelhead, 297 unclipped sockeye/kokanee and 62 coho. There were 105 clipped yearling Chinook that died after being tagged. There were 112 mortalities recovered from the raceways prior to handling including 73 clipped yearling Chinook, 38 clipped steelhead and one unclipped sockeye/kokanee.

NMFS-Subyearling Fall Chinook Transportation Evaluation Study

The objective of this study is to compare the survival and return rate of subyearling fall Chinook that are transported to those that migrate to the ocean in-river. This study was conducted during the late-season trucking season from September 7 through November 1. Fish were taken from the daily samples and PIT-tagged at the juvenile fish facility three to four times each week. NMFS staff handled 11,066 subyearling fall Chinook during this study. Of these 5,517 subyearling fall Chinook were taken from daily samples, PIT-tagged and transported by truck and released below Bonneville Dam and 5,517 were taken from daily samples, PIT-tagged and bypassed to the river. There were 32 subyearling fall Chinook that died after tagging.

United States Fish and Wildlife Service (USFWS), United States Geological Service (USGS), Pacific Northwest National Laboratory (PNNL) 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 2010 release of Dworshak hatchery fish in the SBC tanks at LGR during their April and May out-migration. This season NMFS personnel sampled 24 yearling fall Chinook holdovers. There were 13 non-target clipped yearling Chinook handled and bypassed from the SBC tanks.

United States Fish and Wildlife Service (USFWS), United States Geological Service (USGS), Pacific Northwest National Laboratory (PNNL)–Gene Expression and Bioenergetics study

The goal of this project is to provide empirical data and analyses on the dam passage timing, travel rate, survival and life history variation of fall Chinook salmon juveniles in the Clearwater River that subsequently pass downstream in the four Snake River reservoirs from spring to winter. More specifically, to use radio telemetry, PIT-tags a gene expression study and bioenergetics to study fall Chinook salmon migratory behavior and life history. On three separate days (July 19, August 23 and October 12) 15 unclipped, untagged subyearling fall Chinook were taken from the sample and sacrificed. Tissue and blood samples were taken to analyze smoltification enzyme levels and the expression of genes associated with growth, metabolism and physiological development.

United States Fish and Wildlife Service (USFWS), United States Geological Service (USGS),

Pacific Northwest National Laboratory (PNNL)–Bypass probability study

Unclipped, untagged subyearling fall Chinook were PIT and radio tagged and released upstream of LGR at Blyton Landing to estimate survival through the bypass system and turbines during the fall and winter when the bypass facility is not operated. Radio telemetry fixed detection sites will be used to estimate bypass probability and survival at LGR during the fall and winter. Smolts greater than 42 g were collected from the sample, tagged and released the following day. For the season 235 smolts were tagged and bypassed, nine fish were handled and rejected and one fish died before being tagged.

United States Fish and Wildlife Service (USFWS), United States Geological Service (USGS), NMFS, Nez Perce Tribe (NPT)-Post Release Performance of Subyearling Fall Chinook Study

Subyearling fall Chinook were PIT-tagged at Dworshak Hatchery and released into the Snake River. Subyearling fall Chinook were also caught by hook and line and PIT-tagged in the Clearwater River and in the reservoir above LGR. These fish were diverted into the Separation-By-Code (SBC) tank at LGR from May 25 to August 2 to measure growth. USFWS sampling crews handled 408 smolts from the SBC tanks including 196 PIT-tagged target subyearling fall Chinook that were bypassed to the river. Seventy-nine targeted unclipped subyearling fall Chinook smolts were sacrificed. There were two unclipped subyearling fall Chinook handling mortalities. Another126 non-target smolts were bypassed to the river including 35 clipped subyearling fall Chinook, 62 unclipped subyearling fall Chinook, 15 clipped steelhead and 14 unclipped steelhead. There were five target PIT-tags found in non-target clipped steelhead that were bypassed. In 2010 this study found 11 target PIT-tags in non-target clipped steelhead.

Kintama Research-An Acoustic Tracking Array for Studying Ocean Survival and Movements of Columbia River Salmon

The goal of this study is to use Pacific Ocean Survey Tracking (POST) acoustic telemetry array technology to perform direct measurements of the marine survival of Columbia River spring Chinook salmon smolts as compared to their in-river survival and the relative survival of in-river and transported Snake and Yakima River spring Chinook smolts. Four detection arrays are located in the lower river below Bonneville Dam and three ocean detection arrays are located at Willapa Bay (Washington), Vancouver Island and Graves Harbor (Alaska). Study fish (yearling spring Chinook greater than 130 mm fork length) were taken from the sample and tagged from May 13 to May 21. Kintama personnel handled 274 yearling spring/summer Chinook during this study. Ten unclipped and 190 clipped yearling Chinook were acoustic tagged and transported. Another 61 smolts including 54 clipped and seven unclipped yearling Chinook were handled, rejected and transported. Five clipped yearling Chinook died before being tagged and eight clipped yearling Chinook died after being tagged.

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, measurements and genetic samples were

taken from fish in the sample from March 29 to July 9. IDFG personnel handled 6,605 smolts during this study. A scale sample and a fin clip was taken from 2,173 unclipped and not fin eroded steelhead, 127 unclipped yearling Chinook and 87 unclipped subyearling fall Chinook. A fin clip only was taken from another 4,218 smolts including 2,499 unclipped yearling Chinook and 1,719 unclipped subyearling fall Chinook.

Univ. of Idaho/Columbia River Intertribal Fisheries Commission (CRITFC)/Nez Perce Tribe (NPT)-Developing Strategies to Improve Survival and Return Recruitment of Steelhead Kelts from Snake River Stocks

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. NPT personnel impacted 1,905 steelhead kelts during this study including 558 clipped and 1,347 unclipped steelhead kelts. Kelts that were PIT-tagged, blood sampled and returned to the tailrace including 480 clipped and 1,145 unclipped steelhead kelts. Another 22 clipped and 24 unclipped steelhead kelts were PIT-tagged, blood sampled and transported by barge. Another 19 clipped and 28 unclipped steelhead kelts were PIT-tagged, blood sampled and transported by truck. One hundred fourteen clipped steelhead kelts was handled and transported to Dworshak Hatchery. Forty-seven unclipped steelhead kelts were blood sampled, PIT and acoustic tagged and barged below Bonneville Dam. Ten clipped and ten unclipped steelhead kelts died in the tank before handling by UI personnel. There were two clipped and four unclipped steelhead kelts that died after being PIT-tagged and blood sampled. Another 20 steelhead kelts, four clipped and 16 unclipped were sacrificed by University of Idaho researchers who took tissue samples for physiological and genetic testing. University of Idaho also sampled ten kelts for genetics that were also sampled by NPT researchers so these fish are included in the totals above.

Facility Operations and Maintenance

Turbine Operations

Turbine unit operating priorities at Lower Granite continued as in 2010. Operational guidelines at Lower Granite are turbine units 1, 2, 3, then 4-6 (in any order), 24 hours per day, from March 1 through December 15. From December 16 to February 28, any unit may be run 24 hours per day without regard to order. Turbine unit operating priority may be coordinated differently to allow for fisheries research activities, construction, or project maintenance activities. The project followed the normal turbine unit operation as outlined in Table LWG-5 in the Fish Passage Plan during 2011.

During 2011, turbine units 1-6 were unavailable for service 16,205.1 hours out of a possible 52,560 operational hours. This computes to an overall availability factor of 71.9%. This is slightly better than in 2010 when the availability factor was 69.06%. The 2011 availability factor on a per unit basis was: turbine unit 1 (90.6%, turbine unit 2 (84.0%), turbine unit 3 (39.7%), turbine unit 4 (77.5%), turbine unit 5 (67.0%), and turbine unit 6 (73.2%). Turbine unit 1 was unavailable for service a total of 819.2 hours for various reasons. The biggest outage factor was annual maintenance which required 727 hours. Turbine unit 2 was unavailable for service 1404.5 hours. The biggest outage factor was annual maintenance in November and

December which required 919.1 hours. Turbine unit 3 was unavailable for service for a large part of the year with a total of 5,284.5 hours attributed to a rewind and comprehensive overhaul that carried over until May 19 from the previous year – this accounted for 3,320.2 hours of the unit's unavailability. Turbine unit 4 was unavailable for service a total of 1,966.8 hours. The biggest outage factor was annual maintenance from August through October which required 1,905.3 hours. Turbine unit 5 was unavailable for service a total of 2,892.2 hours. The biggest outage factor was a 15 KV ground fault on March 9 which required 1351.3 hours. Turbine unit 6 was unavailable for service a total of 2,350.0 hours. The biggest outage factor was annual maintenance and exciter rehabilitation activities from July to October which required 2,172.7 hours. In general, turbine unit availability was highest during the months of May – July and lowest during August – December.

Fish-related work did not cause much turbine unit unavailability during 2011. Nearly all fish-related outages were due to fish screen installation and removal activities and video inspections of the VBSs and ESBSs. Per the Ombil database system there were approximately 39 hours and 33 minutes (39.6 hours) of direct fish-related turbine unit outages during 2011. By comparison during 2010 and 2009 there were a recorded 95.7 hours, and 131.6 hours of outages, respectively. During 2011, there were also approximately 29 hours of unit outages related to trash raking activities in early March which were not included in the fish-related outages. Per Ombil, the following outage hours were directly related to fish work in 2011: Unit 1 (18.1 hours), unit 2 (4.7 hours), unit 3 (none, unit out of service more than 60% of the year), unit 4 (12 hours), unit 5 (0 hours) and unit 6 (4.6 hours).

Forebay Debris/Trashracks

Unit trashracks were raked for debris on March 1-3. Lower Granite turbine unit 1 was taken out of service between 0915 and 1430 hours for trash rack raking on March 1, 2011. Turbine unit 2 was also taken out of service for trash rack racking on March 1 between 1106 and 1640 hours. Turbine unit 3 was out of service and the rashrack was not raked. Turbine units 4-6 were taken out of service on March 3 between 1010 to 1624 hours. Trashrack cleaning on unit 6 was not completed that day but was finished on March 7. It initially appeared as if 2011 was going to be a low flow year but late season moisture quickly changed the situation and flows reached 200 kcfs for a few days in early June. The high flows resulted in some accumulation of debris in the forebay. Most of this debris was eventually spilled downstream through the RSW. Although debris levels were problematic at the juvenile fish facility during June, it was not necessary to rake trash racks a second time in 2011. Frequent inspection of the gatewells and hand dipping of debris off the gatewell surfaces helped prevent problems at the fish facility.

Removable Spillway Weir

The removable spillway weir was operated as an integral part of the spill plan beginning on April 3. A large log became lodged in the RSW on April 5. Permission was granted to close spillbays 1 & 2 for a couple hours on the morning of April 6 and the log was removed.

Extended-length Submersible Bar Screens (ESBSs)

All operating turbine units were equipped with ESBSs during the 2011 fish passage season. Winter maintenance on the screens was ongoing in late February and early March and an inspection of the screens was conducted in mid-March - just prior to installation. No significant problems of any kind were detected. Installation of fish screens was completed in all units by March 24.

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 were conducted in April and no problems were detected with any ESBS. The inspections on May 21 were postponed due to high water turbidity which prevented the camera operator from seeing anything. The inspections scheduled for June 24-25 were also postponed due to high water turbidity and the fact that shutting off a unit (and spilling more water) would contribute to already high dissolved gas levels in the tailrace. Per the Fish Passage Plan, it is not necessary to conduct video inspections during July. Video inspections during August and October revealed no problems of any kind with the ESBSs.

Operation of the ESBSs was relatively trouble-free during the 2011 season. The ESBS scrub brushes can be individually set to clean the screens at the following interval times: 15 minutes, 1 hour, 2 hours, and 4 hours. Brush cycle times during 2011 ranged from one to four hours dependent on the amount of debris moving through the system. Due to high debris levels this season, all brushes were set to clean the screens once per hour for most of the season. All ESBSs were raised and dogged off for the winter maintenance season by December 19.

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 2011 fish season. During 2011, VBSs were inspected with an underwater video camera per FPP guidelines in conjunction with a limited inspection of the ESBSs. One minor VBS problem was detected on those inspections. On the April 22 inspection the inspector noted that a four foot section of strapping used for securing the mesh was possibly missing from unit 2 VBS but that poor visibility made it hard to be sure. He also noted that the mesh was still entirely in place. During the August 6 – 7 inspection the inspector noted that an approximately 3 foot section of VBS retaining strap was missing on a screen in gatewell slot 1-B. He also noted that the mesh was entirely in place. No additional problems were detected on subsequent video inspections. This item should be repaired during the 2012 winter season.

Gatewells

Gatewells were inspected during adult fishway inspections throughout the 2011 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 - 2010, constant debris movement through the orifices prevented the need for extensive gatewell cleaning during 2011.

Some larger debris was removed from individual gatewell surfaces with a small dipping basket when it appeared that it might cause problems with movement through the collection gallery orifices. This operation first took place in late March and continued throughout the season as circumstances warranted. Gatewell 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 2011 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 21, 2011 to accommodate fish screen installations. Bulkhead (downstream) slot orifices were operated in the usual manner during 2011 with at least one orifice per gatewell slot opened to divert fish into the collection channel. Upstream (fish screen slot orifices) were operated to provide additional water and fish guidance as hydraulic conditions allowed. During 2007, the upstream gatewells (fish screen slots) were dipped to see if any fish were present (gatewells and Wagner Horns were sealed in the mid 1990s). Very few fish were found with the exception of fish screen slot 5B where approximately 50 steelhead and 50 Chinook were removed. Consequently, an orifice from slot 5B was left open during the entire 2011 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.

The air backflush orifice cleaning system worked well during 2011 and there were no significant maintenance issues of any kind. Due to the variability of the debris moving through the system, the project maintained a schedule of backflushing orifices every 3 hours around the clock from late March through the cessation of fish collection activities in early November. 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 system was shut down for the season on December 19.

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. Small invertebrates in the river can also plug the screen and make cleaning very difficult. During late May and early June 2011, high river flows and a preponderance of fine debris resulted in the need to clean the screen on an hourly basis to prevent clogging.

It is likely that the fish facility would have had to go into primary bypass mode during late May and early June due to all the fine debris had it not been for the initiative of the Lower Granite FFF maintenance crew. A long handled brush with high pressure air jets was developed to help clear the debris from the screen. In practice the separator technician hooked the hose on the brush into the facility air supply. The brush was then pushed as far back on the inclined screen as possible and slowly pulled forward. The high pressure air pushed through the screen material and then bubbled back up freeing the debris immediately in front of the brush. By slowly pulling the brush forward it was possible to clean the debris off a portion of the screen one section at a time. Had it not been for this development, it is highly likely the screen would have become clogged at a critical time and an emergency fish release implemented.

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 easily 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).

Debris impingement on the inclined screen was quite a bit worse during 2011 than in 2010 when only a couple of bypass events were necessary to clean the screen. During 2011 it was necessary to go into primary bypass mode on 15 separate occasions to clear the inclined screen of material. These cleaning events took place between May 21 and July 16. Cleaning events took from 15 minutes up to nearly an hour dependent on the severity of impingement of fine debris in the screen and the need to powerwash the screen to clean it sufficiently. Separator technicians were able to stay away from having to dewater the inclined screen most of the season by cleaning the screen on an hourly basis when high levels of debris were moving through the system. This was especially problematic during early to mid June when river flows were high.

Another problem that developed during the 2011season at Lower Granite was a relatively high level of the aquatic plant Elodea moving through the system. This was something that had not previously been encountered to any extent at this site. Bushels of this plant were removed off the inclined screen and from raceways during early to mid July. We attempted to chase down the cause of this influx of material (thinking that perhaps someone upstream might have been cleaning vegetation from around docks) but were unsuccessful in finding the source.

Separator

The separator at Lower Granite is a single stage separator and currently has no provision

for size separation of juvenile fish. The separator functioned well during the 2011 season with the exception of the few periods of time when high levels of debris became an issue. It was necessary to check the separator exits more frequently than normal during the late May to mid-July time frame due to debris blockages. It was not necessary to partially dewater the separator bin (below the bars) to remove debris during 2011. After high debris levels dropped off in July, there were very few problems with the separator and related mechanisms. Both the 72-inch and 42-inch separator controller valves were replaced during the winter of 2003-2004 and they continued to perform flawlessly during most of the 2011 fish collection season. Late in the season the 42-inch valve electric controller failed due to a bad circuit card. It was necessary to manually operate the valve for the last portion of the season. Operation of the separator in the normal collection/sampling mode took place from 0700 hours on March 25 through 0700 hours on November 1.

In 2011 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. (Unlike 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) through December 15. The JFF maintenance crew kept electric/diesel heaters available for use at the separator and other exposed pipe areas. Maintenance and separator personnel started the heaters whenever overnight temperatures dropped to the point that pipes could potentially freeze. Unlike recent seasons, temperatures remained mild enough during November and December that we were able to operate the system in the secondary bypass mode continuously and avoid going into primary bypass. The separator technicians and maintenance crew kept diesel/electric heaters near the separator and utilized them during the few evenings temperatures dropped low enough to cause the possibility of freezing pipes.

During 2011 small Chinook jacks caused some problems by falling through the separator bars and ending up in the sample. This is problematic because the jacks tend to thrash around quite a bit while being anesthetized and can cause injury to the much smaller juvenile fish in the sample. 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 bars with a smaller spacing were place on top of the existing separator bars on the morning of September 26. These bars were removed after the end of fish collection and sampling activities when the system had been switched back to secondary bypass mode. These bars were first utilized during the 2009 season when jack Chinook numbers were very high and large numbers of them were ending up in the sample. During 2010 it was not necessary to use them at all due to lower numbers of jacks. The 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.

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 2011 this occurred from startup on March 25 until the morning of August 2. From 0700 hours on August 2 until the end of normal separator operations on November 1, the PIT-tag diversion system was set to divert all PIT-tagged fish and override the sample diversion gate.

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. Samples were taken four to six times per hour during the course of the season until August 15 when the system was switched to a 100% sample rate. The sample rate remained at 100% for most of the extended season but was reduced to less than 50% on September 22-24 due to too many fish in the sample and the lab not finishing the sample until late in the morning. This was impacting the departure of fish transport trucks to Bonneville. Weekly sample rates ranged from 0.500% to 50.000% prior to the 100% sample period. 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 between March 12 and March 21, 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 2011.

Cooling Water Strainers

In accordance with District policy the turbine unit cooling water strainers were inspected for juvenile lamprey on a monthly basis during 2011. An attempt was made to inspect all strainers each month but this was not always possible due to units being tagged out for maintenance. January was the highest month for lamprey entrainment with a total of 469 dead lamprey removed from the strainers. April and May also had relatively high entrainment rates

with respective monthly totals of 107 and 183 juvenile lamprey. September, October, and 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 978 juvenile lamprey (all dead) were removed from the cooling water strainers at Lower Granite.

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. This decreases handling a second time and is thought to reduce the overall stress to the fish. During 2011, an estimated 43.4% of the smolts barged from Lower Granite (1,674,590 smolts out of 3,859,265 smolts barged) were direct loaded into barges at Lower Granite. This is nearly the same as in 2010 but somewhat better than most recent years. During 2010, 1,499,663 smolts were direct loaded out of 3,378,007 smolts barged (44.4%). Direct load percentages for other years were: 2009 (32.5%), 2008 (38.8%), and 2007 (24.5%). The ability to direct load is dependent a number of factors including time of arrival of fish barges, spill patterns, total river flow and fish marking operations. The increased diversion of fish into the upstream raceways to accommodate NOAA-Fisheries research marking operations has significantly impacted the direct-loading of fish onto barges at Lower Granite in recent years.

Recommendations

1. Install a generator to power the fish facility during electrical outages.
2. Refurbish the existing separator inclined screen with bar screen material; add an airburst cleaning system under the inclined screen; beef up the existing screen support system (it is rusted and could fail in the not too distant future).
3. Tune up/recondition the Cat engines on barges 8105 and 8106 and develop a plan to tune/repair/overhaul engines on the remaining barges over a several year period.
4. Tune up the Cummins barge engines (per company specs this should be done every 1,000 hours).
5. Pour concrete to serve as ballast in fish barges 4394 and 4382. Paint exterior of both barges while concrete work is being done. (Try to contract this work in FY 2012 or 2013).
6. Refurbish the concrete on the raceway interiors with a new sac-rub finish (pending a new JFF).
7. Paint exteriors of all fish barges.
8. Paint the holds on fish barge 4382.
7. Replace the lab chiller system. (The chiller for the recirculation system is unable to keep the recirculation water at spring/summer temperatures.)
8. Refurbish the chain drive system for the sample holding tank.
9. Increase size of catch basin which is used to drain water from cans holding research fish from the sample.
10. Install or remove push knees (as needed) on the barges and explore a new bumper system to use in place of the present cable and tire system.

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A total of 20 people were employed in various capacities at the Lower Granite Juvenile Fish Facility during 2011. 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: Suzette Frazier, Gene Sprofera, Robert Traufer, and John Dammann. Corps separator technicians were: Robert Horal, Gary Fitzgerald, Chris Foster, and Gary Mellstrom. The Corps maintenance and truck driving staff consisted of Greg Eickmann and Raymond Cooper. Bradley Clarke served as the engineering equipment operator leader. Mike Knapp served as the heavy mobile equipment operator.

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