

COLEMAN NATIONAL FISH HATCHERY ANNUAL REPORT

FISCAL YEAR – 2020



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COLEMAN NATIONAL FISH HATCHERY
ANDERSON, CALIFORNIA 96007



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INTRODUCTION

Located in California's Central Valley, Coleman National Fish Hatchery (NFH) is situated on the north bank of Battle Creek, a tributary of the Sacramento River. Coleman NFH was established in 1942 to mitigate for the loss of salmonid spawning habitat that ensued following the construction of Shasta and Keswick Dams on the Sacramento River. The hatchery is operated by the U.S. Fish & Wildlife Service (Service) and funded by the U.S. Bureau of Reclamation (USBR). The hatchery propagates four distinct runs of fish: fall Chinook salmon, late fall Chinook salmon, winter Chinook salmon, and steelhead. Annual production goals for Coleman NFH are 12 million fall Chinook salmon, 1 million late fall Chinook salmon, and 600,000 steelhead. In addition to these mitigation production goals, Coleman NFH has begun rearing winter Chinook salmon on a provisional basis as part of an effort to reintroduce the endangered fish to the Battle Creek drainage.

The hatchery is situated on 75 acres of land, and an additional 63 acres exist in perpetual easements. The hatchery has three water intake structures on Battle Creek, allowing for uninterrupted delivery of rearing water to the facility. Water treatment at Coleman NFH is accomplished through a combination of settling, filtration, and ozonation. There are 2 settling ponds that are used to reduce suspended solids prior to filtration. A four bay Dual Media Filter system capable of filtering 45,000 gallons per minute further reduces levels of suspended solids. The Ozone Treatment Plant is capable of treating 30,000 gallons per minute and greatly reduces the risk of fish pathogens being introduced into the facility.

The hatchery operates a barrier weir spanning the entire width of Battle Creek, capable of diverting fish through a fish ladder and into several large broodstock holding ponds. The Spawning Building contains a cross-channel equipped with a hydraulic fish-crowder connecting the primary holding ponds. A tower containing a vertical fish lift and an anesthetizing tank connects the cross-channel with the sorting area in the spawning building.

The facility has a combination of 28 15x150ft raceways and 30 8x80ft raceways for juvenile rearing. The Incubation Building houses hatchery incubation trays and early-rearing tanks. Other buildings on the property include: The Administration Building, Shop Building, Vehicle Storage Building, Fabrication Shop/Maintenance Building, Feed Storage Building, 3 Residences, Chiller Building, and the Emergency Generator Building.

Also located on the facility is the CA/NV Fish Health Center (CA/NV FHC) that consists of two former residences converted into offices and lab spaces, and a Wet Lab located on the south side of the hatchery. Located on the hatchery grounds adjacent to the Wet Lab is the Anderson Field Office, which is a satellite workstation of the Red Bluff Fish and Wildlife Office (Red Bluff FWO).



STATION HIGHLIGHTS

Funding

Coleman National Fish Hatchery is fully funded by the USBR.

Personnel

At the end of the fiscal year Coleman NFH was staffed with: a Project Leader, a Deputy Project Leader, an Administrative Officer, a Fisheries Program Assistant, a Supervisory Fishery Biologist, a Fishery Biologist, an Information and Education Specialist, a Motor Vehicle Operator, 4 Animal Caretakers, 2 seasonal Animal Caretakers, 2 Electronic Industrial Control Mechanics, an Electrician, 2 Maintenance Mechanics, and a Maintenance Worker.

Summary of significant staffing changes during fiscal year 2020: Sonia Thomas (Administrative Officer) was hired on 29 March 2020. Cody Thomas (Animal Caretaker) was hired on 10 February 2020. Kathleen Johnson's (Animal Caretaker) last day was 15 February 2020 and Emily VanSeeters (Animal Caretaker) transferred to the Army Corps of Engineers on 1 August 2020.

LOT DESIGNATORS

At the request of the Regional Office, lot designator codes have been changed to comply with the policy outlined in 712 FW 2 (21 June 1994). The new designator codes will also aid in differentiating between Battle Creek, Sacramento River, and captive brood, winter Chinook salmon. Appendix B contains a list of new and legacy lot designator codes.

FISH PRODUCTION SUMMARY

Fall Chinook Salmon Brood Year 2019 (CSA-FBW-19-COL)

Broodstock Collection and Spawning

Collection of brood year 2019 FCS began when the hatchery fish ladder was opened on 1 October 2019. Fish returned in sufficient numbers to meet production purposes; however, preliminary data from the California Department of Fish and Wildlife (CDFW) operated video monitoring weir suggested that the run size would likely be moderate to meager. In response, the hatchery minimized the practice of excessing FCS and operated the hatchery ladder in such a way as to maximize the number of fish remaining in the creek for natural production while taking ample fish to ensure production goals were met.

The first take occurred on 3 October 2019, and due to a low percentage of ripe females, spawning was stopped after only 8 crosses. The following week a sufficient number of females were found to be ripe and takes 2-4 were spawned over 3 consecutive days. Spawning continued until 14 November 2019, when the last take (16) occurred. Eggs were fertilized from a total of 4,587 female FCS (Table 1). Levels of pre-spawn mortality (Table 2) were lower than in recent years when exceptionally low numbers of returning FCS required banking of all green fish to ensure that production targets were met.

Table 1. Fall Chinook salmon brood year 2019 number of female, male, and jack broodstock spawned at Coleman NFH by date and take

Date	Take	Number Spawned			Total
		Female	Male	Jack	
10/3/2019	1	8	8	0	16
10/8/2019	2	207	199	8	414
10/9/2019	3	91	88	3	182
10/10/2019	4	169	163	6	338
10/15/2019	5	476	441	35	952
10/16/2019	6	246	244	2	492
10/17/2019	7	405	394	11	810
10/19/2019	8	536	518	18	1072
10/22/2019	9	495	487	8	990
10/23/2019	10	390	375	15	780
10/24/2019	11	412	393	19	824
10/29/2019	12	240	228	12	480
10/31/2019	13	242	232	10	484
11/5/2019	14	394	247	59	700
11/7/2019	15	136	132	4	272
11/14/2019	16	140	127	13	280
Total		4,587	4,276	223	9,086

Table 2. Fall Chinook salmon brood year 2019 disposition and number of fish collected at Coleman NFH from 3 October 2019 through 3 December 2019

Disposition	Female	Male	Jack	Total
Spawned	4,587	4,276	223	9,086
Excessed	1,313	2,093	257	3,663
DIPS ¹	352	413	127	892
Total	6,252	6,782	607	13,641

1. Dead in Pond Salmon (pre-spawn mortality)

Incubation

The first take was culled prior to inventory due to the exceptionally low number of females spawned that day. The culled eggs were used for educational purposes during the Return of the Salmon Festival and a portion were later transferred to Evergreen Middle School for a salmon in the classroom project.

Each year the spawning plan is designed to harvest more eggs than are needed to meet production goals in order to hedge against a lack of ripe fish later in the spawning season and/or poor survival of earlier egg-takes. After inventory, eggs from each take are reduced to aggregates that will populate one or more ponds while attempting to both maintain a normal distribution (bell shaped curve) of eggs over time to mimic the run/spawn timing of the natural population and to retain enough eggs to achieve the production goal of releasing 12 million FCS smolts. For the second consecutive year an increased number of eggs were retained to evaluate the practice of trucking and releasing FCS smolts offsite at the Scotty's Landing Boat Ramp on the Sacramento River. The study is being done in cooperation with the Red Bluff FWO, Golden Gate Salmon Association (GGSA) and the NorCal Guides Association.

Survival of harvested eggs to the 'eyed egg stage' was good (population mean = 89.4%). Volumetric sampling estimated the total number of eyed eggs at the time of inventory was 18,335,746. These eggs were further reduced to an estimated 13,996,951 eggs to meet production goals (Table 3).

Table 3. Fall Chinook salmon brood year 2019 numbers of green eggs, eyed eggs, post-reduction eyed eggs, eggs per female, eggs per ounce, and percent survival to the eyed egg stage by date spawned and take

Date Spawned	Take	Green Eggs	Eyed Eggs	Post-Reduction Eyed Eggs	Eggs per Female	Eggs per oz	Percent Survival to Eyed Egg Stage
10/3/2019	1	NA	NA	NA	NA	NA	NA
10/8/2019	2	985,683	875,066	875,066	4,762	85.1	88.8
10/9/2019	3	433,520	385,890	295,801	4,764	86.6	89.0
10/10/2019	4	845,098	755,389	686,817	5,001	83.5	89.4
10/15/2019	5	2,178,904	1,863,812	1,452,150	4,578	85.2	85.5
10/16/2019	6	1,153,354	1,006,474	968,100	4,688	86.4	87.3
10/17/2019	7	1,926,149	1,704,733	1,452,150	4,756	85.2	88.5
10/19/2019	8	2,604,134	2,413,385	1,936,200	4,858	85.7	92.7
10/22/2019	9	2,382,601	2,193,027	1,452,150	4,813	86.2	92.0
10/23/2019	10	1,538,959	1,275,949	968,100	4,664	87.7	82.9
10/24/2019	11	1,491,498	1,343,448	993,480	4,811	84.6	90.1
10/29/2019	12	1,122,113	988,425	968,100	4,675	86.3	88.1
10/31/2019	13	1,200,602	1,140,066	484,050	4,961	86.5	95.0
11/5/2019	14	1,249,444	1,100,396	484,050	4,843	85.2	88.1
11/7/2019	15	699,861	650,037	496,050	5,146	83.0	92.9
11/14/2019	16	686,998	639,649	484,687	4,907	86.1	93.1
Total/Avg.		20,498,918	18,335,746	13,996,951	4,815	85.6	89.4

Juvenile Rearing

The first two takes (2 & 3) were transferred to the raceways (ponding, *past*: ponded) on 20 December 2019. Shortly after ponding it was observed that FCS fry had elevated levels of mortality. Fish appeared lethargic and were feeding poorly with many exhibiting a corkscrew-like swimming behavior. Likewise, several of the CDFW operated hatcheries in the Sacramento Basin were also reporting unusually high levels of mortality amongst newly ponded salmon fry. The CA/NV FHC investigated the cause of the mortality and after coagulated yolk and infectious disease were dismissed, a diagnosis of thiamine deficiency syndrome was made. It was hypothesized that there was a change in the marine food web that resulted in a lack of thiamine in the diet of adult salmon likely due to a diet composition of prey fish containing high concentrations of the enzyme thiaminase. Thiaminase degrades thiamine – decreasing rates of the nutrient’s biological absorption. Furthermore, the ova developing within thiamine deficient adult female salmon may not contain adequate levels of the nutrient for early ontogeny of salmon fry prior to the start of exogenous feeding. Thiamine deficiency among adult salmon has been described elsewhere, notably in the Great Lakes Region, and has led to increased rates of mortality and thiamine deficiency syndrome among the progeny of deficient fish.

On 22 January 2020, CA/NV FHC staff successfully tested a thiamine treatment protocol on FCS fry in the laboratory. On 28 January 2020, a heath stack was modified so that the water was able to be recirculated, and a thiamine treatment was attempted on a single stack of fry (take 13) while

in the heath stack; however, D.O. levels could not be maintained and the treatment was stopped after 30 minutes and the fry were ponded.

On 31 January 2020, a thiamine treatment was successfully completed on FCS take 14 using a large tank and an aeration system (including blowers and oxygen). FCS, while still in their heath tray inserts, were moved to a 700L static bath containing 1.4kg of thiamine hydrochloride (2000ppm) and treated for one hour. Water quality measurements (oxygen and pH) were closely monitored and oxygen was supplemented as needed and pH was maintained by adding Sodium Bicarbonate. Fry were ponded immediately following treatment. Takes 15 and 16 were treated using the same protocol, and mortality of treated takes was significantly lower than untreated takes.

The affects of the thiamine deficiency on untreated raceways were most apparent for a 2-3 week period after ponding, after which rates of mortality returned to more normal levels and fish appeared healthy and converted feed at good rates (Table 4).

For the second consecutive year the Service at the request of the Golden Gate Salmon Association (GGSA) and the NorCal Guides Association reared an additional 360,000 FCS in the 8x80ft raceways to evaluate the practice of trucking and releasing FCS smolts offsite at the Scotty's Landing Boat Ramp on the Sacramento River. The experimental release was later canceled due to the Covid-19 pandemic and both the experimental and control groups were released onsite (see Release section).

Table 4. Summary by month of number brood year 2019 juvenile fall Chinook salmon in raceways, total mortality, mean weight, length, DI, FCR and total pounds of feed fed

Month	Number In Raceways	Mortality	Mean				
			(Fish/lb)	Length (in)	Density Index (DI)	Feed Conversion (FCR)	Feed Fed (lbs)
December	5,690,494	39,590	1,316.9	1.3	0.10	0.70	172
January	12,641,343	334,163	692.8	1.7	0.16	0.53	5,553
February	13,531,742	72,608	240.2	2.4	0.19	0.64	25,265
March	5,985,466	13,544	117.2	3.1	0.10	0.75	45,976
April ¹	0	1,553	93.4	3.2	-	0.73	8,621

1. Size at release

Marking and Tagging

The process of coded wire tagging (CWT) and marking the fall Chinook salmon commenced during February and was completed in April. The production release group of FCS were marked and tagged at a 25% constant fractional rate, with each raceway receiving a unique CWT code. FCS reared for the Scotty's Landing offsite release study (cancelled due to the Covid-19 pandemic) along with a control group were marked and tagged at a 100% rate.

The AutoFish System™ used in the marking and tagging process provides an accurate census of the fish population in each raceway processed. The number generated by the tagging census was found to be 1,175,455 fish less than the hatchery inventory number (~9.5%). Typically, the difference between the hatchery inventory number (eyed egg number – pre-tag mortality) and the tagging census is approximately 5%. The higher than expected difference in these numbers is likely

a result of increased mortality between the eyed egg stage and ponding (after hatch loss) due to thiamine deficiency.

Release

Due to uncertainties regarding the continuity of hatchery operations during the Covid-19 pandemic the first production release of FCS occurred somewhat earlier than normal. On 23 March 2020, raceways 1-14 were released onsite into Battle Creek. The following day raceway 15 and the experimental and control fish for the cancelled Scotty's Landing release study were released onsite into Battle Creek. These releases were timed to coincide with a storm event that increased flows and turbidity in Battle Creek and the Sacramento River. Two additional production releases of FCS occurred on 3 & 22 April 2020. A total of 12,311,246 BY19 FCS were released with an average size of 100.1 fish/lb (Table 5).

Table 5. Fall Chinook salmon brood year 2019 number released, location, fish/lb, and total weight by date

Date	Total Released	Release Location	(Fish/lb)	Total Weight (lbs)
3/23/2020	5,878,838	Battle Creek	103.4	57,369
3/24/2020	769,207	Battle Creek	87.0	4,318
4/3/2020	2,496,076	Battle Creek	98.5	25,380
4/22/2020	3,167,125	Battle Creek	89.1	35,915
Total/Avg.	12,311,246		100.1	122,982

Late Fall Chinook Salmon Brood Year 2019 (CSA-LBW-19-COL)

Juvenile Rearing

At the beginning of the fiscal year there were 1,072,049 juvenile brood year 2019 LFCS on station with a mean size of 21.5 fish/lb. Feed conversion rate was good for LFCS during October (mean FCR 0.79) before slowing (mean 1.65 FCR) during the month of December (Table 6). Very low rates of feed conversion in LFCS are often observed during the last months of rearing and may be attributable to changes in condition factor of fish undergoing the process of smoltification.

Table 6. Summary by month of number brood year 2019 juvenile late fall Chinook salmon in raceways, total mortality, mean weight, length, DI, FCR and total pounds of feed fed

Month	Number In		Mean				
			Mortality	Length (in)	Density Index (DI)	Feed Conversion (FCR)	Feed Fed (lbs)
	Raceways						
October	1,069,936	363	14.7	5.9	0.16	0.79	15,871
November	1,068,171	265	13.0	6.2	0.17	0.61	11,892
December	77,866	9	12.4	6.3	0.18	1.65	2,197
January ¹	0	0	11.8	6.3	-	-	909

1. Size at release

Release

The production release of brood year 2019 LFCS occurred 5 December 2019, onsite into Battle Creek (Table 7). The release was timed to coincide with a storm event and was comprised of eleven raceways totaling 824,774 fish. There were also 3 ‘spring surrogate’ releases of LFCS in December and January. Spring surrogate releases are used to estimate the take of ESA listed species at fish salvage facilities associated with State and Federal water export conveyances.

Table 7. Late fall Chinook salmon brood year 2019 number released, location, fish/lb, and total weight by date

Date	Total Released	Release Location	(Fish/lb)	Total Weight (lbs)
12/5/2019	824,774	Battle Creek	12.6	65,817
12/9/2019	84,858	Battle Creek	13.7	6,194
12/18/2019	77,664	Battle Creek	12.7	6,115
1/13/2020	77,863	Battle Creek	11.8	6,598
Total/Avg.	1,065,159		12.5	84,724

Late Fall Chinook Salmon Brood Year 2020 (CSA-LBW-20-COL)

Broodstock Collection and Spawning

The Fish Ladder was closed on 2 December 2019 to start the ‘Broodstock Management Period’ between FCS and LFCS. All remaining adipose-fin clipped Chinook salmon were excessed and bio-sampled. The fish ladder was re-opened for collection of LFCS on 23 December 2019. The first take of LFCS occurred on 27 December 2019. Eggs were harvested and fertilized from 27 hatchery-origin pairs of salmon (Table 8). Spawning continued weekly the last take (8) occurred on 19 February 2020.

In addition to eggs taken to meet the mitigation production goal, on 26 February 2020, eggs from 8 females were fertilized, pooled, and divided into three equal groups by volume. The three egg groups were incubated in chilled water at treatment levels of 40, 42, and 44°F. The purpose of this was twofold: firstly to test the new chiller system that was installed for winter Chinook salmon incubation, and secondly to produce LFCS of a size that can be used as surrogates for winter Chinook salmon in field research studies in the fall of 2020.

The Service collects natural-origin LFCS at the Keswick Dam Fish Trap for use in the spawning matrix; natural-origin fish are crossed 1:1 with hatchery-origin broodstock. This year only 7 natural-origin LFCS were collected at the Keswick Dam Fish Trap; well below the target of 10-15% natural-origin inclusion (n = 51-81). In all a total of 1,630 LFCS were spawned (Table 9).

Table 8. Late fall Chinook salmon brood year 2020 numbers of hatchery-origin and natural-origin, male, female, and jack broodstock spawned at Coleman NFH by date and take

Date	Take	Hatchery-Origin			Natural-Origin			Total
		Female	Male		Female	Male		
			Adult	Jack		Adult	Jack	
12/27/2019	1	27	26	1	0	0	0	54
1/2/2020	2	90	90	0	0	0	0	180
1/8/2020	3	218	215	8	1	0	0	442
1/15/2020	4	199	196	7	2	0	0	404
1/22/2020	5	110	107	5	1	0	0	223
1/29/2020	6	72	77	1	3	0	0	153
2/5/2020	7	52	51	0	0	0	0	103
2/19/2020	8	26	26	0	0	0	0	52
2/26/2020	NA ¹	9	10	0	0	0	0	19
Total		803	798	22	7	0	0	1,630

1. On 26 February 2020 eggs were fertilized from 9 females for the purpose of evaluating the new incubation building chiller system.

Table 9. Late fall Chinook salmon brood year 2020 disposition and number of fish handled at Coleman NFH

Disposition	Female	Male	Jack	Total
Spawned	810	798	22	1,630
Excessed	891	438	75	1,404
DIPS	125	60	14	199
Passed Upstream	12	9	0	21
Total	1,838	1,305	111	3,254

Incubation

An estimated 3,922,907 hatchery-origin (Table 10) and 39,838 natural-origin (Table 11) green eggs were harvested over the course of the LFCS spawning season. Each year the spawning plan is designed to harvest more eggs than are needed to meet production goals in order to hedge against an early diminishing run of fish and, or poor survival of earlier egg takes. Excess eggs are later reduced if sufficient eggs are obtained in later takes to achieve production goals. This year additional eyed eggs were retained to hedge against potential increased losses due to the sudden high prevalence of thiamine deficiency syndrome amongst Chinook salmon cultured at Central Valley fish hatcheries. At inventory the combined hatchery and natural-origin total number of eyed eggs was 3,362,698; hatchery-origin eggs were reduced and a total of 1,328,891 eyed eggs were retained for production purposes (Table 12). Survival of hatchery and natural-origin eggs to the eyed stage was 84.8% and 86.1% respectively.

Table 10. Late fall Chinook salmon brood year 2020 numbers of hatchery-origin green eggs, eyed eggs, post-reduction eyed eggs, eggs per female, eggs per ounce, and percent survival to the eyed egg stage by date spawned and take

Date Spawned	Take	Green Eggs	Eyed Eggs	Post-Reduction Eyed Eggs	Eggs per Female	Eggs per oz	Percent Survival to Eyed Egg Stage
12/27/2019	1	115,594	86,986	86,986	4,281	89.4	75.3
1/2/2020	2	426,215	362,765	195,000	4,736	84.6	85.1
1/8/2020	3	1,016,433	843,599	273,547	4,663	74.3	78.3
1/15/2020	4	913,952	772,910	179,716	4,593	85.5	84.6
1/22/2020	5	534,200	470,224	183,351	4,856	80.0	88.0
1/29/2020	6	339,076	285,594	188,000	4,709	82.3	84.2
2/5/2020	7	252,970	219,902	94,000	4,865	82.7	86.9
2/12/2020	8	182,312	159,481	46,989	5,209	83.0	87.5
2/19/2020	9	142,155	126,935	47,000	5,468	76.1	89.3
Total/Avg.		3,922,907	3,328,396	1,294,589	4,941	82.0	84.8

Table 11. Late fall Chinook salmon brood year 2020 numbers of natural-origin green eggs, eyed eggs, eggs per female, eggs per ounce, and percent survival to the eyed egg stage by date spawned and take

Date Spawned	Take	Green Eggs	Eyed Eggs	Eggs per Female	Eggs per oz	Percent Survival to Eyed Egg Stage
1/8/2020	3	9,582	7,502	9,582	74.3	78.3
1/15/2020	4	8,947	8,284	4,473	82.8	92.6
1/22/2020	5	5,507	4,649	5,507	71.5	84.4
1/29/2020	6	15,802	13,867	5,267	80.6	87.8
Total/Avg.		39,838	34,302	6,207	77.3	86.1

Table 12. Late fall Chinook salmon brood year 2020 numbers of hatchery-origin and natural-origin green eggs, eyed eggs, eggs per female, eggs per ounce, and percent survival to the eyed egg stage

Broodstock Origin	Green Eggs	Eyed Eggs	Post-Reduction Eyed Eggs	Eggs per Female	Eggs per oz	Percent Survival to Eyed Egg Stage
Hatchery	3,922,907	3,328,396	1,294,589	4,941	82.0	84.8
Natural	39,838	34,302	34,302	6,207	77.3	86.1
	3,962,745	3,362,698	1,328,891	4,892	83.7	84.6

Juvenile Rearing

Take 1 was transferred from the incubation stacks (tanking, *past*: tanked) to 4 early-rearing tanks on 19 March 2020. Typically LFCS are transferred from the incubation stacks directly to the 8x80ft raceways; however, due to the prevalence of thiamine deficiency syndrome in Brood Year 2019

FCS, it was decided to rear the first take of LFCS in tanks so that they could be observed and treated, if necessary.

Shortly after tanking, LFCS take 1 showed signs of thiamine deficiency syndrome and 2 of the 4 tanks were given a thiamine standing bath treatment on 25 March 2020. Mortality and the prevalence of symptomatic fish was reduced in the treatment group and on 27 March 2020 the 2 remaining tanks were given a thiamine standing bath treatment.

LFCS take 2 was ponded on 26 March 2020 and was treated with thiamine (standing bath treatment) using the same method previously used on FCS takes 14-16 (see Fall Chinook Salmon Brood Year 2019 section). No additional thiamine treatment of LFCS occurred following takes 1 & 2. The decision to cease thiamine treatments was based upon both staffing limitations associated with the ongoing Covid-19 pandemic and the number of additional buffer eggs that were retained due to the emergence of thiamine deficiency syndrome amongst other runs of Chinook salmon. Take 2 had lower levels of mortality than untreated groups; take 1 (treated in early-rearing tanks) still experienced somewhat high levels of mortality suggesting that the method of treating within the tanks may not have been as efficacious as treating fry in submerged health trays. This difference may have been due to the slightly older age of the fry at treatment or something inherent in the method itself.

Once the late fall Chinook salmon reached 250 fish/lb or larger they were vaccinated against enteric redmouth disease (*Yersinia ruckeri*). Raceways that were initially loaded with populations of fish destined for two ponds were split and vaccinated at the same time to reduce stress on the fish. Once split, the late fall Chinook salmon were fed to reach tagging and marking size (140 fish/lb). The first take was vaccinated on 4 May 2020 and the last take (9) was vaccinated on 29 May 2020 when it reached the minimum size.

Coded wire tagging and marking of late fall Chinook salmon commenced on 18 May 2020. The AutoFish™ trailer was positioned at the tail end of Raceways 13 and 14. Fish were pumped from the 8x80ft raceways to the trailer, processed, and then released into the 15x150ft raceways. The marking and tagging process was completed on 10 June 2020. The tagging census number was found to be 59,552 fewer fish (~5.3%) than the hatchery inventory projected.

Brood year 2020 LFCS suffered from recurrent fish health issues for the entire fiscal year starting with elevated mortality and thiamine deficiency syndrome shortly after ponding. In May hexamita was found in 3 out of 4 intestinal samples of symptomatic (distended abdomens) fish in raceway 30. Starting in June, warmer than average water temperatures, columnaris (*Flavobacterium columnare*), and Ich (*Ichthyophthirius multifiliis*) all led to persistent fish health issues and elevated levels of mortality. Chloramine-T treatments were used several times (Table 13) to attempt to gain control of mortality due to columnaris. The efficacy of the treatments appeared less successful as the number of symptomatic fish increased over the course of the summer. A salt treatment was applied to all LFCS raceways on 27 & 28 July 2020. Raceways were drained to half volume and 250 lbs of salt were added at the head end of each raceway to create a solution of approximately 1500ppm. The salt treatment had no noticeable affect on levels of mortality.

Terramycin 200 (TM-200) medicated feed was fed to all 14 LFCS raceways from 28 July 2020 through 6 August 2020 in an attempt to control mortality due to columnaris. Fish feed was top-coated with TM-200 using a cement mixer and vegetable oil as a binding agent. This treatment was done under the Investigative New Animal Drug (INAD) program. TM-200 was added to feed at an inclusion rate of 5% and fed to fish at a rate of 1% body weight to achieve a dosage of 10g/100 lbs of fish. Due to an error, the treatment only occurred for 10 days versus the 14 days outlined in the INAD method protocol. Following treatment, levels of mortality decreased substantially; however, 10 days post-treatment, mortality levels were again elevated.

In a further attempt to reduce mortality due to columnaris, florfenicol (Aquaflor®) medicated feed was fed to all 14 LFCS raceways from 31 August 2020 through 9 September 2020. A Veterinary Feed Directive was obtained from Dr. Hugh Mitchell (AquaTactics Fish Health) recommending treatment with florfenicol at 15 mg/kg weight for 10 consecutive days. Prepared medicated fish feed was purchased from BioOregon with an inclusion of 1362 grams florfenicol/ton feed. The medicated fish feed was fed at a 1% body weight ration to achieve the specified dosage. The treatment decreased mortality rates during the treatment; however, it appeared to be significantly less efficacious than the previous TM-200 treatment. Shortly after the treatment ended mortality rates were higher than at any other point during the summer.

On 15 September 2020, a second TM-200 (10g/100 lbs of fish) antibiotic feed treatment was administered for 14 consecutive days. This treatment was successful at decreasing mortality rates for the remainder of the fiscal year. Water temperatures began to decrease during the treatment which likely also contributed to the drop in mortality. A total of 120,897 LFCS were lost during the month of September alone.

Table 13. Summary by date of brood year 2020 late fall chinook salmon treatments, dosage, and rearing units/groups treated

Dates	Treatment	Dosage	Rearing Units/ Group Treated
3/25/2020 & 3/27/2020	Thiamine	2000ppm	Take 1
3/26/2020	Thiamine	2000ppm	Take 2
6/23/2020 - 6/25/2020	Chloramine-T	20mg/L	Raceways 8-11
6/24/2020 - 6/26/2020	Chloramine-T	20mg/L	Raceway 14
6/29/2020 - 7/1/2020	Chloramine-T	20mg/L	Raceways 1-6 & 13
7/13/2020 - 7/15/2020	Chloramine-T	20mg/L	Raceways 1,3,5,8 & 12-14
7/27/2020 - 7/28/2020	Salt	1500 ppm	Raceways 1-14
7/28/2020 - 8/6/2020	Terramycin 200	10g/100 lbs fish	Raceways 1-14
8/17/2020 - 8/19/2020	Chloramine-T	20mg/L	Raceways 4,6,7,8,10,11 & 13
8/31/2020 - 9/9/2020	Florfenicol	10-15mg/kg fish	Raceways 1-14
9/15/2020 - 9/28/2020	Terramycin 200	10g/100 lbs fish	Raceways 1-14

At the end of the fiscal year there were 875,398 late fall Chinook salmon on station with a mean size of 28.4 fish/lb (Table 14).

Table 14. Summary by month of number brood year 2020 juvenile late fall Chinook salmon in raceways and tanks, total mortality, mean weight, length, DI, FCR and total pounds of feed fed

Month	Number In Tanks/ Raceways	Mortality	Mean				
			Length (Fish/lb)	Length (in)	Density Index (DI)	Feed Conversion (FCR)	Feed Fed (lbs)
March	280,906	1,080	1,048.8	1.4	0.15	0.70	44
April	1,290,060	23,875	542.6	1.9	0.21	0.53	1,196
May	1,106,574	7,346	128.4	2.9	0.09	0.80	4,526
June	1,063,509	15,599	90.7	3.2	0.05	1.25	4,086
July	1,009,239	54,220	65.4	3.6	0.06	1.19	4,842
August	996,295	12,944	41.4	4.2	0.07	0.63	5,518
September	875,398	120,897	28.4	4.8	0.08	1.23	9,946

Steelhead (CVS-WBW-19-COL)

Juvenile Rearing

Brood year 2019 juvenile steelhead (STT) converted feed at acceptable rates until December when water cooled and slowed growth rates (mean FCR 1.35). There were no fish health issues with the STT from the beginning of the fiscal year through release and rates of mortality were low (Table 15).

Table 15. Summary by month of number brood year 2019 juvenile steelhead in raceways, total mortality, mean weight, length, DI, FCR and total pounds of feed fed

Month	Number In Raceways	Mortality	Mean				
			Length (Fish/lb)	Length (in)	Density Index (DI)	Feed Conversion (FCR)	Feed Fed (lbs)
October	609,147	95	7.0	7.5	0.15	0.91	22,166
November	609,059	88	5.0	8.3	0.18	0.77	25,571
December ¹	608,899	60	4.9	8.5	-	1.35	7,721

1. Size at release

Release

This year, the Service received approval from the National Marine Fisheries Service (NMFS) for a modification to the strategy used for releasing juvenile STT. Previously STT were released the first week of January at the Bend Bridge Boat Ramp on the Sacramento River regardless of environmental conditions (*e.g.* flow/turbidity). Under the new release strategy, the Service has flexibility to release STT earlier during December if favorable environmental conditions are present. Releasing fish during periods of increased flow and turbidity typically results in rapid downstream emigration and increased survival of juvenile fish.

There were two separate production releases of brood year 2019 STT during the month of December. The first release occurred 6 & 7 December 2019 and the second release occurred on 20 December 2019. At release, fish were crowded to the front of each raceway and loaded onto distribution trucks by means of a fish pump and dewatering tower. A total of 608,899 juvenile STT were released into the Sacramento River at the Bend Bridge in December 2019.

Table 16. Steelhead brood year 2019 number released, location, fish/lb, and total weight by date

Date	Total Released	Release Location	(Fish/lb)	Total Weight (lbs)
12/6/2019	114,685	Bend Bridge	4.8	24,188
12/7/2019	178,583	Bend Bridge	5.1	34,919
12/20/2019	315,631	Bend Bridge	4.8	66,431
Total/Average	608,899	-	4.9	125,539

Steelhead (CVS-WBW-20-COL)

Broodstock Collection and Spawning

STT broodstock returned to the hatchery in low numbers during October; however, by mid-November an increased amount of STT were being collected on all spawning days. A total of 3,351 adult hatchery-origin STT were collected during the 2019-2020 spawning season.

Early returning STT broodstock (October through mid-December) and late returning STT (Late-December through February) are typically held separately in Ponds 5 and 4 respectively. Separation of these fish allows for targeted spawning of either group with the goal of incorporating a relatively equal number of both early and late returning fish into the spawning plan. To allow for identification and better enumeration, early and late returning fish received an anal fin and caudal fin punch respectively.

For the fourth consecutive year, to better manage returning FCS broodstock, Ponds 4 and 5 were used for holding non-ripe FCS that would typically be euthanized without spawning (excessed); consequently, STT broodstock that returned during FCS spawning were transferred to the Pre-release Pond instead of Pond 5. Transferring STT to the Pre-release Pond also allows for better feeding of broodstock and enumeration and removal of pre-spawn mortalities. On 18 December 2019, the Pre-release Pond was seined and approximately 866 STT were transferred to Pond 5.

During early December it was discovered that a number of returning adult hatchery-origin STT were entrained upstream of the traveling screens on Nevis Creek. These fish either migrated upstream of the barrier weir while the upstream ladder was open to allow passage of winter and spring Chinook salmon or were able to bypass the weir during a high-flow event. It is believed that the fish gained access to upper Nevis Creek by swimming through an unscreened pipe. On 18 December 2019, hatchery staff lowered the water level in Nevis Creek and used 3 seine nets to salvage the entrained fish. A total of 105 hatchery-origin STT and 3 natural-origin STT were rescued. The STT were bio-sampled by the Red Bluff FWO and the hatchery-origin STT were moved to Pond 5 and the natural-origin STT were returned to Battle Creek. A screen was mounted on the pipe that allowed the STT to access Nevis Creek to prevent future entrainment of fish.

The first STT egg take occurred on 27 December 2019, and due to a low number of ripe broodstock only 5 pairs of fish were spawned (Table 16). STT are classified as shorts or longs based upon their fork-length. Shorts have lengths that are greater than or equal to 16.5in and less than 21.75in; longs are fish greater than or equal to 21.75in. The ratio of short to long broodstock was approximately 6:1. The last take occurred on 26 February 2020, a total of 685 pairs of STT were spawned throughout the spawning season.

Table 17. Steelhead brood year 2020 numbers of female and male, short, and long broodstock spawned at Coleman NFH by date and take

Date	Take	Hatchery-Origin				Total
		Female		Male		
		Short	Long	Short	Long	
12/27/2019	1	4	1	2	3	10
1/2/2020	2	40	11	40	11	102
1/9/2020	3	96	33	105	24	258
1/16/2020	4	77	17	78	16	188
1/23/2020	5	84	8	84	8	184
1/30/2020	6	70	24	84	10	188
2/6/2020	7	61	4	63	2	130
2/12/2020	8	27	8	33	2	70
2/19/2020	9	51	9	59	1	120
2/26/2020	10	58	2	58	2	120
Total		568	117	606	79	1,370

Broodstock Reconditioning

The STT kelt release occurred on 17 April 2020, water was lowered in the Pre-release Pond and a seine net was used release fish through the wastewater canal into Battle Creek. Two staff members independently attempted to enumerate fish as they transited the canal. The two counts were: 1,027 and 1,058; the difference is likely attributable to a short time period when a large number of fish moved out at the same time.

Incubation

Eggs from take 1 were culled prior to inventory due to the low number of eggs that were taken that day (5 females). At inventory there were an estimated 1,348,784 green eggs from crosses of short females and 419,423 green eggs from long females (Tables 18 & 18). In order to increase the genetic diversity of hatchery-origin STT, the spawning plan incorporates twice as many broodstock as is needed to meet egg-take goals. Eyed eggs from short and long crosses were reduced in such a way that the remaining eggs were proportional to the ratio at which they were collected. A total of 683,301 eyed eggs were and retained for production (Table 20).

Table 18. Steelhead brood year 2020 numbers of green eggs, eyed eggs, post-reduction eyed eggs, eggs per female, eggs per ounce, and percent survival to the eyed egg stage by date spawned and take from short females

Date Spawned	Take	Green Eggs	Eyed Eggs	Post-Reduction Eyed Eggs	Eggs per Female	Eggs per oz	Percent Survival to Eyed Egg Stage
12/27/2019	1	NA	NA	NA	NA	NA	NA
1/2/2020	2	85,791	51,756	51,756	2,145	281.3	60.3
1/9/2020	3	255,592	167,073	76,732	2,662	293.1	65.4
1/16/2020	4	187,781	124,565	69,366	2,439	266.7	66.3
1/23/2020	5	168,433	133,711	82,840	2,005	304.6	79.4
1/30/2020	6	159,532	80,624	56,832	2,279	285.9	50.5
2/6/2020	7	144,453	100,916	86,694	2,368	288.3	69.9
2/12/2020	8	76,208	50,805	34,406	2,823	282.3	66.7
2/19/2020	9	142,825	49,989	30,649	2,800	285.7	35.0
2/26/2020	10	128,169	48,857	22,843	2,210	317.3	38.1
Total/Avg.		1,348,784	808,296	512,118	2,391	289.0	59.9

Table 19. Steelhead brood year 2020 numbers of green eggs, eyed eggs, post-reduction eyed eggs, eggs per female, eggs per ounce, and percent survival to the eyed egg stage by date spawned and take from long females

Date Spawned	Take	Green Eggs	Eyed Eggs	Post-Reduction Eyed Eggs	Eggs per Female	Eggs per oz	Percent Survival to Eyed Egg Stage
12/27/2019	1	NA	NA	NA	NA	NA	NA
1/2/2020	2	46,188	18,573	18,573	4,199	244.4	40.2
1/9/2020	3	127,564	92,959	45,592	3,866	226.2	72.9
1/16/2020	4	59,508	52,376	27,169	3,500	222.9	88.0
1/23/2020	5	29,516	22,219	8,733	3,690	217.8	75.3
1/30/2020	6	79,302	55,940	39,494	3,304	214.3	70.5
2/6/2020	7	17,085	11,601	9,703	4,271	210.9	67.9
2/12/2020	8	28,362	20,135	13,757	3,545	216.5	71.0
2/19/2020	9	26,803	17,590	6,888	2,978	209.4	65.6
2/26/2020	10	5,095	1,274	1,274	2,548	212.3	25.0
Total/Avg.		419,423	292,667	171,183	3,616	221.9	69.8

Table 20. Steelhead brood year 2020 numbers of green eggs, eyed eggs, eggs per female, eggs per ounce, and percent survival to the eyed egg stage from short and long females

Broodstock Origin	Green Eggs	Eyed Eggs	Post- Reduction Eyed Eggs	Eggs per Female	Eggs per oz	Percent Survival to Eyed Egg Stage
Short	1,348,784	808,296	512,118	2,391	289.0	59.9
Long	419,423	292,667	171,183	3,616	221.9	69.8
Total/Avg	1,768,207	1,100,963	683,301	2,600	269.7	62.3

Juvenile Rearing

The first take of STT was transferred from the incubation stacks to the early-rearing tanks on 2 March 2020, tanking of STT continued until the last take was tanked on 15 April 2020. Fish were started on a high percent body weight diet, and feed conversion rates (FCR) were very good while in tanks. Fish were closely monitored, and tanks were split as needed to maintain acceptable density indices.

During May several takes of STT had slightly elevated levels of mortality and were observed to be flashing. The CA/NV FHC diagnosed the symptomatic fish with Ich. Standing bath formalin treatments (110 mg/L) were used to control mortality and deemed successful.

Starting in April fish were vaccinated for enteric redmouth disease, and transferred to the 8x80ft raceways when they reached a size of approximately 250 fish/lb. The last take (9/10) was transferred to the 8x80ft raceways on 28 May 2020 without being vaccinated due to a lack of available vaccine. This take was later vaccinated in the 8x80ft raceways and transferred to the 15x150ft raceways by forklift tank while other raceways were moved using a fish pump.

Marking (adipose fin-clipping) of STT commenced on 12 May 2020. In addition to marking, the AutoFish System™ used by PFMFC provides an accurate count of fish populations in each raceway processed. Marking was completed on 6 June 2020 and the final difference between the hatchery inventory number and the census taken from the marking trailer was -39,828 fish (~ 6.1 %).

STT were pumped from the 8x80ft raceways to the 15x150ft raceways on 11 & 12 June 2020.

During July, STT mortality rates increased, and fish were diagnosed with columnaris infection. On 28 July 2020, a salt treatment (1500 ppm) was administered to raceways 23, 25 and 26. Terramycin 200 (TM-200) medicated feed was fed to all 14 STT raceways from 28 July 2020 through 6 August 2020 in an attempt to control mortality due to columnaris. Fish feed was top-coated with TM-200 using a cement mixer and vegetable oil as a binding agent. TM-200 was added to feed at an inclusion rate that achieved a dosage of 3.75g/100 lbs of fish. The treatment was successful at reducing levels of mortality. Further treatment was not required; however, mortality levels were moderate through the end of the fiscal year.

At the end of the fiscal year, there were 633,551 STT in the 15x150ft raceways with an average size of 10.6 fish/lb (Table 21).

Table 21. Summary by month of numbers of brood year 2020 juvenile steelhead in tanks and raceways, total mortality, mean weight, length, DI, FCR and total pounds of feed fed

Month	Number In Tanks/ Raceways	Mortality	Mean				
			(Fish/lb)	Length (in)	Density Index (DI)	Feed Conversion (FCR)	Feed Fed (lbs)
March	485,488	6,863	1,304.8	1.4	0.24	0.57	157
April	676,832	11,614	495.8	2.1	0.18	0.61	1,169
May	655,115	1,715	102.4	3.1	0.13	0.70	3,171
June	641,885	3,120	56.2	3.8	0.04	0.89	4,576
July	637,645	4,240	34.1	4.5	0.05	1.10	7,923
August	635,588	1,957	18.0	5.5	0.08	0.76	12,553
September	633,551	2,037	10.6	6.5	0.12	0.88	21,161

Winter Chinook Salmon (WCS-WBD-19-LIV)

Egg and Fry Transfers

Captive broodstock were spawned at Livingston Stone NFH from 6 August 2019 through 11 September 2019. There was a total yield of 205,416 eyed eggs from 11 separate takes (Table 22). Eyed eggs and button-up fry began being transferred from Livingston Stone NFH to Coleman NFH as soon as mean daily water temperature were consistently under 56 degrees Fahrenheit. When temperatures were deemed suitable, takes 1-4 had already hatched and therefore were transferred later as fry. Takes 5 and 6 were transferred while in the eyed egg stage to Coleman NFH. Takes 7 and 8 were also transferred as fry as there was insufficient time between inventory and hatching to allow for transfer. Takes 9-11 were transferred as eyed eggs. Fry were loaded into PVC live-cars and hauled in a tank mounted on a flatbed truck and eggs were transported in mesh laundry bags.

The very low green-egg to eyed-egg survival was due to use of cryopreserved milt, much of which, was determined afterward to have very low viability.

Table 22. Take, date spawned, numbers of green and eyed eggs, number tanked and transfer dates for progeny of winter Chinook captive brood stock spawned at the Livingston Stone NFH and transferred to the Coleman NFH

Take	Date Spawned	Green Eggs	Eyed Eggs	Date Tanked	Number Tanked	Date to CNFH
1	8/6/2019	27,558	13,440	10/22/2019	8,937	10/22/2019 (fry)
2	8/9/2019	40,950	20,521	10/23/2019	46,311	10/23/2019 (fry)
3	8/14/2019	43,915	24,153	10/29/2019	88,807	10/29/2019 (fry)
4	8/16/2019	32,285	15,310	10/30/2019	14,245	10/30/2019 (fry)
5	8/21/2019	30,634	14,212	10/29/2019	13,500	10/2/2019 (eggs)
6	8/22/2019	43,700	39,543	11/1/2019	34,071	10/2/2019 (eggs)
7	8/27/2019	41,982	23,608	11/7/2019	21,423	11/7/2019 (fry)
8	8/28/2019	59,126	26,951	11/7/2019	23,372	11/7/2019 (fry)
9	9/4/2019	33,220	14,382	11/15/2019	13,546	10/15/2019 (eggs)
10	9/6/2019	33,586	3,092	11/15/2019	2,411	10/15/2019 (eggs)
11	9/11/2019	16,976	10,204	11/20/2019	9,420	10/17/2019 (eggs)
Totals		403,932	205,416		144,055	

Juvenile Rearing

Fry were started in early rearing tanks fitted with half-height standpipes in the Hatchery Building. When the density index approaches 0.30, half standpipes are replaced with full standpipes. Previously WCS fry have been fed by belt feeders, this year fry were hand-fed in an attempt to promote better feeding. The separate takes were grouped to form 3 lots; feed rate was manipulated to help achieve a uniform size of the takes prior to combining.

WCS fry feed conversion was poor throughout rearing (Table 23). It has been observed that the WCS are very skittish and do not feed as heavily or predictably as other runs of Chinook salmon under intensive culture.

During December, slightly higher than expected mortality was observed in takes 6 & 7. A five fish sample showed gill, kidney and distal intestine appeared normal. Stomach contents were found to contain food; however, there appeared to be a lipid metabolism issue related to coagulated yolk.

As WCS reached a size of approximately 180 fish/lb they were injected with a CWT and marked with both an adipose and left-pelvic fin clip. The left-pelvic fin clip will allow for differentiation between returning WCS and LFS adults. Adipose fin clipping and CWT tagging were accomplished in an AutoFish™ trailer, fish were subsequently pumped into a manual tagging trailer where they received the left pelvic clip by hand.

Table 23. Summary by month of number brood year 2019 winter Chinook salmon in tanks and raceways, total mortality, mean weight, length, DI, FCR and total pounds of feed fed

Month	Number In Tanks/ Raceways	Mortality	Mean		Density Index (DI)	Feed Conversion (FCR)	Feed Fed (lbs)
			(Fish/lb)	Length (in)			
October	53,275	875	1,237.1	1.3	0.15	0.90	4
November	180,317	6,522	852.7	1.6	0.12	1.12	124
December	178,773	1,544	374.7	2.0	0.20	1.17	325
January	173,181	2,090	244.3	2.3	0.17	1.65	533
February	169,216	2,639	126.1	2.9	0.18	1.14	730
March ¹	167,719	997	73.5	3.4	-	1.07	1,052

1. Size at release

Release

All 3 Lots of WCS were released *en masse* on 23 March 2020 (Table 24). At the time of release, smolts were loaded onto a fish distribution truck and hauled to Wildcat Bridge on the North Fork of Battle Creek. Several pieces of flexible irrigation hosing were used to release WCS directly into the creek.

Table 24. Winter Chinook salmon brood year 2019 number released, CWT, fish/lb, and release location by date and lot

Date	Lot/(Take)	Number Released	CWT	Size (Fish/lb)	Release Location
3/23/2020	1 (1-4)	60,596	056433	58.3	Wildcat Bridge
3/23/2020	2 (5-7)	62,780	056434	73.3	North Fork
3/23/2020	3 (8-11)	44,843	056435	88.9	Battle Creek
		168,219		73.5	

CYCLICAL MAINTENANCE AND CONSTRUCTION

Maintenance Activities

New Ozone Generator

During Fiscal Year 2020 maintenance staff conducted extensive planning and prepping for the installation of a new ozone generator. During October, maintenance staff held a conference call with USFWS Region 1 Engineering and a Contractor to discuss replacement of ozone generator #2. In December, Electronic Controls Specialists Norm Daniels and Randy Busjahn reviewed a request for information document regarding the project. In March, Ralph Winstead (Maintenance Mechanic) and Jason Fookes (Maintenance Worker) coated the concrete footprint for the new ozone generator in epoxy.

On 7 April 2020, the new ozone generator was delivered. There was a meeting between hatchery staff and the contractor installing the new ozone generator on 27 May 2020. Staff in attendance were Brett Galyean (Project Leader), Norm Daniels, and Randy Busjahn.

On 1 June 2020, the contractor installing the new ozone generator arrived onsite. Over a 3-week period, the generator was installed, and the necessary electrical and plumbing work was completed. On 8 June 2020, there was a planned ozone outage to install plumbing for the new ozone generator. On 15 June 2020, there was a planned ozone outage for the installation of electrical infrastructure for the new ozone generator.

Johnson Controls and Pinnacle Ozone Solutions contractors were both on station from 22-25 June 2020 to provide training and fine-tune adjustments of the new ozone generator. The generator was online and running 23 June 2020. Johnson Controls was on-site 7 July 2020, to finish ‘punch-list’ items for the new ozone generator installation.

On 28 August 2020, staff from Pinnacle Ozone Solutions met with Norm Daniels and Randy Busjahn concerning a recent communication issue with the new ozone generator.

On 25 September 2020, there was a planned outage to the ozone generators in order to replace a faulty valve in the PSA system.

Water Treatment and Delivery

During the last week of October Cisco Air performed maintenance on 3 oil free air compressors.

Norm Daniels and Randy Busjahn performed maintenance and repairs on Filter Bays 3 & 4 during the months of November and March.

Multiple pumps were pulled from the Upper Canal Pump Station and delivered to a contractor to be rebuilt. Lonnie Sullivan picked up pump #10 on 8 July 2020; the pump was installed on 14 July 2020. On 28 September 2020, a second rebuilt water pump was installed by A1 Crane.

Randy Busjahn and Norm Daniels upgraded the hatchery online water consumption data.

On 29 April 2020, the Coleman Canal was taken offline for annual cleaning. A local contractor (Fischer) excavated the Coleman Canal from 4-8 May 2020. The canal was watered-up and back online 11 May 2020.

The Sand Traps were drained on 19 May 2020, and a fish salvage occurred on the following day. From 21-29 May 2020, Ralph Winstead, Jason Fookes, Randy Busjahn, and Norm Daniels removed debris from the Sand Traps.

On 28 May 2020, Norm Daniels, Ralph Winstead, and Jason Fookes worked to correct a mechanical issue that resulted in a misalignment of the Filter 4 Bridge.

On 1 June 2020, PG&E started diverting a higher proportion of water from the South Fork of Battle Creek into the canal that feeds the hatcheries primary water intake. Water originating in the South Fork Battle Creek is typically warmer than that of the North Fork.

On 1 August 2020, the hatchery switched from Intakes 1 and Expanded 1 to Intakes 2 & 3 when PG&E had to take the Coleman Powerhouse offline due to a loss of communications. There was a failed attempt to restart the Coleman Powerhouse on 17 August 2020; and the hatchery remained on Intakes 2 & 3 throughout the month of August.

On 10 September 2020, the PG&E operated Coleman Powerhouse was taken offline and water delivery from Intake 1 was interrupted – prompting a switch from Intakes 1 & 3 to Intakes 2 & 3. The hatchery utilized Intakes 2 & 3 for water delivery until the Coleman Powerhouse was placed back online on 16 September 2020 and water delivery from Intakes 1 & 3 resumed. On 26 September 2020, the Coleman Powerhouse was taken offline again and water delivery from Intakes 2 & 3 resumed.

Fish Ladder and Spawning Building

During April and July, maintenance staff repaired hydraulic leaks and performed maintenance on hydraulic lines in the Spawning Building.

On 16 April 2020, Maintenance Staff assisted with the dewatering of the Spawning Building and fish ladder and fish rescue efforts. Also, on 16 April 2020, Maintenance staff installed necessary infrastructure for the STT kelt release.

On 3 August 2020, A1 Crane installed the bulkhead into the upstream ladder arm of the fish ladder.

On 17 September 2020, A1 Crane assisted with removing the guidance structure for video monitoring from the fish ladder.

Also, during the third week in September, maintenance staff performed maintenance on the hoist for the entrance gate to the fish ladder and the pond 3 crowder

On 29 September 2020, The Spawning Building was watered-up. This was done slowly with a single pump to not affect flows in Battle Creek.

Boneyard Expansion Project

During the week of 21 October 2019, maintenance staff cleaned the Boneyard and prepped the old Ozone Contact Chambers for demolition. Staff began demolition of the old ozone contact chambers on 13 January 2020.

During February, Ralph Winstead, Lonnie Sullivan, Jason Fookes, Norm Daniels, Jeff Freund (Motor Vehicle Operator), and Spencer Gutenberger (Animal Caretaker) worked on Phase 2 of the Boneyard Expansion Project. Fill material was brought from the settling pond area and used to bury the old ozone infrastructure. A dump truck was borrowed from the Sacramento National Wildlife Refuge to help complete the project.

During the month of April and May, Lonnie Sullivan and Ralph Winstead leveled and graded the gravel in the boneyard.

New Equipment Acquisitions

During the month of July, all maintenance staff assisted in the purchasing of necessary equipment and vehicles for the hatchery in preparation of the end of the fiscal year and expiration of funds. Staff performed market research and wrote Statements of Work enabling the hatchery to acquire new pumps for the lower pump station, a new fish truck, and a skid-steer loader.

On 11 August 2020, a new GSA truck was acquired that will be used as the ‘Intake Truck’.

Lonnie Sullivan drafted a Purchase Request for a new Fish Distribution Truck and Norm Daniels submitted a Purchase Request for a chiller for the ozone building.

On 18 September 2020, a new skid-loader and attachment was delivered to the hatchery.

Fish Hauling Trucks

Ralph Winsted, Lonnie Sullivan, and Jason Fookes set-up and installed a fish distribution tank for the newly acquired Ford F450.

Ralph Winsted, Lonnie Sullivan, and Joe Livesay (Electrician) performed maintenance and contracted work on the Fish Distribution Trucks to ensure that they would be serviceable for the STT release. The trucks received electrical work, new tires, oxygen lines, and smog checks as needed.

Joe Livesay installed an electrical disconnect on a Fish Haul Truck used by the Anderson Field Office.

Government Quarters

During the month of July, hatchery management met with station residents and planned updates for residences including the installation of energy efficient windows and new insulation. Renovations began later in July.

On 16 July 2020, generators and transfer switches were purchased for the station residencies to prepare for PG&E power shutdowns and Joe Livesay wired the new generators.

Telecommunications

On 4 October 2019, Norm Daniels met with a contractor to develop a plan to organize telecommunication lines for the facility.

Randy Busjahn and Norm Daniels installed cell phone boosters in the Administrative Building, Old Shop Building, and Spawning Building.

Other Maintenance

Joseph Livesay continued to work on the Incubation Chiller System. On 26 May 2020, temperature control of the Incubation Chiller System failed and Joseph Livesay (Electrician) began corrective maintenance on the system.

On 25 September 2020, a new actuator was ordered for the sump that allows wastewater for Raceways 1-14 to be routed to the abatement pond.

Joseph Livesay installed automatic feeders for the delta smelt at Livingston Stone NFH.

The fire extinguishers received annual servicing on 28 May 2020.

On 29 July 2020 at 0715, PG&E took the hatchery power offline for maintenance, the emergency power generators maintained power without issue. Power was restored on 30 July 2020 at 1830.

OUTREACH, INFORMATION, AND EDUCATION

During October, Laura Mahoney (Information and Education Specialist) participated in several outreach activities: Turtle Bay educator's night, fish anatomy lesson and dissection at Bella Vista School, and she also gave a presentation on fish anatomy and career opportunities with the Service to approximately 120 students at the Redding Collegiate Academy. Laura Mahoney also provided an onsite tour for students in the Watershed Management and Ecology class at Shasta College and participated in Anderson Library Story Time with Terrera Hopkins (Fisheries Program Assistant)

On 9 October 2019, the hatchery had an open house for approximately 40 staff members from the Sacramento Regional Office (RO). Staff from the RO were given tours of the hatchery and the CA/NV FHC. Staff also had the opportunity to participate in FCS spawning and egg incubation operations. A potluck lunch was held for everyone in attendance.

The 27th Annual Return of the Salmon Festival was held on 19 October 2019. Approximately 2,700 visitors took part in the festival. Hatchery staff and 43 participant groups setup informational booths and interactive activities for visitors.

During October, water treatment staff provided tours to USBR staff, members of the Hoopa Tribe, and students from Shasta College (with Laura Mahoney).

On 15 November 2019, Laura Mahoney presented to the California Department of Fish and Wildlife Volunteer Group regarding opportunities for their volunteers at Coleman NFH.

Laura Mahoney participated in the Tehama County 8th grade Career Day at the Tehama District Fair grounds on 21 November 2019.

The volunteer group gave tours to over 3,100 school children and their chaperones during the spawning season. This year tours were limited to 300 students per day (in previous years it has been 500 children per day); limiting the size of tours made groups more manageable with the lower number of volunteers this year.

On 5 December 2019, Laura Mahoney gave a presentation and hosted a craft project at the Red Bluff Library for homeschool students in Tehama County.

On 11 December 2019, Laura Mahoney gave a Career Day presentation at Happy Valley Elementary School for 6th-8th graders.

On 13 December 2019, hatchery staff provided a potluck luncheon to thank our volunteers for their service. At the luncheon we honored three retiring volunteers: Ed Boyce, Gale Taylor, and Jack Blanke (volunteer coordinator).

On 16 January 2020, a tour of Coleman NFH was provided to 13 international fish biologists; Laura Mahoney provided the tour of the hatchery and Norm Daniels and Joe Livesay provided a tour of the ozone treatment plant.

On 10 January 2020, a tour of Livingston Stone NFH was provided to CDFW volunteers. Many of their volunteers also spent time volunteering at Coleman NFH during this past fall.

On 23 January 2020, a tour of Livingston Stone NFH was provided to volunteers from Coleman NFH.

On 7 February 2020, Laura Mahoney gave a presentation about WCS to a 1st grade class at Antelope Elementary School. The students brainstormed ideas of ways to help recover WCS and planned to use the information to give a presentation to the Tehama County Department of Education.

The annual Sport, Boat and RV show was held at the Anderson Fairgrounds during the last weekend in February. Coleman NFH had a booth at the festival that was staffed by employees and the volunteer group.

For the second year in a row, Coleman NFH provided eggs for the “Trout in the Classroom Project” for schools in Tehama County. On 6 February 2020, an employee from the CDFW and a representative of the Tehama County Fish and Game Commission picked up eyed eggs from Coleman NFH and delivered them to six different schools in Tehama County.

On 7 March 2020, Laura Mahoney participated in a STEM conference (Science, Technology, Engineering and Math) for 6th-8th grade girls at Simpson College. Laura gave a presentation that included a career talk and a hands-on activity for the girls. Additional events were scheduled but were cancelled due to the COVID-19 pandemic.

Starting in March 2020, limited outreach activities occurred due to the Covid-19 Pandemic. The Return of the Salmon Festival was officially cancelled in 2020. In anticipation of some visitation occurring during the fall months, a contract was submitted to rent porta potties and hand washing stations to have on station during October for public use. Laura Mahoney has been engaging with the public through social media with weekly trivia and highlights of hatchery happenings. Other ongoing outreach activities include working with Turtle Bay Exploration Park to supply fish for a display tank at the museum, which will highlight local fish in the Sacramento River. New trail signs and outreach activities were also created during this period.

MEETINGS, TRAINING, AND OTHER EVENTS

On 7 October 2019, Brett Galyean participated in a conference call regarding the completion of the phase 2 design for the Trap Sorter.

Emily VanSeeters (Animal Caretaker) was hired on 15 October 2019.

Ralph Winstead provided training for the newly acquired forklifts on 15 October 2019.

KRCR was on station to report on The Annual Return of the Salmon Festival, which was held on 19 October 2019.

KRCR met with Brett Galyean on 23 October 2019 for a public interest news story.

Brett Galyean provided employees from the CA Water Resource Board a tour of the facility on 29 October 2019.

On 31 October 2019, Brett Galyean and Robert Null (Deputy Project Leader) met with staff from the Red Bluff FWO to discuss the WCS Transition Plan.

Brad Carter (Animal Caretaker) returned to Coleman on 4 November 2019 for a seasonal position.

Rachel Thomas (USFWS Region 8, Hydrologist) took flow measurements on 5 November 2019.

Brett Galyean had a meeting on 6 November 2019 with the USBR (represented by Derrick Rupert) to discuss the upcoming Budget.

There was a conference call on 6 November 2019 to discuss a proposed flood plain rearing project. Staff from Coleman NFH, Red Bluff FWO, USFWS Region 8 Office, and CalTrout participated in the call.

On 14 November 2019, the hatchery hosted a meeting to discuss the potential of a short-term rearing facility for WCS on the North Fork Battle Creek.

Brett Galyean met with staff from the Red Bluff FWO to discuss the WCS Transition Plan on 14 November 2019.

Robert Null attended a Greater Battle Creek Watershed Work Group meeting on 19 November 2019.

Brett Galyean and Bob Clarke (Fisheries Program Supervisor, Legacy Region 8) attended an interagency budget meeting with staff from the USBR on 19 November 2019.

Brett Galyean met with representatives from the NorCal Guides Association on 4 December 2019 to film an interview for an upcoming documentary.

On 5 December 2019, journalist Julia Yarbough visited the hatchery to film a public interest segment on the LFCS release for Action News Now Chico.

Brett Galyean and Robert Null met with Phil Mackey and Katie Harris of Mount Lassen Trout Farms on 5 December 2019.

Brett Galyean and Robert Null attended a Project Leader Meeting in Lodi from 10 – 12 December 2019.

A Volunteer Appreciation Luncheon was held at the hatchery on 13 December 2019.

There was a delta smelt coordination meeting in Willows on 19 December 2019. In attendance were staff from Coleman and Livingston Stone NFH's, the Red Bluff FWO, the Bay Delta FWO, and the Regional Office.

On 6 January 2020, Brett Galyean, and Robert Null met with Laurie Early and Matt Brown of the Red Bluff FWO to work on a budget for the proposed WCS short term rearing facility.

On 14 January 2020, Robert Null met with Katie Harris and Phil Mackey of Lassen Trout Farms to discuss the WCS short term rearing facility.

On 16 January 2020, Brett Galyean and Laurie Earley (Red Bluff FWO) met with staff from the Bureau of Land Management, CA Department of Water Resources, and River Partners to discuss the feasibility of creating side-channel habitat at the Rancho Breisgau property adjacent to Battle Creek.

On 17 January 2020, staff from the hatchery and the Red Bluff FWO had a WebX conference call with staff from the NMFS, Southwest Fisheries Science Center. NMFS is requesting hatchery fish to be used in an upcoming study investigating the effect of pulsed flow on fish emigration in the Sacramento River.

Rachel Thomas (USFWS Region 8, Hydrologist) took flow measurements on 30 January 2020.

There was a Fish Health Team (comprised of staff from the hatchery, RBFOW, Regional Office, and the CA/NV FHC) conference call on 31 January 2020 to discuss the thiamine deficiency complex.

Ralph Winstead attended training in Albuquerque, NM during February to certify him to be a Heavy Equipment Trainer.

Cody Thomas (Animal Caretaker) was hired 10 February 2020.

Kathleen Johnson's (Animal Caretaker) last day at Coleman NFH was 15 February 2020.

On 18 February 2020, A1 crane installed the video monitoring infrastructure in the Hatchery Ladder.

Taylor Lipscomb (Supervisory Fish Biologist) started at Livingston Stone NFH on 1 March 2020.

Natalie Pierson's (Seasonal Animal Caretaker) last day at Coleman NFH was 14 March 2020.

On 18 March 2020, staff from the Anderson Field Office performed acoustic tagging surgeries on WCS as part of an experiment to study post-release movement of these fish.

Avery Currier's (Seasonal Animal Caretaker) last day at Coleman NFH was 28 March 2020.

Sonia Thomas was selected to fill the vacant Administrative Officer position and started on 29 March 2020.

On 15 April 2020, the hatchery leg of the fish ladder was closed.

The STT kelt release occurred on 17 April 2020.

Brett Galyean participated in a joint ES/FAC Project Leader Meeting via Microsoft Teams on 22 April 2020.

Fish were rescued from the Coleman Canal after it was taken offline for annual cleaning on 29 April 2020.

Brett Galyean and Robert Null participated in a FAC Project Leader Meeting via Microsoft Teams on 30 April 2020.

Brad Carter's (Seasonal Animal Caretaker) last day was 8 May 2020.

There was a Senior Staff Meeting on 13 May 2020.

There were Legacy Region 8 All Employee Calls on 5 & 19 May 2020 hosted by Regional Director Paul Souza.

There was a Legacy Region 8 Supervisor Call to discuss the Covid-19 Pandemic on 27 May 2020.

On 28 May 2020, there was a Legacy Region 8 Supervisor Forum on Microsoft Teams to assist supervisors with development to create a better work climate for employees.

On 29 May 2020, Derrick Rupert (USBR) and Brett Galyean had a phone conference to finalize a draft for the 5-Year Inter-Agency Agreement regarding the Statement of Work.

Rachel Thomas (USFWS Region 8, Hydrologist) was on station 1 June 2020 to take water measurements and check measuring devices.

There were Legacy Region 8 All Employee Calls on 2 & 24 June 2020 hosted by Regional Director Paul Souza.

There was an All Hands Call with USFWS Director Aurelia Skipwith on 16 June 2020

There was a conference call with participants from the hatchery, the Red Bluff FWO, the RO, the Department of Water Resources, and the California Department of Fish and Wildlife on 16 July 2020. The discussion focused on the use of FCS releases as surrogates for monitoring activities focused on natural-origin Chinook survival and passage in March and April as allowed by the Biological Opinion.

Emily VanSeeters' (Animal Caretaker) last day on the job was on 22 July 2020 and her official date of transfer was 1 August 2020.

On 23 July 2020, Brett Galyean had a WebEx meeting with staff from the USBR to discuss Long Term Operations (LTO) planning.

The fish ladder was closed at 0900 on 31 July 2020.

On 6 August 2020, Robert Null and Marc Provencher (Fish Biologist) had a Microsoft Teams meeting with staff from the RO and the contractor Four Peaks concerning the Hatchery Data Standardization Project.

There was a Legacy Region 8 All Employee Call on 13 August 2020 hosted by Regional Director Paul Souza.

Laura Mahoney attended a Greater Battle Creek Workgroup meeting on 18 August 2020.

On 31 August 2020, Lonnie Sullivan began a 2-week Maintenance Action Team (MAT) detail at the Humboldt National Wildlife Refuge.

On 4 September 2020, Brett Galyean had a conference call with staff from the RO, General Services Administration (GSA), and Kenworth Manufacturing Company regarding streamlining the purchase of a new fish distribution truck.

There was a Legacy Region 8 All Employee Call on 9 September 2020 hosted by Regional Director Paul Souza.

There was a Hatchery Evaluation Team meeting on 17 September 2020.

On 25 September 2020, Coleman NFH marked its 75th Anniversary of operations.

Seasonal Animal Caretakers Clay Hines and Patty Doolittle started work on 27 September 2020.

COVID-19 PANDEMIC

In response to the global Covid-19 pandemic, the hatchery staff was divided into 3 teams (red, blue, purple) on 30 March 2020. The red and blue teams worked 10 hour days onsite for 5 days each pay period. Telework eligible staff worked an additional 30 hours from home each pay period, while other staff received paid administrative leave. The purple team worked 2 - 8 hour shifts each weekend. Dividing the staff into teams helped to limit the risk of virus exposure and contain any potential outbreaks. Hatchery staff also practiced social distancing and wearing PPE when performing tasks that required working within close proximity of one another. In June, weekend shifts were covered on a volunteer basis and the crew was split between red and blue teams.

On 31 August 2020, the hatchery began to bring staff back to work together in a phased approach. Initially fish staff, returned to a normal tour of duty; however, red and blue teams were segregated in terms of assignments and used separate break rooms. On 12 September 2020, maintenance staff returned to a normal tour of duty but also segregated by red and blue team. Joe Livesay and Jason Fookes moved into a temporary office in the Old Shop Building to facilitate better social distancing amongst maintenance staff.

Laura Mahoney (Information and Education Specialist) and Terrera Hopkins (Fisheries Program Assistant) resumed working onsite on 2 September 2020 and 11 September 2020 respectively. Laura and Terrera were previously teleworking full-time in response to the COVID-19 pandemic.

During the month of September maintenance staff constructed physical barriers for use in the Spawning Building to create separation between staff during spawning operations in response to the covid-19 pandemic.

The hatchery remained closed through September 2020 while plans were being made to reopen on a limited basis in October 2020.

APPENDIX A
COLEMAN NFHC STATION PERSONNEL

NAME	FUNCTIONAL TITLE	GRADE	PERIOD WORKED	REMARKS
Brett Galyean	Project Leader	GS-0482-14	10/01/19-09/30/20	
Robert Null	Deputy Project Leader	GS-0482-13	10/01/19-09/30/20	
Taylor Lipscomb	Supervisory Fishery Biologist	GS-0482-12	03/01/20-09/30/20	
Sonia Thomas	Administrative Officer	GS-0341-11	03/29/20-09/30/20	
Terrera Hopkins	Fisheries Program Assistant	GS-0303-06	10/01/19-09/30/20	
Ron Stone	Supervisory Fishery Biologist	GS-0482-12	10/01/19-09/30/20	
Marc Provencher	Fishery Biologist	GS-0482-11	10/01/19-09/30/20	
Laura Mahoney	Information & Ed. Specialist	GS-1001-11	10/01/19-09/30/20	
Travis Webster	Fishery Biologist	GS-0482-09	10/01/19-09/30/20	
Kaitlin Gooding	Fishery Biologist	GS-0482-09	10/01/19-09/30/20	
Joe Livesay	Electrician	WG-2805-10	10/01/19-09/30/20	
Lonnie Sullivan	Maintenance Mechanic	WG-4749-10	10/01/19-09/30/20	
Ralph Winstead	Maintenance Mechanic	WG-4749-10	10/01/19-09/30/20	
Jason Fookes	Maintenance Worker	WG-4749-08	10/01/19-09/30/20	
Randy Busjahn	Electronic Control Mechanic	WG-2606-10	10/01/19-09/30/20	
Norm Daniels	Electronic Control Mechanic	WG-2606-10	10/01/19-09/30/20	
Jeffrey S. Freund	Motor Vehicle Operator	WG-5703-08	10/01/19-09/30/20	
William Hopkins	Animal Caretaker	WG-5048-05	10/01/19-09/30/20	
Brad Carter	Animal Caretaker	WG-5048-05	11/04/19-05/08/20	Seasonal
Brandt Becnel	Animal Caretaker	WG-5048-05	10/01/19-09/30/20	
Kathleen Johnson	Animal Caretaker	WG-5408-05	10/01/19-02/15/20	Resigned
Spencer Gutenberger	Animal Caretaker	WG-5408-05	10/01/19-09/30/20	
Matt Peckham	Animal Caretaker	WG-5408-05	10/01/19-09/30/20	
Cody Thomas	Animal Caretaker	WG-5408-05	02/10/20-09/30/20	
Clay Hines	Animal Caretaker	WG-5408-05	09/27/20-09/30/20	Seasonal
Patty Doolittle	Animal Caretaker	WG-5408-05	09/27/20-09/30/20	Seasonal
Avery Currier	Animal Caretaker	WG-5408-05	10/01/19-03/28/20	Seasonal
Natalie Pearson	Animal Caretaker	WG-5408-05	10/01/19-03/14/20	Seasonal
Emily VanSeeters	Animal Caretaker	WG-5408-05	10/11/19-08/01/20	Transferred

APPENDIX B
LOT DESIGNATOR CODES

RUN NAME	SPECIES CODE	STRAIN CODE	STATION CODE	SAMPLE DESIGNATOR CODE	LEGACY
Fall Chinook salmon - Battle Creek	CSA	FBW	COL	CSA-FBW-19-COL	FCS-BCW-19
Late Fall Chinook salmon - Battle Creek	CSA	LBW	COL	CSA-LBW-19-COL	LFS-BCW-19
Central Valley Steelhead - Battle Creek	CVS	WBW	COL	CVS-WBW-19-COL	STT-BCW-19
Winter Chinook salmon - Battle Creek (Captive broodstock)	WCS	WBD	LIV	WCS-WBD-19-LIV	WCS-BCW-19
Winter Chinook salmon - Sacramento River	WCS	WSW	LIV	WCS-WSW-19-LIV	WCS-SRW-19
Winter Chinook salmon - Battle Creek (Wild broodstock)	WCS	WBW	LIV	WSR-WBW-20-LIV	NA

APPENDIX C
STATION PHOTOS



Returning FCS challenging the barrier weir



Returning adult WCS to Battle Creek from release of captive brood progeny



Jeff Freund works with WCS fry in the incubation building



Coleman staff participating in outreach activities at the Return of the Salmon Festival