CENWW-ODO BARNES (1130) 23 January, 2018

MEMORANDUM THRU:
Brian Vorheis, Operations Project Manager, Lower Monumental Dam

FOR Chief, Operations Division
ATTN: Eric Hockersmith / Ann Setter

SUBJECT: Submission of 2017 Juvenile Fish Collection and Bypass Report, Lower Monumental Dam Juvenile Fish Facility.

1. Enclosed find the 2017 Juvenile Fish Collection and Bypass Report for Lower Monumental Dam as requested.

2. If you have any questions contact Chuck Barnes at Lower Monumental Dam, (509) 282-7211.

Charles A. Barnes
Supervisory Fisheries Biologist, Lower Monumental Dam

Enclosure

2017 Juvenile Fish Collection and Bypass Report
Lower Monumental Dam Juvenile Fish Facility

Prepared by

Charles Barnes

U.S. Army Corps of Engineers

and

Jordan Korenkiewicz

Jaqi Walt

Anchor QEA

23 January, 2018

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX

TRANSPORT OPERATIONS - LOWER MONUMENTAL DAM

Introduction

Juvenile fish transportation and bypass operations occurred for the twenty fifth year at Lower Monumental Dam Juvenile Fish Facility (JFF) in 2017. The bypass system was watered up at 1200 hours on March 21, 2017, and submersible traveling screens (STSs) were installed March 21 through 23, 2017. The JFF was watered up for testing at 1200 hours March 21, 2017. Primary bypass occurred through March 31, 2017. From April 1 through April 15, 2017, primary bypass was intermittently interrupted every third day for fish condition monitoring. From April 16, 2017 through 0700 on May 1, 2017, condition monitoring occurred every other day. Early season condition monitoring involved 24-hour sampling on target days. During this period, 5,960 fish were examined and returned to the river. These fish are included in the estimated numbers of fish collected and bypassed for the 2017 season (Appendix Tables 1 through 4).

Collection for transport began at 0700 hours on May 1, 2017, and ended at 0700 hours on October 1, 2017. On October 1, 2017, the facility was returned to primary bypass and continued in bypass mode through December 18, 2017. Smolt collection in the 2017 season was 3,151,499. This includes expanded numbers of those sampled during pre-transport. This is three-fifths of 2016's 5,028,464 record collection and nearly triple the 1,167,619 fish collected in the 2015 season. Of the 3,151,499 fish collected in the 2017 season, 383 were trucked, 2,088,322 were barged, and 1,060,714 were bypassed.

Pacific States Marine Fisheries Commission (PSMFC) technicians examined 1,699 fish for gas bubble trauma (GBT) in 2017. Examinations were conducted once a week from April 6 through August 3, 2017.

The passive integrated transponder (PIT) tag system detected 111,209 tagged fish coming through the JFF from April 1 to October 1, 2017. Estimated numbers of fish bypassed were based on the numbers of fish collected during periods when transportation was not occurring (i.e., before transportation began and when transportation was curtailed due to navigational outages and highway closures).

This season's total collection by species group included: 1,085,863 clipped yearling Chinook salmon, 373,783 unclipped yearling Chinook salmon, 143,911 clipped subyearling Chinook salmon, 201,653 unclipped subyearling Chinook salmon, 973,825 clipped steelhead, 321,374 unclipped steelhead, 8,370 clipped sockeye salmon, 8,920 unclipped sockeye salmon, and 33,800 clipped/unclipped Coho salmon. Full powerhouse screening and bypass operations continued through December 18, 2017.

Juvenile hatchery Chinook salmon, hatchery Coho salmon, and hatchery steelhead in the Snake River Basin are normally designated by fin clips, usually the adipose fin, but occasionally one of the pectoral or ventral fins. Before 1998, Idaho Fish and Game was the only agency releasing sizeable numbers of unclipped hatchery fish. Starting in 1998, increasing numbers of unclipped hatchery fish were released by state, federal, tribal, or other agencies (i.e., the Fish

Passage Center); therefore, the reported clipped/unclipped fish collected, sampled, bypassed, and transported no longer represent the origins (i.e., hatchery, wild) of these fish. As of the 2005 report, juvenile salmonids are designated as clipped or unclipped rather than hatchery or wild. Coho salmon were reintroduced by the tribes and regardless of clipping, these fish are all hatchery progeny.

U.S. Army Corps of Engineers personnel included: Supervisory Biologist Charles Barnes, Assistant Biologist Raymond A. Addis, biological technicians: Shelly Montoya, Tasha Geiger, Jon Saylor, Dawn Kunkel, and Paul Bertschinger, and truck driver / maintenance personnel: Rick Blevins and Kenneth Fletcher. Quality control tasks were conducted by Anchor QEA biologists Jordan Korenkiewicz and Jaqi Walt. Smolt monitoring was conducted by PSMFC biologist Wm. Monty Price and Washington Department of Fish and Wildlife biologist Sharon Lind. PSMFC technicians, Carol Williams and Ryan Parkhill, were involved in fish sampling and smolt monitoring quality control and data keeping tasks.

River Conditions

During the 2017 collection season, the average daily flow did not exceed 190.0 thousand cubic feet per second (kcfs). The highest daily average flow for the season was 180.6 kcfs on both April 1 and May 13. The lowest daily average flow for the season occurred on September 2 with a flow of 19.1 kcfs. The average flow for the season was 84.6 kcfs. Spill mandated by the Federal Columbia River Power System Biological Opinion (BiOp) occurred for 152 days from April 3, 2017 through midnight on August 31, 2017, with a maximum daily average spill of 114.0 kcfs on June 7, 2017. High water conditions were present in the beginning of the season, forcing involuntary spill before the 2017 fish passage season. Involuntary spill was performed intermittently after September 1 due to turbine unit outages. The Removable Spillway Weir was in operation when the BiOp-mandated spill began on April 3, 2017, and was taken out of service for the season on August 18, 2017, due to three consecutive days of average daily outflow less than 30 kcfs.

A comparison of daily powerhouse flow and spill is shown in Figure 1. Average monthly flow and spill for the 2013 to 2017 collection seasons are provided in Table 1. River temperature averaged 62.1°F for the 2017 season and ranged from 47.1 °F on April 1 to 71.7 °F on August 17 and 19.

Figure 1. Comparisons of daily powerhouse flow and spill at Lower Monumental Dam, 2017.

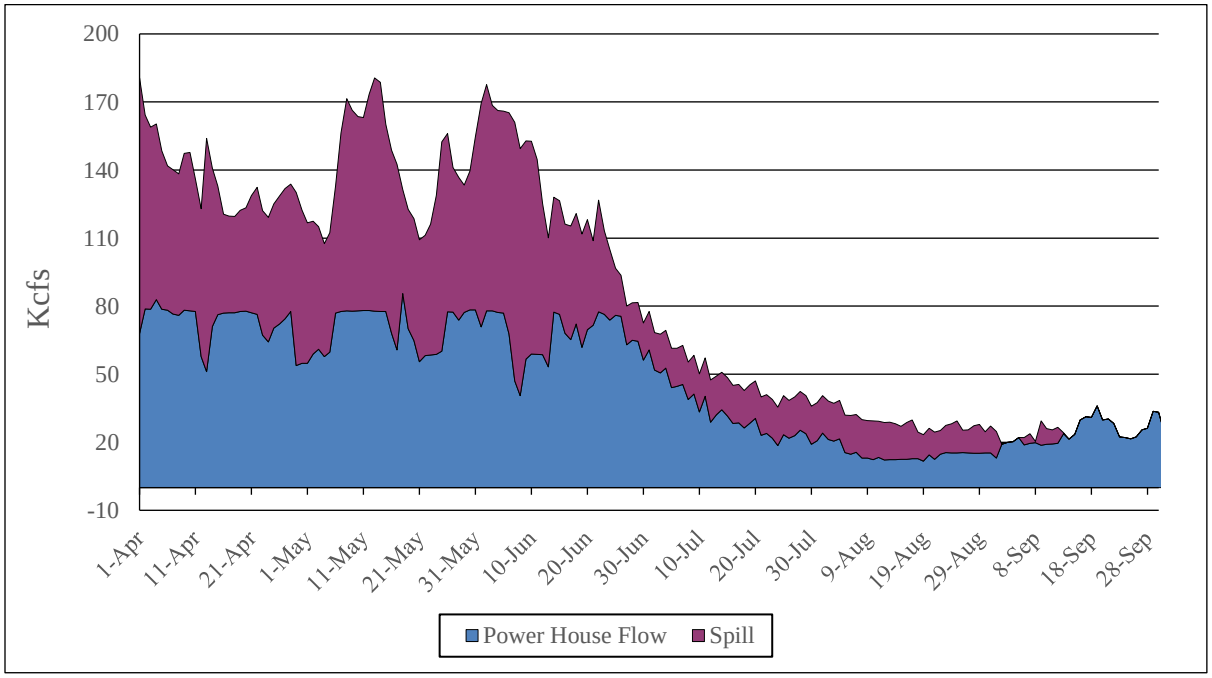

Table 1. Comparisons of average monthly flow (kcfs) and spill (kcfs) at Lower Monumental Dam, 2013-2017.

Month	2013	2014	2015	2016	2017	Average
Flow						
April	59.7	75.2	50.0	87.0	136.5	81.7
May	82.2	100.9	60.3	85.2	140.6	93.8
June	56.4	84.5	41.0	51.3	126.9	72.0
July	34.0	45.5	27.0	31.5	49.7	37.5
August	23.4	26.8	21.0	22.5	29.2	20.4
Sept.	19.4	20.2	18.2	19.2	25.7	20.5
Spill						
April	27.4	26.4	25.7	25.2	63.7	33.7
May	26.3	29.3	24.2	35.3	69.9	37.0
June	21.7	25.9	19.3	24.5	59.8	30.2
July	16.0	17.1	14.1	16.2	16.9	16.1
August	11.0	13.1	8.5	10.4	14.3	11.5
Sept.	0.2	0.3	0.2	0.2	1.7	0.5

Fish Collection

Migration and Collection

Pre-transport primary bypass occurred from March 21 through May 1, 2017. Fish collection for transportation began at 0700 hours on May 1, 2017, and continued until 0700 hours on October 1, 2017. An estimated 3,151,499 juvenile salmonids were collected in 2017 (Table 2). Within each species group, the number collected and percent of the total collection was: 1,085,863 clipped yearling Chinook salmon (34.5%), 373,783 unclipped yearling Chinook salmon (11.9%), 143,911 clipped subyearling Chinook salmon (4.6%), 201,653 unclipped subyearling Chinook salmon (6.4%), 973,825 clipped steelhead (30.9%), 321,374 unclipped steelhead (10.2%), 8,370 clipped sockeye/kokanee (0.3%), 8,920 unclipped sockeye/kokanee (0.3%), and 33,800 clipped/unclipped Coho salmon (1.0%). Post-season bypass occurred from October 1 through December 18, 2017. Daily collection and bypass numbers are provided in Appendix Table 1.

By the end of May, 88.6% of the total yearly collection for 2017 had arrived. The percent of 2017's total collection arriving by the end of June and the end of July was 96.99% and 99.97%, respectively. The months of August and September contributed 0.03% of the total collection and were responsible for the collection of 0.5% of 2017's unclipped subyearling Chinook salmon.

In 2017, the peak daily collection total and date for each species group were: clipped yearling Chinook salmon 78,000 (May 9 and 12), unclipped yearling Chinook salmon 34,200 (April 18), clipped subyearling Chinook salmon 11,550 (June 2), unclipped subyearling Chinook salmon 12,000 (June 2), clipped steelhead 98,200 (April 22), unclipped steelhead 24,000 (May 9), clipped sockeye 2,200 (May 14), unclipped sockeye 1,000 (May 4), and clipped/unclipped Coho salmon 5,400 (May 13). Total daily collection in 2017 peaked at 181,600 (May 9). Peak collection date and daily collection total by species group are listed in Table 3. Daily collection of all species combined versus total flow is shown graphically in Figure 2.

Adult Fallbacks

A total of 727 adult salmonids fell back through the juvenile bypass system and were bypassed from the separator between April 1 and October 1, 2017 (Table 4). The total includes: 101 adult Chinook salmon, 42 jack Chinook salmon, 263 clipped steelhead, and 321 unclipped steelhead. The total number of fallbacks in 2017 was the lowest in the last 5 years. The daily number of adult fallbacks and fallback mortalities at Lower Monumental Dam can be found in Appendix Table 4.

As has been the case in previous years, most adult fallbacks in 2017 were steelhead. The months of April and May accounted for 76.3% of steelhead fallbacks while August and September accounted for 5.6% of all steelhead fallbacks in 2017 (Table 5). Spring/summer Chinook salmon accounted for 64.3% and fall Chinook salmon accounted for 35.7% of Chinook salmon fallbacks. Monthly adult salmonid fallback peaked in April through May, with a second (much smaller) increase in September.

Table 2. Annual collection, bypass, and transport at Lower Monumental Dam, 2013-2017.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clip/Un.	Total
Collection										
2013	351,719	118,229	61,709	108,369	334,849	123,933	4,388	3,674	7,999	1,114,869
2014	868,447	271,339	104,635	152,371	536,410	150,324	13,550	31,858	17,705	2,146,639
2015	514,612	127,462	66,316	108,154	252,560	69,705	5,840	850	22,120	1,167,619
2016	2,887,590	619,657	83,808	100,029	1,009,016	276,408	10,300	1,070	40,586	5,028,464
2017	1,085,863	373,783	143,911	201,653	973,825	321,374	8,370	8,290	33,800	3,151,499
Bypass										
2013	79	50	5,784	7,646	237	97	0	0	0	13,893
2014	175	67	236	380	237	112	0	0	0	1,207
2015	34,051	26,431	201	417	31,786	5,011	0	30	300	98,227
2016	1,195,352	417,149	307	1,663	550,091	105,023	0	0	6244	2,275,829
2017	277,539	212,024	1,336	4,332	472,639	87,447	0	4,597	800	1,060,714
Truck										
2013	0	2	201	3,192	4	13	0	0	0	3,412
2014	0	5	150	1,617	11	2	0	2	0	1,787
2015	0	0	8	760	14	1	0	0	0	783
2016	1	0	103	551	12	2	0	0	0	669
2017	1	3	32	344	1	2	0	0	0	383
Barge										
2013	351,214	118,070	55,493	96,942	334,411	123,768	4,388	3,670	7,998	1,095,954
2014	867,541	271,038	103,940	149,906	536,007	150,172	13,544	31,566	17,705	2,141,419
2015	480,257	100,972	65,845	106,548	220,464	64,610	5,821	819	21,816	1,067,152
2016	1,691,793	202,472	83,276	97,727	458,818	171,354	10,280	1,066	34,341	2,751,127
2017	807,367	161,580	142,397	196,759	500,873	233,819	8,329	4,239	32,959	2,088,322
Total Transported										
2013	351,214	118,072	55,694	100,134	334,415	123,781	4,388	3,670	7,998	1,099,366
2014	867,541	271,043	104,090	151,523	536,018	150,174	13,544	31,568	17,705	2,143,206
2015	480,257	100,972	65,853	107,308	220,478	64,611	5,821	819	21,816	1,067,935
2016	1,691,794	202,472	83,379	98,278	458,830	171,356	10,280	1,066	34,341	2,751,796
2017	807,368	161,583	142,429	197,103	500,874	233,821	8,329	4,239	32,959	2,088,705

Table 3. Annual peak collection dates at Lower Monumental Dam, 2013-2017.

Year	Yearling Chinook Clipped	Yearling Chinook Unclip.	Subyearling Chinook Clipped	Subyearling Chinook Unclip.	Steelhead Clipped	Steelhead Unclip.	Sockeye/Kokanee Clipped	Sockeye/Kokanee Unclip.	Coho Clip/Un	Total
2013	May 15 50,035	May 14 15,400	June 11 7,766	June 10 12,347	May 14 52,900	May 14 18,700	May 18 1,600	May 20 1,000	May 14 2,200	May 14 138,800
2014	May 7 90,000	May 2 31,400	June 6 9,750	June 6 9,400	May 2 50,800	May 2 10,000	May 20 6,200	May 2 3,400	May 19 2,000	May 7 156,800
2015	May 6 74,226	May 6 13,411	June 5 7,400	June 5 7,150	May 2 21,800	May 9 5,200	May 18 1,300	May 7[2] 200	May 17 2,800	May 9 109,200
2016	May 9 339,800	April 26 70,000	June 10 13,550	June 10 10,300	April 26 140,200	May 9 18,200	May 22 2,900	May 5[1] 200	May 9 7,000	April 26 431,000
2017	May 9[3] 78,000	April 18 34,200	June 2 11,550	June 2 12,000	April 22 98,200	May 9 24,000	May 14 2,200	April 20[4] 1,000	May 13 5,400	May 9 181,600

1 May 5, 8, and 11, same number collected each day
2 May 7, 8, 9, and 18, same number collected each day
3 May 9 and 12 same number collected each day
4 April 20 and May 4 same number collected each day

Figure 2. Daily juvenile salmonid collection, all species combined, versus daily average river flow at Lower Monumental Dam, 2017.

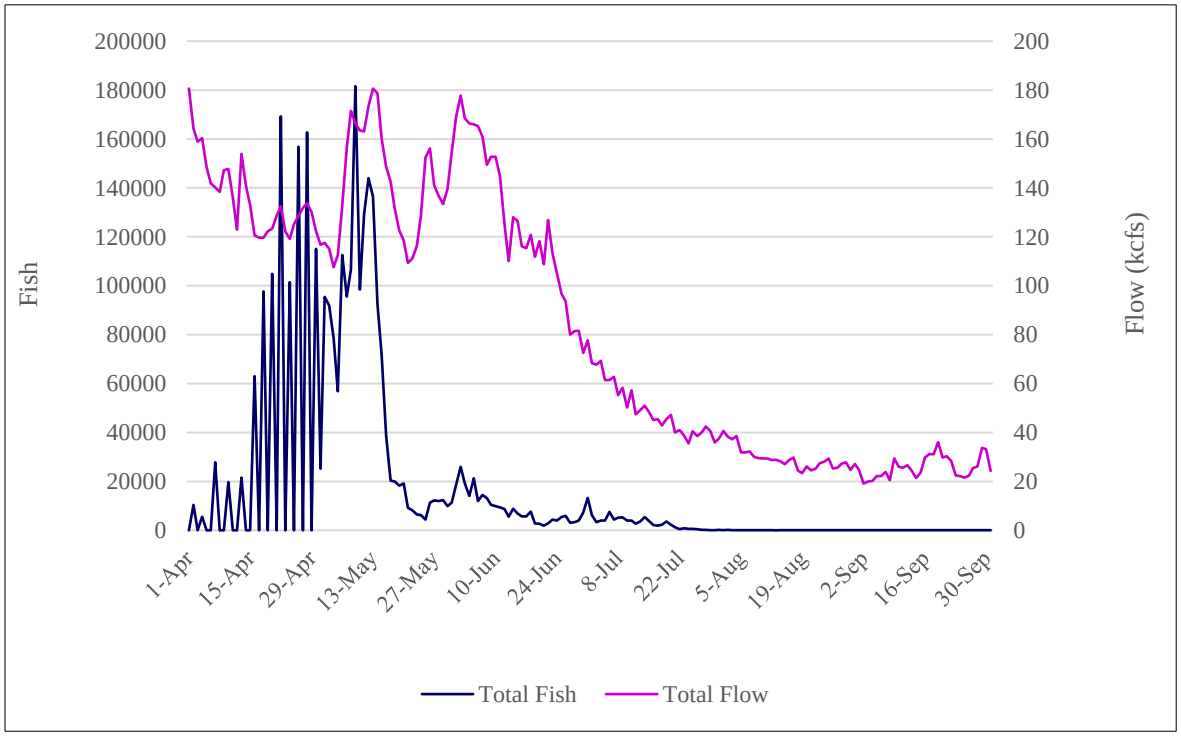

Table 4. Annual totals of adult salmonids released from the juvenile fish separator at Lower Monumental Dam, 2012-2017.

Year[1]	Adult Chinook	Jack Chinook	Clipped Steelhead	Unclipped Steelhead	Total
2013	135	89	556	505	1,294[3]
2014	163	58	321	992	1,561[3,2]
2015	178	34	224	312	761[3,2]
2016	113	26	339	432	915[3,2]
2017	101	42	263	322	728[3,2]

1 Seasons varied in length.
2 Coho salmon are included in the total.
3 Clipped and/or unclipped sockeye are included in the total.

Table 5. Monthly totals of adult salmonids[1] released from the juvenile fish separator at Lower Monumental Dam, 2017.

Month	Adult Chinook	Jack Chinook	Clipped Steelhead	Unclipped Steelhead	Total
April	0	0	64	95	159
May	10	1	126	161	298
June	39	13	42	43	137
July	22	4	4	0	30
August	4	2	4	2	12
September	20	16	12	14	63
October	6	6	11	6	29
Total	101	42	263	321	727

1 Neither Coho nor sockeye salmon are included in this table.

The condition of adult salmonids was evaluated as the fish were released from the separator. Their condition was predominantly good to fair with 64.4% of the fallbacks rated in these categories (Table 6). Condition ratings of the 728 adults examined (excluding sockeye and Coho salmon) were as follows: 469 good (64.4%), 163 fair (22.4%), 77 poor (10.6%), and 19 were dead (2.6%). The number of dead in each species group of adult salmonids was: 10 clipped steelhead and 9 unclipped steelhead. Adult Chinook salmon had a higher percentage of good/fair fish (96.0%) than adult steelhead (84.6%).

Table 6. Condition of adult salmonids[1] released from the juvenile fish separator at Lower Monumental Dam, 2017.

Condition	Adult Chinook	Jack Chinook	Clipped Steelhead	Unclipped Steelhead	Total
Good	73	37	162	197	469
Fair	24	3	55	81	163
Poor	4	2	36	35	77
Dead	0	0	10	9	19
Total	101	42	263	322	728

1 Neither Coho nor sockeye salmon are included in this table.

Separator Efficiency

The separator is designed with bar spacing to allow only smaller smolts—subyearling Chinook and sockeye salmon—to divert to the A side of the collection facility. Larger smolts—steelhead and yearling Chinook salmon—divert to the B side through wider spaced bars. Separator efficiency for 2017 by species group was: clipped yearling Chinook salmon 60.8%, unclipped yearling Chinook salmon 57.0%, subyearling Chinook salmon 64.4%, clipped steelhead 86.8%, unclipped steelhead 63.0%, clipped sockeye/kokanee 45.0%, and unclipped sockeye/kokanee 28.2% (Table 7).

Table 7. Annual separator efficiency in percent at Lower Monumental Dam, 2013-2017.

Year	Clipped Yearling Chinook A-side	Unclipped[1] Yearling Chinook A-side	Subyearling Chinook A-side	Clipped Steelhead B-side	Unclipped[1] Steelhead B-side	Clipped Sockeye/ Kokanee A-side	Unclipped Sockeye/ Kokanee A-side
2013	62.8	67.6	21.6	88.1	68.3	45.7	59.5
2014	70.6	68.0	59.1	78.8	32.5	38.0	44.3
2015	87.1	79.6	60.8	83.2	74.9	41.4	60.7
2016	85.1	80.2	75.0	76.6	47.9	63.1	4.7
2017	60.8	57.0	64.4	86.8	63.0	45.0	28.2

1 This category includes unclipped hatchery fish.

Sampling

From the 2014 Federal Columbia River Power System BiOp:

> Data on fish survival, adult returns, current year in-river conditions, and water supply forecast will be reviewed with Regional Implementation Oversight Group each year to

determine the best operation for the fish Transport Start Date. The Technical Management Team (TMT) will review the results of transport studies annually and provide an annual recommendation on how to operate the juvenile transport program to achieve the goal of transporting about 50% of juvenile steelhead. Planning dates to initiate juvenile transport at Lower Granite Dam will be April 21 to April 25, 2017, unless the Corps adopts a recommendation by TMT that proposes a later start date (No later than May 1) and accompanying alternative operation in their annual recommendation to achieve the goal of transporting about 50% of juvenile steelhead. Transport will begin up to 4 days and up to 7 days after the Lower Granite start date at Little Goose and Lower Monumental dams, respectively. Transport will continue until approximately September 30 at Lower Monumental and through October 31 at Lower Granite and Little Goose dams.

Sampling for condition and outmigration indexing at Lower Monumental Dam began April 1, 2017. Sampling for transport began at 0700 hours on May 1, 2017, and ended at 0700 hours on October 1, 2017.

Sampling is defined as diverting and segregating groups of fish in a consistent fashion so data collected from those segregated groups will accurately represent the sum total of the fish being collected in real time. Sampling is not the act of evaluating those groups.

Fish were sampled every third day (24-hour sampling) from April 1 through April 15, 2017, and every other day from April 15 through May 1, 2017, to monitor fish condition, ensure the system was operating correctly, and to train personnel on facility operation and sampling protocols. This type of sampling is termed "sampling for condition." The total number of fish sampled during the April 1 through May 1, 2017, period was 5,960. The number sampled within each species group was: 1,580 clipped yearling Chinook salmon, 1,271 unclipped yearling Chinook salmon, 5 unclipped subyearling Chinook salmon, 2,602 clipped steelhead, 474 unclipped steelhead, 24 unclipped sockeye, and 4 hatchery Coho salmon.

Total sampling includes both "sampling for condition" as well as "sampling for transport," which was conducted during the 2017 operating year. Sampling for transport was conducted daily from May 1 through October 1, 2017. A total of 28,460 fish (0.9% of the collection) was sampled in 2017. Within each species group, the number and percent sampled of those collected in that group was: 6,033 clipped yearling Chinook salmon (0.6%), 2,579 unclipped yearling Chinook salmon (0.7%), 3,833 clipped subyearling Chinook salmon (2.7%), 6,924 unclipped subyearling Chinook salmon (3.4%), 6,001 clipped steelhead (0.6%), 2,566 unclipped steelhead (0.8%), 91 clipped sockeye/kokanee (1.1%), 68 unclipped sockeye/kokanee (0.8%), and 365 clipped/unclipped Coho salmon (2.2%) (Table 8).

Average weekly sample rates can be found in Table 9 and ranged from 0.5% to 100%.

Table 8. Annual percentage sampled of each juvenile salmonid species group at Lower Monumental Dam, 2013-2017.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clip/Un.	Total
2013	1.1	1.9	16.5	22.3	1.4	1.7	1.7	2.2	2.6	4.3
2014	0.6	0.7	4.9	7.8	0.7	0.8	0.6	0.8	0.7	1.4
2015	0.7	0.9	3.5	5.4	1.0	1.1	1.1	1.1	1.5	1.4
2016	0.6	0.7	4.9	7.0	0.6	0.7	2.7	1.3	0.8	0.8
2017	0.6	0.7	2.7	3.4	0.6	0.8	1.1	0.8	2.2	0.9

Table 9. Weekly sample rates in percent and sample totals at Lower Monumental Dam, 2017.

Week Ending	Weekly Rate (%)	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Totals*
		Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clip/Un.	
6-Apr	0.8	4	6	0	2	70	26	0	0	0	108
13-Apr	1.0	247	241	0	2	166	31	0	1	0	688
20-Apr	0.7	368	483	0	1	668	110	0	10	2	1,642
27-Apr	0.5	483	336	0	0	1,141	168	0	9	0	2,137
4-May	0.5	1,110	380	0	2	1,038	295	0	12	6	2,843
11-May	0.5	1,929	280	0	6	1,270	392	1	5	20	3,903
18-May	0.5	1,336	243	0	4	543	384	23	2	79	2,614
25-May	1.4	229	80	0	3	202	266	29	3	77	889
1-Jun	3.3	287	242	229	347	751	769	31	19	146	2,821
8-Jun	1.1	13	18	632	674	46	56	2	1	15	1,457
15-Jun	2.0	6	32	576	526	21	13	2	3	8	1,187
22-Jun	2.9	5	24	284	359	21	14	2	3	7	719
29-Jun	5.0	10	74	574	766	49	20	0	0	4	1,497
6-Jul	5.0	1	77	771	1,419	6	1	1	0	1	2,277
13-Jul	5.0	2	40	360	1,041	2	0	0	0	0	1,445
20-Jul	5.0	2	13	249	802	1	0	0	0	0	1,067
27-Jul	7.9	0	4	64	224	1	0	0	0	0	293
3-Aug	25.0	0	2	39	187	0	0	0	0	0	228
10-Aug	50.0	0	0	9	78	0	2	0	0	0	89
17-Aug	71.4	0	0	5	39	0	0	0	0	0	44
24-Aug	100.0	0	1	15	120	0	1	0	0	0	137
31-Aug	100.0	0	2	6	60	0	0	0	0	0	68
7-Sep	100.0	1	0	4	70	3	18	0	0	0	96
14-Sep	100.0	0	0	5	73	0	0	0	0	0	78
21-Sep	100.0	0	1	7	80	2	0	0	0	0	90
28-Sep	100.0	0	0	3	28	0	0	0	0	0	31
1-Oct	100.0	0	0	1	11	0	0	0	0	0	12
Total Sampled		6,033	2,579	3,833	6,924	6,001	2,566	91	68	365	28,460
% of Sample		21.2	9.1	13.5	24.3	21.1	9.0	0.3	0.2	1.3	100.0
% of Collection		0.6	0.7	2.7	3.4	0.6	0.8	1.1	0.8	1.1	0.9

* Daily 24-hour sampling at Lower Monumental Dam began this year on May 1.

Transportation

An estimated 2,088,705 juvenile salmonids (66.3% of the collection) were transported from Lower Monumental Dam in 2017. Of these, 383 were transported by truck and approximately 2,088,322 by barge. Within each species group, the number transported and percent of those collected in each group was: 807,368 clipped yearling Chinook salmon (74.4%), 161,583 unclipped yearling Chinook salmon (43.2%), 142,429 clipped subyearling Chinook salmon (99.0%), 197,103 unclipped subyearling Chinook salmon (97.7%), 500,874 clipped steelhead (51.4%), 233,821 unclipped steelhead (72.8%), 8,329 clipped sockeye/kokanee (99.5%), 4,239 unclipped sockeye/kokanee (47.5%), and 32,959 clipped/unclipped Coho salmon (97.5%). Daily truck and barge transportation numbers are provided in Appendix Table 3.

There was no early season trucking from this site this year. Juvenile fish were scheduled to be trucked by midi-tanker from August 15, 2017, at 1500 hours through October 1, 2017, at 0700 hours. Fish were not transported from September 7 to September 19 due to road closures caused by the Eagle Creek fire. A salt solution of 2.5 grams per liter (g/l; 6 pounds per 300 gallons of water) is used routinely in the mini and midi-tankers to treat or ease the *Columnaris* symptoms common at this time of year. A total of 383 fish (0.0% of the collection) were transported by truck in 2017 (Table 2). Within each species group, the number trucked and percent of those collected in each group was: 1 clipped yearling Chinook salmon (0.0%), 3 unclipped yearling Chinook salmon (0.0%), 32 clipped subyearling Chinook salmon (0.0%), 344 unclipped subyearling Chinook salmon (0.2%), 1 clipped steelhead (0.0%), and 2 unclipped steelhead (0.0%).

Juvenile fish collected at Lower Monumental Dam from May 1 through August 15, 2017, at 1500 hours were transported by barge. An estimated 2,088,322 (66.3% of the collection) were transported by barge in 2017 (Table 2). Within each species group, the number barged and percent of those collected in each group was: 807,367 clipped yearling Chinook salmon (74.4%), 161,580 unclipped yearling Chinook salmon (43.2%), 142,397 clipped subyearling Chinook salmon (99.0%), 196,759 unclipped subyearling Chinook salmon (97.8%), 500,873 clipped steelhead (51.4%), 233,819 unclipped steelhead (72.8%), 8,329 clipped sockeye/kokanee (99.5%), 4,239 unclipped sockeye/kokanee (47.5%), and 32,959 clipped/unclipped Coho salmon (97.5%).

Bypass

During the 2017 season (April 1 to October 1) a total of 1,060,714 fish were bypassed, 33.7% of the collection (Table 2). Within each species group, the number bypassed and percent of those collected in each group was: 277,539 clipped yearling Chinook salmon (25.6%), 212,024 unclipped yearling Chinook salmon (56.7%), 1,336 clipped subyearling Chinook salmon (0.9%), 4,332 unclipped subyearling Chinook salmon (2.1%), 472,639 clipped steelhead (48.5%), 87,447 unclipped steelhead (27.2%), 4,597 unclipped sockeye/kokanee (51.5%), and 800 clipped/unclipped Coho salmon (2.4%). These numbers do not include fish bypassed by the PIT-tag diversion system.

Juvenile salmonids were bypassed rather than transported for the following purposes this season.

1. Condition sampling and secondary bypass occurred from 0700 hours on April 1 through 0700 hours May 1, 2017 (see condition sampling frequency in sampling section); a total of 1,055,574 fish were bypassed during this period. Within each species group, the number bypassed was: 277,519 clipped yearling Chinook salmon, 211,974 unclipped yearling Chinook salmon, 600 unclipped subyearling Chinook salmon, 472,637 clipped steelhead, 87,447 unclipped steelhead, 4,597 unclipped sockeye/kokanee, and 800 clipped/unclipped Coho salmon. These numbers include fish examined for GBT during this primary bypass period.
2. Salmonid fry measuring less than 60 millimeters (mm) were bypassed and not sampled due to smolt monitoring protocol.
3. On July 20, 2017, a railroad bridge located above McNary Dam on the Columbia River got stuck in the down position. Fish on the transport barge were released into the river at this location and Lower Monumental Dam fish facility was placed in secondary bypass. All large vessel transport was delayed until repairs were made and the route was opened for river passage on July 25, 2017. A total of 4,985 fish were bypassed. There were 20 clipped yearling Chinook salmon, 49 unclipped yearling Chinook salmon, 1,321 clipped subyearling Chinook salmon, and 3,595 unclipped subyearling Chinook salmon bypassed.
4. On September 4, Interstate 84 was closed due to the Eagle Creek wildfire which started on September 2, 2017. Early September 5, 2017, the fire jumped the Columbia River and State Route 14 was closed to commercial traffic in both directions, but open to passenger vehicles. On September 5, 2017, the U.S. Army Corps of Engineers' Walla Walla District Transportation Coordinator directed the project biologist to change from collection for transport to secondary bypass until access to release sites was restored. Lower Monumental Dam JFF operation was switched to secondary bypass at 0830 on September 5. Previously collected smolts loaded into the fish transportation truck were transported to Windust boat ramp, a few miles downstream of the dam, for immediate release.

   The facility started collecting fish for transportation at 0700 on September 19, with the trucking resuming at 0900 on September 21, 2017. A total of 153 fish were bypassed from September 7 to September 19, 2017. Of the 153 fish bypassed, there were 1 unclipped yearling Chinook salmon, 15 clipped subyearling Chinook salmon, 136 unclipped subyearling Chinook salmon, and 1 clipped steelhead.
5. The PTAGIS3 database revealed 111,209 PIT-tagged fish of different species groups were bypassed through the PIT-tag system. These fish are not included in the facility bypass total.

PIT-tag diversion gates are set to bypass PIT-tagged fish when sample rates are 20% or higher and during sampling intervals when fish were being collected for research (this prevents anesthetizing study fish a second time).

The fish rearing designation used by PTAGIS is hatchery/wild, not clipped/unclipped; therefore, you will find said designation used to report the PIT-tag numbers in the following section rather

than the clipped/unclipped designation used throughout the rest of this report. According to the PTAGIS3 database the total of bypassed PIT-tagged fish was 111,209. The total by unit group was: 23,507 hatchery spring Chinook salmon, 9,631 hatchery summer Chinook salmon, 13,702 hatchery fall Chinook salmon, 504 hatchery Chinook salmon of unknown run, 4,934 wild spring Chinook salmon, 2,641 wild summer Chinook salmon, 53 wild fall Chinook salmon, 5,176 wild Chinook salmon of unknown run, 58 spring Chinook salmon of unknown run or rearing disposition, 5 Chinook salmon of unknown run or rearing disposition, 41,643 hatchery steelhead, 7,495 wild steelhead, 1 steelhead of unknown rearing, 1 steelhead of unknown run or rearing disposition, 728 hatchery sockeye, 64 wild sockeye, 729 hatchery Coho salmon, and 331 fish of unknown species. An unknown number of other fish were bypassed incidentally with the PIT-tagged fish as the PIT-tag diversion gates opened and closed to divert the PIT-tagged fish.

Incidental Species

Non-target fish species that were too large to pass through the separator bars were recorded and bypassed through the adult release pipe at the separator. Those small enough to pass through the separator bars were either sampled and bypassed, or held in the raceways and transported with the juvenile salmonids. Fortunately, most incidental fishes generally arrive late in the season when 100% of the collection is sampled. At this time, incidental species are easily removed while working up the sample; therefore, avoiding transport. Sample fish from each incidental species were counted and their total numbers were calculated using the sample rate. These numbers were then added with separator counts of the same group to estimate the total collection for each species. The most common incidental species groups for 2017 included: juvenile shad (55,901), Siberian prawn (9,020), sucker (3,217), large/smallmouth bass (1,764), juvenile Pacific lamprey (1,450), sculpin (1,178), juvenile brown lamprey (814), adult shad (739), and walleye (733).

The number of juvenile shad (55,901) in 2017 is far greater than the 38,051 collected in the 2016 operating year. Other incidental fish species numbers collected at the facility have increased as well. Historically, juvenile crappie was one of the most encountered incidental species. Their numbers this year have decreased from 1,978 in 2016 to 407 in 2017. Estimated numbers of some groups may also become exaggerated high or low due to the low sample rates at the time of their collection. This season the number of walleye collected increased from 608 in 2016 to 733 in 2017. Larger walleye, removed from the separator and bypassed, increased from 79 in 2016 to 348 in 2017.

Some variability in past years is explained by facility problems which have been found and corrected; however, many incidental species show mild to strong decline. In 2010, the collection of the juvenile (silver/macrophthalmia) lamprey was 218,102; by 2015 they dropped to 2,121. The 2016 season had 17,907 juvenile lamprey while 2017 showed a sharp decline with 1,450. The estimated collection of brown lamprey in 2016 was 74 while the 2017 collection saw a rapid increase in numbers with 814. A summary of incidental fish collection is provided in Table 10.

Table 10. Estimated collection of incidental species at Lower Monumental Dam, 2017.

Common Name	Scientific Name	Exp. Sample	Separator	Total Collection[1]
American shad (Adult)	*Alosa sapidissima*	55	684	739
American shad (Juvenile)	*A. sapidissima*	53,895	2,006	55,901
Banded Killifish	*Fundulus diaphanus*	100	0	100
Bullhead (misc.)	*Ameiurus* spp.	100	12	112
Bull Trout	*Salvelinus confluentus*	0	0	0
Brown Trout	*Salmo trutta*	0	0	0
Channel catfish	*Ictalurus punctatus*	428	88	516
Chiselmouth	*Acrocheilus alutaceus*	7	0	7
Common carp	*Cyprinus carpio*	230	92	322
Crappie	*Pomoxis* spp.	407	0	407
Kokanee	*Oncorhynchus nerka*	0	0	0
Mosquitofish	*Gambusia affinis*	0	0	0
Northern Pikeminnow	*Ptychocheilus oregonensis*	24	3	27
Pacific lamprey (Adult)	*Lampetra tridentatus*	87	1	88
Pacific lamprey (Juvenile)	*L. tridentatus*	1,450	0	1,450
Pacific lamprey (Ammocoete)	*L. tridentatus*	814	0	814
Peamouth	*Mylocheilus caurinus*	696	2	698
Redside Shiner	*Richardsonius balteatus*	0	0	0
Sandroller	*Percopsis transmontana*	0	0	0
Sculpin	*Cottus* spp.	1,177	1	1,178
Siberian Shrimp/Prawn	*Exopalaemon modestus*	9,020	0	9,020
Largemouth/Smallmouth bass	*Micropterus dolomieu/salmoides*	1,748	16	1,764
Sucker (misc.)	*Catostomus* spp.	3,031	186	3,217
Sunfish (misc.)	*Lepomis* spp.	607	6	613
Tadpole Madtom	*Noturus gyrinus*	0	0	0
Whitefish	*Prosopium* spp.	521	0	521
White Sturgeon	*Acipenser transmontanus*	3	4	7
Walleye	*Stizostedion vitreum*	385	348	733
Warmouth	*Lepomis gulosus*	0	0	0
Yellow perch	*Perca flavescens*	334	47	381
Others	----------	340	3	343
Total		75,459	3,499	78,958

1 Incidental species collection estimates are based on (sampled number of group expanded by the sample rate) plus separator count. All incidental fish in the sample and the separator are removed and bypassed.

Fish Condition

Descaling

Descaling data were collected from all live sample fish (full sample) rather than just a portion (subsample). Full sample data collection provides a larger sample size and therefore a better representation of fish condition.

The descaling rate for all fish sampled in 2017 was 2.3%. The annual descaling rate by species group was: clipped yearling Chinook salmon (2.2%), unclipped yearling Chinook salmon (2.2%), clipped subyearling Chinook salmon (1.7%), unclipped subyearling Chinook salmon (1.9%), clipped steelhead (3.5%), unclipped steelhead (1.6%), clipped sockeye/kokanee (3.3%), unclipped sockeye/kokanee (3.1%), and clipped/unclipped Coho salmon (1.1%), (Table 11). The highest rate ever recorded at the JFF was 6.7 in 1993. Rates over the last 5 years have ranged from a low of 1.9% in 2013 and 2014 to a high of 2.6% in 2015.

In 2017, the highest weekly descaling rate for all species combined was 8.3% for the week ending October 1 (with 12 fish sampled in a week of condition sampling), while the lowest rate (0.0%) occurred in the weeks ending July 13 and September 28 (Table 12). Daily descaling rates are provided in Appendix Table 2.

Table 11. Annual descaling rates (%) for fish sampled at Lower Monumental Dam, 2013-2017.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clip/Un.	Total
2013	2.7	2.9	1.5	1.2	4.2	3.5	0.0	4.9	2.0	1.9
2014	2.4	1.8	1.2	1.3	3.5	1.8	5.3	3.8	2.3	1.9
2015	3.0	3.0	1.3	1.6	4.6	4.7	3.2	22.2	2.7	2.6
2016	1.4	1.4	1.2	1.6	2.6	2.7	6.9	0.0	1.0	1.7
2017	2.2	2.2	1.7	1.9	3.5	1.6	3.3	3.1	1.1	2.3

Table 12. Weekly descaling rates (%) for fish sampled at Lower Monumental Dam, 2017.

Week Ending	Yearling Chinook Clipped	Yearling Chinook Unclip.	Subyearling Chinook Clipped	Subyearling Chinook Unclip.	Steelhead Clipped	Steelhead Unclip.	Sockeye/Kokanee Clipped	Sockeye/Kokanee Unclip.	Coho Clip/Un.	Total
4-Apr	0.0*	0.0*	---	0.0*	2.9*	0.0*	---	---	0.0*	1.9
13-Apr	1.6	0.8	---	---	1.8	0.0*	---	100.0*	---	1.5
20-Apr	2.0	2.0	---	0.0*	3.3	1.8	---	0.0*	0.0	2.5
27-Apr	2.7	2.1	---	---	1.9	0.6	---	0.0*	---	2.0
4-May	2.2	1.3	---	0.0*	2.3	2.7	---	0.0*	0.0*	2.2
11-May	2.2	2.2	---	0.0*	4.4	1.0	0.0*	0.0*	0.0*	2.8
18-May	2.1	3.7	---	0.0*	5.9	2.6	0.0*	0.0*	2.5*	3.1
25-May	2.2	2.6*	---	0.0*	4.0	0.8	3.4*	0.0*	2.9*	2.1
1-Jun	2.5	0.5	0.2	1.5	5.2	2.0	5.3*	0.0*	9.5*	2.3
8-Jun	13.3*	0.0*	0.6	0.9	10.9*	1.8*	0.0*	0.0*	0.0*	1.2
15-Jun	16.7*	0.0*	0.5	1.1	4.8*	0.0*	0.0*	0.0*	0.0*	0.9
22-Jun	0.0*	0.0*	1.8	1.7	4.8*	7.1*	50.0*	33.3*	0.0*	2.1
29-Jun	0.0*	2.3*	1.0	0.8	2.0*	0.0*	---	---	0.0*	0.9
6-Jul	0.0*	7.9*	2.4	1.4	0.0*	0.0*	0.0*	---	---	1.9
13-Jul	0.0*	10.0*	1.7	2.7	0.0*	---	---	---	---	0.0
20-Jul	0.0*	15.4*	6.4	2.6	0.0*	---	---	---	---	3.7
27-Jul	---	25.0*	1.6*	4.1	0.0*	---	---	---	---	3.3
3-Aug	---	0.0*	13.2*	2.7	---	---	---	---	---	4.4
10-Aug	---	---	0.0*	2.6*	---	0.0*	---	---	---	2.2*
17-Aug	---	---	0.0*	2.6*	---	---	---	---	---	2.3*
24-Aug	---	0.0*	0.0*	2.5	---	0.0*	---	---	---	2.2
1-Sep	---	0.0*	0.0*	1.9*	---	---	---	---	---	1.7*
8-Sep	100.0*	---	0.0*	1.1*	---	0.0*	---	---	---	2.1*
15-Sep	---	---	0.0*	1.4*	---	---	---	---	---	1.3*
22-Sep	---	100.0*	0.0*	1.3*	0.0*	---	---	---	---	2.2*
29-Sep	---	---	0.0*	0.0*	---	---	---	---	---	0.0*
1-Oct	---	---	0.0*	9.1*	---	---	---	---	---	8.3*
Total Descaled	134	57	64	128	207	41	3	2	4	640
Total Examined	6,010	2,566	3,810	6,893	5,984	2554	90	64	363	28,334
Percent Descaled	2.23%	2.22%	1.68%	1.86%	3.46%	1.61%	3.33%	3.13%	1.10%	2.26%

--- No fish sampled during the week.
* Fewer than 100 fish sampled during the week.

Other Injuries and Disease

Injury data were gathered from a subsample of 100 of the dominant species and not more than 100 each of the non-dominant species. There were 18,586 fish examined for injury and disease in 2017. The most common symptom observed in 2017 was fin injury. A vast majority of fin injuries were observed to be split caudal and pectoral fins; however, other fin injuries were also included in this category. Split caudal fins have been defined as a split in the caudal fin membrane that extends the full length of the fin to the caudal peduncle. Split fin injuries are

primarily observed in the lower lobe of the caudal fin within each species rearing and run type, aside from subyearling Chinook salmon, where most fin injuries were located at the center of the caudal and pectoral fins. Fin injuries were found on 3.1% of all fish examined. The incidence of fin injury was: clipped yearling Chinook salmon (4.9%), unclipped yearling Chinook salmon (4.5%), clipped subyearling Chinook salmon (5.4%), unclipped subyearling Chinook salmon (6.3%), clipped steelhead (2.8%), unclipped steelhead (3.0%), and clipped sockeye/kokanee (1.1%), unclipped sockeye/kokanee (1.7%), and clipped/unclipped Coho salmon (3.3%). Fin hemorrhaging occasionally coincided with split fin injuries.

Fin hemorrhaging is the discharge of blood outside the fin tissue. Fin hemorrhaging is a sign of trauma and was found on 1.4% of all fish examined for injuries in 2017. The highest incidence of fin hemorrhaging was seen in subyearling Chinook salmon. The incidence of fin hemorrhaging by species group was: clipped yearling Chinook salmon (1.2%), unclipped yearling Chinook salmon (1.6%), clipped subyearling Chinook salmon (5.4%), unclipped subyearling Chinook salmon (5.3%), clipped steelhead (0.04%), unclipped steelhead (0.04%), clipped sockeye/kokanee (1.1%), unclipped sockeye/kokanee (1.7%), and clipped/unclipped Coho salmon (0.0%).

Other common injuries and disease observed included: blood pooling, bird marks, fish marks, fungus, and *Columnaris*.

Blood pooling is defined as the vasodilatation of the capillaries in fins (also referred to as fin pinkness). It seems to be a symptom of anesthetic use during higher water temperatures and is mostly found on subyearling Chinook salmon. Evidence of blood pooling was found on 1.0% of all fish examined. The incidence of blood pooling by species group was: clipped yearling Chinook salmon (0.6%), unclipped yearling Chinook salmon (0.5%), clipped subyearling Chinook salmon (2.8 %), unclipped subyearling Chinook salmon (2.6%), clipped steelhead (1.2%), unclipped steelhead (1.3%), clipped sockeye/kokanee (1.1%), unclipped sockeye/kokanee (0.0%), and clipped/unclipped Coho salmon (0.3%).

Bird marks were observed on 1.8% of all fish examined. The incidence of bird marks by species group was: clipped yearling Chinook salmon (2.6%), unclipped yearling Chinook salmon (1.4%), clipped subyearling Chinook salmon (0.8 %), unclipped subyearling Chinook salmon (1.0%), clipped steelhead (4.8%), unclipped steelhead (2.9 %), clipped sockeye/kokanee (2.3 %), unclipped sockeye/kokanee (1.7%), and clipped/unclipped Coho salmon (2.5%).

Fish marks were found on 0.8% of all fish examined. Fish marks were found on all species and rearing types with the exception of unclipped sockeye. Subyearling Chinook salmon showed the highest percentage of fish mark injuries.

Fungus was found on 0.1% of all fish examined. Fungus was found on all species and rearing types with the exception of clipped subyearling Chinook and Coho salmon. The occurrence of fungus is generally seen early in the season while the water is still relatively cold. Fungus on fish was often found concurrently with body injuries.

Columnaris was seen again this year. It occurs most frequently in subyearling Chinook salmon, but has been seen on Coho salmon and steelhead as well. Typically, it is found on the fish during the warmer water conditions of July, August, and September. Peamouth also appear to be susceptible to this disease. *Columnaris* can be recognized by the presence of yellowish lesions on the belly, as well as some damage to the gills, pelvic fins, snout, and caudal fins. It has also been found in the dorsal region. This year both clipped and unclipped subyearling Chinook salmon showed *Columnaris* signs with rates of 0.2% and 0.5%, respectively. In contrast to previous years and despite high water temperatures, we did not see an increase in the incidence of *Columnaris* this season.

The maximum daily *Columnaris* rate in 2016 for subyearling Chinook salmon was 50.0% (only 2 fish examined). In 2015, it reached a high of 45.5% (only 11 fish sampled). Increased mortality in the summer months is frequently attributed to *Columnaris*.

Mortality

Annual facility mortality for all groups combined was 0.1% in 2017 (Table 13) and totaled 2,080 fish. Within each species group, the number of facility mortalities and percent of those collected in that group was: 956 clipped yearling Chinook salmon (0.1%), 176 unclipped yearling Chinook salmon (0.0%), 146 clipped subyearling Chinook salmon (0.1%), 218 unclipped subyearling Chinook salmon (0.1%), 312 clipped steelhead (0.0%), 106 unclipped steelhead (0.0%), 41 clipped sockeye/kokanee (0.5%), 84 unclipped sockeye/kokanee (0.9%), and 41 clipped/unclipped Coho salmon (0.1%). Total annual facility mortality was 0.1% in all 3 years prior to 2016 and 0.0% in 2016. In 2017, weekly mortality rates reached a high of 8.3% for the week ending October 1 (only 12 fish sampled) and a low of 0.0% for multiple weeks (Table 14). Daily mortality rates are provided in Appendix Table 2.

Annual sample mortality for all groups combined was 0.4% in 2017 (Table 15) and totaled 126 fish. The number of sample mortalities and mortality rate by species group was: 23 clipped yearling Chinook salmon (0.4%), 13 unclipped yearling Chinook salmon (0.5%), 23 clipped subyearling Chinook salmon (0.6%), 31 unclipped subyearling Chinook salmon (0.4%), 17 clipped steelhead (0.3%), 12 unclipped steelhead (0.5%), 1 clipped sockeye/kokanee (1.1%), 4 unclipped sockeye/kokanee (5.9%), and 2 clipped/unclipped Coho salmon (0.5%). Sample mortality for all groups combined has ranged from a high of 2.0% in 2011 to a low of 0.3% in 2008 and 2010.

Annual post-sample mortality for all groups combined was 0.2% in 2017 and totaled 5 fish. The number of post-sample mortalities and mortality rate by species group was: 1 clipped yearling Chinook salmon (0.0%), 1 clipped subyearling Chinook salmon (0.0%), 2 unclipped subyearling Chinook salmon (0.1%), and 1 unclipped steelhead (0.0%). The highest post-sample mortality rate (0.7%) occurred in 2004 and the lowest (0.0%) in 1999.

Annual truck mortality in 2017 was 0.8% (3 of 383 fish). The number of truck mortalities and mortality rate by species group was: 1 clipped subyearling Chinook salmon (0.3%) and 2

unclipped subyearling Chinook salmon (0.5%). The annual truck mortality rate in 2016 was 0.5%.

Table 13. Annual facility mortality (%) at Lower Monumental Dam, 2013-2017.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clip/Un.	Total
2013	0.1	0.1	0.3	0.5	0.0	0.0	0.0	0.1	0.0	0.1
2014	0.1	0.1	0.3	0.3	0.0	0.0	0.0	0.9	0.0	0.1
2015	0.1	0.0	0.4	0.4	0.1	0.1	0.3	0.1	0.0	0.1
2016	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.4	0.0	0.0
2017	0.1	0.0	0.1	0.1	0.0	0.0	0.5	0.9	0.1	0.1

Table 14. Weekly facility mortality rates (%) at Lower Monumental Dam, 2017.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Week Ending	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clip/Un.	Total
6-Apr	0.0	0.0	---	0.0	0.0	0.0	---	---	---	0.0
13-Apr	0.0	0.0	---	0.0	0.0	0.0	---	0.0	---	0.0
20-Apr	0.0	0.0	---	0.0	0.0	0.0	---	0.0	0.0	0.0
27-Apr	0.0	0.0	---	---	0.0	0.0	---	0.2	---	0.0
4-May	0.1	0.0	---	0.0	0.0	0.0	---	0.3	0.0	0.0
11-May	0.1	0.1	---	0.0	0.0	0.0	0.0	5.8	0.0	0.1
18-May	0.1	0.1	---	0.1	0.1	0.1	0.0	0.3	0.0	0.1
25-May	0.8	1.0	---	0.0	0.2	0.1	1.5	0.3	0.6	0.5
1-Jun	0.2	0.0	0.1	0.0	0.1	0.0	0.1	1.8	0.1	0.1
8-Jun	1.6	0.4	0.1	0.1	0.1	0.0	1.0	3.0	0.1	0.1
15-Jun	0.7	0.5	0.1	0.0	0.4	0.0	0.0	0.7	0.0	0.1
22-Jun	1.5	0.3	0.1	0.2	0.0	0.2	0.0	0.0	0.0	0.1
29-Jun	0.0	0.0	0.1	0.1	0.1	0.0	---	---	0.0	0.1
6-Jul	10.0	0.3	0.1	0.2	0.0	0.0	0.0	---	0.0	0.1
13-Jul	0.0	0.0	0.2	0.1	0.0	---	---	---	---	0.1
20-Jul	0.0	1.2	0.2	0.3	0.0	---	---	---	---	0.3
27-Jul	---	0.0	0.5	0.3	10.0	---	---	---	---	0.4
3-Aug	---	0.0	0.0	0.5	---	---	---	---	---	0.4
10-Aug	---	---	0.0	1.3	---	0.0	---	---	---	1.1
17-Aug	---	---	0.0	0.0	---	---	---	---	---	0.0
24-Aug	---	0.0	0.0	0.0	---	0.0	---	---	---	0.0
31-Aug	---	0.0	16.7	0.0	---	---	---	---	---	1.5
7-Sep	0.0	---	0.0	0.0	---	0.0	---	---	---	0.0
14-Sep	---	---	0.0	4.1	---	---	---	---	---	3.8
21-Sep	---	0.0	0.0	0.0	0.0	---	---	---	---	0.0
28-Sep	---	---	0.0	3.6	---	---	---	---	---	3.2
1-Oct	---	---	0.0	9.1	---	---	---	---	---	8.3

--- No fish collected during the week

Table 15. Annual sample mortality (%) at Lower Monumental Dam, 2013-2017.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clipped	Unclip	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clip/Un.	Total
2013	0.2	0.3	0.8	1.5	0.3	0.2	0.0	0.0	0.0	1.0
2014	0.2	0.2	0.9	1.6	0.1	0.2	0.0	0.4	0.0	0.9
2015	0.8	1.4	0.9	0.8	1.2	1.3	0.0	0.0	0.6	0.9
2016	0.7	0.2	0.8	0.5	0.2	0.4	1.8	0.0	0.0	0.5
2017	0.4	0.5	0.6	0.4	0.3	0.5	1.1	5.9	0.5	0.4

Research

Gas Bubble Trauma Monitoring (PSMFC)

Juvenile Chinook salmon and steelhead were sampled once a week for GBT from April 6 through August 3 in 2017. The GBT inspections were stopped early due to small numbers of available fish. Typically, inspections end when spill stops (August 31). This season, 1,699 fish were sampled for GBT. PSMFC personnel examined up to 100 individuals each of the following groups: yearling Chinook salmon, subyearling Chinook salmon, and juvenile steelhead. The fish were examined for evidence of bubbles in paired and unpaired fins and in the eye, as per Fish Passage Center GBT protocols. Prior to collection for transport, the GBT fish were bypassed to the river after examination. Weekly GBT sampling continued for up to 8 hours or until 100 fish had been sampled per species group. The number of fish sampled for GBT, by species group was: 242 clipped yearling Chinook salmon, 111 unclipped yearling Chinook salmon, 237 clipped subyearling Chinook salmon, 518 unclipped subyearling Chinook salmon, 413 clipped steelhead, and 178 unclipped steelhead. In the 2017 season, 46 fish showed signs of GBT.

Operation and Maintenance

Turbine Operations

Efforts were made to operate all turbine units within 1% of peak efficiency from April 1, 2017 to October 31, 2017. Deviations were infrequent and brief or required by the Bonneville Power Administration.

Below is a summary of unit outages and cause from March 1 through October 1, 2017.

Unit	Dates out of service	Reason out of service
All Units	March 21-23	STS installation
All Units	Monthly (2-3 days)	STS/VBS inspection
All Units	May 16-18	Trash rack raking (6-8 hours/day alternating units)
Unit 1	All Year	Contractor continuing Rehab/Rewind
Unit 2	May 22-25	Oil leak inspection
	August 2-Sept 25	Investigation of leaking blade seals
Unit 3	April 27	Repair generator brush issue
	July 14-17	Investigation of CO2 fire alarm
	August 21-31	Lowering hub oil level to prevent leakage
	September 5-12	Hydraulically fixing blades
Unit 4	August 17	Head gate cylinder install (1 hour)
	August 21- Sept 13	Installation of digital governor
Unit 5	All Year	Turbine oil leak investigation
Unit 6	June 6-13	Investigation and repair of oil leak
	July 5-Aug 17	Unit annual inspection and installation of digital governor

Debris/Trash Racks

In 2017, trash rack raking occurred March 30-31, May 16-17, June 7-8, and July 12. Several semi-truck loads of debris were removed during each effort. With much higher than average flows, debris loads were extremely heavy in 2017 and extended well into July.

Submersible Traveling Screens

The STSs were inspected and tested on March 16, 2017, and were installed from March 21 through March 23, 2017. After installation, inspection was done monthly by underwater video camera through November. The mesh was found separated from the framework on all three slots in unit 3 on April 11. Spare screens were installed to replace them on April 13.

STSs are usually operated in “cycle” mode while the average fork length of subyearling Chinook salmon and/or sockeye/kokanee is greater than 120 mm, and in continuous “run” mode when either is less than 120 mm. In 2017, the STSs were placed in continuous run mode March 30 due to the heavy debris load. The STSs were later changed to cycle mode at 1730 on July 18 due average lengths of collected fish being less than 120 mm.

Vertical Barrier Screens

The vertical barrier screens (VBSs) were inspected by underwater video camera on August 1 and 2. Additionally, they were spot-checked monthly during STS inspections. No problems were found.

Gatewells

Due to extremely high debris loads in 2017, gatewells exceeded the 50% debris criterion approximately every 3 days from the start of the season until mid-June. When debris coverage over 50% was reported, the powerhouse crew promptly removed the debris by dipping the gatewells.

Orifices/Collection Channel

During the 2017 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. The 2017 season presented a challenge when it came to keeping orifices free of debris. Beginning March 31, the project increased orifice checks to four inspections per day due to problems with debris. On April 18, operators noticed a blocked orifice and removed a clog, sending approximately 250 smolt mortalities into the separator. This event prompted the project to further increase orifice inspections to eight times per day. By July 25, debris loads had lightened significantly and orifice inspections were returned to their normal schedule. 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

The compressed air screen cleaner functioned well throughout the 2017 season. However, the mechanical screen cleaner malfunctioned and was intermittingly failing from late June until late July. Extensive troubleshooting found the problem to be a limit switch on the unit and it was repaired and returned to service. The problem with the mechanical screen cleaner had little impact on keeping debris off of the incline screen as the bubbler was still operating and technicians were able to run the brush manually during their shifts.

Wet Separator/Distribution and Sampling Systems

Sudden water level drops at the separator were not a problem this year. Water level remained fairly consistent at the separator with the automated weirs of the primary dewaterer in manual

mode. As has been the case for the last few years, the separator was run at a higher water level to assure no problem with exposed separator bars would occur.

PIT-tag diversion gate position sensors were installed 10 years ago. These sensors act to prevent the over-travel problem Lower Monumental dam once had, and by so doing, they eliminated gate failure problems caused by metal fatigue.

Barge Loading Operations

A diving inspection was completed on the barge dock in January 2017. The report concluded the existing mooring bits were unsafe for use. Through the emergency contract process, new temporary mooring bits were installed by a contractor in time for the 2017 barging season and there were no impacts to transport.

Fish were transported by barge from May 1 through August 15, 2017. Barge loading went very smoothly this season except for one incident that was out of the project's control. A malfunctioning railroad bridge across the Columbia River near Burbank, Washington was stuck in the down position and prevented commercial navigation traffic from July 20 through July 25. Fish were bypassed during this period and two planned barge loadings were cancelled.

Truck Loading Operations

Juvenile fish were scheduled to be collected and transported by truck from August 14, 2017, at 1500 hours to October 1, 2017, at 0700 hours. However, the Eagle Creek Fire burning near Cascade Locks, Oregon, prevented safe travel through the gorge from September 7 through September 20. During this time, roads through the gorge were closed to commercial trucks and the collected fish were held in raceways long enough to recover and returned to the river.

Throughout the late season the midi-tanker was used because of low fish numbers. A 2.5 milligram per liter salt solution was used to treat and/or ease outbreaks of *Columnaris*.

Recommendations

1. 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.
2. 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 the U.S. Army Corps of Engineers' engineer Ryan Laughery, and he is optimistic regarding its feasibility and functionality. (in Asset Management Requirements Identification & Prioritization)
3. 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 TABLES

Appendix Table 1. Daily collection and bypass numbers and river conditions at Lower Monumental Dam, 2017.

See Excel Spreadsheet “2017 Fish Numbers LoMo.xls”.

Appendix Table 2. Daily number of fish trucked and barged from Lower Monumental Dam, 2017.

See Excel Spreadsheet “2017 Fish Numbers LoMo.xls”.

Appendix Table 3. Percent descaling and daily facility mortality numbers at Lower Monumental Dam, 2017.

See Excel Spreadsheet “2017 Fish Numbers LoMo.xls”.

Appendix Table 4. Daily number of adult fallbacks and fallback mortality at Lower Monumental Dam, 2017.

See Excel Spreadsheet “2017 Fish Numbers LoMo.xls”.