ADULT AND JUVENILE FISH FACILITIES MONITORING REPORT
LITTLE GOOSE DAM – 2011

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Introduction

This report summarizes the operation and maintenance of the adult fish passage facility located at Little Goose Dam (LGS) from March 1, 2011 to February 28, 2012. The report also summarizes activities and results associated with the collection, transportation, and bypass of migrating juvenile salmon and steelhead at LGS in 2011. A more detailed annual report on juvenile fish is available upon request.

River Condition

The 2011 water year was relatively wet with 20.8 inches of precipitation or 117% of the 1971 to 2000 average observed for the Snake River basin above Little Goose. Flows were well above the five year average throughout the 2011fish collection season. Daily average flows for the months of May, June, July and August were 133%, 166%, 203% and 141% of the 2006 – 2010 five year average.

From April 1 through October 31, average daily flow past LGO was 84.6 kcfs with a peak daily flow of 200.8 kcfs on June 8 and a minimum daily flow of 18.8 kcfs on October 28. The major components of total flow at LGO were discharge through turbine units (powerhouse flow) and discharge over spillways. Minor sources of discharge were the fish passage structures and the navigation lock.

The spillway weir was placed into operation on April 3, and spill to aid downstream fish passage occurred from April 3 to September 1in accordance with the 2011 Fish Passage Plan (FPP). The FPP specified that spill at Little Goose was to be kept at a constant 30% of outflow. Factors that affected spill management were excess flows from runoff, total dissolved gas (TDG) levels, generation unit outages, low power demand, debris management, and adult fish passage. All deviations from the spill mandates were coordinated through the Technical Management Team (TMT). In 2011, spill exceeded 30% of flow during the peak spring runoff period. The average daily discharge from April 3 to August 31 was 106.5 kcfs. Daily spill averaged 38.4% of total flow during that time period. In 2011, spill averaged 29.7% of total flow for the month of April, 54.8% of total flow for May, 44.5% of total flow for June, 30.4% of total flow for July and 31.9% of total flow for August.

Adult Fish Facility

Facility Description

The adult fish facility is located on the downstream side of the dam and functions to attract and pass adult migrating fish upstream over the dam. The facility consists of a fish ladder and a collection channel. The collection channel acts to both attract and route fish from across the tailrace to the fish ladder. Components of the collection channel system include two South Shore Entrances (**SSE**), two North Powerhouse Entrances (**NPE**), two North Shore Entrances (**NSE**), the collection channel itself, a fallout fence, a auxiliary water supply system, and an electronic monitoring and control system.

The pool-and-weir fish passage ladder is located on the south shore. It is approximately 1,000 feet long and rises a vertical distance of about 100 feet. The ladder begins at the junction pool near the SSE and leads upstream westward approximately 400 feet and switches backed with a curve south and then east. It continues another 550 feet to the east where it passes under the dam's intake deck and exits into the forebay.

The viewing room and fish counting windows are located approximately 300 feet from the start of the ladder at the junction pool. The fish counting slot is approximately 18" wide by 36" high. Underwater vertical fences called "Picketed Leads" guide and confine fish to pass through the counting slot.

The two SSE (SSE1 and 2) have overflow weirs that are normally open. The two NPE (NPE1 and 2) have overflow weirs and were normally open. NPE3, a lift gate entrance, was permanently closed with a concrete bulkhead. The two north shore entrances (NSE1 and 2) are also overflow weirs and were normally open. NSE3, a lift gate entrance, was also permanently closed with a concrete bulkhead.

Additionally, ten floating orifice gates located in front of the powerhouse have been removed and permanently sealed with bulkheads. Floating orifice gates 1, 4, 6, and 10 have been closed since the 2000 fish passage season and floating orifice gates 2, 3, 5, 7, 8, and 9 have been closed since January 1996. Research has proved that adult fish attraction into the adult fish channel improved with these ten gates closed.

The adult collection channel begins at the NSE, passes under the spillway, past the NPE and fallout fence then continues along the base of the powerhouse, and terminates in the junction pool near the base of the ladder. A separate short channel connects the SSE to the junction pool and ladder. The fallout fence, consisting of a pipe framework and chain link fencing, is located in the channel near NPE1 and 2. It functions to prevent fish in the channel from leaving the channel and re-entering the tailrace via NPE.

The collection channel water is supplied from three sources. First, the fish ladder coupled with a diffuser (diffuser 13) supplies approximately 75 cfs of water and flows via gravity into the channel. Second, three turbine-driven pumps (fish pumps) supply approximately 1,700-2,000 cfs of auxiliary water. The fish pumps move water from the tailrace into a head channel that through gravity forces water through floor diffusers located on the bottom of the collection channel in front of the powerhouse, near the junction pool and lower end of the ladder. Third, 175-230 cfs of excess water from the primary dewater unit of the juvenile fish collection system also flows into the floor diffusers.

An electronic computer interface system for operating and monitoring the adult fishway was put in service in March 1994. The Fishway System Control (**FSC**) monitors and controls the fishway. The FSC includes water elevation sensors for the fishway channel and for the tailrace near each entrance (six sensors total). All six-overflow weirs also have elevation sensors and controls. The FSC system is based on an old DOS computer and 5 and 1/4 inch disk to make calibrations and corrections. An electronic water velocity meter (flowmeter) was added to the collection channel near the SSE in November 1997. The meter was positioned near the junction pool and diffuser 2. Diffuser 2 (the largest of the water supplying diffusers) produced upwelling and non-laminar flows and the flowmeter was consistently unreliable. The flowmeter failed in spring of 2011 and not repaired. It was replaced with a newer manually operated "current meter". The current meter is located near the NPE, approximately midpoint of channel and is more representative of the average underwater flows throughout most of the channel.

Fish Passage and Fishway Activities

In 2011 a total of 424,713 salmonids were visually counted passing upstream through the adult fish ladder. The species counts were 138,454 Chinook adults, 58,970 Chinook Jacks, 221,002 Steelhead, 1,436 Sockeye, 4,445 Coho and 406 Coho Jacks. Additionally, 80 Adult Lamprey were counted migrating upstream through the adult fishway system.

Operations and Maintenance

The adult fishway facility was in service from March 2 through December 31, 2011. The facility was operated similar to that in 2010. New in 2011 was that NPE3 and NSE3 were permanently sealed closed with a concrete. NSE1, NSE2 weir gate hoists continued to be out of service in 2011 and the top of the weir gates were held fixed at 531.5 ft. The fixed position of the NSEs was determined to be best elevation throughout the season with fluctuating pool elevations of 5 feet. The weirs were unable to move using the chain-fall hoist once the pumps were operating and flow forces were established. At times the NSE elevations were slightly below criteria when tailrace elevations decreased below 537.5 feet. The new metal halide lamps installed in the spillway section of the channel in February 2011 significantly improved the visibility in this section and work well all season.

Fish pump performance in 2011 continued to improve. There were a total of three pump outages. The first was scheduled for preventive maintenance, the second occurred to pump #2 due to overheated bearings and the third occurred to all three pumps as a result of electrical switching operations to test a newly installed back-up diesel generator.

The FSC computer system originally installed in 1994 was again problematic in 2011. The system uses the antiquated DOS and 5.25 inch floppy disks. The computer readouts values were often incorrect during the season at which manual measurements were used to record channel and tailwater elevations. The procedure to purchase and install a new computer system to operate the fishway has been started.

The subsurface flowmeter failed in early 2011. The project purchased a new "current flowmeter" to determine subsurface velocity. The new meter was positioned near the NPE approximately mid-point of the length of the channel. With all three pumps operating at normal operating ranges, subsurface velocities measured at multiple depths average approximately 2.3 - 2.7 fps. The old flowmeter was positioned near the junction pool and electronically measured water velocity using a formula calculated from the average water speed from three sections of the channel; near the surface, mid depth and near the bottom. As determined by the 2001 hydraulic evaluation, water velocities near the junction pool more often than not would not meet criteria due to strong upwelling flows from diffuser 2. The upwelling interfered with measurements of horizontal laminar flows. The new current flowmeter positioned near the NPE is best located to measure laminar flows that best represent the overall functioning of the channel as a whole.

Surface water velocities were measured near the junction pool and near the NSE. As in past years, these velocities were calculated by recording the time of travel of sticks or bubbles over a known distance.

The adult fishway was removed from service beginning January 1, 2012 when the pumps were shut down and diffuser 13 valve closed. On January 3, the ladder was dewatered to the tailrace elevation. The powerhouse of the collection was dewatered on January 9 followed by the spillway section on January 10.

Ladder maintenance included; repairing the fish counting slot support base, sealing expansion joints, inspecting weirs, removing debris, cleaning the picketed leads, servicing the window brush cleaning motors, replacing light bulbs, cleaning lamp lenses and cleaning the viewing windows.

Collection channel maintenance included; repairing 2 dislodged diffuser grates, removing debris, minor repairs to the fall-out fence. Repairs to the fall-out fence were made in January 2006, 2007, February 2008, 2010, 2011 and again in 2012. Extensive repairs to the fence were performed in January 2011. These repairs held up through the 2011 season. However, the chain-link fencing continued to corrode at points of contact with the structural supports. New stainless steel welded mesh is scheduled to be installed in January 2013.

<u>Adult Fishway Inspections</u>

Adult fishway inspections during the 2011 fish passage season were conducted by Corps fishery biologists and/or technicians and by natural resources specialists with the Oregon Department of Fish and Wildlife (ODFW). Inspections by the ODFW were done twice a week from April through October, generally on designated days. Inspections by the Corps were conducted weekly but on different days and at different times each week through October and conducted two to three times each week during November and December. Problems observed during an inspection were reported to the Project Biologist and/or the Dam Operator for appropriate action. Chronic problems with no immediate fix (e.g. inadequate weir depth at the NPE) were simply recorded. The more important problems are detailed below in the results section.

All inspection data were entered into a computer spreadsheet that provided an indication as to whether operating criteria were met (Appendix 1). Spreadsheet outputs includes: "yes" (meets criteria), "no" (does not meet criteria), "NA" (no reading taken), "closed" (entrance closed due to weir failure or for two-pump operation), and "sill" (overflow weir bottomed out on its sill, due to minimum operating pool (MOP) conditions). The two criteria used to determine "sill" is listed below. In all cases when both criteria were met, then a weir was judged to be on sill. Criteria were:

1) Weir elevation was less than or equal to 532.20' for NPE and less than or equal to 529.20' for SSE and NSE.
2) Weir depth was less than 8.00' for SSE, less than 7.00' for NPE and less than 6.00' for NSE. (Minimum required depths in accordance with the 2009 Fish Passage Plan.)

Inspection Results

The adult fish ladder portion of the fishway which includes the ladder exit, ladder weirs and counting station) met criteria 100% in 2011 (Table 1). The ladder exit trash rack and picketed leads remained relatively clean throughout the season. The air bubbler at the ladder exit was in service during the season and keep debris from collecting at the ladder exit area.

The collection channel of the fishway performed adequately throughout the season. NSE weir depths did not meet enough depth criteria on 29 of the 133 inspections for78.2% in criteria (Table 1). This was due to the fixed depth of the weirs at 531.5 feet. When tailrace water elevations lowered to below 537.5 feet the weir depth would register too shallow and out of criteria. Most (23) of the out of criteria were greater the 0.2 feet but less than 0.5 feet. This means during these 23 inspections water over the weir was between 5.5 and 5.8 feet vice the required 6.0 or greater feet. This ½ foot or less did not appear to adversely affect adult fish guidance or migration into the fishway system. NPE1 and 2 weir depths met criteria 95.5% and 97.0% respectively when coupled with on sill meeting criteria (Table 2). Low tailwater elevations caused the weirs to sit on sill at 532.2 feet on 82 of the 133 inspections. Also, a fishway inspection occurred on May 10 when transformer repairs were initiated and the power plant went to 100% spill causing tailwater to fluctuate wildly.

Surface water velocities measured near the south shore junction pool (S) and near the NSE (N) met criteria (1.5 – 4.0 fps) 100.0% and 98.6% respectively (Tables 1 and 2).

Table 1. Summary of adult fishway inspections at Little Goose Dam, 2011. [1]

LITTLE GOOSE						----------Not Enough Depth----------		
Criteria and	**No. in**	**% In**	**No./%**	**No./%**	**No./%**	**No./%**	**No./%**	**No./%**
Locations	**Criteria/**	**Criteria/**	**Within**	**Within**	**>0.2**	**Within**	**Within**	**>0.2**
	No. on Sill/	**% On**	**0.01-0.1**	**0.11-0.2**	**Foot**	**0.01-0.1**	**0.11-0.2**	**Foot**
	No. of	**Sill**	**Foot**	**Foot**		**Foot**	**Foot**	
	Inspections							
Channel Velocities (S)	113	100.0	***	***	***	***	***	***
	***	***	***	***	***	***	***	***
	113							
Channel Velocities (N)	73	98.6	***	***	***	***	***	***
	***	***	***	***	***	***	***	***
	74							
Differentials								
Ladder Exit (staff)	133	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	133							
Ladder Weirs (staff)	133	100.0	0	0	0	0	0	0
	***	***	0.0	0.0	0.0	0.0	0.0	0.0
	133							
Counting Station (staff)	133	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	133							
South Shore (FSC)	131	98.5	0	0	1	1	0	0
	***	***	0.0	0.0	0.8	0.8	0.0	0.0
	133							
North Pwrhse (FSC)	127	95.5	0	0	1	1	3	1
	***	***	0.0	0.0	0.8	0.8	2.3	0.8
	133							
North Shore (FSC)	126	94.7	1	0	2	0	0	3
	***	***	0.8	0.0	1.5	0.0	0.0	2.3
	133							
Weir Depths								
SSE-1 (FSC)	126	94.7	3	0	4	***	***	***
	Not Applic.	***	2.3	0.0	3.0	***	***	***
	133							
SSE-2 (FSC)	124	93.2	3	1	5	***	***	***
	Not Applic.	***	2.3	0.8	3.8	***	***	***
	133							
NPE-1 (FSC)	45	33.8	1	0	5	***	***	***
On Sill	82	61.7	0.8	0.0	3.8	***	***	***
	133							
NPE-2 (FSC)	47	35.3	0	1	3	***	***	***
On Sill	82	61.7	0.0	0.8	2.3	***	***	***
	133							
NSE-1 (FSC)	104	78.2	4	2	23	***	***	***
	Not Applic.	***	3.0	1.5	17.3	***	***	***
	133							
NSE-2 (FSC)	104	78.2	4	2	23	***	***	***
	Not Applic.	***	3.0	1.5	17.3	***	***	***
	133							

[1] Data are from Appendix 1.
[2] "On sill" means the weir gate was bottomed out on its sill and within criteria at this location.

Table 2. Inspection in-criteria success rates for adult collection channel components at Little Goose Dam, 2007-2011.

Location	Collection Channel Success Rates - Annual Comparison				
	2007	2008	2009	2010	2011
Channel Surface Water Velocities					
Near Junction Pool	98.6%	100%	98.4%	83.2%	100.0%
Near NSE	88.8%	99.1%	74.3%	99.1%	98.6%
Channel Head Differentials					
SSE	96.4%	99.2%	98.4%	97.6%	98.5%
NPE	97.1%	97.5%	93.5%	97.6%	95.5%
NSE	95.7%	96.7%	90.3%	81.6%	94.7%
Channel Weir Depths					
SSE1	94.2%	100%	98.4%	99.2%	94.7%
SSE2	92.8%	100%	98.4%	98.4%	93.2%
NPE1 without on-sill criteria NPE1 with on-sill criteria	31.9% 97.1%	43.4% 98.3%	49.2% 100%	33.6% 100%	33.8% 95.5%
NPE2 without on-sill criteria NPE2 with on-sill criteria	31.2% 98.6%	44.3% 98.4%	49.2% 100%	28.0% 89.6%	35.36% 97.0%
NSE1	90.6%	100%	90.3%	99.2%	78.2%
NSE2	85.5%	98.4%	48.4%	98.4%	78.2%

[1] Data compiled from Appendix 1, previous monitoring report appendixes and inspection forms for the years 2007-2011.

Average tailrace elevations in 2011 were similar to those recorded in 2007 - 2010 (Table 3). To enhance lotic conditions supporting juvenile fish out-migration, reservoirs were drafted down to minimum operating pool (MOP) elevations from April through September. During MOP, Lake Herbert G. West is operated between 537.0 and 538.0 as measured at Lower Monumental Dam. At Little Goose Dam, during the spring freshet tailrace elevations range one to four feet higher. After the freshet the tailrace elevations subsided to range from one to four tenths of a foot higher as measured at LMO.

During inspections, tailrace water elevations were simultaneously collected at the FSC for the SSE, NPE and NSE locations. These readings usually varied from 0 to 3 tenths of a foot in height difference. The variations are caused by the upwelling of water being released from the turbine draft tube and the number of and/or sequence of turbine units operating. In general, over the course of the season, water elevations are generally higher at the SSE and lowest at the NSE with the NPE ranging in-between. Table 3 doesn't reflect this observation at the NSE location. The FSC electronically measures the water surface using a transducer but debris collects and holds fast throughout the season at the location of the transducer. Water elevations were often exaggerated because woody debris floating on the surface of the water was measured in place of the actual water surface. However, manual measurements were used to correct this discrepancy. Also, spill created wave action near the NPE that often interfered with accurate electronic measures.

Table 3. Average tailrace water elevations at Little Goose Dam, 2007-2011.

Location	Average Tailrace Water Elevations Per FSC					
	2007	2008	2009	2010	2011	2007 – 2011 Average
SSE	538.16	538.38	538.60	538.82	538.88	538.57
NPE	537.94	538.38	538.65	538.84	538.65	538.49
NSE	538.02	538.44	538.68	538.91	538.43	538.49

Overall, average channel to tailwater head differentials in 2011 were higher to those recorded in 2007 through 2010 (Table 4). This was due in part to the high flows in 2011 and possible to the less water leakage through NSE and NPE 3 into the tailrace. Both NSE and NPE3 were permanently sealed with concrete.

Water over the tops of the weirs increased in 2011 thus weir depths were higher (Table 4). NSE1 and 2 depths increased to nearly seven feet deep as a result of their fixed position at 561.5 feet in elevation. At higher tailwater pool elevations water over these weirs often reached 9 feet.

Table 4. Average channel/tailwater differentials and weir depths for the adult fishway at Little Goose Dam, 2007-2011.[1]

Location	**Average Differential or Depth in Feet Per FSC**					
Head Differential	2007	2008	2009	2010	2011	2007 – 2011 Average
SSE	1.45	1.49	1.49	1.57	1.68	1.54
NPE	1.31	1.34	1.28	1.52	1.68	1.43
NSE	1.26	1.23	1.18	1.14	1.37	1.24
Weir Depth						
SSE-1	8.25	8.33	8.29	8.29	8.40	8.31
SSE-2	8.21	8.31	8.27	8.29	8.37	8.29
NPE-1	6.18	6.44	6.47	6.34	6.47	6.38
NPE-2	6.15	6.46	6.47	6.23	6.50	6.36
NSE-1	6.10	6.21	6.61	9.10	6.93	6.99
NSE-2	6.00	6.22	4.99[2]	6.61	6.93	6.15

[1] Data compiled from Appendix 1 and previous monitoring report appendixes for the years 2007-2011.
[2] Data does include weir gate in the raised position but not in the closed position.

Juvenile Fish Facility

Facility Description

The Little Goose Juvenile Fish Facility was designed to bypass juvenile salmon and steelhead to the tailrace, or transport them by truck and barge below Bonneville Dam. The bypass system includes extended length submersible bar screens in the turbine intakes, vertical barrier screens, 12-inch diameter gatewell orifices, a 14-inch diameter gatewell orifice, a collection channel running the length of the powerhouse, a dewatering structure, two emergency bypass routes, and a corrugated metal flume/outfall pipe.

The transport system includes a fish separator, fish distribution system, raceways, a sampling and marking building, truck and barge loading areas, and a passive integrated transponder (PIT) tag detection and diversion / bypass system. Untagged fish (without PIT tags) may also be bypassed from the transport system.

Facility Modifications

Several modifications was made prior to, during, and after the 2011 season.

1. Adult fish collection channel entrances, North Shore Entrance 3 and North Powerhouse Entrance 3 were permanently closed off in February 2011. Both these entrances faced inward perpendicular to tailrace spillways one and eight. The permanent closure consisted of removing the recessed removable bulkheads and filling the entrances with concrete and with a flush finished to match the existing concrete walls. The flush finish removes the recessed rectangular opening thus making safer passage for fish migrating in river through spillways one and eight.

2. Upgrades to ESBS include new control systems for the cleaning brushes. The new controls consist of new proximity switches located on the screen and new PLC's located in the orifice gallery, a switch to change the brush cycle between 2 or 4 hours, an emergency stop switch, and a computer monitor in the dam's control room for operators to observe ESBS operations.

3. In March of 2011, all pneumatic hoses and fittings were replaced on all 36 orifice air cylinders and valves. Pneumatic air cylinders that operated the orifice valves are being rebuilt over a 4 year period. Currently, 14 cylinders are rebuilt with 24 remaining.

4. Raceway tail screens were replaced in March of 2011. The new screens are 12.2 mm in width as measured from corner to corner. The old screens were 7.2 mm. The larger opening allows juvenile lamprey to pass through the screen without becoming entangled and passing to the tailrace via the overflow outlet.

5. A new underwater video camera, new monitor and new DVD recorder was purchased in 2010 to be used in underwater inspections of ESBS and VBS.

6. Pacific States Marine Fisheries Counsel installed a new PLC and Interface controller to operate the PIT-tag and sample gate system. The new components are an upgrade to improve sample and PIT-tag gate system performance.

Juvenile Fish Collection

In 2011, ESBS were lowered into operating position beginning on March 21 and ending on March 28. The juvenile fish passage channel was watered up on March 22 and the system was placed in primary bypass mode. Primary bypass operations occurred throughout April except for fish condition sampling and GBT monitoring.

Beginning May 5, at 0700 hours and continuing to October 31 at 0700 hours juvenile fish were collected for transportation. An estimated 3,388,061 juvenile salmonids were collected April 1 through October 31. Composition by species was 1,449,342 yearling Chinook (42.8%), 740,304 sub-yearling Chinook (21.9%), 1,132,428 steelhead (33.4%), 24,356 sockeye (0.7%), and 41,631 Coho (1.2%). An estimate 3,034,232 (89.6%) were transported.

Barge transportation began May 5, at 0700 hours and ended August 15, at 0700 hours. A total of 3,029,027 smolts were collected during this time of which 3,023,090 (99.8%) fish were transported 5,844 were mortalities and 93 Chinook fry were bypassed for continued growth.

Truck transportation began on August 16 at 0700 hours and ended at 0700 on October 31. A total of 11,142 fish were collected during this time of which 10,747 were transported, 394 were mortalities, and 1 was bypassed.

The maximum daily collection of 225,048 smolts occurred on May 13, representing 6.6% of the total collection for the season. The peak collection dates for Chinook salmon, Coho, and unclipped sockeye were similar to recent years. The peak collection dates for steelhead and clipped sockeye were later than observed in recent years.

Bypass

In 2011 primary bypass began on March 22 and ended when collection for barge transportation began on May 5 at 0700 hours. There is no estimate of the number of fish that passed while the facility was in primary bypass mode. The facility performed several abbreviated collections during April for SMP condition monitoring, and for WDFW GBT sampling. All fish were again bypassed back to the river.

Bypass totals during collection for transportation from May 5 at 0700 hours until October 31 at 0700 hours included 93 smolts. The 93 were Salmonid fry under 60 mm in fork length which were bypassed back to the river for continued growth.

The facility was also placed into primary bypass on two occasions in 2011. First occasion was for The Dalles Dam navigation lock outage. Separator clean out occurred during this time also. Second occurrence was for separator debris removal. This occurred on August 3 from 1230-1300 hours. During this time an unknown number of fish were bypassed back to the river.

From April 1 through October 31, a total of 254,198 PIT tagged salmonids were detected within the juvenile collection/bypass system: 181,775 Chinook salmon, 480 Coho salmon, 67,641 Steelhead, 2,834 Sockeye salmon and 1,459 orphans. Of this total, 99,754 smolts, or 39.2%, were routed to the river, 3,567 smolts, or 1.4%, were routed to the sample, 70,634 smolts, or 27.8%, were routed to transport areas and 80,243 smolts, or 31.6%, had unknown disposition as they were last detected at locations that did not constitute an exit from the facility. PIT tagged smolts in the subsample were treated as the other fish in the sample and were either routed back to the river, if the facility was operating in secondary bypass mode, or to a transport holding area when the facility operated in collection mode.

Transportation

Juvenile salmonids collected for transport by barge were held in raceways or directly loaded into barges. Juveniles awaiting transportation by truck were held in tanks or loaded directly into the transport truck. Maximum fish holding time prior to transport varied from 24 to 48 hours depending on the transportation schedule. Transport time from Little Goose to the approved release point was approximately 2 days by barge or 6 hours by truck. Fish that were transported by truck were transported in a mild saline solution of 1mg/L to reduce stress and treat columnaris disease. In 2011, daily barging and direct loading operations occurred from May 5 to May 23, alternate day barging occurred from May 29 to August 16 and alternate day trucking occurred from August 18 to October 31. There was a six day gap in transportation from May 23 to May 29 due to the closure of the Dalles Dam navigation locks. There were no incidents which resulted in transportation related mortalities during the 2011 season.

A total of 3,030,558 juvenile salmonids were transported from Little Goose in 2011, 99.6% by barge and 0.4% by truck/midi tank (Table 2). Salmonids transported by truck in 2011 were primarily (96.4%), unclipped subyearling Chinook salmon.

Adult Fallbacks

Fallbacks are adult Salmonids that have passed the dam and have entered the juvenile collection and bypass system. These adult sized fish were usually too large to pass between the separator bars. Fallback adults were identified by species and fin clip and assessed for condition prior to being released to the river.

A total of 6,280 adult fallbacks were removed from the sample or separator in 2011. Composition by species and clip type included 1,081 clipped and 602 unclipped adult Chinook salmon, 590 clipped and 430 unclipped jack or mini jack Chinook salmon, 1,996 clipped and 1,549 unclipped steelhead, 12 clipped and 5 unclipped sockeye, and 14 Coho. Many of the steelhead observed in April, May, and June were kelts. Of the 6,279 total fallbacks, 9 clipped and unclipped mini-jacks occurred in the SMP sample. Mini-jacks are mature salmon with a fork length of less than 300 mm.

In addition to adult salmon and steelhead, there were 10 white sturgeon, 7 bull trout, 19 adult Lamprey and numerous other adult incidental fish removed from the separator or sample. All fallback fish were released to the river.

Operations and Maintenance

Turbine Operation

Efforts were made to operate all turbine units within 1% limitation of best efficiency from April 1 to October 31. Best efficiency operations provide greatest fish passage survival through operating turbines. Reportable deviations consist of operations outside the 1% criteria for more than 15 minutes in duration and/or 5 or more periods of at least 5 minutes during a single calendar day. In 2011, all units were operated within the best efficiency range. There were no reportable deviations.

Drawdown inspections across trashracks and ESBS/VBS were performed according to the FPP. All drawdown inspection measurements were within criteria throughout the season. Debris removal using the trash rack rake occurred in 2011 but at a reduced rate due to mechanical problems.

In recent years, it has become evident that juvenile fish were being trapped in cooling water strainers. Beginning in March 2010, turbine unit cooling water strainers were checked weekly for juvenile fish entrapment. The cooling water originates from an inlet located in the scrollcase. The grating covering the inlet has open spaces large enough to allow small fish to pass through and thus getting trapped into the cooling water system and strainer. In 2011 there were a total of 906 juvenile lamprey and 53 salmonid smolts, all mortalities collected from the strainers.

Forebay Debris/Trashracks

Estimates of debris volume and location in the forebay were recorded daily during JFF inspections. Large accumulations of woody debris were present in the Little Goose forebay beginning June 10 and extending through July. The maximum amount of surface debris was reported on May 20 and measured an estimated

25,000 square feet. As in past years, debris caused the majority of smolt injury and mortality. The debris was removed by spill, trash rack raking, gatewell debris dipping, separator debris cleanouts, and increased orifice rotations. At the conclusion of MOP when forebay elevations were increased, debris floated from the banks and accumulated in the forebay. No blockages were reported during this latter time.

Temporary Spillway Weir

The TSW was used in spillway one in 2011 and placed into operation on April 3 in the high crest position. The weir height was changed on July 26 to the low crest position. The TSW was removed for the season on Sept. 01.

Extended-Length Submersible Bar Screens

Initial drawdown measurements were conducted on April 4, and weekly thereafter through June, every two weeks from July through October. All drawdown measurements met criteria. Underwater camera inspections were attempted on the ESBS screens on April 4 and were canceled due to high turbidity. Visibility was less than a foot. Units #1 and #6 were performed on May 10 when water conditions improved. Inspections were performed thereafter during turbine unit annual maintenance. During the video inspections ESBS were observed to be in good operating condition and clear of debris.

Beginning with the high flow and debris events in May, ESBS cleaning brushes were switched to operate from 4 hour interval to 2 hour interview. By increasing the frequency of cleaning brush operations to every 2 hours reduced the amount of debris collected on the screens between brush operations. This in turn, reduced debris swept up into the gatewell during each brush operation and helped to reduce orifice blockages.

Vertical Barrier Screens (VBS)

Scheduled inspections of the VBS were performed by underwater video camera concurrently with ESBS inspections. Thorough VBS inspections of screens 1A -6C were performed on June 22. All inspections showed VBS in good operating condition.

Gatewells

Gatewells were checked for debris and oil contamination daily. As needed, debris was removed using a dip basket or grappling hook. As in most years, small traces of oil were occasionally observed in gatewells during the season. The oil contamination was attributed to rain-washed drippings from vehicles and mechanical equipment which accumulated on intake deck or gatewell walls. In 2011, observation of oil traces was less than those in previous years.

Orifices and Collection Channel

The juvenile collection channel and flume were placed into service March 22 with the Juvenile fish facility in Primary bypass. The collection channel was operated throughout the season with 18 to 22 open orifices depending on forebay elevations. Minimum operating pool (633.0 feet msl) plus 1’ elevation (MOP +1) occurred from April 1 through September 3.

Orifices were inspected and/or back-flushed 1 to 3 times per 10 hour shift. Flushing's were increased in frequency in response to debris loading. Full-time night shifts were added when needed to operate and back-flush orifices to clear and prevent debris blockages.

All orifice operations (opening, closing, backflushing) were manually performed throughout the year. The orifices, collection channel, dewatering structure and flume were taken out of service for winter maintenance on December 19.

Primary Dewatering Structure

Overall, the primary dewatering structure functioned adequately throughout the season. All components operated satisfactorily throughout the season. Excess water was diverted to the adult fish channel pump chamber the entire season to help supplement flows for adult fish migration. On Sunday Dec. 11, the stilling basin surface water froze resulting in erroneous electronic surface water elevation readings. This caused the weirs to lower and prevent flow to the bypass flume. This caused all fish to be bottled-up in the collection channel and primary dewaterer for up to 24 hours. As a result, 2 adult Steelhead were found dead at the flume entrance. Upon discovery of problem, the weirs were raised and flow was restored to the bypass flume. The weir controls were placed into manual operation through the end of the fish passage season.

Flume

The primary bypass flume functioned satisfactorily in 2011. During winter maintenance 2010, the primary bypass outfall flume was relocated from near shore to mid channel. The relocation extended the release site approximately 400 feet towards the mid-channel. This new section of outfall is made of 36 inch corrugated metal pipe. The new point of release will allow bypassed fish to migrate downstream with less delay. The old point of release was located close to shore and further upstream where bypassed smolts were likely to be entrained into a back current eddy slowing downriver out migration. The flume was inspected during the winter maintenance period 2011 and observed in good condition and found free of obstructions and rough edges.

Separator

The separator was operated in a similar fashion as previous years. The water level was kept about 1 to 2 inches above the downstream ends of the A-side separator bars. At times the water level was lowered to force fish to pass through the bars. Heavy accumulations of debris occurred in the separator which prompted the facility to clean the separator on June 21 and August 3. The facility switched to primary bypass operations for 1 hour to clean debris from the separator. During debris removal, large numbers of Juvenile Pacific Lamprey (Ammocoete life stage) were salvaged and released to the river unharmed. During the winter maintenance period, the interior and exterior surfaces of the separator were cleaned and/or refurbished.

Sample System/PIT Tag System

The PIT tag detection and diversion systems at the lower Snake and Columbia River dams are maintained and operated by the Pacific States Marine Fisheries Commission. PIT tagged salmonids have been monitored for movement and behavior in the Columbia and Snake Rivers since 1987. At Little Goose Dam, there are 11 PIT tag monitors located throughout the JFF. A new "full flow" unit that monitors the main channel of the juvenile flume upstream from the JFF was added in 2009. Upon the completion of construction and winter maintenance operations, the full flow unit was brought into service for the first time March 23, 2009.

In 2011 the PIT-tag system functioned adequately. There were several occasions early in the season when the timing of the diversion gates were off or the sensor did not adequately detect gate opening an/or

closure. These problems were relatively minor and generally did not affect fish diversion. PSMFC personnel usually serviced and corrected the problems within 24 hours.

Truck/Barge Loading Operations

In 2011, daily barging and direct loading operations started on May 5-6 and ran through May 22. Alternate day barging occurred from May 29 to August 15. Alternate day trucking occurred from August 16 to October 31. The loading boom and fish routing pipes and flumes performed satisfactorily. Barged fish were transported to a release point at mid-channel below Bonneville Dam.

The 3,500 gallon tanker semi-tractor combination assigned to LGO was not used in 2011. All truck transportation was performed using the one ton truck and 300-gallon midi-tank starting on August 18. On August 21, 23, 25, 27, 29 and 31 LGO piggy backed with LGR due to mechanical problems with the LGO one ton pick-up. On October 8 everyday trucking started and continued through the end of the season due to high mortality (presumed Columnaris). A second truck was equipped with the mini-tank holding 150 gallons. Salt in small concentrations of approximately 1 g/L is added to the midi-tank water to treat potential Columnaris disease and reduce stress. In 2011 trucked fish were again released into the outfall fish flume located at the juvenile fish facility downstream of Bonneville dam.

Avian Predation

Springtime gull predation on juvenile salmon and steelhead at Little Goose has been significantly reduced since 1999 when the USDA Animal and Plant Health Inspection Service (APHIS) began bird hazing activities. Prior to 1999, 150 to 200 birds were continuously observed in the tailrace area for several weeks from late April to mid-June, during the peak of the smolt migration season. On some days, up to 300 to 400 gulls were observed roosting on the North Shore riprap. Since 1999, these numbers have been significantly reduced due to bird hazing activities.

In 2011, APHIS bird hazing activities at Little Goose took place from April 13 through June 27. Gulls (*Larus spp.*) were observed throughout the entire year with the peak period recorded between May 9 and May 15. During the peak period in 2010, daily observations ranged between 25 and 150 gulls. Maximum gull numbers seen in one day in 2011 was 33. In 2011 about half of the numbers of gulls were seen. Total gull numbers counted in 2011 was 4,145. 2010 total gull numbers were 8,112. On average gull numbers were much lower than that observed in previous years. This could be related to the higher flows seen in 2011 over previous years. Higher flows forced the birds farther downstream outside of the counting area.

Double Crested Cormorants (*Phalacrocorax auritus)* numbers continued to be lower in 2011. Cormorant numbers seen in 2010 were 1,030. In 2011 the total count was 438. Cormorants were observed throughout the early juvenile fish migration season but their numbers were usually less than 10. The peak period for Cormorants occurred late July through November also in response to juvenile shad out migration. During the peak period, up to 18 Cormorants were observed during a single sighting (July 26). The majority of the birds were counted within the area one half mile upstream and downstream of the dam. These numbers are far less than the 100 to 200 observed during the previous years (2005-2008) during the same period. The decline in 2009 and 2010 may be the result of lethal take for research purposes. Approximately 45 Cormorants were taken in the fall/winter of 2007-08 and 2008-09.

American White Pelicans (*Pelecanus erythrorhynchos*) numbers increased between 2007 and 2009. In 2010, Pelican observations and numbers were less than that observed in 2009 and in 2011 only a few sightings were recorded near the Dam.

Other piscivorous bird species observed during the 2011 season include Western Grebes (*Aechmophorus occidentalis*) Belted Kingfisher (Ceryle alcyon) and Caspian Terns (*Sterna caspia*).

A summary of actions taken by the Corps to reduce avian predation at Little Goose as follows:

1. Fifteen bird wires were installed over the tailrace area below the powerhouse, thirteen in 1992, one each in 2007 and 2008. Additionally, one bird wire was replaced in 2008. Gulls avoid flying under the wires. Since 1992, proposals have been made to have wires strung below the spillway as well. However, this was not presently feasible due to the lack of an existing structure to which wires could be attached. Bird wires effectively deter gulls, as they tend to locate prey from above. In the case of cormorants, bird wires do not appear to be effective as they approach prey at or below water level.
2. The two 10" bypass pipes were rerouted to swifter water in the middle of the river in 1997. The pipes and much of the support structure are outfitted with needle strips to prevent gulls from perching. The primary bypass flume/pipe was rerouted to this site in 2010. It too was outfitted with needle strips to prevent gulls from perching.
3. A large "sprinkler" is located at the outfall of the bypass flume and pipes. The sprinkler interferes with gull flight patterns, except in high winds.
4. A propane bird scare cannon was successfully utilized in the tailrace to help haze away birds in 2008. A second cannon was purchased in 2008 however, only one cannon was used at a time. The cannon proved to be effective for short-term dispersal of piscivorous birds.
5. The U.S. Department of Agriculture, under contract with the Corps, provided an animal control specialist to work at Little Goose (and Lower Granite) from 1999 to 2002. An animal control specialist has been solely assigned to Little Goose during weekdays from 2003 – 2007. Beginning in 2007, and continuing through 2011, specialists performed hazing activities seven days a week. It is anticipated that similar work will continue well into the future.
6. The upstream 200 feet of the vertical wall of the trash-shear boom located in the forebay was outfitted with needle strips in 2008. The needle strips prevented gulls and cormorants from perching along the top of the wall.

Acronyms

APHIS – Animal and Plant Health Inspection Service.
BPA – Bonneville Power Administration
CRITFC – Columbia River Inter-Tribal Fish Commission
DDS – Diversion During Sample
ESBS – Extended Submersible Bar Screen
F – Fahrenheit (temperature scale)
FGE – Fish Guidance Efficiency
FPC – Fish Passage Commission
GBT – Gas Bubble Trauma
NMFS – National Marine Fisheries Service (Now known as NOAA Fisheries)
NOAA – National Oceanic and Atmospheric Administration
ODFW – Oregon Department of Fish Wildlife
PIT – Passive Integrated Transponder (tag)
PSMFC – Pacific States Marine Fisheries Commission
PTAGIS – PIT Tag Information System
RSW – Removable Spillway Weir
SW – Spillway Weir
USGS – United States Geological Service