Hatchery and Supplementation Program

2019 Annual Report

April, 2020

Lewis River Hydroelectric Projects

FERC Project Nos. 935, 2071, 2111, 2213

PACIFICORP
A BERKSHIRE HATHAWAY ENERGY COMPANY

TABLE OF CONTENTS

APPENDICES AND ATTACHMENTS

TABLES

FIGURES

1.0 INTRODUCTION

The purpose of this report is to document results from monitoring and evaluation activities associated with implementing the Hatchery and Supplementation (H&S) program in 2019. Program activities and studies are developed through a collaborative effort of the Hatchery and Supplementation (H&S) Subgroup which are documented within Annual Operating Plans (AOP). The AOP is reviewed and approved by the Aquatic Coordination Committee (ACC) each year. The following key activities were completed as part of the 2019 AOP:

1. Transport of adult late winter steelhead, spring Chinook and coho salmon returns upstream of Swift Dam
2. Production of late winter steelhead smolts using NOR broodstock
3. Abundance and distribution estimates of spawning adults downstream of Merwin Dam.
4. Hatchery production of trout and salmon as stipulated in Section 8 of the Lewis River Settlement Agreement.
5. Ongoing spring Chinook rearing and release evaluations
6. Morphology sampling of pre and post volitional released hatchery juveniles

This report is required by Section 8.2.4 of the Lewis River Settlement Agreement that states:

"On an annual basis, the Licensees shall provide to the ACC for review and comment a report compiling all information gathered pursuant to implementation of the Hatchery and Supplementation Plan. The report also will include recommendations for ongoing management of the Hatchery and Supplementation Program. The ACC shall have 60 days to comment on the annual report. Within 60 days of the close of the comment period, the Licensees shall finalize the report after consideration of all comments. The Licensees shall also provide the comprehensive periodic review undertaken pursuant to Section 8.2.6 below to the ACC. The Licensees shall provide final annual reports and the comprehensive periodic review to the Services during the development of any required ESA permit or authorization for hatchery operations, including NOAA Fisheries' HGMP process. The report may be included as part of the detailed annual reports of the ACC activities required by Section 14.2.6."

2.0 WINTER STEELHEAD

In 2019, the North Fork Lewis River supported three stocks of winter running steelhead:

1. A hatchery produced winter steelhead stock derived from Chambers Creek (Puget Sound) with a peak spawn time of December
2. An endemic natural stock with a peak spawn time in April
3. A fully integrated stock derived from the endemic population but spawned and reared in the hatchery (program or supplementation stock).

The primary goal of the fully integrated program is to produce adult returns that are genetically identical to the late winter steelhead endemic stocks to be used for upstream supplementation.

This program has three main components:

- Collection of broodstock at traps and through in-river netting.
- Spawning and rearing at Merwin Hatchery.
- Transport of returning adults upstream of Swift Dam.

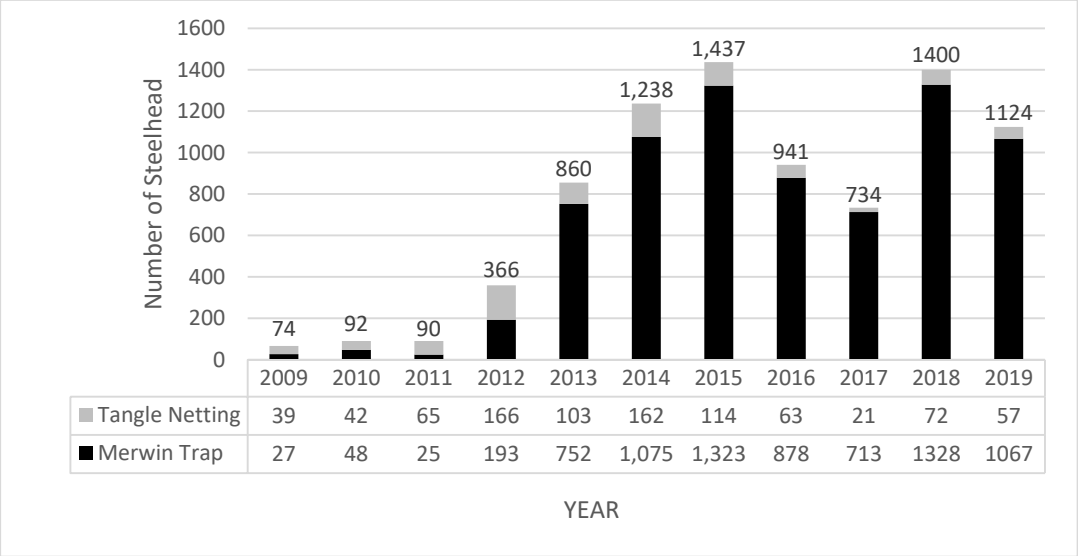

Figure 2-1. Total captures of NOR and BWT late winter steelhead by method between 2009 and 2019 (excludes same year recaptures and adipose fin clipped steelhead)

2.1 Broodstock Collection

In 2019, broodstock collection relied on NOR returns from both the Merwin trap (n=37) and to a lesser extent in-river captures (n=8). All NOR steelhead collected at the Merwin Trap were either transferred to Merwin Hatchery as potential broodstock, or released back to river downstream of Merwin Dam. Sampling data for all steelhead transported to Merwin hatchery are provided in Appendix A.

2.1.1 Merwin Trap

During the period from January 1 through June 21, 2019, a total of 79 NOR and 988 blank wire tagged[1] (BWT) winter steelhead were captured at the Merwin trap (Table 2-1). The ratio of females to males was 0.78 and 1.57 for BWT and NOR, respectively. BWT steelhead represented 91 percent of all captures between BWT and NOR steelhead.

[1] Adult steelhead that possess a blank wire tag in their snout are referred to as BWT steelhead and represent returns from the hatchery supplementation program using native broodstock.

Table 2-1. Origin and gender of late winter steelhead captured at the Merwin Trap from 2015 to 2019 (period between January and July)

		2015	2016	2017	2018	2019
NOR						
	Males	40	26	47	46	51
	Females	28	23	43	72	28
HOR (BWT)						
	Males	743	403	340	680	511
	Females	504	414	283	530	477

Figure 2-2 illustrates the cumulative proportion of both NOR and BWT steelhead captured during the first six months of 2019. As in previous years, BWT returns to the Merwin Trap begin earlier than NOR winter steelhead and achieve 50 percent collection earlier.

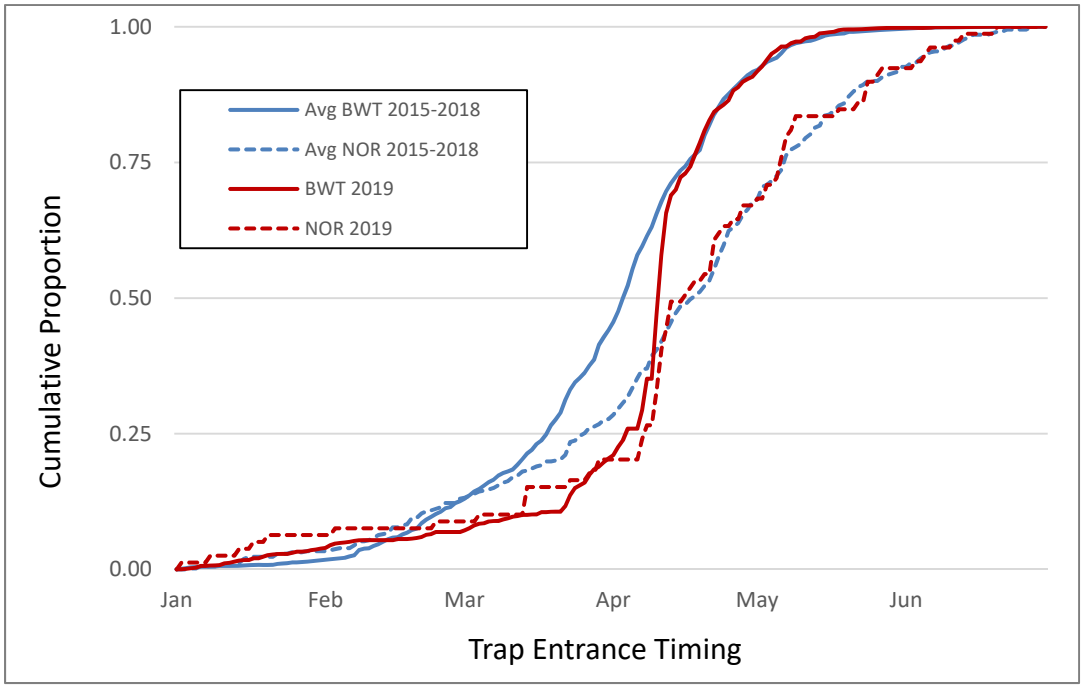

Figure 2-2. Cumulative proportion of NOR and BWT late winter steelhead trapped at the Merwin Collection Facility for the years between 2015 and 2018 (average) and 2019

2.1.2 Tangle Netting

Tangle netting efforts began on February 22, 2018 and continued through May 2, 2018. A total of 21 netting days were conducted during this period. Table 2-2 provides a summary of late winter steelhead captured for the 21 days of effort.

Table 2-2. Origin, gender and disposition of late winter steelhead captured through tangle netting between 2015 and 2019 (excludes same year recaptures)

Disposition	2015		2016		2017		2018		2019		TOTAL
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
NOR shipped to Merwin	10	6	16	6	7	1	3	0	6	2	57
Upstream Transport	20	4	0	0	0	0	0	0	0	0	24
NOR Released on site	28	5	14	4	1	1	20	18	13	7	111
BWT Released on site	23	7	15	7	6	5	16	14	20	8	121
AD Clip (Euthanized)	0	4	0	1	0	0	0	3	1	0	9
AD Clip (released)	1	3	0	1	0	0	0	0	0	0	5
Mortality	0	0	1	0	0	0	1	0	0	0	2
TOTAL	82	29	46	19	14	7	40	35	40	17	329

In total, 57 steelhead were handled through the tangle netting program. Of these, 28 (49 %) were of natural origin and 29 (51 %) were of hatchery origin (Table 2-3).

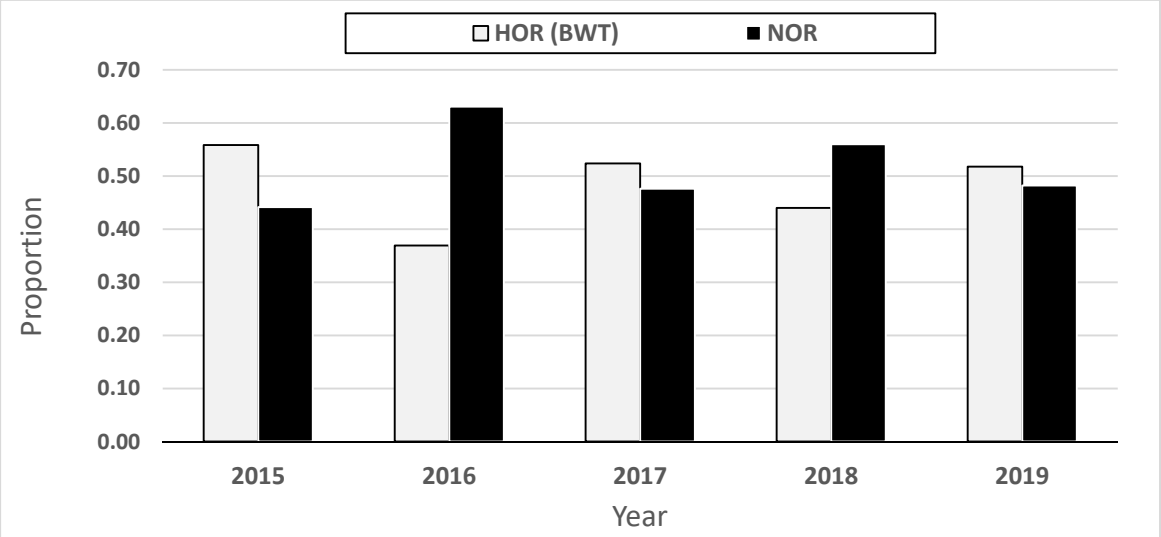

Figure 2-3. Composition of late winter steelhead captured by year through tangle netting from 2015 to 2019

Table 2-3. Composition of late winter steelhead captured by month during tangle netting: 2015-2019

Month	2015		2016		2017		2018		2019		TOTAL	
	HOR (BWT)	NOR	HOR (BWT)	NOR	HOR (BWT)	NOR	HOR (BWT)	NOR	HOR (BWT)	NOR	HOR (BWT)	NOR
February	19	7	0	0	0	0	8	7	1	1	28	15
March	23	21	12	11	3	1	15	11	15	7	68	51
April	20	21	6	25	8	9	7	20	13	20	54	95
May	0	0	6	5	0	0	3	4	0	0	9	9
TOTALS	62	49	24	41	11	10	33	42	29	28	159	170

2.2 Late Winter Steelhead Broodstock Collection Timing

The ability to conform to predetermined collection curves presents several difficulties in the field. Several variables continue to make broodstock collection challenging including:

- Genetic assignment results may reduce available broodstock being held.
- Spawning maturity in females is highly variable creating uncertainty when deciding to retain or release male broodstock.
- The number of kelts increases substantially from mid to late April.
- Individual fecundity is highly variable

The collection curve proposed in the annual operating plan is intended to help ensure that broodstock are collected across their spawning period. Up to 50 steelhead are spawned over the course of the run with a collection goal total of 75.

In 2018, a total of 93 NOR steelhead were transferred to Merwin Hatchery as potential broodstock. Of these, 46 were spawned and 2 died while being held. All live steelhead (including those spawned) were returned to river. Figure 2-4 shows the actual collection timing of broodstock held at Merwin compared to the proposed timing curve. The actual timing and number of spawners is also provided.

Table 2-4. Actual collection of late winter steelhead broodstock by year and period: 2015 - 2019

Period	Collection Curve (2015 - 2017)	Collection Curve (2018 - present)	2015	2016	2017	2018	2019
Jan - Feb	1	3	5	3	4	3	0
Mar 1 – 15	4	6	4	2	4	7	1
Mar 16 – 31	7	9	13	2	7	8	2
Apr 1 – 15	13	21	12	15	16	20	25
Apr 16 – 30	18	24	10	8	15	14	13
May 1 – 15	5	9	5	6	2	7	4
May 16 – 31	2	3	1	1	0	1	0
Total	50	75	50	37	48	60	45

2.3 Genetic Analysis of Potential Broodstock

The H&S Subgroup agreed to use a primary genetic assignment target level of 50 percent or greater to the NF Lewis River or Cedar Creek stock(s) to be considered acceptable broodstock. After April 1, steelhead may be considered broodstock if assignment probability is 50 percent or greater to Cascade Strata. The only exception to these requirements is any steelhead indicating assignment probabilities to any hatchery stock of more than 5 percent will never be incorporated in the broodstock.

A total of 67 samples were taken from steelhead captured in the Merwin Trap or through in-river capture. All sampled steelhead were assigned a probability percentage as to likelihood of assignment to known baselines established for Lower Columbia River tributaries including the North Fork Lewis River. Probabilities are classified as primary, secondary and tertiary to account for introgression from other basins and provide a more complete picture of diversity present within the samples. Figure 2-4 illustrates the results of primary assignment for all samples between 2009 and 2019. Appendix B provides the tabular genetic assignments results for each individual unclipped steelhead captured at the Merwin trap and tangle netting in 2019.

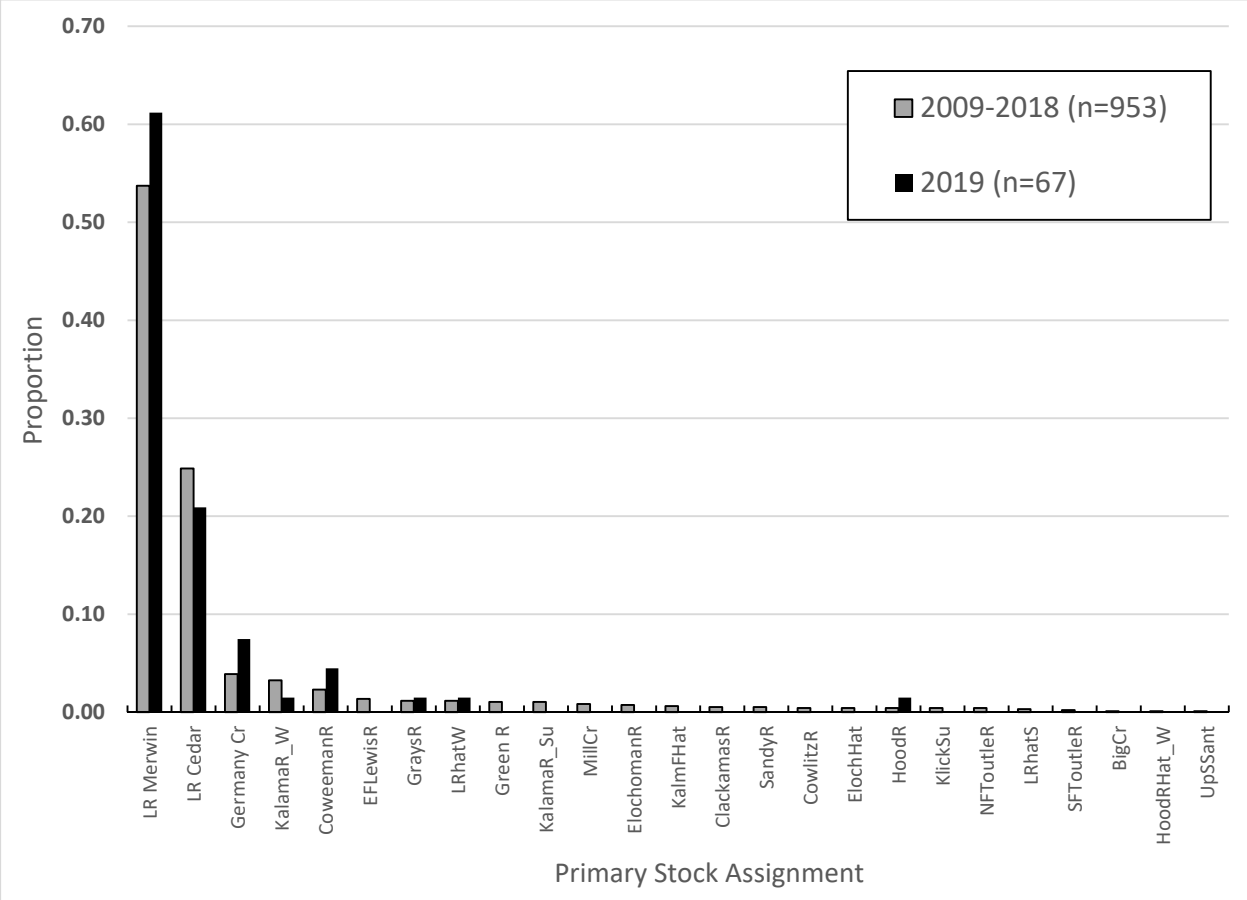

Figure 2-4. Proportion of primary genetic assignment of NOR late winter steelhead collected from the Merwin trap and tangle netting: 2009 - 2019

2.4 Spawning

A total of 32 NOR winter steelhead (16 females, 16 males) were spawned at Merwin Hatchery. However, two spawning crosses were removed representing two females and two males due to unacceptable genetic assignment. With removal of these two crosses, there were 14 spawning crosses representing 28 potential families (Table 2-5, Appendix C).

Table 2-5. Number of spawning crosses and parents including the duration of each spawning periods for brood years between 2009 and 2019

Brood Year	Crosses	Females	Males	Potential Families	Spawn Period	Days
2009	10	12	19		Mar 2 - May 21	81
2010	22	22	24		Mar 17 - May 14	56
2011	9	16	19		Mar 30 - May 18	49
2012	12	19	23		Apr 10 - May 29	49
2013	8	8	11		Apr 10 - May 6	26
2014	26	26	25		Apr 7 - May 16	39
2015	25	25	25		Mar 26 - May 22	58
2016	10	17	20		Apr 8 - May 27	49
2017	10	25	24		Apr 7 - May 19	43
2018	22	22	23	54	Mar 23 - May 25	63
2019*	14	14	14	28	Apr 16 - May 17	32

* two crosses were removed after genetic assignment results were obtained, reducing the number of actual crosses from 16 to 14 (see Appendix C)

2.5 Spawn Timing

Steelhead broodstock are captured over a collection period that extends from February through the first week of May. The purpose of this protocol is to collect steelhead over the course of the run so that a representative sample of the total run is spawned to limit any bias in spawn time or other variables. Collection timing, however, is not a reliable predictor of spawn timing as most fish, regardless of collection time, typically spawn between April 1 and mid-May (Figure 2-5).

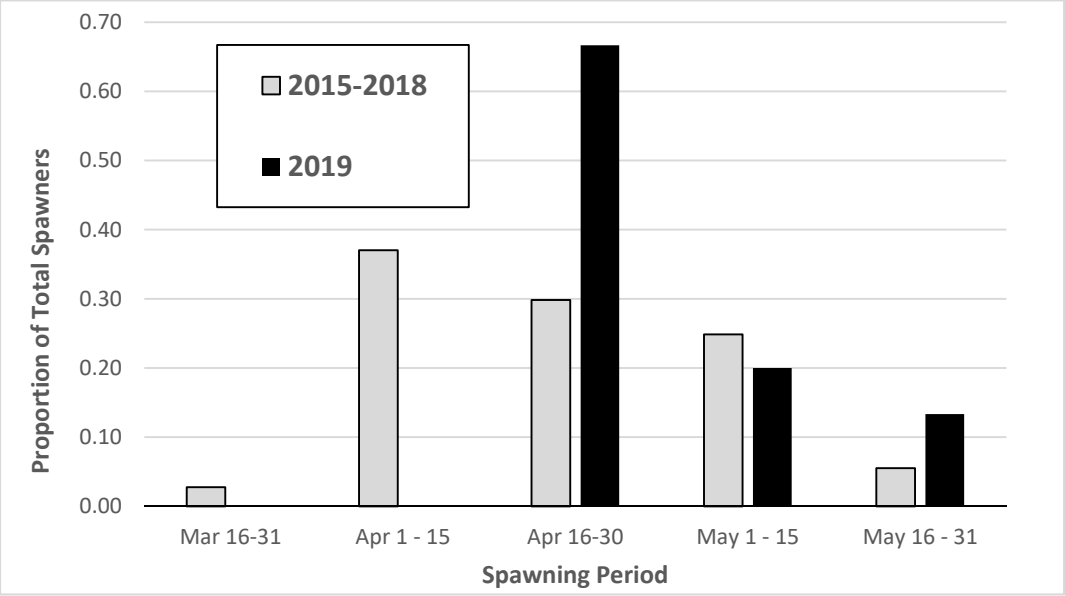

Figure 2-5. Proportion of spawners by period: 2015 - 2019

2.5.1 Tagging

All subyearling steelhead were tagged with a blank wire snout tag in December 2019.

2.5.2 Release

All broodyear 2019 late winter steelhead juveniles will be volitionally released starting on May 1, 2020 at the Merwin boat launch. Volitional release will continue until June 1, 2020. Any fish remaining in the ponds on June 1, 2020 will be forced out and released downstream at the Pekins Ferry Boat Launch (RM 3.1) near the confluence with the East Fork Lewis River. Projected average release size is 8 to 10 fish per pound. A total release number of between 40,000 and 45,000 smolts is projected. This is below the target release of 50,000 and was due to both insufficient broodstock and higher mortality rates from ichthyopthirius infections.

3.0 MONITORING AND EVALUATION

OBJECTIVE 1: Evaluate the Effects of Hatchery Plants on Reintroduced Species.

This objective was moved to the Aquatic Monitoring and Evaluation Plan in 2016 and serves only as a placeholder until the H&S Plan is updated in 2020.

OBJECTIVE 2: Determine Proportion of Hatchery Origin Winter Steelhead, Spring Chinook and Coho Salmon on Spawning Grounds Downstream of Merwin Dam

Late Winter Steelhead

Program returns (BWT) are treated as hatchery origin (HOR) steelhead despite their genotype assignment to NOR stocks. This is due to the hatchery influence during mating and captive rearing conditions during their first year of life. As these program fish return as adults, there is opportunity for these (HOR) fish to spawn with NOR stocks. It has been shown that reproductive success (fitness) declines rapidly (up to 37 percent per captive reared generation) within a natural population (Araki et. al. 2007). The evolutionary mechanisms for declines in fitness are not fully understood, but hatchery protected rearing environments and controlled mating selection are suspected contributors to this decline (Araki et. al. 2007). Inbreeding between program fish is also a concern because of loss in genetic diversity or effective population size further limits fitness and adaptability of the natural spawning population.

Appendix **G** provides the formal analysis and estimates of pHOS for late winter steelhead downstream of Merwin Dam during the 2018 and 2019 sampling seasons. In 2017, there were insufficient numbers of steelhead captured for tagging due to turbidity. PHOS estimates including estimated abundance and resdiualism as provided by the pHOS model are summarized in Table 3-1.

Table 3-1. Summary of pHOS, abundance and residualism rates as estimated by the pHOS model for mainstem North Fork Lewis River late winter steelhead

SPECIES	pHOS % (CI at 90% CL)	Fish Counts		Residualism	
		NOR	HOR	Males	Females
2016	51 (41, 60)	175 (135, 218)	182 (142, 224)	7.7% (4.2-12)	0.7% (0-2.2)
2017	*Insufficient Data*				
2018	*Not yet available, will be provided in the 2020 Annual Report*				
2019	*Insufficient Data*				

Coho Salmon

Carcass surveys are used to estimate abundance of Coho salmon spawning in the mainstem North Fork Lewis River. The origin (hatchery or natural) of each carcass sampled is determined by the presence or absence of an adipose fin. To assign proper origin, all fish are wanded for the presence of a CWT as a portion of the return includes double index tagging (DIT). That is, adipose fin intact, but presence of CWT. An estimate of pHOS is generated by pooling the total number of carcasses sampled (including surveyed tributaries) over the sampling period (Table 3-2). Appendix G provides data and analysis related to coho sampling in the mainstem and tributaries of the North Fork Lewis River during the 2018 and 2019 seasons.

Table 3-2. Origin of sampled Coho carcasses from pooled mainstem and tributary surveys downstream of Merwin Dam with implied pHOS: 2016 - 2019

Year	Carcasses Sampled			
	HOR	NOR	TOTAL	pHOS %
2016	42	39	81	52%
2017	17	20	37	46%
2018	51	11	62	82%
2019	24	26	50	48 %

Chinook Salmon: *Awaiting results from WDFW for 2018 and 2019 Fall Chinook and Chum salmon surveys. It is expected that these results will be available for the 2020 Annual Report.*

Table 3-3. Fall Chinook pHOS estimates for tule and bright stocks downstream of Merwin Dam on the North Fork Lewis River mainstem: 2013 - 2017

	Stock	pHOS
2013		**0.077**
	Tule	*0.33*
	Bright	*0.02*
2014		**0.105**
	Tule	*0.51*
	Bright	*0.01*
2015		**0.180**
	Tule	*0.63*
	Bright	*0.01*
2016		**0.229**
	Tule	*0.60*
	Bright	*0.01*
2017		**0.176**
	Tule	*0.58*
	Bright	*0.02*

Source: Bentley 2018

OBJECTIVE 3: Develop and Monitor Hatchery Protocols to Reduce Hatchery Effects on Juvenile Native and Listed Species Present Downstream of Merwin Dam

Since 2018, morpohological sampling of smolts has been implemented prior to (volitional) and at the end of (forced) volitional release periods. Sampling serves two primary purposes. First, a comparison can be made between hatchery smolts that volitionally leave the facility and those that do not. Secondly, handling smolts allows assessments to be made regarding maturity (e.g., smolt index). This is especially relevant for spring Chinook which are known to achieve sexual maturity as yearlings (mini jacks).

Table 3-4. Average length, weight, smolt indexes and K factors measured during volitional and forced release groups for spring Chinook, Coho salmon and late winter steelhead at the Lewis River hatcheries

Sample Date	Brood Year	Release Group	N	Length (avg, mm)	Weight (avg, g)	Smolt Index (avg)	K factor (avg)
Spring Chinook							
Sep 2018	2017	Volitional	100	144.2	37.7	2.58	1.23
Oct 2018		Forced	112	141.2	34.9	2.48	1.19
Jan 2019		Volitional	223	161.0	49.2		1.14
Feb 2019		Forced	180	144.0	35.8		1.15
Sep 2019	2018	Volitional	101	147.7	37.9		1.17
Oct 2019		Forced	126	135.9	39.4		1.58
Dec 2019		NA	293	145.8	38.6		1.21
Winter Steelhead (Chambers Stock)							
Apr 2018	2017	Volitional	100	200.6	84.7	2.84	1.04
May 2008		Forced	150	195.3	73.5	2.77	0.96
Winter Steelhead (NOR)							
Apr 2018	2017	Volitional	150	165.0	48.5	2.27	1.03
May 2018		Forced	201	147.0	31.1	2.16	0.91
Apr 2019	2018	Volitional	100	161.4	52.0	1.87	1.15
May 2019		Forced	101	176.6	55.2	1.49	0.95
Coho Salmon							
Mar 2018	2017	Volitional	802	130.6	25.6	1.73	1.14
Apr 2018		Forced	310	131.4	27.2	1.77	1.18
Mar 2019	2018	Volitional	347	134.2	28.7	1.97	1.17
Apr 2019		Forced	262	135.4	28.9	2.00	1.15

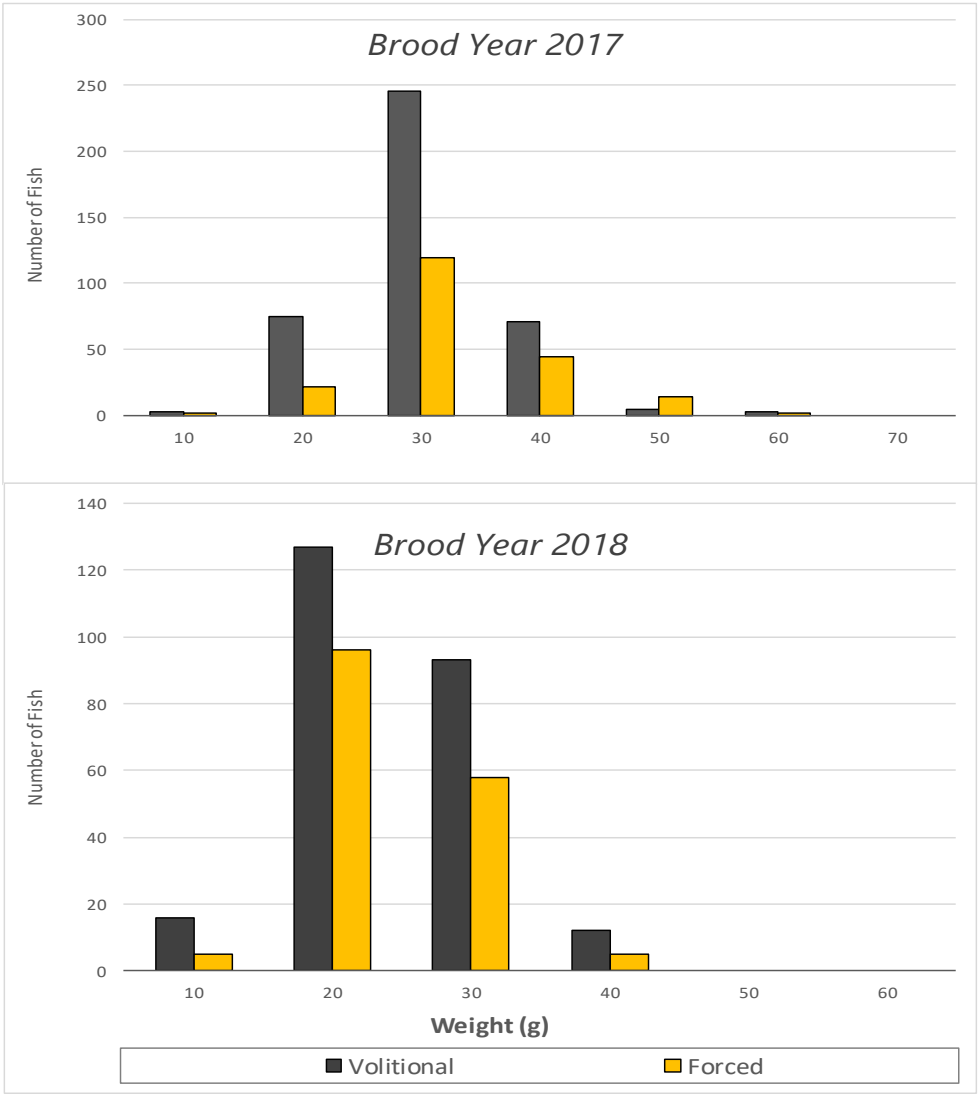

Figure 3-1. Weight frequency of yearling early Coho salmon prior to release (volitional) and at the end of the release period (forced): Brood years 2017 and 2018

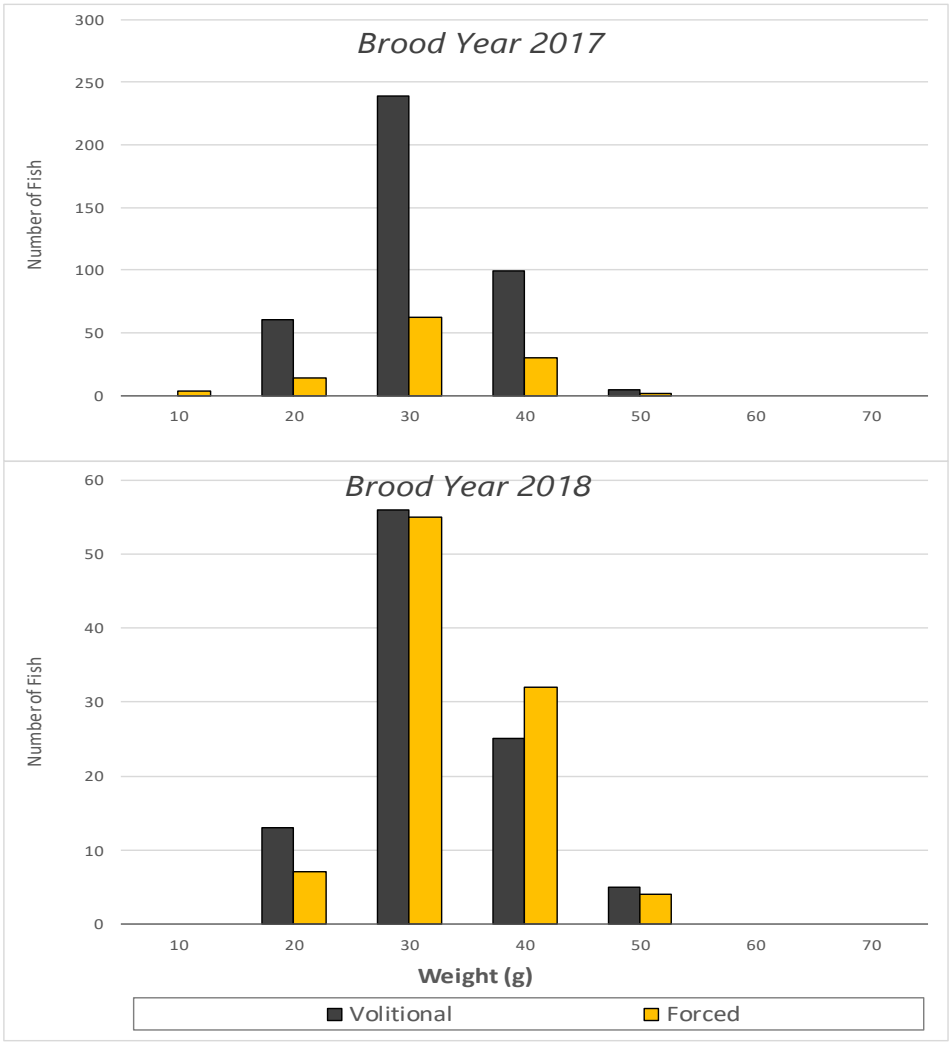

Figure 3-2. Weight frequency of yearling late Coho salmon prior to release (volitional) and at the end of the release period (forced): Brood years 2017 and 2018

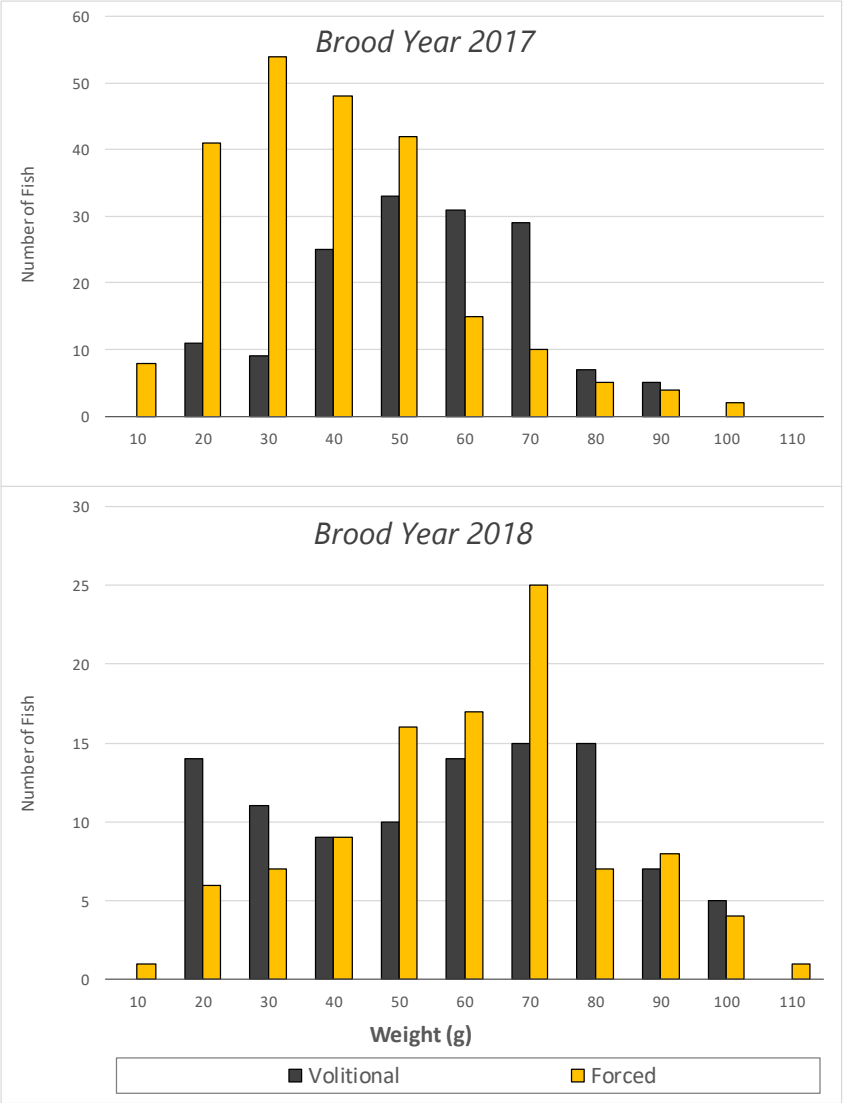

Figure 3-3. Weight frequency of yearling NOR late winter steelhead prior to release (volitional) and at the end of the release period (forced): Brood years 2017 and 2018

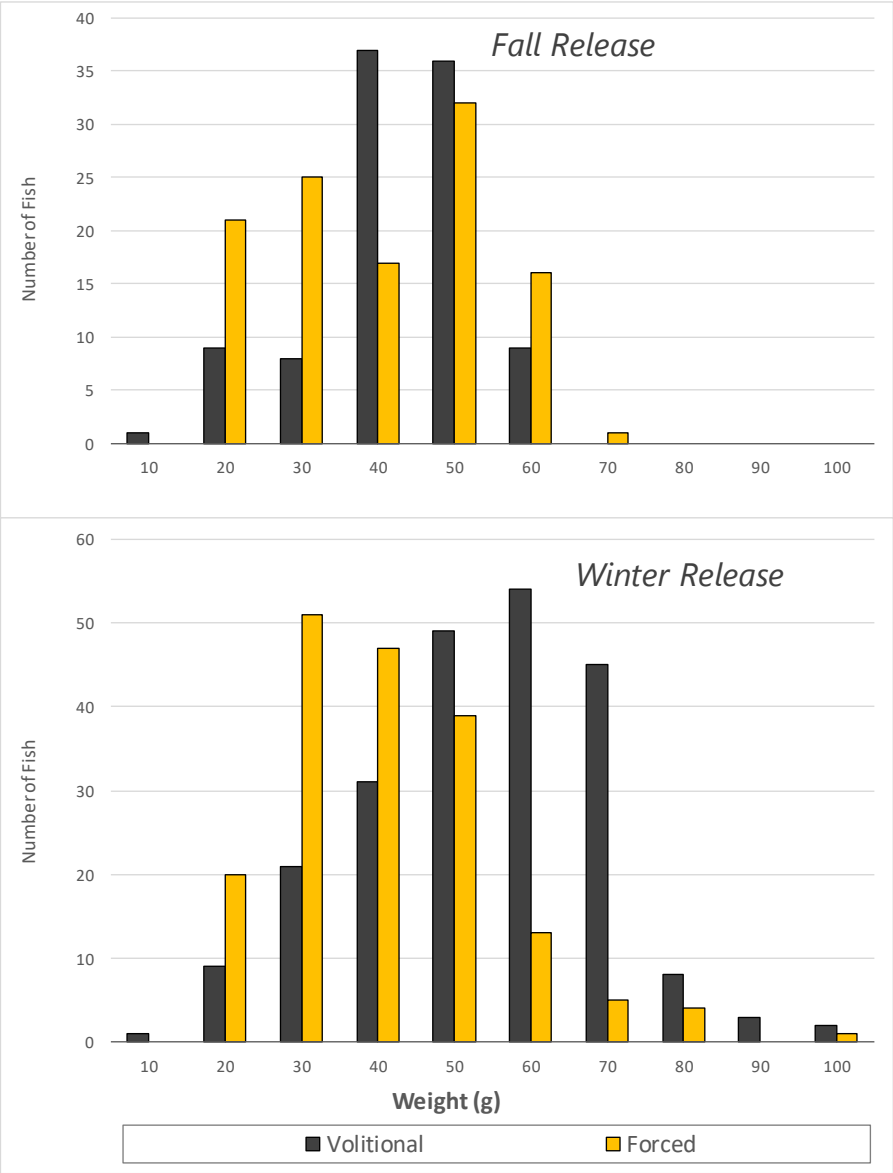

Figure 3-4. Weight frequency of yearling spring Chinook prior to release (volitional) and at the end of the release period (forced): Brood Year 2017, fall and winter releases

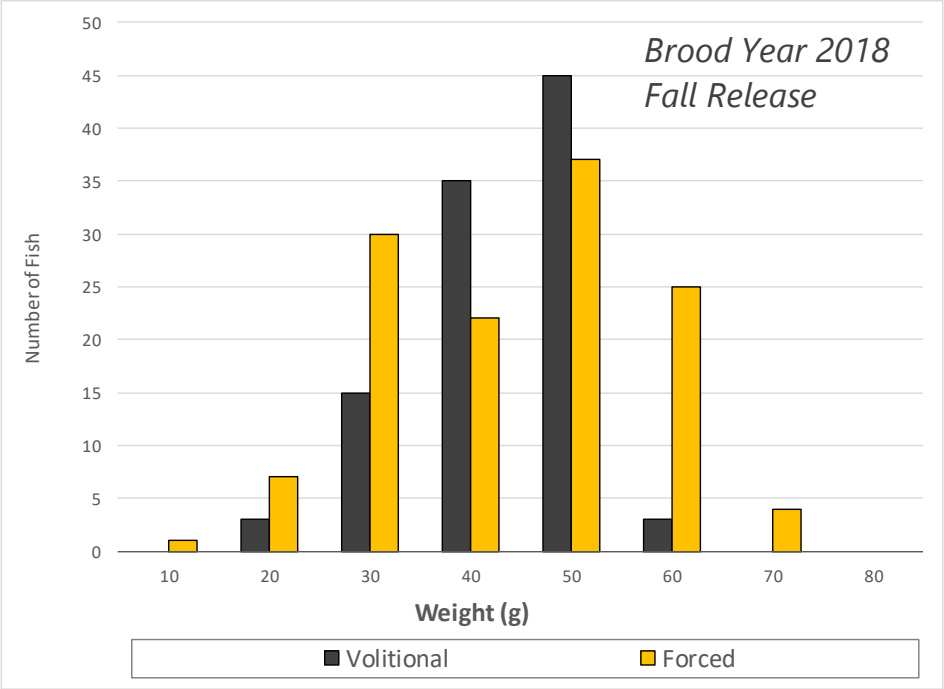

Figure 3-5. Weight frequency of yearling spring Chinook prior to release (volitional) and at the end of the release period (forced): Brood Year 2018, fall release

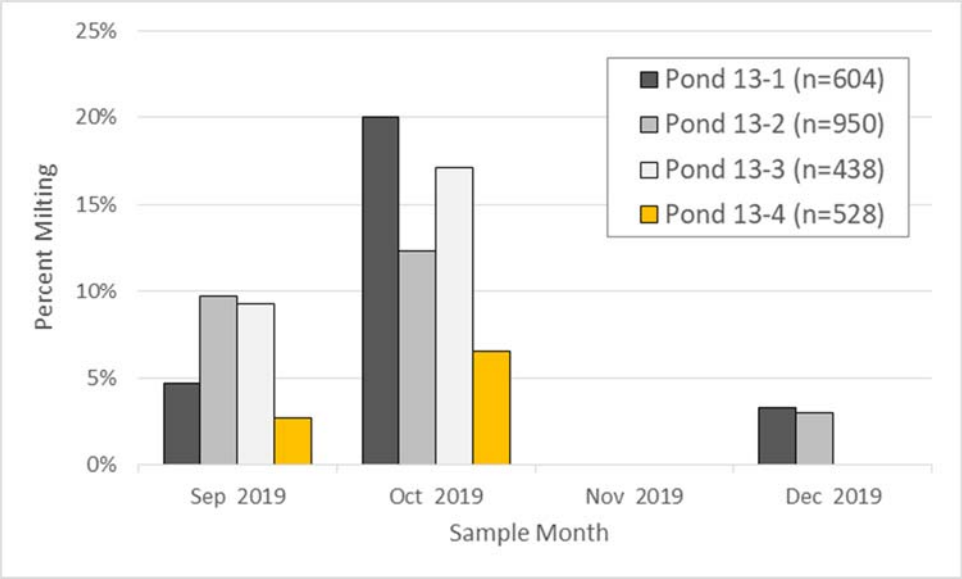

Figure 3-6. Milting rate among yearling hatchery reared spring Chinook smolts at Lewis River Hatchery sampled in September, October and December of 2019

OBJECTIVE 4: Estimate Juvenile Release Behavior or Residualism after Release from Hatcheries Downstream of Merwin Dam.

Methods to quantify residualism after release from the Lewis River hatcheries were not implemented in 2019. However, the monitoring and use of several hatchery surrogate metrics has been included in the most recent draft of the H&S Plan. This methodology is consistent with methods described by NOAA (NOAA 2017).

OBJECTIVE 5: Produce an Annual Hatchery Operations Report

The annual hatchery operations report is provided in Appendix H

OBJECTIVE 6: Monitor Rearing Conditions to be Consistent with Producing a High Quality Smolt that Emigrates Quickly with a Relatively High Rate of Survival

Objectives 6 and 8 were combined into one rearing and release evaluation involving several treatment groups of spring Chinook. The methodology for this evaluation is described in the 2019 AOP. Results from this evaluation will come primarily from observed CWT adult return rates (SAR's) to the traps and recovered from the spawning grounds. No data are available yet for analysis in this report. As returns begin to be documented, this report will provide updates on an annual basis and provide a project end report providing analysis of all return years when available.

OBJECTIVE 7: Monitor Hatchery Upgrades

All projects as prescribed by the Agreement have been completed (Table 3-5)

Table 3-5. Schedule of completion of hatchery upgrades

	COMPLETION YEAR							
Lewis River Hatchery	2008	2009	2010	2011	2012	2013	2014	2015
Pond 15 and Sorting Facility upgrades		✓						
Convert rearing ponds to raceways			✓	✓				
Modify downstream water intake								✓
Inspect Intake Pipe				✓				
Merwin Hatchery								
Ozone PLC upgrade							✓	
Rearing pond flow Enhancement			✓	✓				
Modify smolt release ponds			✓					
Purchase two fish hauling trucks	✓		✓					
Speelyai Hatchery								
Convert Pond 14 into raceways						✓		
Convert burrow's ponds into raceways		✓	✓					
Improve water intake structure								✓
Improve and Expand adult fertilization area			✓					
Improve adult kokanee trap			✓					
Net Pen purchase and installation			✓					

OBJECTIVE 8: Adopt Release Strategies that are Consistent with Hatchery Scientific Review Group and HGMP Recommendations

Please refer to description provided under Objective 6.

OBJECTIVE 9: Monitor Production Levels and Program Release Numbers

Table 3-6. Hatchery target and actual production by species

Species (or stock)	Brood Year	Target Production (smolts)	Actual Production (smolts)	Difference
Spring Chinook	2018	1,350,000	1,278,855	(71,145)
Coho Salmon	2018	2,000,000	2,193,389	193,389
Winter Steelhead	2018	100,000	108,128	8,128
Late Winter Steelhead	2018	50,000	44,861	(5,139)
Summer Steelhead[1]	2018	175,000	239,786	64,786
Rainbow Trout	2018	50,000	43,800	(6,200)
Kokanee	2018	93,000	94,000*	1,000
			3,908,819	

[1] **includes Echo Bay net pen production**

*** projected**

OBJECTIVE 10: Submit and Gain HGMP Approval for all Hatchery Programs on the Lewis River

As of the date of this draft report, no HGMP's have been submitted to NOAA for approval.

OBJECTIVE 11: Determine the Genetic Effective Population Size of Late Winter Steelhead Downstream of Merwin Dam.

Analysis of tissue samples submitted to NOAA has not yet been provided

OBJECTIVE 12: Develop Sampling Protocols for Supplementation Adults Returning to Traps or In-River Capture

See Appendix A and B of the 2019 AOP

OBJECTIVE 13: Effects of Upstream Adult and Juvenile Supplementation on Listed Species

This objective was moved to the Aquatic Monitoring and Evaluation Plan and is provided here only as a placeholder to ensure that numbering of each objective remains consistent with the Hatchery and Supplementation Plan.

OBJECTIVE 14: Estimate Adult and Juvenile Abundance of Winter Steelhead, Coho and Spring Chinook Downstream of Merwin Dam

Spawning Abundance

Spawning abundance estimates the number of spawners in the North Fork Lewis River mainstem downstream of Merwin Dam. This is not a total abundance estimate as spawner abundance estimates do not account for fish trapped and either used as broodstock or transported upstream as part of the supplementation program. Therefore, North Fork Lewis River total abundance should include trap counts regardless of their disposition after trapping.

Late Winter Steelhead

Spawning abundance estimates rely on new redd census data, assumed sex ratio and females per redd to calculate total spawner abundance (Freymond and Foley 1986). Females per redd follow WDFW generalized guidelines of 0.81 females per redd and sex ratio is assumed equal (Table 3-7). Beginning in 2013, we also calculate the spawner abundance using the observed sex ratio of late winter steelhead entering the Merwin Trap. This may be a more accurate estimate of female to male ratio in the river because of the large numbers captured in the trap and is unbiased in terms of capture efficiency for males or females.

Redd surveys are used to estimate spawning abundance and distribution of winter steelhead in the mainstem North Fork Lewis River. Surveys are conducted weekly throughout the spawning period, which starts on March 1 and extends into mid-June.

A total of 292 individual redds were counted during redd surveys in 2019. Surveys began on March 3, when the first redd was observed, and continued through June 16. The survey reach begins at Merwin Dam and continues downstream to the downstream end of Eagle Island.

Using Merwin Trap capture data between January 1 and June 21, 2019, a total of 1,067 late winter steelhead were trapped (excludes adipose clipped fish). This total includes 988 BWT and 79 NOR late winter steelhead. Of this total, 53 percent were male and 48 percent were female.

Therefore, based on observed trapping proportions, we provide a corrected sex ratio of 1.1 males for every female.

Table 3-7. Late winter steelhead abundance downstream of Merwin Dam 2008 through 2019 based on redd counts

Year	Number of Redds observed	Spawner Estimate	Observed sex ratio (females : males)	Spawner Estimate (corrected)
2008	131	212		
2009	176	286		
2010	248	402		
2011	108	174		
2012	343	556		
2013	456	739	1 : 1.4	898
2014	364	590	1 : 0.8	531
2015	384	622	1 : 1.5	765
2016	NA	NA	1 : 1.0	NA
2017	NA	NA	1 : 1.2	NA
2018	317	514	1 : 0.9	493
2019	292	473	1 : 1.1	500

* No data are available in 2016 and 2017 due to severe spring turbidity.

Adult Spring Chinook:

No escapement data exist for spring Chinook

Adult Coho Salmon

Table 3-8. Adult Coho escapement estimates for the mainstem North Fork Lewis River downstream of Merwin Dam: 2013 to present

Year	Number of marked carcasses	Number (%) of recaptured carcasses	Est. Gross Population Size	Bootstrap SE	95%-Confidence Interval	CV	Total Weeks Surveyable	Average Daily Flow during Surveys (cfs)	Average Daily Flow Oct 16-Jan-31
2013	328	41 (13%)	**1,970**	297	1,523 to 2,679	0.2	15	4,700	4,804
2014	431	18 (4%)	**7,805**	2,106	5,172 to 13,186	0.3	15	7,765	7,876
2015	12	2 (17%)	**NA**	NA	NA	NA	12	5,632	8,429
2016	65	20 (31%)	**124**	17	103 to 169	0.1	16	4,587	6,721
2017	24	8 (33.3%)	**44**	5	33 to 55	0.1	16	8,817	8,587
2018	61	22 (36%)	**137**	20	98 to 176	0.2	16	5,009	5,044
2019	40	7 (17.5%)	**83**	10	64 to 102	0.1	15	6,181	6,761

Table 3-9. Tributary Coho salmon estimates of spawners, carcasses and redds by tributary and year

Year	Weeks Surveyable	Total Live Spawners	Total Carcasses	Total Redds
Ross Creek				
2013	13	44	20	18
2014	14	14	68	33
2015	10	10	5	2
2016	15	49	10	33
2017	16	20	11	30
2018	15	10	3	12
2019	12	29	10	13
Johnson Creek				
2015	10	2	0	0
2018	16	8	3	17
Bratton Creek				
2015	10	0	1	0
2018	13	0	0	0
Hayes Creek 1				
2014	4	0	0	0
2015	11	0	1	0
2018	13	1	0	1
Hayes Creek 2				
2018	13	0	0	0
Hayes Tributary 2				
2013	14	0	0	0
2014	2	0	0	0
2016	9	0	0	0
2017	16	0	0	0
2018	13	0	0	0
2019	11	0	0	0
Houghton Creek				
2013	15	52	2	8
2014	13	13	14	8
2015	10	0	0	0
2016*	16	10	2	10
2019*	14	5	2	16
*Note: A single one mile-long reach was surveyed in each year for each stream, except two reaches (one mile-long each) were surveyed in Houghton Creek in 2016 and 2018.				

Juvenile Abundance

No screw trapping occurred downstream of Merwin Dam in 2019. This decision was made to allow the ATS to develop a more robust sampling design based on existing JMX protocols used by WDFW at other trapping sites. The methodology has not yet been fully developed; however, the ATS agreed to include an additional trapping site approximately 1.2 km downstream of the existing site in 2020. The 2020 annual report will compare the efficiency of both sites. As the traps are operating in 2020 the ATS will use the initial data of both trapping sites to assist in the development of a 2021 trapping plan.

Table 3-10. Species, size and origin composition of fish captured by screw trapping in the mainstem North Fork Lewis River downstream of Merwin Dam: 2016 to present.

	HOR > 60mm	HOR < 60mm	NOR < 60 mm	NOR > 60 mm	Marked and Released > 60 mm	Recaptured	Seasonal Efficiency
2016							
Coho	25,539		62	1,447	2,867	57	0.020
Chinook	47		53,356	48	47	1	0.021
Steelhead	9		1	555	514	15	0.029
Cutthroat	0		0	66	48	0	NA
2017							
Coho	7,774		6,253	594	2,708	27	0.010
Chinook	0		12,221	182	181	2	0.011
Steelhead	181		67	80	254	6	0.024
Cutthroat	0		0	45	37	0	NA
2018							
Coho	21,753	0	60	117	3,434	49	0.014
Chinook	3	0	13,380	6	4	0	0.000
Steelhead	8	0	1	26	33	0	0.000
Cutthroat	0	0	0	12	10	0	0.000
2019	No Data - Screwtrap was not installed (by ATS decision)						

Table 3-11. Abundance estimates of outmigrating juvenile salmonids by origin and species: 2016 to present

	Trap Efficiency	Bootstrap Estimate	CI 95% ±	Discrete Interval Estimate	CI 95% ±
2016					
NOR Coho	0.020	74,065	19,306	76,504	21,614
HOR Coho	0.020	1,309,518	330,310	1,548,800	644,012
NOR Chinook	0.021	2,327	854		
NOR Steelhead	0.029	20,404	11,942		
NOR Cutthroat	0.021	3,180	1,089		
2017					
NOR Coho	0.01	62,075	25,557	45,967	15,698
HOR Coho	0.01	811,302	314,270	808,227	384,804
NOR Chinook (all)	0.013	14,763	5,018	12,169	6,978
NOR Chinook (CWT)	0.013	2,114	1,494	1,822	1,306
NOR Rainbow	0.012	6,866	2,652	6,257	3,499
HOR Rainbow	0.012	14,941	5,093	14,540	8,649
Cutthroat	0.012	3,420	1,541	3,368	1,837
2018					
NOR Coho > 60 MM	0.011	10,893	4,072	9,648	4,645
NOR Coho < 60 MM	0.011	5,595	2,348	3,905	3,728
HOR Coho	0.012	1,852,836	546,035	1,352,784	450,647
NOR Chinook < 60MM	0.011	1,250,158	402,614	1,036,912	864,701
NOR Rainbow > 60 mm	0.012	2,212	1,084	2,001	1,761
NOR Cutthroat > 60mm	0.017	714	466	625	854
2019	*Trap not operated by ATS decision*				

OBJECTIVE 15: Determine Spatial and Temporal Distribution of Spawning Late Winter Steelhead, Coho and Spring Chinook Downstream of Merwin Dam

Late Winter Steelhead

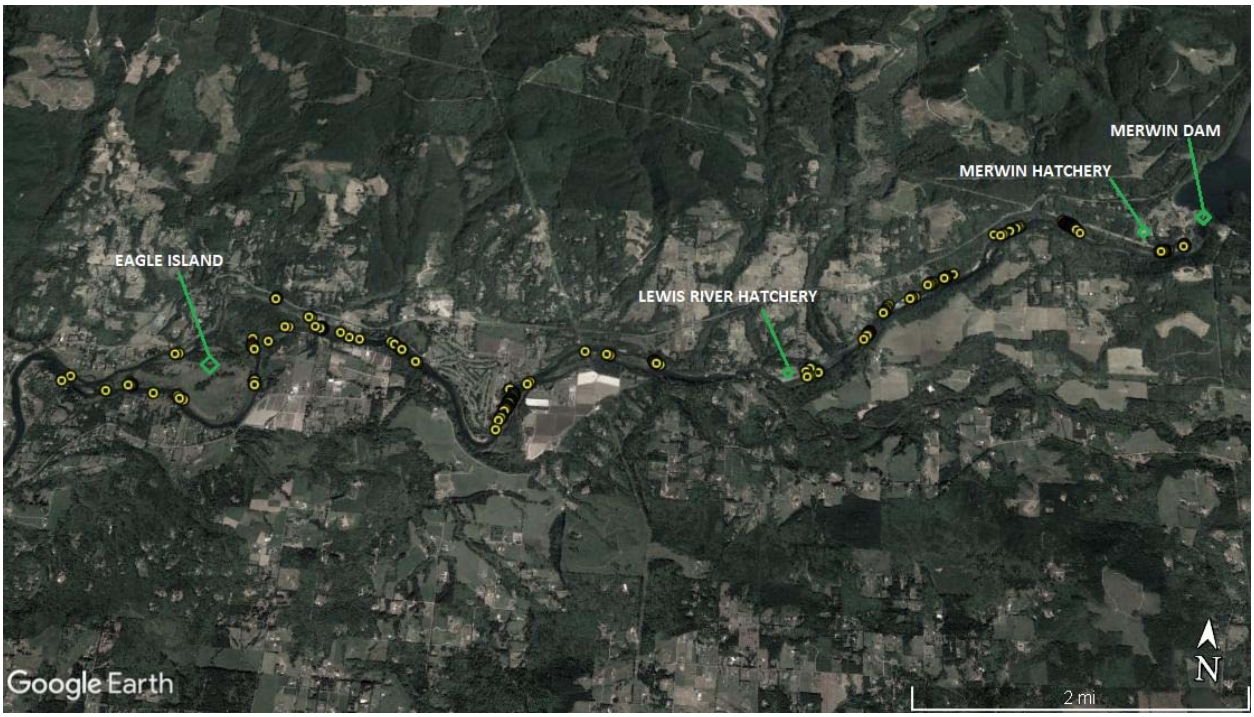

Figure 3-7. Distribution of late winter steelhead redds downstream of Merwin Dam – 2019

Table 3-12. Redd distribution for late winter steelhead by reach and redds per mile for the years 2015 and 2019

		YEAR				
		2015		2019		
	Length (miles)	Redds	Redds/mile	Redds	Redds/mile	Proportion of total
Reach 1	0.55	24	44	28	51	10%
Reach 2	0.83	130	157	79	95	27%
Reach 3	0.95	77	81	22	23	8%
Reach 4	1.00	37	37	34	34	12%
Reach 5	7.71	116	15	129	17	44%
Totals	11.04	384	35	292	26	

Chinook Salmon

No data available for 2019

Coho Salmon

Table 3-13. Coho distribution data downstream of Merwin Dam: 2016 to present

	NF Lewis River	Reach Length (miles)	Total Weeks (mid-Oct to Jan 31)	Total Weeks Surveyable	Total Live Holders	Total Live Spawners	Total Carcass Unable to Sample	Hatchery Male Carcass	Hatchery Female Carcass	Unmarked Male Carcass	Unmarked Female Carcass	Total Carcass	Total Carcass Tagged	Total Carcass Recoveries	% Pre-spawn Mortality (Females)	Carcass Wanded for CWT	CWT Positive Carcass
2016																	
	Reach 1	0.57	16	16	1	24		3	3	1	1	8	7	4	0%	8	1
	Reach 2	0.68	16	16	6	44		0	2	0	1	3	3	1	50%	3	0
	Reach 3	0.97	16	16	0	108		2	1	0	2	5	4	1	0%	5	1
	Reach 4	1.32	16	16	56	78		2	3	6	3	14	14	7	33%	14	0
	Reach 5	7.3	16	15	0	25		12	9	13	5	39	37	7	14%	39	0
	Total	10.84	16	16	63	279		19	18	20	12	69	65	20	18%	69	2
2017																	
	Reach 1	0.57	16	16	6	4		0	0	0	0	0	0	0	NA	0	0
	Reach 2	0.68	16	16	4	14		0	1	1	0	2	2	1	0%	2	0
	Reach 3	0.97	16	16	0	8		0	0	0	0	0	0	0	NA	0	0
	Reach 4	1.32	16	16	20	25		1	3	1	3	8	8	3	0%	8	0
	Reach 5	7.3	16	15	20	12		7	2	3	2	14	14	4	25%	14	0
	Total	10.84	16	16	50	63		8	6	5	5	24	24	8	9%	24	0
2018																	
	Reach 1	0.57	16	16	30	15	3	4	4	0	0	11	8	4	0%	8	0
	Reach 2	0.68	16	16	50	20	0	3	3	1	0	7	7	2	33%	7	0
	Reach 3	0.97	16	16	25	5	0	0	1	1	2	4	4	0	33%	4	0
	Reach 4	1.32	16	16	100	30	1	4	4	1	2	12	11	3	50%	11	5
	Reach 5	7.3	16	15	50	20	4	13	15	2	2	36	31	13	53%	32	3
	Total	10.84	16	16	255	90	8	24	27	5	6	70	61	22	42%	62	8
2019																	
	Reach 1	0.57	16	15	16	0	1	1	2	2	1	7	6	2	33%	6	0
	Reach 2	0.68	16	15	23	0	0	0	1	2	0	3	3	0	0%	3	0
	Reach 3	0.97	16	15	13	0	1	1	0	1	0	3	2	0	0%	2	0
	Reach 4	1.32	16	15	25	0	0	2	1	4	1	8	8	0	0%	8	0
	Reach 5	7.3	16	15	45	0	2	7	6	6	2	23	21	5	63%	21	0
	Total	10.84	16	15	122	0	4	11	10	15	4	44	40	7	43%	40	0

Coho Salmon (tributary surveys):

Table 3-14. Tributary Coho salmon survey summary: 2016 to present

	Stream	Reach Length (miles)	Total Weeks (mid-Oct through Jan)	Total Weeks Surveyable	Total New Redds	Total Live Holders	Total Live Spawners	Total Carcass Unable to Sample	Hatchery Male Carcass	Hatchery Female Carcass	Unmarked Male Carcass	Unmarked Female Carcass	Total Carcass	% Pre-spawn Mortality (Females)	Carcass Wanded for CWT	CWT Positive Carcass
2016																
	Hayes Trib 2	0.5	16	9	0	0	0		0	0	0	0	0	NA	0	0
	Lower Houghton	1	16	13	0	1	0		0	0	0	0	0	NA	0	0
	Ross Creek	1	16	15	33	9	49		2	1	5	2	10	0%	10	1
	Upper Houghton	1	16	16	10	7	10		2	0	0	0	2	NA	2	0
2017																
	Hayes Trib 1	1	16	16	2	0	0		0	0	0	0	0	NA	0	0
	Hayes Trib 2	0.5	16	16	0	0	0		0	0	0	0	0	NA	0	0
	Robinson Creek	1	16	16	15	0	16		0	0	1	1	2	0%	2	0
	Ross Creek	1	16	16	30	0	20		0	3	5	3	11	0%	11	0
2018																
	Ross Creek	1	16	15	12	1	10	0	1	2	0	0	3	0%	3	0
	Johnson Creek	0.95	16	16	17	2	8	1	1	0	0	1	3	0%	2	0
	Hayes Creek 1	1	16	13	1	0	1	0	0	0	0	0	0	0%	0	0
	Hayes Creek 2	1	16	13	0	0	0	0	0	0	0	0	0	NA	0	0
	Hayes Trib. 2	1	16	13	0	0	0	0	0	0	0	0	0	NA	0	0
	Bratton Creek	1	16	16	0	0	0	0	0	0	0	0	0	NA	0	0
2019																
	Ross Creek R1	1	15	12	13	2	29	2	0	2	2	4	10	0%	8	0
	Houghton Creek R1	1	15	14	16	0	5	0	0	1	0	1	2	0%	2	0
	Houghton Creek R2	1	15	11	0	0	0	0	0	0	0	0	0	NA	0	0
	Hayes Creek	1	15	11	0	0	0	0	0	0	0	0	0	NA	0	0

OBJECTIVE 16: Evaluate Fall Chinook and Chum Populations Downstream of Merwin Dam

Note: Awaiting results from WDFW for 2018 and 2019 Fall Chinook and Chum salmon surveys. It is expected that these results will be available for the 2020 Annual Report.

Table 3-15. Fall Chinook escapement estimates in the North Fork Lewis River (excluding tributaries) downstream of Mewin Dam

Stock	pHOS	Mean	SD	L.95%	Median	U.95%	CV
2013	**0.077**	**20,862**	**496**	**19,990**	**20,830**	**21,940**	**2%**
Tule	*0.33*	*3,511*	*462*	*2,642*	*3,495*	*4,533*	*13%*
Bright	*0.02*	*17,351*	*450*	*16,500*	*17,340*	*18,300*	*3%*
2014	**0.105**	**24,859**	**588**	**23,790**	**24,830**	**26,100**	**2%**
Tule	*0.51*	*4,055*	*409*	*3,326*	*4,027*	*4,902*	*10%*
Bright	*0.01*	*20,803*	*620*	*19,670*	*20,780*	*22,050*	*3%*
2015	**0.180**	**24,364**	**981**	**22,550**	**24,310**	**26,431**	**4%**
Tule	*0.63*	*5,449*	*381*	*4,759*	*5,440*	*6,265*	*7%*
Bright	*0.01*	*18,915*	*992*	*17,120*	*18,850*	*21,080*	*5%*
2016	**0.229**	**13,487**	**496**	**12,660**	**13,440**	**14,600**	**4%**
Tule	*0.60*	4,127	482	3,329	4,073	5,225	12%
Bright	*0.01*	9,360	243	8,912	9,357	9,863	3%
2017	**0.176**	**9,523**	**536**	**8,632**	**9,470**	**10,720**	**6%**
Tule	*0.58*	*2,255*	*450*	*1,560*	*2,203*	*3,258*	*20%*
Bright	*0.02*	*7,268*	*355*	*6,664*	*7,240*	*8,084*	*5%*

Source: Bentley 2018

OBJECTIVE 17: Annual Review of Existing and Proposed Harvest Regulations (if any) to Determine if Recommendations are Warranted to Protect Supplementation Program Objectives

No recommendations were received by the ATS or ACC during 2019.

3.4 Upstream Transport of Steelhead, Coho and Spring Chinook

In 2019, a total of 1,013 blank wire tagged steelhead were transported upstream of Swift Dam (Table 3-16). All steelhead were transported from the Merwin Trap. This year represents the seventh year of steelhead transportation activities. The target goal of the H&S program is 500 winter steelhead transported each year. We have exceeded this target the last seven years.

Spring Chinook remain below the target transport goal of 2000 adults. Since the program began, there have not been sufficient numbers of Chinook to meet targets. In 2019, only 109 Chinook were passed upstream of which 85 were jacks.

Table 3-16. Number of fish transported upstream of Swift Dam: 2012 to present

	STEELHEAD			COHO				SPRING CHINOOK			
	Male	Female	Total	Male	Female	Jack	Total	Male	Female	Jack	Total
2012	141	48	189	NA	NA	NA	206	0	0	0	0
2013	440	301	741	3,858	3,104	73	7,035	270	243	66	579
2014	452	581	1,033	4,788	4,217	174	9,179	0	0	0	0
2015	746	477	1,223	2,030	1,694	30	3,754	0	0	0	0
2016	382	390	772	3,430	3,377	539	7,346	0	0	0	0
2017	331	261	592	3,254	3,494	65	6,813	370	430	310	1,110
2018	682	535	1,227	3,999	2,659	402	7,060	491	177	32	700
2019	527	486	1,013	2,898	2,367	266	5,531	12	12	85	109
Average	**463**	**385**	**849**	**3,465**	**2,987**	**221**	**5,866**	**143**	**108**	**62**	**312**

4.0 RECOMMENDATIONS FOR ONGOING MANAGEMENT

The annual operating plan (AOP) for the Hatchery and Supplementation program continues to be updated and used as an adaptive management tool to address both ongoing and new priorities as they relate to hatchery operations, supplementation activities and development of effective monitoring designs.

In 2019, the ATS began to add substantial detail and focus to several objectives. This work is still ongoing, but will also provide the foundation for consistent monitoring designs that will be helpful moving forward and have some application to other monitoring plans such as the Aquatic Monitoring and Evaluation Plan.

5.0 REFERENCES

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APPENDIX A –

Late winter unmarked steelhead captured at the Merwin Trap and Tangle Netting and transported to Merwin Hatchery - 2019

	Trap Date	Location of Capture	Gender	Fork Length (mm)	Floy Tag #	Pit Tag #	DNA VIAL #	Scale Card - pos	Comments
1	3/5/2019	Merwin Trap	F	62	Purple Gold 1	3DD003 047BCAF	MFCF 19-001	46441-1	Live spawned 4/16 w/ FCF-09 & TN-46
2	3/25/2019	Merwin Trap	F	78	Purple Gold 2	3DD.003 D47BCD2	MFCF19-2	46441-2	MORT 4/11
3	3/28/2019	Merwin Trap	F	72	Purple Gold 3	3DD.003 BC95FC9	MFCF 19-003	46441-3	LIVE SPAWNED 4/16 w/ FCF-07 & TN-044
4	3/30/2019	Merwin Trap	F	71	Purple Gold 4	3DD.003 BC95FBB	MFCF-19-004	46441-4	Live spawned 4/16 w/ FCF-09 & TN-46
5	4/4/2019	Hook & Line	M	64	NONE	3DD.003 D2BE6B1	TN-18-044	NA	LIVE SPAWNED 4/16 w/ FCF-15 & FCF-03
6	4/4/2019	Hook & Line	M	73	NONE	3DD.003 D2BE6BD	TN-18-046	NA	Live spawned 4/16 w/ FCF-01 & FCF-04
7	4/4/2019	Hook & Line	M	57	NONE	3DD.003 D2BE6CD	TN-18-048	NA	Live spawned 4/30 w/ FCF-30 & FCF-23 (returned to river 5/3)
8	4/9/2019	Tangle Net	M	95	ORG/WHT 6	3DD.003 D2BE6B8	TN-18-050	NA	NON-VIABLE RETURNED TO RIVER (4/19)
9	4/8/2019	Merwin Trap	M	72	ORG/WHT 1	3DD.003 D2BE722	MFCF-19-006	46441-6	Live spawned 5/17 w/ TN-56 & TN-57…returned to river 5/17
10	4/8/2019	Merwin Trap	M	55	ORG/WHT 2	3DD.003 D2BE72C	MFCF-19-007	46441-7	LIVE SPAWNED 4/16 w/ FCF-15 & FCF-03
11	4/8/2019	Merwin Trap	M	51	ORG/WHT 3	3DD.003 D2BE712	MFCF-19-008	46441-8	Returned to river 5/17 due to poor condition (Descaling)
12	4/9/2019	Merwin Trap	M	69	ORG/WHT 4	3DD.003 D2BE6FD	MFCF-19-009	46447-1	Live spawned 4/16 w/ FCF-01 & FCF-04
13	4/9/2019	Merwin Trap	M	67	ORG/WHT 5	3DD.003 D3BE6D1	MFCF-19-010	46447-2	Live spawned 4/30 w/ FCF-34 & FCF-29 (returned to river 5/3)
14	4/11/2019	Hook & Line	M		PNK/ WHT 1	3DD.003 D2BE6C3	TN-18-052	NA	Live spawned 4/30 w/ FCF-30 & FCF-23 (returned to river 5/3)
15	4/11/2019	Merwin Trap	M	69	NONE	3DD.003 D27FBCD	MFCF-19-011	NA	RETURNED TO RIVER 5/22
16	4/11/2019	Merwin Trap	M	61	NONE	3DD.003 D27C9E2	MFCF-19-012	46447-3	LIVE SPAWNED 5/8 w/ FCF-43 & FCF-41 (Returned to river 5/9)
17	4/11/2019	Merwin Trap	M	46	NONE	3DD.003 D2BE756	MFCF-19-013	46447-4	RETURNED TO RIVER 5/22
18	4/11/2019	Merwin Trap	F	78	NONE	3DD.003 D278CC4	MFCF-19-014	46447-5	LIVE SPAWNED 4/30 w/ FCF-31 & FCF-33 (Returned to river 5/3)
19	4/11/2019	Merwin Trap	F	83	NONE	3DD.003 D2BE753	MFCF-19-015	46447-6	LIVE SPAWNED 4/16 w/ FCF-07 & TN-044
20	4/12/2019	Merwin Trap	M	63	NONE	3DD.003 D2BE760	MFCF-19-016	46447-7	Live spawned 4/30 w/ FCF-34 & FCF-29 (returned to river 5/3)
21	4/12/2019	Merwin Trap	M	49	NONE	3DD.003 D279645	MFCF-19-017	46447-8	RETURNED TO RIVER 5/22
22	4/12/2019	Merwin Trap	M	41	NONE	3DD.003 D2BE786	MFCF-19-019	46448-1	RETURNED TO RIVER 5/22
23	4/12/2019	Merwin Trap	M	30	NONE	3DD.003 BE8D2EE	MFCF-19-020	46448-2	RETURNED TO RIVER 5/22
24	4/15/2019	Merwin Trap	M	38	BLU/WHT 1	3DD.003 D279A24	MFCF-19-021	46448-3	RETURNED TO RIVER 5/22
25	4/15/2019	Merwin Trap	M	42	BLU/WHT 2	3DD.003 D227AF31	MFCF-19-022	46448-4	RETURNED TO RIVER 5/22

	Trap Date	Location of Capture	Gender	Fork Length (mm)	Floy Tag #	Pit Tag #	DNA VIAL #	Scale Card - pos	Comments
26	4/15/2019	Merwin Trap	F	58	BLU/WHT 3	3DD.003 D2279F04	MFCF-19-023	46448-5	Live spawned 4/30 w/ TN-48 & TN-52 (Returned to river 5/3)
27	4/15/2019	Merwin Trap	M	43	BLU/WHT 4	3DD.003 D27D26A	MFCF-19-024	46448-6	RETURNED TO RIVER 5/22
28	4/16/2019	Merwin Trap	F	59	BLU/WHT 6	3DD.003 D2789DD	MFCF-19-027	46449-1	LIVE SPAWNED 4/30 w/ FCF-31 & FCF-33 (Returned to river 5/3)
29	4/17/2019	Hook & Line	F	71	PUR/GLD 7	3DD.003 D2BE6HD	TN-18-057	NA	Live spawned 5/17 w/ FCF-6 & FCF-42…returned to river 5/17
30	4/17/2019	Hook & Line	F	74	PUR/GLD 6 & 8	3DD.003 D2BE679	TN-18-056	NA	Live spawned 5/17 w/ FCF-6 & FCF-42…returned to river 5/17
31	4/18/2019	Merwin Trap	F	57	PUR/GOLD 10	3DD.003 D279162	MFCF-19-029	46449-3	Live spawned 4/30 w/ FCF-10 & FCF-16 (Returned to river 5/3)
32	4/19/2019	Merwin Trap	F	66	PUR/GLD 11	3DD.003 D27C3F6	MFCF-19-030	46449-4	Live spawned 4/30 w/ TN-48 & TN-52 (Returned to river 5/3)
33	4/21/2019	Merwin Trap	M	86	PNK/WHT 3	3DD.003 D2BE632	MFCF-19-031	46449-5	Live spawned 4/30 w/ FCF-14 & FCF-27 (Returned to river 5/3)
34	4/22/2019	Merwin Trap	M	57	PNK/WHT 7	3DD.003 D2BE612	MFCF-19-033	46449-7	Live spawned 4/30 w/ FCF-14 & FCF-27 (Returned to river 5/3)
35	4/23/2019	Merwin Trap	F	77	BLU/PNK 109	3DD.003 D2BE657	MFCF-19-034	46449-8	Live spawned 4/30 w/ FCF-10 & FCF-16 (Returned to river 5/3)
36	4/23/2019	Merwin Trap	M	70	BLU/PNK 111	3DD.003 D2BE63C	MFCF-19-036	62762-1	Live spawned 5/9 w/ FCF-46 & FCF-40 (Returned to river 5/10)
37	4/24/2019	Hook & Line	M	56	BLU/PNK 2112	3DD.003 D2BE69E	TN-18-061	NA	LIVE SPAWNED 5/8 w/ FCF-43 & FCF-41 (Returned to river 5/9)
38	4/25/2019	Merwin Trap	M	78	BLU/WHT 7	3DD.003 D2BE60E	MFCF-19-037	62762-2	Spawned out…returned to river 5/17
39	4/29/2019	Merwin Trap	M	73	BLU/WHT 8	3DD.003 D2796C3	MFCF-19-038	62762-3	Live spawned 5/9 w/ FCF-46 & FCF-40 (Returned to river 5/10)
40	4/29/2019	Merwin Trap	M	76	BLU/WHT 9	3DD.003 D27B2F4	MFCF-19-039	62762-4	MORT 5/2
41	4/29/2019	Merwin Trap	F	57	BLU/WHT 10	3DD.003 D2BE62C	MFCF-19-040	62762-5	Live spawned 5/9 w/ FCF-46 & FCF-40 (Returned to river 5/10)
42	5/6/2019	Merwin Trap	M	89	WHT/ ORG 7	3DD.003 D27A20C	MFCF-19-042	62762-7	Live spawned 5/17 w/ TN-56 & TN-57…returned to river 5/17
43	5/6/2019	Merwin Trap	F	74	WHT / ORG 8	3DD.003 D278ABA	MFCF-19-043	62762-8	LIVE SPAWNED 5/8 w/ TN-61 & FCF-12 (Returned to river 5/9)
44	5/7/2019	Merwin Trap	M	62	WHT/ORG 9	3DD.003 D279172	MFCF-19-044	62769-1	RETURNED TO RIVER 5/22
45	5/13/2019	Merwin Trap	M	59	GRN/WHT 3	3DD.003 C01170	MFCF-19-048	62763-5	Returned to river 5/17 due to poor condition (Descaling)

APPENDIX B –

Genetic Assignment Results from Late Winter Steelhead Captures at Merwin Trap (MFCF) and Tangle Netting (TN) – 2019

			Assignment Probability					
	Date Sampled	Sample No.	Primary	*p*	Secondary	*p*	Tertiary	*p*
1	1/17/2019	1/17/19-1	LR Merwin	0.90	LRCedar	0.05	Cowman	0.04
2	1/14/2019	MFCF17153	LR Merwin	0.93	GermCr	0.03	MillCr	0.01
3	3/5/2019	MFCF19001	LR Cedar	0.79	GermCr	0.07	ElochR	0.05
4	2/25/2019	TN18035	LR Merwin	0.88	LRCedar	0.06	KalamW	0.03
5	3/5/2019	TN18036	CoweemanR	0.80	LRMerwin	0.14	KalamW	0.04
6	3/13/2019	TN18038	LR Merwin	0.64	Cowman	0.07	Clack	0.07
7	3/13/2019	TN18039	LR Merwin	0.81	LRCedar	0.15	GermCr	0.02
8	3/13/2019	TN18040	LR Cedar	0.41	SandyR	0.30	GermCr	0.20
9	3/25/2019	MFCF19002	LR Cedar	0.46	LRMerwin	0.29	KalamW	0.18
10	4/11/2019	MFCF19011	LR Cedar	0.58	LRMerwin	0.39	SFTout	0.01
11	4/11/2019	MFCF19012	LR Merwin	0.54	ElochR	0.14	KalamW	0.13
12	4/11/2019	MFCF19013	LR Merwin	0.97	GrRLC	0.03		
13	4/11/2019	MFCF19014	LR Cedar	0.95	LRMerwin	0.03	KalamW	0.01
14	4/11/2019	MFCF19015	LR Merwin	0.77	GrRLC	0.14	Cowman	0.04
15	4/12/2019	MFCF19016	LR Merwin	0.78	LRCedar	0.14	Cowman	0.03
16	4/12/2019	MFCF19017	LR Cedar	0.87	LRMerwin	0.10	GermCr	0.02
17	4/12/2019	MFCF19018	Germany Cr	0.38	LRMerwin	0.30	SandyR	0.20
18	4/12/2019	MFCF19019	LR Merwin	0.99				
19	4/12/2019	MFCF19020	LR Merwin	0.96	LRCedar	0.01	KalamW	0.01
20	4/15/2019	MFCF19021	LR Cedar	0.82	LRMerwin	0.14	CowlitzR	0.02
21	4/15/2019	MFCF19022	LR Merwin	0.73	LRCedar	0.17	GrRLC	0.04
22	4/15/2019	MFCF19023	LR Cedar	0.61	LRMerwin	0.38	KalamW	0.01
23	4/15/2019	MFCF19024	LR Merwin	0.94	GermCr	0.03	GrRLC	0.02
24	4/15/2019	MFCF19025	Germany Cr	0.79	SandyR	0.11	LRMerwin	0.07
25	4/15/2019	MFCF19026	LR Merwin	0.95	ElochR	0.03	LRCedar	0.01
26	4/11/2019	TN1852	LR Merwin	0.76	GermCr	0.11	LRCedar	0.09
27	4/16/2019	TN1855	Germany Cr	0.43	LRMerwin	0.37	ElochR	0.15
28	4/16/2019	MFCF19027	LR Merwin	0.58	LRCedar	0.20	KalamW	0.12
29	4/18/2019	MFCF19028	Germany Cr	0.36	Cowman	0.31	ElochR	0.10
30	4/18/2019	MFCF19029	LR Cedar	0.57	LRMerwin	0.42		
31	4/19/2019	MFCF19030	LR Merwin	0.84	LRCedar	0.11	KalamSu	0.02
32	4/21/2019	MFCF19031	LR Merwin	0.95	LRCedar	0.05		
33	4/22/2019	MFCF19032	LR Merwin	0.75	GermCr	0.17	MillCr	0.02
34	4/22/2019	MFCF19033	LR Merwin	0.70	LRCedar	0.21	GarysR	0.06
35	4/23/2019	MFCF19034	LR Merwin	0.66	Cowman	0.28	LRCedar	0.05

			Assignment Probability					
	Date Sampled	Sample No.	Primary	*p*	Secondary	*p*	Tertiary	*p*
36	4/23/2019	MFCF19035	LR Merwin	0.46	GermCr	0.33	KalamW	0.14
37	4/23/2019	MFCF19036	LR Merwin	0.55	LRCedar	0.25	Cowman	0.06
38	4/17/2019	TN18051	LR Merwin	0.88	GermCr	0.09	KalamW	0.02
39	4/17/2019	TN18056	LR Merwin	0.61	LRCedar	0.37	MillCr	0.02
40	4/17/2019	TN18057	LR Cedar	0.63	LRMerwin	0.25	GermCr	0.04
41	4/25/2019	MFCF19037	LR Merwin	0.98	LRCedar	0.02		
42	4/29/2019	MFCF19038	HoodR	0.65	EFLewisR	0.21	LRMerwin	0.04
43	4/29/2019	MFCF19039	LR Merwin	0.53	LRCedar	0.20	BigCr	0.09
44	4/29/2019	MFCF19040	LR Cedar	0.52	LRMerwin	0.36	KalamW	0.04
45	4/24/2019	TN18061	LR Merwin	0.87	LRCedar	0.07	EFLewisR	0.02
46	5/9/2019	MFCF19-046	GraysR	0.64	ElochR	0.13	LRCedar	0.11
47	5/13/2019	MFCF-19-047	LRhatW	0.54	LRCedar	0.33	LRMerwin	0.08
48	5/13/2019	MFCF19-048	CoweemanR	0.42	LRMerwin	0.32	SandyR	0.11
49	3/28/2019	MFCF19003	LR Merwin	0.77	Cowman	0.20	GermCr	0.02
50	3/30/2019	MFCF19004	LR Merwin	0.96	LRCedar	0.02	GermCr	0.01
51	3/30/2019	MFCF19005	LR Merwin	0.46	ElochR	0.29	GarysR	0.13
52	3/28/2019	TN18043	LR Merwin	0.77	LRCedar	0.19	Cowman	0.04
53	4/4/2019	TN18044	LR Merwin	0.82				
54	4/4/2019	TN18045	Germany Cr	0.29	BIG CR	0.27		
55	4/4/2019	TN18046	LR Merwin	0.96				
56	4/4/2019	TN18048	CoweemanR	0.59	LRCedar	0.24		
57	4/8/2019	MFCF19006	LR Merwin	0.61	LRCedar	0.21		
58	4/8/2019	MFCF19007	LR Merwin	0.68				
59	4/8/2019	MFCF19008	LR Merwin	0.95				
60	4/9/2019	MFCF19009	LR Cedar	0.72	LRMerwin	0.27		
61	4/9/2019	MFCF19010	LR Merwin	0.90				
62	4/9/2019	TN18050	LR Merwin	0.71	ElochR	0.15		
63	5/2/2019	MFCF-19-041	KalamaR_W	0.38	BIG CR	0.21		
64	5/6/2019	MFCF-19-042	LR Merwin	0.96				
65	5/6/2019	MFCF-19-043	LR Merwin	0.43	LRCedar	0.36		
66	5/7/2019	MFCF-19-044	LR Cedar	0.71	LRMerwin	0.26		
67	5/7/2019	MFCF-19-045	LR Cedar	0.63	LRMerwin	0.27	elochhat	0.06

APPENDIX C –

NOR Late Winter Steelhead Spawning Crosses -2019

Spawn Date	Spawning Cross	Female	Males		Families	Notes
4/16/2019	1	FCF01	FCF09	TN-46	2	
	2	FCF04	FCF09	TN-46	2	
	3	FCF015	FCF07	TN-44	2	
	4	FCF03	FCF07	TN-44	2	
4/30/2019	5	FCF-14	FCF31	FCF33	2	
	6	FCF-27	FCF31	FCF33	2	
	7	FCF-34	FCF10	FCF16	2	
	8	FCF-29	FCF10	FCF16	2	
	9	FCF-30	TN48	TN52	2	
	10	FCF-23	TN48	TN52	2	
5/8/2019	11	FCF-43	TN61	FCF12	2	
	12	FCF-41	TN61	FCF12	2	REMOVED FROM PRGRAM
5/9/2019	13	FCF-46	FCF38	FCF36	2	REMOVED FROM PRGRAM
	14	FCF-40	FCF38	FCF36	2	
5/17/2019	15	TN56	FCF6	FCF42	2	
	16	TN57	FCF6	FCF42	2	
					32	

APPENDIX D –

North Fork Lewis River Downstream of Merwin Dam – 2018 Coho Salmon Spawning Survey Results (October 2018 through January 2019)

Memorandum

To: Erik Lesko, PacifiCorp

From: Jason Shappart, Meridian Environmental, Inc.

Date: March 12, 2019

Re: North Fork Lewis River Downstream of Merwin Dam – 2018 Coho Salmon Spawning Survey Results (mid-October 2018 through January 2019)

Introduction

As a component of its existing FERC license, PacifiCorp conducts annual coho salmon spawning surveys from mid-October through January to facilitate estimating coho salmon spawning escapement in the North Fork Lewis River downstream of Merwin Dam (PacifiCorp and Cowlitz PUD 2017). Meridian Environmental, Inc. (Meridian) has performed these surveys under contract with PacifiCorp since 2013. The mainstem North Fork Lewis River spawning survey area is divided into five index reaches as defined by the Washington Department of Fish and Wildlife (WDFW), extending from the boat barrier downstream of Merwin Dam to the downstream end of Eagle Island (Figure 1), encompassing 10.84 river miles (mainstem channel and Eagle Island side channel). The North Fork Lewis River tributary spawning survey reaches are defined annually by WDFW using a Generalized Random Tessellation Stratified (GRTS) sample design. In 2018, WDFW designated three survey reaches within the Hayes Creek watershed, and one reach each in Bratton, Johnson, and Ross creeks (Figure 1). All surveys were conducted on a weekly basis as environmental conditions allowed (flow, turbidity, etc.) following methods described in PacifiCorp's revised Monitoring and Evaluation Plan (PacifiCorp and Cowlitz PUD 2017). This memorandum summarizes the results of the coho salmon spawning surveys from mid-October 2018 through January 2019.

Survey Conditions

In 2018, North Fork Lewis River flows below Merwin Dam were variable. Flows were generally near median conditions from mid-October through early-November; substantially below median conditions from mid-November through mid-December; and then generally variable around median flow conditions for the remainder of the survey season (Figure 2). Conditions were surveyable during every week of the survey period for the mainstem North Fork Lewis River. Tributary survey reaches were generally surveyable every week; however, the Hayes Creek watershed reaches were too turbid to survey the last week in December and first week in January. Survey days vs. mainstem NF Lewis River discharge are depicted in Figure 3.

On each survey occasion, all five mainstem North Fork Lewis River reaches were surveyed via jet boat during a single day. All tributary surveys were conducted on foot. In prior years, PacifiCorp conducted river drawdowns once per week during the coho and fall Chinook spawning survey seasons at the request of WDFW to facilitate WDFW's ability to recover fall Chinook carcasses. From 2013 to 2015, Meridian purposefully avoided conducting coho surveys during the Wednesday drawdowns at the request of WDFW. However, additional data analyses suggested that coho carcass recovery rates may be improved during lower flows. As a result, starting in 2016, Meridian conducted coho surveys during drawdown days to improve carcass detection probability and increase carcass resight probability, and attempted to do so during the 2018 survey season.

Figure 1. NF Lewis River mainstem and tributary coho spawning survey reaches below Merwin Dam in 2018.

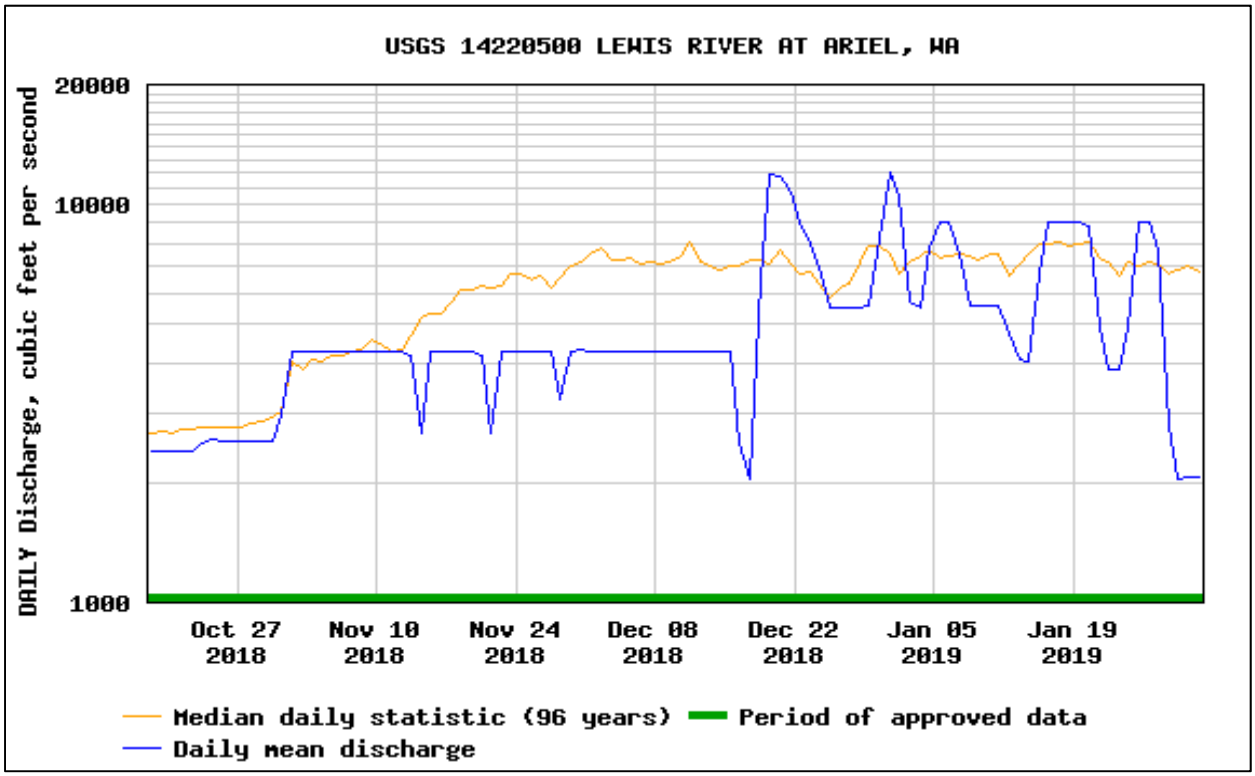

Figure 2. USGS Lewis River Arial Gage - mean daily discharge (cfs) during the survey season and median daily statistics over the period of record.

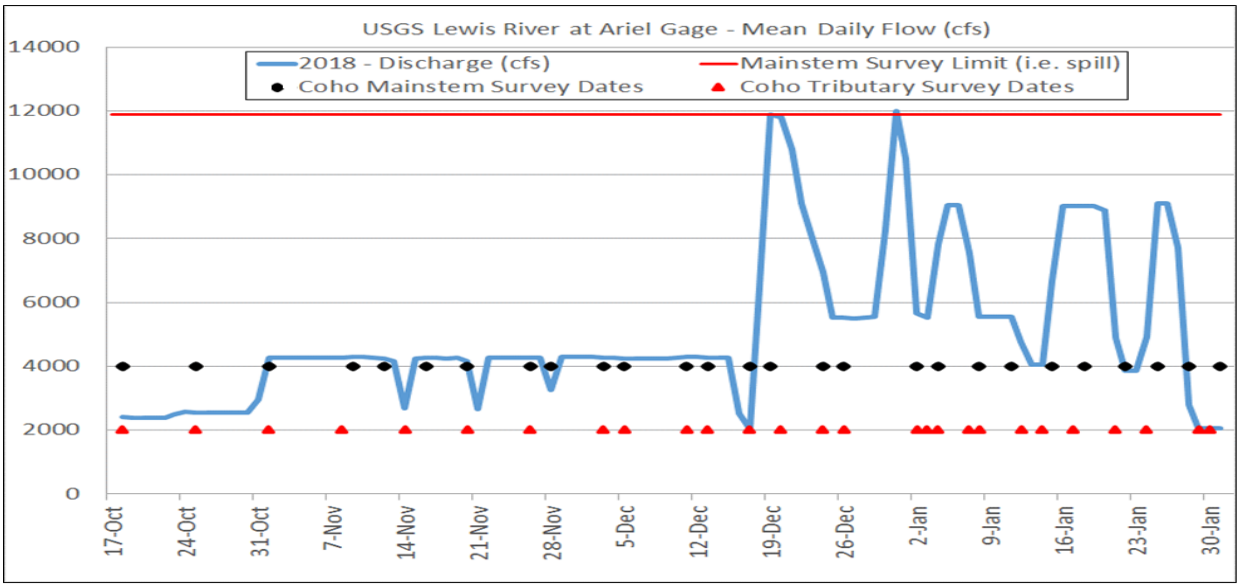

Figure 3. USGS Lewis River Ariel Gage – mean daily discharge (cfs) and survey timing.

Results

North Fork Lewis River Tributary Surveys

Meridian biologists counted a total of 30 redds, 19 live coho spawners, and 6 coho carcasses across the six tributary survey reaches. The majority were in Ross and Johnson creeks (Table 1). One redd and one live spawner were observed in Hayes Creek 1. No redds, live coho, or carcasses were observed in Hayes Creek 2, Hayes Creek Tributary 2, or Bratton Creek. These same tributary reaches were surveyed in some or all prior years from 2013 to 2017; data for years when surveys were conducted is summarized in Table 2. Ross Creek continues to be a tributary with relatively high coho spawning activity. Coho spawning activity has not been observed in Hayes Creek Tributary 2 since Meridian began surveys in 2013 (Table 2).

Table 1. Summary of tributary coho salmon spawning surveys downstream of Merwin Dam (mid-October 2018 through January 2019).

Stream	Reach Length (miles)	Total Weeks (mid-Oct to Jan 31)	Total Weeks Surveyable	Total New Redds	Total Live Holders	Total Live Spawners	Total Carcass Unable to Sample	Hatchery Male Carcass	Hatchery Female Carcass	Unmarked Male Carcass	Unmarked Female Carcass	Total Carcass	% Pre-spawn Mortality (Females)	Carcass Wanded for CWT	CWT Positive Carcass
Ross Creek	1.0	16	15	12	1	10	0	1	2	0	0	3	0%	3	0
Johnson Creek	0.95	16	16	17	2	8	1	1	0	0	1	3	0%	2	0
Hayes Creek 1	1.0	16	13	1	0	1	0	0	0	0	0	0	0%	0	0
Hayes Creek 2	1.0	16	13	0	0	0	0	0	0	0	0	0	NA	0	0
Hayes Trib. 2	1.0	16	13	0	0	0	0	0	0	0	0	0	NA	0	0
Bratton Creek	1.0	16	16	0	0	0	0	0	0	0	0	0	NA	0	0

Table 2. Prior year survey data summary (2013-2018) for tributary stream reaches selected for survey in 2018 (if a year is not shown under a specific stream reach, then it was not selected for survey during that year by WDFW).

Year	Weeks Surveyable	Total Live Spawners	Total Carcasses	Total Redds
Ross Creek				
2013	13	44	20	18
2014	14	14	68	33
2015	10	10	5	2
2016	15	49	10	33
2017	16	20	11	30
2018	15	10	3	12
Johnson Creek				
2015	10	2	0	0
2018	16	8	3	17
Bratton Creek				
2015	10	0	1	0
2018	13	0	0	0
Hayes Creek 1				
2014	4	0	0	0
2015	11	0	1	0
2018	13	1	0	1
Hayes Creek 2				
2018	13	0	0	0
Hayes Tributary 2				
2013	14	0	0	0
2014	2	0	0	0
2016	9	0	0	0
2017	16	0	0	0
2018	13	0	0	0

North Fork Lewis River Mainstem Surveys

As in prior years, Meridian biologists conducting coho redd surveys in the mainstem North Fork Lewis River found it difficult to differentiate coho redds from fall Chinook redds due to the relatively large number of fall Chinook spawning in the mainstem North Fork Lewis River compared to coho. A total of 70 coho carcasses were observed in the entire mainstem North Fork Lewis River survey area over the 27 survey occasions in the 16-week survey period (Table 3). Of those, 8 carcasses were not sampleable (i.e., generally too deep to recover). A total of 62 carcasses were sampled. A total of 8 carcasses had coded-wire tags present. A total of 82 percent of sampled carcasses were of hatchery origin (identified as having an adipose fin clipped or CWT present). A total of 61 sampled carcasses were tagged and released to complete the mark-resight estimate of total carcasses. A total of 22 (36 percent) of the tagged carcasses were resighted at least once over the 27 sampling occasions. Carcass tagging results were used to make estimates of spawner escapement (i.e., total carcasses; see report from Leigh Ann Starcevich, PhD, Biometrician, West Inc., 2019). Total coho carcasses in the North Fork Lewis River mainstem between the downstream end of Eagle Island and the boat barrier downstream of Merwin Dam during the 2018 survey season was estimated to be 137 carcasses; bootstrap 95 percent confidence interval: 98 to 176 (Starcevich 2019). The coefficient of variation for the total carcass estimate was 0.15.

Table 3. Summary of North Fork Lewis River mainstem coho salmon spawning surveys downstream of Merwin Dam (mid-October 2018 through January 2019).

NF Lewis River	Reach Length (miles)	Total Weeks (mid-Oct to Jan 31)	Total Weeks Surveyable	Total Live Holders	Total Live Spawners	Total Carcass Unable to Sample	Hatchery Male Carcass	Hatchery Female Carcass	Unmarked Male Carcass	Unmarked Female Carcass	Total Carcass	Total Carcass Tagged	Total Carcass Recoveries	% Pre-spawn Mortality (Females)	Carcass Wanded for CWT	CWT Positive Carcass
Reach 1	0.57	16	16	30	15	3	4	4	0	0	11	8	4	0%	8	0
Reach 2	0.68	16	16	50	20	0	3	3	1	0	7	7	2	33%	7	0
Reach 3	0.97	16	16	25	5	0	0	1	1	2	4	4	0	33%	4	0
Reach 4	1.32	16	16	100	30	1	4	4	1	2	12	11	3	50%	11	5
Reach 5	7.3	16	15	50	20	4	13	15	2	2	36	31	13	53%	32	3
Total	*10.84*	*16*	*16*	*255*	*90*	*8*	*24*	*27*	*5*	*6*	*70*	*61*	*22*	*42%*	*62*	*8*

Discussion and Conclusions

Incorporating surveys on drawdown days in 2016 nearly doubled the proportion of tagged carcasses that were resighted compared to the highest resight proportion in previous years (2013 to 2015) when surveys were conducted on non-drawdown days (Table 4). It is important to note that the same crew conducted all surveys during all six years covering the same reaches and season. Drawdown operation for spawning surveys generally did not occur during the 2017 coho spawning survey season and average daily flow on survey days and average daily flow during the survey season was the highest since 2013 (Table 4). However, the coho carcass resight rate in 2017 was the highest since 2013, which could be due to random chance due to low sample size. In 2018, drawdown surveys generally did not occur, but flows were generally low and clear during the majority of the survey season, which likely increased detection probability compared to prior years. As it appears that drawdown surveys can increase detection probability in some years, we recommend to continue conducting coho spawning surveys during drawdown days in the future as possible.

Table 4. Total coho redd estimates for 2013 to 2018.

Year	Total Carcasses Tagged	Total Carcasses Resighted	% Carcasses Resighted	Total Weeks Surveyable	Average Daily Flow during Surveys (cfs)	Average Daily Flow Oct 16 to Jan-31	Total Carcass Estimate	Bootstrap SE	95% Confidence Interval	CV
2013	328	41	13%	15	4,700	4,804	1,970	297	1,523 to 2,679	0.17
2014	431	18	4%	15	7,765	7,876	7,805	2,106	5,172 to 13,186	0.27
2015	12	2	17%	12	5,632	8,429	no estimate due to low sample size			
2016	65	20	31%	16	4,587	6,721	124	17	103 to 169	0.14
2017	24	8	33%	16	8,817	8,587	44	5	33 to 55	0.11
2018	61	22	36%	16	5,009	5,044	137	20	98 to 176	0.15

Over the long term, these data suggest that as the trap-and-haul upstream passage program has been implemented (beginning in 2012 and refined over time) to transport coho upstream of the Lewis River Hydroelectric Projects, returning coho are electing to travel further upstream to spawn, and continue to spawn in lower North Fork Lewis River tributaries, rather than spawn in the lower mainstem North Fork Lewis River. The primary evidence of this effect is that thousands of adult coho have been captured at the fish passage facilities each year since 2013, while the number of coho carcasses encountered in the lower North Fork Lewis River mainstem downstream of the fish passage facilities appears to be declining. Over the same time, redd counts in important spawning tributaries, such as Ross Creek, have remained relatively similar. Of note, the low redd count in Ross Creek during 2018 was likely due to the very low return of early coho to the Lewis River basin during 2018, which was so low that the fishery was closed for the season in December to improve spawning escapement and hatchery broodstock collection. Only two of the total 30 redds counted in the tributary survey reaches were observed prior to the December fishery closure. All redds in Ross Creek were observed after the closure.

References

PacifiCorp and Cowlitz PUD. 2017. Aquatic monitoring and evaluation plan for the Lewis River – first revision, objective 15 - determine spawner abundance, timing and distribution of transported anadromous adults, dated February 28, 2017. Prepared by PacifiCorp and Public Utility District No. 1 of Cowlitz County.

Starcevich, L.A. 2019. Estimates of 2018 Coho Adult Escapement from Tagged Carcass Surveys in the Lower North Fork Lewis River downstream of Merwin Dam, dated March 8, 2019. Prepared for Meridian Environmental, Inc. by Leigh Ann Starcevich, PhD, Biometrician, West Inc., Environmental & Statistical Consultants, Corvallis, Oregon.

Appendix E –

Abundance estimate of 2018 coho escapement from carcass surveys in the lower Lewis River mainstem

ENVIRONMENTAL & STATISTICAL CONSULTANTS
456 SW Monroe Ave, Suite 106, Corvallis, OR 97333
Phone: 541-738-6198 ◆ www.west-inc.com

Date: March 8, 2019
To: Jason Shappart (Meridian Environmental, Inc.)
From: Leigh Ann Starcevich (WEST, Inc.)
Re: Estimates of 2018 Coho Adult Escapement from Tagged Carcass Surveys in the Lower North Fork Lewis River downstream of Merwin Dam

Introduction

Coho salmon spawning surveys (including carcass tagging) are conducted annually by Meridian Environmental, Inc. (Meridian) for PacifiCorp to provide the basis for estimating escapement in the mainstem North Fork Lewis River downstream of Merwin Dam to the downstream end of Eagle Island. The area of interest is divided into 5 reaches ranging from 0.57 to 7.30 miles long, previously defined by Washington Department of Fish and Wildlife (WDFW).

Coho carcass surveys were conducted on 27 occasions between October 18, 2018 and January 31, 2019. All observed coho carcasses in sufficient condition were identified and tagged with a uniquely-numbered plastic disk behind the gills (two tags per carcass) so that re-sighting probabilities of tagged carcasses do not differ from untagged carcasses. The tagged carcasses were returned to the river in the same location where found as suggested by WDFW. On successive survey occasions, carcasses were counted by reach. In previous years, after tagging, carcasses were placed in the current to re-distribute, and tails and tags from resighted tagged carcasses were removed and carcasses deposited adjacent to the river to prevent subsequent sightings. This year, resighted tagged carcasses were recorded but not destroyed so that carcasses were available for multiple resightings. After each resight, the tagged carcass was returned to the river in the same location where found.

Statistical Methods

Analysis tools developed for a similar analysis used by California Department of Fish and Wildlife (Bergman et al. 2012) were applied to the carcass data from the Lower Lewis River surveys. In the R statistical environment (2014), the *rma* package (McDonald 2015) was used to apply the super-population parameterization (Schwarz and Arnason 1996) of the Jolly-Seber model to estimate the total escapement in the population while accounting for subsampling of coho for marking. Escapement is quantified by Schwarz and Arnason (1996) as the total number of gross "births" in the area of interest, which includes coho present at the beginning of the study, those that move into the study area during the monitoring period, and those that do not survive to the end of the monitoring period.

Intercept-only models were used for capture and survival probabilities because preliminary modeling indicated that the 2018 data were too sparse for time-dependent

models. A nonparametric bootstrap (Manly 2007) was used to obtain the standard error and 95%-confidence intervals on total escapement.

Results

A total of 70 carcasses were observed and 61 carcasses were in sufficient condition to mark. Of the 61 marked carcasses, 39 were re-sighted once, 15 were resighted twice, 6 were resighted three times, and one carcass was resighted 5 times over the 27 sampling occasions. Escapement (i.e. the total number of carcasses) was estimated in 2018 as 137 (95%-CI: 98, 176) individuals (Table 1). The carcass sighting probability was estimated as 0.46 (95%-CI: 0.30, 0.63). Analysis with the Cormack-Jolly-Seber model resulted in similar estimates, with an estimated gross population size of 127 (bootstrap SE = 18) and a bootstrap 95%-confidence interval of (103, 174).

Table 1. Estimated 2018 coho spawner escapement by year to the mainstem North Fork Lewis River from Merwin Dam to the downstream end of Eagle Island, with 95%-confidence intervals.

Year	Number of marked carcasses	Number (%) of captured carcasses	Est. Escapement	SE	95%-Confidence Interval	CV
2018	61	22 (36.1%)	137	20	(98, 176)	0.15

Literature Cited

Bergman, J. M., R. M. Nielson, and A. Low. 2012. Central Valley in-river Chinook salmon escapement monitoring plan. Fisheries Branch Administrative Report Number: 2012-1. California Department of Fish and Wildlife. Sacramento, CA.

Manly, B. 2007. *Randomization, Bootstrap, and Monte Carlo Methods in Biology, 3rd edition*. Chapman and Hall, Boca Raton, Florida, USA.

McDonald T. 2015. mra: Analysis of Mark-Recapture Data. R package version 2.16.4. http://CRAN.R-project.org/package=mra.

R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Schwarz, C.J., and A.N. Arnason. 1996. A general method for analysis of capture-recapture experiments in open populations. *Biometrics* 52:860-873

APPENDIX F

North Fork Lewis River Downstream of Merwin Dam – 2019 Coho Salmon Spawning Survey Results (October 2019 through January 2020)

Memorandum

To: Erik Lesko, PacifiCorp

From: Jason Shappart, Senior Fisheries Scientist

Date: February 28, 2020

Re: North Fork Lewis River Downstream of Merwin Dam – 2019 Coho Salmon Spawning Survey Results (mid-October 2019 through January 2020)

Introduction

As a component of its existing FERC license, PacifiCorp conducts annual Coho Salmon spawning surveys from mid-October through January to facilitate estimating Coho Salmon spawning escapement in the North Fork (NF) Lewis River downstream of Merwin Dam (PacifiCorp and Cowlitz PUD 2017). Meridian Environmental, Inc. (Meridian) has performed these surveys under contract with PacifiCorp since 2013 using the same survey crew each year. The mainstem NF Lewis River spawning survey area is divided into five index reaches as defined by the Washington Department of Fish and Wildlife (WDFW), extending from the boat barrier downstream of Merwin Dam to the downstream end of Eagle Island (Figure 1), encompassing 10.84 river miles (mainstem channel and Eagle Island side channel). The NF Lewis River tributary spawning survey reaches are defined annually by WDFW using a Generalized Random Tessellation Stratified (GRTS) sample design. The tributary survey data is used by WDFW to estimate Coho escapement within the lower Columbia River area. In 2019, WDFW designated two survey reaches within the Houghton Creek watershed, and one reach each in the Hayes Creek and Ross Creek watersheds (Figure 1). Each survey reach was approximately one mile in length. All surveys were conducted on a weekly basis as environmental conditions allowed (flow, turbidity, etc.) following methods described in PacifiCorp's revised Monitoring and Evaluation Plan (PacifiCorp and Cowlitz PUD 2017). This memorandum summarizes the results of the Coho Salmon spawning surveys from mid-October 2019 through January 2020.

Survey Conditions

In 2019, NF Lewis River flows downstream of Merwin Dam were variable. Flows were generally well below median conditions until mid-December due to the lack of precipitation (Figure 2). Large storm events resulted flows generally much higher than median conditions from mid-December through the end of January (Figure 2). Conditions were surveyable during every week of the survey period for the mainstem NF Lewis River except the last week in January, when spill occurred at Merwin Dam. Tributary survey reaches were generally surveyable every week through December; however, conditions in all

tributaries were either poor or not surveyable during most of January due to high flows and/or high turbidity. Survey days and mainstem NF Lewis River discharge are depicted in Figure 3.

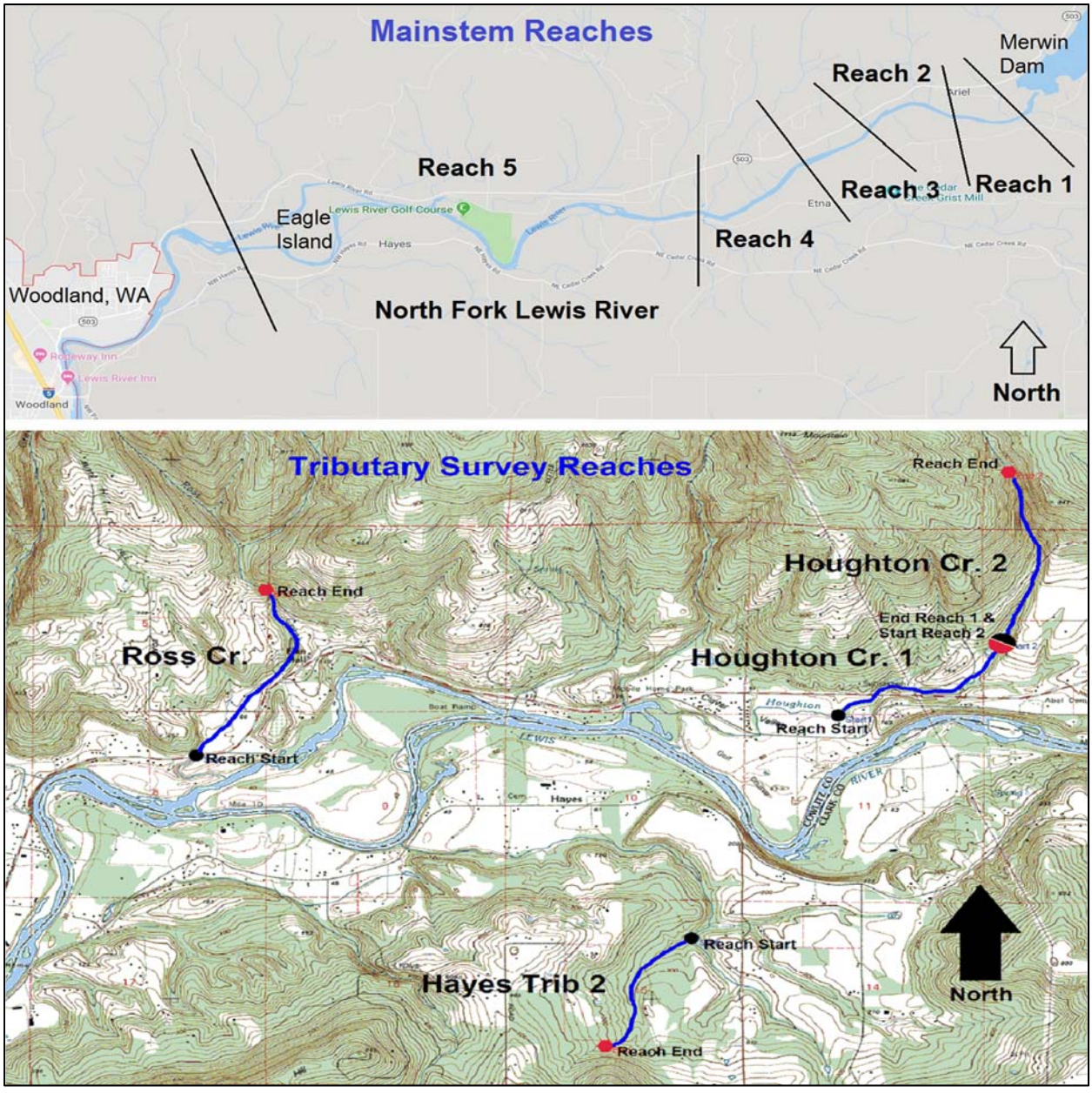

Figure 1. North Fork Lewis River mainstem and tributary Coho spawning survey reaches below Merwin Dam in 2019.

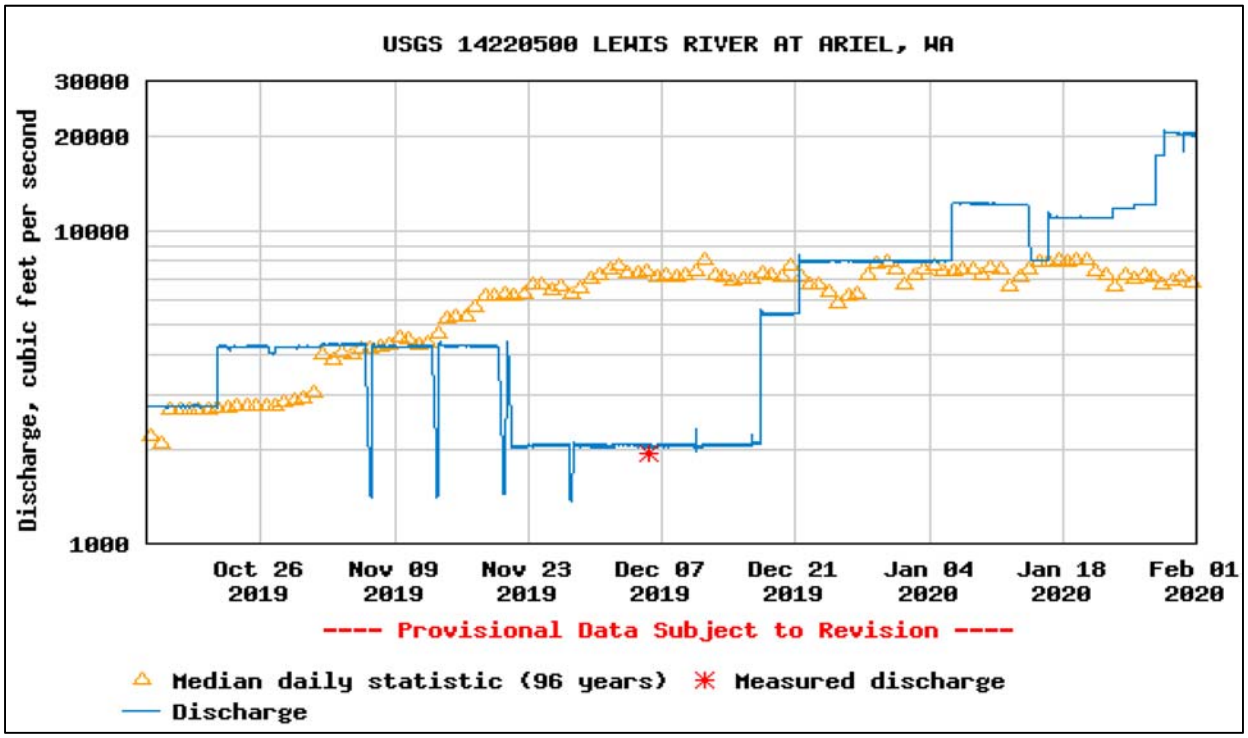

Figure 2. USGS Lewis River Ariel Gage - mean daily discharge (cfs) during the 2019 survey season and median daily statistics over the period of record.

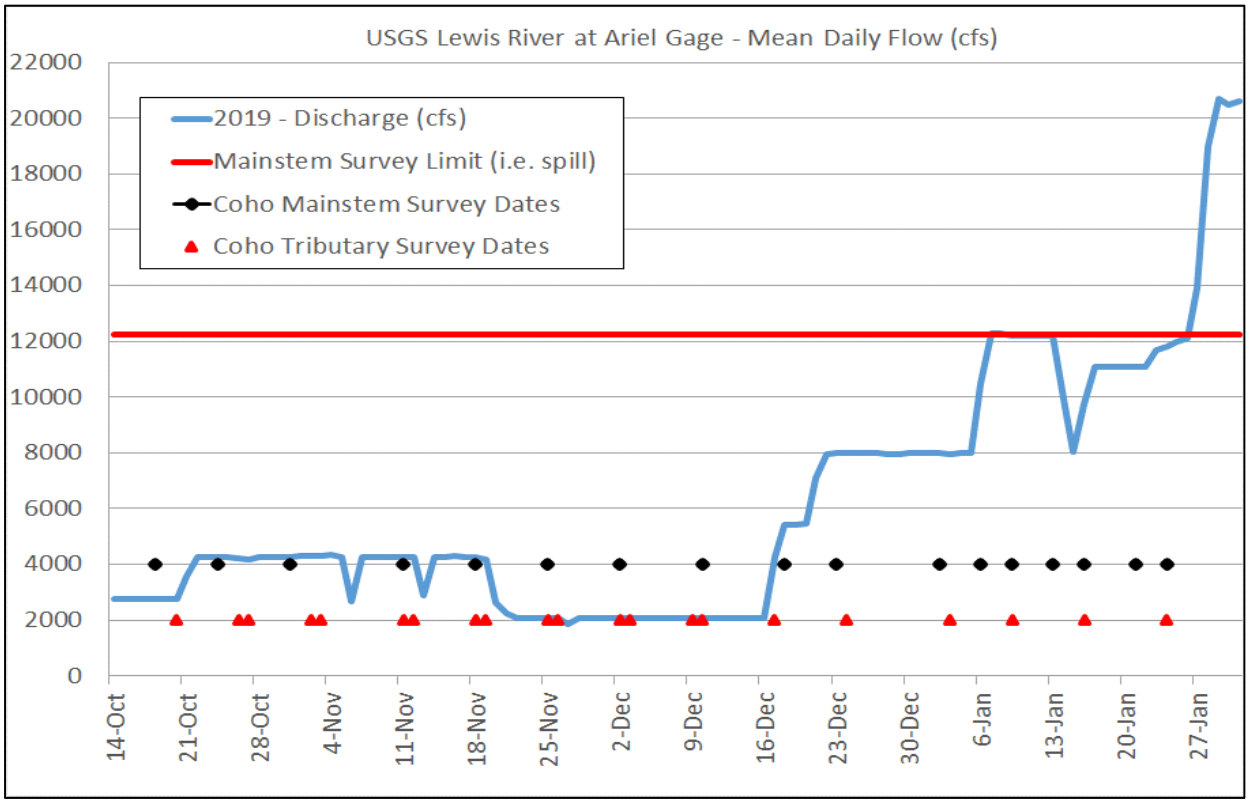

Figure 3. USGS Lewis River Ariel Gage – mean daily discharge (cfs) and survey timing in 2019.

On each survey occasion, all five mainstem NF Lewis River reaches were surveyed via jet boat during a single day. All tributary surveys were conducted on foot. In prior years, PacifiCorp conducted river drawdowns once per week during the Coho and fall Chinook spawning survey seasons at the request of WDFW to facilitate WDFW's ability to recover fall Chinook carcasses. From 2013 to 2015, Meridian purposefully avoided conducting Coho surveys during the Wednesday drawdowns at the request of WDFW. However, additional data analyses suggested that Coho carcass recovery rates may be improved during lower flows. As a result, starting in 2016, Meridian conducted Coho surveys during drawdown days to improve carcass detection probability and increase carcass resight probability, and attempted to do so during the 2019 survey season, though few drawdown days occurred.

Results

North Fork Lewis River Tributary Surveys

Meridian biologists counted a total of 29 redds, 34 live Coho spawners, and 12 Coho carcasses across the four tributary survey reaches. All Coho and redds observed were in Ross and Houghton creeks (Table 1). No Coho or redds were observed in Hayes Creek Tributary 2. These same tributary reaches were surveyed in some or all prior years from 2013 to 2018; data for years when surveys were conducted is summarized in Table 2. Ross and Houghton creeks continue to have relatively high Coho spawning activity. A total of 30

percent of sampled carcasses were of hatchery origin (identified as having an adipose fin clipped or coded wire tag (CWT) present). Coho spawning activity has not been observed in Hayes Creek Tributary 2 since Meridian began surveys in 2013 (Table 2).

Table 1. Summary of tributary Coho Salmon spawning surveys downstream of Merwin Dam (mid-October 2019 through January 2020).

Stream	Reach Length (miles)	Total Weeks (mid-Oct to Jan 31)	Total Weeks Surveyable	Total New Redds	Total Live Holders	Total Live Spawners	Total Carcass Unable to Sample	Hatchery Male Carcass	Hatchery Female Carcass	Unmarked Male Carcass	Unmarked Female Carcass	Total Carcass	% Pre-spawn Mortality (Females)	Carcass Wanded for CWT	CWT Positive Carcass
Ross Creek Reach 1	1.0	15	12	13	2	29	2	0	2	2	4	10	0%	8	0
Houghton Creek Reach 1	1.0	15	14	16	0	5	0	0	1	0	1	2	0%	2	0
Houghton Creek Reach 2	1.0	15	11	0	0	0	0	0	0	0	0	0	NA	0	0
Hayes Creek Tributary 2	1.0	15	11	0	0	0	0	0	0	0	0	0	NA	0	0

Table 2. Prior year survey data summary (2013-2019) for tributary stream reaches selected for survey in 2019 (if a year is not shown under a specific stream reach, then it was not selected for survey during that year by WDFW).

Year	Weeks Surveyable	Total Live Spawners	Total Carcasses	Total Redds
Ross Creek				
2013	13	44	20	18
2014	14	14	68	33
2015	10	10	5	2
2016	15	49	10	33
2017	16	20	11	30
2018	15	10	3	12
2019	12	29	10	13
Houghton Creek				
2013	15	52	2	8
2014	13	13	14	8

2015	10	0	0	0
2016 (2 reaches)*	16	10	2	10
2019 (2 reaches)*	14	5	2	16
Hayes Tributary 2				
2013	14	0	0	0
2014	2	0	0	0
2016	9	0	0	0
2017	16	0	0	0
2018	13	0	0	0
2019	11	0	0	0

*Note: A single one mile-long reach was surveyed in each year for each stream, except two reaches (one mile-long each) were surveyed in Houghton Creek in 2016 and 2018.

North Fork Lewis River Mainstem Surveys

As in prior years, Meridian biologists conducting Coho redd surveys in the mainstem North Fork Lewis River found it difficult to differentiate Coho redds from fall Chinook redds due to the relatively large number of fall Chinook spawning in the mainstem NF Lewis River compared to Coho. A total of 44 Coho carcasses were observed in the entire mainstem NF Lewis River survey area over the 16-week survey period (Table 3). Of those, two carcasses were not sampleable (i.e., generally too deep to recover). A total of 40 carcasses were sampled. Zero carcasses had CWT present. A total of 53 percent of sampled carcasses were of hatchery origin (identified as having an adipose fin clipped or CWT present). All sampled carcasses were tagged and released to complete the mark-resight estimate of total carcasses. A total of seven (17.5 percent) of the tagged carcasses were resighted at least once during the survey season. However, high flows after mid-December affected carcass resight efficiency. For the survey period from October through December 18, 2020, a total of 21 carcasses were tagged and six (28.6 percent) of the tagged carcasses were resighted. However, once flows increased after December 18, a total of 19 carcasses were tagged, but only one carcass (5.3 percent) was resighted.

Carcass tagging results were used to make estimates of spawner escapement (i.e., total carcasses; Starcevich 2020). Total Coho carcasses in the North Fork Lewis River mainstem between the downstream end of Eagle Island and the boat barrier downstream of Merwin Dam during the 2019 survey season was estimated to be 83 carcasses; bootstrap 95 percent confidence interval: 64 to 102 (Starcevich 2020). The coefficient of variation for the total carcass estimate was 0.12.

Table 3. Summary of North Fork Lewis River mainstem Coho Salmon spawning surveys downstream of Merwin Dam (mid-October 2019 through January 2020).

NF Lewis River	Reach Length (miles)	Total Weeks (mid-Oct to Jan 31)	Total Weeks Surveyable	Total Live Holders	Total Live Spawners	Total Carcass Unable to Sample	Hatchery Male Carcass	Hatchery Female Carcass	Unmarked Male Carcass	Unmarked Female Carcass	Total Carcass	Total Carcass Tagged	Total Carcass Recoveries	% Pre-spawn Mortality (Females)	Carcass Wanded for CWT	CWT Positive Carcass
Reach 1	0.57	16	15	16	0	1	1	2	2	1	7	6	2	33%	6	0
Reach 2	0.68	16	15	23	0	0	0	1	2	0	3	3	0	0%	3	0
Reach 3	0.97	16	15	13	0	1	1	0	1	0	3	2	0	0%	2	0
Reach 4	1.32	16	15	25	0	0	2	1	4	1	8	8	0	0%	8	0
Reach 5	7.3	16	15	45	0	2	7	6	6	2	23	21	5	63%	21	0
Total	*10.84*	*16*	*15*	*122*	*0*	*4*	*11*	*10*	*15*	*4*	*44*	*40*	*7*	*43%*	*40*	*0*

Discussion and Conclusions

Incorporating surveys on drawdown days in 2016 nearly doubled the proportion of tagged carcasses that were resighted compared to the highest resight proportion in previous years (2013 to 2015) when surveys were conducted on non-drawdown days (Table 4). It is important to note that the same crew conducted all surveys during all seven years covering the same reaches and season. Drawdown operation for spawning surveys generally did not occur during the 2019 Coho spawning survey season and average daily flow on survey days and average daily flow during the survey season was the highest since 2013 (Table 4).

Though drawdown surveys generally did not occur in 2019, flows were generally low and clear through mid-December, which resulted in relatively high carcass detection probability. However, after mid-December, high flows greatly reduced carcass detection probability. High water could have washed marked carcasses downstream or could have caused detection issues due to reduced water clarity. Field crews also noticed the presence of what appeared to be a substantially higher abundance of bald eagles in the area during surveys compared to previous years, and predation on marked carcasses could have reduced the number of marked carcasses available for resight. During a low Coho run year when few carcasses are available for tagging, increased predation could have a pronounced effect on Coho carcass resighting probability.

Over the long term, these data suggest that as the trap-and-haul upstream passage program has been implemented (beginning in 2012 and refined over time) to transport Coho upstream of the Lewis River Hydroelectric Projects, returning Coho are electing to travel further upstream to spawn, and continue to spawn in lower NF Lewis River tributaries,

rather than spawn in the lower mainstem NF Lewis River. The primary evidence of this effect is that thousands of adult Coho have been captured at the fish passage facilities each year since 2013, while the number of Coho carcasses encountered in the lower NF Lewis River mainstem downstream of the fish passage facilities appears to be declining.

Table 4. Total Coho redd estimates for 2013 to 2019.

Year	Total Carcasses Tagged	Total Carcasses Resighted	% Carcasses Resighted	Total Weeks Surveyable	Average Daily Flow during Survey Days (cfs)	Average Daily Flow All Days Oct 16 to Jan-31	Total Carcass Estimate	Bootstrap SE	95% Confidence Interval	CV
2013 Season Total	328	41	13%	15	4,700	4,804	1,970	297	1,523 to 2,679	0.17
2014 Season Total	431	18	4%	15	7,765	7,876	7,805	2,106	5,172 to 13,186	0.27
2015 Season Total	12	2	17%	12	5,632	8,429	no estimate due to low sample size			
2016 Season Total	65	20	31%	16	4,587	6,721	124	17	103 to 169	0.14
2017 Season Total	24	8	33%	16	8,817	8,587	44	5	33 to 55	0.11
2018 Season Total	61	22	36%	16	5,009	5,044	137	20	98 to 176	0.15
2019 Oct 18-Dec 20	21	6	29%	10	3,491	3,240	Low water period			
2019 Dec 21-Jan 31	19	1	5%	5	10,942	10,440	High water period			
2019 Season Total	40	7	18%	15	6,181	6,761	83	10	64 to 102	0.12

References

PacifiCorp and Cowlitz PUD. 2017. Aquatic monitoring and evaluation plan for the Lewis River – first revision, objective 15 - determine spawner abundance, timing and distribution of transported anadromous adults, dated February 28, 2017. Prepared by PacifiCorp and Public Utility District No. 1 of Cowlitz County.

Starcevich, L.A. 2020. Estimates of 2019 Coho Adult Escapement from Tagged Carcass Surveys in the Lower North Fork Lewis River downstream of Merwin Dam, dated February 26, 2020. Prepared for Meridian Environmental, Inc. by Leigh Ann Starcevich, PhD, Biometrician, West Inc., Environmental & Statistical Consultants, Corvallis, Oregon.

Appendix G –

Abundance estimate of 2019 coho escapement from carcass surveys in the lower Lewis River mainstem

ENVIRONMENTAL & STATISTICAL CONSULTANTS
2725 NW Walnut Blvd, Corvallis, OR 97330
Phone: 541-738-6198 ◆ www.west-inc.com

Date: February 26, 2020
To: Jason Shappart (Meridian Environmental, Inc.)
From: Leigh Ann Starcevich (WEST, Inc.)
Re: Estimates of 2019 Coho Adult Escapement from Tagged Carcass Surveys in the Lower North Fork Lewis River downstream of Merwin Dam

Introduction

Coho salmon spawning surveys (including carcass tagging) are conducted annually by Meridian Environmental, Inc. (Meridian) for PacifiCorp to provide the basis for estimating escapement in the mainstem North Fork Lewis River downstream of Merwin Dam to the downstream end of Eagle Island. The area of interest is divided into 5 reaches ranging from 0.57 to 7.30 miles long, previously defined by Washington Department of Fish and Wildlife (WDFW).

Coho carcass surveys were conducted on 17 occasions between October 18, 2019 and January 24, 2020. All observed Coho carcasses in sufficient condition were identified and tagged with a uniquely-numbered plastic disk behind the gills (two tags per carcass) so that resighting probabilities of tagged carcasses do not differ from untagged carcasses. On successive survey occasions, carcasses were counted by reach. Resighted tagged carcasses were recorded but not destroyed so that carcasses were available for multiple resightings. After each resight, the tagged carcass was returned to the river in the same location where found as suggested by WDFW.

Statistical Methods

Analysis tools developed for a similar analysis used by California Department of Fish and Wildlife (Bergman et al. 2012) were applied to the carcass data from the Lower Lewis River surveys. In the R statistical environment (2019), the *rma* package (McDonald 2015) was used to apply the super-population parameterization (Schwarz and Arnason 1996) of the Jolly-Seber model to estimate the total escapement in the population while accounting for subsampling of Coho for marking. Escapement is quantified by Schwarz and Arnason (1996) as the total number of gross "births" in the area of interest, which includes Coho present at the beginning of the study, those that move into the study area during the monitoring period, and those that do not survive to the end of the monitoring period. The super-population parameterization of the Jolly-Seber model (POPAN model) was also applied to the carcass data with the RMark package (Laake 2013). Intercept-only models were used for capture and survival probabilities because preliminary modeling indicated that the 2019 data were too sparse for time-dependent models.

ENVIRONMENTAL & STATISTICAL CONSULTANTS
2725 NW Walnut Blvd, Corvallis, OR 97330
Phone: 541-738-6198 ◆ www.west-inc.com

Results

The results of the 2019 carcass survey are provided in Table 1. A total of 44 carcasses were observed and 40 carcasses were in sufficient condition to mark. Of the 40 marked carcasses, 7 were re-sighted once for an observed resighting probability of 0.175. No carcasses were observed more than once. Escapement (i.e. the total number of carcasses) was estimated in 2019 as 83 (95%-CI: 64, 102) individuals. However, the model results indicated poor convergence as demonstrated by large estimates of the standard error of the capture probability, so model results may not be reliable. Lack of convergence occurs when the iterative algorithm used to obtain estimates does not identify a single solution within a specified error range. This is likely due to a low number of marked carcasses (40) and a low proportion of resighted marked carcasses (0.175), so data are insufficient for estimation of all model parameters. Data were restricted to the set of survey occasions occurring on or before December 18, 2019 before high water conditions occurred, but modeling resulted in similarly large standard errors.

Table 1. Estimated 2019 coho spawner escapement to the mainstem North Fork Lewis River from Merwin Dam to the downstream end of Eagle Island, with 95%-confidence intervals.

Year	Number of marked carcasses	Number (%) of captured carcasses	Est. Gross Population Size	SE	95%-Confidence Interval	Coefficient of Variation (SE/Est. Size)
2019	40	7 (17.5%)	83	10	(64, 102)	0.12

Discussion

Environmental conditions likely impacted the resighting probabilities of marked carcasses, but data are too sparse to quantitatively assess the impact. High water could have washed marked carcasses downstream or could have caused detection issues due to water turbidity. Field crews also noticed the presence of a higher abundance of bald eagles in the area during surveys compared to previous years, and predation on marked carcasses could have reduced the number of marked carcasses available for resight. During a low Coho run year when few carcasses are available for tagging, increased predation could have a pronounced effect on Coho carcass resighting probability.

Literature Cited

Bergman, J. M., R. M. Nielson, and A. Low. 2012. Central Valley in-river Chinook salmon escapement monitoring plan. Fisheries Branch Administrative Report Number: 2012-1. California Department of Fish and Wildlife. Sacramento, CA.

Laake, J.L. (2013). RMark: An R Interface for Analysis of Capture-Recapture Data with MARK. AFSC Processed Rep 2013-01, 25p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

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Schwarz, C.J., and A.N. Arnason. 1996. A general method for analysis of capture-recapture experiments in open populations. *Biometrics* 52:860-873.

APPENDIX H

Lewis River Annual Hatchery Operations Report - 2019

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
FISH PROGRAM
HATCHERIES DIVISION

LEWIS RIVER COMPLEX OPERATIONS PROGRAM
FOR
JANUARY 1, 2019 TO DECEMBER 31, 2019

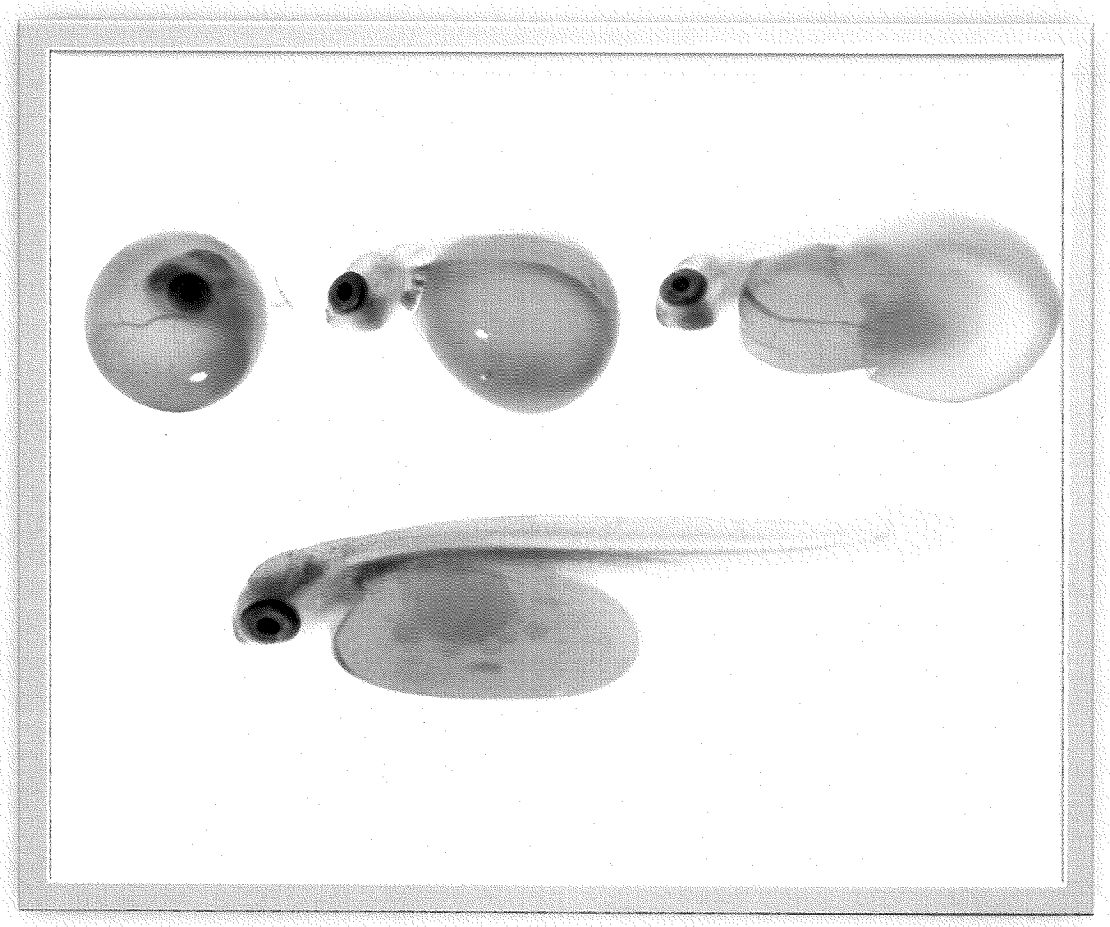

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TABLE OF CONTENTS

OPERATIONS PROGRAM

LEWIS RIVER HATCHERY

FOR

JANUARY 1, 2019 TO DECEMBER 31, 2019

Washington Department of
FISH and WILDLIFE

WRITTEN AND COMPILED BY:

LEWIS RIVER HATCHERY STAFF

Introduction

The Lewis River Salmon Hatchery is located approximately eight miles east of Woodland, WA. on the North Fork of the Lewis River. Originally constructed in 1909 on Johnson Creek, the hatchery was moved to its present site in 1923.

Program Goals

- 1,350,000 yearling Spring Chinook at 8 to 12 fpp released into the North Fork Lewis River.
- 1,100,000 yearling Early Coho at 16 fpp released into the North Fork Lewis River.
- 900,000 yearling Late Coho at 16 fpp released into the North Fork Lewis River.

Approximately 29,000 gallons of water per minute can be delivered to the hatchery system by eight pumps that are located at two separate intakes. Four booster pumps permit further distribution of water to other areas of the facility as needed. Three gas stabilization towers and one packed column are available to remove supersaturated gases from the water supply when necessary.

There is approximately 312,000 cubic feet of available rearing space. This space consists of 14 super raceways and 12 standard raceways. Adult holding space consists of 4 large concrete ponds with a common center channel totaling 53,000 cubic feet.

The incubation facility houses fifty stacks (16 trays/stack) of vertical incubators and four shallow troughs.

The Lewis Hatchery facility also includes three residences, hatchery/office building, freezer building, two three bay storage buildings, two small storage buildings, public restroom, two intake structures, two generator/pump control buildings, two compressor buildings a two-story adult handling facility and a domestic water pump house.

Lewis River hatchery is staffed with a FHS 4, FHS 3, three FHS 2s and a FHT.

TRAPPING

The Merwin Fish Collection Facility (F.C.F.) and the Lewis Ladder Trap operate continuously year around. Once the fish are captured, staff identify, numerate, and sort for hatchery brood stock, watershed escapement goals, tribal harvest agreements, food banks, and nutrient enhancement.

2019 Lewis River Winter Steelhead

The last 2019 brood winter steelhead was trapped at the Lewis Ladder on February 5, 2019. The last one trapped at the Merwin F.C.F was on April 12, 2019. Broodstock was collected at the Merwin F.C.F. and shipped to Merwin Hatchery.

Total Trapped (F.C.F.)	889
Total Trapped (Lewis)	4
Trap Mortality	10
Brood stock Shipped	139
Food Banks/Tribes	744

2019 Brood Lewis River Late Winter Steelhead Hatchery Origin

The last 2019 hatchery origin brood late winter steelhead trapped at the Merwin F.C.F. was on June 17, 2019 and the only late winter trapped at the Lewis River Hatchery was on May 14, 2019. The fish returned to river were planted into the upper Lewis River at Eagle Cliff.

Total Trapped (F.C.F.)	1,010
Total Trapped (Lewis)	1
Trap Mortality	5
Planted	1,006

2020 Brood Lewis River Summer Steelhead

The first summer steelhead was trapped at Merwin F.C.F. on March 15, 2019. The first summer steelhead trapped at the Lewis Ladder was on July 16, 2019. Steelhead utilized for brood stock were collected from the Merwin F.C.F. and shipped to Merwin Hatchery from June 24, 2019 through September 10, 2019.

Total Trapped (F.C.F.)	1,428
Total Trapped (Lewis)	77
Recycled	434
Trap Mortality	10
Brood stock Shipped	348
Food Banks/Tribes	713

2020 Brood Lewis River Winter Steelhead

The first winter steelhead was trapped at Merwin F.C.F. on November 19, 2019. At the Lewis River Hatchery Ladder, the first winter arrived on December 10, 2019. Steelhead utilized for brood stock were collected and shipped from the Merwin F.C.F and Lewis River Hatchery, from December 3rd through December 30th, 2019.

Total Trapped (F.C.F.)	174
Total Trapped (Lewis)	23
Planted into Horseshoe Lake	16
Trap Mortality	14
Brood stock Shipped	130
Food Banks/Tribes	51

2018 Brood Lewis River (Type N) Coho

The last late Coho captured at Merwin F.C.F. was on February 22, 2019. The last late Coho captured at the Lewis Ladder was on February 5, 2019.

Adults Trapped (F.C.F.)	1,167
Jacks Trapped (F.C.F.)	321
Adults Trapped (Lewis)	9,258
Jacks Trapped (Lewis)	1,925
Trap Mortality (Adults)	1,901
Trap Mortality (Jacks)	155
Spawned (Adults)	1,069
Spawned (Jacks)	6
Food Banks/Tribes (Adults)	1,012
Food Banks/Tribes (Jacks)	1,006
Nutrient Enhancement (Adults)	2,472
Nutrient Enhancement (Jacks)	1,057
Brood stock Shipped (Adults)	754
Brood stock Shipped (Jacks)	23
Shipped to Swift (Adults)	4,160
Shipped to Swift (Jacks)	2

2019 Brood Lewis River Spring Chinook

The first spring Chinook trapped at the Merwin F.C.F. was March 2, 2019. The first arrival at the Lewis Ladder was May 14, 2019. Brood stock was collected at both trapping sites and shipped to Speelyai Hatchery.

Adults Trapped (F.C.F.)	740
Jacks Trapped (F.C.F.)	240
Adults Trapped (Lewis)	97
Jacks Trapped (Lewis)	3
Trap Mortality (Adults)	6
Brood stock Shipped (Adults)	830
Brood stock Shipped (Jacks)	141
Shipped to Swift (Adults)	0
Shipped to Swift (Jacks)	80

2019 Brood Lewis River (Type S) Early Coho

The first early Coho trapped at Merwin F.C.F. was on August 14, 2019. The first early Coho trapped at the Lewis Ladder was on August 27, 2019. Brood stock for hatchery production may be collected at both trapping sites then shipped to Speelyai Hatchery. Early Coho not kept as brood stock are transported to the upper Lewis River at Eagle Cliff and released.

Adults Trapped (F.C.F.)	1,423
Jacks Trapped (F.C.F.)	167
Adults Trapped (Lewis)	5,160
Jacks Trapped (Lewis)	1,048
Trap Mortality (Adults)	113
Trap Mortality (Jacks)	35
Food Banks/Tribes (Adults)	5,917
Food Banks (Jacks)	1,409
Nutrient Enhanced (Adults)	837
Nutrient Enhanced (Jacks)	213
Broodstock Shipped (Adults)	1,589
Broodstock Shipped (Jacks)	72
Shipped to Swift (Adults)	1,775
Shipped to Swift (Jacks)	10

2019 Brood Lewis River (Type N) Late Coho

The first late Coho trapped at the Merwin F.C.F. and the Lewis Ladder was on October 15, 2019. All brood stock is held and spawned at the Lewis River Hatchery. The spawned carcasses were all nutrient enhanced. Late Coho that are not kept as brood stock, distributed to tribes and foodbanks, or used for nutrient enhancement, are transported to the upper Lewis River at Eagle Cliff and released.

Adults Trapped (F.C.F.)	504
Jacks Trapped (F.C.F.)	168
Adults Trapped (Lewis)	4,812
Jacks Trapped (Lewis)	918
Trap Mortality (Adults)	817
Trap Mortality (Jacks)	22
Spawned (Adults)	1,676
Spawned (Jacks)	27
Food Banks/Tribes (Adults)	15
Food Banks/Tribe (Jacks)	55
Nutrient Enhanced (Adults)	311
Nutrient Enhanced (Jacks)	955
Shipped to Swift (Adults)	277
Shipped to Swift (Jacks)	27
On Hand (Adults)	2,220
On Hand (Jacks)	0

INCIDENTAL TRAPPING

2019 Brood Lewis River Wild Winter Steelhead

Brood stock was collected at the Merwin F.C.F. and then shipped to Merwin Hatchery for spawning. No fish were trapped in the Lewis Ladder. The last wild winter steelhead was trapped at the Merwin F.C.F. on June 21, 2019. Fish not used for brood stock were returned to the Lewis River.

Adults Trapped (F.C.F.)	74
Adults Trapped (Lewis)	0
Mortality	2
Returned to Stream	26
Brood stock Shipped	46

2020 Brood Lewis River Wild Summer Steelhead

The first wild summer steelhead was trapped at Merwin F.C.F. on May 22, 2019. The Lewis Ladder did not trap any wild summer steelhead. All fish were returned to the Lewis River downstream of the Merwin Fish Collection Facility.

Adults Trapped (F.C.F.)	7
Returned to Stream	7

2020 Brood Lewis River Wild Winter Steelhead

The first 2020 brood wild winter was trapped at the Merwin F.C.F. on December 1, 2019. The fish was returned to the Lewis River downstream of the Merwin F.C.F.

Adults Trapped (F.C.F.)	1
Returned to Stream	1

2019 Brood Lewis River Wild Spring Chinook

The first wild spring Chinook was trapped at Merwin F.C.F. on March 28, 2019. All fish trapped at the Merwin F.C.F. were planted in Swift Reservoir at Eagle Cliff.

Adults Trapped (F.C.F.)	23
Jacks Trapped (F.C.F.)	9
Adults Trapped (Lewis)	3
Returned to Stream (Adults)	26
Returned to Stream (Jacks)	9

2019 Brood Lewis River Sockeye (Unknown Origin)

The first Sockeye was trapped at Merwin F.C.F. on July 2, 2019. No Sockeye were captured in the Lewis Ladder in 2019. All live fish were returned to the Lewis River downstream of the Merwin F.C.F.

Adults Trapped (F.C.F.)	12
Returned to Stream (Adults)	12

2019 Brood Lewis River Wild Fall Chinook

The first wild fall Chinook was trapped at Merwin F.C.F. on August 7, 2019. The first arrival at the Lewis Ladder was August 17, 2019. All fish were returned to the Lewis River.

Adults Trapped (F.C.F.)	116
Jacks Trapped (F.C.F.)	10
Adults Trapped (Lewis)	11
Jacks Trapped (Lewis)	1
Mortality	1
Returned to Stream (Adults)	126
Returned to Stream (Jacks)	11

2019 Brood Fall Chinook (Unknown Hatchery Origin)

These fall Chinook are adipose clipped indicating that they are of hatchery origin. We identify them as unknown because the Lewis River does not have a hatchery fall Chinook program. The fish are strays from another hatchery program(s). The first fall Chinook was trapped at Merwin F.C.F. on August 8, 2019. The first arrival at the Lewis Ladder was September 3, 2019.

Adults Trapped (F.C.F.)	155
Jacks Trapped (F.C.F.)	27
Adults Trapped (Lewis)	73
Jacks Trapped (Lewis)	9
Mortality (Adult)	39
Mortality (Jack)	2
Food Banks/Tribes (Adults)	189
Food Banks/Tribes (Jacks)	34

2019 Brood Lewis River Wild Early Coho

The first wild early Coho was trapped at Merwin F.C.F. was August 12, 2019. The first arrival at the Lewis Ladder was August 27, 2019. All wild early Coho were planted in to the Lewis River at Eagle Cliff above the Swift Reservoir.

Adults Trapped (F.C.F.)	819
Jacks Trapped (F.C.F.)	202
Adults Trapped (Lewis)	211
Jacks Trapped (Lewis)	24
Mortality	2
Returned to Stream at Swift (Adults)	1,028
Returned to Stream at Swift (Jacks)	226

2019 Lewis River Chum (Unknown Origin)

The Merwin F.C.F. captured one Chum for the year on July 18, 2019. The chum was returned to the Lewis River downstream from the F.C.F.

Adults Trapped (F.C.F.)	1
Adults Trapped (Lewis)	0
Returned to Stream	1

2019 Brood Lewis River Wild Late Coho

The first wild late Coho was trapped at Merwin F.C.F. on November 4, 2019. The first arrival at the Lewis Ladder was October 22, 2019. Some of the wild late Coho captured at Lewis were used as brood stock at Lewis River Hatchery, as the integrated portion of the hatchery's late Coho program. Additional fish were shipped down from the Merwin F.C.F for broodstock. Live fish not used for brood stock were returned to the Lewis River above Swift reservoir.

Adults Trapped (F.C.F.)	253
Jacks Trapped (F.C.F.)	31
Adults Trapped (Lewis)	152
Jacks Trapped (Lewis)	3
Mortality (Adults)	13
Mortality (Jacks)	0
Spawned (Adults)	51
Spawned (Jacks)	0
Returned to Stream at Swift (Adults)	303
Returned to Stream at Swift (Jacks)	34
Broodstock Shipped to Lewis from FCF (Adults)	38

ADULT TRAPPING - LEWIS RIVER LADDER 2019

SPECIES	ESTIMATED TRAPPED/RECEIVED		SHIPPED / PLANTED			MORTALITIES			CARCASS DISTRIBUTION			LETHAL SPAWNED				MARKS RECOVERED			ESTIMATED EGGS
	A	J	M	F	J	M	F	J	M	F	J	M	VF	NVF	J	M	F	J	TAKEN
CO:NO:LEWI:18:H	175	107	39	3		65	68	107											
CO:NO:LEWI:18:W	0																		
SH:SU:MEHA:19:H	33								8	25									
SH:WI:MEHA:19:H	4								1	3									
SH:WL:LEWI:19:H	1		1																
SH:WL:LEWI:19:W	0																		
CK:SP:LEHA:19:H	97	3	56	40	3														
CK:SP:LEWI:19:W	3		2	1															
SH:SU:MEHA:20:H	77		13				6		23	35									
SH:SU:LEWI:20:W	0																		
SO:NA:UNKN:19:U	0																		
CT:AC:LEWI:19:W	0																		
CO:SO:LEHA:19:H	5,160	1,048	1,018	1,158	81	45	50	30	1,826	1,063	937					194	109	76	
CO:SO:LEWI:19:W	211	24	120	91	24														
CK:FA:UNKN:19:H	73	9				9	4	1	52	8	8								
CK:FA:LEWI:19:W	11	1	11		1														
CO:NO:LEWI:19:H	4,812	918	1,325	729		562	216	22	203	101	869	825	849	2	27	270	190	59	1,588,021
CO:NO:LEWI:19:W	152	3	52	40	3	4	5					25	26						1,175,766
SH:WI:MEHA:20:H	23		2	12					8	1									
SH:WL:LEWI:20:W	0																		
TOTALS	10,832	2,113	2,639	2,074	112	685	349	160	2,121	1,236	1,814	850	875	2	27	464	299	135	2,763,787

Egg Take and Incubation

2018 Brood Lewis River Late Coho (Integrated and Segregated)

Egg inventory and distribution was as follows:

Total Egg Take (green)	1,849,024
Egg Loss	334,929
Short/Over	65,291
Adjusted Egg Take	1,914,315
Total Eyed Eggs	1,479,616
Shipped	633,836
Fecundity	3,493

Once a strong eye developed, the eggs were shocked and picked to remove dead eggs. After the morbid eggs are removed, the eyed eggs were re-inventoried and laid down to hatch or ship. Total eggs loss (roughly 18.5%) was 334,929. The live 945,550 eyed eggs for the Lewis River program were integrated and kept on station.

A total of 633,836, both green and eyed, segregated eggs were shipped out. Washougal Hatchery received 99,770 green eggs in December of 2018. The remaining egg shipments were shipped as eyed eggs during January 2019. The eggs were distributed as followed: Fish First 460,066; Clark PUD 46,000; Columbia Springs 13,000; Ridgefield High School 10,000; The Steve Syverson Project 5,000.

2019 Brood Lewis River Early Coho

No fish were spawned at Lewis River Hatchery for this stock. All adult fish were shipped to Speelyai Hatchery. Eggs were incubated to the eyed stage at Speelyai Hatchery. 1,360,353 eyed eggs were transferred to the Lewis River Hatchery in November 2019.

2019 Brood Lewis River Late Coho (Integrated & Segregated)

Egg inventory and distribution was as follows:

Total Egg Take (green)	2,763,787
Shipped	1,555,006
Fecundity	3,158

Over 2.76 million green eggs were taken in 2019. The first spawn of late Coho took place on November 19, 2019, and the last was on December 17, 2019. The Washougal Hatchery received about 1.48 mill (segregated) green eggs. The remaining green eggs were laid down for incubation at Lewis River Hatchery. At the time of this report the LRH had 1.28 million green eggs on hand and of those eggs approximately 1.18 million are integrated for the Lewis River late Coho production. The remaining 106K, once eyed, will be distributed and shipped out to Clark PUD, Ridgefield High School, Columbia Springs, and the Steve Syverson project.

REARING PROGRAM

2017 Brood Lewis River Late Coho

Lewis River Hatchery volitionally released 965,009 late Coho averaging 16.4 fpp between April 1 and 15, 2019. Approximately 75K identified with an AD+CWT, 75K was CWT only (double index group) and the rest with an AD clip only. At time of release, the fish appeared healthy and ready to emigrate.

Final Stock Inventory

Beginning Balance	1,049,685
Pounds Ponded	801
Rearing Mortality (4.5%)	46,878
Adjustment	(37,798)
Fish Planted	965,009
Pounds Planted	58,733
Feed Fed (lbs.)	51,347
Net Gain (lbs.)	57,932
Conversion	0.89:1
CV	7.0

2017 Brood Spring Chinook

The last of the 2017 brood Spring Chinook were volitionally released from February 1st to the 19th of 2019. This group totaled 502,813 and was a mix of size groups of 8 and 12 fish per pound. The prior October release totaled 710,708, making the total of 1,213,521 fish planted from the 2017 brood year. Of the 2017 brood spring chinook, approximately 75k fish were adipose clipped with coded wire tag AD+CWT, 75k were only CWT tagged, and the rest were only adipose clipped.

Final Stock Inventory

Fish Received	1,224,800
Pounds Received	27,971
Rearing Mortality (0.9%)	11,279
Fish Planted	1,213,521
Pounds Planted	116,468
Feed Fed (lbs.)	63,976
Net Gain (lbs.)	88,497
Conversion	0.72:1
Average CV of Groups Planted	7.91

2017 Brood Lewis River Early Coho

Lewis River Hatchery volitionally released 1,228,380 early Coho averaging 16.1 fpp between April 1st and 29th, 2019. Approximately 75K identified with an AD+CWT, 75K was CWT only (double index group) and the rest with an AD clip only.

Final Stock Inventory

Beginning Balance	1,387,034
Pounds Ponded	1,131
Rearing Mortality (4.1%)	57,217
Adjustment	(101,437)
Fish Planted	1,228,380
Pounds Planted	76,433
Feed Fed (lbs.)	64,916
Net Gain (lbs.)	75,302
Conversion	0.86:1
Average CV	6.4

2018 Brood Lewis River Spring Chinook

On May 6th and continuing through May 7, 2019, the Lewis River Hatchery received 1,029,830 spring Chinook from Speelyai Hatchery. In addition, 315,250 were shipped from Speelyai to Lewis River Hatchery on December 3rd and 5th of 2019, and will be released in February of 2020. The 2018 brood year spring Chinook were adipose clipped (AD) and snout tagged (CWT) prior to the transfer. Approximately 75K were AD+CWT, 75K CWT only (double index group), and the rest AD only. From October 1st to the 17th 2019 we volitionally released 776,042 of the fish transferred in May and kept the remainder of the May group (around 168k) here to overwinter.

Stock Inventory This Period

Fish Received	1,345,080
Pounds Received	28,922
Rearing Mortality (7.5%)	101,309
Planted	776,042
On Hand	467,729
Pounds Planted	66,111
Pounds On Hand	38,935
Feed Fed (lbs.)	60,108
Net Gain (lbs.)	76,124
Conversion	0.79:1
CV of Fish Planted	5.3

2018 Brood Lewis River Early Coho

The last take of early Coho left the incubation room and was ponded into a small raceway on February 5, 2019. The condition of the fry prior to ponding was good with fry loss (mortality between eyed and ponding) being about 0.4%. Approximately 75K was identified with an AD+CWT, 75K was CWT only (double index) and the rest AD clip only. The 2018 early Coho are scheduled for release starting April 2020.

Stock Inventory This Period

Balance Prior To Ponding	1,357,439
Fry Loss	5,800
Beginning Balance	1,351,639
Pounds Ponded	965
Rearing Mortality (7.7%)	-103,531
Adjustment	-155,407
Fish on Hand	1,092,701
Pounds on Hand	48,061
Feed Fed (lbs.)	43,460
Net Gain (lbs.)	47,096
Conversion	0.92:1

2018 Brood Lewis River Late Coho

All 934,550 fry were moved from the incubation room to standard raceways outside between February 27th and March 29, 2019. Fry loss (mortality between eyed stage and ponding) was about 1.2%. Marking of these fish took place in June 2019. Approximately 75K was identified with an AD+CWT, 75K was CWT only (double index) and the rest AD clip only. The 2018 late Coho are scheduled for release starting April 2020.

Stock Inventory This Period

Balance Prior to Ponding	945,550
Fry Loss	11,000
Beginning Balance	934,550
Pounds Ponded	705
Rearing Mortality (2.4%)	-22,739
Rearing Adjustment	-81,490
Fish on Hand	830,321
Pounds on Hand	35,433
Feed Fed (lbs.)	32,823
Net Gain (lbs.)	34,728
Conversion	0.95:1

2019 Brood Lewis River Early Coho

On December 30, 2019 the first take of early Coho, 262,964, were transferred from the incubation room to raceway two. The fry loss for the first take was around 3.5%. The remaining takes will be ponded in January and February of 2020.

Stock Inventory This Period

Balance Prior to Ponding	272,364
Fry Loss	9,400
Fry Ponding	262,964
Pounds Ponded	137
Rearing Mortality (0.0%)	0

RAINFALL REPORT

Hatchery: Lewis River **Year: 2019** **Water Source: Lewis River**

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1	0	0.4	0	0	0	0	0	0.2	0	0	0	0	
2	0	0	0	0.1	0	0	0	0.3	0	0.5	0	0	
3	0.2	0.2	0	0	0	0	0	0	0	0.5	0	0	
4	0	SNOW	0	0.2	0	0	0	0	0	0	0	0	
5	0.2	0	0	0.6	0	0	0	0	0	0	0	0	
6	0.3	0	0.3	1.2	0	0.3	0	0	0	0	0	0.6	
7	0.2	0	0.2	0.2	0	0.3	0	0	0.2	0.2	0	0.5	
8	0	SNOW	0.3	0.6	0	0	0	0	1.8	0.2	0	0	
9	0.5	SNOW	0	0.2	0	0	0.5	0.4	0.4	0	0.4	0	
10	0	0.2	0	1	0	0	0	0.4	0.4	0	0.05	0.8	
11	0	3.5	0.9	0.6	0	0	0	0	0	0	0	0.5	
12	0	1.2	0.1	0	0	0	0	0	0.5	0	0.3	1	
13	0	0	0	0.4	0	0	0	0	0	0	0	0.1	
14	0	0.6	0	0.2	0.2	0	0	0	0.6	0	0.3	0	
15	0	0.7	0	0.1	0.2	0	0.05	0	1.5	0.1	0	0	
16	0.2	0.4	0	0.1	0.3	0	0	0.1	0.3	1	0.3	0	
17	0.2	0	0	0	0	0	0.1	0	1	1	0.3	0	
18	0.9	0	0	0	0.6	0	0	0	0.1	2.2	0.7	0.3	
19	0.1	2	0	0.3	0	0.1	0	0	0	0.2	0	1.7	
20	0.1	0.1	0	0	0.05	0	0	0	0	0.5	0	2.3	
21	0	0	0	0	0	0	0	0.5	0	0.9	0	0.6	
22	1.4	0.4	0.2	0	0	0	0	0	0.7	0	0	0.4	
23	0.3	0.4	0	0	0	0	0	0	0.3	0	0.3	0	
24	0	0.1	0	0	0.1	0	0	0	0	0	0.5	0.1	
25	0	0	0.5	0	0.4	0	0	0	0	0	0.4	0	
26	0	0	0	0	0.1	0.5	0	0	0	0	0.2	0.1	
27	0	0	0.2	0	0	1.1	0.1	0	0	0	0	0.1	
28	0	0	0	0	0	0	0	0.3	0.2	0	0	0	
29	0		0	0	0	0	0	0.1	0	0	0	0	
30	0		0	0	0	0	0	0	0	0	0.1	0	
31	0		0		0		0	0		0		1.4	Year Total
TOTAL	4.60	10.20	2.70	5.80	1.95	2.30	0.75	2.30	8.00	7.30	3.85	10.50	60.3

YEARLY TEMPERATURE REPORT

HATCHERY: LEWIS RIVER YEAR: 2019 **WATER SOURCE: N.F. LEWIS RIVER**

	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	47	46	44	43	42	42	44	42	47	44	51	47	55	51	59	55	60	57	60	58	57	56	52	51
2	46	46	44	43	43	42	44	42	46	44	51	47	55	51	59	55	60	56	60	58	57	56	51	50
3	46	46	44	43	43	41	44	42	47	44	51	47	53	51	59	55	60	57	60	59	56	55	52	50
4	46	46	44	43	42	41	44	42	47	44	51	47	54	51	59	55	60	57	60	60	56	55	52	51
5	46	46	44	43	42	41	45	43	48	44	48	47	53	51	60	55	60	57	61	60	55	55	51	50
6	46	46	44	43	42	41	45	43	48	44	50	47	53	52	59	55	59	57	61	60	55	54	51	50
7	46	45	44	43	42	42	45	43	48	44	50	48	53	52	58	55	58	57	61	60	55	54	51	50
8	46	46	43	42	42	41	44	43	48	45	50	47	54	52	57	55	59	57	61	60	55	54	51	50
9	46	46	43	42	42	41	44	43	48	45	51	47	54	52	59	55	58	58	62	60	55	54	50	50
10	46	46	43	42	43	41	44	43	48	44	52	48	55	52	58	56	60	57	62	60	55	54	50	50
11	46	46	43	43	43	41	45	44	48	45	53	48	55	52	58	55	60	57	62	60	55	54	50	50
12	46	46	43	43	42	42	46	44	48	45	52	48	56	52	60	55	60	57	61	60	55	54	50	49
13	46	45	44	43	42	41	44	44	48	45	53	48	56	52	60	55	60	57	61	60	55	54	50	49
14	46	45	43	43	43	41	45	43	46	46	52	49	56	53	59	55	59	57	61	60	55	54	49	49
15	45	45	43	43	43	41	45	44	47	46	52	48	54	53	60	56	58	58	61	60	54	54	49	49
16	45	45	43	43	43	41	44	43	46	46	52	48	56	53	58	56	59	58	61	60	54	53	49	49
17	45	45	43	43	43	41	45	43	47	46	53	48	54	53	58	56	58	58	60	60	53	53	49	49
18	45	45	43	42	43	41	46	43	48	46	53	49	56	53	59	56	59	57	60	59	53	53	49	49
19	45	45	43	43	44	42	45	44	47	46	51	49	56	53	60	56	59	57	59	59	53	52	50	49
20	45	44	44	42	44	42	45	44	47	46	51	49	57	53	60	56	59	58	59	59	53	52	49	49
21	44	44	43	42	43	42	45	44	47	46	51	49	57	53	58	56	60	58	59	59	53	52	49	49
22	44	44	42	42	43	42	46	44	49	46	52	50	57	53	58	56	59	58	60	59	53	52	49	48
23	44	44	42	42	43	42	45	43	49	46	51	49	56	53	60	56	59	58	59	58	53	52	48	48
24	44	44	42	42	43	42	46	43	48	46	53	49	58	53	59	56	60	58	59	58	53	52	48	48
25	44	43	42	42	43	42	46	43	47	46	53	50	59	54	60	56	60	58	58	58	53	52	48	48
26	44	43	43	42	44	42	47	44	49	46	53	50	57	54	60	56	59	58	58	57	52	52	48	48
27	44	43	42	42	43	42	47	44	48	46	52	51	59	54	60	56	59	58	58	57	53	52	48	47
28	44	43	42	42	44	42	47	44	47	47	53	51	59	54	60	56	60	58	58	56	52	51	48	47
29	44	44			44	42	47	44	49	46	54	51	59	54	59	57	59	58	57	56	52	51	47	47
30	44	43			44	42	47	44	50	47	55	51	59	55	59	57	60	58	58	57	52	51	47	47
31	44	43			44	42			50	47			59	55	60	56			57	57			47	47
AVG.	45.13	44.77	43.11	42.54	42.94	41.55	45.2	43.3	47.74	45.42	51.8	48.57	55.94	52.71	59.1	55.65	59.33	57.47	59.81	58.84	54.07	53.23	49.42	48.94
MIN	44	43	42	42	42	41	44	42	46	44	48	47	53	51	57	55	58	56	57	56	52	51	47	47
MAX	47	46	44	43	44	42	47	44	50	47	55	51	59	55	60	57	60	58	62	60	57	56	52	51

Washington DEPARTMENT OF FISH AND WILDLIFE NPDES Chemical Operational Log. Records of Disease Control Chemicals Used

YEAR 2019

Keep records on station for at least five years

Facility: Lewis River Hatchery

NPDES Permit Number: WAG 13-1040

Brood Stock Species	Pond/ Raceway	Date of Application	Chemical Name	Dosage	Duration	Method Application	Amount used	Reason for use	Flow	Water Temp	Estimated Concentration Discharge	Method Disposal	location any disposed spent chemical dip	Name
CO:SO:LEHA:18:H	2	1/25/2019	Formalin	1;6000	1 hr	Drip	1 gal	Profolactic	100	44				JT
CO:SO:LEHA:18:H	2 to 6	1/30/2019	Formalin	1;6000	1 hr	Drip	6.5 gal	Costia	135	44				DMC
CO:SO:LEHA:18:H	2 to 6	1/31/2019	Formalin	1;6000	1 hr	Drip	6.5 gal	Costia	135	44				DMC
CO:SO:LEHA:18:H	2	2/10/2019	Formalin	1;6000	1 hr	Drip	1.3 gal	Costia	135	42.5				DMC
CO:SO:LEHA:18:H	2	2/11/2019	Formalin	1;6000	1 hr	Drip	1.3 gal	Costia	135	43				JT
CO:SO:LEHA:18:H	2 to 7	2/14/2019	Formalin	1;6000	1 hr	Drip	7.8 gal	Profolactic	135	44				JT
CO:SO:LEHA:18:H	2 to 7	2/15/2019	Formalin	1;6000	1 hr	Drip	7.8 gal	Profolactic	135	44				JT
CO:SO:LEHA:18:H	2 to 7	3/7/2019	Formalin	1;6000	1 hr	Drip	9 gal	Profolactic	150	42				JT
CO:SO:LEHA:18:H	2 to 7	3/8/2019	Formalin	1;6000	1 hr	Drip	9 gal	Profolactic	150	42				JT
CO:NOLEWI:18:H	8 to 12	6/19/2019	Formalin	1;6000	1 hr	Drip	13.75 gal	Costia	271	51				JT
CO:NOLEWI:18:H	8 to 12	6/20/2019	Formalin	1;6000	1 hr	Drip	13.75 gal	Costia	271	51				JT

Notes:

MAINTENANCE AND CAPITAL PROJECTS – 2019

MAINTENANCE

1. Lifted and pressure washed DSI pump screens.
2. Rented man lift to clean coke rings in incubation de-gassing tower.
3. Replaced bulbs and some ballasts in overhead lights on Ponds 13,14,15,16.
4. Serviced Gators and lawn equipment.
5. Rebuilt benches in wood shop.
6. Replaced lift cables on DSI pump screens.
7. Put up news yard lights over RW's 1-12 and behind the hatchery building.
8. Repainted hatchery restrooms.
9. Dug up and repaired main water line to restrooms.
10. Serviced hatchery vehicles.
11. Replaced heater in boot room.
12. Repaired truck gate at entrance to pond 15.
13. Replaced air lines on diverter table in adult sorting facility.
14. The USI and DSI diesel tanks were cleaned by Fuel Care.

CAPITAL

1. New heat pumps were installed at Res. 2 and 3. Work was done by Entek.
2. Generators at the USI and DSI were serviced and load tested.

OPERATIONS PROGRAM

MERWIN HATCHERY

FOR

JANUARY 1, 2019 TO DECEMBER 31, 2019

Washington Department of
FISH and WILDLIFE

WRITTEN AND COMPILED BY:

MERWIN HATCHERY STAFF

Introduction

The Merwin Hatchery is a PacifiCorp owned and funded facility that is operated by the State of Washington's Department of Fish and Wildlife. The facility has been in operation since October of 1993.

Merwin Hatchery is located 11 miles east of Woodland off state route 503 adjacent to the PacifiCorp Merwin Dam and Lake Merwin.

Program Goals

- 50,000 Rainbow Trout at 2.5 fpp stocked into Swift Reservoir.
- 175,000 summer Steelhead at 4.8 fpp stocked into N.F. Lewis River.
- 100,000 winter Steelhead at 4.8 fpp stocked into N.F. Lewis River.
- 50,000 wild winter Steelhead at 6 fpp stocked into N.F. Lewis River.

Approximately 5,000 gallons of water per minute can be delivered to the hatchery by three-intake pumps located midway on Merwin Dam, which draft water from Lake Merwin. Two screened intakes located at depths of approximately fifteen feet and ninety feet below the surface of the reservoir enable some temperature manipulation for fish rearing.

Ozone water sterilization is part of the design criteria to meet fish health needs not only at the hatchery but also for fish stocks and the Lewis River Hatchery downstream of our effluent discharge area. Two ozone generators fed by compressed air supply ozone gas to a water/ozone contact chamber. A maximum flow of 3,800 gallons per minute can be sterilized and supplied to the hatchery building, raceways and rearing ponds. The facility has the capability to ozone treat all effluent water from the adult holding area and incubation room in the event of a viral outbreak.

There is approximately 216,470 cubic feet of rearing space. These areas consist of four one-quarter acre rearing ponds, ten 9.5 x 80 x 2.5 fingerling raceways, four 7.5 x 33 x 4 adult holding ponds, six 4.5 x 34 x 2 intermediate raceways, one 3x14x2 deep trough, four 16 c.f. fry troughs and 15 double stack Mari Source incubators.

The hatchery complex has an operations building housing the office, feed room, shop, lab, day room, locker room, shower room, mud room, crew rest room and public restrooms. Other buildings associated with this facility are; the hatchery building with attached covered adult holding ponds, water treatment facility including the ozone generator building/ contactor structure, one three bay storage building, chemical storage building and three residences.

Trapping

During this reporting period, trapping was conducted at the Merwin Dam Fish Collection Facility, Lewis River Hatchery and the lower river, depending on the species.

2020 Brood Lewis River Summer Steelhead

A total of 349 adults were received for spawning purposes. All of these fish were trapped at the Merwin Dam Fish Collection Facility. Disposition is as follows:

Adults Spawned	218
Non-Viable females	0
Mortality (6.30%)	22
Landfill	109

2020 Brood Lewis River Winter Steelhead

A total of 204 adults were received for spawning purposes. These fish were trapped at the Merwin Dam Fish Collection Facility and Lewis River Ladder. Disposition is as follows:

Adults Spawned	98
Non-Viable females	1
Mortality (0.70%)	1
Landfill	104

2019 Brood Lewis River Wild Winter Steelhead

A total of 56 adults were received for live spawning purposes. These fish were collected at various sites, to include: the Merwin Dam Fish Collection Facility, and tangle net fishing in the lower river. Disposition is as follows:

Adults Spawned	32
Non Viable Females	0
Mortality (3.57%)	2
Nutrient Enhancement	0
Culled (hatchery genetics)	0
Return to river	54

2019 Brood Lewis River Late Winter Steelhead Hatchery Origin

This stock is a result of live spawning wild winter steelhead broodstock at Merwin Hatchery. The adult wild steelhead were collected from the Merwin F.C.F., tangle netting in the lower river, and the Lewis River Ladder. These fish are reared at Merwin Hatchery and blank wire tagged as juveniles. Then, are transported upstream by PacifiCorp staff as part of a supplementation project when they return as adults. A portion of the returning adults were planted downstream for a survey of trap efficiency, these fish were then hauled upstream once recaptured.

Below is a list of fish trapped in the 2019 season. The first arrival at Merwin F.C.F. was on December 23rd, 2018 and the last was trapped on June 17th, 2019. All upstream fish were planted at Eagle Cliff release site at the upper end of Swift Reservoir. Downstream plants were at Merwin boat ramp and Martins Access boat ramp (WDFW public access).

Adults Trapped (F.C.F.)	1,010
Mortality (0.50%)	5
Planted upstream	916
Planted downstream	89
Recaptured & planted upstream	89
Total planted upstream	1,005

MERWIN HATCHERY ADULT COLLECTION

SPECIES	ESTIMATED TRAPPED/RECEIVED		RETURNED TO STREAM			RECYCLED FISH TRAPPED			RECYCLED FISH RETURNED TO STR.			SHIPPED / PLANTED			MORTALITIES			CARCASS DISTRIBUTION			LETHAL SPAWNED				LIVE SPAWNED				ESTIMATED ON-HAND		MARKS RECOVERED			ESTIMATED EGGS
	A	J	M	F	J	M	F	J	M	F	J	M	F	J	M	F	J	M	F	J	M	VF	NVF	J	M	VF	NVF	J	A	J	M	F	J	TAKEN
SH:SU:MEHA:20:H	349	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	0	56	53	0	109	109	0	0	0	0	0	0	0	0	0	0	0	446,900
SH:WI:MEHA:20:H	204	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	66	33	0	49	49	1	0	0	0	0	0	0	0	0	0	0	215,600
SH:WL:LEWI:19:W	56	0	34	20	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	16	16	0	0	0	0	0	0	0	68,452

ADULT TRAPPING - MERWIN DAM FISH COLLECTION FACILITY 2019

SPECIES	ESTIMATED TRAPPED/RECEIVED		RETURNED TO STREAM			RECYCLED FISH TRAPPED			PLANTED UPSTREAM			SHIPPED			MORTALITIES			CARCASS DISTRIBUTION			PLANTED HORSESHOE LK			ESTIMATED ON-HAND		MARKS RECOVERED			ESTIMATED EGGS TAKEN
	A	J	M	F	J	M	F	J	M	F	J	M	F	J	M	F	J	M	F	J	M	F	J	A	J	M	F	J	
CK:SP:LEHA:19:H	740	240									77	448	286	141	3					22							1		
CK:SP:LEWI:19:W	23	9							12	11	9																		
CK:FA:LEWI:19:W	116	10	67	48	10											1													
CK:FA:UNKN:19:H	155	27													15	11	1	83	46	26						1			
CO:SO:LEHA:19:H	1,423	167							490	497		78	123	1	7	11	5	157	60	161						61	37	29	
CO:SO:LEWI:19:W	819	202							389	428	202				1	1													
CO:NO:LEWI:18:H	30	13							1						15	14	12			1									
CO:NO:LEWI:18:W	4	2							3	1	2																		
CO:NO:LEWI:19:H	503	168							83	83		149	128	27	20	18		15	7	141						11	1	8	
CO:NO:LEWI:19:W	252	31							117	94	31	15	23		2	1													
SH:SU:MEHA:20:H	1,428		220	589		125	324					174	174		1	3		211	444										
SH:SU:LEWI:20:W	7		5	2																									
SH:SU:MEHA:19:H	66																	20	46										
SH:WI:MEHA:20:H	174											59	57					36	6		15	1							
SH:WI:MEHA:19:H	566											21	21		3	7		170	344										
SH:WL:LEWI:20:H	3								2	1																			
SH:WL:LEWI:19:H	1,002								515	483					2	3										2	3		
SH:WL:LEWI:20:W	1			1																									
SH:WL:LEWI:19:W	71		17	6								28	18		2														
SO:NA:UNKN:19:U	12		4	8																									
CH:NA:LEWI:19:W	1		1																										
PK:OD:UNKN:19:W																													
CT:AC:LEWI:19:W	8		7	1																									
CT:AC:LEWI:20:W	36		35	1																									
TOTALS	7,440	869	356	656	10	125	324	0	1,612	1,598	321	972	830	169	71	70	18	692	953	351	15	1	0			75	42	37	

Egg Take and Incubation

2019 Brood Goldendale Rainbow

Merwin Hatchery received 81,754 eyed eggs from Goldendale Hatchery on December 2nd 2019.

2020 Brood Lewis River Summer Steelhead

The first eggs were taken on November 26th, 2019. Disposition of this stock to date is as follows:

Total Egg Take	458,804
Egg Loss (18.7%)	86,020
Eggs Culled	95,091
Shipped	0
Fecundity	4,209

2020 Brood Lewis River Winter Steelhead

The first eggs were taken on December 23rd, 2019. All of these eggs are incubating and none of the egg takes have been shocked or picked. Disposition of this stock to date is as follows:

Estimated Total Egg Take	215,600
Egg Loss	0
Eggs Culled	0
Estimated Fecundity	4,400

2019 Brood Lewis River Winter Steelhead

The first eggs were taken on December 26th, 2018 and finalized by January 7th, 2019. Disposition of this stock to date is as follows:

Total Egg Take	182,112
Egg Loss (4.2%)	7,563
Eggs Culled	57,827
Fecundity	5,029

2019 Brood Lewis River Wild Winter Steelhead

These fish were spawned from April 16th 2019 - May 17th, 2019. Disposition is as follows:

Total Egg Take	63,985
Egg Loss (4.2%)	2,699
Eggs Culled	0
Fecundity	3,999

REARING PROGRAM

2018 Brood Lewis River Summer Steelhead

The rearing of this brood went very well year and all program goals were achieved. During this rearing cycle these fish were diagnosed with ichthyopthirius. They were therapeutically treated accordingly with normal mortality rates. 8,484 juveniles were shipped to Beaver Creek Hatchery on November 5th, 2018. Hatchery staff began releasing the fish on station in April 2019. All of these fish were trucked and planted at river mile 5 on the North Fork of the Lewis River.

Final Stock Inventory

Fry Ponded	274,117
Fry Pounds Ponded	110
Juveniles Shipped	8,484
Juveniles Pounds Shipped (16.5 fpp)	514
Smolts Planted	180,146
Smolt Pounds Planted @ Release (5.5 fpp)	32,754
Rearing Mortality (6.8%)	18,670
Destroyed	0
Shortage	0
Feed Fed (lbs)	42,896
Net Gain (lbs)	32,644
Conversion	1.31:1
Average CV @ Release	8.00

2018 Brood Lewis River Summer Steelhead @ Echo Net Pens

59,640 adipose only clipped summer steelhead were shipped from Merwin Hatchery to Echo Net Pen site on March 5th, 2019. These fish were released on April 15th, 2019.

Stock Inventory This Period

Juveniles Received	59,640
Juvenile Pounds Received (7.5 fpp)	8,144
Smolts Planted	59,640
Smolt Pounds Planted @ Release (5.6 fpp)	10,650
Rearing Mortality (0.0%)	0
Feed Fed (lbs.)	1,848
Net Gain (lbs.)	2,506
Conversion	0.74:1
Average CV @ Release	9.05

2018 Brood Lewis River Winter Steelhead

The rearing of this brood went very well this year and all programs goals were achieved. During this rearing cycle these fish were diagnosed with ichthyopthirius and they were therapeutically treated accordingly with average mortality rates. Hatchery staff began releasing the remaining fish on hand in April 2019. All fish on site were trucked and planted at river mile 5 on the North Fork of the Lewis River.

Final Stock Inventory

Fry Ponded	118,900
Fry Pounds Ponded	48
Juveniles Shipped	0
Juvenile Pounds Shipped	0
Smolts Planted	108,128
Smolt Pounds Planted @ release (5.1 fpp)	21,202
Rearing Mortality (9.3%)	11,104
Destroyed	0
Shortage	0
Feed Fed (lbs)	20,468
Net Gain (lbs)	21,154
Conversion	0.97:1
Average CV @ Release	7.0

2018 Brood Lewis River Wild Winter Steelhead

The overall rearing of this brood went well and all program goals were achieved. During this rearing cycle these fish were diagnosed with ichthyopthirius. They were therapeutically treated accordingly with average loss. Hatchery staff released these fish in May 2019. All of these fish that were volitional release were planted at the Merwin Boat Launch on the North Fork of the Lewis River. The remaining forced out fish were planted at Martin Access river mile 5 on the North Fork of the Lewis River.

Final Stock Inventory

Fry Ponded	66,671
Fry Pounds Ponded	27
Smolts Planted	44,861
Smolt Pounds Planted @ Release (9.3 fpp)	4,824
Rearing Mortality (28.4%)	18,936
Planted as unfed fry	0
Transferred	0
Shortage	0
Feed Fed (lbs)	5,024
Net Gain (lbs)	4,797
Conversion	1.05:1
Average CV @ Release	8.3

2019 Brood Lewis River Summer Steelhead

The overall rearing of this brood has gone really well and program goals will be achieved. 9,194 juveniles were shipped to Cowlitz Trout Hatchery on November 7th 2019. During this rearing cycle, these fish were diagnosed with ichthyopthirius. They were therapeutically treated accordingly with average loss. Hatchery staff will start the release of the remaining fish on hand in April 2020.

Stock Inventory this period

Fry Ponded	275,495
Fry Pounds Ponded	110
Juveniles on hand	248,907
Juvenile Pounds on hand (8.0 fpp)	31,113
Rearing Mortality (5.4%)	14,923
Destroyed	0
Eggs Transferred	0
Juveniles Transferred	9,194
Juvenile Pounds Transferred (15.1 fpp)	609
Juveniles Planted	0
Feed Fed (lbs)	27,614
Net Gain (lbs)	31,003
Conversion	0.89:1

2019 Brood Lewis River Winter Steelhead

The overall rearing of this brood has gone really well and program goals will be achieved. During this rearing cycle, these fish were diagnosed with ichthyopthirius. They were therapeutically treated accordingly with average loss. Hatchery staff will start the release of the fish on hand in April 2020.

Stock Inventory this period

Fry Ponded	115,522
Fry Pounds Ponded	46
Juveniles on hand	105,114
Juvenile Pounds on hand (8.0 fpp)	13,139
Rearing Mortality (7.1%)	8,183
Destroyed	0
Eggs Transferred	0
Juveniles Transferred	0
Juvenile Pounds Transferred	0
Feed Fed (lbs)	11,354
Net Gain (lbs)	13,029
Conversion	0.87:1

2019 Brood Lewis River Wild Winter Steelhead

The overall rearing of this brood has gone very well but due to insufficient broodstock collection and unfed fry plants which were a result of genetic assignment that did not meet broodstock criteria, program goals will not be met. During this rearing cycle these fish were diagnosed with ichthyopthirius. They were therapeutically treated accordingly with average loss. Hatchery staff will start the release of the fish on hand in May 2020.

Stock Inventory this period

Fry Ponded	60,861
Fry Pounds Ponded	24
Rearing Mortality (10.3%)	6,270
Unfed Fry Plant	11,075
Fish Transferred	0
Juveniles on Hand	45,193
Juvenile Pounds on Hand (20 fpp)	2,260
Feed Fed (lbs)	1,624
Net Gain (lbs)	2,236
Conversion	.73:1

2020 Brood Lewis River Summer Steelhead

Spawning operations were completed in three egg-takes and went well this period. All takes are still in the incubators with the last take yet to hatch. Female fecundities (4,209) were average this year and eyed egg loss (18.7%) was higher than average this year. 95,091 surplus eyed eggs were culled. Currently there are a combination of 277,693 alevin and eggs on hand.

2020 Brood Lewis River Winter Steelhead

Spawning operations were completed in two egg-takes and went excellent this period. Currently there are 215,600 eggs on hand; these eggs have not been picked yet.

2019 Brood Goldendale Rainbow

We received 81,754 eyed eggs from Goldendale Hatchery in November. These fish will be ponded to IR#6.

Stock Inventory this period

Fry Ponded	0
Pounds Ponded	0
Rearing Mortality	0
Shortage	0
Fry on Hand	Approx. 80K

2018 Brood Goldendale Rainbow

The rearing of this stock has gone really well. During this rearing cycle these fish were diagnosed with ichthyopthirius. They were therapeutically treated accordingly with average loss. A total of 43,120 fish were transferred to Speelyai Hatchery on November 4th, 2019. Approximately 2,500 of the remaining fish on hand will be panted to Swift Power Canal in April 2020. The remaining fish will used for the Merwin Park Fishing Derby in June 2020 and the Merwin Special Kids Derby (MSKD) in July 2020. Also, approximately 2,000 fish will be held over for the 2021 MSKD.

Stock Inventory this period

Fry Ponded	74,759
Fry Pounds Ponded	17
Fish Planted	0
Rearing Mortality (21.6%)	21,364
Destroyed	0
Transferred	43,120
Pounds Transferred (14.0 fpp)	3,080
Fish on Hand (Derby fish 2020/2021)	4,978
Fish on Hand for Swift Power Canal Plant	2,506
Pounds on Hand (6.0 fpp)	1,247
Shortage	0
Feed Fed (lbs)	3,323
Net Gain (lbs)	4,310
Conversion	.77:1

2019 Merwin Special Kids Derby and Forest Service Derby

For the purpose of this report, we have listed all these fish under one section. Ten of the 2016 Brood Goldendale Rainbow were planted into Merwin Reservoir for the Forest Service Derby in June 2019. The remaining 2016 brood were caught at the MSKD derby in July 2019 or planted into Merwin Reservoir following the derby. The disposition of the 2016 brood is as follows: 1,416 planted into Merwin Reservoir and 470 caught at the derby.

The disposition of the 2017 brood is as follows: 2,500 planted in Swift Power Canal in April 2019, 1,500 planted in Merwin Reservoir for Forest Service Derby in June 2019, 1,142 planted in Merwin Reservoir following the MSKD derby in July 2019, and 128 caught at the derby (July 2019). Approximately 2,000 were kept for the 2020 MSKD derby and 2,500 for Swift Power Canal plant in April 2020.

Stock Inventory This Period 2016 Brood: Derby Goldendale Rainbow

Beginning Balance	1,911
Rearing Mortality (2.3%)	44
Fish Caught 2019 Derby	470
After MSKD Merwin Plant	1,416
Forest Service Derby Plant	10
Shortage	0
On Hand (Derby fish 2020)	0

Stock Inventory This Period 2017 Brood: Derby & Planting Goldendale Rainbow

Beginning Balance	7,502
Rearing Mortality (3.0%)	223
Fish Planted to Swift Power Canal	2,500
Fish Caught 2019 Derby	128
After MSKD Merwin Plant	1,142
Forest Service Derby Plant	1,500
Shortage	0
On Hand (Derby fish 2020)	2,141

RAINFALL REPORT

Rainfall is recorded from 8:00 a.m. to 8:00 a.m. day prior

HATCHERY: MERWIN HATCHERY **YR:** 2019 **WATER SOURCE:** MERWIN

YEAR TOTAL: 65.24 INCHES

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0	0.4	0	0	0	0	0	0.1	0	0	0	0.15
2	0.55	0.01	0	0.05	0	0	0	0.35	0	0.1	0	0
3	0.35	0.1	0	0.01	0	0	0	0	0	0	0	0
4	0.01	0.1	0	0.3	0	0	0	0	0	0.1	0	0
5	0.2	0	0	0.6	0	0.01	0	0	0	0	0	0
6	0.3	0	0.25	1.1	0	0.15	0	0	0	0.05	0	0.6
7	0.18	0	0.2	0.1	0	0.55	0	0	0.1	0.25	0	0.4
8	0.1	0	0.25	0.8	0	0	0	0	1.85	0.2	0	0
9	0.5	1.3	0	0.4	0	0	0.5	0.35	0.7	0	0.25	0
10	0	1.9	0	1.3	0	0	0	0.5	0.35	0	0	0.8
11	0	3.4	0.95	0.4	0	0	0	0	0	0	0.1	0.65
12	0	1.35	0.1	0	0	0	0	0	0.45	0	0.2	0.9
13	0	0.15	0.1	0.6	0	0	0	0	0	0	0	0.15
14	0	0.55	0	0.2	0.3	0	0	0	0.55	0	0.4	0.1
15	0	0.75	0	0.15	0.2	0	0.1	0	1.4	0	0.35	0
16	0.3	0.4	0	0.1	0.45	0	0.01	0	0.15	1	0.01	0
17	0.15	0.01	0	0.01	0.1	0	0.15	0	1.05	0.8	0.25	0
18	0.95	0.05	0	0	0.55	0	0	0	0.3	1.8	0.55	0.35
19	0.15	0.9	0	0.35	0.01	0.1	0	0	0.05	0.2	0.05	1.7
20	0.15	0.05	0	0	0	0.1	0	0	0	0.65	0	2.2
21	0	0.45	0	0	0	0	0	0.35	0	0.95	0	0.5
22	1.9	0.45	0.1	0.1	0	0	0	0	0.3	0	0	0.5
23	0.4	0.1	0	0	0	0	0	0	0.25	0	0.2	0
24	0	0.01	0	0	0.1	0	0	0	0.1	0	0.5	0.15
25	0	0	0.45	0	0.4	0	0	0	0	0.01	0.45	0
26	0	0	0	0.01	0	0.7	0	0	0	0	0.25	0.25
27	0	0	0.25	0.01	0	1.25	0.1	0	0.15	0	0	0.01
28	0	0	0	0	0.01	0	0	0.25	0.55	0	0	0.01
29	0		0	0	0	0	0	0.1	0.1	0	0	0
30	0		0	0	0	0	0	0.05	0	0	0	0.05
31	0.05		0		0		0	0		0		1.9
Total	6.24	12.43	2.65	6.59	2.12	2.86	0.86	2.05	8.40	6.11	3.56	11.37

TOTAL RAINFALL 65.24

* SNOW

YEARLY TEMPERATURE REPORT

HATCHERY MERWIN HATCHERY **YEAR:** 2019 **WATER SOURCE:** N.F. LEWIS RIVER

MERWIN RESERVOIR

	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	47	46	44	43	42	41	43	42	46	45	51	49	55	53	58	57	59	58	63	62	57	56	51	51
2	46	46	43	43	42	42	43	42	46	45	52	49	56	53	57	57	59	58	63	62	57	56	51	51
3	46	46	43	43	42	41	43	42	47	46	51	49	55	53	57	56	59	58	63	62	56	55	51	51
4	47	46	43	43	42	41	43	42	46	45	51	49	55	53	58	57	62	58	62	62	55	55	51	50
5	46	45	43	43	42	41	44	42	47	46	50	49	56	53	57	57	59	58	62	62	55	55	50	50
6	46	45	43	42	41	41	44	43	48	45	52	49	56	53	59	57	60	58	62	62	55	54	51	50
7	46	45	43	42	42	41	44	43	47	45	51	49	54	53	58	57	61	58	62	62	56	55	51	50
8	46	45	43	42	42	41	43	43	49	45	52	49	55	54	58	57	60	58	62	62	55	55	51	50
9	46	45	43	42	42	41	43	42	47	45	51	49	56	54	58	57	60	58	62	62	55	55	50	50
10	46	45	42	42	42	41	44	43	46	45	51	50	56	54	58	57	60	58	62	61	55	55	50	50
11	46	45	42	42	42	41	45	43	48	46	53	50	56	55	58	57	60	59	62	61	55	55	50	50
12	46	45	42	42	42	41	45	44	49	46	52	50	56	54	57	57	60	58	62	61	55	54	50	49
13	46	45	43	42	42	41	44	44	49	46	52	50	57	54	58	57	61	59	62	60	55	54	49	49
14	45	45	42	42	42	41	45	43	47	46	54	50	57	55	58	57	61	59	61	60	55	55	49	49
15	45	44	42	42	42	41	45	44	48	46	52	50	56	55	59	57	60	59	61	60	55	54	50	49
16	45	44	42	42	42	41	45	44	48	46	53	50	57	55	58	57	60	59	61	60	54	53	50	49
17	45	44	42	42	43	42	44	44	48	47	54	51	57	55	59	57	60	59	60	59	53	53	50	49
18	45	44	42	42	43	41	44	44	49	47	53	51	57	55	59	57	60	59	60	59	53	53	49	49
19	45	44	42	42	44	43	45	44	48	46	53	51	57	55	59	57	61	60	60	59	53	53	49	49
20	45	44	42	42	44	43	45	44	50	48	54	51	58	56	59	57	60	59	60	59	53	52	49	49
21	44	44	42	42	44	42	45	44	48	47	53	51	57	56	59	57	62	59	60	59	53	52	49	48
22	44	43	42	42	44	43	46	45	49	47	54	51	58	56	59	57	61	60	60	59	53	52	49	48
23	43	43	42	42	42	42	46	44	48	47	53	52	57	56	58	57	62	60	59	59	52	52	48	48
24	43	43	42	41	42	42	45	44	48	47	53	52	57	56	59	57	62	60	59	58	52	52	48	48
25	43	43	42	42	42	42	46	44	50	47	53	52	57	56	59	57	62	61	59	58	52	52	48	48
26	43	43	42	41	43	42	46	45	48	48	55	52	57	56	59	57	62	61	58	58	53	52	48	48
27	43	43	42	41	43	42	46	44	49	48	53	52	59	56	60	57	62	61	58	58	52	52	48	47
28	44	43	42	41	43	42	47	45	51	48	54	52	57	56	59	57	63	62	58	57	52	52	48	47
29	44	43			43	42	47	45	49	48	54	53	57	56	59	58	62	62	58	57	52	51	47	46
30	44	43			43	42	46	44	51	48	55	53	59	56	59	58	63	62	57	57	52	51	48	47
31	44	43			43	42			49	48					59	58							48	46
AVG	44.96774	44.25806	42.39286	42.03571	42.48387	41.58065	44.7	43.53333	48.16129	46.41935	52.63333	50.5	56.56667	54.73333	58.41935	57.06452	60.76667	59.26667	60.6	59.9	54	53.5	49.3871	48.8709677
MIN	43	43	42	41	41	41	43	42	46	45	50	49	54	53	57	56	59	58	57	57	52	51	47	46
MAX	47	46	44	43	44	43	47	45	51	48	55	53	59	56	60	58	63	62	63	62	57	56	51	51

Raised Intake
n/a

Lowered Intake
n/a

DISEASES AND TREATMENTS

DATE: 1/1/19 - 12/31/19

HATCHERY: MERWIN HATCHERY

DATE	BROOD YEAR/ SPECIES	POND NUMBERS	TREATMENT CHEMICAL	DISEASE
January-July	2019 Summer, Winter & Wild Winter Steelhead	(Eggs) Incubators	Formalin	Fungus
June - November	2020 Summer Steelhead Brood	SP 1 & 2	Formalin	Fungus
September- October	2017 Goldendale Rainbow	RW's 9 &10	Formalin	Ichthyopthirius
September- October	2018 Goldendale Rainbow	RW's 1, 2, & 5	Formalin	Ichthyopthirius
September- October	2019 Winter Steelhead	RW 4 & RP-13	Formalin	Ichthyopthirius
September- October	2019 Summer Steelhead	RW 3 & RP 11, 12, & 14	Formalin	Ichthyopthirius
September- October	2019 Wild Winter Steelhead	RW's 7 & 8	Formalin	Ichthyopthirius
December	2019 Goldendale Rainbow	(Eggs) Incubators	Formalin	Fungus
November - December	2020 Summer & Winter Steelhead	(Eggs) Incubators	Formalin	Fungus
December	2020 Winter Steelhead Brood	AP-2	Formalin	Fungus

MAINTENANCE AND CAPITAL PROJECTS

Maintenance

1. Cleaned all dielectric tubes, inspected all fuses and rings, replaced any damaged or worn out parts on Ozone Generator #1
2. Replaced all elements and filters on Kaser Compressor supply lines and Pure Gas air dryers
3. Routine maintenance on Kaiser Compressors
4. Yearly calibration for ambient ozone sensors and generators
5. Replaced residual dissolved ozone sensor, had other tested
6. Replaced alarm floats in passive draw
7. Routine maintenance for International planting Truck
8. Routine maintenance for Ford Cargo planting Truck
9. Modified fish gate on International plant truck Jetco tank
10. Replaced air compressor for incubation building fire suppression system
11. Removed beauty bark and replaced with river rock in facility flower beds
12. Routine maintenance for Nissan forklift
13. Routine service for Hatchery building walk in freezer compressor & heat pump
14. Repair and service for one residence heat pump & all residence's heat pumps
15. New gravel for 3-Bay storage area
16. Septic pumped for hatchery building and all three residences
17. Replaced shaft and both bearings on one blower at Ozone Plant
18. Replaced two residences kitchen ranges
19. Replaced shaft on cooling water pump #4 at Ozone Plant
20. Replaced damaged mower deck wheel on John Deere Z-Trak
21. New blocks and slides for rearing pond gates purchased
22. Replaced Facility and residences mail boxes
23. Routine maintenance for Ford F-250
24. Routine maintenance for Ford F-350

Capital

OPERATIONS PROGRAM

SPEELYAI HATCHERY

FOR

JANUARY 1, 2019 TO DECEMBER 31, 2019

Washington Department of
FISH and WILDLIFE

WRITTEN AND COMPILED BY:

SPEELYAI HATCHERY STAFF

Introduction

Speelyai Hatchery is a PacifiCorp owned and funded facility that is operated by the Washington Department of Fish and Wildlife. It has been in operation since 1958.

Speelyai Hatchery is located 21 miles east of Woodland, just off Highway 503. The hatchery is adjacent to Speelyai Creek on the north shore of Lake Merwin.

Program Goals

- 1,100,000 Spring Chinook transferred to Lewis river hatchery in May.
- 300,000 Spring Chinook transferred to Lewis river hatchery in December.
- 45,000 Rainbow planted in Swift Reservoir at 2.5fpp.
- 2,500 Rainbow planted in Swift power canal at 2.5fpp.
- 45,000 Kokanee released into Merwin Reservoir at 8.0fpp.
- 48,000 Kokanee released into Merwin Reservoir at 6.9fpp.
- 1,325,000 Type S coho eyed eggs transferred to Lewis river hatchery.

Approximately 9,200 gallons of water per minute can be delivered to the hatchery system by gravity flow from Speelyai Creek.

There are approximately 166,450 cubic feet of available rearing space. This space consists of four 17'x3'x3' intermediate troughs, twenty-four 10'x 80'x4' raceways, four 115'x10'x5' raceways, and one large asphalt pond that serves as an adult holding/spawning pond for both Spring Chinook and Type S Coho stocks.

Incubation consists of fifty stacks of FAL vertical incubators, two deep troughs, and one shallow trough.

The Speelyai hatchery site also includes two residences, a hatchery building, a two bay storage building, a shop/garage, a domestic pump house, a small storage building, and two chemical storage buildings.

The Speelyai hatchery staff is also responsible for ten 20'x20'x20' net pens located at Speelyai Bay in Merwin Reservoir.

Adult Holding

2019 Lewis River Spring Chinook, Hatchery Origin

The first fish was received on March 04, 2019. Brood stock was collected from the Merwin Dam Fish Collection Facility, Lewis River Hatchery and Cedar Creek Grist Mill. Disposition is as follows:

Adults Received	917
Jacks Received	115
Mortality (5.6%)	51
Adults Spawned	856
Non-Viable	5
Nutrient Enhancement	0
Landfill	1,032

Both ELISA and PCR (Polymerase Chain Reaction) testing that checks DNA extracts for bacterium in salmonid eggs were performed. A sufficient number of females were tested to ensure that only gametes from females that tested in the "Below Low" range will be used in the February release groups. All carcasses were disposed of at the Cowlitz County Landfill.

2019 Lake Merwin Kokanee

Adult collection started September 11, 2019. Fish were collected from the hatchery effluent Kokanee trap and held in raceway 12. All carcasses were disposed of at the Cowlitz County landfill. Disposition is as follows:

Adults Trapped	476
Mortality (0.0%)	0
Returned to Stream	0
Adults Spawned	476
Non-Viable	0

2019 Lewis River Type S Coho

The first fish were received on September 10, 2019. Brood stock was collected at the Merwin Dam Fish Collection Facility and Lewis River trap. Disposition is as follows:

Adults Received	1,592
Jacks Received	72
Mortality (2.3%)	37
Adults Spawned	1,276
Non-Viable	10
Nutrient Enhancement	1,555
Landfill	37

All mortality carcasses were disposed of at the Cowlitz County Landfill.

SPEELYAI HATCHERY ADULT COLLECTION

SPECIES	ESTIMATED TRAPPED / RECEIVED		RETURNED TO STREAM			SHIPPED / PLANTED			MORTALITIES			CARCASS DISTRIBUTION			LETHAL SPAWNED				LIVE SPAWNED			ESTIMATED ON-HAND		MARKS RECOVERED			ESTIMATED EGGS TAKEN
	A	J	M	F	J	M	F	J	M	F	J	M	F	J	M	F	NVF	J	M	F	J	A	J	M	F	J	
CK:SP:LEHA:19:H	917	115							23	28	13	5		17	375	481	5	85	13		8			154	119	94	1,636,000
KO:NA:MERL:19:M	476														304	172								N/A	N/A	N/A	140,000
CO:SO:LEHA:19:H	1,592	72							19	18	2	108	161	34	620	656	10	36						75	98	5	1,527,000

Egg Take and Incubation

2019 Lewis River Spring Chinook, Hatchery Origin

Egg Inventory and distribution is as follows:

Total Egg Take	1,649,400
Egg Loss (5.4%)	89,400
Destroyed	0
Shipped	0
Ponded	1,560,000
Fecundity	3,429

2019 Lewis River Type S Coho, Hatchery Origin

Egg Inventory and distribution is as follows:

Total Egg Take	1,603,903
Egg Loss (15.2%)	243,550
Shipped	1,360,353
Fecundity	2,445

2019 Lake Merwin Kokanee, Mixed Origin

Egg Inventory and distribution is as follows:

Total Egg Take	140,000
Adjustment	(1,000)
Egg Loss (13.6%)	19,000
Fecundity	954

At the time of this report, the 2019 Kokanee are still in incubation and will be ponded in January 2020.

Rearing Program

2017 Lake Merwin Kokanee

On March 1, 2019, the remaining 51,140 Kokanee were released from Speelyai hatchery at an average size of 7.02 F/LB.
Disposition is as follows:

Stock Inventory

Beginning Balance	192,900
Rearing Mortality (6.5%)	12,570
Fish Planted	170,865
Pounds Planted	12,866
Beginning Pounds	54
Feed Fed (lbs.)	10,473
Net gain (lbs.)	12,812
Conversion	0.82:1
Population Adjustment	0

2017 Goldendale Rainbow

On May 21st, the power canal received 2,500 fish at 2.63 F/LB and Swift reservoir received 38,800 at 2.63 F/LB.
Disposition is as follows:

Stock Inventory

Beginning Balance	41,958
Rearing Mortality (4.1%)	658
Beginning Pounds	3,814
Pounds Planted	15,703
Feed Fed (lbs.)	8,740
Net Gain (lbs.)	11,889
Conversion	0.74:1
Population Adjustment	0

2018 Lewis River Spring Chinook, Hatchery Origin

Coded-wire tagging and mass marking were completed on April 26, 2019. In May, 1,029,830 hatchery origin spring Chinook were shipped to Lewis river hatchery at an average size 140 F/LB. In June, 1,015,570 were planted in the Lewis River at Pekins boat launch. In December, the remaining 315,250 were shipped to Lewis river hatchery.
Disposition is as follows:

Stock Inventory

Beginning Balance	2,347,750
Rearing Mortality (2.0%)	41,540
Fish Shipped	1,345,080
Pounds Shipped	29,097
Fish Planted	1,015,570
Pounds Planted	10,601
Beginning Pounds	2,042
Feed Fed (lbs.)	29,130
Net gain (lbs.)	45,092
Conversion	0.65:1
Population Adjustment	54,440

2018 Lake Merwin Kokanee

On October 28, 2019, 45,800 were released at an average size of 8.32 F/LB. At the time of this report, there are 48,850 fish on hand at an average size of 11.1 F/LB to be released from raceways into Speelyai bay in March 2020.

2018 Goldendale Rainbow

On November 4, 2019, 43,120 fish were received from Merwin hatchery at an average of 14 F/LB. At the time of this report there are 43,000 fish on hand at an average size of 9.6 F/LB. These fish are currently being reared in Pond 13 and are on schedule to be planted into Swift reservoir and the power canal in May 2020

2019 Lewis River Spring Chinook, Hatchery Origin

At the time of this report, 1,304,660 Chinook have been ponded and are at an average size of 840 F/LB. There are an additional 220,000 in incubation that will be ponded in early January. Mass marking and coded-wire tagging will begin in March 2020.

2019 Lake Merwin Kokanee

At the time of this report there are 126,000 fish in incubation to be ponded in early January 2020.

YEARLY TEMPERATURE REPORT

HATCHERY: Speelyai **YEAR:** 2019 **WATER SOURCE:** Speelyai Creek

DAY	JAN			FEB			MAR			APR			MAY			JUN			JUL			AUG			SEP			OCT			NOV			DEC			DAY
	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	
1	45.7	44.8		47.1	45.3	0.10	46.9	44.2	0.04	49.6	47.8		51.1	49.3		54.1	52.7		54.9	53.2		55.8	54.0		56.7	52.9		52.0	47.8		47.5	45.3		45.1	43.2		1
2	45.7	44.6		48.4	46.6	0.52	48.4	44.2		49.8	47.8		50.7	49.1		54.3	52.9		54.9	52.9		55.9	54.7	0.1	57.0	53.2		51.6	47.7		48.4	45.9		46.4	45.1	0.11	2
3	47.1	44.8	0.80	48.6	47.1		47.3	43.7		49.8	49.3	0.14	50.7	49.3		54.1	52.7		54.5	53.4		55.9	54.7	0.17	56.7	52.9		52.2	48.2	0.2	48.7	46.4		46.8	44.2		3
4	48.2	46.9	0.70	47.8	46.2	0.31	47.3	42.6		49.6	49.3	0.08	51.1	49.3		54.1	52.7		53.6	53.1		56.1	54.7		56.8	52.9		52.2	50.9	0.4	48.6	46.2		48.4	45.8		4
5	49.1	47.3		46.9	45.1	0.13	47.3	42.4		49.6	48.9	0.32	51.8	49.3		53.6	52.6		54.0	52.7		56.5	54.7		56.8	53.1		52.2	51.1	0.45	48.6	46.2		48.6	46.9		5
6	49.1	47.3	0.27	46.9	43.3		45.3	43.7		49.6	48.9	0.9	52.7	50.4		53.8	52.4		54.1	53.1		56.5	55.0		56.8	52.9		52.2	48.9	0.38	47.8	45.9		48.4	46.8		6
7	48.0	46.9	0.50	46.9	43.0		45.7	43.7	0.24	49.6	48.6	1.05	52.7	51.3		53.4	52.0	0.29	53.8	52.7		56.5	55.2		56.8	53.6		52.7	48.9		48.7	46.9		48.9	47.5	0.96	7
8	47.5	46.6	0.24	45.7	43.3		45.9	45.3	0.26	49.6	48.6	0.28	52.3	51.3		52.2	51.6	0.6	53.6	52.9		56.5	55.2		54.3	53.2	0.25	52.2	49.3		50.0	48.0		48.9	47.5	0.13	8
9	48.0	46.6	0.12	46.2	40.5		45.7	45.2	0.25	49.5	48.9	0.7	52.3	51.6		52.3	51.6		54.0	52.9		56.5	54.9		54.9	53.2	2.88	52.0	48.6	0.23	49.1	47.1	0.06	49.3	46.8	0.05	9
10	48.6	46.6	0.66	45.1	41.5		46.2	45.0		49.5	48.9	0.39	52.5	51.6		53.2	52.6		54.0	52.9	0.48	55.4	54.3		54.5	53.6	0.93	52.0	47.1		49.6	47.3	0.28	46.8	45.0		10
11	50.0	48.2	0.04	45.5	42.3		46.4	44.8		49.1	48.7	1.81	53.0	51.6		54.3	52.3		54.0	52.7	0.15	55.6	55.0		55.8	53.4	0.12	50.5	47.1		51.4	48.9	0.06	47.5	45.0	0.88	11
12	50.0	47.3		45.5	42.1	7.70	47.3	45.3	0.82	50.0	48.6	0.85	53.6	51.6		55.0	52.9		54.5	53.6		55.4	54.5		55.9	52.3		51.3	48.4		49.8	48.6		48.2	47.5	1.07	12
13	48.0	46.8		46.9	43.5	0.97	46.8	45.9	0.4	50.0	48.4	0.68	52.9	52.0		55.6	52.8		55.0	53.8		55.6	54.6		55.9	52.2		52.2	49.1		49.8	48.6	0.23	48.6	47.8	0.75	13
14	47.3	46.2		46.8	44.8	0.36	47.7	45.9	0.08	49.3	48.2		52.7	51.3		55.6	53.4		55.4	54.3		55.7	54.8		56.1	53.4		52.5	49.3		48.9	47.7	0.02	48.6	47.7	0.22	14
15	46.6	45.3		46.0	45.0	0.79	47.7	46.4		48.7	48.2	0.2	52.7	51.4	0.3	54.7	53.2		55.6	53.6	0.09	55.9	54.6		55.4	53.4	1.31	52.5	49.3		50.0	47.7	0.37	48.6	46.2	0.2	15
16	46.9	45.3		46.8	45.3	0.63	48.0	46.4		49.1	48.0	0.15	51.6	51.3	0.24	54.0	52.9		55.6	53.6		55.8	54.1		55.4	53.2	1.15	52.2	49.3	0.04	49.5	48.7	0.27	47.8	46.2		16
17	47.8	46.0		46.8	45.1	0.32	48.4	46.9		49.6	48.7	0.12	51.4	51.3	0.65	54.3	53.1		55.0	54.0		55.4	54.7		54.3	53.1	0.78	51.3	50.4	0.98	50.5	48.7		48.0	46.3		17
18	48.4	47.8	0.76	47.1	45.0	0.03	48.6	46.8		49.8	48.7	0.18	51.5	51.3	0.1	54.5	53.1		54.9	53.8	0.21	55.2	54.3		54.3	53.1	1.15	51.4	50.5	1	50.9	50.0	0.21	48.0	46.2		18
19	48.7	47.8	1.23	46.9	45.0	0.08	48.9	47.5		51.1	48.7		52.2	51.3	0.5	54.7	53.6		54.5	52.9		55.2	54.3		54.5	52.3	0.25	51.6	50.5	2.62	50.5	50.0	0.72	47.5	46.2	0.69	19
20	49.3	47.7	0.17	46.4	45.1	0.90	49.5	48.0		51.1	48.7	0.28	52.2	51.6	0.04	54.0	52.9	0.06	54.3	53.2		55.3	54.4		54.3	52.7	0.1	51.3	50.4	0.56	50.9	47.1		49.4	46.8	3.15	20
21	48.6	46.8	0.07	47.5	44.8	0.04	49.5	48.1		50.5	49.6		52.0	50.7	0.04	53.2	52.5	0.08	54.9	52.9		55.3	54.4		54.7	52.5		51.6	50.4	0.68	47.3	45.3		49.6	49.1	2.66	21
22	48.0	46.8		46.8	44.4		49.3	48.2		50.4	49.1		52.0	50.9	0.08	53.6	52.7		55.9	53.8		55.4	54.3	0.36	54.9	52.7	0.16	51.6	50.4	0.93	46.6	45.1		49.1	47.8	0.37	22
23	48.0	46.4	2.68	45.3	43.7	0.20	49.3	48.0	0.32	50.4	49.1	0.14	52.2	51.1	0.17	53.4	52.5		55.8	54.5		54.7	53.8		53.8	52.7	0.6	52.0	49.6		45.5	44.6	0.3	48.7	47.8	0.46	23
24	49.3	47.3	0.21	46.8	45.1	0.70	48.9	48.4	0.12	50.5	50.0		53.1	51.1	0.02	53.2	52.3		55.0	54.1		55.0	53.6		54.5	52.7	0.2	52.5	48.7		47.3	45.3		48.2	45.5		24
25	49.3	47.1		45.9	45.0	0.10	48.4	48.0		50.7	49.8		52.9	51.8	0.16	53.2	52.3		55.2	54.0		55.4	54.1		55.2	52.2		50.9	48.7		48.9	47.3	0.47	46.8	45.3	0.1	25
26	48.6	45.3		46.8	44.4		48.9	48.0	0.47	50.9	49.5		51.8	51.1	0.21	53.6	51.8		55.1	54.0		55.4	54.1		54.5	51.8	0.15	51.3	49.1		48.9	46.6	0.27	47.8	45.1		26
27	48.6	45.3		46.0	44.1		48.9	48.0		51.4	50.0		52.5	50.9	0.28	54.1	51.8	0.37	55.9	54.0	0.05	55.6	54.1		54.0	51.8	0.1	50.4	46.2		47.3	45.7	0.25	47.8	45.1	0.3	27
28	48.0	45.8		46.4	44.2		48.9	47.3	0.4	50.5	49.6	0.01	52.5	50.9	0.03	54.1	51.8	0.67	55.9	54.0		55.6	54.0		53.2	50.7	0.21	48.0	45.7		46.9	45.0		47.1	46.0	0.13	28
29	47.6	46.2					48.9	48.4		50.7	48.7		52.2	51.8		53.8	52.5		55.4	54.0		57.7	53.4	0.36	52.7	50.2		47.7	45.5		45.7	43.7		48.0	46.8		29
30	47.3	46.0					49.3	47.8		50.7	49.1		53.2	50.9		54.5	52.5		55.8	54.0		54.3	54.0	0.18	51.3	48.7		46.2	45.0		44.2	43.0		48.6	46.8		30
31	47.3	45.5											53.4	52.0					55.4	54.5		57.3	54.0	0.03				47.1	45.0					48.6	46.4	0.13	31
Avg / Tot	48.1	46.4	8.45	46.6	44.3	13.88	47.9	46.1	3.40	50.0	48.9	8.28	52.2	51.0	2.82	54.0	52.6	2.07	54.9	53.5	0.98	55.8	54.4	1.20	55.1	52.6	10.34	51.2	48.6	8.47	48.6	46.8	3.51	48.1	46.3	12.36	Avg / Tot
Acc. Rain	8.45			22.33			25.73			34.01			36.83			38.90			39.88			41.08			51.42			59.89			63.40			75.76			Acc. Rain

DISEASES AND TREATMENTS

DATE:	1/1/19 - 12/31/19	HATCHERY:	SPEELYAI HATCHERY

DATE	BROOD YEAR/ SPECIES	POND NUMBERS	TREATMENT CHEMICAL	DISEASE
2/3 - 4/19	2019 Lewis River Spring Chinook	Raceways	Formalin Drip	Costia
3/4	2019 Kokanee	Raceways	Formalin Drip	Costia
3/15 - 9/3	2019 Lewis River Spring Chinook Brood	Raceways 25-28	Formalin Drip	Fungus
9/28 - 10/26	2019 Lewis River Type S Coho Brood	Adult Pond	Hydrogen Peroxide	Fungus
9/14 - 9/24	2019 Kokanee Brood	Raceway 12	Formalin Drip	Fungus
10/14 - 11/17	2019 Type S Coho	Incubation	Formalin Drip	Fungus
8/30 - 11/22	2019 Spring Chinook	Incubation	Formalin Drip	Fungus
9/28 - 12/3	2019 Kokanee	Incubation	Formalin Drip	Fungus

MAINTENANCE AND CAPITAL PROJECTS

Maintenance

1. Replace UV bulbs on domestic water system.
2. Annual preventative maintenance to fork-lift.
3. Annual preventative maintenance to generator.
4. Annual preventative maintenance to three-phase compressor.
5. Annual preventative maintenance to residential HVAC.
6. Annual preventative maintenance to tractor.
7. Annual maintenance completed on traveling screens at intake structure.
8. New lights in the shop.
9. Built new adult screens.
10. Repaired tractor bucket.
11. The rotating screen for the intake has been rebuilt.
12. Replaced the radiator for the generator.

Capital

1. Road has new asphalt.
2. Paved small patch near the hatchery for landing zone.

Complex Staff Jan. 2019-Dec. 2019

Complex Manager-	**Aaron Roberts**
FHS4-	**Michael Chamberlain**
FHS4-	**Kevin Young**
FHS3-	**Scott Peterson**
FHS3	**Luke Miller**
FHS3	**Jesse Cody**
FHS2-	**Jay VonBargen**
FHS2-	**Jim Trammell**
FHS2-	**Dwayne Fossen**
FHS2-	**Bryan Coyle**
FHS2-	**Grant Sill**
FHS2-	**Tiffany Farrar**
FHS2-	**Doni Grove**
FHS2-	**Chris Roe**
MHCC Student-Work Study	**Ian Anderson**
MHCC Student-Work Study	**Chance Balch**

2019 LEWIS RIVER COMPLEX

	CK:SP:LEHA:19:H			CK:FA:UNKN:19:H			CK:FA:UNKN:19:W			CO:SO:LEHA:19:H			CO:SO:LEWI:19:W		CO:NO:LEWI:19:H			CO:NO:LEWI:19:W		CO:NO:LEWI:19:H			SH:SU:MEHA:19:H		SH:SU:MEHA:20:H		SH:WI:MEHA:19:H		SH:WI:MEHA:20:H		SH:WL:LEWI:19:W		SH:WL:LEWI:19:W		KO:NA:MERL:19:M		Total
	M	F	J	M	F	J	M	F	J	M	F	J	M	F	M	F	J	M	F	M	F	J	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
AMERICAN CANADIAN				9	8	1				8	13	5														1											45
CAP										64	99	166													14	49											392
Landfill	406	517	115	14	8	1		1		65	65	31	1	1	582	234	22	6	6	80	82	119			179	183	48	43	16	29	3	1	2	3	270	155	3,288
NW Harvest				113	44	23				1,149	470	433			15	38	17								76	182											2,560
Nutrient Enhancement										841	885	238			1,043	944	982	25	26																	4,984
Cowlitz Tribe			22	22	10	11				590	423	193										1	28	71	114	210	171	347	44	7							2,264
Chinook Tribe										0	0	0													23	41											64
N. County FB										58	73	138																									269
TOTAL	406	517	137	158	70	36	0	1	0	2,775	2,028	1,204	1	1	1,640	1,216	1,021	31	32	80	82	120	28	71	406	666	219	390	60	36	3	1	2	3	270	155	13,866

Executive Summary

Adult returns on the NF Lewis River for all species were below average for 2019. Broodstock goals were met on all species but spring Chinook. We were able to send Early Coho, Late Coho and Late Winter Steelhead upstream for reintroduction. Our egg take program goals were met as well for Coho and Steelhead with spring Chinook just falling short but still have a potential of meeting release goals based on juvenile survival at the facilities and all five release strategies will be implemented for the 2019 brood year.

Juvenile rearing overall between all facilities was good. As you can see in the mitigation summary below all three facilities were able to release a respectable amount of smolts in 2019. Fish health is always a concern especially in the spring Chinook breaking with BKD but with proper rearing densities and feeding schedule to reduce stress has helped in suppressing outbreaks. Our Fish Health Specialist continues to monitor BKD levels in our spawning spring Chinook adults thru ELISA testing as well as testing the egg levels of BKD thru PCR (Polymerase Chain Reaction) testing.

All facilities kept up with routine maintenance and had some minor projects done this year. There were only a few capital projects done in 2019. Thanks to our outstanding WDFW staff and the local staff from PacifiCorp, all three stations are looking and operating well.

As we move forward into re-licensing, we will be presented with many new challenges, both with upstream re-introduction, facilities modifications and continuing changes to our program goals to better provide higher quality smolts and better adult returns. Staff here on the Lewis River system are some of the best in the industry, and committed to facing these challenges with both professionalism and dedication. Their efforts are much appreciated.

Mitigation Summary

Stock	Mitigation Target	Actual Production
Spring Chinook	**1,350,000@ 8-12 FFP**	1,278,855 @ 8-12 FPP
Early Coho	**1,100,000@ 16 FFP**	1,228,380 @ 16.1 FPP
Late Coho	**900,000@ 16 FFP**	965,009 @ 16.4 FPP
Summer Steelhead	**175,000@ 4.8 FFP**	180,146 @ 5.5 FPP
Winter Steelhead	**100,000@ 4.8 FFP**	108,128 @ 5.1 FPP
Wild Winter Steelhead	**50,000@ 6-8 FFP**	44,861 @ 8.0 FPP
Kokanee	**12,500 Pounds**	12,866 Pounds
Rainbow	**50,000@ 2.5 FFP**	43,800 @ 2.5 FPP

*** 100,000 Spring Chinook upstream production was suspended and moved to the hatchery downstream production.**