2014 ADULT AND JUVENILE FISH FACILITY MONITORING REPORT

ICE HARBOR DAM

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List of Acronyms

BPA – Bonneville Power Administration
CFS – Cubic feet per second
FPC – Fish Passage Center
FPP – Fish Passage Plan
JCC – Juvenile Collection Channel
JFF – Juvenile Fish Facility
KCFS – kilo cubic feet per second
NFL – North shore fish ladder
OOS – Out of service
PDS – Primary dewatering structure
PLC – Programmable logic controller
SFL – South shore fish ladder
STS – submersible traveling screens
RSW – removable spill weir
USDA-WS – United States Department of Agriculture-Wildlife Services
VBS – vertical barrier screen

Summary

This report summarizes the operation and maintenance of the adult and juvenile fish passage facilities at Ice Harbor Dam in 2014. Submersible traveling screens (STSs) for all operating units were installed between March 24-27, except for Unit 6. Unit 6 was undergoing the installation of a digital governor; therefore, the STSs were installed on March 31. The Juvenile collection channel (JCC) was watered up on March 17. Fish condition monitoring began April 3 and ended July 15. The JCC was dewatered on December 17.

Total smolts sampled in the 2014 season was 3,242. This season sample by species group included: 477 clipped and 484 unclipped yearling Chinook salmon *Oncorhynchus tschawytscha*, 763 clipped and 243 unclipped steelhead *O. mykiss*, 465 unclipped and 676 clipped subyearling Chinook salmon, 38 clipped/unclipped Coho salmon *O. kisutch*, and 10 clipped and 86 unclipped Sockeye/Kokanee *O. nerka*.

The removable spillway weir (RSW) was operated for juvenile fish passage from April 2 to July 15. Spill in support for fish passage began on April 3 and ended on August 31.

Facility Introduction and Description

The juvenile fish passage facility at Ice Harbor Dam consists of standard-length submersible traveling screens, vertical barrier screens, 36 12-inch diameter orifices, a collection channel and dewatering structure, fish sampling facilities, and a transportation flume to the tailrace downstream from the dam. The juvenile fish collection channel is operated with approximately 300 cubic feet per second (kcfs) flow (forebay head-dependent), which is the design operating flow produced by 20 of the juvenile fish passage orifices open. All but 30 kcfs of the flow is removed at the primary dewatering structure and utilized as adult fish attraction water. The remaining 30 kcfs flow and fish are routed through a transport pipe and flume to the fish sampling facility or directly to the tailwater.

The adult fish passage facilities at Ice Harbor dam are comprised of separate north and south shore systems. The north shore facilities include a fish ladder with an adult counting station, an adult fish collection channel, and a pumped auxiliary water supply system. The collection system includes two downstream entrances near the navigation lock wall at the base of the dam and one side entrance, which is bulkheaded off from the spillway basin. The downstream entrance nearest the navigation lock wall is normally open for fish passage. Three electric pumps supply the auxiliary water for fish attraction flow. Two of the three pumps operate continuously during normal operation. The third pump serves as a backup in the case of a pump failure.

The south shore facilities are comprised of a fish ladder with an adult counting station, two south shore entrances, a powerhouse collection system, and a pumped auxiliary water supply system. The powerhouse collection system includes two downstream entrances and one side entrance bulkheaded off from the spillway basin at the north end of the powerhouse, twelve floating orifices, and a common fish transportation channel. The fishway entrances used during normal operation include: one south shore entrance nearest the powerhouse, one downstream north powerhouse entrance, and four floating orifice gates. Eight electric pumps are available to supply the auxiliary water for fish attraction, of which five to eight pumps are used during normal operation.

Facility Modification, Maintenance, and Improvements

During winter maintenance, repairs to caulking, juvenile collection channel netting, damaged Plexiglas orifice covers, and screen cleaner repairs were accomplished.

River Conditions

During the 2014 season, the average monthly powerhouse flow was lower than the 2010-2013 average monthly flow during all months except in the month of May. During the month of May, the monthly average flow for 2014 was higher than the 2010-2014 monthly average. The monthly average spill was lower than the 2010-2014 monthly average spill, except during April and May. During those months the spill was higher than the 2010-2014 average (Table 1).

Table 1. Comparison of average flow (kcfs) and spill (kcfs) at Ice Harbor Dam, 2010-2014 and the 5-year average.

Powerhouse Flow						
Month	**2010**	**2011**	**2012**	**2013**	**2014**	**2010-2014 Avg**
April	43.3	123.5	110.3	60.0	77.6	83.0
May	67.2	104.6	145.3	83.4	105.3	101.1
June	129.4	89.9	177.7	56.6	86.7	108.1
July	46.8	46.4	96.8	34.1	46.9	54.2
August	28.9	28.1	41.2	23.4	27.8	29.9
Sept.	22.3	21.5	34.0	19.2	19.8	23.3
Spill						
Month	**2010**	**2011**	**2012**	**2013**	**2014**	**2010-2014 Avg**
April	28.8	78.1	67.7	0.0	92.0	53.3
May	36.0	54.3	78.7	0.2	92.0	52.2
June	65.4	59.4	95.9	32.9	22.9	55.3
July	30.7	31.0	57.7	45.4	16.5	36.3
August	18.5	17.7	31.1	32.6	10.9	22.2
Sept.	0.0	0.0	0.0	21.9	0.0	4.4

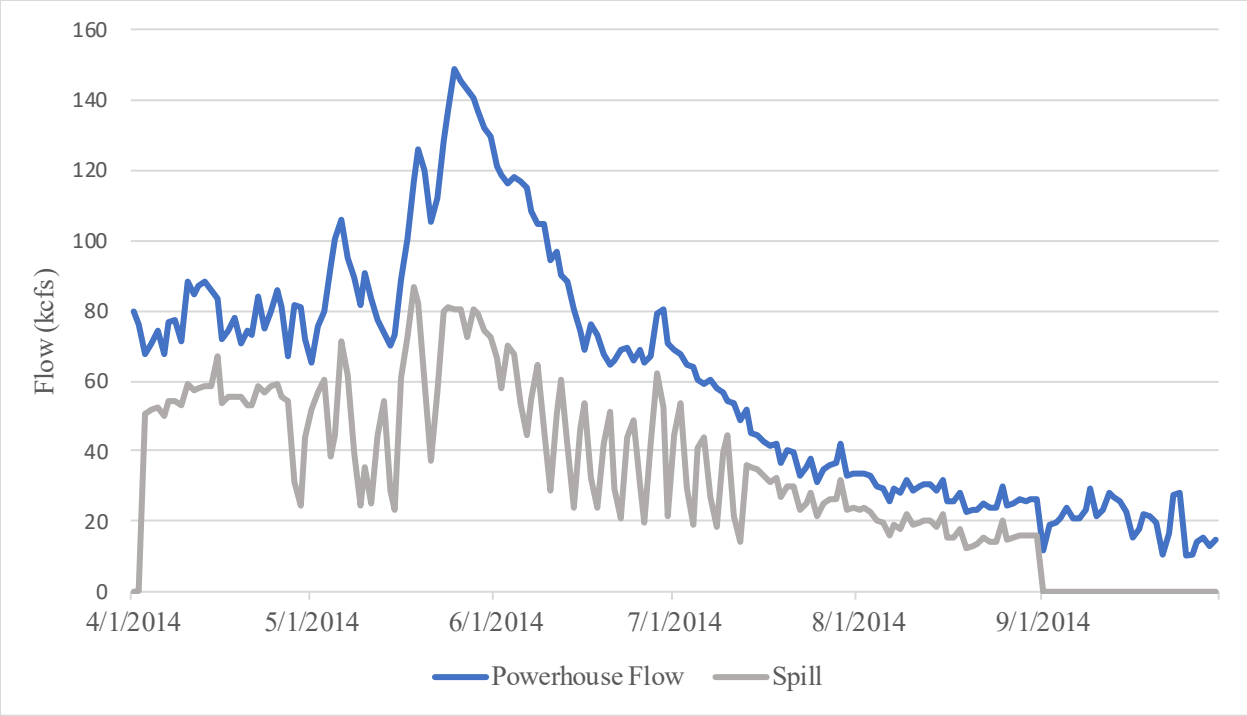

Figure 1. Comparison of daily powerhouse flow and spill at Ice Harbor Dam, 2014.

River Temperature

The highest river temperature of 71°Foccurred during the week of August 22 and the lowest average weekly river temperature occurred during the week of April 4 at 45 °F. The average monthly temperatures for 2014 were higher than the average 4-year temperature, except in September. The average monthly temperature was 0.5 degrees higher in 2014 than the 2011-2014 average (Table 2).

Table 2. Average monthly river temperatures, 2011-2014 at Ice Harbor Dam and 4-year average.

Temperature °F					
Month	**2011**	**2012**	**2013**	**2014**	**2011-2014 Avg**
April	47.5	46.9	39.0	49.1	45.6
May	52.3	52.3	40.7	53.8	49.8
June	56.8	55.3	43.1	59.0	53.5
July	66.6	61.6	46.9	68.2	60.9
August	69.7	68.4	52.9	67.8	64.7
Sept.	66.6	67.4	57.0	63.0	63.5

Juvenile Fish Facility Operations and Maintenance

Juvenile Fish Conditioning

Sampling

Sampling is defined as diverting and segregating groups of fish in a consistent fashion so data collected from those segregated groups will accurately represent all fish collected. Fish were sampled at Ice Harbor to monitor fish condition. This type of sampling is called sampling for condition. Normal operation of the facilities is to bypass all collected fish directly to the river, except when routine sampling is conducted for monitoring fish condition. The goal of a sampling event is to collect 100 fish of the predominant species within a four-hour period. Fish are visually counted as they come into the fish separator structure. Migrating fish numbers can be low during the beginning and the latter part of the season, so the target number of fish may not be collected during the four-hour period. Fish condition sampling began on April 2 and occurred on Mondays and Wednesdays or Tuesdays and Thursdays, alternating each week. Sampling did occur on May 30, because of the holiday on May 26. The last sample of the season occurred on July 15.

A total of 3,242 juvenile salmonids were sampled during the 2014 season (Table 3). This is an increase from 2013 which sampled 2,428 juvenile salmonids.

Within each species group the number and percent sampled of those collected in 2014 was: 763 clipped (23.5%) and 243 unclipped (7.5%) steelhead, *Oncorhynchus mykiss*, 676 unclipped (20.9%) and 465 clipped (14.3%) subyearling Chinook salmon, *O. tschawytscha*, 484 unclipped (14.9%) and 477 clipped (14.7%) yearling Chinook salmon, 86 clipped (.3%) and 10 unclipped (2.7%) Sockeye/Kokanee salmon *O. nerka*, 38 clipped/unclipped (1.2%) Coho salmon, *O. kisutch* (Tables 4 & 5).

In 2014, the peak daily collection and date for each species group was: 69 clipped yearling Chinook salmon (May 6), 97 clipped steelhead (May 12), 66 unclipped subyearling Chinook salmon (June 11), 64 clipped subyearling Chinook salmon (June 25), 57 unclipped yearling Chinook salmon (April 28), 30 unclipped steelhead (May 30), 7 clipped Sockeye/Kokanee salmon (May 22), 9 unclipped Sockeye/Kokanee salmon (April 2), and 10 Coho (May 20) (Table 6). The daily maximum collection occurred on May 30 at 137 fish.

Descaling

The most fish found with descaling in a day occurred on May 14 totaling 18 (Table 7). All other days during sampling the number of fish found with descaling was less than 18. The highest descaling rates were found in Steelhead.

Table 3. Number of juvenile salmonids sampled per day at Ice Harbor Dam, 2014.

Date	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Daily Total
	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clip/Unclip	
2-Apr	5	49	0	0	8	27	0	9	0	98
8-Apr	2	33	0	0	5	6	0	5	0	51
10-Apr	5	44	0	0	35	17	0	7	0	108
14-Apr	32	51	0	0	11	0	0	6	0	100
16-Apr	40	55	0	0	12	6	0	6	3	122
22-Apr	28	39	0	0	37	10	0	6	2	122
24-Apr	25	37	0	0	57	9	0	5	1	134
28-Apr	29	57	0	0	40	3	0	1	0	130
30-Apr	33	23	0	0	65	1	0	2	2	126
6-May	69	32	0	1	26	4	0	1	2	135
8-May	56	23	0	0	39	6	0	7	0	131
12-May	26	2	0	0	97	6	0	1	0	132
14-May	24	5	0	1	77	9	0	7	1	124
20-May	62	7	0	5	19	21	2	2	10	128
22-May	20	8	0	1	61	27	7	2	7	133
28-May	11	6	0	17	55	26	1	5	3	124
30-May	4	0	10	40	42	30	0	6	5	137
3-Jun	2	0	17	61	29	18	0	3	1	131
5-Jun	1	2	38	65	16	3	0	3	1	129
9-Jun	1	6	34	41	11	12	0	1	0	106
11-Jun	0	1	48	66	1	1	0	0	0	117
17-Jun	1	0	46	47	0	0	0	0	0	94
19-Jun	0	0	48	53	5	0	0	0	0	106
23-Jun	0	0	44	49	9	0	0	0	0	102
25-Jun	1	2	64	44	2	0	0	0	0	113
1-Jul	0	2	32	55	4	1	0	0	0	94
3-Jul	0	0	31	39	0	0	0	1	0	71
7-Jul	0	0	17	27	0	0	0	0	0	44
9-Jul	0	0	32	56	0	0	0	0	0	88
15-Jul	0	0	4	8	0	0	0	0	0	12
Totals	477	484	465	676	763	243	10	86	38	3242
% Totals	14.71%	14.93%	14.34%	20.85%	23.53%	7.50%	0.31%	2.65%	1.17%	***

The descaling rate for all fish sampled in 2014 was 3.7% (Table 8). The annual descaling rate by species group was 2.3% for clipped and 1.9% for unclipped yearling Chinook salmon, 2.2% for clipped and 1.3% for unclipped subyearling Chinook salmon, 7.9 % for clipped and 7.8% for unclipped steelhead, and 2.6% for Coho salmon. Clipped and unclipped Sockeye/Kokanee had a descaling rate of less than 1%.

In 2014, the overall descaling rate for all fish examined was higher than the rates in 2010-2013 (Table 9). Unclipped steelhead had the highest descaling rate observed at 7.9% and the second highest was clipped steelhead at 7.8% .

Table 4. Number of juvenile salmonids sampled at Ice Harbor Dam, 2010-2014

Year	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Total
	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clip/Unclip	
2010	364	158	265	435	1,061	227	1	4	7	2,522
2011	624	566	456	630	722	205	14	74	14	3,305
2012	639	631	240	494	585	325	0	18	35	2,970
2013	327	271	338	525	676	260	10	12	9	2, 428
2014	477	484	465	676	763	243	10	86	38	3242

Table 5 Annual percentage sampled of each juvenile salmonid species at Ice Harbor Dam, 2010-2014.

Year	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho
	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clip/Unclip
2010	14.4%	6.3%	10.5%	17.2%	42.1%	9.0%	0.0%	0.2%	0.3%
2011	18.9%	17.1%	13.8%	19.1%	21.8%	6.2%	0.4%	2.2%	0.4%
2012	21.5%	21.2%	8.1%	16.6%	19.7%	10.9%	0.0%	0.6%	1.2%
2013	13.5%	11.2%	13.9%	21.6%	27.8%	10.7%	0.4%	0.5%	0.4%
2014	14.7%	14.9%	14.3%	20.9%	23.5%	7.5%	0.3%	2.7%	1.2%

Table 6. Annual peak collection dates at Ice Harbor Dam, 2010-2014.

Year	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho
	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clip/Unclip
2010	20-May 97	20-May 26	-----	------	10-May 131	27-May 32	10-Jun 1	3-May 2	10,14-Jun 2
2011	16-May 94	21-Apr 79	20-Jun 85	5-Jul 98	19-May 114	19-May 35	9-Jun 7	14-Apr 13	26-May 4
2012	7-May 89	12-Apr 83	21-Jun 45	9-Jul 84	26-Apr 63	2-Apr 44	----- 0	4,7-Jun 4	4-Jun 12
2013	6-May 43	6-Apr 16	11-Jun 67	15-Jul 90	14-May 67	19-Jun 70	22-May 5	22-May 9	3-Jun 5
2014	6-May 69	28-Apr 57	25-Jun 64	11-Jun 66	12-May 97	30-May 30	22-May 7	2-Apr 9	20-May 10

-- No fish of this species sampled

Table 7. Number of salmonids sampled with descaling at Ice Harbor, 2014.

Date	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Total
	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clip/Unclip	
2-Apr	0	2	0	0	0	0	0	0	0	2
8-Apr	0	2	0	0	0	0	0	1	0	3
10-Apr	0	3	0	0	3	0	0	1	0	7
14-Apr	0	1	0	0	0	0	0	1	0	2
16-Apr	1	2	0	0	0	0	0	1	0	4
22-Apr	2	3	0	0	2	0	0	1	0	8
24-Apr	1	1	0	0	3	1	0	0	0	6
28-Apr	3	2	0	0	0	0	0	0	0	5
30-Apr	2	0	0	0	3	0	0	1	0	6
6-May	6	4	0	0	2	0	0	0	0	12
8-May	4	2	0	0	2	1	0	1	0	10
12-May	1	0	0	0	4	0	0	0	0	5
14-May	5	2	0	0	9	1	0	1	0	18
20-May	1	2	0	0	2	1	0	0	0	6
22-May	2	1	0	0	8	3	1	0	1	16
28-May	0	1	0	0	7	2	0	0	0	10
30-May	0	0	0	1	2	2	0	1	0	6
3-Jun	0	0	1	1	1	0	0	1	0	4
5-Jun	0	0	1	2	2	0	0	0	1	6
9-Jun	0	1	4	2	0	0	0	0	0	7
11-Jun	0	0	1	1	0	0	0	0	0	2
17-Jun	0	0	0	1	0	0	0	0	0	1
19-Jun	0	0	2	0	0	0	0	0	0	2
23-Jun	0	0	3	1	1	0	0	0	0	5
25-Jun	0	0	1	2	0	0	0	0	0	3
1-Jul	0	0	0	4	0	1	0	0	0	5
3-Jul	0	0	1	2	0	0	0	0	0	3
7-Jul	0	0	5	3	0	0	0	0	0	8
9-Jul	0	0	3	3	0	0	0	0	0	6
15-Jul	0	0	1	0	0	0	0	0	0	1
Totals	28	29	23	23	51	12	1	10	2	179

-- No fish of this species sampled

Table 8. Percent of descaled salmonids at Ice Harbor Dam, 2014.

Date	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho
	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clip/Unclip
2-Apr	---	4.1%	---	---	---	---	---	---	---
8-Apr	---	6.1%	---	---	---	---	---	20.0%	---
10-Apr	---	6.8%	---	---	8.6%	---	---	14.3%	---
14-Apr	---	2.0%	---	---	---	---	---	16.7%	---
16-Apr	2.5%	3.6%	---	---	---	---	---	16.7%	---
22-Apr	7.1%	7.7%	---	---	5.4%	---	---	16.7%	---
24-Apr	4.0%	2.7%	---	---	5.3%	11.1%	---	---	---
28-Apr	10.3%	3.5%	---	---	---	---	---	---	---
30-Apr	6.1%	---	---	---	4.6%	---	---	50.0%	---
6-May	8.7%	12.5%	---	---	7.7%	---	---	---	---
8-May	7.1%	8.7%	---	---	5.1%	16.7%	---	14.3%	---
12-May	3.8%	---	---	---	4.1%	---	---	---	---
14-May	20.8%	40.0%	---	---	11.7%	11.1%	---	14.3%	---
20-May	1.6%	28.6%	---	---	10.5%	4.8%	---	---	---
22-May	10.0%	12.5%	---	---	13.1%	11.1%	14.3%	---	14.3%
28-May	---	16.7%	---	---	12.7%	7.7%	---	---	---
30-May	---	---	---	2.5%	4.8%	6.7%	---	16.7%	---
3-Jun	---	---	5.9%	1.6%	3.4%	---	---	33.3%	---
5-Jun	---	---	2.6%	3.1%	12.5%	---	---	---	100.0%
9-Jun	---	16.7%	11.8%	4.9%	---	---	---	---	---
11-Jun	---	---	2.1%	1.5%	---	---	---	---	---
17-Jun	---	---	---	2.1%	---	---	---	---	---
19-Jun	---	---	4.2%	---	---	---	---	---	---
23-Jun	---	---	6.8%	2.0%	11.1%	---	---	---	---
25-Jun	---	---	1.6%	4.5%	---	---	---	---	---
1-Jul	---	---	---	7.3%	---	100.0%	---	---	---
3-Jul	---	---	3.2%	5.1%	---	---	---	---	---
7-Jul	---	---	29.4%	11.1%	---	---	---	---	---
9-Jul	---	---	9.4%	5.4%	---	---	---	---	---
15-Jul	---	---	25.0%	---	---	---	---	---	---
Total Examined	477	484	465	676	763	243	10	86	38
% Descaled	2.3%	1.9%	2.2%	1.3%	7.9%	7.8%	0.0%	0.0%	2.6%

-- No fish of this species sampled

Table 9. Annual descaling rates in percent for fish sampled at Ice Harbor Dam, 2010-2014.

Year	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Total
	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clip/Unclip	
2010	3.9%	2.3%	0.7%	0.6%	3.3%	3.9%	0.0%	5.4%	0.0%	2.6%
2011	2.7%	3.2%	4.2%	2.0%	5.5%	3.7%	0.0%	0.0%	0.0%	3.5%
2012	2.7%	3.2%	4.2%	2.0%	5.5%	3.7%	0.0%	0.0%	0.0%	3.5%
2013	3.7%	3.3%	1.5%	2.5%	3.4%	2.7%	30.0%	0.0%	0.0%	3.0%
2014	2.3%	1.9%	2.2%	1.3%	7.9%	7.8%	0.0%	0.0%	2.6%	3.7%

Mortality

Total juvenile facility mortality of salmonids totaled 7 for 2014 (Table 10). Fish that are dead prior to coming into the lab are not examined for condition but are included in the sample number of fish.

Table 10. Total sample mortality at Ice Harbor Dam, 2014.

Date	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Total
	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clip/Unclip	
2-Apr	0	0	0	0	0	0	0	0	0	0
8-Apr	0	0	0	0	0	1	0	0	0	1
10-Apr	0	0	0	0	1	0	0	0	0	1
14-Apr	0	0	0	0	0	0	0	0	0	0
16-Apr	0	0	0	0	0	0	0	0	0	0
22-Apr	0	0	0	0	0	0	0	0	0	0
24-Apr	0	0	0	0	0	0	0	1	0	1
28-Apr	0	0	0	0	0	0	0	0	0	0
30-Apr	0	0	0	0	0	0	0	0	0	0
6-May	0	0	0	0	0	0	0	0	0	0
8-May	0	0	0	0	0	0	0	0	0	0
12-May	0	0	0	0	0	0	0	0	0	0
14-May	0	0	0	0	0	0	0	0	0	0
20-May	1	0	0	0	0	0	0	0	0	1
22-May	0	0	0	0	0	0	0	0	0	0
28-May	1	0	0	0	0	0	0	0	0	1
30-May	0	0	0	0	0	0	0	0	0	0
3-Jun	0	0	0	0	0	0	0	0	0	0
5-Jun	0	0	0	1	0	0	0	0	0	1
9-Jun	0	0	0	0	0	0	0	0	0	0
11-Jun	0	0	0	0	0	0	0	0	0	0
17-Jun	0	0	0	0	0	0	0	0	0	0
19-Jun	0	0	0	0	0	0	0	0	0	0
23-Jun	0	0	0	0	0	0	0	0	0	0
25-Jun	0	0	0	0	0	0	0	0	0	0
1-Jul	0	0	0	0	0	0	0	0	0	0
3-Jul	0	0	1	0	0	0	0	0	0	1
7-Jul	0	0	0	0	0	0	0	0	0	0
9-Jul	0	0	0	0	0	0	0	0	0	0
15-Jul	0	0	0	0	0	0	0	0	0	0
Totals	2	0	1	1	1	1	0	1	0	7

Within each species group, the number of mortalities and percent of those collected in that group was: 2 clipped yearling Chinook salmon, (0.4%), 1 clipped subyearling Chinook salmon (0.2), 1 unclipped subyearling Chinook salmon (.1%), 1 clipped steelhead (0.1%), 1 unclipped steelhead (0.4%), and 1 unclipped Sockeye/Kokanee salmon, (1.2%). No mortalities of Coho salmon or unclipped Sockeye/Kokanee (Table 11).

Table 11. Annual mortality in percent at Ice Harbor Dam, 2010-2014.

Year	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Total
	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clip/Unclip	
2010	0.0%	0.6%	---	----	0.1%	0.4%	0.0%	0.0%	0.0%	0.2%
2011	0.2%	0.0%	---	----	10.0%	0.0%	0.0%	0.0%	0.0%	0.1%
2012	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.5%
2013	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.0%
2014	0.4%	0.0%	0.2%	0.1%	0.1%	0.4%	0.0%	1.2%	0.0%	0.2%

---clipped/unclipped combined subyearlings equaled 0.3% in 2010 and 0.2% in 2011

Maladies

Maladies are recorded for each sample and sent to the Fish Passage Center (FPC) after the sample is completed. For the 2014 season, maladies found within all species groups included body injury, head injury, eye injury, eye hemorrhage, popeye, operculum injury, fin injury, fungus, fin hemorrhage, fin deformity, parasites, columnaris, and fin discoloration. Maladies varied depending on the species and phase. In clipped subyearling Chinook, the most occurring malady was eye hemorrhage. Deformity, fin hemorrhage, and body injury were found occurring in equal numbers as the second highest malady found in clipped subyearling Chinook. In unclipped subyearling Chinook, three maladies were found to be the highest in equal numbers, including eye hemorrhage, eye injury, and fin hemorrhage. The leading malady was eye hemorrhage in both clipped and unclipped yearling Chinook. The leading malady found in steelhead, varied depending on if the fish were clipped (operculum injury) or unclipped (fungus). Only one Coho, was observed with a malady, which was parasites. No Sockeye/Kokanee, were observed with a malady. Most of the maladies found came from clipped steelhead. No exact counts are listed within this report for maladies, only general observation of the data provided from the samples was used.

Incidental Species

Non-target fish species were counted and then released at the separator or with the sample fish. The most common incidental species group for 2014 was Siberian prawn, *Exopalaemon modestus* (52). Other incidental species with a total of two or more found in the sample were channel catfish, *Ictalurus punctatus* (12), largemouth bass, *Micropterus salmoides* (11), Sand Rollers, *Percopsis transmontane* (4), and Peamouth, *Mylocheilus caurinus* (2) (Table 12).

Siberian prawns were collected in the sample at the Juvenile Fish Facility and were humanely euthanized by fish condition personnel, frozen and properly disposed of in a landfill.

Table 12. Incidental species collected during sampling at Ice Harbor Dam, 2014.

Common Name	Sample
Siberian Prawn	52
Channel Catfish	12
Largemouth & Smallmouth Bass	11
Sandroller	4
Sunfish	3
Peamouth	2
Yellow Perch	2
Bullhead (misc.)	1
Chiselmouth	1
Crappie	1
Stickleback	1
Whitefish	1
White Sturgeon	1
Total	92

Adult Salmonid Fallbacks

A total of 15 salmonids were released from the separator in 2014. All the salmonids were classified in good or fair condition except for 2 unclipped steelhead released on June 3 and 25. These steelhead were classified in poor condition (Table 13).

The annual totals of adults released from the separator for 2014 were more than the previous years (Table 14).

Table 13. Daily totals and condition of adult salmonids released from the separator at Ice Harbor Dam, 2014.

Date	Chinook	Chinook Jack	Steelhead Clipped	Steelhead Unclip	Sockeye	Coho	Condition
2-Apr				2			Good
20-May			1				Fair
30-May				2			Good
3-Jun	2						Good
3-Jun				1			Poor
5-Jun		1		1			Good
9-Jun			1				Good
25-Jun				1			Good
25-Jun	1						Good
25-Jun				1			Poor
9-Jul	1						Good
Total	4	1	2	8	0	0	

Table 14. Annual totals of adult salmonids released from the separator at Ice Harbor Dam, 2010-2014.

Year	Chinook	Chinook Jack	Steelhead Clipped	Steelhead Unclip	Sockeye	Coho	Total
2010	2	0	3	2	0	0	7
2011	3	4	0	0	0	0	7
2012	3	1	2	3	0	0	9
2013	3	1	1	0	0	0	5
2014	4	1	2	8	0	0	15

Facility Operations and Maintenance

Turbine Operations

Efforts were made to operate all turbine units within 1% of peak efficiency from April 1 to October 31, inclusive. Deviations were infrequent and brief. The project ran outside the constraint at the request of the Bonneville Power Administration (BPA). Unit priority was in effect from March 1 to November 30. Units were taken out of service (OOS) for various reasons throughout the year. Table 15 provides a summary of some of the unit outages and causes, the remainder are described below.

Unit 3 was taken out of service on July 7 to investigate a generator electrical grounding problem and annual maintenance. It remained out of service due to an oil leak from the hub through the end of the year. September 3 unit 6 was removed from service from 0825 hours to 1700 hours, and on September 4 from 0700 hours to 1500 hours to accommodate RSW inspection dives. Unit 5 was out of service on October 21 to accommodate an ROV inspection of the unit 6 stop log guide slot. Unit 6 was out of service from 0700 hours to 1700 hours on October 29 and from 0630 hours to 1834 hours on September 30 for spillbay 2 dive inspection. Unit 6 was out of service from December 8 at 1245 hours to December 16 at 0909 hours to accommodate BPA work on the Ice Harbor-Franklin No. 3 115 kV line and due to a faulty sectionalizing disconnect. Units 4 and 5 were out of service on December 17 from 0633 hours to 0810 hours and from 0636 hours to 0809 hours, respectively, to perform the switching.

Table 15. Unit outages and return to service dates for Ice Harbor Dam, 2014.

Dates OOS	Unit	Reason OOS
12-13 Mar	6	Validation testing
26-Mar	5	In support of a line outage
28-29 Mar	6	No reason given
21-Apr to 8-May	1	Repair STS
7-8 May	1	Unintentional release of oil in turbine pit
7-9 May	3	Unintentional release of oil in turbine pit
18-May to 12-Aug	2	Re-center turbine shaft and annual maintenance
12-Jun-21 Jul	6	Replaced oil and repaired turbine bearing link
3-Jun	5	Annual maintenance
7-Jul	3	Investigate generator grounding problem and annual maintenance
28-Jul	1	Line switching in support of transformer station work
31 Jul to 6-Aug	6	Replaced pressure relief valve
4-Aug to 8- Sep	4	Annual maintenance
9-Sep to 1-Oct	5	Annual maintenance
30-Sep to 10- Oct	4	Repair governor oil leak
6-Oct to 26-Nov	6	Annual maintenance
14-Oct to 19-Dec	2	Digital governor installation
1- Dec to 2- Dec	6	Fix vacuum breaker problem
8-Dec	6	Accommodate BPA work on 115 KV line
19-Dec	1	Electrical check of wiring on unit 2
22-Dec	2	Repair leak in turbine oil piping system
23-Dec	1	Annual maintenance and digital installation
29-Dec	4,5	Repair bus sectionalizing disconnect

Removable Spillway Weir

The removable spillway weir (RSW) was operated for juvenile fish passage from April 2 to July 15. Spill began as river flows exceeded powerhouse capability March 6. Spill in support for fish passage began on April 3 and ended on August 31. The contractor for the spill bay 2 ogee and flow deflector modification began mobilizing materials and equipment to the project on September 9. Spillway 2 modifications occurred between October 3-9. A work access platform from the north powerhouse deck to spill bay 2 was installed and access decks were constructed on the ogee during the week of October 10-16. Concrete cutting and chipping of the ogee began during the week of October 20 and continued through November 20, with these activities occurring between the hours of 1300 and 2400 when there were generally fewer adult fish present in the fish ladders. Diving began during the week of October 31 and lasted through December 18 to install temporary bulkheads in preparation for the flow deflector modification. During the week of December 19 concrete was poured for the modification of the ogee, and temporary bulkheads were installed for preparation for the modification of the flow deflector.

Debris and Trash Racks

Turbine unit trash rack raking occurred March 25. Turbine unit 1 had 25 cubic yards removed and turbine unit 2 had 15 cubic yards removed. Very little debris was present in the other units.

Gatewells

Gatewell slots were checked for debris three times a week during ladder inspections. Small amounts of woody material were noted in gatewell slots but never approached the 50% coverage criteria point for mandatory cleaning. Slots were dipped for debris removal prior to installing STSs.

On March 5, oil was detected in gatewell 2 C. The problem was a leaking valve in the headgate slot. The problem was corrected, and the oil was removed by placing oil absorbent pads in the slot. Oil sheens were periodically observed in intake slot 3C and gatewell slot 3C beginning on July 10. Oil absorbent pads were put in the gatewell slot to reduce and absorb the oil. No sheen was observed after July 25. Light oil sheens were observed in gatewell slots 3A and 5B on July 21, but were not observed on inspections later in the week of July 18-24. Oil sheens were observed on the water surface in gatewell and head gate slots 2C during the week of September 19-25. Oil socks were placed in the slots to absorb the oil. Oil sheens were observed on the water surface in gatewell slot 5B and head gate slot 5B during the week of September 26-October 3. Powerhouse mechanics were notified. During the week of October 17-23 an oil sheen was observed in gatewell slot 2C. An oil absorbent sock was deployed in the slot. An observation of oil in 1A gatewell and intake gate slots was reported to the shift operator on December 22. The oil had leaked from the gear box of the raised slot 1A STS when a seal ruptured. Oil socks were deployed in the gatewell and intake gate slots.

Submersible Traveling Screens

STSs were installed March 24-27 for units 1-5 and unit 6 was installed on March 31. Inspections with an underwater camera were performed monthly. There were no significant problems found during any inspections listed above, except for what is listed below.

STSs were in cycle-run mode until switched to continuous-run mode on April 2, due to the presence of subyearling Chinook salmon and Sockeye salmon in the sample with an average fork length of less than 120 mm. On May 19, STSs were switched back to cycle mode. On May 27, STSs were placed back to continuous-run mode. In July, STSs were placed on cycle mode. During 2014, only two significant issues was discovered concerning STSs. During STS inspections performed from April 21-23, the STS in Slot 1 C was found detached from the cross bar. The repair was made the same day. During STSs inspections conducted June 24-25, personnel observed a narrow gap in the mesh of the STS in slot 5A due to a few missing retaining clips at the end of one of the seams. Clips were immediately reinstalled to close the gap. Pipes for the release of sensor fish were installed on the framework of the STS in gatewell slot 3B between September 19-25 and gatewell slot 1B on November 5 to prepare for the turbine characterization study. Unit 1 STSs were operated in continuous-run mode on November 6 in support of vibration testing on the STS in slot 1B. Unit 1 STSs were found to be mistakenly in

continuous run mode on November 10 and were switched back to cycle mode. Unit 3 STSs and unit 2 STSs were removed for the season on November 4 and December 10, respectively, since both units will remain out of service past December 15. Unit 4, 5, and 6 STSs were removed on December 16 and unit 1 STSs were removed on the morning of December 17.

Vertical Barrier Screens

Project personnel inspected vertical barrier screens (VBS) while conducting STS inspections. No problems were found during any inspections.

Juvenile Collection Channel (JCC) Orifices

The JCC channel was watered up on March 17. The collection channel was typically operated with 20 orifices open. At least one orifice was open in each gatewell slot. Some exceptions to this were if orifices were closed in individual gatewells for brief periods during the season to accommodate routine maintenance and repair, such as backflushing, STS inspections, or STS repair. Starting on April 1, orifices were backflushed three times a day until July 31. The light for the north orifice in gatewell slot 6A was found to be burnt out during the weekend of August 9. The operating orifice in 6A was immediately swapped until the light was replaced the morning of August 11. On August 24, an adult steelhead mortality was found in the fish collection channel. The fish was found on the walkway grating of the collection channel, above and adjacent to orifice 6C south. The fish had jumped out of the channel sometime over the weekend. To correct this, the channel was assessed and monitored on a regular basis to determine specific areas that may have been prone to fish jumping and which needed additional netting or other barriers. The number of orifices opened varied during three different weeks. These weeks were September 19-25 when the number of opened orifices varied between 19 and 22, the week of October 31-November 6 when 20 to 21 orifices were open, and during the week of December 12-18 when the number of open orifices operating varied between 15 to 20. Subfreezing temperatures during the week of November 28 caused icing of the water level sensors in the collection channel, which created problems for the automated system that controls water level. An additional heat lamp was installed over the stilling well pipes that house the water level sensors to reduce the icing problem. The juvenile fish bypass was dewatered for the season on the afternoon of December 17.

Primary Dewatering Structure (PDS)

The juvenile fish collection channel, including the PDS was opened on March 17. On December 10, the mechanical screen cleaner at the primary dewaterer was taken out of service for the remainder of the season due to possible failure of the gear box that raises and lowers the brush. Fish facility personnel and powerhouse shift operators monitored channel water levels and used the air burst system to clean the downstream section of the inclined screen for the remainder of the season.

Juvenile Fish Facility

The raw water supply lines at the fish facility were watered up on March 17.

Fish Salvage

On May 20, 1 unclipped and 4 clipped juvenile steelhead mortalities were found in turbine unit 2 scroll while it was being dewatered. The causes of death were unknown, but it was determined they had been dead for several days. The scroll case was full of water until dewatering. During the fish salvage for the dewatering of the collection channel, 43 clipped and 20 unclipped steelhead, 1 clipped Chinook salmon, and 3 Channel Catfish were rescued. The fish recovered during unwatering operations were released to the river in good condition.

Cooling Water Strainers

Turbine unit cooling water strainers were examined for biologic content at least once per month. The strainers were also cleaned when accumulation of debris and fish resulted in a high-pressure differential. The number and species found in the strainers were: 603 American Shad, 483 Pacific Lamprey, 29 Siberian Prawns, 2 Chinook and 1 Coho salmon. The total percentages for American Shad and Pacific lamprey found in the strainers were 53.9% and 43.2%, respectively. Siberian Prawn and salmonids were less than 1% of the total observed in the strainers. The juvenile Chinook mortality was discovered in Unit 5 during the inspection that occurred between April 21-23. A juvenile Coho mortality was discovered during the inspection conducted May 19-21.

The total number of Pacific Lampreys removed, dead or alive, from the water cooler strainers for the last 5 years is listed in Table 16. Less Pacific lamprey were found in 2014 than in the last 5 years, except for in 2013. Probability of individuals being alive at the time of strainer cleaning was likely more related to time of entry rather than which unit's strainer it was found in.

Table 16. Pacific lamprey removed from turbine cooling water strainers from Ice Harbor Dam, 2010-2014.

Pacific lamprey (Juvenile)			
Year	Live	Dead	Total
2010	7	853	860
2011	26	1518	1544
2012	12	608	620
2013	2	290	292
2014	0	483	483

Research

During the week of November 17-23, researchers began releasing sensor fish through Unit 1 for the turbine characterization study. The release of sensor fish through unit 1 for the turbine characterization study ended on December 1. A redd survey of the downstream approach to the navigation lock occurred on December 2, as required prior to conducting scheduled maintenance dredging.

Avian Predation

Avian Predation-General

The piscivorous bird count program occurred from April 1 to July 15. Contracted hazing of piscivorous birds for 16 hours per day began on April 1 and ended on June 30. Both land and boat hazing occurred. Land hazing was conducted 7 days a week and boat hazing occurred 3 days a week on Mondays, Wednesdays, and Fridays. Land-based hazing was generally effective at dispersing birds away from the dam, except for the spillway tailrace zones on windy days. Winds blowing from the south or southwest prevent the shooting of pyrotechnics from the north shore because of the danger of starting a grass fire. Boat-based hazing was found to be effective at moving birds out of all the tailrace zones, except when turbulent river conditions from spill make it unsafe. Gulls, cormorants, Caspian terns, western grebes, and American white pelicans were counted once per day for 6 to 7 days a week from April 1 to June 30 and for 4 days from July 1 to July 15 (Monday-Thursday). Areas of avian predation monitoring included: forebay, powerhouse tailrace (two areas), spillway tailrace (three areas), Eagle Island and JFF bypass outfall (Figure 2). Deterrent measures include bird deterrent hydro cannon, bird wires, and hazing, which occurred from April 1 to June 30 under the animal control contract with United States Department of Agriculture-Wildlife Services (USDA-WS). On May 30, personnel observed that the water spray shooting from the hydrocannon at the bypass outfall pipe was significantly reduced. The hydrocannon was turned off at 1000 hours for about two hours on May 30 to allow any debris that was impinged on the intake screen to wash off. This was unsuccessful, so the hydrocannon was shut off from 0750 hours to 0830 hours on June 2 to raise the pump and clean the intake screen to restore the full water spray. The bird abatement hydro-cannon was turned off and winterized for the season on November 13 due to increasing ice buildup on the outside of the hydrocannon and bypass outfall pipe.

The juvenile fish collection channel and bypass pipe were dewatered for the start of the winter maintenance period December 17.

Gulls

The highest number of gulls observed in a one-month period for the 2014 season during April 1-July 15 was in May with a total count of 851 birds. The highest amount observed in one day was 78 gulls on May 6. In the months following May, gull numbers decreased.

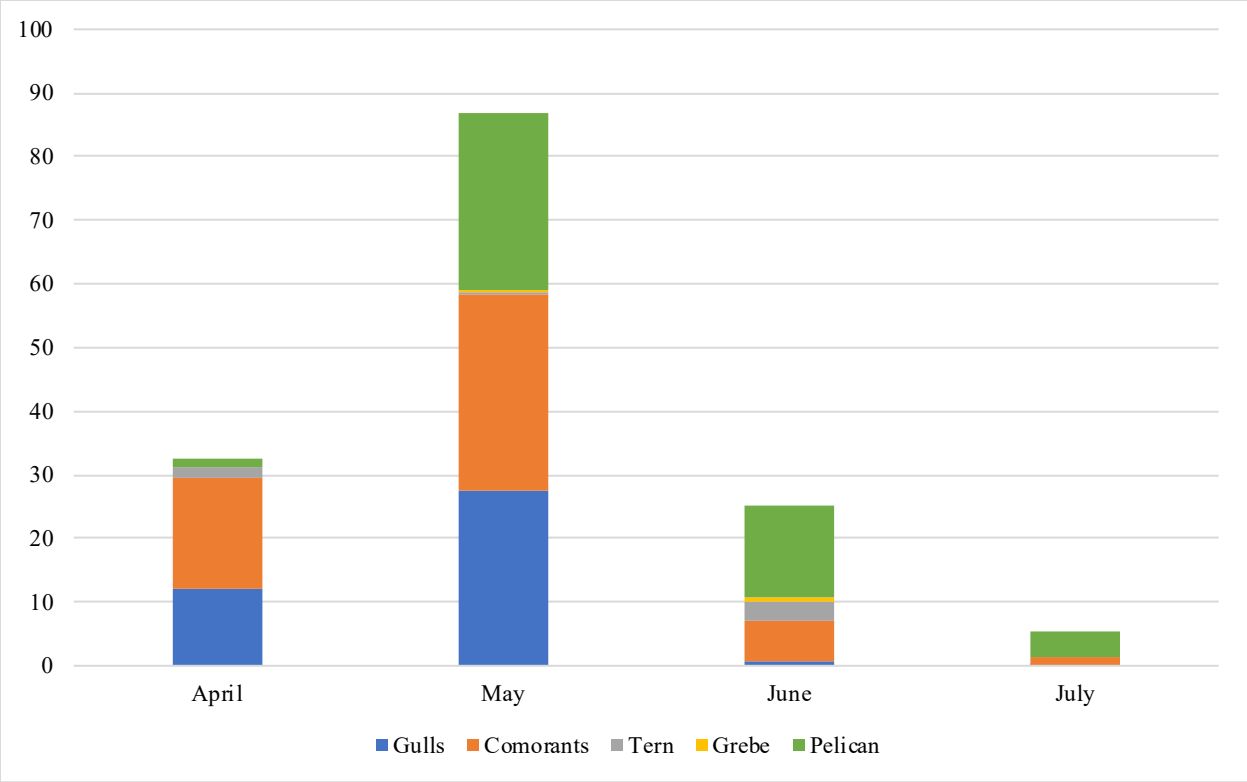

Figure 2. Daily average bird count at Ice Harbor Dam, 2014.

Cormorants

Cormorant counts continued to climb until May in the 2014 season from April 1-July 15. The month of May had the highest total count of cormorants seen at 956 birds. The most observed in a day was 100 cormorants on May 15. In the months following May, Cormorant numbers steadily decreased.

Terns

June had the highest overall monthly count of terns at 95 birds for the month with the largest number of terns observed occurred on June 13, totaling 30 birds. The lowest number seen totaled 0 and occurred on many different days. The number of terns observed did not steadily increase or decrease, but varied through the season, with April's total equaling 51, and May 17, June 95, and July equaling 0.

Grebes

The monthly number of grebes steadily increased through the season until peaking in June at 21. Only one grebe was seen during the month of July. The highest amount observed in a day occurred on June 29 and totaled 29.

Pelicans

The monthly total of pelican counts in 2014 peaked in May. The monthly overall total of pelicans for May observed was 956 birds. The largest count for a day occurred on May 9 at 185. Only 1 pelican was observed on multiple days in April.

Recommendations for the Juvenile Fish Facility

1. Repaint the interior of the juvenile fish bypass pipe/flume and separator exit flume. The inside surfaces of the pipe and flumes have peeling paint and corroded areas, which created rough spots that could possibly descale or injure fish.
2. Extend the air bubbler screen cleaning system under the entire unwatering floor screen in the primary dewatering structure. This system would serve as a reliable extra cleaning system in the event of failure of aging components of the mechanical screen cleaner.
3. Install a crowding mechanism in the juvenile collection channel that would encourage adult fish to exit.
4. Install a walkway alongside the outfall pipe to provide access to the outfall pipe and hydrocannon water line to conduct inspections and maintenance.
5. Install a fish release chute connecting to the main bypass pipe downstream of the JFF lab. This would permit fish rescued during certain unwatering events to be more easily returned to the tailrace via the bypass pipe.
6. Install stairs on the hillside to provide a direct and safe walking path between the JFF and tailrace deck level.
7. Pave the road and parking area inside the JFF and provide curbing that would direct any water runoff away from the juvenile facility and the hillside. Pavement would provide stable ground for heavy equipment access and setup as needed to perform maintenance and repairs.

Adult Fish Facility

Operations and maintenance

The south shore fish ladder (SFL) and north shore fish ladder (NFL) were operated for fish passage for most of the year. The fish ladders were dewatered one at a time for annual winter maintenance in January and February. Adult fish counting started March 1 and ended for the season on October 31. For all species groups, the SFL was used much more than the NFL. The total counts for each species group were well below the previous ten years' average, except for Chinook, Sockeye, Coho, Coho jack, and shad (Table 17).

Table 17. Number of adult fish passing Ice Harbor Dam in 2014 and average of previous ten years.

	Chinook	Chinook Jack	Steelhead Clipped	Steelhead Unclip	Sockeye	Coho	Coho Jack	Shad	Lamprey
SFL	71,488	12,845	17,036	6,289	1,567	4	3	84,912	203
NFL	28,892	4,416	6,478	2,214	823	-2	1	5,878	418
Total (SNL + NFL)	100,380	17,261	23,514	8,503	2,390	2	4	90,790	621
10 YR-Avg (SNL + NFL)	99,939	29,631	179,744	44,600	541	2,896	285	173,911	335

Auxiliary Water Supply

The auxiliary water supply (AWS) pumps were operating or available for operation to help maintain fish entrance criteria in 2014. AWS pumps were turned off, taken OOS, or forced OOS during the fish passage season to facilitate maintenance, operations, or emergency repairs. Five to eight AWS pumps were operated to maintain criteria in the SFL depending on tailwater elevation. Two AWS pumps were operated to maintain criteria in the NFL. In season maintenance and minor repairs can be performed on the pumps that are in standby. Each north shore pump operates at 350 cfs and each south shore pump operates at 300 cfs. In addition, approximately 270 kcfs of excess water from the juvenile fish collection channel is added to the south shore AWS pump discharge chamber. Any outages or disruptions that occurred in 2014 are listed below or are cited in (Table 18).

Table 18. AWS pump outages and significant events requiring pumps to be shut off at Ice Harbor Dam, 2014.

Date	Pump Number or How Many Pumps Affected	Duration that Entrances Head/Depth was Out of Criteria	Pump Outage Description or Reason for Turning Off
6 May-12 May	#4	In criteria	Repair an oil leak
9-Jul	#2	25 minutes	False oil leak alarm

Six of the 8 south AWS pumps were operated until November 26. On November 26, south AWS pump 3 tripped off at 0935 hours and was available for service at 1523 hours the same day, but only five pumps were needed to meet fishway criteria. On December 3 at 1415 hours, south pump 3 was turned back on and 6 pumps were running again.

Adult Fishway Inspections

Visual Inspections

Ice Harbor project fisheries personnel conducted visual inspections of the fish ladders during the adult fish passage season from March 1 to December 31. In addition, powerhouse operators conducted daily limited inspections of the fishways. Fish facility staff averaged over three fishway inspections per week with 142 ladder inspections completed, however, on December 29 the channel velocity was not recorded. The inspections were conducted by visually inspecting various areas of the fishways and recording readings from staff gauges, fishway entrance hoist motors, meters, and tape measures. The data was subsequently transferred to a computer spreadsheet, Appendix 1. Fisheries staff also collected data on flow discharge, AWS pump operation and juvenile fish orifice operation. In addition, estimates were made for the amount of debris observed in the forebay, fish ladder exits, and gatewells. When the fishway was out of criteria, the powerhouse operator was notified to make any needed adjustments to the fishway control system or arrange for repairs as needed. The combined fish passage data collected was used to compose weekly reports on the status of the fish facility operation and maintenance. The north ladder was dewatered from February 4 to February 17 and the south ladder was dewatered from January 2 to February 3 for annual maintenance. During the dewatering of the upper section of the south fish ladder, 1 bass was recovered and released to the river in good condition. No data was available to determine if fish salvage had been done in any other locations during the dewatering of the fish ladders. The bubbler was off at the south ladder exit on May 22 and 27 to secure new air piping in place. On March 10, 1 dead unclipped juvenile chinook was found at the south shore adult fish ladder upstream of the picketed leads. The cause of death was unknown but there were bird marks on the carcass. Bird hazing began on April 1. In addition, 3 clipped Chinook mortalities were found on July 21 and appeared to have been dead for several days. Two of the fish were on the ground, about 5" south of the middle of the south fish ladder. The third fish was found on the walkway grating above and between the picket leads at the north ladder, next to the count slot. The first two fish were believed to have been dropped by an osprey seen in the area and the third Chinook was believed to have been caught above the window cleaning brush as it rose. The area was assessed to see if any modifications needed to be made, including the addition of more fish jump netting. However, the incidence of fish stranding themselves above the count slot was very rare during the period this report covers.

The north and the south shore picketed leads were placed in their raised positions on November 3. Adult fish counts ended for the season on October 31. The south shore forebay debris boom was found to be disconnected from its shoreline attachment point on November 12. The boom was reattached on November 13. On December 29, a northeast wind created turbulent conditions in the forebay causing damage to the ladder exit debris booms. The south debris boom logs started to separate from each other, and the north debris boom became detached from its anchor points and was found floating near spill gate 9. Both debris booms were repaired and reinstalled on December 30.

Automated Fishway Control Systems

In the 2014 fish season, the readings from the automated fishway control system were compared to the visual inspection results to ensure that the readings were similar and the fishways were operated within criteria. Any significant discrepancies between the readings were reported to the electricians for calibration. The time difference between reading a staff gage and checking the PLC display may have been as much as 120 minutes. The time difference between the automated and visual readings may give different inspection results due to operational changes, such as changing spill volumes, switching units, and water elevation fluctuations.

Inspection Results

Channel Velocity

The water velocity in the south shore channel junction pool was in criteria at 1.5-4.0 feet per second (fps) on 100% of the inspections where it was read. The chart displays 98.6% due to the reading not being taken on December 29.

Ladder Exits

The north and south fish ladder exit head differentials were in criteria (<0.3 feet) during all inspections. Picketed leads were put down between March 3-March 13.

Ladder Weirs

The depth over the stationary weirs in both fish ladders were in criteria (1.0-1.3 feet) in all fishway inspections.

Counting Stations

The differential across the north shore picketed leads were in criteria (<0.3 feet) on all inspections. The south shore picketed leads were in criteria on 99.2% of inspections.

South Shore Entrance

The SFE-1 weir gate depth was in criteria (> 8 feet or on sill) 99.3% of the inspections. The weir gate was in sill criteria on 38.7% of inspections. On June 16 the south shore entrance depth was out of criteria with readings of 7.6 feet. The powerhouse operator was informed.

North Powerhouse Entrance

The NFE-2 weir gate depth was in criteria (>8 feet or on sill) on 99.3% of inspections. The weir gate was in sill criteria on 40.8% of inspections. The NFE-2 depth was out of criteria on June 16 with a depth of 6.3 ft. The powerhouse operator was informed.

North Shore Entrance

The NEW-1 was in criteria 99.3% of inspections. The weir gate was in sill criteria on 49.3% of inspections. The entrance head differential was out of criteria at 0.7 ft on May 5. The entrance weir depth was reduced to provide the required head differential on subsequent inspections.

Fish Collection Channel and Tailwater Head Differential

South Shore Entrance

The south shore entrance channel/tailwater head differential was in criteria (1-2 ft) on 92.3% of inspections. On June 16, the south shore channel differential was out of criteria at 2.2 ft. The powerhouse operator was informed. The south shore entrance (SFE) channel/tailwater differential was above criteria on August 5, 14, 18, and 19. This may have been due to the low tailwater levels and difficulty getting accurate readings of the tailwater elevation because of turbulence from project spill. The south shore entrance (SFE) channel differential was above criteria on November 6, 12, 13, 19, and 24. The lower tailwater elevation in November contributed to these readings. The lower tailwater elevation in November contributed to these readings.

North Powerhouse Entrance

The north powerhouse entrance head differential was in criteria (1-2 feet) on 99.3% of inspections. On May 5, the differential was below criteria. The entrance weir depth was reduced, but kept in criteria, to provide the required head differential on subsequent inspections.

North Shore Entrance

The north shore entrance head differential was in criteria (1-2 ft) on 85.2% of inspections. The north shore entrance channel/tailwater differential was out of criteria on March 3. On this inspection, the channel/tailwater differential was at 0.8 ft. The shift operator was notified to raise the entrance weir to increase the channel/tailwater differential to criteria. The north channel/tailwater differential was out of criteria on March 18 at 2.2 ft. On April 23, the north shore channel was at 2.1 ft differential, but the entrance weir was on sill. On July 10, the north shore channel differential was out of criteria when the differential was 2.4 ft. The high differential was most likely due to an errant reading of the fluctuating tailwater elevation caused by project spill. The differential was high on July 16, 21, 28, 31, and on August 4, 5, 7, 11, 12, 13, 14, 18, 19, 21, 26, 27, and 28, which may have been due to the low tailwater levels and difficulty in getting accurate readings of the tailwater elevation because of turbulence from project spill. However, the north channel diffuser valves were closed to 50% on August 19 in an attempt to reduce the high channel/tailwater differentials that had been occurring, but the differentials remained high.

Table 19. Adult Fishway Inspection Results at Ice Harbor Dam, 2014.

Criteria and Locations	No. in Criteria/ No. on Sill/ No. of Inspections	% In Criteria/ % On Sill	No./% Within 0.01-0.1 Foot	No./% Within 0.11-0.2 Foot	No./% >0.2 Foot	No./% Within 0.01-0.1 Foot	No./% Within 0.11-0.2 Foot	No./% >0.2 Foot
Channel Velocities	139	98.6	***	***	***	***	***	***
	***	***	***	***	***	***	***	***
	141							
Differentials								
South Fish Ladder								
Ladder Exit	142	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	142							
Ladder Weirs	142	100.0	0	0	0	0	0	0
	***	***	0.0	0.0	0.0	0.0	0.0	0.0
	142							
Counting Station	142	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	142							
North Fish Ladder								
Ladder Exit	142	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	142							
Ladder Weirs	142	100.0	0	0	0	0	0	0
	***	***	0.0	0.0	0.0	0.0	0.0	0.0
	142							
Counting Station		0.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	142							
Collection Channels								
South Shore	131	92.3	0	0	0	3	6	2
	***	***	0.0	0.0	0.0	2.1	4.2	1.4
	142							
North Powerhouse	141	99.3	0	0	1	0	0	0
	***	***	0.0	0.0	0.7	0.0	0.0	0.0
	142							
North Shore	121	85.2	0	1	0	1	5	14
	***	***	0.0	0.7	0.0	0.7	3.5	9.9
	142							
Weir Depths								
SFE 1	86	60.6	0	0	0	***	***	***
	55	38.7	0.0	0.0	0.0	***	***	***
	142							
NFE 2	83	58.5	0	0	0	***	***	***
	58	40.8	0.0	0.0	0.0	***	***	***
	142							
NEW 1	71	50.0	1	1	1	***	***	***
	70	49.3	0.7	0.7	0.7	***	***	***
	142							

Recommendations for the Adult Fish Facility

1. Repair south fish ladder mud valves in the auxiliary water supply conduit to facilitate unwatering the lower ladder for inspection and maintenance.
2. Remove the accumulated silt in the south shore AWS conduit that is clogging the mud valves and blocking access to some of the mud valves and sluice gates for inspection and maintenance.
3. Rehabilitate fish ladder entrance weir gates and hoisting equipment.
4. Install a handrail along the outside edge of the north and south shore fish ladders to allow routine in-season inspection of the entire fish ladders and to facilitate safer unwatering and fish evacuation procedures for personnel.
5. Replace the debris booms and attachment systems at the north and south shore fish ladder exits. The log booms are prone to detachment under high winds.
6. Proactively replace fish ladder diffuser grating as needed.
7. Replace broken/dirty staff gauges and guides so that the gauges are easier to clean and read.
8. Relocate staff gages and transducer units as needed so the staff gage and the automated fishway control system readings will be more precise.
9. Install an audible alert on the automated control system PLC when the fish ladder entrance criteria are not being met.
10. Initiate a contract to repair leaks in the fish ladder joints.