

Annual Report for

Dworshak National Fish Hatchery

Orofino, Idaho

Oct. 1, 2018 through Sep. 30, 2019



Photo: Drone Skies

Authored by staff of the Dworshak Fisheries Complex and Pacific Region Fish Health Center

TABLE OF CONTENTS

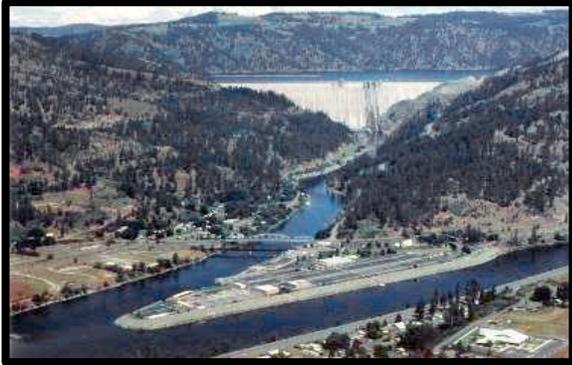
INTRODUCTION	5
FISH CULTURE OPERATIONS	9
Summer Steelhead Brood Year 2018	9
System Rearing	9
Table 1. BY18 SST on-station at the start of FY19 until final release.	9
Table 2. SST Systems BP production, BY18 SST, FY2018/19.	10
Release	10
Table 3. DNFH Fish Release BY18 SST, April 2019.	10
Table 4. DNFH Fish Release by Mark Type, BY18 SST	11
Summer Steelhead Brood Year 2019	11
Adult Collection and Holding	11
Table 5. Trapping and Out-planting Numbers for BY 2018 SST.	12
Spawning Summary	12
Magic Valley SFH	13
GNRH Males	13
Surplus Eggs	14
Adult Disposition	14
Table 6: SST spawned at DNFH during the BY19 SST season. Includes kelt spawning.	14
Table 7. Egg disposition of BY 2019 SST spawned at DNFH.	15
Research	15
Early Rearing	15
Table 8. Illustrates the SST in BP production as they are moved out of the nursery.	17
Projected Release	17
Table 9. SST on station at the end of FY 2019 and projected release numbers.	17
Spring Chinook Salmon Brood Year 2017	17
Raceway Rearing	17
Table 10. BY17 SCS, May 2018 through March 2019.	19
Release	19
Spring Chinook Salmon Brood Year 2018	20
	2

Adult Collection and Holding	20
Table 11. Ladder operation for BY18 SCS trapped at DNFH.	20
Spawning	21
Eggs	21
Table 12. DNFH BY18 SCS Egg Take and Survival.	22
Early Rearing	22
Table 13. Raceway production, BY18 SCS, FY19.	23
Projected Release	24
Table 14. BY18 SCS at the end of the FY and projected release from DNFH, March 2020.	24
Spring Chinook Salmon Brood Year 2019	24
Adult Collection and Holding	25
Table 15. Ladder operation for BY19 SCS trapped at DNFH.	25
Figure 1. SCS Adult Collections at DNFH/KNFH 1993-2019	26
Table 16. Mortality of adult BY19 SCS held at DNFH.	26
Table 17. Mortality of DNFH SCS returns 2015-2019.	27
Table 18. Mortality of adult SCS returns - KNFH stock transferred to DNFH BY2015–2019.	27
Table 19. Illustrates BY19 SCS adult fish disposition from both DNFH stock held at DNFH.	28
Spawning	28
Eggs	29
Research	30
Projected Release	30
Table 20. Projected Release Numbers for BY19 SCS, DNFH.	31
Lyon’s Ferry SFH Production at Dworshak NFH	32
Summary	32
Fish Transfers	32
Fish Health	32
FISH HEALTH	34
Fish Health: All Life Stages	34
Broodstock Sampling	35
Broodyear 2018 Steelhead	35
Broodyear 2019 Steelhead	36

Broodyear 2017 Spring Chinook	36
Broodyear 2018 Spring Chinook	37
Broodyear 2019 Spring Chinook	38
Broodyear 2017 Coho	39
Broodyear 2018 Coho	40
Release Sampling: Juveniles	40
Fish Health Diagnostics and Monitoring	42
Research and Technology	43
Hatchery Evaluation Team and Coordination Meetings	43
Reports	43
Training	43
Outreach Provided by Fish Health	44
FACILITY MAINTENANCE	45
General Routine and Preventative Maintenance	45
Maintenance Highlights by month	45
Power Outages and Planning	57
ADMINISTRATION	59
Personnel	59
Meetings and Administration	63
INFORMATION AND EDUCATION	68
Visitor Use Statistics	68
Table 21. DNFH Visitor Use Statistics, FY 2019	68
FY19 Outreach Program Summary	68
Kids Fishing Day, Tunnel Pond, 2019	71
APPENDIX 1. SIGNIFICANT CHANGES IN OPERATIONS AND MAINTENANCE.	73

INTRODUCTION

Dworshak National Fish Hatchery (Dworshak or DNFH) is located in North Central Idaho



approximately one mile downstream from Dworshak Dam, at the confluence of the North Fork and the mainstem of the Clearwater Rivers. Dworshak Dam was constructed by the Army Corps of Engineers (COE) between 1966-70 under congressional authorization through the Flood Control Act of 1962. The hatchery was built at the same time to mitigate for lost fisheries in the North Fork Clearwater River resulting from construction and operation of the dam, which has no fish passage facilities due to its significant

height. Operation of the hatchery by the United States Fish and Wildlife Service (USFWS or Service) was authorized by a 1969 Memorandum of Understanding between the COE and Service.

In 2004, the Snake River Basin Adjudication (SRBA) Settlement Agreement (SRBA Agreement) was ratified by Congress through the Snake River Water Rights Act of 2004 (Public Law 108-447). Through the SRBA Agreement, the Nez Perce Tribe (NPT or Tribe) assumed total management of Kooskia National Fish Hatchery (KNFH or Kooskia) and became a joint-operator and manager of the hatchery programs at DNFH. In accordance with the SRBA Agreement, joint operation of DNFH by the Service and Tribe is funded through the hatchery budget.

DNFH produces unique North Fork “B” strain summer steelhead trout (*Oncorhynchus mykiss*) (SST), as mitigation for construction of the dam. These fish are presently listed as threatened under the Endangered Species Act (ESA). DNFH has an annual SST mitigation production goal of 2.1 million smolts released at 5.8 fish per pound (fpp) or 200 millimeters (mm). Of these fish, 1.2 million are released directly from the hatchery into the mainstem Clearwater River and 900,000 are trucked upstream and released at various sites in the mainstem Clearwater and South Fork Clearwater Rivers. From these releases, the desired outcome is to return 20,000 adult SST to the Clearwater River each year, while also maintaining the unique genetics of the stock (Appendix 1 and 2).

The COE also has a resident fish mitigation responsibility associated with the construction and operation of the Dworshak Dam. This goal has been modified over the years, and is currently about 18,000 pounds of rainbow trout (RBT) stocked into Dworshak Reservoir and the North Fork Clearwater River basin annually.

The RBT were initially reared at DNFH. However, continued issues with fish pathogens associated with use of river water for rearing at DNFH led to a significant change. The RBT

mitigation was moved to Hagerman National Fish Hatchery (HNFH) in southern Idaho, because that hatchery doesn't have the same level of pathogen issues associated with its water sources. To meet the mitigation economically, a 'fish exchange' was developed involving Idaho Fish and Game (IDFG). This exchange avoids trucking RBT from southern Idaho all the way up to the Dworshak Reservoir area, which is not logistically sound or cost effective. Instead, RBT grown at HNFH are stocked into various waters in southern Idaho on behalf of the state's fishery. In exchange, IDFG produces catchable-sized, sterile RBT in north central Idaho and stocks them into various landlocked ponds and lakes within the North Fork Clearwater drainage and in Dworshak Reservoir to meet the COE's RBT mitigation responsibility. Currently IDFG operates HNFH. Funding from the COE is provided to DNFH, and then transferred to the Lower Snake River Compensation Plan (LSRCP) office, which funds HNFH. LSRCP in turn passes the COE funding on to IDFG at HNFH to meet the annual mitigation.

The Service administers the LSRCP program, through funding from Bonneville Power Administration (BPA). The LSRCP was congressionally authorized to mitigate for impacts to fisheries caused by construction and operation of the four federal lower Snake River dams. In June of 1982, DNFH was expanded to include spring Chinook (*Oncorhynchus tshawytscha*) (SCS) production to help meet LSRCP mitigation goals. New facilities were constructed in Washington, Idaho and Oregon, and included new infrastructure at DNFH. Adding SCS production capacity at DNFH was thought to be much more cost effective compared to permitting and constructing an entirely new facility in Idaho.

Currently, the United States versus Oregon (U.S. vs. Oregon) SCS production target at DNFH is the release of 1.05 million smolts into the North Fork Clearwater River each year at 20 fpp. A formal adult return goal was also established for the DNFH SCS program of 9,135 adults returning over lower Granite Dam (LGR) annually. This goal was based on an assumed adult return rate of 0.87 percent at the time the program was developed. The goal has only been achieved three times (i.e. 2001, 2012, 2015) since the onset of the program in 1982.

There is a desire by the Clearwater Basin fishery managers for SCS production in the basin to increase to achieve the adult return goal more consistently. As a result, a study was conducted at DNFH from 2012 to 2019 (three release years and five return years) comparing standard versus high-density raceway production groups, focused on both in-hatchery survival and adult return rates. The in-hatchery component of the study concluded no appreciable difference in survival between standard density and high density groups in the hatchery and in migration downstream to LGR. Adult returns also yielded no significant difference between the two rearing strategies. The general conclusion therefore is that higher density rearing of SCS at DNFH should yield more adults back. To date, the fishery managers have not determined if permanent changes to SCS production at DNFH will be made based on this study. However, based on data after the first year's performance between the low and high density groups showing similar survival, the rearing densities in some of the fifteen B Bank raceways at DNFH have already been increased to the higher density production level. This increase represents an additional 600,000 smolts released above the U.S. vs. Oregon mitigation goal of 1.05 million; or a total SCS release of 1.65 million smolts at 20 fpp into the North Fork Clearwater River

annually. Managers hope the increased production will lead to increased adult returns, and may increase densities across all raceways in the future.

In addition to the smolt production, 300,000 SCS parr listed in the U.S. vs. Oregon Agreement are reared for the Tribe at DNFH, before release into the Upper Selway River at 100 fpp each fall. DNFH also produces 380,000 pre-smolts for the Nez Perce Tribal Fish Hatchery, which are transferred from DNFH to the Nez Perce Tribal Hatchery (NPTH) in the fall. Of those, 200,000 are released as smolts at 20 fpp from NPTH directly into the Clearwater River the following April. They provide returning adults for several NPTH SCS programs, and are identified in the U.S. vs. Oregon Agreement. The other 180,000 are released into Lolo Creek as smolts at 20 fpp during the following spring to supplement natural production there. The Lolo Creek release group is not currently part of the U.S. vs. Oregon agreement.

The NPT began the Clearwater Coho Restoration (CCR) Program in the Clearwater Basin in 1995. The goal of the program is to restore a viable population of these fish in the Clearwater Basin following extirpation by the Lewiston Dam built on the Clearwater River in 1927 (since removed in 1976). Hatchery rearing of Coho salmon began at DNFH in 1999. Each fall, coho salmon adults are trapped at KNFH, LGR, Lapwai Creek, and DNFH if needed. Trapped adults from these locations are held at DNFH until spawning in October. A portion of the progeny (550,000) are incubated and reared at DNFH for about seventeen months, before being trucked to KNFH in late February for acclimation and release into Clear Creek in March. An additional 550,000 eggs are transferred to the Eagle Creek National Fish Hatchery, and the remaining 500,000 eggs are transferred to Cascade State Fish Hatchery operated by the Oregon Department of Fish and Wildlife. Program funding is provided through a combination of NOAA's Pacific Coastal Salmon Recovery Act funds and through the Mitchell Act. The total CCR production goal is 1.55 million smolts annually. DNFH produces 500,000 smolts at 20 fpp as a portion of the goal. The CCR project is gradually building its smolt production effort to achieve a Clearwater stock adult return goal of 14,000 adults to the Clearwater Basin, per the 2004 Coho Master Plan.

Beginning in 2008, a ten-year Steelhead Kelt Reconditioning Project was initiated at DNFH by the NPT and Columbia River Inter-Tribal Fish Commission (CRITFC), with science support from the University of Idaho. It is a Bonneville Power Administration Remand-funded study to increase understanding of factors necessary to enable post-spawn survival of B-Run SST adults returning to the Snake River Basin, in hopes that reconditioning might help them survive to spawn a second time. Currently, up to 300 spawned-out adult unclipped B SST are trapped at LGR and transferred to both NPTH and DNFH. Physiology, nutrition, physical condition and survival are studied to determine if adults migrating above eight dams can survive to spawn a second time. On-site work focuses on re-conditioning the trapped adults for several months before releasing them back into the river. The NPT conducts the work at NPTH, and CRITFC and the University of Idaho reconditions fish at DNFH. Through BPA funding, proper kelt reconditioning infrastructure is planned to be constructed at NPTH in the next several years. Once completed, CRITFC plans to move their research from DNFH down to NPTH. Reports summarizing this work can be found by searching for 'kelt reconditioning' on the CRITFC website at <https://www.critfc.org/fish-and-watersheds/fishery-science/scientific-reports/>.

All species combined, the hatchery's current production target is 4,980,000 fish released, and 478,868 pounds produced annually. Return goals are 20,000 SST, 9,135 SCS, and 14,000 coho salmon adults returning from this production each year.

FISH CULTURE OPERATIONS

Summer Steelhead Brood Year 2018

System Rearing

During the summer of 2018, DNFH hatchery staff moved approximately 2.4 million BY 18 SST from the nursery to outside Burrows Ponds (BPs). All BY18 SST moved out of the nursery were placed into System I (SYS I) on reservoir water supply for initial outdoor rearing. Columbia River Fish and Wildlife Conservation Office (CRFWCO) clipped adipose fins from May through August 2018, at the time fish moved from the nursery to SYS I. Flows increased to 1000 gpm each per BP, which increased water exchange rates. This benefitted the fish to help maintain a clean rearing environment in the BPs and improved Oxygen levels. Initial loading of a BP was 140,000 fingerlings at 100 to 150 . At a size of 60 fpp, hatchery staff split the initial SYS I BPs using a fish pump and Vaki fish counter. Fish moved into BPs into Systems II and III (SYS II, III), which are supplied by pumped river water. During outdoor rearing, increased survival resulted in surplus to the production target release of 2.1 million SST smolts. Table one shows the number of smolts DNFH released (n=2,394,570) between April 1 and April 9, 2019. The monthly summaries for FY18/19 for outdoor rearing of SST at Dworshak are shown in Table two.

Table 1. BY18 SST on-station at the start of FY19 until final release.

As of October 1, 2018					Final Release April, 2019				
Stock	Number	Weight (lbs)	FPP	L mm	Oct 1 - April % Loss	Number	Weight (lbs)	FPP	L mm
Dworshak	2,404,905	108,687	22.1	134	0.43	2,394,570	401,261	6.0	199

Source: DNFH Monthly Inventory and Final Release Summary

Table 2. SST Systems BP production, BY18 SST, FY2018/19.

BY18 SST	Fish on Feed End of Month (systems only)				Gain this FY	Gain this Mo	Fish Feed Fed				FY Feed	Mo Feed	Ave Temp	Lgth Incr inch	Den	Flow
	EOM	Number	Wt lbs	FPP	Lgth in	Wt	Wt	LBS FY	Cost FY	LBS Mo	Cost Mo	Conv	Conv	for Mo	30 day	Index
Jun-18	1,245,660	16,591	75.1	3.4	5,247	5,247	4,891	9,733	4,891	9,733	0.93	0.93	51.0	0.97	0.21	1.27
Jul-18	1,479,372	25,443	58.1	3.9	11,099	5,852	10,951	21,792	6,060	12,059	0.99	1.04	49.5	0.86	0.25	0.96
Aug-18	2,411,700	71,277	33.8	4.6	35,961	24,862	30,912	58,434	19,961	36,642	0.86	0.80	48.8	0.57	0.14	0.55
Sep-18	2,404,905	108,687	22.1	5.1	73,462	37,501	59,473	101,987	28,561	43,552	0.81	0.76	49.6	0.55	0.14	0.64
Oct-18	2,402,213	164,961	14.6	5.8	129,736	56,274	103,189	138,928	43,716	36,941	0.80	0.78	50.0	0.77	0.17	0.65
Nov-18	2,401,194	198,530	12.1	6.2	163,305	33,569	146,177	172,029	42,988	33,101	0.90	1.28	43.3	0.37	0.19	0.73
Dec-18	2,400,004	253,994	9.4	6.7	218,974	55,669	194,739	203,108	48,562	31,080	0.89	0.87	45.4	0.54	0.22	0.85
Jan-19	2,398,235	317,445	7.6	7.3	282,424	63,451	241,176	232,953	46,437	29,845	0.85	0.73	42.3	0.51	0.25	1.00
Feb-19	2,396,719	354,739	6.8	7.5	319,719	37,294	290,569	264,698	49,393	31,745	0.91	1.32	40.3	0.28	0.27	1.07
Mar-19	2,394,831	401,261	6.0	7.8	366,251	46,533	340,675	296,901	50,106	32,203	0.93	1.08	40.2	0.31	0.30	1.00
Apr-19	2,394,570	401,261	6.0	7.8	366,251	0	340,675	296,901	0	0	0.93	0.00	40.2	0.00	0.30	1.48

Source: DNFH Monthly Inventory Summary

Release

Releases at Dworshak began on April 1 and ended April 9, 2019. Offsite trucking began on the 1st, with releases to the South Fork Clearwater River at Red House hole and Clear Creek. The Lolo Creek destined offsite group was released at Red House hole. This was due to the heavy snow pack on the access road to Lolo Creek and the inability to have the road cleared out to allow truck travel. The decision to release at Red House was made through basin-wide coordination following the AOP procedure for alternate release locations. Table three shows the number of fish released at each site, noting the change in releases of the Lolo group.

Onsite releases were successful, with new methodologies employed. Releases of the onsite group took two days (April 8 – April 9, 2019). This coincided with spill initiated at the downstream dams. Traditional crowding with releases through BP knife-gates to the mainstem Clearwater River via the hatchery’s channel system occurred on non-PIT tagged BPs. FWCO staff pumped all PIT tagged on-site release BPs through the *Mykiss* scanner. These BPs were then released in the traditional crowding method aforementioned. Table four gives the breakdown of tag groups across the various release sites. DNFH met goal for size at an average release size of 6.0 fpp.

Table 3. DNFH Fish Release BY18 SST, April 2019.

Release sites	Systems	Number	Wt	FPP	Length in	Length mm	Density Index (at release)	Flow Index	Release Dates
Red House	1,2	391,199	64,014	6.1	7.8	197	0.31	1.22	4/1-4/5/2019
Clear Creek	1,2	421,177	74,260	5.7	8.0	202	0.29	1.13	4/1-4/4/2019
Lolo (Red House)**	1,3	246,859	34,334	7.2	7.4	187	0.32	1.25	4/5 & 4/8/2019
Direct Release	1,2,3	1,335,335	228,653	5.8	7.9	200	0.29	1.14	4/8-4/9/2019
Total/Ave		2,394,570	401,261	6.0	7.8	199	0.30	1.24	

** Due to the heavy snow pack and inability to clear the road, the Lolo group was released at Red House on the South Fork Clearwater River.

Source: DNFH Final Release Summary

Table 4. DNFH Fish Release by Mark Type, BY18 SST

Release Site	Actual Releases by Mark Type							PIT Tags Released				
	Dates	Number	Size (FPP)	Adipose Fin Clip		No Clip		Number	Tags Purchased			
				No CWT	CWT	CWT	No CWT		CSS	LSRCP	USFWS	NPT
DNFH	4/8-4/9/2019	1,335,335	5.8	1,216,158	119,177	-	-	17,050	6,000	-	-	-
Clear Creek	4/1-4/3/2019	421,177	5.6	401,233	19,944	-	-	6,866	2,400	-	-	-
SF CLWR, Red House	4/1-4/8/2019	638,058	6.5	352,054	39,145	-	246,859	8,735	3,000	-	-	-
Lolo Creek	246,859 (3368 PIT tags) destined for Lolo Creek outplanted into SF CLWR, Red House due to winter road conditions at release site.											
		2,394,570	6.0	1,969,445	178,266	-	246,859	32,651	11,400	-	-	-

Source: 2019 CLWR End of Season Tables

Summer Steelhead Brood Year 2019

Adult Collection and Holding

Adult SST for BY19 were collected during fall 2018 and winter/spring 2019. The ladder opened on October 17th-20th, November 14th-17th and December 8th-10th 2018 for collection of early returning SST to hold for spawning. Fall 2018 collection target was to pond 150 fish in October, another 150 fish in November, and 100 fish in December. Total early SST trapped was 729 (including recaptures and jacks) and staff ponded---- 425 adults to the adult holding ponds (HP). Fish in excess of the early return collection targets were out-planted to the mainstem Clearwater River via the Hocus Boat Launch.

The ladder opened for winter and spring returning SST on January 29, 2019 and remained open discontinuously throughout the winter/spring to limit the number of SST entering the hatchery. The trap closed for the final time on April 4, 2019. During the winter/spring intermittent ladder operation (excluding the 729 “early” trapped fish from October-December), a total of 410 adult males, 1376 adult females and 69 one ocean SST entered the hatchery (FINS Trapping Query).

Table 5. Trapping and Out-planting Numbers for BY 2018 SST.

Ocean Age Class	Dworshak NFH BY 2018 Rack Return		SF returns angler trapped		Killed for CWT		Dworshak NFH Holding Mortality	SF Brood holding mortality	Dworshak NFH Adults Outplanted
	males	females	males	females	males	females	total	total	total
I - Salt	929				58	0	32		333
II - Salt	720	1,502	122	128	3	31	172		470
III - Salt									
Total	3,151		250		92		204		803

1 Ladder operated intermittently

Source: FINS database, DNFH Spawning Activity Report take 10, IFWCO Rack Return worksheet, DNFH Mort Log

Note: Rack return total does not include recaptures.

Spawning Summary

There were 1,268 SST spawned at Dworshak and incubated to meet DNFH, Clearwater Fish Hatchery (CFH), and Magic Valley Hatchery (MVH) production this season: 481 males and 787 females. Of the 787 total females spawned, 457 were for DNFH production, 155 for CFH South Fork production, and 175 were for MVH production

To meet brood needs for the BY19 SST season, DNFH completed ten egg-takes. Take 1 was January 15, 2019, and Take 10 on April 9, 2019. A total of 461 females, 332 males spawned to fill DNFH egg needs. Additionally, 175 females and 57 adult male DNFH stock spawned to meet the brood needs for MVH. Eggs for CFH’s program came from a combination of angler caught, SFLB from the South Fork Clearwater River, and 24 spawned DNFH stock males. There were 155 females and 68 adult male South Fork SST spawned at DNFH to fill the CFH program needs. Average fecundity for females eggs eyed and enumerated for DNFH production needs was 7,040 eggs per female. Early-returning adults (October-December) spawned at Takes 1 and 2, and later returning adults (January-April) spawned during Takes 3-10. DNFH incorporated 2,557,575 eyed-eggs into the program. For CFH’s program, DNFH incubated an estimated 1,178,727 green eggs. MVH had an estimated 1,189,300 green eggs spawned at DNFH (FINS). CFH personnel transported the green eggs to their facility for incubation until final shipment to MVH.

In an effort to reverse the trend of smaller brood fish returning to the Clearwater Drainage each year, the USFWS, NPT and IDFG decided males greater than or equal to 85cm in length spawned should have their milt used to fertilize 3-5 females, instead of administering the usual 1:1 spawning ratio. These males were noted with an “XL” on the milt cup and spawning sheet. Males between 82 and 85 cm milt were used up to three times if XL males were not available

and would be noted with an “L” on the cup and spawning sheet. Male SST ranging from 72 cm and 82 cm will be designated small males and were only used once. A portion of these males are 1-ocean and this nearly eliminated the probability that a 1-ocean fish was used multiple times while allowing a small proportion (< 5%) of 1-ocean jacks in the broodstock. Male SST 72 cm or less were not included in the broodstock. During the BY19 spawning period, there were 239 XL males spawned for DNFH, CFH, and MVH production.

Magic Valley SFH

The initial egg request from MVH was 21 females. This number increased to 175 females after basin-wide coordination due to poor adult returns to the Pahsimeroi Fish Hatchery. During Take 9, DNFH spawned all 175 females for MVH. CFH staff placed green eggs into egg tubes and transported eggs to CFH the same day spawning took place.

GNRH Males

It is typical to inject early returning male SST with salmon gonadotropin-releasing hormone analogue (sGnRHa) to aid in male gamete maturation. Dworshak partnered with Syndel to test the efficacy of a new sGnRHa drug, OvaNext, on the maturation of male SST. OvaNext is sGnRHa mixed into a liquid-gel formulation, so it is injectable. It is mixed at 100ug/mL, and is available in 20mL bottles. The dose can be tailored for the size of the fish.

Historically, Dworshak has used Ovaplant, which is sGnRHa in a cholesterol pellet, and must be implanted. Syndel has 150ug and 250ug (sGnRHa) pellets. Thus, the dose is not tailorable for the size of the fish.

Both are slow release, and have very similar diffusion kinetics out of their respective media (gel for Ovanext, cholesterol pellet for Ovaplant), at least in vitro. This goal of the project was to determine if the diffusion kinetics are similar in vivo. This was the first trial on live fish.

Dworshak typically injects a portion of its early returning males with Ovaplant to aid in gamete maturation. In the past, we have injected 80 males with Ovaplant and have held 10 additional males as controls. For this study, DNFH targeted a total of 80 males for injections; 40 using Ovaplant and 40 using Ovanext. Final injected numbers for each product was 34 male SST were injected with Ovaplant, 35 males with OvaNext, and held 10 as controls. Males injected with OvaNext were marked with a clear zip-tie; Ovaplant fish were marked with a black zip-tie; control fish were marked with an orange zip-tie. Production staff transferred tagged fish from HP1 into HP2 post-injection. Injections occurred on Dec. 31, 2018. All tagged carcasses from injected males were disposed of in the landfill.

Surplus Eggs

DNFH staff enumerated eyed-eggs for each egg take in BY19. Take 3 & 7 were the only egg takes that did not yield surplus eyed-eggs after meeting goal for DNFH production. In past years, surplus eyed-eggs were planted into the spawning gravel along the North Fork and mainstem Clearwater Rivers. This year we utilized our ability to use chilled and secondary water to slow down fry development to incorporate surplus eggs from earlier takes into later egg takes and provide eggs to CWH. This also allowed us to decrease our broodstock needs, putting more adults back into the river.

Surplus eggs from Takes 4 & 5 were held on secondary water and added into take 7 cutting our female need by 50% for that egg take. Surplus eggs from Takes 8 & 9 were held on secondary water and incorporated into Take 10, and the surplus eggs from take 10 were transferred to CWH as eyed eggs.

Adult Disposition

There were 1,028 hatchery adults returned to the river from DNFH in BY19. Fish traveled by truck to Hocus boat launch in Ahsahka, ID on the mainstem of the Clearwater River for out-planting. IDFG and Dworshak Education and Outreach took carcasses (n=359) for the Hatchery in the classroom program. All remaining carcasses went to either the landfill (n=115), or the Kamiah, Idaho based Emergency Feeding Outreach Food Bank (EFO) (n=915). EFO volunteers processed and distributed donated fish to people in the community.

Table 6: SST spawned at DNFH during the BY19 SST season. Includes kelt spawning.

Take	Spawn date 2019	DNFH Males Total	DNFH Jacks	DNFH Fmls	DNFH BroodCW H Males	DNFH BroodCW H Jacks	DNFH BroodCW H Fmls	*S.F. CWH Males	*S.F. CWH Jacks	*S.F. CWH fmls	MVH Males	MVH Jacks	MVH Fmls
1E	15-Jan	51		95									
2E	22-Jan	16		16									
3	5-Feb	45		53									
4	19-Feb	40		53									
5	26-Feb	43		54				3		3			
6	5-Mar							9		9			
7	12-Mar	21		28				10		20			
8	19-Mar	36		53				13		38			
9	26-Mar	41		59	24			33		85	57		175
10	9-Apr	39		50									
Total		332	0	461	24	0	0	68	0	155	57	0	175
E= Early returning adults (Fall 2018).													
* South Fork (S.F.) Clearwater River Localized Broodstock are not included in Dworshak rack return. Fish collected by anglers and put on IDFG trucks on S.F.													
Source: FINS database													

Table 7. Egg disposition of BY 2019 SST spawned at DNFH.

Egg Take	Spawn Date 2019	Total Females Spawned	Actual Enum. Fecundity Per Female	Actual Green Eggs/Take	Number Females Actually Enum.	Total Eyed Eggs Enum.	Green Eggs to Eyed Egg Percentage	Total Eyed For DWOR Production	Number Fry Per Take After Marking Trailer	Survival Eyed Egg To Marking Trailer %
1	15-Jan	95	6,772	643,296	82	512,554	79.7%	512,554	544,788	92%
2	22-Jan	15	6,693	100,390	13	82,008	81.7%	76,692		
3	5-Feb	53	7,513	398,188	47	264,713	66.5%	264,713	239,295	90%
4 ¹	19-Feb	53	7,326	388,301	53	364,288	93.8%	285,993	252,100	88%
5 ²	26-Feb	54	7,349	396,833	52	333,310	84.0%	293,915	253,818	86%
7	12-Mar	28	7,508	210,227	28	169,655	80.7%	287,309	238,509	83%
8 ³	19-Mar	53	7,236	383,508	52	336,673	87.8%	281,223	228,981	81%
9 ⁴	26-Mar	59	7,041	415,434	51	308,979	74.4%	293,545	246,290	84%
10 ⁵	9-Apr	50	6,991	349,549	43	262,990	75.2%	351,219	288,957	82%
Total		460		3,285,725	421	2,635,170		2,647,163	2,292,738	
	Takes 1 & 2 combined into one mega-Take when ponded into Nursery									
1	Take 4: 84K surplus eyed eggs held back on secondary water and incorporated into Take 7									
2	Take 5: 39K surplus eyed eggs held back on secondary water and incorporated into Take 7									
3	Take 8: 55,450 surplus eyed eggs held back on secondary water and incorporated into Take 10 Direct Release									
4	Take 9: 203,921 eyed eggs went into Take 9 RedHouse and 89, 624 eyed eggs into Take 10 Lolo									
5	Take 10: 55,468 eyed eggs went into Take 10 Direct Release and 150,677 went into Take 10 Lolo									

Research

IDFG:

DNFH collaborated with CFH again for BY19 to develop a localized broodstock for the South Fork (SF) Clearwater River. Personnel from CFH collected broodstock from the SF and transported them to DNFH HP3 where they resided until spawning. While we were able to collect the required number of SST for broodstock, adults did not ripen soon enough for DNFH to use. DNFH did not use any SF fish for the Red House release group. There were 155 females and 68 adult male SFLB SST spawned at DNFH to fill the CFH program needs. Personnel from CFH picked up eggs after eye-up and transported them to their facility for enumeration.

IDFG continued to collect fin clips for the genetic parentage-based tagging (PBT) database. All SST spawned at DNFH were sampled this year and all male:female crosses were tracked throughout rearing. Matt Campbell from the IDFG oversees and manages the PBT database.

Western Fisheries Research Center

Gael Kurath of the Western Fisheries Research Center and Andrew Wargo of the Virginia Institute of Marine Science requested 2500 eyed eggs to continue studies on IHNV transmission.

Early Rearing

All eggs were hatched in incubation trays and moved into nursery tanks as swim-up fry at approximately 16,000 - 18,000 fry/tank. All fry were loaded at final rearing numbers in the nursery with the exception of Take 10 Lolo. BY19 Take 10 Lolo was reared for an extended

period in the Nursery in an effort to maximize growth. To avoid exceeding the recommended density indices this take was split from 13 tanks to 26 tanks.

Fingerlings from the nursery generally average 100 fpp when they are moved from the nursery to the System I BPs supplied with reservoir water. The fingerlings are pumped (via 2.5 inch pump) directly to a marking trailer operated by the USFWS Columbia River Fisheries Program Office (CRFPO). Adipose (AD) fins are clipped on all but ~240,000 fingerlings under the U.S. vs. Oregon Agreement. This reservoir water supplied to the Nursery and the System I BPs (System I: reservoir water available on a seasonal basis) is shared with IDFG's CFH with close coordination between the facilities.

BY 19 takes 1 & 2 were moved out of the nursery prior to marking to allow the youngest takes to be moved into the Nursery to gain additional rearing days to maximize the opportunity for these fish to reach the target release size. Fish are ponded at approximately 150,000 fish per Burrows pond in System I. This allowed for cleaning and disinfection of tanks so that Take 10 could be ponded and reared into the same bank of tanks Take 1 previously occupied. Ponding Take 1 prior to marking allowed take 10 into the nursery ten days earlier than the previous year. Takes 3-10 Direct Release were moved through the marking trailer and ponded into System I as usual. Once the fish in System I reach ~60 fpp, they are split into systems II and III BPs which are supplied with pumped North Fork Clearwater River water. Rearing the fish to the 60 fpp size allows for greater immune system development to reduce the risk of mortality associated with IHNV present in the river water supply. All BPs are loaded at a final rearing density of 35,000-45,000 fish per pond. This number varies with release site, egg take, parental based tagging (PBT) and other hatchery logistics.

Fish in two nursery tanks were treated for Bacterial Gill Disease with Chloramine T. Fish Health recommended this course of treatment based bacteria seen during the initial exam. Samples were sent to WADDL for bacteriology, which came back positive for Cold Water Disease. A Veterinary Feed Directive was written for Aquaflor and fish were treated for 10 days. Mortality from this disease event was 3,740 fish.

Fish in 10 System 1 BP's were initially diagnosed with Bacterial Gill Disease based on bacteria seen during the initial examination. The fish in these BP's were treated with Chloramine T per fish health recommendation. Samples were sent to WADDL for bacteriology, which came back positive for Cold Water Disease. A Veterinary Feed Directive was written for Aquaflor and fish were treated for 10 days. Mortality from this disease event was 15,152 fish. This disease event occurred when Sys 1 was operating with 100% Reservoir water.

SST in the nursery were fed Bio Vita then switched to Bio-Pro feed once in the BPs. The Bio-Pro feed is specially formulated to provide the smolts with increased resistance to stress events such as converting the smolts from the reservoir water supply to the pumped river water supply. That change is their first exposure to IHNV and other potential diseases. SST in the Burrow's ponds were hand fed until 40 fpp, at which time they were switched to demand feeders and finished on Classic steelhead Diet from Nelsons and Sons (Skretting).

Table 8. Illustrates the SST in BP production as they are moved out of the nursery.

BY 19 SST	Fish on Feed End of Month (systems only)				Gain this FY	this Mo	Fish Feed Fed				FY Feed	Mo Feed	Ave Temp	Incr inch	Den	Flow	Comments
	EOM	Number	Wt lbs	FPP			in	Wt	Wt	LBS FY							
May-19	400,000	4,000	100	3.1													
Jun-19	1,287,651	18,650	69	3.4	6,904	6,904	6,455	11,672	6,455	11,672	0.93	0.93	52	0.79	0.21	0.90	Fish being moved out from nursery. Numbers may be adjusted for tagging trailer inventory
Jul-19	2,002,682	42,743	47	3.9	18,657	11,753	16,482	29,889	10,027	18,217	0.88	0.85	45	0.86	0.09	0.90	
Aug-19	1,985,203	68,119	29	4.7	40,725	22,068	35,720	65,238	19,238	35,349	0.88	0.87	48.2	0.65	0.11	0.64	
Sep-19	2,179,201	97,727	22	5.0	67,373	26,648	65,003	117,118	29,283	51,880	0.96	1.10	49.1	0.55	0.12	0.68	

source: DNFH- Monthly Inventory Summary

Projected Release

Table 9. SST on station at the end of FY 2019 and projected release numbers.

As of October 1, 2019					Projected Final Release April 2020		
Stock	Number	Weight (lbs)	fpp	L mm	Proj % Loss to Release	Projected Release Number	Proj Size at Release mm
Dworshak	2,176,147	143,972	15	153	0.5	2,165,266	200

The BY 19 juvenile mortality rate remained below average through fall and into early winter. Early detection and treatment of parasites and no IHNV incidence resulted in healthy fish and a higher than average survival rate. The current projected release of 2,165,266 will be on target for the stated release goal of 2.1 million smolts.

Spring Chinook Salmon Brood Year 2017

Raceway Rearing

At the start of Fiscal Year 2019, there were 1,725,317 BY17 SCS on station at DNFH.

Early rearing went according to plans and the fish were ponded by into raceways utilizing low head oxygenators (LHO’s) and shade cloth. Both A-bank and B-bank destined fish were from Dworshak and Rapid River origin fish with a low BKD Eliza value. The fish had no health problems and grew ahead of schedule and actually had to be slowed down in some raceways for marking. The eyed egg to juvenile marking percent survival for this group was 98%; much higher than the five year average of 93.2%. As a result, at marking DNFH had a significant

surplus. Some of this surplus was released with the Selway parr, the rest was absorbed into the program. All raceways were cleaned 3 times/week.

Coded wire tag and adipose fin clip marking occurred from September 4-20, 2018. All fish were AD clipped approximately 120k were CWT; half in A bank and half in B bank. Fish performed to expectations with few exceptions and mortality remained low. Three raceways (split from the same origin raceway) were diagnosed with IHNV but the moderate low levels of mortality quickly dropped to normal levels. Some of the fish in this raceway exhibited the bloated look of BKD but bacteriology was negative. The serial reuse valves were closed to B-bank in these three raceways to prevent potential disease transmission. DNFH also had a planned power outage during this time period where the 36" valve failed necessitating a low flow scenario for all SCS. We utilized the LHO's to maintain excellent oxygen levels during the outage. In December, DNFH switched to 5 days/week feeding and 10 or more ponds were cleaned daily.

January PIT tagging was delayed due to a government shutdown. PIT tagging occurred from January 28 - 31, 2019. Per standard tagging procedures, the fish were not fed during the tagging operation and therefore raceway cleaning was also suspended during this time period. Mortality started increasing in early- to mid-February in a mix of A-bank and B-bank, in both the PIT tagged and non-PIT tagged raceways. The IHNV raceways were not part of the BKD event and demonstrated some of the lowest mortalities of all raceways. Cleaning continued at a rate of 10 or more raceways daily and feeding continued at the 5 day/week schedule. Flows were increased in sick ponds where possible. February also saw frozen degassers at the main aeration, increased river flows and debris in the LHO's as well as more predator activity in the raceway area..

Due to excellent health and low mortality throughout the rearing cycle, density indices were at the maximum allowable densities at the time of smolt release. Survival from marking to smolt was 99.3% compared with the 5 year average of 98.7. By the end of March, BKD had been diagnosed and mortality had elevated in every raceway in B-bank as well as 5 raceways in A-bank. Due to the late timing of the illness, we were unable to treat these fish as manufacturing, feeding and withdrawal periods would have pushed releases well beyond target dates.

Monthly summaries of rearing data for BY17 SCS for FY19 are in Table 10.

Table 10. BY17 SCS, May 2018 through March 2019.

BY 17 SCS	Fish on Feed EOM				Gain this FY	Gain this Mo	Fish Feed Fed				FY Feed	Mo Feed	Ave Temp	Lgth Incr inch	Den	Flow	Comments
	EOM	Number	Wt lbs	FPP			Lgth in	Wt	Wt	LBS FY							
Apr-18	2,629,530	2,183	1,205	1.4	430	430	25	50	25	50	0.06	0.06	42.9	0.10	0.20	0.22	Ponded end-April
May-18	2,619,889	4,737	553	1.8	2,984	2,554	1,461	2,907	1,436	2,858	0.49	0.56	43.9	0.40	0.16	0.37	
Jun-18	2,607,813	10,688	244	2.1	8,935	5,951	4,748	9,449	3,287	6,541	0.53	0.55	44.4	0.60	0.26	0.56	
Jul-18	2,601,139	18,135	143	2.5	16,382	7,447	9,988	19,876	5,240	10,428	0.61	0.70	44.8	0.50	0.24	0.65	LHOs Increased from 1.0 to 1.5 due to TDG
Aug-18	2,593,807	27,295	95	2.9	25,542	9,160	16,083	32,005	6,095	12,129	0.63	0.67	44.8	0.40	0.31	0.75	NPTH On-Site shipped out 8/13
Sep-18	1,731,162	22,457	77	3.5	20,704	4,838	18,644	34,566	2,561	2,561	0.90	0.70	48	0.20	0.13	0.43	Marking 9/6-9/20, Selway Parr Shipped out by 9/19, SCS at final densities
Oct-18	1,729,197	33,156	52	3.9	31,403	10,699	27,998	52,170	9,354	17,604	0.89	0.87	49	0.50	0.16	0.40	A8, 9, 10 diagnosed IHN, Began Bio Olympic 1.5mm feed
Nov-18	1,726,890	48,301	36	4.3	46,548	15,145	40,848	71,626	12,850	19,455	0.88	0.85	48	0.50	0.20	0.58	
Dec-18	1,725,317	58,628	29.4	4.5	56,875	10,327	52,139	87,885	11,291	16,259	0.92	1.09	45	0.30	0.23	0.65	
Jan-19	1,724,382	64,276	26.8	4.8	62,523	5,648	61,169	100,888	9,030	13,003	0.98	1.59	42	0.20	0.24	0.70	Pit Tagged 1/28-1/31
Feb-19	1,723,363	70,627	24.4	5.1	68,874	6,351	68,331	111,201	7,162	10,313	0.99	1.12	40	0.20	0.26	0.93	817 diagnosed BKD, Flows increased
Mar-19	1,721,499	84,319	20.4	5.3	82,566	13,692	78,357	128,346	10,026	17,144	0.95	0.73	40	0.30	0.29	1.03	B Bank released 3/27. A Bank released 3/28

Source: DNFH- Monthly Inventory Summary, May 2018 – March 2019
Final Release Summary, BY17 SCS

Release

Release goals for BY17 SCS from DNFH were as follows: 1,650,000 smolts on-site, 300,000 Selway parr program, 200,000 parr transfer to NPTH on-site, and 180,000 parr transfer for Lolo releases.

BY17 SCS releases occurred on March 28 and 29, 2019 and DNFH staff used fish pumps and piping to release these fish into the release channels and into the Northfork of the Clearwater River.

Disposition of DNFH BY17 SCS smolts was 1,716,951 released on-site at 20.4 fpp. In September, 2018, 422,561 parr were transported by the Nez Perce Tribe and released in the Selway River at

83 fpp and 218,462 parr transported to NPTH at 137 fpp, and 205,829 parr for the NPTHC-Lolo transfers at 100 fpp.

Spring Chinook Salmon Brood Year 2018

Adult Collection and Holding

The DNFH fish ladder was opened June 15, 2018 to September 22, 2018 for collection of BY18 SCS for spawning. This year the DNFH ladder was utilized to collect adults for DNFH production, CFH production and Nez Perce Tribal Hatchery Complex (NPTHC) production.

Ladder collection was managed on a weekly basis, coordinated through the weekly Snake River Basin Coordination call every Tuesday, which had representatives of each of the state, federal and tribal management offices and/or basin hatcheries. To ensure representative distribution of fish to all parties, a Monday meeting was initiated which determined the ratio of fish to be distributed among hatcheries. KNFH collected more than the projected number of adults this year, filling their designated holding pond at DNFH, as well as at CFH. Adult SCS from KNFH also helped to supplement NPTHC. Due to low returns to the Dworshak trap, the eggs from 176 pairs of surplus adult fish were collected at Little White Salmon National Fish Hatchery (USFWS – Cook, Washington) to meet DNFH production needs.

Table 11. Ladder operation for BY18 SCS trapped at DNFH.

Ladder Opened 2018	Ladder Closed	Date of SCS Inventory	Number of Fish Trapped
15-Jun	22-Sep	16-Jun	354
		30-Jun	143
		14-Aug	124
		21-Aug	124
		28-Aug	98
		4-Sep	41
		11-Sep	41
		18-Sep	16
		25-Sep	8
Trap clean out			
Trap morts			65
Total			949

Source: DNFH – Ladder Operations Record.xlsx
IFWCO – Fish Inventory System (FINS) Online

Spawning

All DNFH stock BY18 SCS eggs were incubated at Dworshak. All Kooskia program eggs were transferred to KNFH immediately after spawning as “green” eggs. All eggs from Little White Salmon NFH were spawned at Little White Salmon NFH and immediately transferred to DNFH as “green” eggs for incubation and incorporated into the DNFH production program.

Eggs

The water temperature (non-chilled) in the Heath stacks averaged 45.2°F. These stacks contained eggs from Takes 1-7 of both Dworshak and Takes 1 and 2 of Little White Salmon stock SCS. Each take was started on secondary reservoir water (non-chilled) and progressively switched to chilled water at increasing intervals to match up temperature units across all takes. Dworshak eggs went on chilled water starting on August 22 for Take 1, August 31 for Take 2, September 12 for Take 3, September 23 for Take 4, October 4 for Take 5, October 18 for take 6, and October 24 for Take 7. Little White Salmon Take 1 went onto chilled water beginning on September 4, and September 14 for Take 2. Temperatures averaged 37.0°F with the chiller system operating normally. Take 7 had an unusually high number of females (18 out of 20) exceed the 0.249 ELISA limit and were culled. Additionally, another tray was culled due to no egg survival leaving only a single viable female from Take 7. To make up for the lost production 50,044 eyed eggs from 16 SCS pairs were transferred to DNFH from KNFH on December 13, 2018.

Upon eye-up, the Dworshak eggs were shocked and enumerated using an electronic egg picker and counter (Van Gaalen Model–100). Table 2 summarizes the egg Take numbers and survival for DNFH BY18 SCS program eggs. DNFH trapped adults had a total enumerated eye-up which averaged 95.1% survival for the season and the female fecundity averaged 3,843 eggs per female.

Table 12. DNFH BY18 SCS Egg Take and Survival.

Take	Stock	Spawn Date 2018	# of Males	# of Females	Females culled BKD	Trays Culled Dead	Eggs Removed Surplus/Research	Eyed Eggs Enumerated	Total Eggs Enumerated	Eggs/Female
1	DWOR	14-Aug	20	20	0	2	0	72,379	79,253	4,403
2	DWOR	21-Aug	49	57	1	0	0	208,193	224,550	4,010
1	LWS	23-Aug	-	90	0	0	0	326,603	358,187	3,980
3	DWOR	28-Aug	70	90	1	0	0	360,725	372,939	4,190
2	LWS	30-Aug	-	86	0	0	0	320,940	334,557	3,890
4	DWOR	4-Sep	63	76	1	0	0	269,399	287,519	3,834
4	Kooskia	11-Sep	-	16	0	0	0	50,044	-	-
5	DWOR	11-Sep	154	180	4	0	0	624,522	645,046	3,665
6	DWOR	18-Sep	59	96	6	0	0	303,517	311,809	3,465
7	DWOR	25-Sep	1	20	18	1	0	3,371	3,396	3,396
Total/Ave			416	731	31	3	0	2,539,693	2,617,256	3,843

1 BKD culling above 0.249 ELISA testing for all takes.

Source: DNFH M:\Production\SCS\BY2018SCS\2 Eggs\ Enumeration | EggEnumeration and shipment BY18SCS

The 2,539,693 DNFH program SCS eyed eggs were kept in incubators at the hatchery for incubation over the winter. These eggs will be used for DNFH production, the Selway Parr Program, and NPTHC programs.

Early Rearing

The target release numbers for BY18 DNFH stock SCS are 1.650 million smolts (1.05 M are U.S. v. Oregon) direct released to the North Fork Clearwater River, 300,000 parr to the Selway River (All 300K are U.S. v. Oregon), and 380,000 parr transferred to NPTH (200K of these are U.S. v. Oregon).

Table 13. Raceway production, BY18 SCS, FY19.

BY 18 SCS	Fish on Feed End of Month				Gain this	Gain this	Fish Feed Fed				Mo Feed	AVG	Lgth Incr	Density	Flow	Comments
	EOM	Number	Wt. lbs	FPP	Lgth in	WT	WT	Lbs FY	Cost FY	LBS Mo	Cost Mo	Conv	for Mo	30 day	Index	
May-19	2,460,659	3,439	715.6	1.7	2,448	2,448	757	\$1,491.98	757	\$1,491.98	0.31	41.5	0.6	0.17	0.3	Ponded May 1st - 6th
Jun-19	2,445,783	7,760	315.2	2.20	6,769	4,321	2915	\$5,742.85	2,158	\$4,250.87	0.5	42.2	0.5	0.19	0.3	Raceways extended 6/24
Jul-19	2,414,111	12,119	199.2	2.6	11,128	4,359	6,644	\$13,088.98	3,729	\$7,346.13	0.86	43	0.4	0.24	0.42	Raceways 4 and 5 to full length 7/19/2019
Aug-19	2,386,005	23,769	100.5	3.2	22,777	11,649	15,004	\$29,337.31	8,360	\$16,248.33	0.72	45.2	0.6	0.23	0.65	Remaining raceways extended full length. NPTH on-site group
Sep-19	1,642,834	20,087	81.8	3.4	25,917	3,140	20,196	\$34,824.41	5,192	\$5,487.10	1.65	48.2	0.2	0.12	0.20	Marking Trailer Operations 9/4-9/19/2019. Lolo group transferred 9/9/19. Selway group transferred 9/9/19 and 9/11/19

September numbers reflect inventory from marking crew minus observed mortality.

Source: DNFH- Monthly Inventory Summary, May 2019 – September 2019

Monthly Activity Reports, May 2019 – September 2019

BY18 SCS were ponded into 20 raceways in A and B-banks between May 1st and 6th, 2019. The Low Head Oxygenators (LHOs) were utilized immediately to allow for the addition of oxygen into the raceways which facilitated the ability to maintain oxygen levels at saturation and also drive off the supersaturated nitrogen in the water. The LHOs are equipped with oxygen flow meters that manually allow for the amount of oxygen (in L/min) to be adjusted to meet the oxygen requirements based on the biomass in the raceways and to mitigate TDG levels in the hatchery’s water supply. Some minor changes were made to this year’s SCS production. Most notably the fish were initially ponded in the upper 1/3 of the raceway then a raceway screen was removed allowing the rearing space in the raceway to be extended down to 2/3 of the total raceway length and the final screen is removed providing the entire length of the raceways as the density index neared 0.20. Each one of these rearing scenarios utilized only 1 tail screen. The production staff were quite pleased with the changes as this ponding strategy reduced labor (fewer screens to clean) and allowed the initial 20 raceways to be cleaned Monday-Friday (i.e. 5 days per week) from initial ponding to marking.

A fungal outbreak of *Phoma herbarum* was confirmed by Washington Animal Disease Diagnostic Laboratory (WADDL) in BY18 SCS raceways. This is the second year that we have seen a Phoma outbreak in the SCS (1st outbreak in 2016 in the BY 2015 SCS). Raceways 4, 5, 11,

and 12 were diagnosed with Phoma but mortality was above average in most of the raceways during the period of the outbreak, which peaked from June-August, 2019. Cumulative mortality in the raceways from June-August was 72,890 fish (3% mortality rate associated with *Phoma herbarum*).

Fish marking began on September 6th with the USFWS fish marking trailer and crew from the CRFPO. Adipose (AD) fin clipping and coded wire tagging (CWT) of the BY 18 SCS ran until September 19, 2019. There were 133,988 tagged to represent the BY 18 SCS for contribution monitoring and evaluation for the returning adults. CRFPO personnel also inventoried and clipped AD fins on all BY18 SCS and split fish into all 30 raceways. During this time NPTH Lolo Parr was also AD clipped. NPT marking trailer staff did not mark or tag any of their NPTH parr prior to transferring this group of this from DNFH to NPTH on August 14, 2019. After these fish were transferred, the NPT clipped/marked these fish which are grown to full term smolts and will be released on site at the NPTH in the spring of 2020.

Projected Release

By the end of FY 2019, there were 1,642,834 BY18 SCS at DNFH. Table 4 illustrates the size and number of BY18 SCS on station at the end of the fiscal year and projected release numbers.

Table 14. BY18 SCS at the end of the FY and projected release from DNFH, March 2020.

As of October 1, 2019					Projected Release - March 2020		
Release Group	Number	Weight (lbs)	FPP	L mm	Proj % loss to release	Projected release number	Projected size at release mm
DWOR On site	1,642,834	20,087	81.8	84	1%	1,626,406	140
Selway	316,801	3,460	91.6	84	Released into Selway 9/9 and 9/11 2019		
NPTH On site	207,013	1,362	152.0	71	Shipped to NPTH on 8/14/19		
NPTH Lolo	194,072	2,168	89.5	85	Shipped to NPTH on 9/9 2019		

Source: DNFH - Monthly Inventory Summary, Oct 2018

A total of 207,013 BY18 SCS parr, unmarked, averaging 152 fpp were shipped on August 14, 2019 for the NPTH on site release group. A total of 194,072 BY18 SCS parr were marked and shipped to NPTH on 9/9/19. There was a total of 316,801 BY18 SCS Parr released into the Selway River. These fish were released unmarked, averaged 91.6 fpp and were transported in two trips by Mike Key, NPT, on September 9th, and 11th, 2019.

Spring Chinook Salmon Brood Year 2019

Adult Collection and Holding

The DNFH fish ladder was open from May 30, 2019 to September 20, 2019 for collection of BY19 SCS for spawning. This year the DNFH ladder and trap were utilized to collect adults for Dworshak production and CFH production. Excess SCS adults were either killed for coded wire tag (CWT) recovery on the last spawn day on September 23rd or killed for the Emergency Food Outreach (Foodbank).

Ladder collection was managed on a weekly basis, coordinated through the weekly Snake River Basin Coordination call every Tuesday, which had representatives of each of the state, federal and tribal management offices and/or basin hatcheries. KNFH collected more than the projected number of adults this year, filling their designated holding pond at DNFH, as well as at CFH. Adult SCS from KNFH also helped to supplement CFH and DNFH production. Due to low returns to the NPTHC trap, and the maintenance at the Lyons Ferry SFH, NPTHC transferred 40 SCS to DNFH. This allowed SCS to be held and spawned at DNFH in aims to make brood and fill the NPTHC programs, in addition the NPTHC holding ponds to be opened earlier for Fall Chinook. In addition, surplus adult fish were collected and spawned at Rapid River Fish Hatchery to meet Dworshak production needs

Table 15. Ladder operation for BY19 SCS trapped at DNFH.

Ladder Opened 2019	Ladder Closed	Date of SCS Inventory	Number of Fish Trapped
30-May	20-Sep	25-Jun	581
		8-Jul	346
		22-Jul	372
		13-Aug	153
		20-Aug	59
		27-Aug	39
		3-Sep	61
		10-Sep	44
		17-Sep	26
		23-Sep	7
Trap morts			
Total			1,688

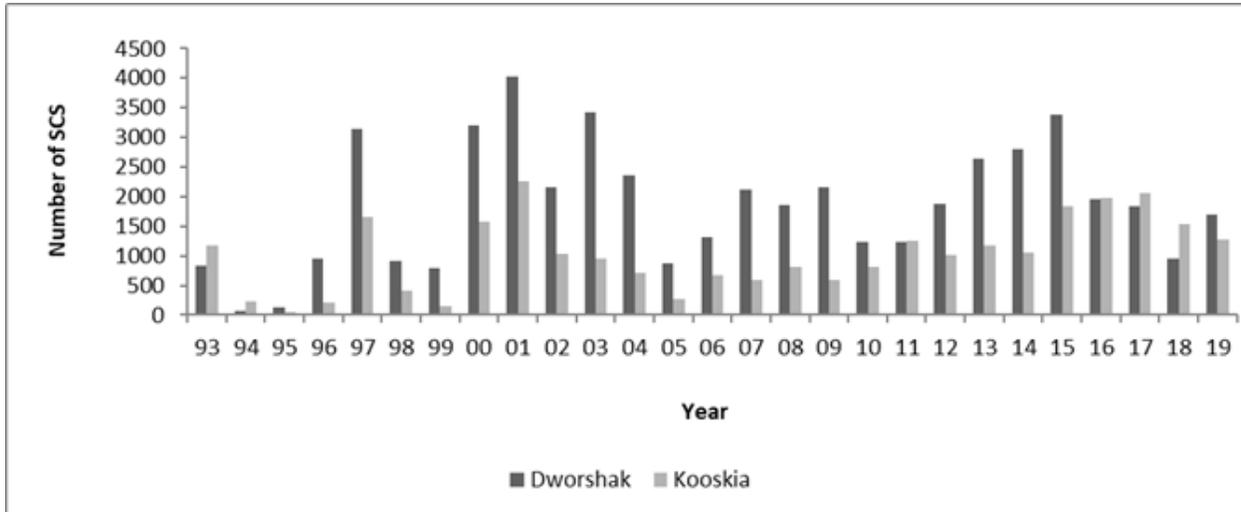
Source: DNFH – Ladder Operations Record.xlsx
IFWCO – Fish Inventory System (FINS) Online

Ladder operations for SCS at DNFH began in late-May and fish were first sorted from holding pond 9 (HP9) on June 25 to quantify and categorize ocean classes as well as attempt to identify male and female numbers. Adult SCS trapping operations began at the KNFH trap which was opened on May 17, 2019. The total SCS trapped at DNFH and KNFH in 2019 was 1688 and 1266 fish, respectively. This includes 441 one-ocean fish returning to Dworshak and 298 to Kooskia.

There were 801 adults transported from KNFH to Dworshak for spawning along with 17 unmarked adults which were passed over the weir at Kooskia. In addition, 154 adults from KNFH were transferred to the CFH to supplement the IDFG’s SCS adult collection shortfall. These adults rounded out the broodstock targets for the Clearwater Basin program.

The number of adult SCS collected at DNFH varies greatly over the past several years. Figure 1 displays the SCS returns to DNFH since 1993; 2019 was a low return year. There were sport fishing seasons and tribal harvest in 1997-1998, and 2000-2019.

Figure 1. SCS Adult Collections at DNFH/KNFH 1993-2019



Source: IFRO SCS Rack Returns 1993-2019

There were 5 Dworshak SCS adults and 7 Kooskia SCS adults which died before spawning began on August 13 (pre-spawning mortalities). All adults were treated with formalin three times per week to minimize mortality associated with fungus. Another 17 Dworshak adults and 32 Kooskia adults were lost to mortality during the spawning season.

Table 16. Mortality of adult BY19 SCS held at DNFH.

	Dworshak NFH		Kooskia NFH	
	Number	% Mortality	Number	% Mortality
Prespawning	5	0.44	7	0.87
During Spawning	17	1.5	32	3.99
	22	1.94	39	4.86

Source: DNFH - Spawning Activity Reports, BY19 SCS.

Tables 17 and 18 illustrate the adult mortality for both DNFH and KNFH stock SCS adults held at DNFH the last five years.

Table 17. Mortality of DNFH SCS returns 2015-2019.

Brood Year	Prespawning %	During Spawning %	Total %
2015	1	9.9	10.9
2016	1.6	1.8	3.4
2017	2.3	3.2	5.5
2018	1.3	2.5	3.9
2019	0.44	1.5	1.94
5-Year AVG	1.32	3.78	5.12

Source: DNFH - SCS Spawning Reports BY2015-19
DNFH - Final BY19 SCS Spawning Activity Report

Table 18. Mortality of adult SCS returns - KNFH stock transferred to DNFH BY2015–2019.

Brood Year	Prespawning %	During Spawning	Total
2015	2.3	12.1	14.4
2016	2.7	0.7	3.4
2017	0.6	1.4	2
2018	1.2	1.9	3.1
2019	0.87	3.99	4.86
	1.53	4.01	5.55

Source: DNFH - SCS Spawning Reports BY 2015–2019
DNFH - Final BY19 SCS Spawning Activity Report

Table 19. Illustrates BY19 SCS adult fish disposition from both DNFH stock held at DNFH.

Destination	Dworshak Stock	Comments
Transfer	40	NPTH M-22 F-18
Foodbank	650	M-484 F-19 J-147
Tribal Subsistence	254	Jacks
Landfill	0	
I&E	12	M-6 F-6
Nutrient Enhancement	795	M-139 F-633 J-23 Locations include Ahsahka Bridge, Lolo Creek, and South Fork Clearwater
Outplant Mainstream Clearwater R.	0	
Total	4,850	

Source: DNFH - SCS Spawning Reports BY 2019
DNFH - Final BY19 SCS Spawning Activity Report

Spawning

The BY19 SCS spawning season began August 13th and ended on September 23rd for Dworshak and Kooskia egg collection. Dworshak brood stock was held in HPs 1, 2 and 9 (new fish), and Kooskia origin fish were held in HP3. Fish from each HP were sorted and spawned once each week. In addition, during take 1, new fish from HP9 were also sorted and spawned. Adults held in HPs 1, 2 and 3 were treated with formalin three times per week to help control fungus.

In 2016, we started using CO2 as an anesthetic during sorting. This allowed us two benefits over Tricaine Methanesulfonate (MS-222) traditionally utilized for SCS spawns. First, we were able to return all ad-intact adults to the Main-stem Clearwater River without any holding period. Second, we were able to contribute fish to the local food bank, and for tribal subsistence. In previous years, as the season progresses and adults become weaker, we typically experience increased mortality when utilizing CO2 as an anesthetic. Following on the success of 2016, we've continued to use Aqui-S as an anesthetic starting with our first spawn on August 13th. Aqui-S has a three day holding period which gave us the benefit of holding spawned male adults for three days and then distributing to the Emergency Food Outreach. In addition, at the end of the spawning season, after a three day holding period, excess adults could be released. As a result, adult mortality remained low and a total of 477 males were provided to the food bank.

There were a total of 526 males (including 9 jacks) and 632 females (1:1.20 ratio) of DNFH stock spawned during the season. There were a total of 315 males and a total of 397 females (1:1.26 ratio) of Kooskia stock spawned yielding eggs for the DNFH, KNFH and CFH. In addition DNFH also spawned 9 females to fill CFH needs. This year's spawning resulted in 2,343,103 Dworshak

origin, 40,271 Kooskia stock, and 41,371 NPTHC origin and 536,500 Rapid River origin for Dworshak production.

Utilization of the Emergency Food Outreach to distribute fish for human consumption was done as much as possible, using CO₂ as an anesthetic during sorting. Beginning on the first spawn date, August 13th, Aqui-S was used as an anesthetic due to ease of handling the fish and reduced mortality associated with using Aqui-S over CO₂. Adults were crowded from the holding ponds into a crowding channel, moved into a channel basket, and placed into an anesthetic bath. Pro-Polyaqua was added to reduce stress and susceptibility to infection. Oxygen was provided at a rate of 1.5 L/minute.

Spinal columns of ripe females were severed using a pneumatic knife. Females were then assigned a number and placed on the rinsing table for approximately 3–10 minutes for blood drainage. A spawning knife was used to cut the ventral side open and eggs were collected in disinfected colanders. Once ovarian fluid was drained, the eggs were poured into a clean bucket labeled with the female number.

Ripe males were killed using either a fish-stunner (Seafood Innovations of Australia) or, when the fish-stunner was not working, clubbing. Milt from ripe males was stripped into labeled Styrofoam cups, and a one-percent saline solution was added to assist in milt motility. When possible, males were utilized at a 1:1 male-female ratio. Large adult males ≥ 85 centimeter were utilized up to three times in an attempt to address the gradual reduction in size and age of returning adults over time to the Clearwater River basin. The milt solution was poured onto the eggs and mixed for complete fertilization. After sufficient time had elapsed for fertilization to take place (a minimum of three minutes), the eggs were rinsed of sperm, blood, and other organic matter.

After rinsing eggs from each female, they were placed in individually labeled Heath incubation trays. Eggs in each tray were treated with a 100 mg/l iodophor solution for one hour to disinfect the eggs as a precaution against disease transmission. After one hour the trays were then pushed into the incubator stack with a water-flow rate of five gallons/minute.

Eggs

All Dworshak origin BY19 SCS eggs were incubated at DNFH. KNFH program eggs were transferred to KNFH after spawning as “green” eggs and incubated there.

The water temperature (non-chilled) in the Heath stacks averaged 44°F. These stacks contained eggs from Takes 1-7 of Dworshak and Takes 1 and 2 of Rapid River. Each take was started on secondary reservoir water (non-chilled) and progressively switched to chilled water at increasing intervals to match up temperature units across all takes. DNFH eggs went on chilled water starting on August 26 for Take 1, September 9 for Take 2, September 12 for Take 3, September 23 for Take 4, and September 30 for Take 5, October 10 for Take 6, and October 21 for Take 7. Rapid River Take 1 went onto chilled water beginning on September 12, and

September 19 for Take 2. Temperatures averaged 37.0°F with the chiller system operating normally.

Upon eye-up, the DNFH eggs were shocked and enumerated using an electronic egg picker and counter (Van Gaalen Model-100). Table 2 summarizes the egg Take numbers and survival for DNFH BY19 SCS program eggs. Dworshak trapped adults had a total enumerated eye-up rate, which averaged 93.9% survival for the season and the female fecundity, averaged 3,758 eggs per female.

On November 8, 2019, we experienced a Chiller break down. As a result we no longer had the capacity to keep all BY19 SCS takes on Chilled water. All of Takes 1 and 2 and 74,164 eggs from Take 3 were transported via egg tubes to NPTHC, where they will continue incubation, ponding, and release at NPTHC. The remaining 2,183,640 DNFH program SCS eyed eggs were kept in incubators at Dworshak for incubation over the winter. The Rapid River eggs will be distributed into the DNFH program and will be retained at Dworshak for Spring 2021 releases.

Projected water temperature will be approximately 37°F for November - March. Maintaining this lower temperature over the winter should allow the fry to begin feeding after BY18 SCS are released from the raceways. BY19 SCS fry will then be stocked into these raceways directly from the incubator trays using an Aqua Life fish pump. This pump was first utilized in 2015 at DNFH and greatly decreased ponding time and handling stress

Research

DNFH continued to coordinate with outside researchers. Matt Campbell from Idaho Department of Fish and Game (IDFG) is creating a parental-base database for hatcheries in the Snake River Basin. The development of this database requires the tracking of the male x female crosses using a fin-clip sample from each fish. This database serves as a tool providing a genetic mark of all of the fish produced at participating hatcheries and therefore facilitates tremendous opportunities for addressing management of these fisheries and enhances research opportunities as specific information gaps are identified.

Projected Release

The target number of SCS smolts for release from DNFH is 1,650,000. All BY19 SCS production smolts will be released from DNFH into the North Fork of the Clearwater River in the spring of 2021. A total of 300,000 SCS will be reared for the Selway River Parr Program for final rearing and release as smolts in 2020. All KNFH production smolts will be released from KNFH into Clear Creek, a tributary to the Middle Fork of the Clearwater River. Estimated release numbers for the BY19 SCS program at DNFH are summarized in Table 20.

Table 20. Projected Release Numbers for BY19 SCS, DNFH.

Final Rearing Location	Fish Stock	Number at Release/ Transfer	Release Site	Stage at Release/Transfer	Release Date
Dworshak	Dworshak	1,650,000	Dworshak	Smolt	3/31/2021
Kooskia	Kooskia	650,000	Kooskia	Smolt	3/23/2021
Upper Selway River	Dworshak	300,000	Selway	Parr	9/9/2020
NPTH	Dworshak	200,000	NPTH	Smolt	9/9/2020
NPTH	Dworshak	180,000	Lolo Creek	Smolt	9/9/2020
Total Smolts		3,060,000			

Lyon's Ferry SFH Production at Dworshak NFH

Summary

Lyons Ferry Hatchery (LFH), operated by Washington Department of Fish and Wildlife (WDFW), suffered a leak in their main water supply pipeline to the hatchery in December 2018. In order to fix the pipeline leak, all fish had to be transferred off station. Fish transfers at that time were not feasible and it was decided to do the pipeline fix when all the fish were at a smaller size. The stocks that had to be transferred off station were: Snake River fall Chinook salmon, Tucannon SCS, Touchet SCS, Wallowa steelhead, Tucannon steelhead, and Spokane stock RBT. The Touchet steelhead program and 6,000 high ELISA Tucannon SCS remained at LFH in the north side incubation room, which was supplied by a separate water supply at the hatchery. LFH reached out for help from other facilities in somewhat close proximity. DNFH, Irrigon Fish Hatchery (IFH), and the Tucannon Fish Hatchery (TFH) were the three hatcheries that could accommodate the needs of LFH without jeopardizing their programs in the months of May to August. The Snake River fall Chinook salmon, Tucannon SCS, and Touchet SCS were transferred to DNFH, the Wallowa steelhead and a portion of the RBT were transferred to IFH, while the Tucannon steelhead and the remainder of the RBT were transferred to TFH.

Fish Transfers

From May 21, 2019 to May 24, 2019, 933,301 fall and SCS were transferred to DNFH; 479,000 Snake River fall Chinook (166 fpp), 264,729 SCS (70 fpp), and 189,572 Tucannon SCS (70 fpp). A total of 10 BPs were utilized: five for the Snake River fall Chinook salmon (BP #65, 67, 69, 71, 73), three for the Touchet SCS (BP #72, 74, 76), and two for the Tucannon SCS (BP #78, 80).

Starting August 12th and finishing August 15th, WDFW staff transferred all fall Chinook salmon and SCS back to LFH. There were 469,867 Snake River fall Chinook salmon (90 fpp), 262,356 Touchet SCS (50 fpp), and 187,387 Tucannon SCS (50 fpp) hauled back to LFH. Proceeding all hauling, WDFW staff cleaned all 10 BP's as agreed upon prior to the initial fish hauling to DNFH.

Fish Health

Upon return, the Snake River fall Chinook salmon were treated with formalin for 3 days, pre-marking and tagging, to clear the fungus problem up.

Fish health was a major concern prior to the initial fish transfer to DNFH. All groups of fish that were transferred to DNFH were sampled and tested for bacteriology and virology. The Snake River fall Chinook salmon group did not show any physical signs or abnormal mortality but the pre-transfer sample came back with a light case of Bacterial Gill Disease (BGD). With approval from DNFH and WDFW, fish were transferred as scheduled and if needed could be treated with Chloramine-T at a later date at DNFH. The Snake River fall Chinook salmon exhibited abnormally high loss from being transferred and continued for the first two weeks being at

DNFH. The fish were treated with Chloramine-T, at 15 ppm for three days, starting June 7, 2019 and ending June 9, 2019. Mortality decreased, but still remained higher than normal for the remainder of the time at DNFH. The total loss due to mortality at DNFH for the Snake River fall Chinook salmon was 9,133.

The pre-transfer samples collected for the Touchet and Tucannon SCS came back free of virus and bacteria. The post transfer mortality remained adequate for most of their stay at DNFH. Burrows pond #80, which contained half of the Tucannon SCS, exhibited higher loss starting in July and were treated for BGD with Chloramine-T on July 30 – August 1 along with BP #78, since it was next to the infected pond. The treatment was at 15 ppm for 3 days. The Pacific Region Fish Health Program (PRFHP) fish health staff co-located at DNFH took samples post treatment and found that they were also positive for IHNV and BKD. These ponds were treated with eight bags (400 lbs.) of coarse water softener salt post Chloramine-T treatment and pre-transfer as a therapeutic treatment to keep stress at a minimum to try and reduce mortality. Once transferred back to LFH, they were isolated from all other stocks of fish and salt treatment continued for an additional two weeks. Mortality decreased after a week.

All stocks of Chinook salmon exhibited some signs of fungus in each pond. Both stocks of SCS exhibited more fungus than the fall Chinook salmon. Most of the mortality in these ponds, with the exception of the IHNV pond of Tucannon SCS, were attributed to fungus. The total loss for the Touchet SCS salmon was 2,373 and for the Tucannon SCS was 2,185. All stocks of fish were salted after being transferred back to LFH for one week, which cleared the fungus up except for the Snake River fall Chinook salmon.

A huge thank you is in order for Steve Rodgers, Mark Drobish, Jeremy Sommer, Adam Izbicki, and all of the DNFH staff for their help and for allowing LFH to utilize their facility in a time of crisis. Without their help and cooperation, the collective goal for the Snake River basin could have been negatively impacted.

FISH HEALTH

Fish Health: All Life Stages

The Pacific Region Fish Health Program (PRFHP) provides fish health services for the COE projects of SST production at DNFH. They also provide fish health services for SCS (LSRCP) and Coho (NPT). PRFHP works to maximize the health of aquatic animals not only at rearing and production facilities, but also to enhance our knowledge of the health of the ecosystems into which, and from which, aquatic species under our care are moved in order to prevent and minimize the spread of disease.

The PRFHP works to maximize the health of fish at DNFH in various ways. One way is by performing diagnostic exams as needed or as requested from production staff at each facility for the detection of viruses, bacteria, parasites, and other disease syndromes. Fish health is often alerted by production staff to determine a cause of mortality or rearing problem which could occur at any life stage of production. Additionally, monthly monitoring performed for general health assessment and incidence/prevalence of pathogens and disease syndromes such as Gas Bubble Disease. Pre-release or pre-transfer inspections are also performed 4-6 weeks before fish are released or transferred. Laboratory procedures used are as described in the American Fisheries Society – Fish Health Section Bluebook that contains standardized protocols for all USFWS Fish Health Centers nationally for detection methods of aquatic animal pathogens. Laboratory equipment and appropriate quality control/quality assurance procedures are also maintained. Beginning August 2019, the PRFHP contracted with the Washington Animal Disease Diagnostic Laboratory (WADDL) to perform laboratory assays previously performed by the fish health staff at Dworshak. This includes viral, bacterial, histological and some parasite assays that require more than general gross microscope examination.

Laboratory results are used by managers to eradicate, control, or minimize the impact of aquatic animal pathogens. The PRFHP provides treatment recommendations if needed. A PRFHP veterinarian is available to provide prescriptions or Veterinary Feed Directives (VFD.) Fish Health staff also provides suggestions for production methods, biosecurity habits, and development of HACCP based upon fish health concerns such as in the case of adverse environmental conditions, emerging pathogens, potential exposure to aquatic nuisance species (ANS) or nutritional problems.

PRFHP serves as the Investigational New Animal Drug (INAD) monitor for the DNFH and NPT programs for treatments under INADs as necessary. Any drugs or chemicals administered under an INAD are reported to the USFWS Aquatic Animal Drug Approval Partnership Program (AADAP) in Bozeman, MT.

According to FDA regulations, the ability to administer any medically important antibiotic used in feed or water for food animals has come under veterinary oversight as of January 1, 2017. For example, this means that florfenicol medicated feed treatments (Aquaflor) or other medicated feeds used to treat Bacterial Coldwater Disease (*Flavobacterium psychrophilum*) for SST juveniles are provided under a Veterinary Feed Directive. Food and Drug Administration (FDA) regulations and changes in guidelines regarding aquatic animal treatments and judicious use of drugs and chemicals are carefully adhered to and followed.

Broodstock Sampling

Broodyear 2018 Steelhead

A total of 80 males were injected with the salmon Gonadotropin Releasing Hormone analogue (sGnRHa) prior to spawning, using the implant form, under INAD. This was to insure that there were enough males that were ripe during the early spawns. Evaluation and assistance in reporting of the effectiveness of the hormone by milt volume and sperm motility as required by the Investigational New Animal Drug (INAD) was performed by PRFHP staff. Adult fish were also treated up to three times per week with formalin for fungus, under a veterinary extra-label prescription.

At spawning, a minimum of 150 ovarian fluid samples were collected individually (not pooled) and tested for viruses throughout the SST spawning run at DNFH by cell culture at a minimum of 30% of each spawning take. Additional samples were taken and tested as needed including 100% three fish pooled sampling of ovarian fluids for virus for eggs transferred to MVH as required by IDFG. Tissue samples of kidneys/spleens taken from males were also collected throughout the run for virus testing by cell culture. Overall, IHNV occurred at 27.8% rate in the BY 2018 SST adults with 41.7% (25/60) positive in kidney/spleens sampled and 30.6% (139/454) positive in ovarian fluids tested. Samples were negative for Infectious Pancreatic Necrosis Virus (IPNV), and Viral Hemorrhagic Septicemia Virus (VHSV). Sixty head wedges consisting of cranial tissue were collected from adults throughout spawning and assayed for *Myxobolus cerebralis* (Whirling Disease) by the pepsin/trypsin assay and confirmation by PCR. No samples were detected as positive for *Myxobolus cerebralis*. Up to sixty intestinal samples were collected throughout spawning and assayed by wet mount for the parasite *Ceratonova shasta* (previously called *Ceratomyxa shasta*). The Dworshak SST were found to be positive for *Ceratonova shasta* which is not uncommon in returning adults. A minimum of 60 kidney/spleens from virus sampling were also used for bacteriology testing including *Yersinia ruckeri* (Enteric Redmouth Disease) and *Aeromonas salmonicida* (Furunculosis) with no positive detections. Sixty individual kidney samples were collected to test for *Renibacterium salmoninarum* (Bacterial Kidney Disease) by the Enzyme-Linked Immunosorbent Assay (ELISA) test with no adults detected as positive by this test.

Broodyear 2019 Steelhead

A target of 80 males were injected with the salmon Gonadotropin Releasing Hormone analogue (sGnRH α) prior to spawning, using both the implant and liquid form, under INAD. This was to insure that there were enough males that were ripe during the early spawns. Evaluation and assistance in reporting of the effectiveness of the hormone by milt volume and sperm motility as required by the Investigational New Animal Drug (INAD) was performed by PRFHP staff. Adult fish were also treated up to three times per week with formalin for fungus, under a veterinary extra-label prescription.

At spawning, a minimum of 150 ovarian fluid samples were collected over the entire spawning run and tested for viruses by cell culture. This was the first year moving away from the minimum 30% individual (not pooled) testing each spawning take. Additional samples were taken and tested as needed including 100% three fish pooled sampling of ovarian fluids for virus for eggs transferred to MVH as required by IDFG. Tissue samples of kidneys/spleens taken from males were also collected throughout the run for virus testing by cell culture. Overall, IHNV occurred at 31.8% rate in the BY 2019 SST adults with 50.0% (30/60) positive in kidney/spleens sampled and 28.1% (85/302) positive in ovarian fluids tested. Samples were negative for Infectious Pancreatic Necrosis Virus (IPNV), and Viral Hemorrhagic Septicemia Virus (VHSV). Up to sixty intestinal samples were collected throughout spawning and assayed by wet mount for the parasite *Ceratonova shasta* (previously called *Ceratomyxa shasta*). The Dworshak SST were found to be positive for *Ceratonova shasta* which is not uncommon in returning adults. A minimum of 60 kidney/spleens from virus sampling were used for bacteriology testing including *Yersinia ruckeri* (Enteric Redmouth Disease), *Aeromonas salmonicida* (Furunculosis) by culture and *Renibacterium salmoninarum* (Bacterial Kidney Disease) by Direct Fluorescent Antibody Test (DFAT). There were no positive detections.

Broodyear 2017 Spring Chinook

Beginning in 2017, no antibiotic injections were administered to adult SCS at Dworshak. Injections were given in the past to help decrease the level of bacteria in the adults to promote survivability as well as to prevent vertical disease transmission of Bacterial Kidney Disease (BKD) to the eggs. However due to the majority of the adults and juveniles at DNFH testing at a low level of BKD for several years and due to the risk of developing antibiotic resistance over time, the injections were discontinued this year. ELISA based culling will continue and the adults will continue to be evaluated to determine if injections will need to be resumed in the future.

During spawning personnel from the PRFHP took ovarian fluid for viral inspection from both Dworshak and Kooskia stock females. They also took kidney/spleen samples from Dworshak and Kooskia males for viral inspection. Overall, 26.4% (56/212) of the adult Dworshak SCS sampled were positive for IHNV and 39.5% of adult Kooskia SCS sampled were positive for IHNV (see IFHC Broodstock Assessment report for additional data). Five pooled kidney/spleen samples (60) and three pooled ovarian fluid (150) samples were collected throughout the spawning season for virology testing. Results for Infectious Hematopoetic Necrosis Virus for Dworshak SCS included 8.3% (5/60) positive in kidney/spleens sampled and 33.6% (51/152)

positive in ovarian fluids tested. Infectious Pancreatic Necrosis Virus and Viral Hemorrhagic Septicemia Virus were not detected.

Kidneys were also sampled for Bacterial Kidney Disease (*Renibacterium salmoninarum*) testing by the Enzyme-linked Immunosorbent Assay (ELISA) from each female spawned. The ELISA test was used to give a quantitative result of the relative amount of *R.salmoninarum* antigen in a given sample by optical density or OD value. According to decisions by managers included in the Clearwater Annual Operation Plan (Clearwater AOP), eggs from females tested at ELISA O.D. values above 0.250 should be culled. Eggs from 19 females or 3.4% (19/553) were recommended to be culled due to ELISA O.D. levels above the 0.250 cut off level for the Dworshak SCS stock in 2017. Eggs from 8 females or 3.1% (8/254) were recommended to be culled due to ELISA O.D. levels above the 0.250 cut off level for the Kooskia SCS stock.

Kidney and spleen samples (60) were collected throughout spawning for bacteriology testing. All samples were negative for *Yersinia ruckeri* and *Aeromonas salmonicida* from the Dworshak SCS stock. All samples were negative for *Yersinia ruckeri*, but one sample was found positive for *Aeromonas salmonicida* from the Kooskia SCS stock, not an uncommon occasional finding for returning adults.

Cranial tissue (60) was collected throughout spawning for *Myxobolus cerebralis* testing by pepsin/trypsin assay and confirmation by PCR. All tested were negative for this parasite. Intestinal scrapings (30) were collected throughout spawning for *Ceratonova shasta* detection. As in most years, these adults were found positive for this parasite.

The PRFHP served as INAD monitor for DNFH SCS program as necessary in FY 2017. During this year, there were sufficient numbers of ripe females to meet production goals, and no females were injected with the sGnRH_a hormone. Aqui-S 20E was administered under INAD to the SCS adults for sedation during sorting and spawning. In addition, all SCS adults were treated with formalin bath for fungus during holding at DNFH up to every other day under veterinary extra-label prescription.

Broodyear 2018 Spring Chinook

During spawning personnel from the PRFHP took ovarian fluid for viral inspection from both Dworshak and Kooskia stock females. Kidney/spleen samples were also taken from Dworshak and Kooskia males for viral inspection. Overall, 27.3% of the adult Dworshak SCS sampled were positive for IHNV and 55.2% of adult Kooskia SCS sampled were positive for IHNV. Five pooled kidney/spleen samples (60) and three pooled ovarian fluid (150) samples were collected throughout the spawning season for virology testing. Results for Infectious Hematopoietic Necrosis Virus for Dworshak SCS included 25.0% (15/60) positive in kidney/spleens sampled and 15.9% (24/151) positive in ovarian fluid tested. Infectious Pancreatic Necrosis Virus and Viral Hemorrhagic Septicemia Virus were not detected.

Kidneys were also sampled for Bacterial Kidney Disease (*Renibacterium salmoninarum*) testing by the Enzyme-linked Immunosorbent Assay (ELISA) from each female spawned. The ELISA test was used to give a quantitative result of the relative amount of *R.salmoninarum* antigen in a given sample by optical density or OD value. According to decisions by managers included in the Clearwater AOP, eggs from females tested at ELISA O.D. values above 0.250 should be culled. Eggs from 30 females or 6.4% (30/470) were recommended to be culled due to ELISA O.D. levels above the 0.250 cut off level for the DNFH SCS stock in 2018. Eggs from 5 females or 1.5% (5/340) were recommended to be culled due to ELISA O.D. levels above the 0.250 cut off level for the Kooskia SCS stock.

Kidney and spleen samples (60) were collected throughout spawning for bacteriology testing for each stock. All samples were negative for *Yersinia ruckeri* and *Aeromonas salmonicida* for both Dworshak and Kooskia stocks.

Cranial tissue (60) was collected throughout spawning for *Myxobolus cerebralis* testing by pepsin/trypsin assay and confirmation by PCR. All tested were negative for this parasite. Intestinal scrapings (30) were collected throughout spawning for *Ceratonova shasta* detection. As in most years, these adults were found positive for this parasite.

The PRFHP served as INAD monitor for DNFH SCS program as necessary in FY 2018. Aqui-S 20E was administered under INAD to the SCS adults for sedation during part of sorting and spawning. In addition, all SCS adults were treated with formalin bath for fungus during holding at DNFH up to every other day under veterinary extra-label prescription.

Broodyear 2019 Spring Chinook

Personnel from the PRFHP took ovarian fluid for viral inspection from both Dworshak and Kooskia stock females during spawning. Kidney/spleen samples were also taken from Dworshak and Kooskia males for viral inspection. Overall, only 2.8% of the adult Dworshak SCS sampled were positive for IHN and 84.4% of adult Kooskia SCS sampled were positive for IHN. Five pooled spleen samples (60) and three pooled ovarian fluid (150) samples were collected throughout the spawning season for virology testing for each stock. For Dworshak SCS, results for Infectious Hematopoietic Necrosis Virus included 0.0% (0/60) positive in kidney/spleens sampled and 3.9% (6/152) positive in ovarian fluid tested. Infectious Pancreatic Necrosis Virus and Viral Hemorrhagic Septicemia Virus were not detected.

Kidneys were also sampled for Bacterial Kidney Disease (*Renibacterium salmoninarum*) testing by the Enzyme-linked Immunosorbent Assay (ELISA) from each female spawned. The ELISA test was used to give a quantitative result of the relative amount of *R.salmoninarum* antigen in a given sample by optical density or O.D. value. According to decisions by managers included in the Clearwater AOP, eggs from females tested at ELISA O.D. values at and above 0.250 should be culled. Eggs from ten females or 1.53% (10/653) were recommended to be culled due to ELISA O.D. levels above the 0.250 cut off level for the Dworshak SCS stock in 2019. Thirteen Dworshak females were culled on the floor due to visible signs of BKD. Eggs from four females

or 1.34% (4/299) were recommended to be culled due to ELISA O.D. levels above the 0.250 cut off level for the Kooskia SCS stock. An additional 5 Kooskia females were culled on the floor due to visible BKD signs.

Kidney and spleen samples (40) were collected throughout spawning for bacteriology testing. All samples were negative for *Aeromonas salmonicida*. 62.5% (% pooled samples) were positive for *Yersinia ruckeri*.

Intestinal scrapings (30) were collected throughout spawning for *Ceratonova shasta* detection. As in most years, these adults were found positive for this parasite.

The PRFHP served as INAD monitor for DNFH SCS program as necessary in FY 2019. AQUI-S 20E was administered under INAD to the SCS adults for sedation during part of sorting and spawning. In addition, all SCS adults were treated with formalin bath for fungus during holding at DNFH up to every other day under veterinary extra-label prescription.

Broodyear 2017 Coho

At spawning, a minimum of 150 ovarian fluid samples are collected and tested for viruses throughout the Coho spawning run at DNFH by cell culture. Additional samples are taken and tested as needed including 100% two-pool sampling of ovarian fluids for virus for eggs transferred to Eagle Creek National Fish Hatchery as required by Oregon Dept. of Fish and Wildlife. Tissue samples of kidney/spleens taken from a minimum of 60 males are also collected throughout the run for virus testing by cell culture. Overall at Dworshak, all samples were negative for IHNV (0/491) for this year with 0% (0/60) positive in kidney/spleens sampled and 0.0% (0/431) positive in ovarian fluids sampled. All samples were negative for Infectious Pancreatic Necrosis Virus (IPNV), and Viral Hemorrhagic Septicemia Virus (VHSV). In addition, Coho at the Kalama State Hatchery in Washington were spawned for the NPT. In this case, the PRFHP in Idaho coordinated with the PRFHP staff near the lower Columbia River area to perform the sampling and testing for these Coho. At Kalama, 56 ovarian fluid samples were collected and tested for virus. All were negative for IHNV as well as IPNV or VHSV. Eggs from these females were used to fill the Eagle Creek NFH program as well as the DNFH program.

Kidneys were also sampled for Bacterial Kidney Disease (*Renibacterium salmoninarum*) testing by the Enzyme-linked Immunosorbent Assay (ELISA) from each female spawned. The ELISA test was used to give a quantitative result of the relative amount of *R.salmoninarum* antigen in a given sample by optical density or OD value. This year there were no eggs from any females that were recommended to be culled due to ELISA O.D. levels above the Clearwater AOP 0.250 cut off level for BY 2017 Coho at DNFH or from the Kalama State Hatchery.

Kidney and spleen samples (60) were collected throughout spawning for bacteriology testing. All tissue samples were negative for *Yersinia ruckeri*, and *Aeromonas salmonicida*. Samples from the Kalama State Hatchery were negative for *Yersinia ruckeri*, and *Aeromonas salmonicida*, two samples were positive for *Flavobacterium psychrophilum* (Bacterial Coldwater

Disease). Intestinal scrapings (6) were collected throughout spawning for *Ceratonova shasta* detection. As in most years, these adults were found positive for this parasite. Sixty head wedges consisting of cranial tissue were collected from adults throughout spawning and assayed for the parasite *Myxobolus cerebralis* (Whirling Disease) by the pepsin/trypsin assay and confirmation by PCR. No samples were detected positive for *Myxobolus cerebralis*.

Broodyear 2018 Coho

At spawning, a minimum of 150 ovarian fluid samples were collected and tested for viruses throughout the Coho spawning run at DNFH by cell culture. Tissue samples of kidneys and spleens taken from a minimum of 60 males were also collected throughout the run for virus testing by cell culture. Overall, from all samples tested for virus zero fish were positive for IHNV. This included 0% (0/60) positive in kidney/spleens sampled and 0% (0/154) positive in ovarian fluids tested. Samples were negative for Infectious Pancreatic Necrosis Virus (IPNV) and Viral Hemorrhagic Septicemia Virus (VHSV). In addition, Coho at the Kalama State Hatchery in Washington were spawned for the NPT. In this case, the PRFHP in Idaho coordinated with the PRFHP staff near the lower Columbia River area to perform the sampling and testing for these Coho. At Kalama, 42 ovarian fluid samples were collected and tested for virus. All were negative for IHNV as well as IPNV or VHSV.

Kidneys were also sampled for Bacterial Kidney Disease (*Renibacterium salmoninarum*) testing by the Enzyme-linked Immunosorbent Assay (ELISA) from each female spawned. The ELISA test was used to give a quantitative result of the relative amount of *R.salmoninarum* antigen in a given sample by optical density or OD value. Eggs from one female or 0.30% (1/330) were recommended to be culled due to ELISA O.D. levels above the Clearwater AOP 0.250 cut off level for BY 2018 Coho at Dworshak.

Kidney and spleen samples (60) were collected throughout spawning for bacteriology testing. All samples were negative for *Yersinia Ruckeri* and *Aeromonas salmonicida*. Intestinal scrapings (30) were collected throughout spawning for *Ceratomyxa shasta* detection. As in most years, these adults were found positive for this parasite.

Sixty head wedges consisting of cranial tissue were collected from adults throughout spawning and assayed for the parasite *Myxobolus cerebralis* (Whirling Disease) by the pepsin/trypsin assay and confirmation by PCR. No samples were detected as positive for *Myxobolus cerebralis*.

Release Sampling: Juveniles

As per the USFWS Aquatic Animal Health Policy, a 60 fish inspection sample of each stock on station at DNFH are sampled within 4-6 weeks of release or date of movement to assess smolt readiness and disease status. Assays include virology by cell culture and confirmation by Polymerase Chain Reaction (PCR); bacteriology by plate growth for bacteria identification and

sensitivity, using API biochemical test strips with PCR for confirmation; Direct Fluorescent Antibody Test (DFAT) for Bacterial Kidney Disease (*Renibacterium salmoninarum*); parasitology using pepsin/trypsin digest and PCR confirmation for Whirling Disease (*Myxobolus cerebralis*). Visual notations of the smolt stage are also performed. Beginning August 2019 processing of samples was conducted by the Washington Animal Disease Diagnostic Laboratory (WADDL).

For BY18 Dworshak juvenile SST (released in spring of 2019), tissue samples from 60 fish were collected prior to release to assess smolt readiness and disease status. Assays included virology, bacteriology, parasitology, hematocrits, and visual notations of smolt stage. By DFAT analysis, Bacterial Kidney Disease (*Renibacterium salmoninarum*) was not detected in any prerelease samples. No viruses or pathogenic bacteria were detected. The parasite *Myxobolus cerebralis* was not detected.

For broodyear 2019 Dworshak juvenile SST (to be released in spring of 2020), tissue samples from 60 fish will be collected prior to release to assess smolt readiness and disease status. Assays will include virology, bacteriology, parasitology, hematocrits, and visual notations of smolt stage.

For BY17 Dworshak juvenile SCS (released in spring of 2019), tissue samples from 60 fish were collected prior to release to assess smolt readiness and disease status. Assays included virology, bacteriology, parasitology, hematocrits, and visual notations of smolt stage. By DFAT analysis, Bacterial Kidney Disease (*Renibacterium salmoninarum*) was detected in 7/12 prerelease samples. BY17 were first diagnosed with BKD in February of 2019. No other pathogenic bacteria and no viruses were detected at pre-release.

For BY18 Dworshak juvenile SCS (to be released in spring of 2020) tissue samples from 60 fish will be collected prior to release to assess smolt readiness and disease status. Assays will include virology, bacteriology, parasitology, hematocrits, and visual notations of smolt stage.

For BY17 NPT juvenile Coho raised at Dworshak and then transferred to KNFH (released in spring of 2019), tissue samples from 60 fish were collected prior to release to assess smolt readiness and disease status. Assays included virology, bacteriology, parasitology, hematocrits, and visual notations of smolt stage. By DFAT analysis, Bacterial Kidney Disease (*Renibacterium salmoninarum*) was not detected in any prerelease samples. No viruses or pathogenic bacteria were detected. The parasite *Myxobolus cerebralis* was not detected.

For BY18 NPT juvenile Coho raised at DNFH and released from KNFH (released in spring of 2020), tissue samples from 60 fish will be collected prior to release to assess smolt readiness and disease status. Assays will include virology, bacteriology, parasitology, hematocrits, and visual notations of smolt stage.

Fish Health Diagnostics and Monitoring

All USFWS stocks at DNFH and KNFH are monitored at a minimum of once a month for parasites, disease, or other adverse conditions or syndromes such as Gas Bubble Disease. Diagnostic exams are performed as needed on all USFWS and NPT stocks.

For BY18 Dworshak juvenile SST had low levels of coagulated yolk and the bacteria *Flavobacterium psychrophilum* (Coldwater Disease) were detected in several tanks in May 2018. Two infected tanks were treated with florfenicol medicated feed. In August 2018, the parasite *Ichthyobo* (*Costia*), was detected in two ponds. These ponds were treated with formalin for the parasite. The SST were treated for the external parasite *Trichodina* in various ponds in December 2018, February and March 2019. In January 2019 the on pond was treated for the external parasite *gyrodactylus*.

For BY19 Dworshak juvenile SST, increased mortality in April 2019 was attributed to pinheads. Bacterial gill disease was diagnosed and treated in June. In August the bacteria *Flavobacterium psychrophilum* (Coldwater Disease) was detected in the BPs and treated with florfenicol medicated feed. The parasite *Trichodina* was detected in several ponds in September and treated with formalin for the parasite.

For BY17 SCS at DNFH at the end of April 2018 the SCS juveniles were treated with Chloramine-T for external bacteria. No further treatments were needed to treat external bacteria. At the beginning of October low levels of Infectious Hematopoietic Necrosis Virus (IHNV) was detected in moribund fish from one raceway that was exhibiting low chronic mortality. Mortality quickly returned to normal. Due to the government furlough the number of examinations for FY19 were decreased. Upon returning Bacterial Kidney Disease was diagnosed in numerous raceways. Due to the lengthy medicated feed time and withdrawal period it was decided to not treat with medicated feed.

BY18 SCS at DNFH alevins in egg stacks experienced blue sac disease in late winter. In May A Bank started experiencing high losses shortly after ponding. It was discovered through histological examination that the fish had *Phoma*. Fish continued to die at high levels into late summer with mortality tapering off after splitting to final rearing densities.

BY17 Coho salmon at DNFH were observed to have low levels of coagulated yolk during the spring monitoring. This did not appear to cause any increase in mortality. June monthly monitoring presented debris and bacteria around swollen gills. Recommendation to ensure pond cleanliness resulted in improved gills in July. One *Trichodina* was observed in the August examination, no other parasites have been observed.

BY18 Coho due to changes in the PRFHP/NPT contract the coho are only examined during a diagnostic or prerelease exam. The BY18 coho have only been examined one time in October 2019. Low levels of *F. psychrophilum* were detected but no treatment was required.

BY19 Coho salmon eggs were transferred to KNFH after a chiller failure at DNFH. These fish will eventually be moved back to Dworshak for rearing and then return to Kooskia for release in 2021.

Research and Technology

The PRFHP coordinates with the USGS Western Fisheries Research Center in Seattle, WA to obtain genotyping information for Infectious Hematopoietic Necrosis Virus isolates from Dworshak juvenile and adult SST and SCS, as well as isolates from other facilities and stocks. This provides further epidemiological information regarding this virus and how the findings at DNFH relate to other IHNV detections throughout the Northwest.

Hatchery Evaluation Team and Coordination Meetings

The PRFHP personnel are active participants on the DNFH Hatchery Evaluation Team. Staff assists by giving recommendations when hatchery procedures and production protocols are set or adjusted to minimize disease issues and assure production of healthy fish as much as possible.

The PRFHP personnel are active participants at the DNFH – COE Quarterly meetings, the Clearwater AOP meetings, and other coordination meetings with the COE, NPT, IDFG, and other involved parties.

Reports

The PRFHP provided fish health reports for each diagnostic, prerelease and monitoring exam performed by staff.

The PRFHP also provided fish health information to the IFWCO and to production staff for DNFH SST BY and annual reports as requested.

Training

The PRFHP provides fish health information and training as well as biosecurity training as needed to all DFC employees. The PRFHP staff in Idaho developed a series of classes given to the DNFH production staff on the basics of fish health and its relationship to fish culture practices. This training was given beginning in October of 2013, FY14 once per week through February of 2014. The training included topics such as: Information/introduction on “What does the Idaho Fish Health Center do Exactly”; Host/Pathogen/Environmental interactions and Infection vs. Disease: “What is a pathogen and how do they interact with the fish in the environment provided”? ; Basic salmonid fish culture—“when do I call the doctor”?, (covering

the subject of fish culture practices related to fish health such as general hygiene, feeding, cleaning, spawning strategies, incubation, early rearing, production, release strategies, expected mortality at ponding, etc); Biosecurity and Disinfection; Stress and how it affects the fish; Nutrition and Nutritional Diseases (webinar by Ann Gannam, nutritionist at the USFWS Abernathy Fish Technology Center); Bacteriology- common bacteria and clinical manifestations, basic information on how to identify bacteria; Parasitology; Cell culture/ Virology- common viruses and how test for them; The Polymerase Chain Reaction (PCR)Test, Quantitative PCR, and Histology; Fish Health Policies and Regulations (for transport, etc.); Treatments for Drug Use on Fish; Emerging pathogens and the National Wild Fish Health Survey; Environmental Diseases- Gas bubble, coagulated yolk, soft shell disease; Basic Fish Anatomy, Necropsy, and Physiology, including tour of lab and examples of fish necropsies to view.

In addition, each staff member of the PRFHP is required to have the opportunity to attend 40 hours of training during each year. The training can be administered through a variety of different venues. For example, on-line training is required each year (IT security, ethics, EEO, etc.). Some staff members may be sent to training specific to fish health and related disciplines. Staff members also attend a variety of meetings during the year. Some meetings are agency sponsored and deal with organizational issues (FWS Hatchery Managers Workshop, FWS Project Leaders Meeting, Strategic Planning Meetings, etc.). Other meetings are professionally oriented (Western Fish Disease Workshop, American Fisheries Society, Northwest Fish Culture Conference, etc.) and give staff opportunities to give presentations as well as to keep staff updated of changes in their areas of professional expertise.

Outreach Provided by Fish Health

The PRFHP coordinates and assists in several Information and Education programs including teaching in the classroom from elementary to college levels, fish health diagnostics for classroom fish culture projects, Kids Fishing Day, the DFC intern program, many tours of the laboratory, and training of volunteers including veterinary students working with and job shadowing the PRFHP staff. In addition, the PRFHP staff have provided projects for students in the Directorate Fellows Program and given them guidance to help them succeed in fish health related fields.

FACILITY MAINTENANCE

General Routine and Preventative Maintenance

Utilizing the Facility Equipment Management System (FEMS), the maintenance crew performs monthly, quarterly, semi-annual, annual, 2, 3, 5 year mechanical and electrical preventative maintenance (PM) on a variety of equipment. Key components in these PMs includes: Monthly generator cycling and maintenance, checks and testing on a variety of safety items such as eye wash stations, AED Lifepack defibrillators, elevator for visitors to access spawning balcony and displays, spill prevention counter control measure items, main river pumps and sump pumps, water control valves, traveling screens, clarifiers scrapers, digesters and components, compressors, boiler mechanical and electrical, recirculating loop pumps, Cushman carts, forklifts, Genie manlift, boom trucks, cranes, low head oxygenators for Chinook salmon raceways, vehicles, fish pumps, fish distribution trailers and on-site fish truck, fire pumps, pressure washers, buildings, lawn irrigation systems, winterization of various systems, HVAC Unit Heaters and Air Conditioning systems, fans and exhaust fans, switchboard and breaker testing/cleaning/maintenance, motor control centers, transformers and other miscellaneous equipment.

Standing Work Orders were utilized for routine maintenance activities associated with Hatchery Operations (DNFH-1901), Hatchery Minor Maintenance (DNFH-1902) and Hatchery Supervision (DNFH-1903).

Contractor expertise was utilized for Generator Maintenance (i.e. Pacific Power Group) including load testing and chiller annual servicing (i.e. Daikin Applied, Inc.) for the two 60 ton chillers used to chill water for the SCS program.

Maintenance Highlights by month

October 2018

- A group of engineers from the U.S. Army COE, Walla Walla District conducted a site visit and took measurements in the Main River Pump House as part of the planning process for a 1.25 megawatt generator to replace generators 3 and 4 (500 KW each) which would provide the capacity to run all 6 main river pumps in the event of a power outage.

November 2018

- The Maintenance Staff along with Lucian Stewart, Chief of the Technical Branch, Dworshak Dam, U.S. Army COE conducted trouble-shooting on an electrical issue associated with Generator #2 and the function of Pump #2. This pump operates fine on commercial power, but will not start when commercial power fails and needs to start and run on Generator #2 to provide water to the SST in the System I BPs.
- Experts from Pacific Power Group conducted evaluations on Generator #2 (i.e. Low voltage output) and Generator #3 (i.e. Excessive vibration and coolant loss) on Monday, November 26, 2018. Parts were ordered and additional maintenance scheduled for January 2019 (once parts are available).
- DNFH worked with Frank Lee, Chief of Contracting and General Services to award (Lager's ET&M) the breaker maintenance contract for 12 air frame breakers. This will ensure this is awarded timely so the work can be completed for 7 of these breakers prior to the Nursery going on-line (Late February). These breakers are approximately 50 years old and their reliability is essential to provide power for the pumps in the Mechanical II Building which in turn supply reservoir water to the Nursery for early rearing of our B-Run SST.
- Lighting in the Maintenance Shop was replaced with LED lighting.

December 2018

No Report

January 2019

- On Monday, January 7, 2019, Lager's ET&M was on-site and completed the annual breaker maintenance on the 7 air frame breakers in the Generator Building. This work went well and the electrical system is ready for the upcoming Nursery operations as we move into SST rearing of the BY19 fish.
- Replaced broken hydraulic motor on snow plow.



- Electricians continued updating the one-line drawings for the DNFH electrical.
- Preparation and planning for the planned electrical outage in April, 2019.

February 2019

- The ballasts were replaced in the Electrical Shop.
- The “electrical raceway” was cleaned for the channel crowders.
- The reset switches for the DNFH fish ladder were adjusted.

March 2019

- Asbestos abatement for the DNFH Quarters was completed. This project removed Asbestos Containing Material (ACM) floor tile and joint compound in the basements.
- A portion of sheetrock was also removed to abate a mold issue from previous water damage.
- Troubleshoot Pump #1, System I Pumphouse Variable Frequency Drive to restore function.

April 2019

- Maintenance staff assisted in transporting SST smolts to the South Fork Clearwater River, Clear Creek and Lolo Creek. Hank Godwin served as a truck driver along with 3 other drivers from the COE. Melissa Wright operated fish pumps during loading procedures.



- DNFH Maintenance Supervisor, Tim Norman coordinated with multiple contractors and Clearwater Power Company for several electrical and mechanical maintenance projects which occurred during the week of April 12, 2019 and the week of April 15, 2019.
- Additionally, a two-day power outage at the request of Clearwater Power Company was incorporated into the schedule for April 15, 16, 2019 in order for Clearwater Power to complete essential work at the Ahsahka Substation which powers DNFH.
- DNFH worked with the Coho Project Leader, NPT to wire in a portable generator to provide reservoir water for Coho which were ponded in System III on April 10-11, 2019. This isolated generator was necessary to provide a complete “blackout” situation to facilitate electrical maintenance associated with the electrical systems (i.e. Schneider Electric Breaker Measurements for Electrical Cradle Design) for Mechanical I Building and Generator #2.
- During the April 15th – 19th planned power and river water supply outage, maintenance installed a new actuator and stem for the 36” valve.



- Once the systems were de-watered, Maintenance discovered a broken section of the 36” valve that will need to be replaced in the spring of 2020 in conjunction with another planned water shutdown.

Broken attachment point on the 36 inch valve



- On Tuesday, April 16, 2019, Schneider Electric was on-site to take measurements for the design development for the breaker cradles for 5 of our Air Frame Breakers which will lead to these breakers being replaced in 2020. This work required a complete electrical blackout; therefore, portions of the DNFH were without commercial or generator power. Generator #2 was shut down in the afternoon to accommodate this work for two breakers in Mechanical Building I. A portable generator (on loan from the NPT) was used to power 1 pump in the Mechanical II Building to supply a portion of the water needs for the Nursery. We successfully routed reservoir water (gravity fed) into the C and D Banks of the Nursery system to provide water for SST in these two banks while the single pump fed from the portable generator supplied water to A and B banks in the Nursery. This is the first time this has ever been tried (as far as any of us know) and it is worked well. Upon completion of the electrical work by Schneider Electric (7pm), generator #2 was re-started.



Above: Kurt McCorkle and Russ Brotnov, Electricians working on removal and reinstallation of the breakers to accommodate the measurements taken by Schneider Electric.

- The Maintenance staff cut new threads to install a permanent plug in the river water supply line near the “A Bank” Chinook raceways. This was a permanent fix for a previous temporary plug.



- When the Main aeration chamber was drained for the 36" valve repair the main aeration chamber was visually inspected for possible repair needs in the future. Additional valve and stem operators will need to be addressed in the next couple of years and coordinated into additional water outages.



- On April 24, 2019, the Annual Valve Exercise was completed successfully. This includes converting both the CFH and DNFH to and from the two Dworshak Reservoir Water supply lines. This project went smoothly and according to protocol.

May 2019

- The COE, Cascade Industrial Services and DNFH staff met on-site to discuss, coordinate and schedule the warranty work for the BPs that were skim coated and painted in 2018 by Cascade Industrial Services. The paint and in some cases, the skim coating has failed in several of the ponds. This was a COE Contract totaling \$451K. These funds were above and beyond DNFH's annual Operations and Maintenance funding from the COE.
- Replaced faulty "push button" on control panel for the spawning room lift baskets.

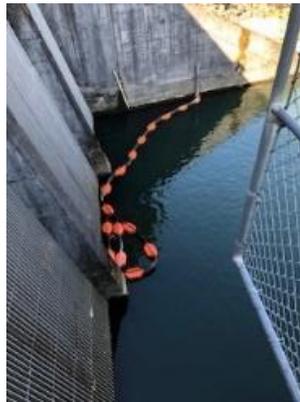
- Installed electrical wire storage box to get excess wire off the ground around the system 2&3 supernatant flight pumps.



- Pacific Power Group performed annual maintenance on Generators 3 and 4 at the Main Pump House. Their work included replacing belts and coolant hoses, changing oil and antifreeze and performing a Load Test on generator 4.



- The attachment point for the Oil Boom came loose in front of Main Pump House intake and it was re-attached.



- A lot of time was spent trouble shooting the boilers and heat exchangers in Mech II. Wes Ketchum from Infinium Corporation visited DNFH to trouble-shoot the boiler and heat exchanger issues in Mechanical Building II. He worked with maintenance crew on

how the system is designed to run and provided a refresher training overview. Adjustments were made to restore reliability to the system.



- The Spawning Lift Basket has had problems throughout the last spawning season where the basket binds with the channel gate when the basket is fully lowered to load fish. After inspection, adjustments were made removing the binding point which allows the basket to fit flat on the concrete floor when it is fully lowered.
- On May 9, 2019, Associated Underwater Services (AUS) in coordination with the COE Dive Coordinator and in cooperation with the IFWCO and DNFH maintenance crew, performed maintenance on the grating systems in the lower end of the Fish Ladder. Maintenance assisted Associated Underwater Services who were contracted to dive in the Fish ladder/Attraction channel to replace a section of grating and pressure wash the rest of underwater grating between the attraction channel and fish ladder. This work was initiated to address a breach in the grating which allowed broodstock to access the Attraction Channel rather than forcing them up the ladder and into Holding Pond 9.



- Daiken Applied performed contractual services to complete the annual chiller maintenance and to gather information for adding a Glycol loop for the Chillers for incubation.

June 2019

- On June 19, 2019, Mark Wright, Construction Control Representative, Walla Walla District, U.S. Army COE conducted an inspection of the warranty work recently completed by Cascade Industrial Services on the BPs (i.e. Painting project). A punch list was developed between the DNFH staff and Mark and has been provided back to Cascade Industrial Services for immediate completion. Once the punch list is completed, all pond repairs (i.e. Painted) require 7 days of cure time before they can be returned to service. This work is now encroaching on DNFH's timing and scheduling for ponding SST.
- Cascade Industrial Services completed the warranty repairs on the DNFH BPs in Systems II and III on Monday, June 24, 2019. Mark Wright, COE will meet with Derrick Badgely, Cascade Industrial Services on Tuesday, July 2, 2019 for the final inspection.
- Replaced main Breaker on Generator #3.
- Replaced faulty 3-way switch in feed building basement.
- Replaced the deteriorated wooden benches with metal (low maintenance benches) near the Hatchery Building entrance.



- Maintenance installed a new sump pump in the Main Hatchery Building Basement below the spawning area.
- Annual clean out of oil and water separator sumps adjacent to the Maintenance Shop by Safety Kleen.



- Repaired grip strut in system 3.
- Installed new aluminum piping for system II supernatant pumping system.



July 2019

- Replaced Variable Frequency Drive on the “B Bank” Nursery Degassing Fan.
- Moved old fiberglass tanks from the COE’ boneyard to the DNFH parking lot to prep for shipping to Eisenhower NFH in Vermont.
- Repaired hood light for sterilizer in fish health lab.
- B&H Power Vac contracted to clean the HVAC ductwork in the four hatchery residences.
- Research including pricing was conducted for the valve positioners for heat exchanger valves in Mechanical Building II.
- Continued repair work on air-lines in incubation and spawning room.
- DNFH Electricians, along with Lucian Stewart, COE continued trouble-shooting Main River Pump #4 issues associated with power outages. This pump is designed to start and run from power supplied by Generator #4; however, it typically operates off power provided by Generator #3 until staff manually convert it over.
- Installed a new transformer in the Main Pumphouse that supplies emergency switchgear.
- Installed new relays in the #4 Heating Unit for the Nursery (located on the Nursery Roof).
- Installed new water temperature probe in the Nursery.
- Designed and installed electrical circuitry for the “wet gear equipment dryer” for Production Staff.

- Re-worked electrical control power facilitating automatic switching from Commercial power to Generator power.
- Replaced a compressor for cooling unit in Quarters #2.
- A wheel hub was replaced on the Janitorial Cushman Cart.
- Installed new purge valves for the Main Aeration Degassing System.
- Repaired Karcher pressure washers experiencing low output pressure.

August 2019

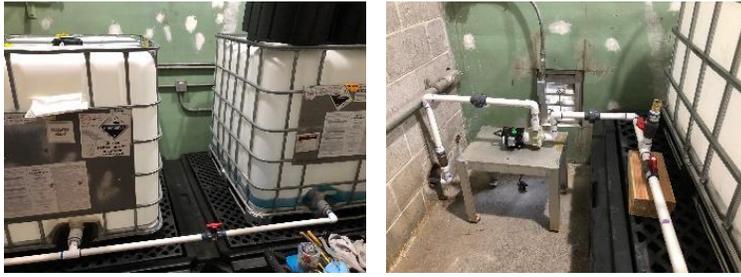
- Nathan Stark, Pump Tech Inc. was on site to train and assist in re-packing pump #2 in the System I Pump House. The pump was re-packed using a graphite packing material.



- Surplus fiberglass tanks were shipped to Eisenhower NFH in Vermont for a salmon restoration project in Lake Champlain.



- Joint effort between Maintenance and Production Staff to install a new formalin room in the old chiller room. This project provides greater efficiency and also improves safety since this new system capacity reduces chemical transfers.



- Broken standpipes in System I were repaired during the month.
- Worn tires were replaced on the Toyota and Hyster Forklifts.
- New prototype burrows pond screens were fabricated by Maintenance Staff. These screens are undergoing a testing/evaluation period. These screens allow for easy changing to allow the hole sizes to align with fish rearing criteria resulting in improved tank hygiene.

September 2019

- On September 5, 2019, the Maintenance Staff/Electricians along with the partnering assistance of the Lucian Stewart, Army COE diagnosed and corrected the electrical issues associated with pump #4 in the Main Pump House. This pump now fully functions as designed to operate during power outages on Generator #4 AUTOMATICALLY!
- The fire hydrant adjacent to the B-Bank Chinook Raceways was repaired.
- The frost-free drain for Hatchery Quarters #4 was replaced.
- Heat trace and insulation was installed on the Main Pumphouse Vacuum Degassing System Lines. The majority of this work was completed in September. Final work will be completed before freeze up potential in FY 2020.



Heat trace and insulation installed on vacuum lines to keep ice from forming and blocking air flow during the cold winter conditions. This will provide full vacuum function throughout the year.

Power Outages and Planning

At 11:00 pm on October 16, 2018, the planned power outage was initiated to repair a transmission line from the Dworshak Dam to the Orofino Substation. In order for this repair to occur, the Ahsahka Substation which feeds the DNFH was without power from 11:00 pm on October 16, 2018 until 3:20 am on October 17, 2018. In preparation for the power outage, the crew made water adjustments during the day on October 16, 2018 to reduce water use from 6 main river pumps down to 4 main river pumps. All breaker and transfer switches worked as designed during the outage. Pump #2 in the System I pump house which supplies reservoir water to System I would not start with power supplied from Generator #2. As it tried to start, it would reduce the voltage from Generator #2 which repeatedly caused pump #1 to drop out. The decision was made to operate using Pump #1 only which resulted in ~ 3,000 GPM reduction in water availability from the original game plan. Based on pre-outage planning, we had a 2,800 GPM buffer (surplus) in water availability and therefore balanced water accordingly. The unique challenge for this power outage and balancing water for DNFH's high water demand at this time of year was our 36 inch water supply valve which provides water to the Adult Holding Ponds and Fish Ladder is currently inoperable. Typically, this valve can be used to trim water use by up to 10,000 GPM. Since this valve is currently not operable we could not use the typical strategy and made alternative plans for balancing water demand and water availability (This valve can only be repaired by draining the main aeration chamber which can only occur after all of the smolts are released in April, 2019). In 2017 and 2018, Low Head Oxygenation was installed on the 30 LSRCPC Chinook Raceways. This allowed tremendous water reductions with continuous oxygen supplied from the liquid bulk tank which maintained oxygen levels at saturation throughout the outage. Commercial Power was restored at approximately 3:20 am on October 17, 2018. The 4 main river pumps were converted automatically from generator power back to commercial power and pumps 2 and 6 were re-started on commercial power to restore full water capability. In the System I pump house, Pump #3 was started on commercial power to restore maximum flow of reservoir water to the System I BPs. The crew performed well and responded well to the challenges that arose during the outage. All in all, a very successful power outage. Items to address: Investigate Generator #2 and System I Pump House Pump #2 and correct so this pump will reliably operate during a power outage. Investigate Generator #3: This generator was transmitting a strong vibration which could be felt through the concrete pad which it sits on and investigate and identify the source of engine noise identified during the outage.

On Tuesday, June 18, 2019, The Clearwater Power Company completed their maintenance work on the old breaker within the Ahsahka Substation. This work went well and therefore, there was no interruption to commercial power provided to the DNFH.

On June 26, 2019, a storm rolled through the local area resulting in a power outage. This outage knocked out power coming into the Ahsahka Substation resulting in a complete blackout at DNFH and all of the customers fed by the Ahsahka Substation. The outage lasted

approximately 4 hours. The DNFH crew response was excellent. Several mechanical/electrical problems were encountered and all were overcome resulting in no loss of fish. A detailed summary was compiled and has been provided to FAC leadership.

On July 30, 2019, DNFH had a scheduled power outage for the Main River Pumphouse to enable the hatchery Electricians and Lucian Stewart, Electrical Engineer, COE to test systems for proper function and to verify electrical to facilitate the development of electrical schematics which will allow for Pump #4 to automatically operate (Control Power) off Generator 4.

On August 24, 2019 at ~5:00 pm, the DNFH experienced a power outage resulting from a failed insulator on the 115 KV line which is fed from Dworshak Dam to the Ahsahka Substation. The failed insulator melted and started a fire on the hillside between the dam and the DNFH. The fire was suppressed with the use of 4 helicopters which dipped water from the Clearwater River just upstream of the DNFH. Power was restored at ~4:15 am. All 4 diesel generators and associated electrical equipment functioned as designed providing water to all fish on-station. Over 800 gallons of diesel fuel was used to power the generators. The COE provided payment for the diesel fuel following the power outage after Mark Drobish asked for their assistance since the DNFH budgets have been depleted with a month remaining in the fiscal year.



Avista Power will be replacing a 442 switch on the 115 KV line between the Dworshak Dam and the Ahsahka Substation. This switch was damaged and is inoperable following the fire (caused by a failed insulator) which occurred on August 24, 2019. The repairs have been delayed until the spring of 2020 due to soft conditions (due to recent rains) on the hillside where the platform will be staged in order to make these repairs.

ADMINISTRATION

Personnel



DNFH Staff in FY 2019.

Name	Position Title	Organization
Baptiste, Stephanie	Fisheries Technician	Nez Perce Tribe
Bisbee Jr., Mike	Coho Project Leader	Nez Perce Tribe
Bohn, Rob	Fish Culturist	US Fish and Wildlife Service
Brotnov, Russell	Electrician	Nez Perce Tribe
Carson, Levi	Fisheries Technician I	Nez Perce Tribe
Coomer, William	Fish Culturist III/Coho Project	Nez Perce Tribe
Devlin, Brian	Administrative Officer	US Fish and Wildlife Service
Dimick, Sara	Animal Caretaker	US Fish and Wildlife Service
Drobish, Mark	Project Leader	US Fish and Wildlife Service
Feldmann, Angela	Fisheries Biologist	US Fish and Wildlife Service
Frye, Aidan	Animal Caretaker	US Fish and Wildlife Service
Godwin, Hank	Maintenance Mechanic	US Fish and Wildlife Service
Hamilton, Wayne	Fish Culturist	US Fish and Wildlife Service

Henry, Savion	Fisheries Technician I	Nez Perce Tribe
Higheagle, Malique	Fisheries Technician I	Nez Perce Tribe
Izbicki, Adam	Assistant Hatchery Manager	US Fish and Wildlife Service
Jeffers, Stephen	Fish Culturist	US Fish and Wildlife Service
Kellar, Rob	Maintenance Worker	US Fish and Wildlife Service
King, Rick	Maintenance Worker	US Fish and Wildlife Service
Koehler, Scott	Maintenance Technician III	Nez Perce Tribe
Johnson Jr., Richard	Fisheries Technician I	Nez Perce Tribe
Lopez, Carter	Fisheries Technician I	Nez Perce Tribe
McCorkle, Kim	Administrative Assistant	US Fish and Wildlife Service
McCorkle, Kurt	Electrician	US Fish and Wildlife Service
Moliga, Tui	M&E Biologist, Coho Project	Nez Perce Tribe
Norman, Tim	Maintenance Supervisor	Nez Perce Tribe
Page, Jarrett	Fisheries Biologist	US Fish and Wildlife Service
Vacant	Outreach Coordinator	US Fish and Wildlife Service
Pike, Jeremy	Fisheries Biologist	Nez Perce Tribe
Rodgers, Steve	Complex Manager	US Fish and Wildlife Service
Shebala, Lautiss	Fisheries Biologist	Nez Perce Tribe
Sommer, Jeremy	Assistant Hatchery Manager	Nez Perce Tribe
Tannehill, Kevin	Fisheries Technician I	Nez Perce Tribe
Tuell, Mike	SRBA Coordinator	Nez Perce Tribe
Wheeler, Xavier	Fisheries Technician I	Nez Perce Tribe
Wright, Melissa	Technician/Custodian	Nez Perce Tribe

Jarrett Page transferred from the HNFH and started with DNFH on October 1, 2018. Jarrett fills the Fishery Biologist position vacated by Tom Tighe (Assistant Hatchery Manager-Mora NFH). With Jarrett's arrival all of the FWS DNFH positions are now filled again.

Carter Lopez resigned his position as a Fisheries Technician at the DNFH and accepted a Maintenance position with the NPT at the Casino in Kamiah, Idaho.

Rick King, Maintenance Worker was presented his 30 Years of Service Certificate and Pin on March 7, 2019 in conjunction with a crew cookout/potluck at the DNFH.



Richard Johnson Jr. resigned his Fisheries Technician position as DNFH and accepted a position with the NPT working in their Harvest Department.

Levi Carson retired from his position as a Fisheries Technician.

On June 19, 2019, the DFC gathered for the monthly potluck. Grilled burgers and hot dogs were complimented with more sides than the crew could eat. In conjunction with the monthly meal, we celebrated the 27-year career of Adam Izbicki. Adam and his wife, Sylvia received the USFWS Retirement Plaque and a framed aerial photo of the DNFH signed by his co-workers. Several former DNFH employees attended along with Adam's colleagues from the COE, KNFH and the NPT included Art Broncheau, Nez Perce Tribal Executive Committee Member and former co-worker of Adam's dating back to Adam's service as the Assistant Hatchery Manager at KNFH. June 20, 2019 was Adam's last day on-site at DNFH. We wish him well!



Roy Elicker presents Adam Izbicki with the USFWS Coin and plaque for his contributions on the "FINS" data development team at the Hatchery Manager Training in Richland, Washington in May, 2019.



In September 2019, Savion Henry returned to the University of Idaho to continue his studies in fisheries.

Hank Godwin, Maintenance Mechanic at DNFH accepted a position as a Construction Contracting Officer Representative with the COE at the Dworshak Project. Hank's last day with DNFH was September 12, 2019.

Meetings and Administration

The week of October 4, 2018, a suite of engineers from the U.S. Army COE, Walla Walla District conducted a site visit and took measurements in the Main River Pump House as part of the planning process for a 1.25 megawatt generator to replace generators 3 and 4 (500 KW each) which would provide the capacity to run all 6 main river pumps in the event of a power outage.

DNFH developed plans for the scheduled power outage on October 16-17, 2018. The facility reduced from 6 main river pumps down to 4 pumps and operated off generators 2, 3 and 4 during the outage. Electricians, maintenance and production staff will be on-site to make adjustments, monitor fish and water quality and address any issues that arise. Clearwater Power Company will be on-site during the conversion process and available to tie us into the emergency residential feed if needed.

Roy Elicker and Dan Nehler visited the DNFH on Tuesday, October 16, 2018 and addressed the FWS staff and fielded questions regarding the Tribe's request to transition into a role as the sole operators of the DNFH. Roy, Dan and Steve Rodgers met with the NPT on Wednesday, October 17, 2018 to initiate discussions to develop the proposal.

Steve Rodgers, Mike Tuell, Jeremy Sommer, Lautiss Shebala, Angela Feldmann, Jarrett Page and Mark Drobish attended the 2018 Snake Basin Salmon Fisheries Collaborative Inter-agency Management-Post Season Review Meeting in Lewiston, Idaho on November 7, 2018. Despite less than favorable ocean conditions and below average adult returns for this year, the Clearwater River Basin collectively was very successful in collecting eggs locally and in support from the Little White Salmon NFH. Managers are finding that fecundities are below average, but all of the U.S. vs. Oregon Production will easily be met plus the majority of the production targets above this legal obligation will also be fulfilled.

Mike Langsley, Business Line Manager for Environmental Stewardship and Fish & Wildlife will tour the DNFH on November 15, 2018.

Nez Perce Tribal staff representing DNFH attended the Northwest Fish Culture Conference in Portland, Oregon on December 4-6, 2018. Sara Dimick and Steve Jeffers, FWS Animal Caretakers traveled to Portland on Monday, December 3rd and returned home on December 4th following direction from the Regional Office that all staff on travel must return home and be off-duty on December 5th in honor of former President George Bush.

Dwayne Lee, FMC/AMC Facilities Ops Specialist, Regional Office visited the DNFH on Monday, November 26, 2018 to inspect electrical equipment associated with arc flash/safety concerns relative to operations and human safety. Collectively, DNFH Complex staff, Dwayne and U.S. Army COE staff will develop solid guidelines for staff conforming to National Fire Protection Association regulations. Bottom line: Keeping staff safe and addressing antiquated electrical systems throughout the facility as necessary. Dwayne visited the KNFH on Tuesday, November 27, 2018.

LTC Christian Dietz visited the DNFH on December 10, 2018. He was accompanied by Jason Achziger and Lucian Stewart also of the COE.

Dan Nehler and Roy Elicker visited the DNFH on Tuesday, December 11th while in the area for a Government to Government meeting with the COE and the NPT in Lapwai, Idaho on Wednesday, December 12th.

Staff from the DFC met with the NPT and IDFG in Lewiston, Idaho on December 18, 2018, to discuss SST broodstock collection, time of collection, spawning and run timing, use of larger adults in hopes of restoring a higher percentage of 3-Ocean adults to the rack as well as release strategies, size at release, residualism, etc. As a result, the hatchery is looking into a couple of options to enhance growth of our later SST takes to shift the average size upward to address residualism.

All hatchery staff continued working despite the government shutdown since DNFH operates on reimbursable funding. 100% of the DNFH funding was received through MIPRs from the COE and Cost Codes from the LSRCF.

DNFH staff attended the Clearwater AOP meeting at the IDFG Regional Office in Lewiston, Idaho on January 16, 2019.

DNFH Maintenance Supervisor, Tim Norman coordinated with multiple contractors and Clearwater Power Company for several electrical and mechanical maintenance projects scheduled for April 12, 2019, and the week of April 15, 2019. Additionally, a two-day power outage at the request of Clearwater Power Company was now scheduled for April 15th and 16th in order for Clearwater Power to complete essential work at the Ahsahka Substation which powers the DFC. Additional planning and coordination amongst DFC staff will occur once the final contractor is scheduled and the crew develops the steps for the Hazardous Energy Control Program and identifies what areas of the facility will be without power during these multiple events.

On March 7, 2019, several DNFH staff (including both FWS and NPT) attended a Genetics Workshop for non-geneticists in conjunction with the Idaho Chapter of the American Fisheries Society Meeting on March 5, 2019. These staff members also represented DNFH at the noon luncheon and received the Idaho Chapter "Excellence in Aquaculture Award".



DFC staff along with the PRFHP staff at Dworshak met on March 21, 2019 to initiate discussions regarding Bacterial Kidney Disease in SCS and develop recommendations for antibiotic injections for the 2019 broodstock. Additional information will be gathered before a recommendation is made. If the recommendation is to inject, this will be run through the formal Hatchery Evaluation Process.

Several staff from the Complex and both Laura Sprague and Corie Samson attended the COE Quarterly meeting at the Little Goose Dam Project on April 3, 2019. Following the meeting, the COE provided a brief tour of the dam, the fish ladder system and the Juvenile Fish Facility system.

On April 11, 2019, several DNFH staff attended the Chinook kick-off meeting with our Snake River Basin partners. The forecast for SCS is poor; however, plans to achieve full broodstock collection and spawning for the future of the SCS are in place and weekly coordination calls will continue starting on April 30, 2019.

Derek Gloyn, Hatchery Manager at the Lyon's Ferry SFH (Washington Department of Fish and Wildlife) met with staff at DNFH on April 17, 2019 to discuss the temporary transfer of fall and SCS to DNFH to facilitate repairs to the Lyon's Ferry water supply line. These fish are anticipated to be on-site at DNFH the week of May 20, 2019. These fish are scheduled to be transferred back to Lyon's Ferry SFH at the end of June, 2019.

On April 25, 2019, Jared Frank, Mechanical Engineer, Walla Walla District, U.S. Army COE toured DNFH along with a group of engineers throughout their agency to better understand their mission, partnerships and complexities of the DNFH.

Jeremy Sommer, Assistant Hatchery Manager (DNFH) and Steve Rodgers attended the Annual LSRCP meeting in Lewiston, Idaho on April 23-25, 2019. Jeremy gave a presentation on the Low Head Oxygenators for our 30 Chinook Raceways on April 24, 2019.

A meeting was held at DNFH with the NPT, DFC, PRFHP staff, COE, and Derek Gloyn, Hatchery Manager, Lyon's Ferry SFH (Washington Department of Fish and Wildlife) on May 7, 2019. This meeting served to coordinate and finalize the game plan for transferring 479,000 Fall Chinook Salmon and 454,000 SCS from the Lyon's Ferry SFH to DNFH while the contractor repairs their water supply line.

Adam Izbicki, Steve Rodgers and Mark Drobish attended the Hatchery Manager Training in Richland, Washington May 15-17, 2019. Adam will present and participate on the Fish Feed Panel Discussion and Mark will present on DNFH electrical challenges and some on-going electrical updates.

The COE, Cascade Industrial Services and DNFH staff met on-site to discuss, coordinate and schedule the warranty work for the BPs that were skim coated and painted in 2018 by Cascade Industrial Services. The paint and in some cases, the skim coating has failed in several of the ponds. This was a COE Contract totaling \$451K. These funds were above and beyond DNFH's annual Operations and Maintenance funding from the COE.

Steve Rodgers led a meeting and tour of DNFH with COE leadership, including LTC Dietz (WW District Commander), Paul Ocker (Chief of Operations), Joyce McDonald (Recreation Joint Business Manager) Greg Parker (Dworshak Project Operations Manager), and Lucian Stewart (Dworshak Project Chief of the Tech Section) on May 29, 2019.

DNFH hosted the COE Quarterly Meeting on June 26, 2019. A range of topics were discussed from NPDES permitting, budgeting, DNFH rehab status, non-routine maintenance projects, Lyon's Ferry SFH fish at DNFH and timelines, Kelt program re-location updates, Coho Real Estate Agreement, NPT Sole-Management of DNFH status, Production procedural changes, Production disease issues and a few other topics. Following the meeting at DNFH, Ann Setter, Greg Parker, Lucian Stewart traveled to Lolo Creek to view the SST release site and the temporary weir at Yoosa Creek managed by the Tribe.

Brigadier General Helmlinger, Lieutenant Colonel Dietz, Captain Grimes, Lucian Stewart, Chief of the Technical Branch at the Dworshak Project, Dean Holocek, Tribal Liaison, U.S. Army COE, Nez Perce Tribal Executive Committee Chairman, Shannon Wheeler, Dave Johnson, Nez Perce Tribal Fisheries Director, Becky Johnson, Nez Perce Tribal Production Supervisor, Mike Tuell, SRBA Coordinator, Jeremy Sommer, DNFH Assistant Hatchery Manager (NPT), Tim Norman, DNFH Maintenance Supervisor (NPT) and Mark Drobish, DNFH Hatchery Manager met for a "Walk and Talk Tour" of the DNFH. Talking points included the history of the facility, mission of the hatchery relative to COE Mitigation/SST program, LSRCP mitigation/SCS program, Coho Restoration Program for the Clearwater River, partnerships, mechanical and electrical infrastructure, the age of these facilities and associated risks for human safety and operational

reliability, tour of the fish tagging trailer (Columbia River Fisheries Marking crew) for SST. The tour ended overlooking the DNFH Fish Ladder and a summary wrap up by BG Helmlinger.

Dan Nehler, Eastside Line Supervisor visited DNFH on Wednesday and Thursday (August 13, 14, 2019) to meet with staff and discuss and review fish health associated mortality resulting from *Phoma sp.*, chemical treatments, fish husbandry and density levels for SCS. Laura Sprague provided cheesecake and fresh berries in honor of Dan's 50th birthday!

On August 26, 2019, the DNFH staff participated in a conference call with the LSRCP to review and discuss the LSRCP budget for FY 2020. Key point of emphasis from the DNFH perspective was the inadequate Maintenance Budget along with explanations of how DNFH makes it work using salary savings from vacant positions. All agreed we need to develop budgets reflective of actual costs which allows LSRCP to better understand and communicate budget needs with Bonneville Power Administration.

On September 4, 2019, DNFH staff participated in a conference call with the Walla Walla District COE for engineering services to interconnect a reservoir water supply line for the System II BPs.

Mark Drobish and John Erhardt attended the Project Leader's Meeting at the Nisqually NWR on September 10-11, 2019.

On September 19, 2019, the NPT hosted the Salmon Advisory Panel at toured multiple locations including the Nez Perce Tribal Fish Hatchery, the Dworshak Project (ie. Dworshak Dam) and the DNFH. Tours were provided to this group and presentations were made to this group by Becky Johnson, Nez Perce Tribal Production Director following the tours at DNFH. The Salmon Advisory Panel is comprised of 18 diverse agencies/organizations.

LTC Dietz, Walla Walla District visited the DNFH on September 26, 2019 along with his 4th grade daughter visited the DNFH for a school project regarding salmon and hatchery operations. Jeremy Pike provided information for her report. Jeremy Pike provided them with a tour and was later given the "Commander's Coin" for making time when he was scheduled to travel to Spokane, WA to catch a flight for annual leave.

Michelle Bowden was on-site September 24-27, 2019 and led two sessions of the Crucial Conversations course for staff at the DFC and Fish Health staff located at the complex.

INFORMATION AND EDUCATION

Visitor Use Statistics

Table 21. DNFH Visitor Use Statistics, FY 2019

Program/Contact Type	# of Contacts
On-site Hatchery Visitors (Visitor Sign in Register)	1,670
Guided Tours (School Groups and Organized Tours)	51
Tour Visitors (School Groups and Organized Tours)	1,213
Total On-Site Contacts	2,883
Off-site (Programs/Displays/Events)	22
Total Off-Site Contacts	9,109

Website and Facebook hits were not included in this report.

FY19 Outreach Program Summary

The Information and Education/Outreach program had a very busy year in 2019. Our visitor attendance increased by 250, but more impressively, our offsite contacts increased by thousands with the increased participation in community events. The SST season proved to be the busiest time of the year. The Hatchery in the Classroom Program (HIC), is a program organized by the IDFG and the Lewis Soil Conservation District. HIC is a program where schools are provided eyed SST eggs and hatch and rear the young SST for a brief period and then participate in a release of the young SST in a coordinated release back into the Clearwater River Basin during a fun-filled educational event called Release Days. This program allows the students to better understand the role of the hatchery by taking part in a short-term propagation effort including the opportunity to release the fish in similar fashion to how it is done at the hatchery. DNFH staff provided eyed eggs, assistance with egg deliveries, aquaria, chillers, equipment, tank setup instruction and maintenance, educational materials, dissection instruction/fish and other educational information as requested. The season wraps up with the release of smolts they raised. Dworshak attended both release days on May 15 with release into Liberty Creek for Lewis Soil conservation District and May 20-23 into the Clearwater with IDFG.



Release Days at Spaulding park, 2019



Volunteer Cynthia sharing knowledge, 2019

During SST spawning, approximately 25 schools brought their students for tours to view spawning. All tours were provided by Staff and volunteers.



Volunteer Tom giving a tour, 2019.



A large class visits DNFH for a tour during Steelhead spawning in 2019

The Outreach and Visitor service activities at DFC continue to rely heavily on the volunteer program. Volunteers lead the majority of the on-site guided tours, and participate in educational outreach programs and curriculum development. In addition, the volunteers round out the spawning crews for SCS and SST spawning, and assist with smolt releases.

The NPT partners with the DFC at Tunnel Pond for the Annual Kids Fishing Day, the Veteran's Fishing Day and The Idaho Department of Corrections Red Shirt Inmate Fishing Day. Tunnel Pond is conveniently located on the Nez Perce Tribal Reservation just outside the city limits of Orofino along the Clearwater River. This year, April 26th, 150 attendees, both adults and children, traveled by scheduled shuttle bus to Tunnel pond where activities and crafts were provided by 12 partnering organizations. A new "passport" system was integrated this year to encourage kids to visit the booths prior to fishing. Food was offered for sale by the Tiwiipu Center and Dworshak employees and volunteers provided personnel for assistance, gear and fish cleaning services. The kids were also provided a bag to carry all of their goodies home, including their fish on ice with recipes for proper food preparation.



Kids Fishing Day, Tunnel Pond, 2019

The Veteran's Fishing Day was held May 29th and was a huge success as always seems to be the case. The hatchery staff, along with volunteers and the local VFW provide on-site assistance with fishing and clean the Veteran's catch for them so they can enjoy their freshly caught trout dinner. Brookdale Senior center transported 4 veterans by bus and the weather was great.



Frank Mullens, IFWCO,
with a Veteran, 2019

Volunteer Roger Meyer, carrying a cleaned fish, 2019

The pond was also utilized on May 18th by Idaho Corrections for their Red Shirt Fishing Day. This day offers inmates who have demonstrated good behavior the opportunity to spend a day fishing with their families. A new program, the amount of inmates fishing doubled from last year and, as with the other days of fishing offered, Dworshak Supplied fishing poles, while the NPT offered the use of Tunnel Pond. Bait was donated for all of these outreach fishing events by the "The Guide Shop" of Orofino, Idaho.



This year was the first annual Family Spawn Day. Six youth, related to hatchery personnel, received first-hand experience of hatchery life. The youth were briefed on the many occupational choices in fisheries, were provided tours of DNFH and KNFH, and participated in spawning of SST. Many of the participants were small children and adults who had never fished before.

The Idaho Youth Challenge Academy (IDYCA) based in Pierce, Idaho is a part of the Idaho National Guard. The IDYCA targets high school dropouts. The primary focus of the IDYCA is academic intervention with additional emphasis in providing structure and discipline for these youth to become productive, responsible adults upon graduation. Each cadet is required to complete "Service Hours" in order to fulfill the requirements of the program and successfully graduate from the academy. The IDYCA works in coordination with the DNFH enabling the cadets to participate in a variety of projects at the DNFH ranging from fish culture to landscaping for the mutual benefit of the IDYCA, the DNFH and most importantly the young cadets.

DFC Outreach is dedicated to bringing fisheries education as well as new and fun activities to the community. In addition to hosting the above events we often partner with other organizations and attend external events, including: College and High School Career Days (Orofino High School, Colton HS, Lewis Clark State College), Orofino Elementary School Health Fair, Hells Canyon Environmental Days, Orofino Nature Days, School Field Days (Kooskia), 6th grade forestry tour, Salmon and Steelhead days in Boise, the Clearwater County Fair (Display booth), and the "Parade of Lights" Christmas parade in Orofino; where Staff and volunteers decorated the fish truck with lights, while staff and family walked to hand out candy.

Finally, this year, the use of Social Media was ramped up greatly to promote DNFH and reach our followers with useful information, weather, local events and finally fish returns and spawning information. Our virtual reach was thousands, with an increase of likes on our page by 500 plus to assist with information regarding our mission and function. In the summer, the DFC Education and Resources Facebook group was launched and is directed towards providing the understanding of the species of fish raised at the DNFH. There are also numerous lesson plans, coloring pages, word searches and the like. The idea behind this page was to add a supplement to teachers for the HIC to serve as teaching aids to for the HIC teachers and homeschoolers while reducing the paper footprint.

APPENDIX 1. SIGNIFICANT CHANGES IN OPERATIONS AND MAINTENANCE.

Year	Description	Explanation of Change and/or Impacts
1982	SCS Production added via LSRC Program	SCS production in 30 raceways was added to the production program at DNFH to target the adult return goals of the LSRC Program of 9,135 adults back annually
1982	IHNV at the hatchery	This is significant as it was the first year that IHNV was detected at the DNFH.
1992	Addition of Reservoir water supply along with CFH coming on-line	Reservoir was incorporated into the DNFH hatchery for egg incubation and for Nursery rearing. This was critical for managing for IHNV as it provided a “disease free” water source for early rearing of SST which had been impacted severely by IHNV.
2008	Heathro Fish Pump is purchased to move fish from the Nursery into the tagging/marking trailer	The hatchery staff previously netted all of the fish from Nursery tanks into a portable tank on the forks of a forklift. The forklift transported the tank and fish to the tagging trailer and then drain the tank into the holding tanks in the tagging trailer. Pumping the fish directly to the tagging trailer reduced stress on the fish, reduced physical labor demands on staff. Much better for the fish and much safer for the crew.
2009	Dr. Rachel Breyta, USGS identifies both the U-Clade and M-Clade IHNV at DNFH.	Due to extremely high mortality in SST resulting in the loss of over 500,000 juveniles in the BY 2008 SST and DNFH producing ~55% of the target for the BY 2009 the Idaho Fish Health Center initiated and coordinated the additional research to better our understanding of IHNV. This research has filled an information gap which has enabled DNFH to manage around IHNV and successfully meet full SST production targets since 2010.
2009	Nursery Roof and Towers Installed	The Nursery Roof was failing (i.e. leaks, structural integrity) and the Towers were designed to reduce Total Dissolved Gas (TDG) for the reservoir water supply which is often heated (which increases TDG)
2009	Generator 3 replaced with Detroit Diesel 500 KW Generator	The original generator had failed in 2008. A Temporary portable unit was rented for a period and then the facility was without any backup generator power for the main river pump supply. Essential piece of reliable equipment for DNFH.
2010	CFH initiates South Fork Localized Broodstock Development Effort	Up to 50 pairs of angler collected SST are brought into DNFH and spawned for production for the CFH for later release back into the South Fork Clearwater River
2010	Discontinued the use of reuse for Systems I, II and III	By design, DNFH operated on a 90% recirculation system. Bio-filtration to address the unionized ammonia build up was/is required for water “reuse” at >70%. Ich (parasite) and IHNV were readily spread throughout system BPs as a result of continued use of “reuse”. Reuse also provided the

		<p>opportunity to heat water via the boiler/heat exchangers to enable the SST to achieve target size. Reuse operations were terminated timely with the water modifications to utilize reservoir water in system I as SST were moved out of the Nursery. The use of reservoir water improved SST growth in alignment with photo-period.</p>
<p>2010</p>	<p>Reservoir Water Capability added to System I BPs on a limited seasonal basis</p>	<p>In order to minimize the risk of infection with <i>Infectious Hematopoietic Necrosis Virus</i> (IHNV), an effort was made to utilize reservoir water rather than river water for early outside rearing of SST. There were multiple ongoing hatchery modifications/improvements to utilize reservoir water in System I. Water treatment includes fabrication and installation of a vacuum degassing system for the reservoir water to eliminate gas supersaturation which is common in the reservoir water supply line, modification to the System I reuse, and a variety of plumbing changes. A “Hot Tap” was completed connecting the reservoir water supply line into the System I reuse line. The result of these modifications provides reservoir water to the BPs in System I. These efforts hinged heavily on the cooperation of CFH staff to communicate and coordinate the water needs and use of both facilities. We were able to run reservoir water exclusively in System I through August and then blended river and reservoir water in System I on September 1st as the CFH water needs increased. This first year of reservoir water operation in System I was a learning experience with high success as IHNV did not occur in System I until after river water was blended on September 1, 2010. Approximately 10,000 GPM of reservoir water was run in System I for a peak reservoir water flow. This allowed us to utilize 17 of the 25 ponds in System I. Additional discussions are ongoing to increase the volume of reservoir water to DNFH and not negatively impact the CFH operations. Additional plans have been compiled by PR Aqua to convert all of System I and II to circular tanks with 75% reuse including mechanical aeration and CO₂ stripping. At this level of reuse, biofiltration is not necessary. IHNV has impacted survival of the B-Run SST resulting in unmet production targets. The System I Reuse line was interconnected with the Reservoir water supply line which allowed the SST to continue to be reared on reservoir water in System I (following rearing in the Nursery) rather than being exposed to the pumped North Fork River Water supply where adults were “shedding” IHNV into the water supply feeding all of the BPs, raceways and holding ponds. The SST rearing strategy was to increase the size of the fingerlings target 60 fish per pond as well as a temporal goal of not exposing these fish to river water until after all adult SST</p>

		<p>spawners were out of the river. Increased size at the time of exposure was a benefit due to the increased immune system development of the fingerlings with size and the timing of exposure being delayed to minimize the exposure to IHNV. SST fingerling exposure to river water typically occurs in late June or July rather than early May while SST adults are still present in the river. Typically, the adult SST sampled for IHNV (carriers) associated with spawning in April is often 60-70%. Another benefit of the reservoir water capability for System I is the water temperature benefit. The CFH controls and manages the primary reservoir water supply line. This line is utilized to pull the warmer water (targeting 52-58°F) for fish production. This is also a benefit to DNFH as we are able to continue with water temperatures allowing for maximum growth during the summer months and therefore no longer need to utilize the reuse system and boilers to achieve growth to meet target stocking size. In 2006, DNFH used 46 million KWH of energy to operate the facility. Current electrical consumption ranges from 20-22 million KWH of energy to meet production targets. This includes increases in SCS and coho salmon production.</p>
2010	Vacuum Degassers installed for Reservoir water use for System I BPs	<p>Simultaneously with the reservoir water supply modifications, the hatchery Maintenance and Production crews combined forces to install vacuum degassers on the System I reservoir water system. The old packed columns were removed as they were needed for aeration after reuse to restore oxygen levels to the water; however, vacuum degassers were the appropriate technology to address elevated TDG in the incoming reservoir water line.</p>
2010	Vacuum Degassers installed on Raceways A1-15	<p>Vacuum Degassers were installed on the "A Bank" Raceways to remove Nitrogen gas as a result of high TDG associated with Dworshak Dam discharge and "spill". The effort focuses on improving water quality for the SCS and reducing the risk of Gas Bubble Disease and secondary infections associated with compromised Chinook fingerlings.</p>
2010	Vaki Micro Fish Counter purchased	<p>The Vaki Micro Fish Counter improved fish culture operations by reducing stress on the fish during splitting and fish inventorying procedures. All attempts to reduce stress to the fish and keep current with the best fish culture methods to produce a quality product. Previous methodology utilized netting and weighing the fish which increases the stress to fish by handling them, weighing them on a scale rather than the fish never leaving the water through the use of Heathro Fish Pumps and computerized enumeration.</p>
2010	IHNV in the Nursery	<p>Low levels of IHNV detected in the Nursery. Since the Nursery is operated on reservoir water since the early 1990s,</p>

		staff tightens up bio-security with footbaths and heightened biosecurity protocols.
2010	Installed Oil Deflection Boom in front of the Main Pump House Intake	Preventative measure given there have been a couple of oil contamination incidents associated with maintenance at the Dworshak Dam.
2011	DNFH Rehabilitation Study Initiated	The COE initiated the Rehabilitation Study for DNFH. Plan for completion in FY 2012. CH2MHill completed design work for the effluent system relative to the NPDES compliance issues dating back to the 2007 Notice of Violation. CH2MHill incorporated this into the design in the Rehab Study.
2011	Installed a new formalin drip system for treating egg in incubation	The old egg treatment system had reached its lifespan. It was replaced with a new system utilizing newer technology. The system was installed by hatchery staff.
2011	IHNV in the Nursery	SST Take 1 in the Nursery tested positive for IHNV. The cause was later identified as one of the original river water hose valves (not labeled) which exposed the young fish to IHNV. A portion of this take was euthanized in the Nursery, the remainder was moved into System I and eventually euthanized as mortality increased and the decision to protect the greater population imperative.
2011	Federal Facility Compliance Agreement (FFCA) developed	DNFH along with the EPA and COE developed the FFCA to map the route for DNFH to achieve NPDES compliance.
2011	Incubation Capability Doubled from 870 trays to 1,740 trays	Incubation and Nursery Expansion and Operational Modifications – Because the hatchery had a limited number of vertical incubator stacks available, influent temperatures to the incubator stacks had to be increased to accelerate the development of the SST eggs so that the incubators could be used multiple times during a single season. Not only did this make the logistics of the incubation program more difficult, the need to increase the temperature of the incubation influent water resulted in a huge electrical demand on the hatchery boiler system. An in-house operational program review by DNFH staff identified that a different temperature profile could be used advantageously throughout incubation and the nursery rearing phase from both a fish culture and energy efficiency perspective if the hatchery could procure and install 58 new double-stacks of vertical incubators. The cost of the incubators was approximately \$130,000 plus the plumbing modifications necessary to support the installation. The DNFH staff installed all plumbing components and all of the new incubators. As a result of

		these planning and installation efforts the electrical demand of the DNFH boiler system has been reduced by over 5,500,000 kWh/year.
2011	Replacement of Nursery water supply line from Mechanical Building II enroute to Nursery Head Tank.	Replacement of Nursery Water Pipeline and Modifications to Original Infrastructure – The original nursery water delivery pipelines were installed almost 4 decades ago. Since this time the flow requirements of the system to meet hatchery production demands have significantly increased while corrosion of the steel piping has reduced the interior diameter of the piping and further increased the pumping energy requirements of the system. The result of the piping being undersized by design and corrosion was an almost 3-fold increase in the energy necessary to deliver the amount of water needed by the program across the hatchery campus when compared to a properly sized piping distribution system. The heavy pipe corrosion levels also placed the hatchery nursery water supply at risk of failure. A new HDPE pipe was installed to replace the original steel pipes. Modifications to remove components of the original system that added additional pumping power demands were also performed at this time by the hatchery maintenance staff. The anticipated reduction in energy demand for these efforts is approximately 600,000 kWh/year.
2011	Installation of VFDs for multiple pumps at the hatchery	Installation of Variable Frequency Drives on Hatchery Pumps (Pump #5 Main Pump House, Pump 1 System I Pump House and Pump 1 in Mechanical II Building) – Several systems at the DNFH provided opportunities to reduce pumping costs through the installation of Variable Frequency Drives (VFD's) to reduce electrical demand when the full output of the pump was not required. The first VFD was installed on a new 200 hp river water pump at DNFH. While three VFD units have been purchased, it is estimated that this first installation alone will save almost 700,000 kWh/year and have a payback of approximately six months. The VFD for nursery water delivery pump in Mechanical II will be installed by hatchery maintenance staff next month. The third VFD will be installed on the 16" System 1 reservoir

		water supply pump following its resizing for optimization in May.
2011	System I Pump #1 Bowl Assembly Upgrade	The estimated delivery date for the new pump bowl assembly for the 16" System 1 reservoir water supply pump is the last week of April. Once the new assembly arrives, DNFH maintenance staff will remove the existing pump and perform all necessary modifications. The original pump utilized a 125 hp motor and was sized to deliver a flow rate of almost 5,000 gallons per minute to the System 1 biofilter system. Because the biofilter is no longer in use and the piping has been re-routed to the vacuum degassing system that was installed in 2010, the head requirements of the pump have been decreased by almost ½. As a result of this pumping head reduction, an optimization of the pump bowl components will allow the rebuilt pump to deliver up to 10,000 gallons per minute of reservoir water. The pump will utilize a new VFD rated 150 hp motor to do so. The new VFD on the pump will allow staff to more easily adjust the System 1 reservoir flow rates to desired levels. It is estimated that this project will reduce DNFH electrical consumption by an additional 840,000 kWh/yr once completed.
2011	Replacement of Bird Netting for System BPs.	The 4 inch bird netting had deteriorated, been damaged by the November 2010 wind storm. Bird netting was purchased and installed by hatchery staff to restore protection from larger avian predators (e.g. Great Blue Heron).
2011	Chinook Release Pipe Replaced	The original Chinook release pipe didn't make a gradual descent to the river level and therefore, the fish dropped up to 35 feet upon release depending upon the elevation of the North Fork Clearwater River at the time of fish release each year. The new pipe (HDPE) provided a fish friendly material and allows the fish to be released just above the river water's surface.
2011	Mechanical Building II Boiler Controls	Due to safety issues, the 4 boilers in the Mechanical II Building were repaired. Boiler controls were moved away from the boiler electrical panels and relocated outside the "Arc Flash" zone. A new system controlled with a PLC was installed. Wes Ketchum, Infinium Engineering provided operational training to staff in January 2012.

2012	Replaced Bird Netting over Raceways	The 4 inch bird netting was deteriorated and was replaced.
2012	No IHNV in the Nursery	The IHNV detected in 2011 and the valving issue was successfully addressed and there was no IHNV in the Nursery in 2012.
2012	Primary Reservoir Water Supply Line Collapses in the reservoir on August 15, 2012.	<p>On August 15, 2012, the water temperature coming from the reservoir dropped in an instant. In short order, we were notified by our neighboring hatchery of the failure of the water supply line from Dworshak Reservoir. A genuine crisis unfolded. Although the water continued to flow, there was great concern over the water supply's reliability, integrity of the damaged infrastructure and available expertise to repair it. Very quickly, the DNFH, CFH staff, NPTH staff, COE, and Environmental Protection Agency (EPA) put plans in place to move 2.5 million SCS from the CFH to DNFH. The fish were moved successfully and reared until distribution/release in March, 2013.</p> <p>As a result of this crisis, hatchery operations were changed and infrastructure modifications were made resulting in the hatchery's ability to "treat" all cleaning waste from System III. This effort included a piping interconnect, removal of plastic media in System II and the installation of submersible pumps. These efforts resulted in the EPA review and support for the increased production and long-term increase in production based on water quality samples.</p> <p>2.5 million SCS were transferred to DNFH and reared in 25 BPs in System III. Additional secondary reservoir water was provided and utilized on SST in System I to allow DNFH to allocate additional river water to System III for the increased water needs in System III.</p> <p>Final repairs were completed in November, 2012.</p>
2012	Chiller 1 installed in Mechanical Building I	The old chiller adjacent to the Incubation Room experienced multiple failures and was no longer reliable and not meeting the operational water temperature requirements for the Chinook egg incubation. It was replaced with a new chiller.
2012	DNFH Rehabilitation Study Continues	The Rehab effort experienced delays, but the Rehab report is expected to be finalized in FY 2013.
2012	Access Bridge was downgraded relative to weight limits	This resulted in 2 seasons of unique fish transport since the tractor/trailer units exceeded the new rating. Tankers and fish were loaded with reduced loads. Water was reduced in the trailers to meet the weight requirements. The tractor/trailers were driven over the bridge to the main aeration where the water level was filled prior to transport.
2012	2-200 HP Pentair pumps installed in	These pumps are high efficiency, propeller style pumps and because of the how they operate, they do not cause

	the Main Pump House	cavitation and do not entrain gas like the vertical turbine style pumps. Funding for pumps provide by BPA through the Energy Smart Program
2013	Main Aeration Degassers installed on half (West half) of the system	Due to cost and funding, half of the Main Aeration Vacuum Degassing Project was completed. Vacuum degassing more effectively removes the Nitrogen component from the water. The hatchery maximizes the vacuum degassing benefit by utilizing the portion of the system which is completed when not utilizing all 6 main river pumps.
2013	Installation of Chiller #2 in Mechanical Building I	A second chiller was installed in Mechanical Building I to serve as a backup for Chiller #1 in the event of maintenance requirement or failure. Installation initiated in December, 2012.
2013	8 Nursery tanks were replaced with 4 longer tanks with 50% reuse capability	A BPA project to save energy by reusing 50% of the heated (reservoir) Nursery water. This concept has the potential to maximize the limited reservoir water
2013	New roof installed on the older portion of the Fish Health Building	Roof had deteriorated to a point where it required replacement
2013	Generator #4 Installed	The additional 500 KW generator was installed in December. This increases main river pumping capability from 2 to 4 pumps providing sufficient water for life support in the event of a power outage.
2013	200 HP Pentair pump was installed in the Main Pump House	This was the 3 rd Pentair 200 HP Propeller style pump installed.
2013	Supernatant pumps installed on the System II and III	The reuse biofilters for Systems II and III were retro-fitted, all of the plastic media in System II and the Koch ring media in System III was removed allowing these 10 chambers (combined total for both systems) to be utilized for solids settling for burrows pond cleaning activities to address NPDES requirements and FFCA criteria.
2013	DNFH Rehab Study with Condition Assessment Continues	Hatchery staff provided input on infrastructure and assets throughout the facility relative to condition resulting in condition assessments linked to facility rehab.
2013	Painted Raceways with the 2 part epoxy paint	All 30 raceways were painted with the 2 part epoxy paint to protect the concrete, improve the fish culture rearing environment and ability to clean raceways.
2014	3-200 HP pumps delivered in May, 2014	Installed in our low period of water use as planned; however, all 3 pumps were built with the opposite rotation based on the motor rotation and were damaged upon initial startup and testing.
2014	3 Pentair Pumps sent back to Kansas City	The 3, 200 HP Pentair Impeller style pumps were sent back to Pentair. The pumps were cast for the wrong rotation and caused damage to all 3 of the newly installed pumps.

	for repairs (June 2014)	
2014	1 Pentair Pump returned to DNFH and installed	1 of the 3 Pentair pumps was returned and installed while the other two pumps continued with repairs and testing to ensure they met all of the pump specifications.
2014	Electronic Water Control Valve installed in Mechanical Building I.	This valve automatically controls the reservoir water supply to the Mechanical Building I sump which in turn supplies water for incubation of eggs. Prior to this valve, all adjustments were done manually and this water supply is impacted by all other water adjustments which resulted in regular alarms where manual corrections had to be made. Eliminating alarms and reduced risk to eggs in incubation on heated or ambient water being pumped from Mech I Building.
2014	Bridge Removal	The access bridge was removed due to reduce (inadequate) weight restrictions and replaced with an "at-grade" crossing. New asphalt and curbing were installed along with an electronic gate with a security code
2014	Shadecloth over "B Bank" Raceways	A 70% Shadecloth was installed over the "B Bank" raceways during the spring, summer and early fall to provide direct sunlight relief to the SCS. The shade cloth is taken down in October prior to winter snow to avoid potential damage to the shade cloth and metal support structure.
2015	Shadecloth over "A Bank Raceways	A 70% Shade cloth was installed over the "A Bank" raceways during the spring, summer and early fall to provide direct sunlight relief to the SCS. The shade cloth is taken down in October prior to winter snow to avoid potential damage to the shade cloth and metal support structure.
2015	East half of the Main Aeration vacuum degassing system was installed	This provided 100% vacuum degassing for the Main Aeration and completed the project. The west half was installed in 2013.
2015	Electrical conductor feeding the Mechanical II Building failed	A temporary above ground line was fed from Mechanical II to HCQ10 to provide power to meeting Nursery Pumping needs for the 2016 and 2017 Nursery rearing cycles. The conductor to vault 13 and 20 failed in November 2015. Fortunately this occurred when the Nursery was NOT in operation.
2016	Pentair pumps which were sent back to Pentair in 2014 were shipped back to DNFH in April and installed in May	Pentair pumps installed, tested and eventually approved meeting the pump output criteria, efficiency specifications and function. 1 pump had a wobble in the shaft/motor, but was repaired per warranty.
2016	50 HP Fire Maintenance Pump Installed	This pump provides Fire Maintenance water at a greater rate than the two smaller pumps meeting the water demands of critical equipment such as the Traveling Water Screen in the

		Main Pump House, other routine uses and for the 200 GPM needed for the Kelt Reconditioning Research on station.
2016	Juvenile Fish Transportation Trailers located at the hatchery rather than at the COE	Storage location and maintenance responsibilities transferred from the COE to the hatchery with the exception of the Refrigeration units which are utilized by the COE will remain their responsibility relative to routine and PM.
2016	Metal equipment storage building added between System II and III BPs	A metal storage shelter was erected provided weather protection and storage space for fish pump hoses and piping, pond scrubber and other miscellaneous equipment routinely used for fish culture.
2016	Bar grating replaced in the raceways	The old gripstrut was 12 inches and didn't meet OSHA requirements. All of the walkways were replaced with 18 inch nominal width Bar Grating to address the safety need.
2016	Raceway mud valves were replaced	The old valves were a safety issue as they would spin open or close when making water adjustments. The replacement valves are a different style that operate similarly, but within the control of the operator. The valve seals much better than the original valves which reduces leakage to the sump facilitating more efficient and compliant cleaning operations.
2016	PLC Replaced for Alarm System	PLC was replaced due to concerns of failure. This is an interim measure ahead of the entire Alarm System being replaced.
2016	Aqui-S incorporated as the anesthetic for Chinook Salmon spawning	CO ₂ was often used or MS-222 was used to anesthetize SCS adults for spawning. Due to higher mortality associated with the use of CO ₂ during spawning and the 21 day withholding requirement for MS-222, Aqui-S becomes the new anesthetic for spawning SCS. CO ₂ is still utilized during the earlier season sorts prior to spawning. Aqui-S is utilized at the onset of spawning and throughout.
2016	CFH-South Fork Broodstock Collection includes Red House Production at DNFH	CFH strives to obtain all of its broodstock from the South Fork Clearwater River via angler efforts to develop a localized broodstock. DNFH agrees to assist and incorporate fish collected from the South Fork Clearwater River into the groups (i.e. egg takes) for the DNFH production that will be reared and released at the Red House location on the South Fork Clearwater River. Shortfalls for the DNFH needs for the Red House Releases are backfilled with DNFH Fish via the Dworshak fish ladder
2016	<i>Phoma herbarum</i> diagnosed in the BY 2015 SCS	For the first time, <i>Phoma herbarum</i> was detected at the DNFH. This is a fungus typically associated with plant materials in the water supply. Mortality declined to normal levels after marking in August/September 2016.
2017	Bio-Oregon: Bio Pro feed used during the transition of SST from	This specialized feed is for stressful events such as water changes, handling events, etc. This feed has been utilized and in 2017, no IHNV was detected in SST.

	reservoir water to river water	
2017	Nursery lighting converted to LED lighting	Energy efficient lighting was installed in the Nursery. The existing lighting control system installed in conjunction with the Nursery roof project is still in operation and aligns lighting periods in the Nursery with the natural photoperiod.
2017	Formalin Building installed and plumbed	A Formalin Building for treating adults in the Holding Ponds was completed. This address' safety issues of handling the formalin, carrying car-buoys on walkways
2017	Log Boom replaced in front of the Main Pump House Intake	The COE and staff from the Fish and Wildlife Conservation Office and DNFH removed the old log boom and replaced it with a new log boom to keep heavy debris from drifting into the bay for the Main Pump House intakes.
2017	Conductors from Generator I building to Mechanical Building II and vault 13 were replaced by COE and Hatchery staff	This work restored safe functionality of electrical that was lost in November 2015 resulting in electrical lines temporarily routed above ground for two nursery rearing cycles.
2017	Maintenance Storage Building Installed	This building provides protection for the Genie Manlift, Backhoe, Utility truck and other equipment and shipments at the facility.
2017	Vacuum Degassers for the "A Bank" Raceways were removed	Ahead of the installation of the new Low Head Oxygenators, the degassers were removed.
2017	Low Head Oxygenators (LHO) were installed on the "A Bank" Raceways	LHO's provide increased oxygen levels and drive off the Nitrogen during high gas "Spill" operations resulting from flood control operations from Dworshak Dam.
2017	No headscreens in the "A Bank Raceways. This was in conjunction with the addition of the LHOs	The decision was made not to use headscreens in the "A Bank Raceways" with the addition of the LHOs. No plugged up screens to clean which also mean increased water reliability to the SCS in the "A Bank Raceways". Since serial reuse is use for the latter part of the rearing cycle, it also means increased water reliability via serial reuse water to the "B Bank Raceways"
2017	BY 2015 SCS pumped into the Clearwater River due to high TDG in the North Fork Clearwater River	Unit 3 in the Dworshak Dam was off-line for maintenance and therefore, a larger proportion of the Dworshak Dam discharge was passed via "Spill" which resulted in North Fork Clearwater River TDGs up to 125-126%. Although LHOs were installed which solved the TDG issue in the "A Bank Raceways", it was decided to pump the Chinook smolts into the Mainstem Clearwater River rather than releasing them into the North Fork Clearwater River and into the extremely high TDG levels.

2017	BY 2016 SST released early due to high TDG resulting from Dworshak Dam "Spill"	Unit 3 in the Dworshak Dam was off-line for maintenance and therefore, a larger proportion of the Dworshak Dam discharge was passed via "Spill" which resulted in North Fork Clearwater River TDGs up to 125-126%. TDG in the hatchery BPs reached levels up to 106% and therefore, co-managers agreed to release fish early to minimize exposure to this level of TDG.
2018	Low Head Oxygenators (LHO) were installed on the "B Bank" Raceways	LHO's provide increased oxygen levels and drive off the Nitrogen during high gas "Spill" operations resulting from flood control operations from Dworshak Dam. With all 30 LSRCP Raceways equipped with LHOs, the hatchery has much greater flexibility in providing excellent water quality to the SCS regardless of water quality from the pumped North Fork Clearwater River water river. The LHOs also provide incredible water conservation when power outage occur in addition to the original justified benefits associated with the purchase.
2018	No headscreens screens used in the "B Bank" raceway headbox area and the serial reuse valves were plumbed with a standpipe	Along with the addition of the LHOs in the "B Bank Raceways", the decision was made to eliminate the use of headscreens. This is one less screen to plug up with algae/moss and with the standpipe added for the serial reuse line, this met the need to keep fish from entering the reuse line.
2018	Raceway flanges for solid standpipes for serial reuse	PVC flanges with gaskets were installed in the "B Bank" Raceways to facilitate a tight fit for PVC standpipes. The benefit of this is that fish cannot get into the interconnecting piping between the headbox of the "B Bank Raceways" and the tailbox of the "A Bank Raceways". This modification eliminated the need for headscreens in the "B Bank Raceways". No plugged up screens to clean which also mean increased water reliability to the SCS in the "B Bank Raceways".
2018	System II Burrows (all 25) Ponds and System III BPs (i.e. 52, 54, 56, 58 & 68) Resurfaced with skim coat and 2-part epoxy paint	Due to severe concrete deterioration, the COE funded a direct contract to coat and paint a total of 30 BPs. Benefits of this project are protecting the concrete structures along with improved rearing conditions for the fish with no areas where feed and waste can accumulate in the old concrete aggregate. The factors reduce risk of bacteria, parasite and disease as the ponds are much cleaner. We did experience some problems with the paint chipping off on several of the ponds. Cascade Industrial Services will return in the spring of 2019 to re-coat/repaint in accordance with the Contract Warranty.
2018	Adult Formalin Treatment System for the Holding Ponds	An enclosed, pumped (Masterflex Pumps) system was installed and operated to provide formalin treatment for Holding Pond 1, 2 and 3. This eliminates filling and manually carrying large quantities of formalin out on walkways over

		deep water areas to administer chemical treatments. This pumped system has much greater precision providing uniformity in chemical application. Better treatments and multiple safety items addressed.
2018	Demand Feeder Mechanisms Replaced with a newer style and system	The old disk style demand feeder mechanisms were worn out and causing feed waste and multiple feeder dumps. The new style mechanisms were tested on a few demand feeders in 2017 and full implementation of these new mechanisms were incorporated in 2018
2018	Continued use of Bio-Oregon Product BioPro feed for SST	Second year in a row with no IHNV in SST.
2018	Alternate SST Trapping Plan at DNFH.	<p>This year an alternative trapping plan was instituted to ensure availability of broodstock for Dworshak late SST takes 8, 9, and 10, and to work towards providing MVH with up to 300 females.</p> <p>NORMAL TRAP SOP</p> <p>Normally the DNFH trap is opened 5-7 days in advance of each egg take to collect adults for each spawn. So DNFH late takes and MV take would require three trapping sessions beginning approximately March 15, March 20, and April 3.</p> <p>ALTERNATE TRAP OPERATION PLAN</p> <p>This year we opened the North Fork trap around March 1st to trap the entire complement of adults needed to supply the total Dworshak late take and MV take egg needs. This was up to 476 females. In order to minimize the risk of held females becoming 'overripe' all ripe females were spawned on March 20. Remaining green females were placed back into the holding pond for spawning on March 27.</p> <p>Spawned green eggs were placed in incubation at three different temperatures. (Primary 54F, Primary 54F blended w secondary or chilled, chilled) in order to create three distinct groups (takes) of fry for procession through the DNFH nursery and subsequent tagging operations. MVH eggs will be placed on incubation temperature which best meets the needed development timelines for MVH program.</p>

2018	BY 2017 SST released early due to high TDG resulting from Dworshak Dam "Spill"	Unit 3 in the Dworshak Dam was off-line for maintenance and therefore, a larger proportion of the Dworshak Dam discharge was passed via "Spill" which resulted in North Fork Clearwater River TDGs up to 125-126%. TDG in the hatchery BPs reached levels up to 106% and therefore, co-managers agreed to release fish early to minimize exposure to this level of TDG.
2018	BY 2016 SCS pumped into the Clearwater River due to high TDG in the North Fork Clearwater River	Unit 3 in the Dworshak Dam was off-line for maintenance and therefore, a larger proportion of the Dworshak Dam discharge was passed via "Spill" which resulted in North Fork Clearwater River TDGs up to 125-126%. Although LHOs were installed which solved the TDG issue in the "A Bank Raceways", it was decided to pump the Chinook smolts into the Mainstem Clearwater River rather than releasing them into the North Fork Clearwater River and into the extremely high TDG levels.
2018	SCS green eggs from the Little White Salmon NFH are transported to the DNFH, CFH and NPTH to meet Clearwater River Basin shortfalls	Due to low adult returns in the Clearwater River, co-managers work together to obtain additional SCS eggs to meet the basins collective egg targets to fulfill production goals
2018	Hand feeding the youngest SST takes (extruded steelhead feed-Skretting) to increase growth to achieve size target at release.	The youngest SST takes were fed the extruded feed by hand in addition to utilizing the demand feeders to maximize growth to enable these fish to reach the size range required to achieve smoltification/out-migration.
2019	Bio-Olympic (Bio-Oregon) feed was no longer available after the BY 2017 fish were released. Bio-Pro Feed used in the final stage of Production	Bio-Olympic feed was utilized following the use of Bio-Vita for years. This feed will no longer be available, so an alternative feed type will need to be utilized for the later growth of these fish. Bio-Pro Feed has been utilized at the tail end of the production cycle prior to release based on the added benefits of this specialty feed for the fish to deal with the additional stressors and changes associated with smoltification and release prior to the journey downstream

2019	FWS to purchase PIT Tags rather than the COE	The FWS will purchase PIT Tags and the funding for SST will come from the COE in a separate Military Interagency Purchase Request (MIPR) along with fish feed with a 6% Pass Through Indirect Rate assessed. The Primary MIPR will continue to be assessed at the 26.1% rate.
2019	SST Take 10 held in the Nursery longer to try to achieve great growth	Since the Nursery water supply includes the ability to receive heated water from Mechanical II Building (Boilers/Heat Exchangers), Take 10 was split into additional Nursery tanks to reduce the density index and to allow these fish to remain on heated water rather than being moved into System I BPs on ambient reservoir water. By the time Take 10 is of size to be moved from the Nursery, a blend of primary and secondary water must be used at DNFH to meet the water demands for the Nursery and System I (CFH's water demands have increased to the level where the primary reservoir water supply is limiting). Heating water for the Nursery at this time of year yields approximately 4°F increase in comparison to System I BPs. Although this seems to be logical, the crew found no statistical difference in growth rates between Takes 9 and 10. There are no plans to repeat this in 2020, since this effort has been attempted previously without achieving increased growth.
2019	SST Takes 1 and 2 transferred earlier into BPs	To free up space in the Nursery to allow the youngest SST takes to begin the growth phases (on feed), Takes 1 and 2 were moved from the Nursery to the System I BPs earlier. Historically, SST have been moved from the Nursery in conjunction with the marking crews efforts to adipose clip and CWT these fish. Due to this, the schedule for moving fish out of the Nursery was set by a predetermined marking schedule. In 2019, moving Takes 1 and 2 out to the system I BPs reduces the density of the fish vs. if they had been kept in the Nursery tanks longer, provides increased flexibility by separating fish culture needs with a marking schedule and provides more "rearing days" to gain growth on the younger SST takes thus maximizing the opportunity for these fish to reach the target release size range to maximize out-migration after release. The marking crew performed adipose clipping and CWT out of BPs and put these fish back into other BPs maintaining the same quality of marking and inventorying. The DNFH crew and marking crew discussed this and it works well from both the rearing and marking aspects. This effort may be expanded to improve the rearing options FY 2020.

2019	Hand feeding the youngest SST takes (Bio-Oregon, Bio Pro) to increase growth to achieve size target at release.	Expanding the hand feeding effort initiated in 2018, the DNFH crew fed a better quality feed (Bio-Oregon Bio Pro) with increased conversion rates to maximize growth to enable these fish to reach the size range required to achieve smoltification/out-migration. The current group of fish (BY 2019) will be released in the spring of 2020 at which time final size data will be available to determine the effectiveness of this effort.
2019	Continued use of Bio-Oregon Product BioPro feed for Steelhead	Third year in a row with no IHNV in SST.
2019	Interconnecting Pipe from the Nursery supply line to System I. Idea to increase options per Adam Izbicki	The actual piping was not installed in 2019; however, a PVC pipe will be installed in 2020 and tested. This modification provides the opportunity to supply water from Mechanical Building II to the System I BPs in the event of electrical failure/generator failure/other. The initial impetus for trying this was to provide the ability to heat water in Mechanical Building II and utilize this warmer water to gain growth on the younger SST takes to increase growth to achieve the target release size of these fish.
2019	Steelhead scheduled for Lolo Creek were released at the Redhouse Release site	In April, 2019, the 200K steelhead scheduled for release at Lolo Creek were released at the Redhouse release site on the South Fork Clearwater River. This change was made due to the heavy snow load and inability to access the Lolo Creek release site at Eldorado Creek. No permanent change made regarding this release group.
2019	SCS Ponding and Cleaning Frequency	Historically, SCS were ponded in the middle section of the raceways using multiple screens. The smallest screen sizes are required for the fry and are labor intensive to clean due to their higher propensity to become plugged by organics and waste. This arrangement required additional screens to be cleaned and also left an empty section above the fish which was also routinely cleaned which resulted in "dirty" water being passed through the section of the raceway where the fish were located. In 2019, Jarrett Page suggested a change and it was implemented. The fish were initially ponded in the upper 1/3 of the raceway rather than in the middle section of the raceway. The fine mesh screen was installed and siliconed meticulously in the screen slot 1/3 of the way down in the raceway. This eliminated additional screen scrubbing, provided improved water and tank hygiene where the fish were being reared and reduced labor to maintain the raceways. The new standard enabled the crew to clean the portion of the raceways where fish were

		daily (5X/week; M-F) rather than every other day (3X/week; M, W, F).
2019	<i>Phoma herbarum</i> diagnosed in the BY 2018 SCS.	For the second time in DNFH history, <i>Phoma herbarum</i> was detected at the DNFH. This is a fungus typically associated with plant materials in the water supply. Mortality declined to normal levels after marking and transfer into final rearing ponds in September 2019. Additional discussions and timing modifications relative to ponding into the raceways from incubation will occur in 2020.
2019	Incubation formalin treatment system modified using large totes in the old chiller room	The incubation formalin treatment system was upgraded in 2011. This system is still in place; however, the old chiller room was modified to facilitate increased formalin storage and delivery to the incubation trays with containment. The system reduces handling and chemical transfers and isolates the storage of formalin thus minimizing safety risks associated with formalin use and storage.
2019	Lyon's Ferry SFH Fall and SCS transferred temporarily to DNFH due to water supply line repair at the Lyon's Ferry SFH	The Lyon's Ferry SFH experienced major electrical problems and also found a hole in their water supply. In order to make the repair and maintain full production, the spring and fall Chinook salmon were transferred to DNFH in May while the contractor made repairs to the water supply line. In August, all fish were transferred back. A summary with dates and numbers is included in the 2019 DNFH Annual Report.