CENWW-ODO BARNES (1130) 27 April, 2020

MEMORANDUM THRU:
Jeannette Wilson, Operations Project Manager, Lower Monumental Dam

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

SUBJECT: Submission of 2019 Juvenile Fish Collection and Bypass Report, Lower Monumental Dam Juvenile Fish Facility.

1. Enclosed find the 2019 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

2019 Juvenile Fish Collection and Bypass Report
Lower Monumental Dam Juvenile Fish Facility

Prepared by

Charles Barnes

U.S. Army Corps of Engineers

and

Jaqualin Walt

Anchor QEA, LLC

27 April, 2020

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Introduction

Juvenile fish transportation and bypass operations occurred for the twenty seventh year at Lower Monumental Dam Juvenile Fish Facility (JFF) in 2019. The juvenile fish facility was watered up at 1200 hours on March 7. Submersible traveling screens (STS's) in Units 1, 2, and 3 were installed prior to March 1, while STS's in Units 4, 5, and 6 were installed by April 3, 2019. The JFF was watered up for testing at 1200 hours on March 7, and every other day fish condition sampling began at 0700 on March 8. From March 9 through April 23, primary bypass was intermittently interrupted every other day for fish condition monitoring. Early season condition monitoring consisted of a 24-hour sample on target days from 0700 to 0700. During this period, 806,886 fish were examined and returned to the river. These fish are included in the 2019 season spreadsheet (Appendix Tables 1 through 4).

Collection for transport began at 0700 hours on April 23, and ended at 0700 hours on August 3. On August 5, the facility sampled all fish for condition and bypassed them. This operation continued until September 30. On September 30 at 0700, the facility was returned to primary bypass mode through December 16. Total smolt collection in the 2019 season was 3,130,052. This includes expanded numbers of those sampled during pre-transport. Of the 3,130,052 fish collected in the 2019 season, 74 were trucked, 2,135,878 were barged, and 992,548 were bypassed.

Pacific States Marine Fisheries Commission (PSMFC) technicians examined 1,302 fish for gas bubble trauma (GBT) in 2019. Examinations were conducted once a week from April 11 through July 24.

The passive integrated transponder (PIT) tag system on adult return pipe and sort by code systems detected 55,646 PIT-tagged fish at the JFF from April 1 to October 1. None of these PIT-tagged fish are included in the bypass numbers.

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, they are all hatchery progeny.

This season's total collection by species group included: 886,572 clipped yearling Chinook salmon, 289,846 unclipped yearling Chinook salmon, 80,401 clipped subyearling Chinook salmon, 142,992 unclipped subyearling Chinook salmon, 1,330,906 clipped steelhead, 324,527 unclipped steelhead, 40,875 clipped sockeye salmon, 3,233 unclipped sockeye/kokanee

salmon, and 30,700 Coho salmon. Full powerhouse screening and bypass operations continued through December 16.

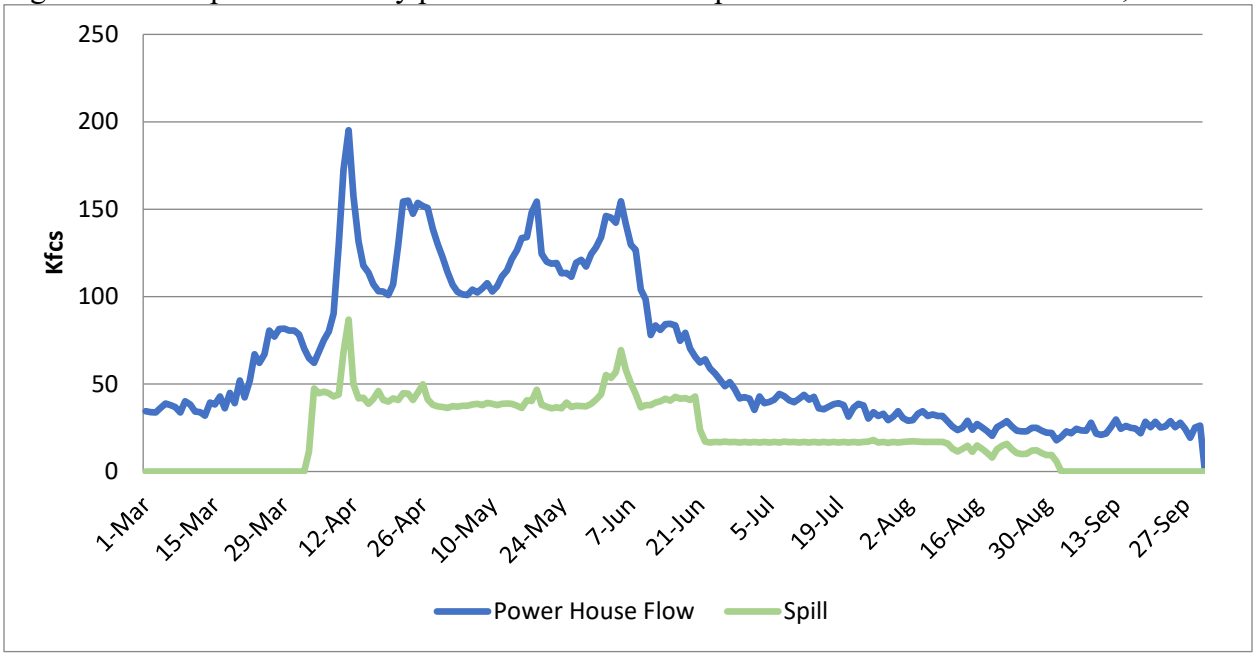
Corps of Engineers personnel included: Supervisory Biologist Charles Barnes, Assistant Biologist Raymond A. Addis, biological technicians: Shelly Montoya, Dawn Kunkel, Paul Bertschinger, Rebecca Schwartz, and Robin Henderson, and truck driver/maintenance personnel: Rick Blevins and Kenneth Fletcher. Quality control tasks were conducted by Anchor QEA technicians Jaqualin Walt, Alexis Bonoff, Christian Meideros, and Meaghan Wright. Smolt monitoring was conducted by PSMFC biologists William Monty Price and Darin Hathaway. PSMFC technicians Carol Williams, Rachel Blackwell, and Wanda Blackwell were involved in fish sampling, smolt monitoring quality control, and data keeping tasks.

River Conditions

For juvenile fish monitoring, averages of river conditions are based on sampling periods (i.e. 0700-0700) rather than calendar days. During the 2019 season, the average daily power house flow did not exceed 200.0 thousand cubic feet per second (kcfs). The highest daily average flow for the season was 195.2 kcfs on April 11. The lowest daily average flow for the season occurred on September 30 with a flow of 13.5 kcfs. The average flow for the season was 65.2 kcfs. Spill mandated by the Biological Opinion (BiOp) occurred for 151 days from April 3 through midnight on August 31, with a maximum daily average spill of 89.8 kcfs on May 27. The Removable Spillway Weir was put into operation when the BiOp-mandated spill began on April 3, and was taken out of service for the season on August 8, due to low river flows.

A comparison of daily powerhouse flow and spill is shown in Figure 1. Average monthly flow and spill for the 2014 to 2019 collection seasons are provided in Table 1. River temperature averaged 61.9°F for the 2019 season and ranged from 46.0°F on April 3 and 8 to 70.5°F on August 7 and 8.

Figure 1. Comparison of daily powerhouse flow and spill at Lower Monumental Dam, 2019.



* For juvenile fish monitoring, averages of river conditions are based on sampling periods (i.e. 0700-0700) rather than calendar days.

Table 1. Comparison of average monthly flow (kcfs) and spill (kcfs) at Lower Monumental Dam, 2014–2019.

Month	2014	2015	2016	2017	2018	2019	Average
Flow							
March						49.4	*
April	75.2	50.0	87.0	136.5	93.7	115.8	88.5
May	100.9	60.3	85.2	140.6	133.3	117.1	104.1
June	84.5	41.0	51.3	126.9	78.5	87.8	76.4
July	45.5	27.0	31.5	49.7	38.0	37.7	38.4
August	26.8	21.0	22.5	29.2	27.3	26.8	25.4
September	20.2	18.2	19.2	25.7	22.1	24.4	21.1
Spill							
March						0.0	0.0
April	26.4	25.7	25.2	63.7	36.4	41.3	35.5
May	29.3	24.2	35.3	69.9	54.5	38.3	42.6
June	25.9	19.3	24.5	59.8	28.5	36.4	31.6
July	17.1	14.1	16.2	16.9	16.9	16.8	16.3
August	13.1	8.5	10.4	14.3	13.1	13.5	11.9
September	0.3	0.2	0.2	1.7	0.4	0.2	0.6

Collection of Juveniles

Migration and Collection

Pre-transport primary bypass occurred from March 9 through 0700 hours April 23. Fish collection for transportation began at 0700 hours on April 23, and continued until September 30. An estimated 3,130,052 juvenile salmonids were collected in 2019 (Table 2). Within each species group, the number collected and percent of the total collection was: 886,572 clipped yearling Chinook salmon (28.3%), 289,846 unclipped yearling Chinook salmon (9.3%), 80,401 clipped subyearling Chinook salmon (2.6%), 142,992 unclipped subyearling Chinook salmon (4.6%), 1,330,906 clipped steelhead (42.5%), 324,527 unclipped steelhead (10.4%), 40,875 clipped sockeye salmon (1.3%), 3,233 unclipped sockeye/kokanee salmon (0.1%), and 30,700 coho salmon (1.0%). Post-season bypass occurred from October 1 through December 16. Daily collection and bypass numbers are provided in Appendix Table 1.

By the end of May, 94.9% of the total yearly collection for 2019 had arrived. The percent of the total collection arriving by the end of June and the end of July was 99.3% and 99.9% respectively. The months of August and September contributed 0.1% of the total collection and were responsible for the collection of 1.1% of 2019's unclipped subyearling Chinook salmon.

In 2019, the peak daily collection for transport total and date for each species group were: 51,000 clipped yearling Chinook salmon (April 24), 13,400 unclipped yearling Chinook salmon (April 24), 7,700 clipped subyearling Chinook salmon (May 31), 23,100 unclipped subyearling Chinook salmon (May 31), 114,600 clipped steelhead (April 24), 28,818 unclipped steelhead (April 25), 14,000 clipped sockeye salmon (May 20), 1,000 unclipped sockeye/kokanee salmon (May 19), and 1,800 coho salmon (May 18 and May 20). Total daily collection in 2019 peaked at 205,200 (April 24). An early release from Lyons Ferry Hatchery and increased spill most likely influenced the early passage timing for yearling Chinook salmon this season. 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.

Table 2. Annual collection, bypass, and transport at Lower Monumental Dam, 2014–2019.

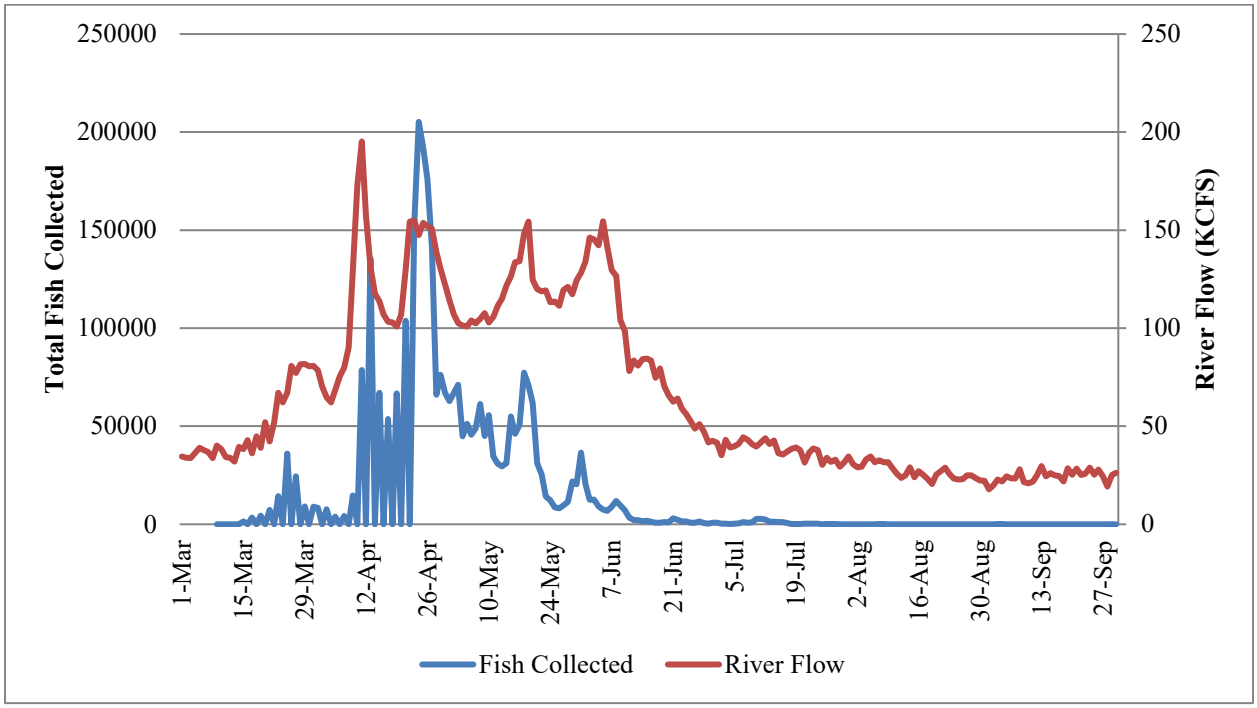
Year	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Total
	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.		
Collection										
2014	868,447	271,339	104,635	152,371	536,410	150,324	13,550	31,858	17,705	2,146,639
2015	514,612	127,462	66,316	108,154	252,560	69,705	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
2018	880,575	337,530	130,343	174,478	970,517	208,054	26,600	8,605	25,044	2,761,746
2019	886,572	289,846	80,401	142,992	1,330,906	324,527	40,875	3,233	30,700	3,130,052
Bypass										
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	6,244	2,275,829
2017	277,539	212,024	1,336	4,332	472,639	87,447	0	4,597	800	1,060,714
2018	99,180	100,255	67	611	222,896	29,278	120	1,479	100	453,986
2019	222,211	131,218	886	4,139	543,987	86,555	0	128	3,424	992,548
Truck										
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
2018	0	0	11	118	0	0	0	0	0	129
2019	0	0	13	59	2	0	0	0	0	74
Barge										
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
2018	781,029	237,187	130,126	173,644	747,509	178,748	26,447	7,113	24,941	2,306,744
2019	663,488	158,459	79,350	138,693	786,712	237,927	40,873	3,104	27,272	2,135,878
Total Transported										
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
2018	781,029	237,187	130,137	173,762	747,509	178,748	26,447	7,113	24,941	2,306,873
2019	663,488	158,459	79,363	138,752	786,714	237,927	40,873	3,104	27,272	2,135,952

Table 3. Annual peak collection dates at Lower Monumental Dam, 2014–2019.

Year	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Total
	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.		
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[a] 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[a] 200	May 9 7,000	April 26 431,000
2017	May 9[a] 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[a] 1,000	May 13 5,400	May 9 181,600
2018	May 9 61,646	April 18 26,000	May 30 19,422	May 30 21,826	May 2 71,040	May 2 12,810	May 18 4,500	April 18 800	May 10 2,000	May 1 129,000
2019	April 24 51,000	April 24 13,400	May 31 7,700	May 31 23,100	April 24 114,600	April 25 28,818	May 20 14,000	May 19 1,000	May 18[a] 1,800	April 24 205,200

a. First instance of multiple collection peaks

Figure 2. Daily juvenile salmonid collection, all species combined, versus daily average river flow at Lower Monumental Dam, 2019.



Adult Fallback

A total of 705 adult salmonids fell back through the juvenile bypass system and were bypassed from the separator between March 9 and October 1, 2019 (Table 4). The total includes: 71 adult Chinook salmon, 24 jack Chinook salmon, 238 clipped steelhead, 371 unclipped steelhead, and 1 sockeye salmon. 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 2019 were steelhead. The months of March through May accounted for 85.9% of steelhead fallbacks while June through September accounted for 14.1% of all steelhead fallbacks (Table 5). Monthly adult salmonid fallback peaked in April through May, with a second (much smaller) increase in September.

Table 4. Annual totals of adult salmonids released from the juvenile fish separator at Lower Monumental Dam, 2014–2019.

Year	Chinook	Jack Chinook	Clipped Steelhead	Unclipped Steelhead	Sockeye	Coho	Total
2014	163	58	321	992	0	0	1,561
2015	178	34	224	312	0	0	748
2016	113	26	339	432	0	0	910
2017	101	42	263	322	0	0	728
2018	106	20	232	347	1	0	706
2019	71	24	238	371	1	0	705

Table 5. Monthly totals of adult salmonids released from the juvenile fish separator at Lower Monumental Dam, 2019.

Month	Chinook	Jack Chinook	Clipped Steelhead	Unclipped Steelhead	Sockeye	Coho	Total
March	1	1	32	56	0	0	90
April	0	0	90	122	0	0	212
May	14	1	96	127	0	0	238
June	28	3	13	36	0	0	80
July	6	5	0	3	0	0	14
August	5	1	0	7	1	0	14
September	17	13	7	20	0	0	57
Total	71	24	238	371	1	0	705

The condition of adult salmonids was evaluated as the fish were released from the separator. Their condition was predominantly good to fair with 87.2% of the fallbacks rated in these

categories (Table 6). Condition ratings of the 705 adults examined were as follows: 504 good (71.5%), 111 fair (15.7%), 78 poor (11.1%), and 12 were dead (1.7%). The number of dead in each species group of adult salmonids was: 2 jack Chinook salmon, 8 clipped steelhead, and 2 unclipped steelhead. Adult Chinook salmon had a higher percentage of good/fair fish (94.4%) than adult steelhead (86.2%).

Table 6. Condition of adult salmonids released from the juvenile fish separator at Lower Monumental Dam, 2019.

Condition	Chinook	Jack Chinook	Clipped Steelhead	Unclipped Steelhead	Sockeye	Coho	Total
Good	59	22	134	288	1	0	504
Fair	8	0	44	59	0	0	111
Poor	4	0	52	22	0	0	78
Dead	0	2	8	2	0	0	12
Total	71	24	238	371	1	0	705

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 2019 by species group was: clipped yearling Chinook salmon 51.0%, unclipped yearling Chinook salmon 47.1%, subyearling Chinook salmon 46.5%, clipped steelhead 88.8%, unclipped steelhead 69.1%, clipped sockeye salmon 44.3%, and unclipped sockeye/kokanee salmon 5.6% (Table 7).

Table 7. Annual separator efficiency in percent at Lower Monumental Dam, 2014–2019.

Year	Clipped Yearling Chinook A-side	Unclipped Yearling Chinook A-side	Subyearling Chinook A-side	Clipped Steelhead B-side	Unclipped Steelhead B-side	Clipped Sockeye A-side	Unclipped Sockeye/ Kokanee A-side
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
2018	64.5	58.8	52.4	90.9	73.2	39.2	36.7
2019	51.0	47.1	46.5	88.8	69.1	44.3	5.6

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, 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 March 9. Sampling for transport began at 0700 hours on April 23, and ended at 0700 hours on August 3.

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. Sampling is not the act of evaluating those groups.

Fish were sampled every other day from March 9 through April 23, and every day from April 23 through July 30, when sampling switched back to every other day. This sampling effort was utilized 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." There was a total number of 7,454 fish sampled during the March 9 through April 23 period. The number sampled within each species group was: 2,109 clipped yearling Chinook salmon, 1,773 unclipped yearling Chinook salmon, 5 unclipped subyearling Chinook salmon, 3,135 clipped steelhead, 406 unclipped steelhead, 6 unclipped sockeye salmon, and 20 coho salmon. Sampling for transport was conducted daily from April 24 through August 1.

Total sampling includes both "sampling for condition" as well as "sampling for transport," which was conducted during the 2019 operating year. A total of 32,508 fish (1.0% of the collection) were sampled in 2019. Within each species group, the number and percent sampled of those collected in that group was: 6,176 clipped yearling Chinook salmon (0.7%), 2,910 unclipped yearling Chinook salmon (1.0%), 4,398 clipped subyearling Chinook salmon (5.5%), 7,866 unclipped subyearling Chinook salmon (5.5%), 8,364 clipped steelhead (0.6%), 2,095 unclipped steelhead (0.6%), 252 clipped sockeye salmon (0.6%), 36 unclipped sockeye/kokanee salmon (1.1%), and 411 coho salmon (1.3%) (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, 2014–2019.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clip/Un.	Total
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
2018	0.6	0.7	3.0	4.6	0.6	0.7	1.1	0.9	1.1	1.0
2019	0.7	1.0	5.5	5.5	0.6	0.6	0.6	1.1	1.3	1.3

Table 9. Weekly sample rates in percent and sample totals at Lower Monumental Dam, 2019.

Week Ending	Weekly Rate (%)	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.	Totals*
14-Mar	36.67	1	24	---	---	0	5	---	2	---	32
21-Mar	15.25	550	583	---	---	230	3	---	2	---	1,368
28-Mar	1.00	353	378	---	---	18	0	---	---	---	749
4-Apr	1.67	219	246	---	---	106	17	---	---	---	588
11-Apr	3.25	458	284	---	---	953	105	---	2	6	1,808
18-Apr	0.50	140	89	---	2	923	132	---	---	4	1,290
25-Apr	0.50	834	300	---	4	2,033	416	---	---	17	3,604
2-May	0.50	960	225	---	1	1,653	429	---	---	15	3,283
9-May	0.50	740	146	---	1	741	205	---	---	7	1,840
16-May	0.79	1,030	225	1	2	662	272	---	3	26	2,221
23-May	0.50	709	165	12	18	348	159	191	11	45	1,658
30-May	2.57	147	101	481	835	346	173	60	8	113	2,264
6-Jun	1.86	22	41	391	760	177	95	1	2	66	1,555
13-Jun	4.71	9	41	689	829	76	52	---	5	62	1,763
20-Jun	15.71	1	10	534	583	39	13	---	0	10	1,190
27-Jun	12.86	1	29	666	798	33	12	---	1	19	1,559
4-Jul	28.57	2	11	326	365	7	3	---	---	9	723
11-Jul	23.93	---	5	541	791	2	1	---	---	7	1,347
18-Jul	11.43	---	2	222	500	1	1	---	---	2	728
25-Jul	50.00	---	3	188	517	6	0	---	---	2	716
1-Aug	64.29	---	2	69	268	3	1	---	---	1	344
8-Aug	100.00	---	---	67	286	3	---	---	---	---	356
15-Aug	100.00	---	---	53	238	---	---	---	---	---	291
22-Aug	100.00	---	---	37	205	1	---	---	---	---	243
29-Aug	100.00	---	---	27	145	3	---	---	---	---	175
5-Sep	100.00	---	---	46	311	---	---	---	---	---	357
12-Sep	100.00	---	---	24	213	---	---	---	---	---	237
19-Sep	100.00	---	---	17	144	---	1	---	---	---	162
26-Sep	100.00	---	---	7	48	---	---	---	---	---	55
3-Oct	10.00	---	---	0	2	---	---	---	---	---	2
Total Sampled		6,176	2,910	4,398	7,866	8,354	2,095	252	36	411	32,508
% of Sample		19.0	9.0	13.5	24.2	25.7	6.4	0.8	0.1	1.0	100.0
% of Collection		0.7	1.0	5.5	5.5	0.6	0.6	0.6	1.1	1.3	1.0

* Daily 24-hour sampling at Lower Monumental Dam began this year on April 23.

Transportation

An estimated 2,135,952 juvenile salmonids (68.2% of the collection) were transported from Lower Monumental Dam in 2019. Of these, 74 were transported by truck and approximately 2,135,878 by barge. Within each species group, the number transported and percent of those collected in each group was: 663,488 clipped yearling Chinook salmon (74.8%), 158,459 unclipped yearling Chinook salmon (54.7%), 79,363 clipped subyearling Chinook salmon (98.7%), 138,752 unclipped subyearling Chinook salmon (97.0%), 786,714 clipped steelhead (59.1%), 237,927 unclipped steelhead (73.3%), 40,873 clipped sockeye salmon (100.0%), 3,104 unclipped sockeye/kokanee salmon (96.0%), and 27,272 coho salmon (88.8%). 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 1, 2019 at 0700 hours, through September 30, 2019 at 0700 hours. Per the 2019 Fish Passage Plan, The Lower Monumental Trucking schedule was contingent upon fish numbers. August 3, 2019 was the third consecutive day with fewer than 50 smolts collected. Therefore, trucking was ceased after the second trip.

A total of 74 fish (0.002% of the collection) were transported by truck in 2019 (Table 2). Within each species group, the number trucked was: 13 clipped subyearling Chinook salmon, 59 unclipped subyearling Chinook salmon, and 2 clipped steelhead.

Juvenile fish collected at Lower Monumental Dam from April 23 through July 30 at 1500 hours were transported by barge. An estimated 2,135,878 (68.2% of the collection) were transported by barge in 2019 (Table 2). Within each species group, the number barged and percent of those collected in each group was: 663,488 clipped yearling Chinook salmon (74.8%), 158,459 unclipped yearling Chinook salmon (54.7%), 79,350 clipped subyearling Chinook salmon (98.7%), 138,693 unclipped subyearling Chinook salmon (97.0%), 786,712 clipped steelhead (59.1%), 237,927 unclipped steelhead (73.3%), 40,873 clipped sockeye salmon (100.0%), 3,104 unclipped sockeye/kokanee salmon (96.0%), and 27,272 coho salmon (88.8%).

Bypass

During the 2019 season (March 9 to September 30) a total of 992,548 fish were bypassed (31.7% of the collection) (Table 2). Within each species group, the number bypassed and percent of those collected in each group was: 222,211 clipped yearling Chinook salmon (25.1%), 131,218 unclipped yearling Chinook salmon (45.3%), 886 clipped subyearling Chinook salmon (1.1%), 4,139 unclipped subyearling Chinook salmon (2.9%), 543,987 clipped steelhead (40.9%), 86,555 unclipped steelhead (26.7%), 128 unclipped sockeye/kokanee salmon (4.0%), and 3,424 coho salmon (11.2%). 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 March 9 through 0700 hours on April 23 (see condition sampling frequency in sampling section). A total of 806,875 fish were bypassed during this period. Within each species group, the number bypassed was: 176,689 clipped yearling Chinook salmon, 120,118 unclipped yearling Chinook salmon, 1,000 unclipped subyearling Chinook salmon, 443,164 clipped steelhead, 62,776 unclipped steelhead, 128 unclipped sockeye/kokanee salmon, and 3,000 coho salmon. These numbers include fish examined for GBT during this primary bypass period.

2. Condition sampling and secondary bypass occurred from 0700 hours August 3 through 0700 hours on September 30. A total of 1,837 fish were bypassed during this period. Within each species group, the number bypassed was: 266 clipped subyearling Chinook

salmon, 1,564 unclipped subyearling Chinook salmon, 6 clipped steelhead, and 1 unclipped steelhead.

3. Salmonid fry measuring less than 60 millimeters (mm) were bypassed and not sampled due to smolt monitoring protocol.

4. The PTAGIS3 database revealed 55,646 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 are being collected for research to prevent anesthetizing study fish a second time.

5. Large numbers of steelhead passing the project during the first week of collection for transportation led to several incidences of fish being bypassed either via secondary bypass or releasing raceways back to the river due to constraints of raceway and barge hold capacities. This explains the bypassed fish the first two days of transport season on Appendix Table 1.

The fish rearing designation used by PTAGIS is hatchery/wild, not clipped/unclipped; therefore, the hatchery/wild designation is 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 56,646. The total by unit group was: 9,804 hatchery spring Chinook salmon, 2,917 hatchery summer Chinook salmon, 4,911 hatchery fall Chinook salmon, 782 hatchery Chinook salmon of unknown run, 1,738 wild spring Chinook salmon, 1,251 wild summer Chinook salmon, 12 wild fall Chinook salmon, 1,528 wild Chinook salmon of unknown run, 4 Chinook salmon of unknown run or rearing disposition, 24,972 hatchery steelhead, 5,799 wild steelhead, 4 steelhead of unknown rearing, 46 steelhead of unknown run or rearing disposition, 1,395 hatchery sockeye salmon, 280 wild sockeye salmon and 182 hatchery coho salmon. 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 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 2019 included: juvenile Pacific lamprey (65,843), juvenile shad (40,529), Siberian prawn (2,812), largemouth/smallmouth bass (1,053),

walleye (656), sculpin (647), Chiselmouth (607), yellow perch (401), and juvenile brown Pacific lamprey (388).

The number of juvenile shad (40,529) in 2019 is far less than the 72,363 collected in the 2018 operating year. Other incidental fish species numbers collected at the facility have increased, such as juvenile Pacific lamprey. In the 2019 season, 65,843 juvenile Pacific lamprey were collected, and only 54,404 were collected in the 2018 season. Walleye numbers have also increased from the 2018 to the 2019 season. Approximately 656 walleye were collected in the 2019 season, while only 352 were collected in the 2018 season. The number of suckers collected dropped from approximately 5,116 in the 2018 season, to 295 in 2019. Estimated numbers of some groups may also become exaggerated high or low due to the low sample rates at the time of their collection.

Some variability in past years is explained by facility problems that have been found and corrected; however, some incidental species show mild to strong decline. Approximately 255 bullhead were collected in 2018, while only 25 were collected in 2019. The estimated collection of brown lamprey in 2016 was 74 while the 2017 collection saw a rapid increase in numbers with 814. In 2018 approximately 1,377 brown lamprey were collected, while only 388 were collected in 2019. A summary of incidental fish collection is provided in Table 10.

Table 10. Estimated collection of incidental species at Lower Monumental Dam, 2019.

Common Name	Scientific Name	Exp. Sample	Separator	Total Collection[1]
American Shad (Adult)	*Alosa sapidissima*	9	137	146
American Shad (Juvenile)	*A. sapidissima*	38,369	2,160	40,529
Banded Killifish	*Fundulus diaphanus*	0	0	0
Bullhead (misc.)	*Ameiurus* spp.	20	5	25
Bull Trout	*Salvelinus confluentus*	0	0	0
Channel Catfish	*Ictalurus punctatus*	27	29	56
Chiselmouth	*Acrocheilus alutaceus*	606	1	607
Common Carp	*Cyprinus carpio*	99	57	156
Crappie	*Pomoxis* spp.	95	7	102
Kokanee	*Oncorhynchus nerka*	2	0	2
Mosquitofish	*Gambusia affinis*	0	0	0
Northern Pikeminnow	*Ptychocheilus oregonensis*	1	0	1
Pacific Lamprey (Adult)	*Lampetra tridentatus*	64	3	67
Pacific Lamprey (Juvenile)	*L. tridentatus*	65,843	0	65,843
Pacific Lamprey (Ammocoete)	*L. tridentatus*	388	0	388
Peamouth	*Mylocheilus caurinus*	12	0	12
Rainbow Trout	*O. mykiss*	0	16	16
Redside Shiner	*Richardsonius balteatus*	0	0	0
Sandroller	*Percopsis transmontana*	0	0	0
Sculpin	*Cottus* spp.	647	0	647
Siberian Shrimp/Prawn	*Exopalaemon modestus*	2,812	0	2,812
Largemouth/Smallmouth Bass	*Micropterus dolomieu/salmoides*	1,051	2	1,053
Sucker (Misc.)	*Catostomus* spp.	211	84	295
Sunfish (Misc.)	*Lepomis* spp.	0	0	0
Tadpole Madtom	*Noturus gyrinus*	0	0	0
Whitefish	*Prosopium* spp.	216	0	216
White Sturgeon	*Acipenser transmontanus*	0	7	7
Walleye	*Sander vitreus*	526	130	656
Warmouth	*Lepomis gulosus*	0	0	0
Yellow Perch	*Perca flavescens*	378	23	401
Others	----------	200	1	201
Total		111,576	2,662	114,238

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 2019 was 2.2%. The annual descaling rate by species group was: clipped yearling Chinook salmon (1.6%), unclipped yearling Chinook salmon (1.6%), clipped subyearling Chinook salmon (2.7%), unclipped subyearling Chinook salmon (2.2%), clipped steelhead (2.5%), unclipped steelhead (2.9%), clipped sockeye salmon (2.4%), unclipped sockeye/kokanee salmon (0.0%), and coho salmon (2.2%) (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 1.7 in 2016 to a high of 2.6% in 2015.

In 2019, the highest weekly descaling rate for all species combined was 5.4% for the week ending September 5 (with 357 fish sampled in a week of condition sampling), while the lowest rate (0.0%) occurred in the weeks ending March 14 and October 3 (Table 12). Daily descaling rates are provided in Appendix Table 3.

Table 11. Annual descaling rates in percent for fish sampled at Lower Monumental Dam, 2014–2019.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clip/Un.	Total
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
2018	2.0	2.0	1.7	1.5	2.1	2.9	2.4	1.3	1.9	1.9
2019	1.6	1.6	2.7	2.2	2.5	2.9	2.4	0.0	2.2	2.2

Table 12. Weekly descaling rates in percent for fish sampled at Lower Monumental Dam, 2019.

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
14-Mar	0.00	0.00	---	---	---	0.00	---	0.00	---	0.00
21-Mar	0.18	1.55	---	---	0.00	33.33	---	0.00	---	0.81
28-Mar	0.28	0.00	---	---	0.00	---	---	---	---	0.13
4-Apr	0.46	0.81	---	---	1.89	0.00	---	---	---	0.85
11-Apr	0.87	2.11	---	---	1.68	0.00	---	0.00	0.00	1.44
18-Apr	0.00	1.14	---	---	1.84	0.76	---	---	0.00	1.48
25-Apr	1.20	1.67	---	---	1.97	1.92	---	---	0.00	1.75
2-May	1.98	1.78	---	---	2.18	2.57	---	---	0.00	2.13
9-May	1.49	1.37	---	---	2.70	3.41	---	---	0.00	2.18
16-May	2.43	4.00	0.00	0.00	4.24	3.69	---	0.00	0.00	3.24
23-May	2.54	0.61	0.00	0.00	3.45	5.66	1.57	0.00	0.00	2.60
30-May	2.72	5.00	1.26	0.60	5.81	3.47	5.00	0.00	5.31	2.44
6-Jun	0.00	2.44	1.79	0.80	5.65	3.16	0.00	0.00	1.54	1.81
13-Jun	11.11	0.00	1.16	1.45	2.63	3.92	---	0.00	1.61	1.48
20-Jun	0.00	10.00	2.26	2.24	2.56	0.00	---	---	0.00	2.28
27-Jun	100.00	0.00	1.80	0.88	6.67	14.29	0.00	0.00	0.00	1.54
4-Jul	0.00	0.00	4.29	2.48	0.00	0.00	---	---	11.11	3.33
11-Jul	---	0.00	4.07	2.41	50.00	0.00	---	---	0.00	3.12
18-Jul	---	0.00	4.07	4.20	0.00	0.00	---	---	0.00	4.13
25-Jul	---	0.00	5.88	4.67	16.67	---	---	---	0.00	5.06
1-Aug	---	0.00	2.90	1.12	0.00	0.00	---	---	0.00	1.46
8-Aug	---	---	4.55	2.45	0.00	---	---	---	---	2.82
15-Aug	---	---	1.89	4.64	---	---	---	---	---	4.14
22-Aug	---	---	2.86	3.03	0.00	---	---	---	---	2.99
29-Aug	---	---	0.00	4.26	0.00	---	---	---	---	3.51
5-Sep	---	---	11.11	4.55	---	---	---	---	---	5.38
12-Sep	---	---	0.00	3.29	---	---	---	---	---	2.95
19-Sep	---	---	11.76	2.08	---	0.00	---	---	---	3.09
26-Sep	---	---	14.29	2.17	---	---	---	---	---	3.77
3-Oct	---	---	---	0.00	---	---	---	---	---	0.00
10-Oct	---	---	---	---	---	---	---	---	---	---
Total Descaled	96	46	116	174	208	60	6	0	9	715
Total Examined	6,169	2,904	4,385	7,821	8,347	2,098	253	36	410	32,423
Percent Descaled	1.6	1.6	2.7	2.2	2.5	2.9	2.4	0.0	2.2	2.2

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

Other Injury and Disease

Injury and disease data were collected from a subsample of 100 of the dominant species and not more than 100 each of the non-dominant species. A total of 24,206 fish were examined for condition. The most common symptoms observed in 2019 were pink fin (3,244 affected fish) and fin injury (2,562 affected fish). A vast majority of fin injuries were observed to be split 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.

Blood pooling is defined as the vasodilatation of the capillaries in fins (also referred to as pink fin). 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 3,244 (13.4%) of all fish examined. The incidence of blood pooling by species group was: Chinook salmon (10.1%), steelhead (3.3%), and sockeye/kokanee/coho salmon (<0.1%).

Fin injuries were found on 2,562 (10.6%) of all fish examined. The incidence of fin injury was: Chinook salmon (8.7%), steelhead (1.4%), and sockeye/kokanee/coho salmon (0.5%). Fin hemorrhaging often 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 964 (4.0%) of all fish examined for injuries. The incidence of fin hemorrhaging was: Chinook salmon (3.9%), steelhead (0.1%), sockeye/kokanee/coho salmon (<0.1%). Other common injuries included: bird marks, fish marks, fungus, and *Columnaris*.

Bird marks were observed on 294 (1.2%) of all fish examined. The incidence of bird marks was: Chinook salmon (0.6%), steelhead (0.6%), and sockeye/kokanee/coho salmon (<0.1%).

Fish marks were found on 198 (0.8%) of all fish examined. The incidence of fish marks was: Chinook salmon (0.5%), steelhead (0.3%), and sockeye/kokanee/coho salmon (<0.1%).

Fungus was found on 25 (0.1%) of all fish examined. There were zero instances of fungus found on 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. The incidence of fungus was: Chinook salmon (<0.1%), steelhead (<0.1%), and sockeye/kokanee (<0.1%).

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. *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, subyearling Chinook salmon showed the greatest number of *Columnaris*: 80 affected fish (0.3%).

Mortality

Annual facility mortality for all groups combined was <0.1% in 2019 (Table 13) and totaled 1,552 fish. Within each species group, the number of facility mortalities and percent of those collected in that group was: 873 clipped yearling Chinook salmon (0.1%), 169 unclipped yearling Chinook salmon (<0.1%), 152 clipped subyearling Chinook salmon (0.2%), 101 unclipped subyearling Chinook salmon (<0.1%), 205 clipped steelhead (<0.1%), 45 unclipped steelhead (<0.1%), 2 clipped sockeye salmon (<0.1%), 1 unclipped sockeye/kokanee salmon (<0.1%), and 4 coho salmon (<0.1%). In 2019, weekly mortality rates reached a high of 3.7% for the week ending August 22 and a low of 0.0% for multiple weeks (Table 14). Daily mortality rates are provided in Appendix Table 3.

Annual sample mortality for all groups combined was 0.2% in 2019 (Table 15) and totaled 74 fish. The number of sample mortalities and mortality rate by species group was: 7 clipped yearling Chinook salmon (0.1%), 6 unclipped yearling Chinook salmon (0.2%), 14 clipped subyearling Chinook salmon (0.3%), 33 unclipped subyearling Chinook salmon (0.4%), 10 clipped steelhead (0.1%), 3 unclipped steelhead (0.1%), and 1 coho salmon (0.7%). There were no clipped or unclipped sockeye salmon sample mortalities in 2019.

Table 13. Annual facility mortality in percent at Lower Monumental Dam, 2014–2019.

	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
Year	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clip/Un.	Total
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
2018	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.2	0.0	0.0
2019	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1

Table 14. Weekly facility mortality rates in percent at Lower Monumental Dam, 2019.

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
14-Mar	0.00	0.00	---	---	---	0.00	---	0.00	---	0.00
21-Mar	0.04	0.03	---	---	0.00	0.00	---	0.00	---	0.02
28-Mar	0.00	0.01	---	---	0.00	---	---	---	---	0.00
4-Apr	0.00	0.00	---	---	0.00	0.00	---	---	---	0.00
11-Apr	0.00	0.00	---	---	0.00	0.00	---	0.00	0.00	0.00
18-Apr	0.00	0.01	---	0.00	0.00	0.00	---	---	0.00	0.00
25-Apr	0.00	0.01	---	0.00	0.00	0.00	---	---	0.00	0.00
2-May	0.17	0.17	---	0.00	0.01	0.01	---	---	0.00	0.07
9-May	0.04	0.06	---	0.00	0.02	0.01	---	--	0.00	0.03
16-May	0.19	0.04	0.00	0.00	0.06	0.02	---	0.00	0.00	0.11
23-May	0.11	0.08	0.04	0.00	0.06	0.03	0.00	0.00	0.00	0.07
30-May	0.80	0.24	0.13	0.05	0.15	0.09	0.00	0.00	0.00	0.14
6-Jun	1.96	0.93	0.20	0.05	0.18	0.06	2.00	0.50	0.12	0.15
13-Jun	0.00	0.00	0.13	0.02	0.31	0.14	---	0.00	0.00	0.08
20-Jun	0.00	0.00	0.13	0.20	0.00	4.21	---	---	0.00	0.21
27-Jun	33.33	0.00	0.23	0.10	0.41	0.00	---	0.00	0.00	0.18
4-Jul	0.00	0.00	0.00	0.25	0.00	0.00	---	---	0.00	0.13
11-Jul	---	6.67	0.34	0.07	0.00	0.00	---	---	0.00	0.20
18-Jul	---	0.00	0.78	0.09	0.00	0.00	---	---	0.00	0.30
25-Jul	---	0.00	0.78	0.37	0.00	---	---	---	0.00	0.47
1-Aug	---	0.00	0.00	0.20	25.00	0.00	---	---	0.00	0.31
8-Aug	---	---	1.49	0.00	0.00	---	---	---	---	0.28
15-Aug	---	---	0.00	0.42	---	---	---	---	---	0.34
22-Aug	---	---	5.41	3.41	0.00	---	---	---	---	3.70
29-Aug	---	---	0.00	2.76	0.00	---	---	---	---	2.29
5-Sep	---	---	2.17	1.61	---	---	---	---	---	1.68
12-Sep	---	---	0.00	0.47	---	---	---	---	---	0.42
19-Sep	---	---	0.00	0.00	---	0.00	---	---	---	0.00
26-Sep	---	---	0.00	4.17	---	---	---	---	---	3.64
3-Oct	---	---	0.00	0.00	---	---	---	---	---	0.00
10-Oct	---	---	---	---	---	---	---	---	---	---

--- No fish collected during the week

Table 15. Annual sample mortality in percent at Lower Monumental Dam, 2014–2019.

Year	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	Total
	Clipped	Unclip	Clipped	Unclip.	Clipped	Unclip.	Clipped	Unclip.	Clip/Un.	
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
2018	0.1	0.1	0.2	0.2	0.1	0.0	0.7	1.3	0.0	0.2
2019	0.1	0.2	0.3	0.4	0.1	0.1	0.0	0.0	0.7	0.2

Research Summary

Gas Bubble Trauma Monitoring (PSMFC)

Juvenile Chinook salmon and steelhead were sampled once a week for GBT from April 11 through July 24 in 2019. The GBT inspections were stopped early due to small numbers of available fish. Typically, inspections end when spill stops (August 31). This season, 1,302 fish were sampled for GBT. PSMFC personnel examined up to 100 individuals of each of the following groups: yearling Chinook salmon, subyearling Chinook salmon, and juvenile steelhead. The fish were searched 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 4 hours or until 100 fish had been sampled per species group. The number of fish sampled for GBT, by species group, was: 244 clipped yearling Chinook salmon, 75 unclipped yearling Chinook salmon, 177 clipped subyearling Chinook salmon, 311 unclipped subyearling Chinook salmon, 382 clipped steelhead, and 113 unclipped steelhead. In the 2019 season, 24 fish showed signs of GBT in the fins (1.84%).

Facility Operations and Maintenance

Turbine Operations

Efforts were made to operate all turbine units within 1% of peak efficiency from April 1, 2019, to October 31, 2019. 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 December 16, 2019.

Unit	Dates out of service	Reason out of service
All Units	February 25 - 27	STS installation
All Units	Monthly(2-3 days)	STS/VBS inspection/hub tapping on fixed blade units
All Units	January 29 – 30 May 20 - 22	Trash rack raking (6-8 hrs/day alternating units)
All Units	December 16 - 17	STS removal
All Units	July 23	Power Outage
All Units	July 25 – August 2	Doble Testing (Units 5 & 6 on service during none day shift working hours)
Units 1–4	April 17 - 18	Trash rack raking (6-8 hrs/day alternating units)
Units 2–6	June 17 – 19	Trash rack raking (6-8 hrs/day alternating units)
Units 2-3	April 26 – July 12 weekly on Fridays	Fish guidance efficiency study headgate installation.
Units 1-3	April 16	Fish guidance efficiency study equipment repair dive.
Unit 1	2018 – March 1	Rehab/rewind
	March 27	PSS set points and operations check.
	May 28 – July 10	Digital governor installation
Unit 2	January 15	Hub tapping
	July 15 – 2020	Annual/Draft tube liner rehab
Unit 3	September 7 – 9	Smoke alarm
	September 12 – 17	Faulty smoke sensor
	September 25	Stator coolers
Unit 4	2018 – March 1	Inspection of Oil Governor System/blade seal replacement/annual/cavitation Repair
	March 1 – 29	Dislodged rotor counterweight
	June 10 – 11	Distributing valve modification
	July 8 – 29	Annual maintenance
	October 9 – December 23	Governor control/Blade seal leak check
Unit 5	February 19	Trash rack raking
	June 11 – 13	Distributing valve modification
	October 3 – December 23	Governor control
Unit 6	January 30	Hub tapping
	February 13 – 27	Water intrusion into hub
	May 10 – 14	Top plate pump failure/Hub oil removal
	June 12	Cylinder move
	June 13	Governor work
	August 5 – November 25	6 year annual

Debris/Trash Racks

In 2019, trash rack raking occurred April 17-18, May 20-22 and June 17-19. Several truck loads of debris were removed during each effort.

Submersible Traveling Screens

The STS's were inspected and tested on February 21, 2019. STS's for units 1, 2, and 3 were installed February 25 and 26, 2019 and units 4, 5 and 6 were installed March 27, 2019. The STS in gatewell 4A was found with three tears in the screen during inspection on April 3, 2019. The STS was lifted and the screen was repaired prior to the next morning. The STS was redeployed on April 4, 2019. The STS screen in gatewell 1B was found not rotating during August 7 inspection. The STS was swapped out with a spare screen.

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. The STSs were operated in cycle mode until 1500 hours on May 16. At this time, they were changed to continuous mode due to average sockeye lengths less than 120 mm. At 1230 on July 11, average subyearling Chinook and sockeye lengths allowed for the screens to return to cycle mode.

Vertical Barrier Screens

The VBS in gatewell 4B was inspected on August 12, 2019 and found to be in good working order. The VBS in gatewell 5A was inspected on November 26, 2019 and found to be in good working order. The VBS in gatewell 6A was inspected on August 20, 2019 and also found to be in good working order. All visual VBS inspections were conducted via crane and man basket.

Gatewells

During the 2019 season, gatewells did not exceeded 50% debris criteria on any inspections.

Orifices/Collection Channel

During the 2019 season, the number of open orifices varied from 17 to 20 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 back-flushed with air daily to remove debris. Orifice 9 was found to have sticks protruding from it on May 7. Orifice 15 was also found to have a blockage June 5. Powerhouse maintenance crews were informed and the blockages were cleared. Orifice lights were also checked daily. If a light was not working, flow was directed to the other orifice in the slot until repairs could be made.

Primary Dewaterer

The compressed air screen cleaner functioned well throughout the 2019 season. The PDW mechanical screen cleaner brush was removed from service on May 19 due to a snapped drive belt and returned to service when a new belt was installed on May 30. The mechanical screen cleaner intermittently malfunctioned from June 24 until the end of the season. Electricians identified the problem and plan on replacing antiquated PLC's and rotary switches during winter maintenance outage. This problem 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. The pneumatic B-side PIT tag bypass cylinder was replaced in 2019 with a prototype electric cylinder. The electrical systems are far more efficient and require significantly less maintenance than the historic pneumatic systems. The prototype cylinder was a success and the A-side will also be transitioned to an electrical system prior to the 2020 season.

Barge Loading Operations

Fish were transported by barge from April 24 through July 30. Barge loading at Lower Monumental occurred without any issues during the 2019 transport season.

Truck Loading Operations

Juvenile fish were scheduled to be transported by truck from August 1 to October 1. Per 2019 Fish Passage Plan, the Lower Monumental trucking schedule is contingent upon fish numbers. Saturday, August 3, was the third consecutive day with less than 50 smolts collected, therefore trucking ceased after the second trip. Truck transport never resumed in 2019.

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 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 has been discussed with District Engineers, and they believe it can be accomplished.

APPENDIX TABLES

Appendix Table 1. Daily collection and bypass numbers and river conditions at Lower Monumental Dam, 2019.

See Excel Spreadsheet "Fish Numbers LoMo_2019.xls."

Appendix Table 2. Daily number of fish trucked and barged from Lower Monumental Dam, 2019.

See Excel Spreadsheet "Fish Numbers LoMo_2019.xls."

Appendix Table 3. Percent descaling and daily facility mortality numbers at Lower Monumental Dam, 2019.

See Excel Spreadsheet "Fish Numbers LoMo_2019.xls."

Appendix Table 4. Daily number of adult fallbacks and fallback mortality at Lower Monumental Dam, 2019.

See Excel Spreadsheet "Fish Numbers LoMo_2019.xls."