2012 ADULT AND JUVENILE FISH FACILITY MONITORING REPORT
ICE HARBOR DAM

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February 2013

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INTRODUCTION

This report summarizes the operation and maintenance of the adult and juvenile fish passage facilities at Ice Harbor Dam in 2012. The juvenile fish passage facility at Ice Harbor Dam consists of standard length submersible traveling screens (STS's), vertical barrier screens (VBS's), 12 inch orifices (36 orifices), a collection channel and dewatering structure, fish sampling facilities, evaluation separator facilities, and a transportation flume/pipe to the tailrace downstream from the Project. The juvenile fish collection channel is operated with approximately 300 cfs flow (forebay head dependent) which is the design operating flow produced by 20 of the juvenile fish passage orifices open. All but 30 cfs of the flow is removed at the primary dewatering structure and utilized as adult fish attraction water. The remaining 30 cfs flow, which the fish are in, is 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 are comprised of separate north and south shore systems. The north shore facilities include a fish ladder with a counting station, an adult fish collection channel, and a three-pump 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 into the spillway basin. The downstream entrance nearest the navigation lock wall is normally open for fish passage, and the other two entrances are closed. 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 a 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 into 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 operating floating orifices. Eight electric pumps are available to supply the auxiliary water for fish attraction. In addition, excess water from the juvenile fish bypass system (approximately 200-270 CFS depending on forebay head) is added to the south shore fish pump discharge chamber from April 1 through December 15.

RIVER CONDITIONS

Peak river flow at Ice Harbor Dam occurred April 27 reaching 192.2 kcfs. River flows intermittently exceeded 100 kcfs March 22 – June 19. Spill for juvenile fish passage began April 3 and continued through August 31. Water temperatures taken at the facility during the juvenile sample season ranged from 46.1 degrees Fahrenheit in early April to 67.2 degrees Fahrenheit July 7.

JUVENILE FISH BYPASS OPERATIONS AND MAINTENANCE

Sampling Summary

The Juvenile Fish Bypass was put in operation March 19, 2012 and continued in operation through December 19. 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. Sampling for fish condition in 2012 began April 2 and continued through July 12. Fish were sampled twice a week (Monday and Thursday) during this time frame. The goal of a sample event is to sample 100 fish of the predominant species per sample day when fish are available. During the beginning and the later part of the season, fish numbers can be too low to collect these fish in a reasonable time period. When this occurred, the collection time was limited to four hours and the fish collected during this period sampled.

A total of 2,970 fish were sampled at the Ice Harbor Facility in 2012 (Table 1). The 2012 sample numbers of fish decreased by 335 fish from the 2011 sample numbers of fish (Table 2). The species composition and percent of the combined total sample for each species group was: 639 clipped yearling Chinook 21.52%, 631 unclipped yearling Chinook 21.25%, 240 clipped subyearling Chinook 8.08%, 494 unclipped subyearling Chinook 16.63%, 586 clipped steelhead 19.73%, 327 unclipped steelhead 11.01%, 0 clipped sockeye 0.0%, 18 unclipped sockeye .61%, and 35 coho 1.18%.

A total of 282 non-target fish and other aquatic life (incidental species) were collected during sampling in 2012 (Table 3). These fish are directed into the sample tank with salmonids during the sampling process. Observed incidental fish are identified, recorded, and released back into the river via the bypass.

Juvenile Fish Condition

The combined annual descaling rate for all fish sampled in 2012 was 2.9% (Table 4,4a, and 5). The descaling rate increased from 2011 by 0.3% (Table 5). Annual descaling rates in 2012 by species group were: clipped yearling Chinook 2.7%, unclipped yearling Chinook 3.2%, clipped subyearling Chinook 3.5%, unclipped subyearling Chinook 3.5%, clipped steelhead 5.3%, unclipped steelhead 3.7%, clipped sockeye 0.0%, unclipped sockeye 0.0%, and coho 0.0% (Table 4). Descaling data was collected from live sample fish. Facility fish mortalities were included in the sample number of fish.

Total juvenile facility percent mortality for all groups combined was 0.2% (Table 6). Facility mortalities by species group included: 1 clipped yearling Chinook.

Eye injuries are observed in sampled fish. This type of physical condition is not reflected in the descaling criteria, but could be significant in the survival of the animal.

Table 1. Number of fish sampled by day at Ice Harbor Dam, 2012.

	Yearling Chinook		All Subyearling	Steelhead		Sockeye/Kokanee		All	Daily
Date	Clipped	Unclipped[1]	Chinook[1]	Clipped	Unclipped[1]	Clipped	Unclipped[1]	Coho	Total
2-Apr	5	29	---	56	44	---	---	---	134
5-Apr	9	34	---	31	25	---	---	---	99
9-Apr	27	71	---	21	39	---	1	---	159
12-Apr	33	83	---	8	12	---	---	---	136
16-Apr	42	66	---	19	19	---	1	---	147
19-Apr	31	54	1	49	9	---	---	---	144
23-Apr	32	42	---	45	4	---	---	---	123
26-Apr	37	36	---	63	10	---	---	---	146
30-Apr	49	27	---	54	20	---	---	---	150
3-May	84	33	1	34	17	---	---	2	171
7-May	89	39	---	29	7	---	---	---	164
10-May	77	39	---	27	3	---	---	---	146
14-May	65	29	---	18	8	---	3	---	123
24-May	39	16	1	38	26	---	3	4	127
31-May	5	5	---	30	31	---	2	7	80
4-Jun	10	15	27	13	25	---	4	12	106
7-Jun	1	3	91	14	11	---	4	8	132
11-Jun	1	3	80	16	5	---	---	---	105
14-Jun	---	4	85	7	4	---	---	1	101
18-Jun	---	2	17	---	---	---	---	1	20
21-Jun	---	1	91	4	1	---	---	---	97
25-Jun	1	---	81	2	4	---	---	---	88
28-Jun	---	---	14	1	---	---	---	---	15
2-Jul	---	---	16	1	---	---	---	---	17
5-Jul	---	---	50	3	1	---	---	---	54
9-Jul	1	---	100	2	---	---	---	---	103
12-Jul	1	---	79	1	2	---	---	---	83
Totals	639	631	734	586	327	0	18	35	2,970
% Totals	21.5%	21.9%	25.2%	20.3%	11.3%	0.00%	0.6%	1.2%	

[1]includes unclipped hatchery reared fish

--- No fish of this species sampled.

Table 2. Number of fish sampled at Ice Harbor Dam, 2007- 2012.

Year	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		All Coho	Total
	Clipped	Unclipped[1]	Clipped	Unclipped[1]	Clipped	Unclipped[1]	Clipped	Unclipped[1]		
2008	819	463	710	662	923	355	18	5	38	3,993
2009	632	431	472	600	1201	328	24	30	36	3,754
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

[1]includes unclipped hatchery reared fish

Table 3. Collection of incidental species during sampling at Ice Harbor Dam, 2012.

Common Name	Scientific Name	Number of fish
Crappie	*Promxis nigromaculatus*	1
Lamprey	*Lampetra tridentatus*	220
Peamouth	*Mylocheilus caurinus*	21
Mountain Whitefish	*Prosopium* sp.	7
Siberian Prawn	*Exopalaemon modestus*	14
Yellow Perch	*Perca flavescens*	1
Carp	*Cyprinus carpio*	3
Sandroller	*Percopsis transmontana*	2
Smallmouth Bass	*Micropterus dolomieu*	1
Tench	*Tinca tinca*	1
American Shad	*Alosa sapidissima*	1
Bluegill	*Lepomis macrochirus*	1
Total		273

Table 4. Sampling event-descaling rates in percent for fish sampled at Ice Harbor Dam, 2012

Date	Yearling Chinook Clipped	Yearling Chinook Unclipped[1]	All Subyearling Chinook[1]	Steelhead Clipped	Steelhead Unclipped[1]	Sockeye/Kokanee Clipped	Sockeye/Kokanee Unclipped[1]	All Coho
2-Apr	20.00%	3.45%	---	---	---	---	---	---
5-Apr	11.11%	---	---	9.68%	8.00%	---	---	---
9-Apr	---	1.41%	0.0%	---	5.13%	---	---	---
12-Apr	3.03%	10.84%	---	12.50%	8.33%	---	---	---
16-Apr	---	---	---	---	10.53%	---	---	---
19-Apr	3.23%	1.85%	---	2.04%	---	---	---	---
23-Apr	3.13%	4.76%	---	11.11%	25.00%	---	---	---
26-Apr	2.70%	8.33%	---	4.76%	---	---	---	---
30-Apr	2.04%	3.70%	---	12.96%	5.00%	---	---	---
3-May	1.19%	---	---	2.94%	---	---	---	---
7-May	2.25%	---	0.0%	6.90%	---	---	---	---
10-May	1.30%	5.13%	---	3.70%	---	---	---	---
14-May	7.69%	---	0.0%	---	---	---	---	---
24-May	2.56%	---	0.0%	2.63%	3.85%	---	---	---
31-May	---	---	0.0%	6.67%	6.45%	---	---	---
4-Jun	---	---	0.0%	15.38%	---	---	---	---
7-Jun	---	---	1.1%	---	---	---	---	12.50%
11-Jun	---	---	0.0%	6.25%	---	---	---	---
14-Jun	---	---	1.2%	14.29%	---	---	---	---
18-Jun	---	---	---	---	---	---	---	---
21-Jun	---	---	11.0%	---	---	---	---	---
25-Jun	---	---	---	---	---	---	---	---
28-Jun	---	---	---	---	---	---	---	---
2-Jul	---	---	---	---	---	---	---	---
5-Jul	---	---	---	---	---	---	---	---
9-Jul	---	---	---	---	---	---	---	---
12-Jul	---	---	2.78%	100%	---	---	---	---
% Totals	2.66%	3.17%	2.30%	5.46%	3.69%	0.00%	0.00%	2.86%

--- No fish of this species sampled.
[1]includes unclipped hatchery reared fish

Table 4a. Number of sample fish descaled at Ice Harbor Dam 2012.

Date	Yearling Chinook Clipped	Yearling Chinook Unclipped[1]	Subyearling Chinook Clipped	Subyearling Chinook Unclipped[1]	Steelhead Clipped	Steelhead Unclipped[1]	Sockeye/Kokanee Clipped	Sockeye/Kokanee Unclipped[1]	All Coho	Total
2-Apr	1	1	0	0	0	0	0	0	0	2
5-Apr	1	0	0	0	3	2	0	0	0	6
9-Apr	0	1	0	0	0	2	0	0	0	3
12-Apr	1	9	0	0	1	1	0	0	0	12
16-Apr	0	0	0	0	0	2	0	0	0	2
19-Apr	1	1	0	0	1	0	0	0	0	3
23-Apr	1	2	0	0	5	1	0	0	0	9
26-Apr	1	3	0	0	3	0	0	0	0	7
30-Apr	1	1	0	0	7	1	0	0	0	10
3-May	1	0	0	0	1	0	0	0	0	2
7-May	2	0	0	0	2	0	0	0	0	4
10-May	1	2	0	0	1	0	0	0	0	4
14-May	5	0	0	0	0	0	0	0	0	5
24-May	1	0	0	0	1	1	0	0	0	3
31-May	0	0	0	0	2	2	0	0	0	4
4-Jun	0	0	0	0	2	0	0	0	0	2
7-Jun	0	0	1	0	0	0	0	0	1	2
11-Jun	0	0	1	0	1	0	0	0	0	2
14-Jun	0	0	0	1	1	0	0	0	0	2
18-Jun	0	0	0	0	0	0	0	0	0	0
21-Jun	0	0	3	7	0	0	0	0	0	10
25-Jun	0	0	2	0	0	0	0	0	0	2
28-Jun	0	0	0	0	0	0	0	0	0	0
2-Jul	0	0	1	0	0	0	0	0	0	1
5-Jul	0	0	0	2	0	0	0	0	0	2
9-Jul	0	0	2	0	0	0	0	0	0	2
12-Jul	0	0	2	0	0	0	0	0	0	2
Totals	17	20	12	10	31	12	0	0	1	101

[1]includes unclipped hatchery reared fish

Table 5. Annual descaling rates in percent for fish sampled at Ice Harbor Dam, 2006 – 2012.

Year	Yearling Chinook Clipped	Yearling Chinook Unclipped[1]	Subyearling Chinook Clipped	Subyearling Chinook Unclipped[1]	Steelhead Clipped	Steelhead Unclipped[1]	Sockeye/Kokanee Clipped	Sockeye/Kokanee Unclipped[1]	All Coho	Total
2008	6.4	5.2	1.7	2.3	8.2	6.5	0.0	60.0	0.0	5.2
2009	3.5	1.9	1.1	1.2	2.3	2.4	0.0	6.7	0.0	2.2
2010	3.9	2.5	3.4	3.0	2.2	3.1	0.0	0.0	0.0	2.8
2011	3.9	2.3	0.7	1.6	3.3	3.9	0.0	5.4	0.0	2.6
2012	2.7	3.2	4.2	2.0	5.5	3.7	0.0	0.0	0.0	3.5

[1]includes unclipped hatchery reared fish

Table 6. Facility sample mortality number and weekly percent of species mortality sampled at Ice Harbor Dam 2012.

Date	Yearling Chinook Clipped	Yearling Chinook Unclipped[1]	All Subyearling Chinook[1]	Steelhead Clipped	Steelhead Unclipped[1]	Sockeye/Kokanee Clipped	Sockeye/Kokanee Unclipped[1]	All Coho	Daily Total
2-Apr	0	0	0	0	0	0	0	0	0
5-Apr	0	0	0	0	0	0	0	0	0
9-Apr	0	0	0	0	0	0	0	0	0
12-Apr	0	0	0	0	0	0	0	0	0
16-Apr	0	0	0	0	0	0	0	0	0
19-Apr	0	0	0	0	0	0	0	0	0
23-Apr	0	0	0	0	0	0	0	0	0
26-Apr	0	0	0	0	0	0	0	0	0
30-Apr	0	0	0	0	0	0	0	0	0
3-May	0	0	0	0	0	0	0	0	0
7-May	0	0	0	0	0	0	0	0	0
10-May	0	0	0	0	0	0	0	0	0
14-May	0	0	0	0	0	0	0	0	0
24-May	0	0	0	0	0	0	0	0	0
31-May	0	0	0	0	0	0	0	0	0
4-Jun	0	0	0	0	0	0	0	0	0
7-Jun	0	0	0	0	0	0	0	0	0
11-Jun	0	0	0	0	0	0	0	0	0
14-Jun	0	0	0	0	0	0	0	0	0
18-Jun	0	0	0	0	0	0	0	0	0
21-Jun	0	0	0	0	0	0	0	0	0
25-Jun	1	0	0	0	0	0	0	0	0
28-Jun	0	0	0	0	0	0	0	0	0
2-Jul	0	0	0	0	0	0	0	0	0
5-Jul	0	0	0	0	0	0	0	0	0
9-Jul	0	0	0	0	0	0	0	0	0
12-Jul	0	0	0	0	0	0	0	0	0
Totals	1	0	0	0	0	0	0	0	0
Percent of Species mortality	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

[1]includes unclipped hatchery reared fish

Table 7. Dam Mortalities Ice Harbor Dam, 2012

Date	Number and Fish	Location
1-03-12	1 juvenile unclipped Chinook	South Fish Ladder
01-31-12	74 juvenile lamprey 3 adult lamprey 1 juvenile catfish	Main Turbine Units Water Cooling Strainers
02-14-12	137 juvenile lamprey 30 peamouth 1 catfish	Main Turbine Units Water Cooling Strainers
03-02-12	8 Adult Shad	1 Adult Peamouth Gatewell Debris Removal
03-14-12	9 juvenile lamprey	Main Turbine Units Water Cooling Strainers
03-20-12	200 juvenile lamprey	Main Turbine Units Water Cooling Strainers
03-21-12	134 juvenile lamprey	Main Turbine Units Water Cooling Strainers
03-21-12	1 four foot adult sturgeon	Unit 1 Trash Rack
04-02-12	1 juvenile sandroller 2 juvenile lamprey	Arrived in separator dead
04-24 & 04-26-12	27 juvenile lamprey 1 juvenile steelhead 1 catfish	Main Turbine Units Water Cooling Strainers
05-22 & 05-23-12	21 juvenile lamprey 1 juvenile steelhead 1 catfish	Main Turbine Units Water Cooling Strainers
05-24-12	1 juvenile steelhead	Picketed leads
06-19 & 06-20-12	4 juvenile lamprey	Main Turbine Units Water Cooling Strainers
06-25-12	1 juvenile unclipped Chinook	Separator
07-12-12	2 juvenile clipped Chinook	Roadway near SFL
07-26-12	1 juvenile unclipped Chinook	Roadway near SFL
07-30-12	4 juvenile lamprey	Separator
07-31-12	1 juvenile clipped Chinook	Roadway near SFL
08-17-12	1 American White Sturgeon (3 feet)	Downstream of navigation lock

Adult Salmon Fallbacks

04-16-12	1 Adult clipped steelhead	Separator
04-19-12	1 Adult clipped steelhead	Separator
05-14-12	1 Adult clipped Chinook	Separator
05-24-12	1 Adult clipped Chinook	Separator
05-31-12	1 Adult unclipped steelhead	Separator
06-07-12	2 Adult unclipped steelhead	Separator
06-18-12	1 unclipped Chinook Jack	Separator
07-05-12	1 Adult unclipped Chinook	Separator

Main Turbine Cooling Water Strainer Inspections

Main turbine cooling water strainers were inspected the entire year on a monthly basis at Ice Harbor from January 2012 to December 2012. A total of 2,130 juvenile lamprey, 1 adult lamprey, approximately 3,111 juvenile shad, 1 juvenile clipped steelhead, 5 juvenile catfish, 31 peamouth, and 5 Siberian prawns were found and removed from the main turbine cooling water strainers in 2012.

Debris/Trash Racks

Main unit trash rack raking began March 19 and was completed March 22. Approximately 20 cubic yards of debris were removed. Turbine units 1 and 2 trash racks held the most debris. No additional trash rack raking was required during the season. One adult sturgeon mortality, estimated at 4 feet in length, was found on turbine unit 1 trash rack during raking March 21.

Submersible Traveling Screens

The STS' installation began March 19 and was completed on all units March 22 without problems. Problems with STS' found during monthly inspections were:

Date	Unit #	Slot	Screen location	Observations
May 23, 2012	1	A	South screen / south edge	Flap undone – must repair
May 22, 2012	4	A	North screen / north edge	Flap undone must be fixed
June 20, 2012	1	A	South screen / south edge	Flap undone must be fixed
September 4, 2012	5	B	South and north screens	Removed
October 22, 2012	5	A,B,C	All screens	Removed

Operating turbine units STS' were raised December 19 and 20.

Vertical Barrier Screens

Project personnel inspected the vertical barrier screens (VBS's) while conducting STS inspections. Each VBS was inspected independently once each month during STS inspections. No problems were found with the VBS screens this season.

Gate Wells

Gate well debris was moderate at Ice Harbor Dam in 2012 and never approached the 50% coverage criteria point for mandatory cleaning. Slots were dipped for debris removal prior to installing the STS screens.

Orifices/Collection Channel

During the 2012 season, the collection channel was operated with 20 open orifices. Orifices were routinely cycled and back flushed by powerhouse operators and fish facility personnel. During periods of higher fish and debris loads (April 1 through July 31), the orifices were back flushed and cycled once per shift. Orifice lights were checked daily and replaced when required.

Primary Dewatering Structure

The primary dewatering screen cleaner brush performed fairly well this season. The drive wire did not need to be changed in season as it has in the past. The largest problem this season was the cleaner electrical supply wires which began to fray toward the end of the season and had to be replaced.

Sampling System

The sampling system functioned well this season. No problems were associated with sampling. Only one juvenile sample mortality occurred.

Removable Spillway Weir

No problems with the operation of the removable spillway weir. The RSW was operated April – August 2012.

Avian Predation

The U.S. Department of Agriculture (APHIS) provided bird hazing April – June. Bird deterrent structures are maintained on area lighting along the navigation lock and upstream navigation lock guide wall in addition to a wire array in the tailrace. The following is a list of

avian predators hazed by APHIS in 2012 during the juvenile fish passage period April 1 – June 30, 2012.

Double Crested Cormorants 23,064
California Gulls 18,306
Ring Billed Gulls 7,594
Caspian Terns 507

Recommendations

1. Install a water line in the primary dewaterer to provide flush water to the transportation flume.

2. Modify the juvenile collection channel to allow fish that are handled during dewatering to be put into the bypass pipe and returned to the river.

3. Pave the road and provide curbing that would direct any water runoff away from the juvenile facility and the hillside.

4. Install a hopper in the main bypass pipe below the sampling stations. This would permit unwatering event rescued fish to be returned to the tailrace via the bypass pipe.

5. Install a crowding mechanism in the juvenile collection channel that would encourage adult fish to exit.

6. Replace the outfall pipe water cannon black iron pipe with stainless steel to prevent corrosion. In addition, replace the pump and water gun.

7. Install handrail along the north and south adult fishway ladders.

8. Install a debris bubbler system under the entire incline screen located in the juvenile fish collection channel.

9. Reposition/replace the orifice fish attraction lights in the juvenile fish collection channel.

Research

<u>Idaho Cooperative Fisheries Research Unit</u>

The Unit conducted an evaluation of adult salmon and steelhead migration past the Snake and Columbia River Dams and monitored lamprey passage in the north shore and south shore adult fish ladders by half duplex PIT tag and video equipment.

<u>USGS</u>

The Service tracked juvenile fall Chinook passing Ice Harbor Dam by radio telemetry.

University of Idaho/UC Davis

This was a cooperative effort identifying and documenting the number of adult lamprey upstream passage at the adult fish counting windows in the north and south fish ladders.

PNNL

Conducted pressure research on JSAT externally tagged fish.

ADULT FISH FACILITY

Operations and Maintenance

The south shore fish ladder was unwatered to tailwater elevation January 3, 2012 and returned to service January 26, 2012. The lower south shore fish ladder and powerhouse collection channel were inspected by underwater video camera (ROV) and a diver. The ROV inspection found a diffuser grating in the adult collection channel lifted and out of its desired position. A diver replaced the grating along with securing it in place. The diver also continued to inspect the remaining lower fish ladder diffusers. No other problems were found. The north shore fish ladder was totally unwatered for inspection and to facilitate installation of modifications for lamprey passage improvements January 28 – February 22. No problems were found. Maintenance work performed on both ladders and juvenile collection channel included: debris removal, picketed lead and staff gage cleaning, adult fish counting/viewing window cleaning, and maintenance of auxiliary water supply pumps.

Areas that were dewatered in 2012 season that required fish removal are listed below.

January 3	Upper South Fish Ladder
January 28	Upper North Fish Ladder
July 24	Unit 4 Scroll Case
July 30	Unit 6 Scroll Case
July 31	Unit 6 Draft Tube
August 1	Unit 5 Scroll Case
August 1	Unit 5 Draft Tube
November 6	Unit 3 Scroll Case
November 21	Unit 2 Scroll Case
November 27	Unit 2 Draft Tube
December 19	Juvenile Collection Channel

The total estimated number of fish handled during unwatering events in the 2012 season was 144. The species composition of the fish handled was 42 adult steelhead, 10 juvenile steel head, 1 smallmouth bass, 1 adult Chinook salmon, 5 juvenile Chinook, 39 catfish, 1 pea mouth, 12 sturgeon, 9 adult shad, and 24 juvenile shad.

Modifications

Modifications were made to the upper north and south adult fish ladder for lamprey passage. Lamprey passage orifices were cut into the weirs at floor level where possible. On the north shore fish ladder, a ramp was installed for lamprey passage due to uneven floor elevations between two sections of weirs.

Adult Fish Trap Operation

The adult fish trap was not operated in 2012.

Auxiliary water supply

All three fish pumps on the north shore and eight on the south shore were available for operation in 2012 with the exceptions listed below. Up to 8 south fish pumps were operated maintaining criteria in the south adult fishway. The north shore two pump operation makes the third north fish pump a backup. This allows normal two pump operation in the event one pump needs to be placed out of service. Each north shore fish pump operates at 350 CFS and each south shore fish pump operates at 300 CFS. In addition, approximately 270 CFS is added to the south adult fish pump chamber from excess water in the juvenile collection channel.

South fish pump 3 out of service for repairs to the gearbox.	August 22, 2011- January 19, 2012
North shore fish pump1 went out of service due to an electrical problem.	February 28, 2012 – May 23, 2012
South shore fish pump 7 was turned off due to high tailwater.	March 28, 2012 - April 9, 2012
South shore fish pumps 1-3 tripped off	March 28, 2012 - March 28, 2012
South fish pumps 6- 7 turned off due to high gear temp and SFP 4 and 8 were turned on. South shore fish pump 4 tripped off due to lube oil system SFP 7 was turned on.	April 22, 2012 –April 22, 2012
South shore fish pump 4, turned on for testing. SFP 5 turned off then placed OOS to change oil and install pressure regulator. SFP 5 returned to service	April 23, 2012 – April 24, 2012
South shore fish pump 8 was turned off and SFP 6 was turned on. South shore fish pump 4 was turned on and SFP 2 was turned off.	April 24, 2012 – April 24, 2012
South fish pump 2 was OOS to replace the motor name plate and to clean the fan box. South shore fish pump 8 was OOS to install a new motor cover. South shore fish pump 7 was OOS to install a new motor cover. South shore fish pump OOS to install a new motor cover.	April 25, 2012 - April 26, 2012

South shore fish pump 3 was OOS to install a motor cover. It then went OOS having tripped on lube system	April 26, 2012 – April 26, 2012
South shore fish pump 1 was OOS to install a new motor cover.	May 2, 2012 – May 2, 2012
South shore fish pump 6 shutdown due to gearbox high oil temp.	May 7, 2012 – May 16, 2012
All south fish pumps were shut down to reduce head and bulkhead off NFE2 and put NFE1 in service	May 9, 2012 – May 9, 2012
South shore fish pump 8 was shut down and south shore fish pump started to check temperature. SFP #8 pressure gauge was replaced it RTS. SFP 6 was shut down due to high temperature	May 15, 2012 – May 15, 2012
South shore fish pump 6 was started to test temperature. It was shut down due to gear box hig temperature. South shore fish pump 6 was turned on.	May 17, 2012 – May 17, 2012
South shore fish pumps 1,2,3 and 4 tripped off on lube failure for a short period.	May 24, 2012 – May 24, 2012
North shore fish pump 7 tripped off on loss of line #2 for a short period.	May 24, 2012 – May 24, 2012
South shore fish pump 7 was stopped for electrical maintenance.	September 4, 2012 –September 4, 2012
South shore fish pump 4 was placed out of service due to excessive gear box oil leakage.	September 20, 2012 -
South shore fish pump 7 was placed in stand-by mode to meet differential criteria.	October 9, 2012 – October 9, 2012

Adult Fishway Inspections

Visual inspections

The Corps project fishery personnel conducted visual inspections of the adult fishways during the fish passage season March through December. In addition, the powerhouse operators conducted daily inspections of the fishways. Fishery personnel averaged 4 to 5 inspections each week with 146 inspections completed from March 2 through December 30. The inspections were conducted by visually inspecting various areas of the fishways and recording readings on a data form from staff gages, fishway entrance hoists motor selysns, and if needed tape measures. The data was subsequently transferred to a computer spreadsheet (Appendix 2). In addition, an estimate of the amount of debris that accumulated near the fish ladder exits and in the gate wells was made during each visual inspection. When the fishway was out of criteria, the powerhouse

operator was informed to make adjustments to the fishway control system or arrange for repairs if needed.

Automated Fishway Control System

In the 2012 Fish Season, Ice Harbor sensed water levels with a sonar based level sensing system manufactured by Milltronics using the Multi Ranger model. This signal was sent to a Programmable Logic Control Center (PLC) that processed the signals from the Multi Ranger then displayed the reading on a screen in the Control room and if needed sent a signal to raise or lower one of the three weirs in services. The automated fishway control system consists of a PLC which interfaces with process level controllers. The remote terminal units control the fishway weir gates according to set points that either controls the gate at a depth below tailwater or a channel to tailwater head differential. A printout from the printer in the control room contains the following information: date; time (hour, minutes, and seconds); channel temperature; channel and tailwater elevation in feet above mean sea level (MSL) for the north shore, north powerhouse and south shore; elevation in feet above MSL for the fishway entrances; water depth at the fishway entrances; channel/tailwater differential; and set points for the fishway entrances and the channel/tailwater differential.

The readings from the automated fishway control system printout were recorded and compared to the visual inspection results to ensure that the fishways were operated within criteria. The automated control system was calibrated bi-monthly to ensure its accuracy. The time difference between reading the staff gage and collecting the computer printout in the control room 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 spill, switching units, and other water elevation fluctuations.

Inspection Results

Overall fishway performance (percent in criteria and on sill) decreased when compared to that of 2011. Problems with entrance weir lifting mechanism, weir jamming, and water elevations readings at the staff gages during spill, significantly contributed to the reductions. Another contributor to out of criteria events is the location of the staff gages in relationship to the water level sensing equipment. Some staff gages are located several feet from the target area to be regulated. This condition makes accurate calibration impossible due to the relationship between the sensing equipment and the staff gage not being linear. The Project is pushing ahead with correcting this problem by the current upgrade to sonar water level detecting devices and moving the staff gages to the proper positions. This has been an ongoing effort due to funding.

South Shore Entrance (SFE): The 2012 SFE weir gate percent in criteria ($\geq$ 8 feet or on sill) was 81.9%, a decrease of 12.3 % from that of 2011 at 94.2%. Most of the out of criteria occurrences can be attributed to unit operation changes, spill, and difficulty in reading staff gages due to fluctuations in water elevation, lower tailwater conditions, and discharges from the navigation lock.

North Powerhouse Entrance (NFE): The 2012 NFE weir gate percent in criteria (≥ 8 feet or on sill) was 87.8%, a decrease of 5.2% from that of 2011 at 93.0%. When the SFE and the NFE fish entrances cannot be maintained at 8 feet depth or on sill simultaneously, criteria is sacrificed at the NFE to maintain criteria at the SFE the most used entrance.

North Shore Entrance (NSE): The 2012 NSE weir gate percent in criteria (≥ 8 feet or on sill) was 76.0%, a decrease of 16.3% from that of 2011 at 92.3%. The majority of the out of criteria conditions at this entrance are due to the inability to lower the entrance weir to 8 feet depth while maintaining the channel/tailwater differential.

Fish Collection Channel/Tailwater Head Differential: The channel/tailwater head differential was in criteria on most inspections in 2012 (criteria = 1 - 2 feet). The percent in criteria at the SFE, NFE, and NSE was 91.8%, 97.3%, and 82.2% respectively.

ICE HARBOR Criteria and Locations	No. in Criteria/ No. on Sill/ No. of Inspections	% In Criteria/ % On Sill	Not Enough Depth---------- No./% Within 0.01-0.1 Foot	No./% Within 0.11-0.2 Foot	No./% >0.2 Foot	Too Much Depth---------- No./% Within 0.01-0.1 Foot	No./% Within 0.11-0.2 Foot	No./% >0.2 Foot
Channel Velocities	121	65.4	***	***	***	***	***	***
	***	***	***	***	***	***	***	***
	185							
Differentials								
South Fish Ladder								
Ladder Exit	188	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	188							
Ladder Weirs	146	77.7	0	0	0	0	0	0
	***	***	0.0	0.0	0.0	0.0	0.0	0.0
	188							
Counting Station	184	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	184							
North Fish Ladder								
Ladder Exit	188	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	188							
Ladder Weirs	146	77.7	0	0	0	0	0	0
	***	***	0.0	0.0	0.0	0.0	0.0	0.0
	188							
Counting Station	185	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	185							
Collection Channels								
South Shore	134	71.3	0	0	0	2	3	6
	***	***	0.0	0.0	0.0	1.1	1.6	3.2
	188							
North Powerhouse	142	75.5	0	0	1	0	0	2
	***	***	0.0	0.0	0.5	0.0	0.0	1.1
	188							
North Shore	120	63.8	1	3	3	2	5	12
	***	***	0.5	1.6	1.6	1.1	2.7	6.4
	188							
Weir Depths								
SFE 1	92	48.9	1	4	29	***	***	***
	62	33.0	0.5	2.1	15.4	***	***	***
	188							
NFE 2	95	50.5	1	2	20	***	***	***
	70	37.2	0.5	1.1	10.6	***	***	***
	188							
NSE 1	69	36.7	1	2	40	***	***	***
	73	38.8	0.5	1.1	21.3	***	***	***
	188							

*** Data from Appendix 2**

Recommendations

1. Continue to repair south ladder mud valves in the entrance channel and auxiliary water supply conduit to facilitate dewatering.
2. Modify the top of the downstream navigation lock gate so it will not strand fish.
3. Rehabilitate fish entrance weirs and hoisting equipment.
4. Relocate staff gages and radar units so the staff gage fishway control system reading and the automated fishway control system readings will be closer to the same depth.
5. Initiate a contract to repair leaks and missing concrete areas in the fish ladders.
6. Install a handrail along the outside edge of north and south fish ladders.
7. Replace the north and south fishway exit wooden log booms.
8. Replace adult fishways and adult collection channel grating.