ADULT AND JUVENILE FISH FACILITY MONITORING REPORT

LOWER MONUMENTAL DAM

2012

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INTRODUCTION

The following report on fishway activities at Lower Monumental Dam is required under the Endangered Species Act consultation on the operation of the Federal Columbia River Power System and its associated fish passage facilities. This report summarizes the operation and maintenance of adult fish passage facilities at Lower Monumental Dam, including the results of visual inspections of fishways conducted by fisheries staff during the adult fish passage period of March 1 to December 31, 2012. Inspection readings are provided in Appendix 1. Recommendations are provided for correcting problems found. This report also contains a synopsis of juvenile fish facility operations. Additional information on juvenile fish collection and transportation activities at Lower Monumental Dam can be found in the, "2012 Juvenile Fish Collection and Bypass Report, Lower Monumental Juvenile Fish Facility".

River Conditions

During the 2012 collection season, the average daily flow exceeded 100.0 kcfs on 50 days and exceeded 150 kcfs on 5 of these days. The highest daily average flow for the season was 193.2 kcfs on April 28. The lowest daily average flow for the season occurred on September 28 with a flow of 12.8 kcfs. The average flow for the season was 68.1 kcfs. Spill occurred for 154 days from April 1 through midnight on August 31, with a maximum daily average spill of 87.1 on April 25. The RSW was put into operation when Court ordered spill began on April 3, and was taken out of service for the season on August 31. River temperature averaged 57.5^{o} F for the season and ranged from 42.3^{o} F in early April, to 67.2^{o} F in mid July.

ADULT FISH FACILITY

Facility Description

The adult fishways at Lower Monumental are comprised of north and south shore fish ladders. The upper ladders extend from the forebay to tailwater and include ladder exits, slotted weirs, upper diffusers, overflow weirs with orifices, and fish counting stations with picketed leads. The lower ladders contain collection channels, channel diffusers, and ladder entrances. The north shore lower fish ladder has two north shore entrances (NSE-1 and NSE-2) and two south powerhouse entrances (SPE-1 and SPE-2). The south shore lower fish ladder has two entrances (SSE-1 and SSE-2). Auxiliary water is supplied by three turbine-driven pumps (fish pumps) located in the north side of the powerhouse. The water is pumped into a supply conduit that extends under the north and south shore lower ladders, distributing water to the lower ladder diffusers. Excess water from the juvenile fish bypass system (approximately 180-200 cfs) additionally contributes to the auxiliary water supply during the juvenile fish bypass/collection season.

Facility Modifications

1. Inclines were fabricated on north and south shore upper ladder weirs to ease adult lamprey passage through orifices and vertical slots. Additionally, horizontal slots were

cut at the base of each weir, opposite the orifice, and were fitted with a grouted in metal form to facilitate adult lamprey passage.

Operations and Maintenance

Fish Ladders and Collection Channels

The adult fishways were in service throughout 2012 with the exception of the winter maintenance season. Inspection and maintenance on the north and south shore fishways occurred from January 3 to February 7 and January 26 to February 27, respectively.

The upper fish ladders are annually dewatered for maintenance activities including: debris removal, diffuser grate and structural support inspections, picketed lead, staff gauge, and fish counting window cleaning, maintenance of count station window cleaning mechanisms, and packing of leaks in expansion joints. Twenty four hours prior to dewatering, the auxiliary water is shut off to discourage newly arriving fish from starting up the ladders. The fish exit is then bulkheaded off, any exit pool fish are removed and released to the forebay, and the upper ladders are partially dewatered leaving about 4 inches running through ladder weir orifices. This flow is maintained to move any remaining fish to tailwater. Approximately a day latter, the flow is reduced to two inches and maintenance personnel go down the ladder through the orifices to remove debris, move remaining fish to tailwater, and inspect the full length of the channel.

The lower ladders are typically dewatered to a depth of one foot providing a holding pool for fish. Once the target depth is obtained, maintenance personnel and biologists inspect entrance weirs, diffuser grates and exposed diffuser gate operating equipment. Staff gauges are then cleaned and debris is removed. The north shore water was lowered to 4/10th of a foot for visual inspection of grating. The inspection revealed three grating sections that were blown out and were resting on adjacent grates. These sections were returned to their respective positions and were refastened in place. Fish salvage was not required. Inspection of the lower south channel also revealed two section of loose grating with failed fasteners. The south lower channel was dewatered and grating sections were refastened into place. Fish salvage included one unclipped adult steelhead. Funding for engineering plans and specs relating to replacement of diffuser grates and supports and other lower ladder work has been funded for fiscal year 2013 and hopes are to get this work done during the 2013-2014 winter maintenance season. When dewatering for repair is necessary; fish are crowded to the entrance pools, netted, and placed in a 600 gallon container (or 32 gallon containers if fish numbers are very low). The large container is manipulated with the crane to release fish to tailwater and refill the tank if needed.

Auxiliary Water Supply

During the winter maintenance period, the auxiliary water supply conduit north of the regulating gate was partially dewatered and inspected.

Fish pumps 1, 2, and 3 were out of service (OOS) from January 1 to February 15 for annual maintenance. Annual maintenance consists of changing oil in pedestals, adjusting or replacing packing and shaft seals, inspecting and cleaning heat exchangers, inspecting and replacing broken shear pins on the wicket gates, adjusting brakes, removing trash and debris from the fish

pump turbine, and a general mechanical and electrical inspection. AWS pump 2 was out of service from February 15 to April 18 due to a misaligned diffuser. All fish pumps were rotated out of service monthly for scheduled maintenance. Fish pump 2 was removed from service on November 21 for shaft realignment and replacement of the bearing housing. To minimize water loss during two-pump operation, pump 2 was bulkheaded off. Pumps 1 and 3 remained in service throughout the passage season. The more significant pump outages are summarized in Table 1.

Table 1. Fish pump outages at Lower Monumental Dam, 2012 *

Affected Pump(s)	Dates	Reason for Outage/Comments
1, 2, 3	Jan 1 – Feb 15	Annual maintenance
2	Feb 15 – Apr 18	Misaligned diffuser
2	Aug 25 – Aug 27	Failed thrust pump cooling water flow meter
2	Nov 21-current	Shaft realignment and replacement of the bearing housing

*Only outages involving two or more calendar days are included.

Adult Fishway Inspections

Methods

The automated fishway control system consists of a computer in the control room that interfaces with process level controllers and receives information from remote terminal units. The terminal units are fed by sensors detecting entrance weir gate positions, collection channel water and tailwater elevations, upper diffuser pool levels, and water temperatures within the fishways. The automated fishway control system is based on a GE Fanuc Series 90 control program. The computer is used to change the control parameters of the terminal units and provides datum acquisition and storage. The remote terminal units control the fishway entrance weir gates according to set points that either regulate the gate depths below tailwater or channel to tailwater entrance head differentials. The computer printout contains the following information: dates; times (hour, minute, and second); channel temperatures; channel and tailwater elevations (feet above mean sea level) for the north shore, south powerhouse, and south shore; gate elevations; gate depths; entrance heads; and set points for the gate depths and entrance heads.

Operating criteria involve normal and special operating conditions. Under normal operating conditions, NSE-1, NSE-2, SPE-1, SPE-2, and SSE-1 weir gates are operated to meet criteria of at least 8-foot depths (depth criteria) or be on sill if less than 8-foot depths (sill criteria). SSE-2 weir gate is operated with a 6-foot opening. Normal operating criteria for the rest of the ladder include maximums of 0.5-foot heads at the exits, maximums of 0.4-foot and 0.3-foot heads at the north and south shore picketed leads, respectively, 1.0-1.3 feet of water over the ladder weirs, 1.5-4.0 feet per second collection channel velocity, and 1.0-2.0-foot head differentials at all fishway entrances. Special operating conditions are used if normal operating criteria cannot be met. When only two fish pumps are operational, SSE-2 and SPE-2 may be closed and SPE-1

raised to provide 1.0-2.0 feet of entrance head differentials. This special operation was not required to maintain depth criteria this season.

Adult fishway inspections consist of observing facility operating conditions and recording visual readings from staff gauges, weir gate selsyns, and electronic meters. Wave action and large debris impacts have consistently resulted in loss of the south ladder tailwater staff gauge. Readings of the lower south ladder and tailwater are therefore taken from an electronic panel in the service gallery.

Inspections by fisheries staff are normally conducted three or more times per reporting week with day and times randomized. An average of 4.4 inspections per week was performed (192 inspections /44 weeks) in 2012. Depths and head differentials that were out of criteria, as well as other problems, were reported to powerhouse shift operators and/or maintenance staff for correction. Powerhouse operators conducted their own daily shift inspections in addition to the inspections performed by fisheries staff.

Inspection Results

Visual readings were recorded and compared with automated control system readings to check for calibration problems. The automated control system readings and mechanical reading systems were routinely calibrated in 2012. High variability between wave crests and troughs created by spill reduces the accuracy of biologists' staff gauge readings in the tailrace. Thus the automated control system printout was also compared to visual reading to ensure fishways were in criteria. Data from fishway inspections was entered into an Excel spreadsheet (Appendix 1). The average compliance of all criteria points in 2012 was 99.6%. A summary of fish ladder performance and variability is provided in Table 2. Ladder entrance weir gates were on sill proportionately more in 2012 than in 2011 due to reduced river flow.

Ladder exits: North and south shore ladder exit head differentials were in criteria on 100% of the inspections.

Ladder weirs: The depths over the weirs of the north shore ladder were within criteria on 100% of the inspections.

Depths over the weirs of the south shore ladder were within criteria on 100% of inspections.

Counting stations: The head differential across the north shore counting station picketed leads was in criteria on 100% of inspections. The south shore counting station met criteria on 100% of inspections.

Entrance heads: North shore entrance head differential was in criteria on 99.5% of inspections. It was out of criteria on the April 6 inspection with depth 0.2 feet. This was attributable to fish pump 3 tripping a breaker while fish pump 2 was out of service for diffuser alignment. This resulted in temporarily being in one pump operation. Shortly after the problem was reported the breaker was reset and fishways returned to two pump operation.

South powerhouse entrance head was in criteria on 99.0% of inspections. It was out of criteria on two inspections (differentials of 0.0' and 0.8 feet). The 0.0 feet reading occurred on April 6

due to the previously mentioned fish pump 3 tripped breaker. The second out of criteria reading occurred on September 29 (0.8 feet) and was likely an inspector misreading as is indicated by a noted 0.7 foot difference between the north and south powerhouse channel elevations. Normal differences run 0.1 to 0.4 feet at these locations. At the time of inspection the entrance head was within criteria on the automated control system.

South shore entrance head differential was in criteria on 100% of inspections.

North shore entrance (NSE-1 & 2) depths: NSE-1 weir gate was in depth criteria on 99.5% of inspections. The gate was out of criteria on one occasion with a depth of 7.8 feet. The ongoing difficulty reading tailwater staff gauges during spill was likely responsible for this deficiency as the gate was in depth criteria on the automated control system.

NSE-2 weir gate was in depth criteria on 98.4% of inspections. The gate was out of criteria on three inspections with depth readings of 7.8', 7.9', and 7.9 feet. These reading were within criteria on the automated control system and were likely related to difficulty reading tailwater staff gauges during spill.

South powerhouse entrance (SPE-1 & 2) depths: SPE-1 weir gate was in depth or sill criteria on 99.0% of inspections (31.8% depth, 67.2% sill). The gate was out of criteria on two inspections with depth readings of 7.9' and 7.8' feet. The 7.9 feet reading was within criteria on the automated control system and was likely related to difficulty reading tailwater staff gauges during spill. The 7.8 feet reading was due to the selsyns registering a 10th higher than the sill position. The problem was reported and the gate was calibrated.

SPE-2 weir gate was in depth criteria or sill on 99.5% of inspections (31.8% depth, 67.7% sill). The gate was out of criteria on one occasion with a depth of 7.8 feet. This was likely do to difficulty reading the tailwater staff gauge during spill. The gate was within criteria on the automated control system.

South shore entrances (SSE-1 & 2): SSE-1 weir gate was in depth or sill criteria on 99.5% of inspections (54.7% depth, 44.8% sill). The gate was out of criteria on one inspection with a depth of 7.6 feet due to the gate being placed in the manual operation setting for an unknown reason. The problem was reported and immediately corrected.

SSE-2 weir gate was in criteria on 100% of inspections.

North shore collection channel velocity: The velocity unit is located in north shore collection channel in the transition area between unit 1 and unit 2. The sending unit is positioned in the channel's length and width to avoid non-characteristic high or low readings that are not representative of overall velocity conditions. Accurate velocity readings require the inspector to wait for the digital display to warm up and achieve a duplication of its peak reading.

Velocities were in criteria on 99.5% of inspections (criteria: 1.5-4.0 ft/s). One out of criteria reading occurred with a channel velocity of 1.0 ft/s. This reading was also attributed to the April 6th fish pump 3 tripped breaker. Two pump operation resumed shortly after the problem was reported.

Recommendations

1. Leave pumps permanently installed in the auxiliary water supply conduit to reduce the preparation time for dewatering the lower ladders.
2. Have a contractor remove sand and debris from the supply conduit and replace all original ladder diffuser grates, support structures, and mud valves.
3. Replace the plastic picketed leads at the north shore with stainless steel leads to eliminate the expansion and warping that the plastic exhibits with hot temperatures. Construct the downstream leads so that the vanes are oriented at an angle to the water flow to prevent algae and debris from adhering to the vanes.
4. Modify the south shore picketed leads from a single set to a double set, and install an electric hoist system. This will allow for easier cleaning of the leads and prevent fish from becoming trapped between the leads during cleaning.
5. Modify the method of attachment of ladder exit debris booms and install exit booms capable of withstanding turbulent waters.
6. Operate the number of fish pumps needed to keep the fishway in criteria, such as three pumps during periods of higher tailwater levels, and two pumps at higher speeds when tailwater is lower. Manipulate weir gate depths and entrance head differentials as needed to keep all inspection points in criteria.
7. Finish rebuilding the fish pumps to fix the bearing housing attachment problems so that three reliable fish pumps are available to meet criteria.
8. Fully open the north shore Diffuser N1 and N2B gates to obtain higher head differentials at main entrances, greater weir depths, and increase total system discharge.
9. Improve south shore fishway conditions by either reversing the direction Diffuser S1 gates move with increasing tailwater or converting them from automatic operation to a fixed setting.
10. Verify the condition and settings for all diffuser gates and calibrate position indicators to actual gate position when the AWS is unwatered for inspection and maintenance.
11. Clean the channel velocity meter probe during the winter maintenance period to remove algae and determine if algae growth is hindering its function.

Table 2. Summary of adult fishway inspections at Lower Monumental Dam, 2012 [1]

			------Not Enough Depth------			-------Too Much Depth-------		
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**
North Channel Water Velocities	191 *** 192	99.5 ***	*** ***	*** ***	*** ***	*** ***	*** ***	*** ***
Differentials								
North Ladder								
Ladder Exit	192 *** 192	100.0 ***	*** ***	*** ***	*** ***	0 0.0	0 0.0	0 0.0
Ladder Weirs	192 *** 192	100.0 ***	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
Counting Station	192 *** 192	100.0 ***	*** ***	*** ***	*** ***	0 0.0	0 0.0	0 0.0
South Ladder								
Ladder Exit	192 *** 192	100.0 ***	*** ***	*** ***	*** ***	0 0.0	0 0.0	0 0.0
Ladder Weirs	192 *** 192	100.0 ***	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
Counting Station	192 *** 192	100.0 ***	*** ***	*** ***	*** ***	0 0.0	0 0.0	0 0.0
Coll. Channels								
North Shore Entrance	191 *** 192	99.5 ***	0 0.0	0 0.0	1 0.5	0 0.0	0 0.0	0 0.0
South Powerhouse Entrance	190 *** 192	99.0 ***	0 0.0	1 0.5	1 0.5	0 0.0	0 0.0	0 0.0
South Shore Entrance	191 *** 192	99.5 ***	0 0.0	0 0.0	1 0.5	0 0.0	0 0.0	0 0.0
Weir Depths								
NSE-1[2]	191 Not Applic. 192	99.5 ***	0 0.0	1 0.5	0 0.0	*** ***	*** ***	*** ***
NSE-2[2]	189 Not Applic. 192	98.4 ***	2 1.0	1 0.5	0 0.0	*** ***	*** ***	*** ***
SPE-1[2]	61 129 192	31.8 67.2	1 0.5	1 0.5	0 0.0	*** ***	*** ***	*** ***
SPE-2[2]	61 130 192	31.8 67.7	0 0.0	1 0.5	0 0.0	*** ***	*** ***	*** ***
SSE-1[2]	105 86 192	54.7 44.8	0 0.0	0 0.0	1 0.5	*** ***	*** ***	*** ***
SSE-2	192 Not Applic. 192	100.0 ***	0 0.0	0 0.0	0 0.0	*** ***	*** ***	*** ***

[1] Data from Appendix 1.
[2] "On sill" means the weirgate is resting on its sill and meets "on sill" criteria at this location

SYNOPSIS OF JUVENILE FISH FACILITY OPERATION

Facility Description

Juvenile fish facilities at Lower Monumental Dam consist of: standard length submersible traveling screens, twelve inch orifices, a collection channel that terminates in a dewatering structure, transport flume, separator, and fish distribution system including, PIT tag bypass, sampling, holding facilities distribution, and barge and truck loading.

Each of the 18 bulkhead slots contains two orifices for diverting fish into the collection channel. Eighteen to 21 orifices are open at any one time with a minimum of one orifice open on all bulkhead slots of operating units. Lights are directed at each open orifice to enhance fish movement into the collection channel. The collection channel terminates at the primary dewatering structure where all but 30 cfs flow is removed. That remaining 30 cfs flow and fish are routed through the transport flume to the separator. Upon reaching the separator, adult and non-target fish are released to the river and juvenile fish pass below the separator bars and enter the distribution system. The distribution system directs the fish to their target locations.

Facility Modifications

The following modifications were made to the JFF prior to or during the 2012 fish collection season:

1. Relocated the counter top in the separator control booth and fabricated and installed new counter box racks to make taking readings and changing of failed counter box units easier. Previous rack design put cord connectors under stress and this had lead to failures.
2. A mirror was mounted in the wet lab above the dewatering unit prior to the sample trough. This allows easy viewing of the dewatering screen to prevent fish stranding and resolves the safety issue of leaning out over the tank or standing on unsecure surface to see into the dewatering section.
3. Installed brackets in both sample holding tanks to prevent release gates to the drains from accidental opening. Last year two of these gates were found partially opened, accounting for fish numbers in the sample being consistently less than expected.
4. Made modifications to raceway gantry sweeper to prevent fish and lamprey from becoming trapped in the lower crowder frame when raising gantry sweeper out of water.
5. Installed new raceway 2 lamprey friendly tailscreens of slotted perforated plate in plastic guiderails to end the killing of juvenile lamprey in the gap between the old model mesh screen frames and their channel metal guides.
6. Installed new catwalk/platform along transition flume at the primary bypass switchgate. This allows safe viewing of the transition flume for stranded fish during operational changes.
7. The separator adult fish release pipe was replaced with a pipe of 2 inch larger internal diameter for the ease of accommodating larger fish. Additionally, PIT tag detection was returned to this new pipe.

8. The bypass outfall pipe discharge was relocated down river beyond the area influenced by spill. The spill causes an eddy upstream along the north shore.
9. A special raceway discharge was added for transporting lamprey juveniles from the raceways to the new bypass outfall.

Operation and Maintenance

Turbine Operations

Efforts were made to operate all turbine units within one percent of the peak efficiency from April 1 to October 31. Deviations were infrequent and brief or required by BPA.

Table 3. Summary of unit outages and cause.

Unit	Dates out of service	Reason out of service
All Units	Monthly	STS/VBS inspection.
All Units	July 30	Doble testing
Units 5 and 6	July 30-August 30	Doble testing T2
Unit 1	July 9 - Aug 9	Annual Maintenance
	Aug 13	Headgate cylinder removal
Unit 2	Apr 9-13	Slip ring repair
	Apr 18	Wicket gate servo packing
	May 1-2	STS repair (2C)
	June 28	DC oil pump start failure
	July 25	Bulkhead inspection, oil filter modification, thermal inspection
	Aug 9-10	Turbine pit flooding during emergency diesel test
	Aug 21	Inspection turbine pit oil/water wiring
Unit 3	July 4-5	Loose exciter fan mount
Unit 4	May 2-3	STS repair (4B) (4C)
	May 10-14	Voltage regulator failure
	July 12	Video inspection 4A STS gearbox
	Aug 13	6 year annual maintenance
Unit 5	March 7-April 20	Exciter replacement
	May 3	STS repair (5A)
	May 3-8	High current/voltage indication
	May 14-19	Exciter problem
	August 10	Test emergency diesel generator
	August 28	XJ01 maintenance
	September 5	GDACS failure
Unit 6	April 5	Unit 5 to Unit 6 exciter tie-in
	April 18	Unit 5 exciter tie-in
	May 9	Replace STS mesh retaining clips
	May 17	Load testing new powerhouse crane
	May 21	Load testing new powerhouse crane
	June 25-July 12	Annual Maintenance

Debris/Trash Racks

Trash rack raking occurred between March 19 and 21. A total of 77.25 cubic yards of debris was removed in this operation. Generally speaking, debris was light this season.

Submersible Screens

The submersible traveling screens (STSs) were inspected and tested on March 14 and were installed on March 21 through 23. Screen inspection began with the on deck inspection March 14. Inspection was done monthly by underwater video camera thereafter through November. The only STS problems during the 2012 season were in gatewells 2C, 4A, 4B, 4C and 5A. Screens had missing clips, tears and or missing mesh fasteners and were repaired and/or replaced generally within a day of when discovered. Mesh retaining clips used during the winter maintenance period 2011 were found to be too hard and so were prone to failure. All these inferior fasteners were replaced during fish season so as to prevent potential fish kill from in season failure.

STSs were operated in "cycle" mode while the average fork length of subyearling chinook and/or sockeye/kokanee were greater than 120 mm (March 21 through June 4), and in continuous "run" mode when either was less than 120 mm (June 4 to August 6). From August 6 to December 16 they again were operated in cycle mode as fish length exceeded 120 mm.

Vertical Barrier Screens

The vertical barrier screens (VBSs) were inspected by underwater video camera in July. Additionally, they were spot-checked monthly during STS inspections. No problems were found.

Gatewells

Dipping the bulkhead slots (gatewells) yielded 31 cubic yards of debris this season. Gatewells were normally less than 10% covered. Gatewells did not exceed the 50% debris criterion this season.

Orifices/Collection Channel

During the 2012 season the number of open orifices varied from 18 to 21 according to forebay level. With the Lower Monumental reservoir at minimum operating pool, water discharge through an orifice is reduced. During this period, extra orifices were opened to supply additional water to the adult fishway. Orifices were cycled and backflushed with air daily to remove

debris. Orifice fouling was a problem while high flows and a large debris load were occurring. Orifice lights were checked daily. If a light was not working, the operating orifice was switched to the other orifice in the slot until repairs could be made.

Primary Dewaterer

A major problem occurred regarding the primary dewaterer this season. Two weir stem drive gear assemblies failed. Weirs that were no longer useable were set to an acceptable elevation and an adjustment nut was used to hold them in place. A new automatic weir drive system is being researched and should be installed during the winter maintenance period of 2014.

The mechanical screen cleaner maintained a clean screen throughout the fish passage season. The compressed air screen cleaner functioned well, as usual, and the system as a whole functioned very well keeping debris from plugging the inclined screen. No other breakdowns occurred during the transport season but occasional adjustment of the cables and cable tension device of the mechanical screen cleaner was required.

Wet Separator/Distribution and Sampling Systems

Sudden water level drops occurred at the separator again this year. Water level fluctuations in the forebay, automatic adjustments of the weirs at the primary dewaterer, and the closing and opening of orifices were the main causes. As has been the case for the last few years, the separator was run at a higher water level to mitigate this problem. The tech section at the dam is investigating the problem to pin down the root cause so that a solution can be formulated.

No problems occurred with the PIT-tag diversion gates this season. Gate position sensors were installed six years ago. These sensors act to prevent the over-travel problem we once had and by so doing they eliminated gate failure problems caused by metal fatigue.

On July 19 the “B” side sample gate actuator shaft unscrewed from its receiver taking it out of service for 20 minutes for repair. New bearings will be installed and Lock Tite will be used to coat the threads during the winter maintenance period to prevent this in the future.

Barge Loading Operations

Barge loading operations occurred from May 6 through August 16. Barge loading went very smoothly this season. The downstream mooring bit guide for the downstream mooring bit, having been deformed in a collision by a barge years ago, has had a problem with sticking low in the guides and not floating. Additionally, it has been taking on water. Plans are being made to refurbish all the mooring bits and repair/replace the damaged downstream mooring bit guide.

Truck Loading Operations

Juvenile fish were trucked by midi-tanker from August 16 to October 1. Throughout the late season the midi-tanker was used because of low fish numbers. A 2.5 mg/l salt solution was used to treat and/or ease suspected outbreaks of *columnaris*. Every other day trucking occurred throughout the trucking season.

Avian Predator Monitoring

Areas of avian predation monitoring included: the forebay, turbine and spillway discharge, and the JFF bypass outfall. Deterrent measures included: bird wires across the tailrace of the powerhouse, water cannon sprinklers at the exit of the bypass outfall pipe, bird deterrent spikes at common perching areas, and hazing (April 1 through June 2) under the animal control contract (APHIS). Two shift coverage (daylight to dusk) occurred from May 6 through June 2.

Avian predators tend to rest in the forebay and chase juvenile fish as they jump. They also spend time perched on the lock wall facing the tailrace. Bird wires were added along the top rail of the lock wall handrail during the winter 08-09 which effectively reduced the perching normally seen there, however, to a great extent the perching only relocated to the deck in front of the handrails.

The following data is based on bird counts taken in three separate procedures: 1. during fish ladder inspections, 2. as hourly observations of the bypass outfall, and 3. as part of the new regional avian monitoring process.

1. Fish Ladder Inspection Bird Monitoring

Fish ladder inspections are conducted three to six times a week at Lower Monumental Dam to assure ladders are operating within criteria. These inspections are conducted at random times and so contain counts during, as well as absent of active hazing. During daylight hours, gulls were present if hazing was not occurring. High juvenile fish numbers passing the dam via spill related to higher gull numbers in the absence of hazing. In the absence of hazing, gulls appeared to be fairly effective at feeding in the forebay and tailrace areas. Each ladder inspection includes an avian predator count section for the four areas including: the forebay, spillway, under birdwires of the turbine discharge, and at the bypass outfall. The following summarizes the data collected during fish ladder inspections.

Gulls

During the transport season the maximum gull count in the forebay was 41 (September 10) with a seasonal daily average sighting of 3.1, in the spillway 97 (July 20) with a daily seasonal average sighting of 7.3, in the birdwire area of the turbine discharge 14 (April 30) with a daily seasonal average sighting of 0.2, and at the bypass outfall 50 (May 4) with a seasonal daily average sighting of 0.6. Gull numbers were again low this year as compared to the past. They began to build in late-April and peaked in mid-May. Gull numbers fell off greatly by mid-June and began increasing again in mid-September as juvenile shad numbers increased.

Hazing was effective at moving the birds out of the area. Two shifts were used to provide daylight to dusk coverage. The second shift of hazing was equally as effective as the morning shift. On days when hazing was not occurring, but fish passage numbers were high, the birds returned and resumed normal feeding behaviors. Gull numbers correlated well with the peak of juvenile fish outmigration this season as has been the rule in the past, but this season as a whole had relatively low total gull numbers. Annual gull numbers were low this year and last as compared to the past.

Pelicans

During the transport season the maximum pelican count in the forebay was 16 (April 26) with a seasonal daily average sighting of 0.5, in the spillway 10 (May28) with a seasonal daily average sighting of 0.6, and at the bypass outfall 2 (June 30) with a seasonal daily average sighting of 0.1. No pelicans were observed under the bird wires this season.

Terns

During the transport season the maximum tern count in the forebay was 4 (May 15) with a seasonal daily average sighting of 0.2, and in the spillway 19 (July 15 and 20) with a seasonal daily average sighting of 0.8. No terns were observed under the bird wires or at the bypass outfall this season.

Grebe

During the transport season the maximum grebe count in the forebay was 16 (September 30) with a seasonal daily average sighting of 0.2, in the spillway 14 (September 30) with a seasonal daily average sighting of 0.2, and under the birdwires of the turbine discharge 7 (September 24) with a seasonal daily average sighting of 0.1. No grebes were observed at the bypass outfall this season.

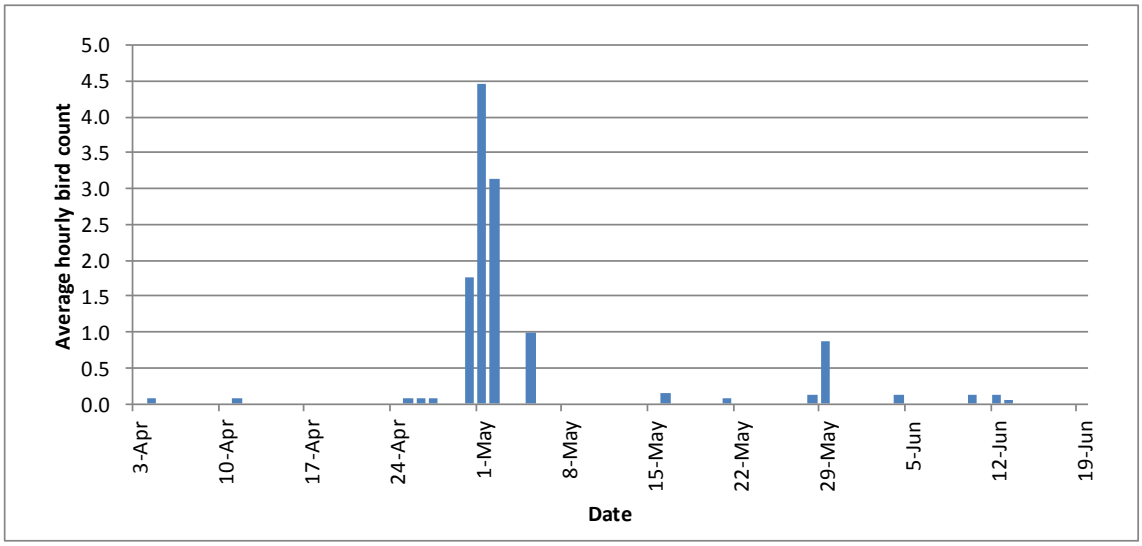
Cormorant

During the transport season the maximum cormorant count in the forebay was 4 (July 12 and September 22) with a seasonal daily average sighting of 0.5, in the spillway 30 (September 29) with a seasonal daily average sighting of 3.7, and under the birdwires of the turbine discharge 11 (September 20) with a seasonal daily average sighting of 0.4. No cormorants were observed at the bypass outfall this season. Overall, cormorant numbers were high in the spillway averaging 3.7 per fishladder inspection.

2. Separator Technician Bird Monitoring of Bypass Outfall

Separator technicians made hourly daylight counts of piscivorous birds at the bypass outfall from April 3 through September 30. A total of 182 birds were sighted during this period. The species sighted and percent of the total sightings were: Gulls 157 (86%), Pelicans 20 (11%), Cormorant 4 (2%), and Osprey 1 (1%). The vast majority of sightings, 149 (82%), occurred from April 30 to May 5 just prior to collection for bypass. During this period fish numbers at the bypass outfall were at their highest providing the greatest predator foraging potential. Average hourly counts can be seen in Figure 1.

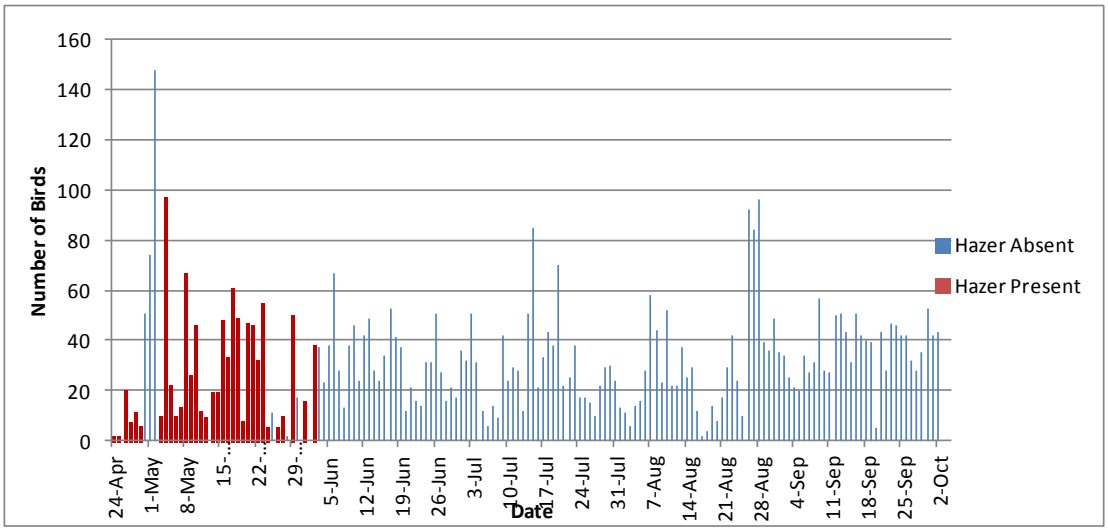
Figure 1. Bypass outfall average hourly piscivorous bird count by day (April 3 – June 19, 2012), Lower Monumental Dam.



3. Regional Avian Monitoring Program

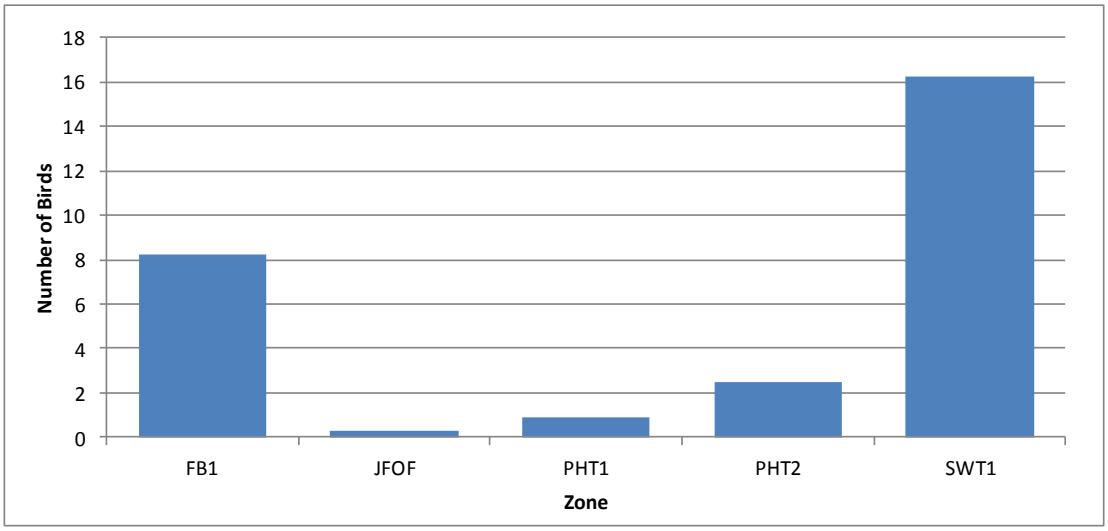
One bird count per day was made April 24 through October 2 for inclusion in the regional database for bird sighting location, abundance, and behavior tracking. The time of observation was variable and included both hazed and un-hazed birds (Figure xxx). Birds moving between the five zones (FB1, JFOF, PHT1 PHT2 and SWT1) were likely counted more than once. Bird behaviors were assigned as: foraging, flyby, resting, and scavenging. The maximum bird count (all species combined) was 148 birds (May 2), the minimum was 0 (June 1), and the average was 31.7. Daily total bird counts (all piscivorous birds) are shown in Figure 2.

Figure 2. Daily total bird counts, all zones (April 24 – October 2, 2012), Lower Monumental Dam.



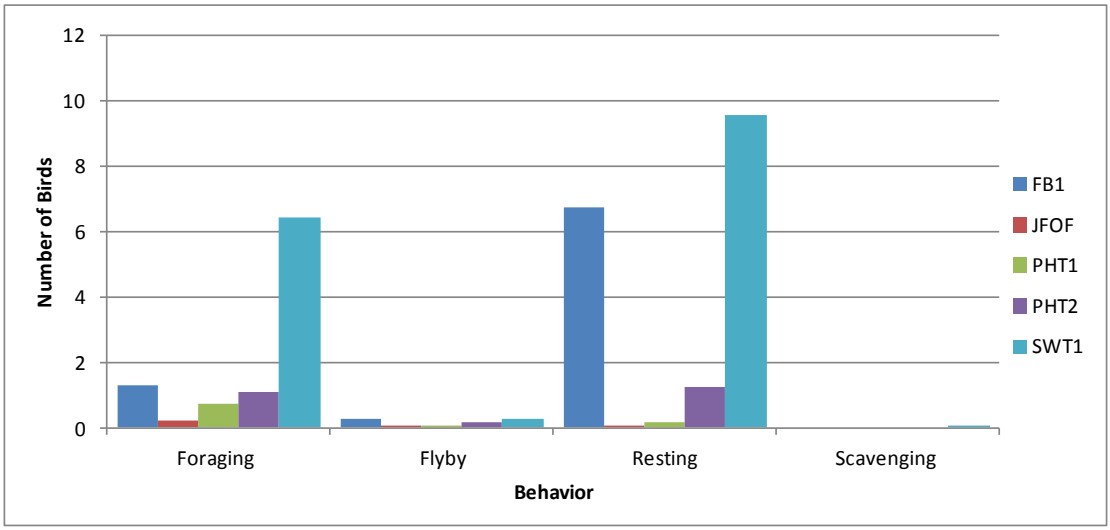
Daily mean total bird counts by zone included: forebay (FB1) 8.26, juvenile facility bypass outfall (JFOF) 0.31, powerhouse tailrace under birdwires (PHT1) 0.93, powerhouse tailrace outside of bird wires (PHT2) 2.51, and spillway tailrace (SWT1) 16.25. Figure 3 shows relative mean total bird numbers across these five zones.

Figure 3. Daily mean bird count by zone (April 24 – October 2, 2012), Lower Monumental Dam.



Within each zone the dominant behavior varied. In FB1 81.5% of birds were resting, 15.4% foraging and 3.1% were flyby. In JFOF 71% of birds were foraging, 12.9% were resting, and 12.9% were flyby. In PHT1 75.3% of birds were foraging, 17.2% were resting and 8.6% were flyby. In PHT2 49.8% were resting, 43.8% were foraging and 6.4% were flyby. In SWT1 58.8% of birds were resting, 39.4% were foraging, 1.6% were flyby and 0.1% were scavenging. Daily mean bird numbers by zone and behavior are shown in Figure 4.

Figure 4. Daily mean bird count by behavior (April 24 – October 2, 2012), Lower Monumental Dam.



Cooling Water Strainer Counts

Turbine unit cooling water strainers were examined for biologic content once per month throughout operating year 2012. Species content included lamprey, salmon species, steelhead, prawn, and a final category titled "other" which included all other species; the vast majority of which were American shad. The number of each group and percent of the total of individuals of all groups combined was: juvenile lamprey 1,305 (75.0%), salmon species 33 (1.9%), steelhead 18 (1.0%), prawn 37 (2.1%), and other 337 (19.5%).

Timing of the entry of each group into the strainers represents migration timing coupled with susceptibly of being drawn into the cooling water system for each group at that growth stage. Juvenile lamprey were generally present from January through June with numbers peaking at 770 in April. Salmon species were generally susceptible only in May and June peaking at 25 in May. Steelhead were only susceptible in May totaling 18. Prawn were present throughout the year peaking at 20 in December. The group "Others" was generally present from August through December peaking at 263 in December. The vast majority of all groups were no longer living at collection. The percent of each group released alive was: lamprey 3.1%, salmon species 0%, steelhead 5.6%, prawn 0%, and other 0%. Probability of any individual being live at the time of strainer cleaning was likely more related to time of entry into that strainer rather than which unit's strainer it was found in.

Recommendations

1. Design and fabricate screened overflow weirs on the sides of the separator to maintain a minimum water level under higher supply volumes. This will prevent water level drops in the separator.
2. Resolve the separator sudden water loss problem so that separator efficiency can be improved and fish safety can be achieved at optimum separator water levels. Also make sure the alarm system for the primary dewaterer will sound when the mechanical screen cleaner stops moving during its cycle.
3. Install a shear boom across the forebay to direct debris to the spillway during the high flow/high debris period to reduce orifice fouling and associated fish injury.
4. Research changing the drive system of the primary dewatering mechanical screen cleaner to a rack and pinion system to reduce maintenance requirements and down time. Most mechanical screen cleaner failures are related to the drive cable and/or sheave attached to the drive motor shaft.
5. Research converting the porosity unit upstream of the separator to a third stage of the separator designed for the removal and bypassing of fry and juvenile lamprey. The concept has been discussed with COE's engineer Ryan Laughery and he is optimistic regarding its feasibility and functionality.
6. Research converting the pipe system between the PIT facility counter tanks and the PIT facility holding tank exits with an open system that eliminates the need to hold fish in the PIT system holding tanks. This also has been discussed with Laughery and he believes it can be accomplished.

APPENDIX