Klamath Falls National Fish Hatchery

Annual Report for Fiscal Year 2023

Prepared by:

U.S. Fish and Wildlife Service

Klamath Falls National Fish Hatchery

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Executive Summary

The 2023 fiscal year (October 1, 2022 to September 30, 2023, hereafter FY23) saw a lot of important developments and improvements made at the Klamath Falls National Fish Hatchery (KFNFH, hereafter "Hatchery"). While this year's larval collection was the lowest on record during the spring of 2023, our hatchery production was at an all-time record high thanks to larger collections during the spring of 2022. To help support the dwindling populations of Klamath Basin Suckers, the staff reared and repatriated 17,399 production fish through the fiscal year, and an additional 9,134 during the Fall of 2023 to close out the production cycle that extended into the beginning of fiscal year 2024. In addition, 15,614 fingerlings and 14,928 fry were repatriated and/or transferred within the Upper Klamath Basin, along with 436 fish salvaged and repatriated from the A-canal headworks, for a grand total of 48,377 fish released during the fiscal year of 2023. It is hoped that in the coming years, once the facility construction is complete, we will begin to see something near that amount of production sized suckers being produced from the facility on an annual basis.

To help move us towards sucker recovery, the KFNFH staff continue to work hard to improve operational processes by conducting applied research, some of which focused on fish spawning and incubation techniques, assessing whether using other feeds could improve growth and survival, and considering whether using the net pens in a new location would predictably improve growth and overall survival during summer growout in the lakes. Many of these efforts will continue to be worked on and monitored into the upcoming fiscal year so that we can continue to refine our processes and get more Klamath suckers repatriated on the local landscape.

Another major milestone for the hatchery to aid in sucker recovery was the commencement and advancement of facility construction during the recent fiscal years. After a few years of environmental assessment and feasibility planning, conceptual design planning, securing the site through a long term lease, the designation of the Klamath Falls National Fish Hatchery, and bid solicitations and awards, both Phases 1 and 2 of construction were awarded within the fiscal year of 2022 and an appreciable amount of on the ground progress has been made on Phase 1 construction, primarily pond construction and underground infrastructure, which is tentatively on track to finish up during the summer of 2024. Progress on Phase 2 construction, namely hatchery buildings, has been limited and is currently about 6-8 month behind schedule and will likely be completed during the spring or summer of 2025. Phases 3 and 4 of construction, namely additional pond construction and the new geothermal well respectively, were awarded in fiscal year 2023 and both will tentatively be completed in 2025. And Phase 5 of construction, namely the last of the planned ponds, is currently being planned for award in fiscal year 2024 for tentative completion in 2026. Needless to say, this new hatchery infrastructure, which should expand our current production space of 0.66 acres to over 8.5 acres and will greatly allow us to expand our production capacity in the coming years. Our staff are eagerly looking forward to these important developments, especially in view of the fact that the construction efforts have reduced our original pond space to nearly a quarter of what we had before.

Although the temporary space constraints will likely lead to reduced stocking numbers moving into fiscal years 2024 and 2025, the future of the hatchery is still very bright and will only get better. Already the staff are planning to implement study and work proposals for the new hatchery that are geared at improving our captive rearing techniques, expanding our population monitoring of hatchery stocks in the wild, refining our documentation of standard operating procedures, and better compiling and reporting

on historical data from the program's inception. And most importantly, the staff at the Hatchery and the Klamath Falls Fish and Wildlife Office (KFFWO) will continue to work closely with and learn from our vital partners within the Klamath Basin as we collective work towards fishery recovery goals.

With all of that said, please give your attention to the following annual report for more information on the activities briefly described during fiscal year 2023 at the Hatchery.

Introduction

The Shortnose Sucker (*Chasmistes brevirostris*) and the Lost River Sucker (*Deltistes luxatus*) were listed by the US Fish and Wildlife Service (USFWS) as endangered in 1988. These species are long-lived freshwater fish that are endemic to very few lakes and rivers in the upper Klamath Basin of southern Oregon and northern California, with lifespans of 30+ and 50+ years respectively. The Revised Recovery Plan for the Lost River Sucker (*Deltistes luxatus*, LRS) and Shortnose Sucker (*Chasmistes brevirostris*, SNS) called for the development of a controlled propagation program to prevent extinction. This was initially achieved in 2016 through a cooperative partnership with a local landowner of fish rearing facility to use the existing geothermal water source, ponds, and infrastructure to growout wild caught sucker larvae and was then known as the Sucker Assisted Rearing Program (SARP). Due to the early success of the program at rearing Klamath suckers in ponds, the USFWS signed a 30-year lease with the landowner and designated the site as the Klamath Falls National Fish Hatchery (KFNFH) in early 2022.

The KFNFH is currently under construction through 2026/2027 to expand the production capacity and infrastructure. Upon completion, the KFNFH will include a total of 33 production ponds, totaling approximately 8.5 acres of rearing space, a new influent retention pond, an effluent retention pond, a hatchery and administrative building, a maintenance shop, chemical and feed storage buildings, a backup well, and telecom and supervisory control and data acquisition (SCADA) control systems. This new infrastructure will allow for the production of approximately 60,000 suckers annually to help support recovery goals and stabilize and rebuild existing sucker populations within Upper Klamath Lake (UKL) and its tributaries. For a conceptual image of the new hatchery infrastructure, please see **Figure 1**.

The current production target for the facility is to raise 8-10,000 fish annually to an average size of 200 mm and in fiscal year 2023, the KFNFH released 17,399 production fish, averaging approximately 194 mm total length. So far, approximately 71,321 production fish have been reared and released from the program since 2018. In addition, since 2022, the program has also released in off-channel rearing locations or transferred to other facilities fingerlings that were excess fish stocks, beyond our rearing capacity, as well as fry produced from experimental wild spawning activities on the lake and stream side. These have totaled approximately 20,269 fingerlings and 34,921 fry to date. There is also the ongoing development of an older refugia population that can act as a redundant captive broodstock should the need arise, with approximately 1,369 fish currently on station that range from the 2017-2022 collection years. In addition, suckers salvaged throughout the year from Klamath Project Operations are rehabilitated, tagged, and repatriated, with 6,606 salvaged suckers repatriated to date. For more information on the collections and releases of suckers since the program's inception until 2023, please see **Table 1**.

Figure 1 – Conceptual site plan for the new construction of the Klamath Falls National Fish Hatchery, which has a tentative completion date of 2026/2027.

Table 1 – Collections and releases from the Klamath Falls National Fish Hatchery since its inception in 2016, by federal fiscal years, running from October 1 through the following September 30. All total lengths (TL) and standard lengths (SL) reported are averages based on length-weight conversions from cumulative total weights of each type, production, fingerling, fry, and salvage fish for each year. The line for fiscal year 2024, which includes fish stocked between October 1 through December 31, 2023, is currently in progress at the time of writing and is included so the most current information is available on releases.

Fiscal Year	Larvae Collected	Production Releases	TL (mm)	Fingerling Releases	TL (mm)	Fry Releases	TL (mm)	Salvage Releases	SL or TL (mm)
2016	4,134	-	-	-	-	-	-	-	-
2017	8,730	-	-	-	-	-	-	-	-
2018	9,544	2,355	147	-	-	-	-	784	102 [SL]
2019	24,426	4,497	189	-	-	-	-	1,586	103 [SL]
2020	40,603	11,774	223	-	-	-	-	1,928	94 [SL]
2021	106,710	13,394	208	-	-	-	-	1,689	143 [SL]
2022	51,929	12,768	193	4,655	118	19,993	10	-	-
2023	6,036	17,399	194	15,614	89	14,928	10	436	129 [TL]
2024	-	9,134	222	-	-	-	-	188	460 [TL]
Total	**252,112**	**71,321**		**20,269**		**34,921**		**6,606**	

Fish Culture Operations

The Klamath Falls National Fish Hatchery (KFNFH) uses a unique water supply sourced from a geothermal well, permitted to supply up to 399 gallons per minute (GPM) of water at approximately 88^{o}C. To make this supply suitable for fish culture operations, it is currently retained in three serial flow head ponds, whereby it is allowed to cool to ambient temperatures for use in tanks and ponds. It can also be used in small quantities directly in ponds for exchange purposes year-round, or in larger quantities to artificially warm the ponds in the spring, fall, and winter months to alter and/or extend the growing season.

During the fiscal year 2023, the outdoor facility included 22 0.03-acre ponds in the P-series and four 0.25-acre ponds in the A-series. Early in the fiscal year, the 24 0.03-acre ponds in the B-series were taken offline and these were demolished in the late spring and early summer to do site preparation for the construction of the hatchery building and maintenance building, as well as for construction laydown areas for the various contractors onsite, amounting to a loss of approximately 0.72 acres of pond rearing space from the 2.38 acres previously on hand. All ponds were used as the primary growout space of juvenile suckers and the fish will be harvested, split, and restocked two or three times during the 18-24 month growing cycle to check inventory, growth, and to tag them. Pond growout starts by stocking juvenile fish after initial collections, prophylactic treatments, and/or early rearing efforts and feed training within indoor tanks is complete. For more information on the pond layout during 2023, please see **Figure 2.**

The indoor intensive facility, which is located in a 30'x100' greenhouse, includes five 1300-gallon and three 500-gallon green circular tanks for processing hatchery fish, 13 150-gallon dark blue rectangular tanks, 12 90-gallon green circular tanks, and eight 60-gallon light blue circular tanks for larval sucker rearing, three 175-gallon light blue circulars for salvage rehabilitation, and four Research Racks, recirculating aquaculture systems (RAS), each with a 180-gallon light blue rectangular sump which were used for egg incubation and/or wet lab space for research. **Figure 3** displays the FY23 tank layout in the greenhouse**.**

The production cycle began with the collection of wild larval suckers drifting down the Williamson River from early May through June, and occasionally early July of each year. Larval suckers were collected, either with stationary drift nets in the middle of the river channel during the night and early morning dark hours and/or by active pursuit with dip nets in the marginal vegetation during daylight hours. The fish were transported back to the Hatchery where were tempered to the hatchery water supply, enumerated into isolation rearing tanks, and placed on a four-day prophylactic treatment protocol for removal of ectoparasites, namely a four-hour static bath of salt (0.5%) and an hour static bath of formalin (50ppm) prior to flushing the tank each day. Thereafter, mortality was monitored daily, and fish health was treated immediately to ensure that the wild caught fish do not pose a threat to established hatchery stocks.

Once the larval suckers were placed in the quarantine tanks, they were fed decapsulated and freshly hatched Artemia nauplii three to four times daily, usually at 7AM, 10AM, 1PM, and 4PM daily, and were later supplemented with commercially available dry feeds, such as Otohime and June Sucker diets in a fine mash after 14-21 days on station. All indoor culture units were cleaned each morning, monitored daily for adequate water quality, and fish mortalities were enumerated and removed from systems daily to monitor fish health and disease. After prophylactic treatments were completed and any observable mortality has subsided to normal levels, usually under 0.1-1.0% of the culture unit inventory, the larval

fish were either stocked directly into fertilized ponds with high zooplankton blooms for natural forage and/or feed trained during early rearing in tanks for four to six weeks prior to stocking in ponds, depending upon available space, manpower, and methodology needed.

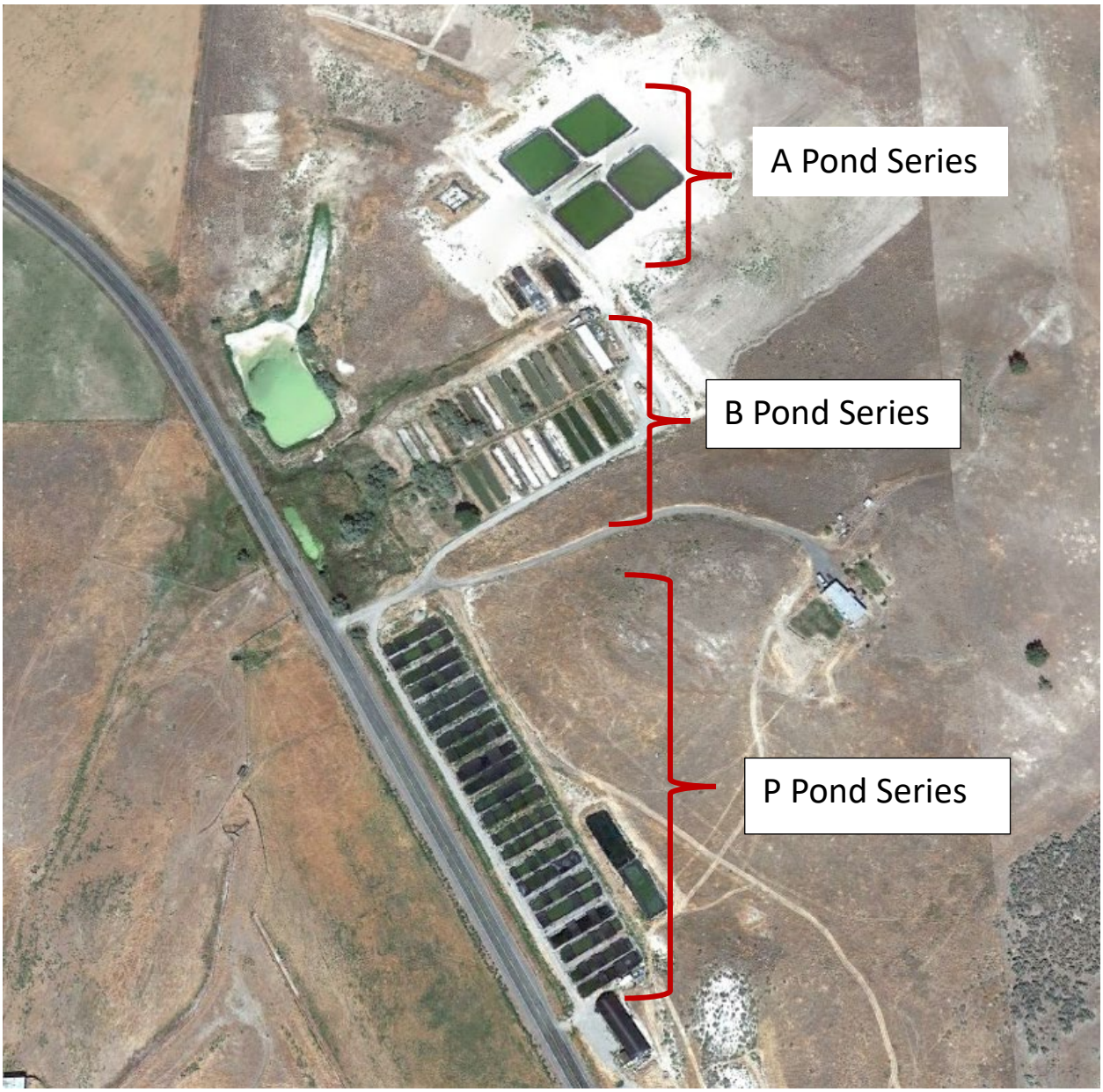

Figure 2 – An aerial view of the layout of ponds during Fiscal Year 2023 at the Klamath Falls National Fish Hatchery.

Once fish were ponded, water quality was monitored daily by staff throughout the 18-22-month growout cycle to ensure that the fish had adequate dissolved oxygen (DO) concentrations to optimize growing conditions; this included ensuring morning DO measurements are above 4-5 mg/L. If the DO

concentration was less than 3 mg/L, during morning DO measurements, fish were temporarily taken off feed for the day or given a reduced ration, and aerators were deployed. The fish were fed commercially available diets in progressively larger sizes as they grew, at rates that began at 15-30% body weight (BW) daily and then were reduced progressively down to about 3-5% BW daily by the end of the first growing season; generally, the juvenile suckers have reached 100-125mm total length by November or December. During the cooler winter months, feed rates are usually reduced in quantity to 1-2% BW, and reduced in frequency to one to three times weekly, depending upon water temperature. During the second growing season, which starts in April or May, feed rates ranged between 2-3% BW daily as the fish get older and their metabolism and growth slows. The fish were grown to the average target size of approximately 200mm total length by that second fall or the following spring and then they are strategically stocked and repatriated into various parts of Upper Klamath Lake and its tributaries. Prior to stocking out an entire year class, 300-500 fish total are randomly taken from multiple ponds to set aside as a refugia broodstock and incorporated into that captive population. After these refugia broodfish get larger and require thinning, we often randomly select some fish for repatriation as larger holdovers to stock at a larger size.

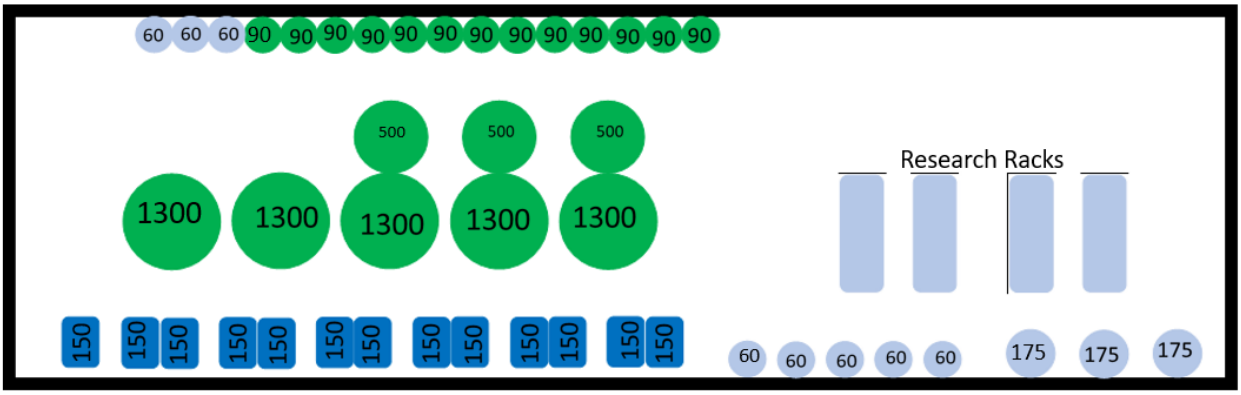

Figure 3 –Layout of tanks in the greenhouse at the Klamath Falls National Fish Hatchery in FY2023. Numbers indicate tank capacity gallons.

One final component to the fish culture operations is seasonally rehabilitating salvaged suckers that were entrained in the forebay of the A-Canal headworks or other unscreened diversions and canals of the Klamath Project. Reclamation salvaged suckers from these locations, fish were transported to the USFWS hatchery, placed in temporary isolation, treated using chemical therapeutant, scanned for a PIT tag, PIT-tagged if untagged, and measured to length and weight. These wild, salvaged suckers were repatriated back to Upper Klamath Lake by hatchery staff. Some years result in large numbers of suckers rehabilitated and repatriated and some years have none. This cooperative effort is important since these wild fish are some of the few suckers aged 0-2 that have survived until the late summer, fall, or early winter of each year and were encountered and found. It may be that these fish have a greater likelihood of surviving into adulthood and rehabilitating them may represent an important sucker conservation measure.

Wild and Captive Sucker Spawning

Wild Lost River Sucker populations spawn in two different locations with a measure of site fidelity in the Upper Klamath Basin, so much so that they are considered separate populations in the recovery plan due to the difference in reproductive behavior; even though no discernable differences exist genetically between these two populations. The first and largest population, with approximately 24,000 fish, spawn in the Williamson and/or Sprague Rivers, near the town of Chiloquin, Oregon, during April and May (USFWS 2023 BiOp- based on estimates derived from 2021 USGS CJS data). The other smaller population, with approximately 4,000 (USFWS 2023 BiOp- based on estimates derived from 2021 USGS CJS) data individuals, spawn on the east side of Upper Klamath Lake, on a series of springs commonly referred to collectively as the East Side Springs, usually a little earlier in the spring than the river spawning population. During all of this spawning activity in this area, US Geological Service (USGS) Biologists conduct annual monitoring of river and spring populations using trammel nets, a weir located on the Williamson River, and PIT tag antenna arrays. The KFNFH staff, along with staff from the Klamath Tribes Hatchery (KTH), used some of these fish, from the springs spawning population, to collect and fertilize gametes for experimental incubation trials and to produce viable offspring for the hatchery broodstock population.

On April 21, April28 and May 5, 2023, four wild males and four wild females were crossed each day to produce 16 family groups of eggs per day, with a spawning matrix of four females and four males each week, and for a total of 48 family groups collected overall. In total, 30 wild adult Lost River Suckers were handled and 24 spawned during these activities and returned safely to the water thereafter. Small batches (<40-50 mL) of eggs were collected from each female during this effort so that these wild fish could still spawn naturally. After the collection of gametes, unfertilized eggs from each female were separated into four bowls, and each bowl of eggs was fertilized by one of four males, silted, and rinsed.(cite Charlee's SOP here). Thereafter, the eggs were transported to the KFNFH and KTH facilities counted via water dispersal then placed in separate jars for incubation. Once hatched, fry are individually counted to get a census of larvae. In total 73,869 eggs counted and transferred to the KFNFH and 18,604 fry were successfully hatched and stocked, with 3,676 fry randomly selected from the 48 family groups stocked into a hatchery rearing pond and the remaining 14,928 fry stocked to Unit 2 on the Lower Klamath Lake Refuge, for a hatching success of approximately 25.2%. For more information on the male and female Lost River Suckers used in the spawning effort, please see **Table 2**.

The hatch rates were very low likely due to water quality limitations with the geothermal water supply and the unstable rearing temperatures in our greenhouse, which fluctuated as much as 5-6^{o}C daily, even while using small chiller systems on our RAS Research Racks. Efforts are currently underway to continue to refine the augmenting of water quality, primarily hardness and other vital minerals after stripping the water through a reverse osmosis system, as well as installing chillers with heat pumps in our newly insulated salvage building to stabilize incubation conditions in 2024.

In addition to spawning wild Lost River Suckers (LRS) from the East Side Spring, staff collected summary broodstock information and to experimentally spawn some Shortnose Sucker (SNS) in the captive broodstock on station. During early May, staff seined fish from the CY2017 broodstock pond over the course of three different weeks, collecting approximately 30 SNS randomly each time. Upon collection each week, all LRS were sorted out to a new pond and the SNS were sexed and sorted. The male SNS were given a single dose of human chorionic gonadotrophin (HCG) hormone, at a rate of 100 µl/kg

injected intramuscularly in the dorsal area, before being placed into a separate “male” tank to ripen for three days. The female SNS were given the first of three doses of HCG, totaling a rate of 100 µl/kg injected intramuscularly in the dorsal area, before being placed into a separate “female” tank, where they would get two additional doses, at 24-hour intervals. Then, after all the fish had three total days to ripen, staff checked for gravidity and ovulation rates of the females and milt volumes of the males. Once all of this handling was complete, and all the data was collected on each fish, then they were placed into a new pond for the growing season. This process was repeated each week for two consecutive weeks at the end of April and May.

None of the fish sampled had high body condition, as they had been reared in high densities the previous year; this may have been a large factor in the results observed. The males had very low milt volumes (<1-2ml) and motility (<50%) compared with what had been observed in previous years with these same fish, and none of the females ovulated and released ripe eggs, across all weeks of this effort. As a result, the number of ponds set aside for broodstock was increased in 2023 to eight of the 26 ponds to allow for lower densities. Lower densities may allow for better growth and condition moving into 2024, and improved ovulation and milt production. These broodstock year will also be another year older, and more likely to be sexually mature as six- and seven-year-olds. However, we may not have reliable ovulation from the SNS broodstock until many of the fish are 8-10 years old, and perhaps even as late as 10-12 years old for the LRS broodstock on station.

Table 2 – Summary of the wild East Side Springs Lost River Suckers handled during spawning activities from Upper Klamath Lake in the spring of 2023. AFTC stands for Abernathy Fish Technology Center.

DATE	SPRING NAME	PIT TAG LAST 5	SEX	FORK LENGTH	ATFC GENETIC ID	SPAWNED/NOT SPAWNED	FRY COLLECTED FOR AFTC
4/21/2023	CINDER	8ECCA	MALE	652	3960-001	SPAWNED	Y
4/21/2023	CINDER	141F7	MALE	685	3960-002	SPAWNED	Y
4/21/2023	CINDER	D6ECA	MALE	655	3960-003	SPAWNED	N
4/21/2023	CINDER	888A7	MALE	659	3960-004	SPAWNED	N
4/21/2023	CINDER	B96F3	FEMALE	714	3960-006	SPAWNED	Y
4/21/2023	CINDER	3D0F7	FEMALE	728	3960-007	SPAWNED	Y
4/21/2023	CINDER	9AA35	FEMALE	772	3960-008	SPAWNED	N
4/21/2023	SILVER	88864	FEMALE	742	3960-009	SPAWNED	N
4/28/2023	SILVER	B9692	MALE	759	3960-010	SPAWNED	N
4/28/2023	SILVER	B968F	MALE	655	3960-011	NOT SPAWNED	N
4/28/2023	SILVER	22C9B	MALE	679	3960-012	SPAWNED	N
4/28/2023	SILVER	FDA66	MALE	720	3960-013	NOT SPAWNED	N
4/28/2023	SILVER	DA6F2	MALE	688	3960-014	NOT SPAWNED	N
4/28/2023	SILVER	2DDB8	MALE	673	3960-015	SPAWNED	N
4/28/2023	SILVER	E2829	MALE	660	3960-016	SPAWNED	N
4/28/2023	SILVER	D5543	FEMALE	-	3960-017	SPAWNED	N
4/28/2023	SILVER	TWO FISH WERE LABELED WITH THIS GE			3960-019		
4/28/2023	SILVER	8D7E7	FEMALE	798	3960-020	SPAWNED	N
5/5/2023	SUCKER	325A5	MALE	646	3960-021	NOT SPAWNED	N
5/5/2023	SUCKER	34071	MALE	635	3960-022	SPAWNED	N
5/5/2023	SUCKER	25EBE	MALE	655	3960-023	SPAWNED	N
5/5/2023	SILVER	157A8	MALE	685	3960-024	SPAWNED	N
5/5/2023	SILVER	3CD95	MALE	645	3960-025	NOT SPAWNED	N
5/5/2023	SILVER	24C75	MALE	630	3960-026	SPAWNED	N
5/5/2023	SILVER	2C839	FEMALE	710	3960-027	SPAWNED	N
5/5/2023	SILVER	SAMPLE NO DATA (DID NOT USE FISH)			3960-028		
5/5/2023	SILVER	E20CA	FEMALE	765	3960-029	SPAWNED	N
5/5/2023	SILVER	8D0CC	FEMALE	733	3960-030	SPAWNED	N
5/5/2023	SILVER	B9605	FEMALE	745	3960-031	SPAWNED	N

Larval Collections and Early Rearing

During the Spring of 2023, the Hatchery staff, along with assistance from the KFFWO staff, collected a total of 6,036 larval sucker from the lower Williamson River, near the town of Chiloquin, Oregon. Staff spent a total of 19 collections days on the river between the dates of May 8th and June 12th. The species composition of this catch was a mix predominantly of Lost River Sucker and Shortnose Sucker, with some potential for limited numbers of Klamath Largescale Sucker. Collection methods included using a passive method of deploying drift nets in the river channel at night for timed collection events, as well as using active methods like long handled dip nets to actively collect larval suckers from a small flat-bottomed boat and/or by wading through marginal emergent vegetation where these fry collect during the early daylight hours. For more information on the daily collection trends, please see **Figure 4**.

All of the collected sucker fry were transported back to the Hatchery daily, tempered into 90-gallon flow through circular rearing tanks with a 0.3% salt concentration, then given prophylactic treatments for four days, comprising of a three hour static bath 0.5% salt treatment immediately followed by a one hour static bath 50ppm formalin treatment each day before tanks are flushed and normal flow through is resumed. Fry were fed freshly hatched decapsulated Artemia nauplii three to four times daily until they are stocked to a fertilized fry pond. If fry are reared for more than 14-21-days, they are supplemented with dry commercial fish diets three to four times daily until stocked into a fertilized fry pond, usually around 30-40 days post collection. Tanks are siphoned and/or inspected daily to collect mortalities and to clean the tanks. Total observed mortality from all the tanks was 1,100 fish overall, which was approximately 18.2% of the entire stock. This included a fish health mortality event in Tank C14 from July 2 through July 4 of 752 fish. A total of 3,969 fish were inventoried and stocked into fry ponds out of the total number of 6,036 fish collected for an overall survival of 65.8% and unobserved mortality at 16.0%. For more information on specific survival and mortality in each culture unit used during the season, please see **Table 3.**

Our sampling efforts suggest that in 2023, larval suckers were in limited supply in the Williamson River and staff did not meet the target collection goal of 40-50,000 fish, in spite of increased efforts compared with previous years. Historically the program only used passive drift net sets to collect fry. In 2020, staff fished drift nets but also started employing active pursuit of fry by wading the marginal vegetation with small aquarium dip nets in the early morning daylight hours, but these active collection efforts were very limited. In 2021, staff employed both passive drift net sets and active dip netting with increased efforts to prove that collections over 100,000 fish per season were feasible for future large scale production efforts. In 2022, low flows in the Williamson River made drift net sets unsuitable for collections and active dip netting was very effective (Figure 5) with great success and surpassingly less effort than ever seen previously invested in a season. During 2023, dip netting was the primary method used with surprisingly poor catch rates throughout the season; drift netting captured less than 50 fish over several nights. A combination of factors, such as a late and colder than normal spring, a very wet winter and spring leading to increased flows and turbidity in the river, followed by sporadic water temperature fluctuations that quickly warmed and recooled more than normal, and a low number of returning adults, all contributed to a poor spawning year and low numbers of larval suckers in 2023. For more information on historical collection trends and methods, as well as a comparison of the past three years of collection data, please see **Figure 5** and **Table 4**.

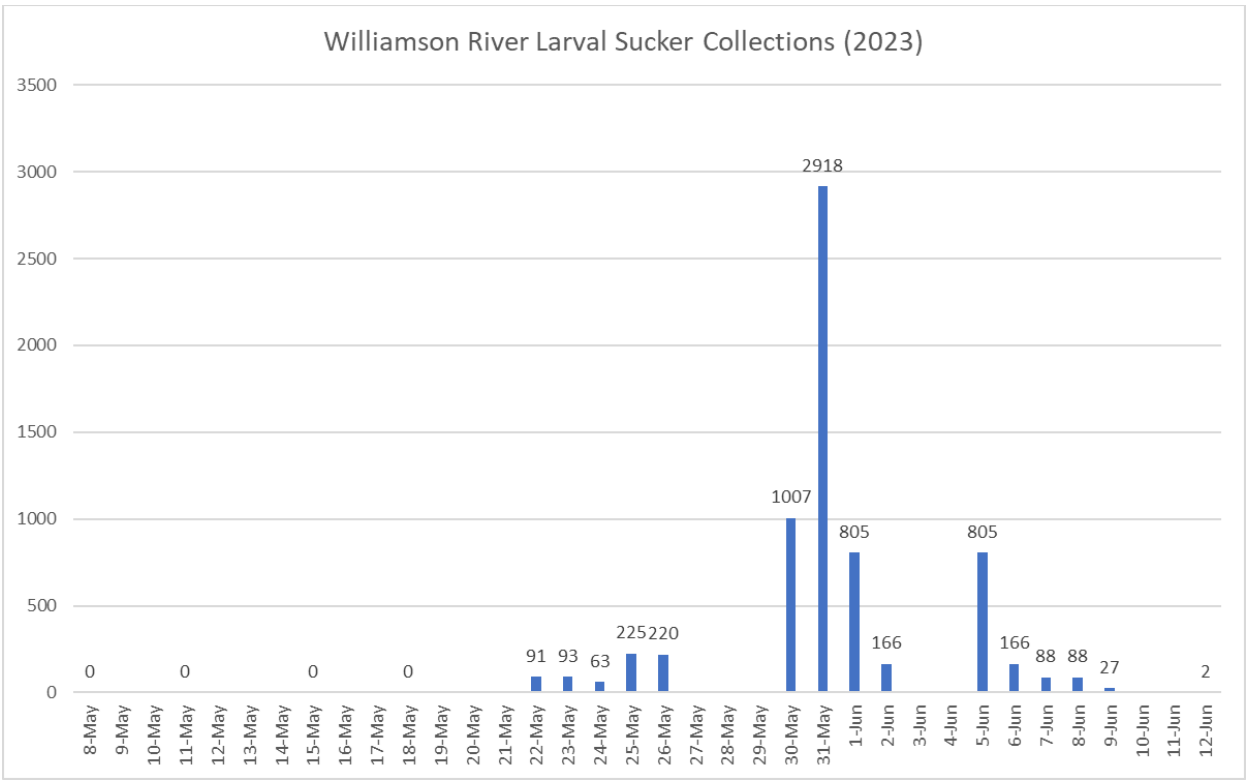

Figure 4 – Catches of larval Klamath suckers per day on the lower Williamson River, near Chiloquin, Oregon, during the Spring 2023 for the Klamath Falls National Fish Hatchery.

Table 3 – This describes the initial collection and stocking numbers of larval suckers, total mortality, and survival of each culture tank, as well as overall summary information.

Collection Date	Culture Unit	Collected (#)	Observed Mortality (#)	Stocked (#)	Overall Survival (%)	Observed Mortality (%)	Unobserved Mortality (%)
5/22/2023	C3	91	0	71	78.0	0	22.0
5/23/2023	C4	93	0	87	93.5	0	6.5
5/24/2023	C5	63	2	29	46.0	3.2	50.8
5/25/2023	C6	225	1	137	60.9	0.4	38.7
5/26/2023	C7	220	4	168	75.9	1.8	22.3
5/30/2023	C8	1,007	21	833	82.7	2.1	15.2
5/31/2023	C9	1,409	50	1,271	90.2	3.5	6.2
5/31/2023	C14	1,509	938	298	19.7	62.2	18.1
6/1/2023	C13	805	9	593	73.7	1.1	25.2
6/2/2023	C12	166	1	137	82.5	0.6	16.9
6/5/2023	C10	257	70	191	14.4	27.2	58.4
6/7/2023	C9	162	4	124	76.5	2.5	21.0
6/9/2023	C8	27	0	27	100.0	0	0
6/12/2023	C7	3	0	3	100.0	0	0
		6,036	**1,100**	**3,969**	**65.8**	**18.2**	**16.0**

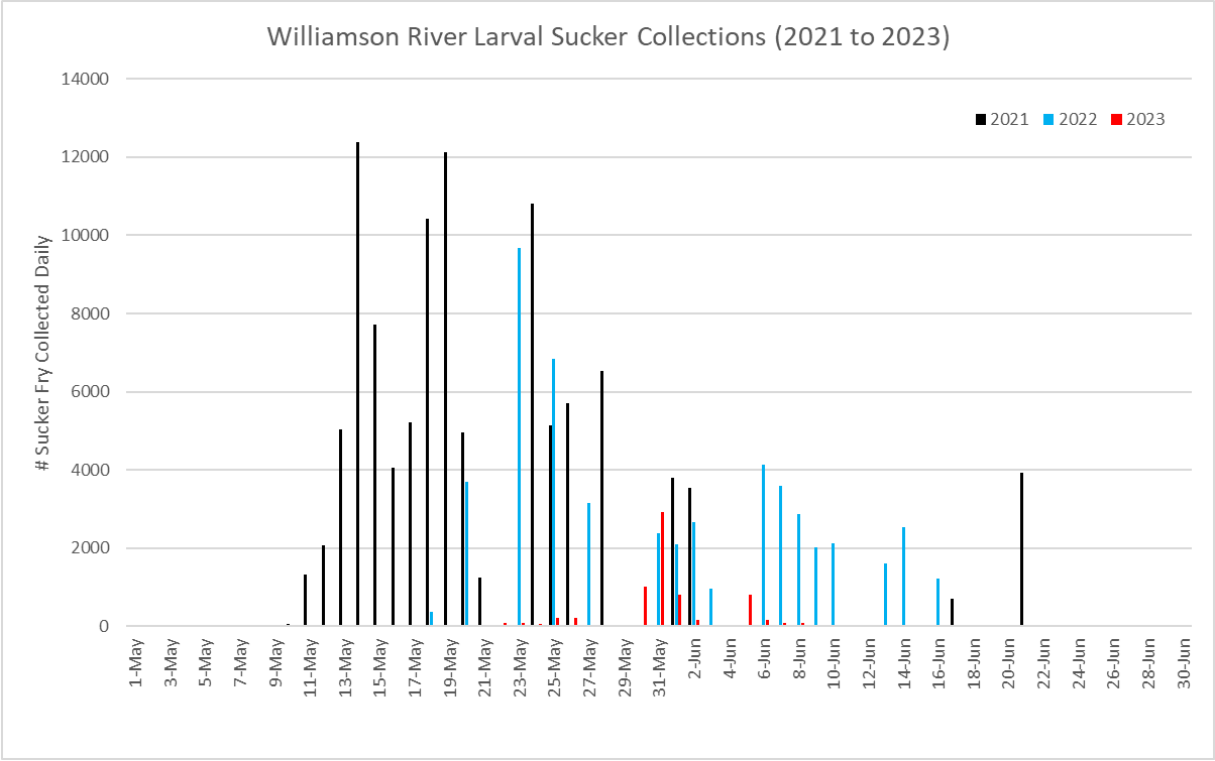

Figure 5 - Catches of larval suckers each day on the lower Williamson River, near Chiloquin, Oregon, during the Springs of 2021, 2022, and 2023 collection efforts.

Table 4 – Historical catches of larval suckers from the lower Williamson River, near Chiloquin, Oregon. (*) Note that 2023 was the first year when collections were limited in the number of fry available during the collection season.

Year (Spring)	# Collected	Primary Collection Method
2016	4,134	Drift Net (Passive Method)
2017	8,730	Drift Net (Passive Method)
2018	9,544	Drift Net (Passive Method)
2019	24,426	Drift Net (Passive Method)
2020	40,603	Drift Net (Passive Method)
2021	106,710	Drift Net (Passive Method) / Dip Net (Active Method)
2022	51,929	Dip Net (Active Method)
2023	6,036*	Dip Net (Active Method)
Total Collected to Date	**252,112**	

Pond Growout

Fish culture of Klamath Suckers is ideal in management ponds because the fish are in a natural environment that hosts the production of natural forage of macroinvertebrates, such as cladocerans, copepods, and insect larvae, all of which serves as a supplemental nutrition source for the fish. The ability to forage naturally not only allows a hatchery reared fish to retain wild characteristics and prevent domestication, but also speeds up the production and growth of the fish while they are also fed commercially-available dry diets. Prior to feeding, pond water quality was monitored each morning to measure temperature and dissolved oxygen concentrations, using a YSI. Water quality measurements determine daily feed rations for each pond. Ponds were checked for mortality and dead fish were removed to prevent or reduce the spread of disease. Data is available in real-time to partners, such as the California Nevada Fish Health Unit, so staff can monitor our water quality and mortality records if problems are observed and reported. Daily water quality monitoring, removal of and quantifying fish mortality trends, and feeding, are the primary pillars, or first lines of defense and observation, to effectively culture Klamath Suckers and allow the staff to make daily management decisions and adjustments as needed to help care for and protect these captive stocks. For more information on the morning water temperature and dissolved oxygen trends, as well as fish mortality, throughout the year, please see **Figures 6-8**.

Our staff also monitored other water quality parameters in ponds, such as pH, ammonia, nitrate, and nitrite, monitoring and adjusted water delivery of cooled and geothermal flows to regulate culture unit (pond or other holding space) temperatures, and sampled and monitored fish health, growth, and size. Suckers were harvested from ponds in the spring and fall to quantify fish, redistribute fish to new ponds and split to lower rearing densities, and to repatriate fish to locations within Upper Klamath Lake and its tributaries when fish reach target sizes. All of the suckers were PIT tagged at the end of the first growing season in late fall, when five to seven months old, so that the tag wound could heal as disease, and water quality problems are less abundant in the winter. Tagging all of the production fish before they are stocked the following fall, about 10-12 months later, removes a vital stressor that can lead to post stocking mortality, with the goal of increasing wild survival in UKL. Overall, fish at the hatchery had fairly high survival rates, generally over 80-90% for most age 1+ fish between harvest cycles, and consistent growth rates throughout the growing season, March/April through October/November. For more information on pond performance, growth, and survival in each of the ponds during the FY 2023, and even into the beginning of Fiscal Year 2024, please see **Tables 5-7**.

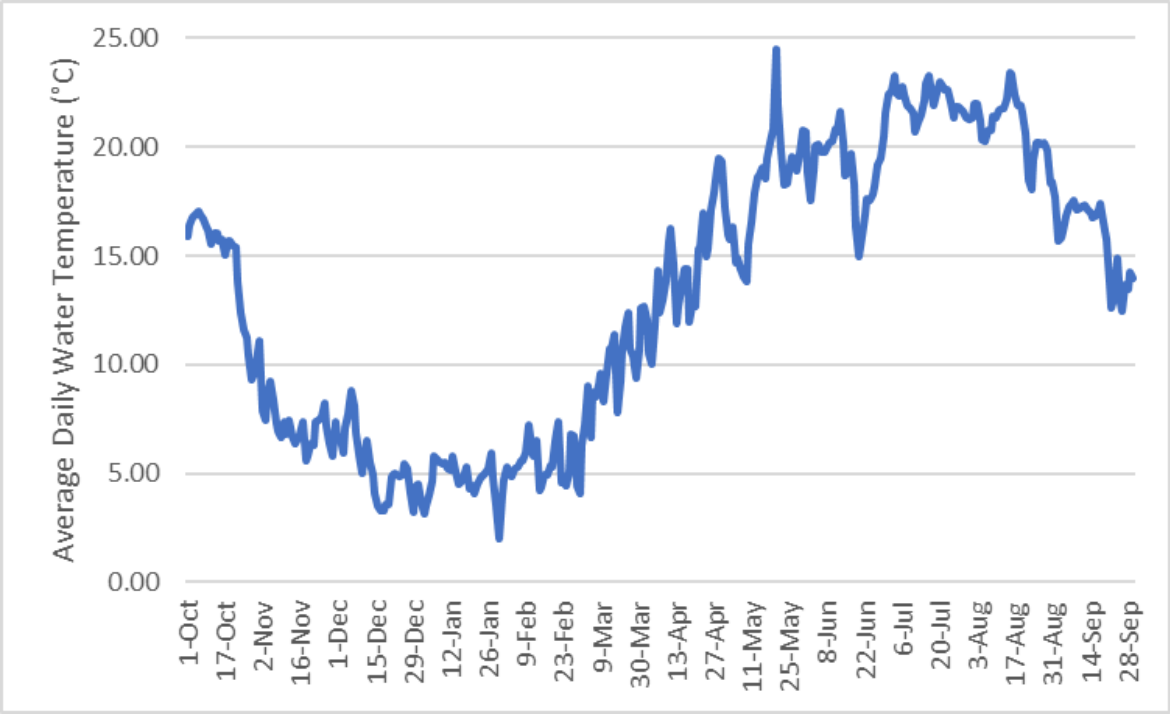

Figure 6 – Average morning temperature (°C) of all ponds, at the Hatchery, during the fiscal year of 2023; Temperature is measured between 0600 and 0730 am each day.

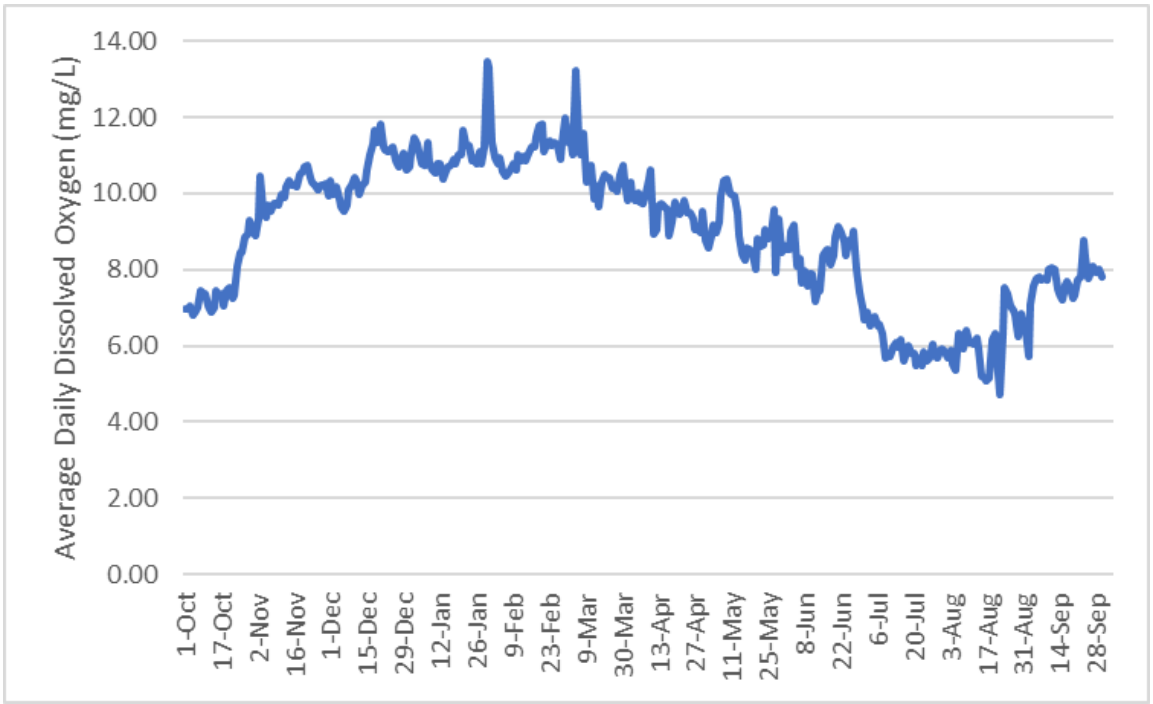

Figure 7 – Average morning dissolved oxygen concentration (mg/L), at the Klamath Falls National Fish Hatchery, in FY 2023; Temperature is measured each morning between 0600 and 0730 am each day.

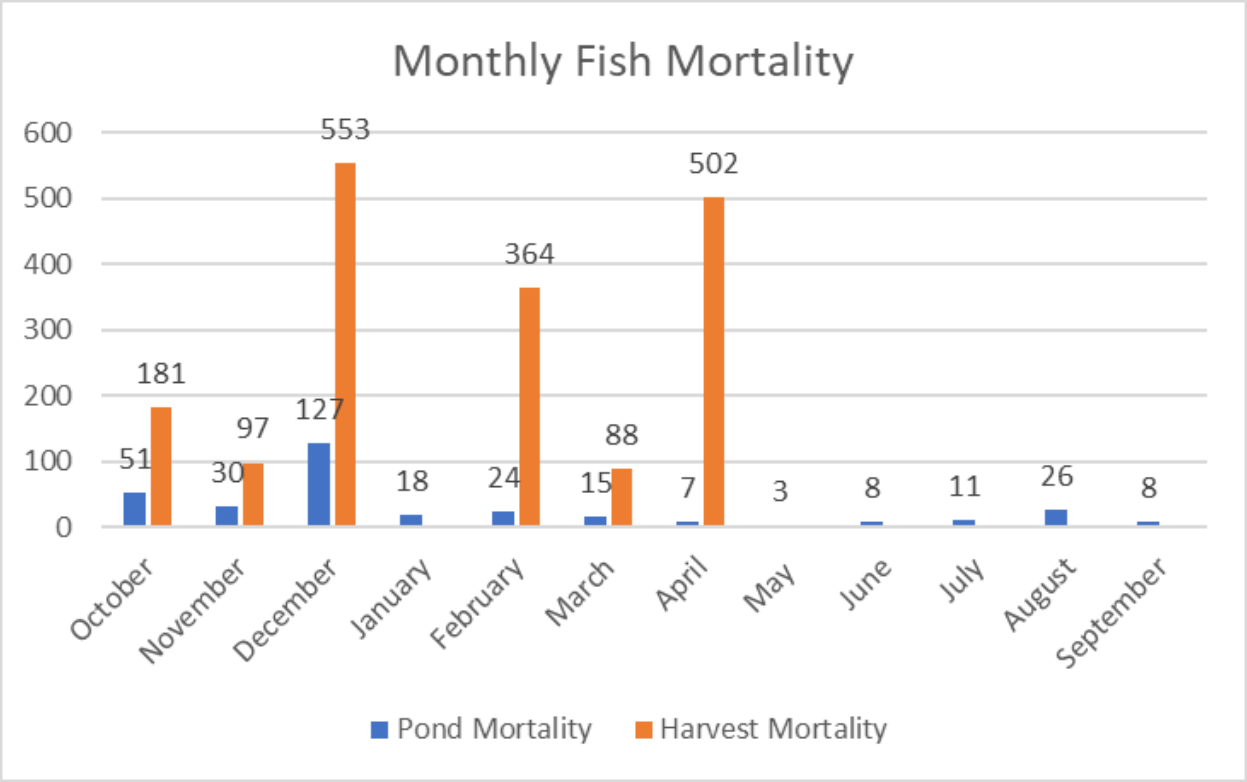

Figure 8 – Total monthly pond and harvest mortalities, at the Klamath Falls National Fish Hatchery, in FY 2023. Harvest mortalities result from handling and are recorded separately.

Table 5 – Pond, collection year, stocking date, number of suckers on stocking date, average weight per fish, total weight of all fish in each pond (used to derive feeding amounts), average total length on stocking date (mm, measured or derived from length weight relationships, date harvested, number of suckers on harvest date, growth, and survival for ponds during the production cycle starting in the Spring of 2022 through the Fall of 2022 at the Klamath Falls National Fish Hatchery. The last seven rows in the table are summary numbers for each year class on station and the overall for the harvest season.

Pond	Lot	Stocked	Total	Average	Weight	Weight	TL	Harvested	Total	Average	Weight	Weight	TL	Days	Months	Growth	Growth	Weight Gain	Harvest Morts	Survival
			#	g/fish	g	lbs	mm		#	g/fish	g	lbs	mm			mm/day	g/fish/mon.	lbs	#	%
P0	**2017**	3/2/2022	90	433.32	38998.6	85.9	351	9/19/2022	87	526.33	45790.44	100.86	392.5	201	7	0.21	13.88	14.96	0	96.67
P1	**2018**	3/1/2022	251	211.08	52981.8	116.7	281	9/19/2022	232	276.71	64195.6	141.4	316.7	202	7	0.18	9.75	24.70	0	92.43
P2	**2019**	3/3/2022	288	197.21	56795.4	125.1	271	9/19/2022	259	265.91	68871.8	151.7	308.7	200	7	0.19	10.31	26.60	0	89.93
P3	**2019**	3/3/2022	228	175.83	40088.2	88.3	265	9/19/2022	183	324.75	59428.6	130.9	318.7	200	7	0.27	22.34	42.60	0	80.26
P4	**2020**	3/8/2022	499	55.68	27784.8	61.2	173	9/20/2022	468	105.64	49440.6	108.9	229.8	196	7	0.29	7.65	47.70	0	93.79
P5	**2020**	3/9/2022	500	63.20	31598.4	69.6	181	9/20/2022	470	124.39	58461.58	128.77	242.6	195	7	0.32	9.41	59.17	0	94.00
P6	**2020**	3/24/2022	546	62.28	34004.6	74.9	172	9/21/2022	502	142.25	71409.66	157.29	317.7	181	6	0.80	13.25	82.39	0	91.94
P7	**2020**	3/24/2022	550	48.29	26559	58.5	169	9/21/2022	505	101.69	51351.94	113.11	278.5	181	6	0.60	8.85	54.61	0	91.82
P8	**2021**	4/10/2022	209	5.87	1225.8	2.7	87.9	8/6/2022	187	18.91	3536.66	7.79	129.5	118	4	0.35	3.32	5.09	0	89.47
P8	**2021/2019**	6/16/2022	80	144.71	11577	25.5	98	9/21/2022	53	299.30	15862.76	34.94	397.6	97	3	3.09	47.81	9.44	0	66.25
P17	**2021**	5/3/2022	1079	12.71	13710.8	30.2	120	10/17/2022	1024	48.95	50121.6	110.4	177	167	6	0.34	6.51	80.20	33	97.96
P18	**2021**	5/3/2022	900	15.23	13710.8	30.2	120	10/18/2022	866	46.32	40110.9	88.35	176	168	6	0.33	5.55	58.15	19	98.33
P19	**2021**	5/3/2022	900	15.23	13710.8	30.2	120	10/17/2022	868	45.31	39325.48	86.62	174	167	6	0.32	5.40	56.42	9	97.44
P20	**2021**	5/3/2022	900	15.23	13710.8	30.2	120	10/18/2022	837	54.19	45354.6	99.9	182	168	6	0.37	6.96	69.70	34	96.78
B1	**2021**	4/14/2022	600	13.17	7899.6	17.4	116	10/24/2022	380	31.90	12121.8	26.7	178	193	6	0.32	2.91	9.30	12	65.33
B2	**2021**	3/28/2022	600	10.82	6492.2	14.3	97	11/2/2022	569	71.97	40950.8	90.2	177	219	7	0.37	8.38	75.90	14	97.17
B3	**2021**	4/18/2022	600	13.62	8172	18	98	11/14/2022	430	50.57	21746.6	47.9	181	210	7	0.40	5.28	29.90	15	74.17
B4	**2021**	3/28/2022	600	10.06	6038.2	13.3	98	11/14/2022	562	55.84	31380.48	69.12	167	231	8	0.30	5.94	55.82	9	95.17
B5	**2021**	4/18/2022	600	13.70	8217.4	18.1	102	11/14/2022	574	61.85	35502.8	78.2	177	210	7	0.36	6.88	60.10	2	96.00
B6	**2021**	3/29/2022	600	9.31	5584.2	12.3	104	11/14/2022	565	67.87	38344.84	84.46	193	230	8	0.39	7.64	72.16	5	95.00
B7	**2021**	4/18/2022	600	13.17	7899.6	17.4	99	11/16/2022	565	47.65	26922.2	59.3	176	212	7	0.36	4.88	41.90	2	94.50
B8	**2021**	3/29/2022	600	9.00	5402.6	11.9	102	11/16/2022	565	50.92	28769.98	63.37	192	232	8	0.39	5.42	51.47	6	95.17
B9	**2021**	4/19/2022	600	13.32	7990.4	17.6	10.5	12/7/2022	547	46.03	25178.84	55.46	95.5	232	8	0.37	4.23	37.86	5	92.00
B10	**2021**	3/30/2022	600	9.46	5675	12.5	115	10/25/2022	565	47.42	26790.54	59.01	189	209	7	0.35	5.45	46.51	2	94.50
B11	**2021**	4/19/2022	600	13.24	7945	17.5	115	10/25/2022	556	45.29	25178.84	55.46	172	189	6	0.30	5.09	37.96	5	93.50
B12	**2021**	3/29/2022	600	10.59	6356	14	115	10/26/2022	587	49.39	28992.44	63.86	171	211	7	0.27	5.52	49.86	3	98.33
B13	**2021**	4/20/2022	600	13.17	7899.6	17.4	115	10/26/2022	575	56.22	32324.8	71.2	172	189	6	0.30	6.83	53.80	13	98.00
B14	**2021**	3/30/2022	600	9.23	5538.8	12.2	115	10/26/2022	561	60.97	34204.36	75.34	180	210	7	0.31	7.39	63.14	8	94.83
B15	**2021**	4/20/2022	600	13.17	7899.6	17.4	115	10/27/2022	537	44.94	24134.64	53.16	170	190	6	0.29	5.02	35.76	2	89.83
B16	**2021**	3/31/2022	600	9.08	5448	12	115	10/27/2022	544	53.99	29369.26	64.69	187	210	7	0.34	6.42	52.69	34	96.33
B17	**2021**	4/19/2022	600	12.64	7581.8	16.7	115	10/31/2022	580	37.63	21823.78	48.07	184	195	7	0.35	3.84	31.37	3	97.17
B18	**2021**	3/31/2022	600	7.87	4721.6	10.4	115	10/31/2022	496	51.82	25700.94	56.61	185	214	7	0.33	6.16	46.21	0	82.67
B19	**2021**	4/19/2022	600	13.09	7854.2	17.3	115	11/2/2022	544	57.14	31085.38	68.47	182	197	7	0.34	6.71	51.17	8	92.00
B20	**2021**	4/1/2022	600	8.17	4903.2	10.8	97	11/2/2022	575	54.93	31584.78	69.57	177	215	7	0.37	6.52	58.77	3	96.33
B21	**2021**	4/14/2022	600	13.62	8172	18	103	11/7/2022	587	36.67	21527.318	47.417	164	207	7	0.29	3.34	29.42	3	98.33
B22	**2021**	3/31/2022	600	10.97	6583	14.5	97	11/7/2022	522	42.30	22078.02	48.63	174	221	7	0.35	4.25	34.13	7	88.17
B23	**2021**	4/14/2022	600	13.70	8217.4	18.1	95	11/7/2022	568	45.36	25764.5	56.75	177	207	7	0.40	4.59	38.65	2	95.00
B24	**2021**	4/1/2022	600	8.02	4812.4	10.6	99	11/7/2022	557	56.53	31484.9	69.35	171	220	7	0.33	6.61	58.75	21	96.33
A2	**2022**	5/23/2022	18985	16.24	308356.8	679.2	120	12/7/2022	8140	6.58	53576.54	118.01	168	198	7	0.24	-1.46	-561.19	548	45.76
A3	**2021**	4/29/2022	3076	15.79	48578	107	114	10/4/2022	804	61.32	49304.4	108.6	195	158	5	0.51	8.65	1.60	4	26.27
	2017		**90**						**87**										**0**	**96.67**
	2018		**251**						**232**										**0**	**92.43**
	2019		**516**						**442**										**0**	**85.66**
	2020		**2095**						**1945**										**0**	**92.84**
	2021		**21544**						**17750**										**283**	**83.70**
	2022		**18985**						**8140**										**548**	**45.76**
	Overall		**43481**						**28596**										**831**	**67.68**

Table 6 - Pond, collection year, stocking date, number of suckers on stocking date, average weight per fish, total weight of all fish in each pond (used to derive feeding amounts), average total length on stocking date (mm, measured or derived from length weight relationships, date harvested, number of suckers on harvest date, growth, and survival for ponds during the production cycle starting in the Summer/Fall of 2022 through the Spring of 2023 at the Klamath Falls National Fish Hatchery. The last eight rows in the table are summary numbers for each year class on station and the overall for the harvest season.

Pond	Lot	Stocked	Total	Average	Weight	Weight	Start TL	Harvested	Total	Average	Weight	Weight	Start TL	Days	Months	Growth	Growth	Weight Gain	Harvest Morts	Survival
			#	g/fish	g	lbs	(mm)		#	g/fish	g	lbs	(mm)			mm/day	g/fish/mon.	lbs	#	%
P0	**2017**	9/19/2022	87	526.01	45763.2	100.8	392	3/13/2023	87	562.02	48895.8	107.7	370	175	6	-0.13	6.17	6.90	0	100.00
P1	**2018**	9/18/2022	232	273.97	63560	140	316	3/13/2023	220	309.19	68022.82	149.83	307	176	6	-0.05	6.00	9.83	2	95.69
P2	**2019**	9/20/2022	160	256.06	40968.96	90.24	308	3/13/2023	137	294.19	40304.304	88.78	297	174	6	-0.06	6.58	-1.46	0	85.63
P3	**2019**	9/19/2022	152	281.66	42812.2	94.3	318	3/14/2023	151	303.73	45862.626	101.02	301	176	6	-0.10	3.76	6.72	0	99.34
P4	**2020**	9/19/2022	468	105.55	49395.2	108.8	229	3/15/2023	471	116.00	54634.36	120.34	222	177	6	-0.04	1.77	11.54	0	100.64
P5	**2020**	9/22/2022	470	124.32	58429.8	128.7	242	3/15/2023	460	137.01	63024.28	138.82	231	174	6	-0.06	2.19	10.12	1	98.09
P6	**2021**	11/14/2022	922	60.02	55342.6	121.9	190	3/20/2023	879	62.04	54537.204	120.13	183	126	4	-0.06	0.48	-1.77	21	97.61
P7	**2022**	12/12/2022	1500	6.14	9216.2	20.3	91.1	2/27/2023	1256	7.80	9792.78	21.57	93	77	3	0.02	0.64	1.27	122	91.87
P8	**2022**	12/12/2022	1500	5.96	8943.8	19.7	91.1	2/27/2023	1250	9.16	11454.42	25.23	93	77	3	0.02	1.25	5.53	61	87.40
P9	**2022**	7/18/2022	799	0.85	681	1.5	46	2/21/2023	533	9.25	4929.986	10.86	96	218	7	0.23	1.16	9.36	12	68.21
P10	**2022**	7/18/2022	686	0.86	590.2	1.3	46.6	2/21/2023	572	13.17	7533.2674	16.59	107	218	7	0.28	1.69	15.29	17	85.86
P11	**2022**	7/18/2022	771	0.82	635.6	1.4	45.7	2/22/2023	695	10.97	7627.2	16.80	102	219	7	0.26	1.39	15.40	28	93.77
P12	**2022**	7/18/2022	708	0.90	635.6	1.4	46.6	2/23/2023	540	12.48	6740.992	14.85	106	220	7	0.27	1.58	13.45	26	79.94
P13	**2022**	7/18/2022	797	0.85	681	1.5	46	2/21/2023	848	10.34	8768.2836	19.31	101	218	7	0.25	1.31	17.81	11	107.78
P14	**2022**	7/18/2022	685	0.86	590.2	1.3	46.7	2/21/2023	616	14.80	9113.8684	20.07	113	218	7	0.30	1.92	18.77	20	92.85
P15	**2022**	7/18/2022	770	0.83	635.6	1.4	45.7	2/22/2023	669	9.34	6251.58	13.77	99	219	7	0.24	1.17	12.37	4	87.40
P16	**2022**	7/18/2022	708	0.90	635.6	1.4	46.6	2/23/2023	515	12.13	6247.04	13.76	105	220	7	0.27	1.53	12.36	18	75.28
P18	**2022**	12/12/2022	1500	6.57	9851.8	21.7	91.1	4/11/2023	850	11.15	9479.066	20.88	99	120	4	0.07	1.15	-0.82	13	57.53
P19	**2022**	12/12/2022	1500	6.57	9851.8	21.7	91.1	2/28/2023	1144	8.89	10174.14	22.41	97	78	3	0.08	0.89	0.71	45	79.27
P20	**2022**	12/12/2022	1500	6.57	9851.8	21.7	91.1	3/2/2023	1135	10.27	11654.18	25.67	100	80	3	0.11	1.39	3.97	37	78.13
P21	**2021**	5/3/2022	900	15.23	13710.8	30.2	216	3/22/2023	773	55.00	42512.56	93.64	181	323	11	-0.11	3.69	63.44	27	88.89
A1	**2018-2021**	9/22/2022	1090	141.66	154405.4	340.1	134	3/8/2023	1040	150.00	155998.94	343.61	239	167	6	0.63	1.50	3.51	0	95.41
A3	**2021**	10/24/2022	7100	18.41	130706.6	287.9	95	4/11/2023	6804	35.23	239712	528.00	170	169	6	0.44	2.99	240.10	19	96.10
A4	**2022**	7/8/2022	11053	3.37	37228	82	60.1	4/26/2023	8965	4.50	40378.76	88.94	190.8	292	10	0.45	0.12	6.94	470	85.36
	2017		**87**						**87**										**0**	**100.00**
	2018		**232**						**220**										**2**	**95.69**
	2019		**312**						**288**										**0**	**92.31**
	2020		**938**						**931**										**1**	**99.36**
	2021		**8922**						**8456**										**67**	**95.53**
	2022		**24477**						**19588**										**884**	**83.64**
	Mixed		**1090**						**1040**										**0**	**95.41**
	Overall		**36058**						**30610**										**954**	**87.54**

Table 7 - Pond, collection year, stocking date, number of suckers on stocking date, average weight per fish, total weight of all fish in each pond (used to derive feeding amounts), average total length on stocking date (mm, measured or derived from length weight relationships, date harvested, number of suckers on harvest date, growth, and survival for ponds during the production cycle starting in the Spring of 2023 through the Fall of 2023 at the Klamath Falls National Fish Hatchery. The last nine rows in the table are summary numbers for each year class on station and the overall for the harvest season.

Pond	Lot	Stocked	Total	Average	Weight	Weight	TL	Harvested	Total	Average	Weight	Weight	TL	Total	Total	Growth	Growth	Weight Gain	Harvest Morts	Survival	Feed Conv.
			#	g/fish	g	lbs	mm		#	g/fish	g	lbs	mm	Days	Months	mm/day	g/fish/mon.	lbs	#	%	
P0	2017	3/14/2023	86	562.02	48333.72	106.46	370	5/22/2023	86	612.70	52692.2	116.06	370	69	2	0.00	22.03	9.60	0	100.00	
P1	2018	3/14/2023	103	309.20	31847.6	70.15	307	11/29/2023	89	461.76	41097	90.52	345	260	9	1.27	17.60	20.37	0	86.41	8.09
P2	2018	3/14/2023	100	294.20	29420	64.80	307	11/29/2023	86	426.07	36642	80.71	336	260	9	0.97	15.22	15.91	0	86.00	6.50
P3	2019	3/14/2023	102	303.70	30977.4	68.23	220	11/28/2023	91	426.51	38812	85.49	335	259	9	3.83	14.22	17.26	0	89.22	9.90
P4	2019	3/16/2023	100	303.70	30370	66.89	299	11/27/2023	91	458.22	41698	91.85	341	256	9	1.40	18.11	24.95	0	91.00	5.76
P5	2020	2/20/2023	302	125.20	37810	83.28	222	11/27/2023	263	233.65	61451	135.35	275	280	9	1.77	11.62	52.07	1	87.42	4.34
P6	2021	3/24/2023	311	64.60	20090.6	44.25	183	11/27/2023	266	175.03	46559	102.55	261	248	8	2.60	13.36	58.30	2	86.17	2.63
P7	ESS 2023	5/10/2023	3631	0.10	363.1	0.80	0.1	11/8/2023	2078	11.01	22884	50.41	108	182	6	3.60	1.80	49.61	59	58.85	2.37
P8	2017	5/22/2023	84	612.70	51466.7	113.36	370	11/27/2023	85	698.94	59410	130.86	395	189	6	0.83	13.69	17.50	0	101.19	11.88
P9	2022	2/24/2023	501	9.18	4599.2	10.13	96	10/23/2023	467	102.31	47781	105.24	217	241	8	4.03	11.59	95.11	1	93.41	1.24
P10	2022	2/24/2023	504	12.71	6405.8	14.11	107	10/24/2023	498	101.41	50504	111.24	216	242	8	3.63	11.00	97.13	0	98.81	1.29
P11	2022	2/24/2023	503	10.53	5296.6	11.67	102	10/23/2023	469	65.57	30753	67.74	189	241	8	2.90	6.85	56.07	2	93.64	1.52
P12	2022	2/24/2023	504	11.94	6017.8	13.26	106	10/25/2023	484	80.00	38718	85.28	205	243	8	3.30	8.40	72.03	3	96.63	1.77
P13	2022	2/24/2023	505	10.34	5221.7	11.50	101	10/23/2023	442	96.04	42449	93.50	216	241	8	3.83	10.67	82.00	0	87.52	1.46
P14	2022	2/24/2023	502	14.40	7228.8	15.92	113	10/24/2023	416	107.88	44876	98.85	221	242	8	3.60	11.59	82.92	2	83.27	1.63
P15	2022	2/24/2023	504	9.16	4616.6	10.17	99	10/23/2023	427	72.49	30953	68.18	196	241	8	3.23	7.88	58.01	3	85.32	1.64
P16	2022	2/24/2023	504	11.72	5906.9	13.01	105	10/25/2023	474	88.65	42018	92.55	208	243	8	3.43	9.50	79.54	2	94.44	1.28
P17	2022	3/3/2023	911	10.83	9866	21.73	103	10/16/2023	771	64.32	49590	109.23	185	227	8	2.73	7.07	87.50	20	86.83	1.52
P18	2023	6/5/2023	1500	0.02	27	0.06	0.1	11/7/2023	1297	10.36	13434	29.59	106	155	5	3.53	2.00	29.53	70	91.13	2.42
P19	2023	7/10/2023	628	0.18	111.5	0.25	0.1	11/7/2023	553	12.04	6658	14.67	111	120	4	3.70	2.97	14.42	17	90.76	2.83
P20	2023	6/9/2023	423	0.17	73	0.16	0.1	11/8/2023	262	21.16	5544	12.21	135	152	5	4.50	4.14	12.05	22	67.14	4.06
P21	2023	7/14/2023	342	0.23	79.5	0.18	0.1	11/8/2023	179	19.64	3516	7.74	131	117	4	4.36	4.98	7.57	6	54.09	3.60
A1	2020-2021	3/25/2023	1372	95.70	131300	289.21	224	10/16/2023	1068	240.53	256889	565.83	283	205	7	1.97	21.20	276.63	3	78.06	MIX
A2	2022	3/3/2023	4574	8.31	38008	83.72	96	10/17/2023	4020	67.27	270423	595.65	194	228	8	3.27	7.76	511.93	5	88.00	1.12
A3	2022	4/24/2023	4339	4.50	19525.5	43.01	80	10/30/2023	2986	31.02	92630	204.03	153	189	6	2.43	4.21	161.02	3	68.89	4.21
A4	2023	6/5/2023	1096	0.10	109.6	0.24	0.1	10/26/2023	897	24.34	21829	48.08	141	143	5	4.70	5.08	47.84	4	82.21	2.22
	2017		86						86										0	100.00	
	2018		203						175										0	86.21	
	2019		202						182										0	90.10	
	2020		302						263										1	87.42	
	2021		311						266										2	86.17	
	2022		13851						11454										41	82.99	
	2023		7620						5266										178	71.44	
	Mixed		1372						1068										3	78.06	
	Overall		23947						18760										225	79.28	

Net Pen Growout

In 2019, the USFWS initiated the Net Pen Project in Upper Klamath Lake. Each spring, PIT-tagged, age 1+, hatchery-raised suckers were introduced into two net pens for growout through the spring, summer, and fall prior to harvesting and repatriating the fish. The objective was to provide an *in-situ* rearing location, away from predation, for suckers to grow while survival is monitored. Due to limited hatchery pond space, net pens allow for some suckers to grow and acclimate in UKL, while those captive stocks that remain at the hatchery can be held at lower stocking densities.

After very poor survival in 2019, modifications in 2020 to raise the ineffective bird predation netting off of the water by installing an elevated railing as we suspected avian predators may have infiltrated the netting in 2019. These modifications were not completed until the summer and reduced the 2020 season to a brief fall growout during September and into October, lasting about five or six weeks. In the summer of 2020, another net pen system was being developed for installation in Gerber Reservoir, as we hypothesized that poor water quality might be a limiting factor in UKL. UKL and Gerber net pens were deployed in the spring of 2021 and required an early harvest in early July due to low surface elevations. Growth and survival were high in Gerber net pens, with survival between 83-97.3% and length gains ranging from about 30-45 mm during this short duration. The UKL net pens also required an emergency harvest in August of 2021, due to long term anoxic conditions forming and resulting in significant losses prior to harvest.

With all of the problems experienced and lessons learned to date, the UKL net pen was moved to a new location in Agency Lake in 2022, at the entrance of Four Mile Canal and deployed two Biomark 5' wagon wheel PIT tag antennas, and a Yellow Springs Instruments (YSI) EXO1 water quality sonde, to better monitor fish movement and water quality parameters. This new location was selected because water quality data collected in the fall of 2021 indicated better water quality than in UKL. The Gerber net pens were not deployed in 2022, as the lake elevation was too low and the net pen structure was on dry land. As the 2022 net pen season closed, we observed the highest survival on record, nearly 48%, from the UKL net pens at Four Mile Canal, although the fish were in very poor condition due to competition and crowding from a large biomass of fathead minnows and blue chubs in the net with the suckers. (The fish in hatchery ponds have more space, generally measured in pounds per acre foot of water. However, similar densities have been used at both UKL/Agency Lake and Gerber Reservoir and the fish appear to be in poor condition in UKL/Agency, and even more so in 4-Mile Canal than at Rattlesnake Point.) Subsequent net pen operations at Four Mile Canal will include biomass removal one or two times during the growing season. Net Pen and release locations are shown in Figure 9 for UKL and Figure 10 for Gerber Reservoir., please see **Figures 9-10**.

UKL Net Pens at Four Mile Canal in 2023

In the spring of 2023, both nets were stocked with the 2021 (age 1) year class of suckers at a new location, near the mouth of Four Mile Canal on the west side of Agency Lake (Figure 9). The Upper Klamath Lake West net pen (UKLW) was stocked on April 13, 2023 with 1,005 suckers at an average total length of 170mm. The second net, Upper Klamath Lake East net pen (UKLE), was stocked on the same day, April 13, 2023, with 1,001 suckers at an average total length of 171mm. These suckers were PIT-tagged at six months old, during the late fall of 2021, and their movements were tracked by Biomark 5'

wagon wheel antennas in each net pen. Although it is not possible to determine mortality with only one antenna per net pen, mortality is recorded at harvest. A YSI EXO1 sonde was installed to monitor temperature, dissolved oxygen, and conductivity in the west(or east) net pen each hour throughout the season, with the sondes being placed in the mid water column, a couple of feet below the surface but also a couple of feet off of the bottom. Sites were visited weekly to assess mortality, download PIT tag and sonde data, calibrate sondes monthly, and replace batteries as needed until the net pen was harvested. Two partial harvests occurred on 6/21/2023 and 7/25/2023 to remove non target fish species.

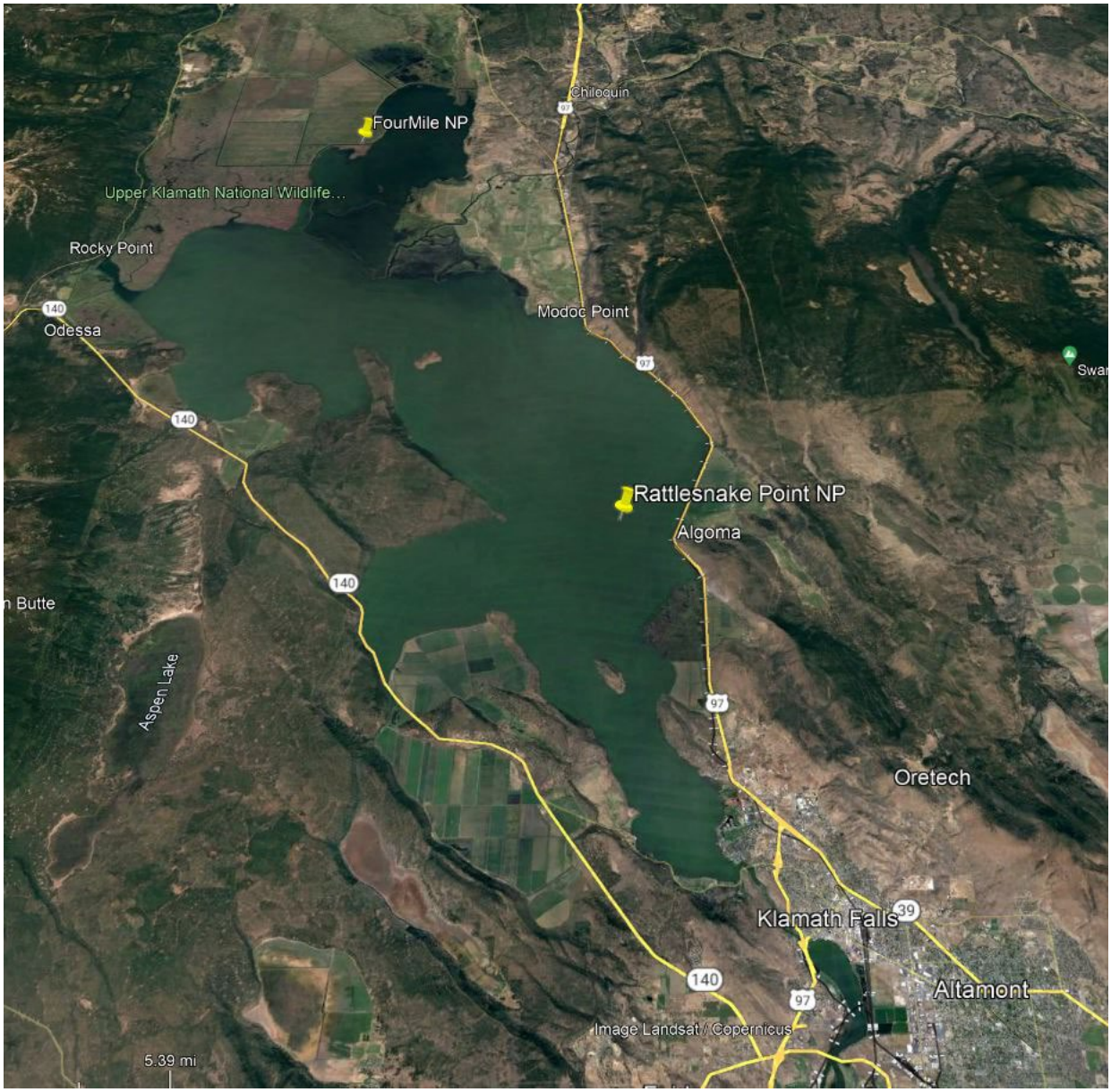

Figure 9 – Locations of the previous net pens location, Rattlesnake Point, in Upper Klamath Lake, and the current net pen location, Four Mile Canal, in Agency Lake, near Chiloquin, Oregon.

Figure 10 – Location of the net pens in Gerber Reservoir (see yellow pin in the middle of the lake, near Bonanza, Oregon.

The UKL net pen was harvested on 9/27/2023; only 60 fish total were collected and released; 29 fish (2.9% survival) from UKLW and 31 fish (3.1% survival) from UKLE, for an overall seasonal survival of 3.0%. The fish were approximately 220mm average total length and had poor body condition; suckers were emaciated and affected by parasites, disease, and had petechial hemorrhaging (diagnostics were not made in the field but secondary infections often result from primary causative agent, either external or from other stressors). One contributing factor for the poor survival and condition were anoxic conditions developing in July, August and September, prior to harvest (Figure 12). Mortalities were observed throughout the year but were greatest in July and August. While we had hoped and prepared for better conditions and results than what was experienced in 2022, the reality for the 2023 net pens season was nearly a total loss of fish despite all that extra work, such as increased monitoring and the partial harvest cycles to remove unwanted fish, to protect these stocks. For more information on the PIT tag and dissolved oxygen monitoring conducted at the UKL net pens in 2023, and the historical survival rates, please see **Figures 11-12 and Table 8**.

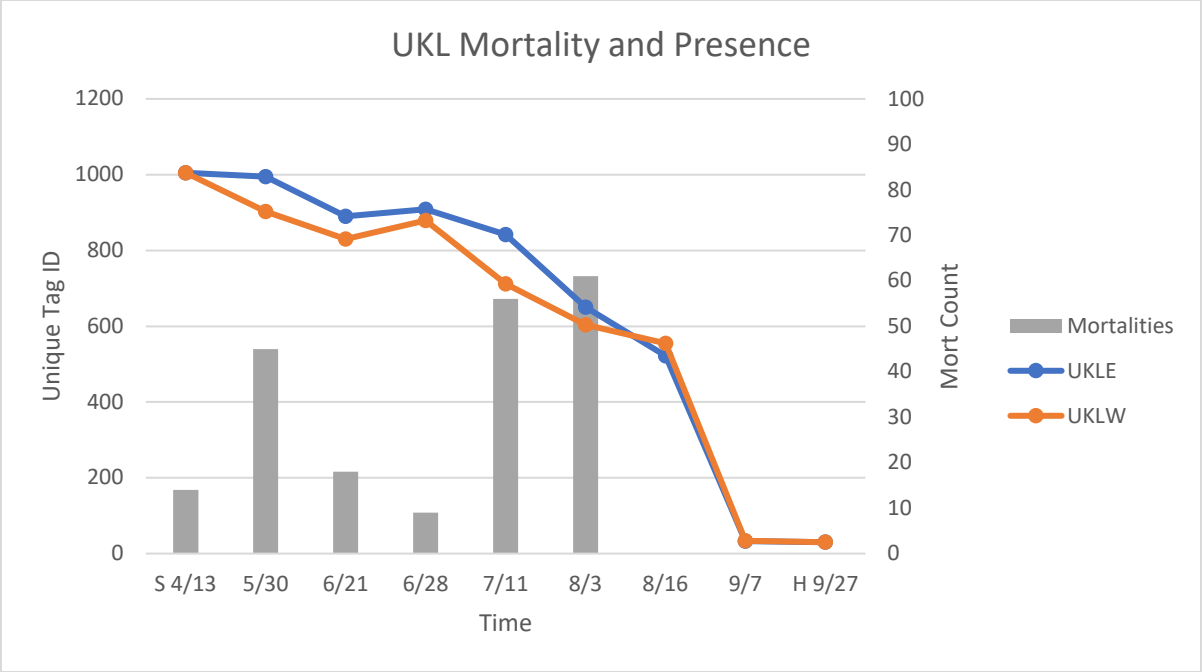

Figure 11 – Passive Integrated Transducer (PIT) tag array mortality and presence detections of suckers in the Upper Klamath Lake net pens located at Four Mile Canal, in Agency Lake, near Chiloquin, Oregon, during the 2023 growing season. The S stands for stocking on 4/13 and the H for harvest on 9/27. The Mort Count were fish mortalities observed or counted on each site visit date.

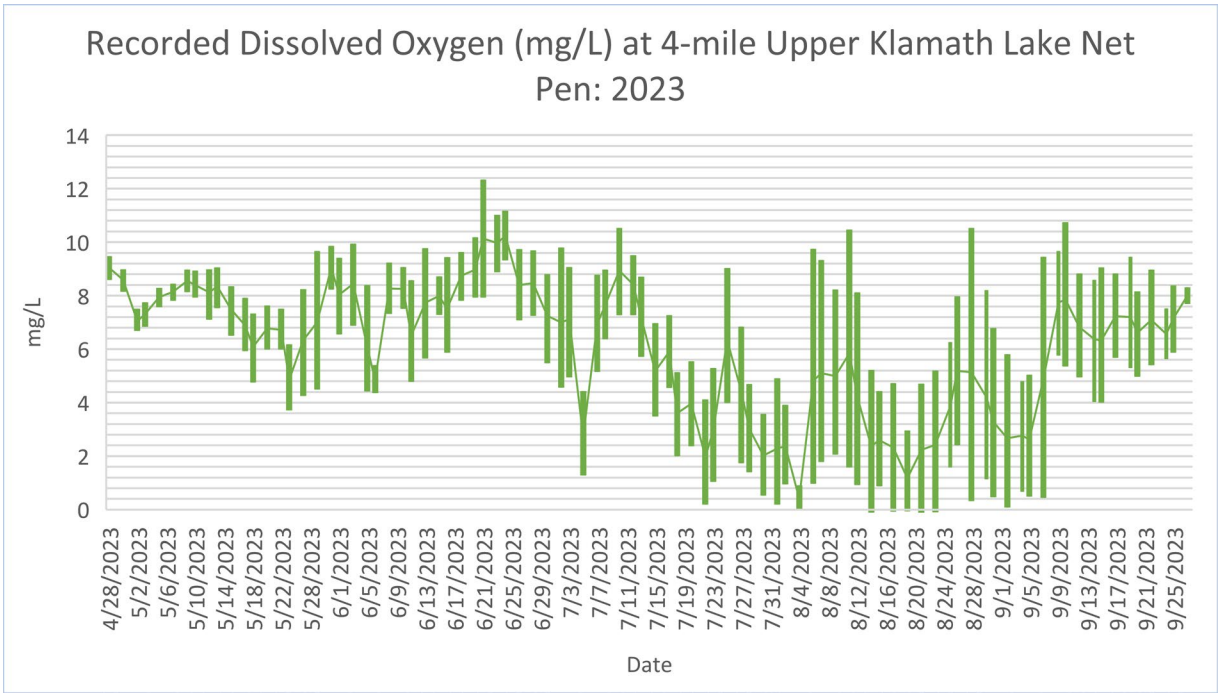

Figure 12 – Dissolved oxygen concentrations from a sonde deployed, at a depth of about 2-3' below the water surface, at the Upper Klamath Lake net pens located at Four Mile Canal, in Agency Lake, near Chiloquin, Oregon, during the 2023 growing season.

Table 8 – Historical survival rates from the Upper Klamath Lake net pens since the initial deployments, first at Rattlesnake Point, in Upper Klamath Lake in 2019-2020 and also at Four Mile Canal, in Agency Lake, near Chiloquin, Oregon in 2021.

Operation Year	Year Class	Pen ID	# Stocked	TL (mm)	# Harvested	TL (mm)	Survival (%)
2019	2018	UKLN	534	160	0	0	0.0
2019	2017	UKLS	480	236	10	263	2.1
2020	2019	UKLN	220	224	180	233	81.8
2021	2019	UKLN	100	228	0	0	0.0
2021	2020	UKLN	900	134	0	0	0.0
2021	2019	UKLS	150	233	87	280	58.0
2021	2020	UKLS	1350	150	519	210	38.4
2022	2021	UKLW	1999	96	947	142	47.4
2022	2021	UKLE	1852	105	897	155	48.4
2023	2021	UKLW	1005	170	29	221	2.9
2023	2021	UKLE	1001	171	31	220	3.1
Overall			**9591**		**2700**		**28.2**

The future operations of the UKL net pens at Four Mile Canal in Agency Lake remains unclear at the moment. Whereas approximately 9,591 Klamath suckers have been stocked for growout at two different locations since 2019, only approximately 2,700 fish have been harvested and repatriated to date, with an overall survival of approximately 28.2%. For some, this may be an acceptable return on these listed suckers, especially in view of the fact that it is an extensive, somewhat "hands-off," growout strategy. But the uncertain stochastic water quality events in both Upper Klamath and Agency Lakes that may limit predictable success from year to year, along with the abundant prevalence of competitive and disease vector minnow and chub biomass that can fill the net pens, lends itself to possibly taking a year off to regroup and possibly move this net pen again before stocking fish for another growout season. One strong option would be to consider moving it to Gerber Reservoir, where both water quality, namely dissolved oxygen levels, as well as growing conditions are generally favorable all year from spring through fall. It might also be prudent to locate these net pens, as well as the current Gerber net pens into a deeper location near the dam in Gerber Reservoir, whereby lake level would not be a limiting factor to utilizing these net pens for growout from year to year. Anything that can be done to conservatively limit losses from known stochastic water quality and water level events should be given priority when making these decisions.

Gerber Reservoir Net Pens in 2023

In the spring of 2023, both nets were stocked with the 2021 (age 1) year class of suckers at the original location in Gerber Reservoir, near Bonanza, Oregon. The first net, Gerber Reservoir East net pen (GERE), was stocked on April 21, 2023 with 1,005 suckers at an average total length of 170mm. The second net, Gerber Reservoir West net pen (GERW), was stocked on the same day, April 21, 2023, with 1,036 suckers at an average total length of 171mm. Also, as was done with the UKL net pens, the suckers were PIT tagged at six months old, during the late fall of 2021, two Biomark 5' wagon wheel antennas, and a YSI

EXO1 sonde was also installed to monitor sucker presence, water temperature, dissolved oxygen, and conductivity at the net pen locations throughout each day. Staff checked this location weekly to visually look for mortality, download tag array and sonde data, and replace batteries as needed until the net pen was harvested.

The Gerber net pen was harvested on 9/26/2023 and 1454 fish total were collected and repatriated to Upper Klamath Lake, with 454 fish (45.2% apparent survival) from GERE and 1000 fish (96.5% survival) from GERW, for an overall apparent survival for the season at 71.2%. The fish were approximately 215mm average total length and had good body condition. One contributing factor for the apparent low survival in the GERE net pen was due to two small holes, less than a foot or two in diameter, in the net. These holes were found during harvest, and allowed for some fish to escape. Since very few mortalities were observed throughout the growing season, it is presumed that nearly half of the fish in pen escaped through those two holes into Gerber Reservoir. Suckers in Gerber(SNS/KLS hybrids) spawn successfully in most years. USFWS suspects successful spawning of suckers in Gerber in 2023 because 66 untagged suckers, likely age-0 fish, averaging 115mm total length, were collected, PIT-tagged, and released from the Gerber net pens. These wild suckers apparently entered the net pen as a smaller fish earlier in the growing season, and remained in the net pen until harvest. For more information on the dissolved oxygen monitoring conducted at the Gerber Reservoir net pens in 2023, and the historical survival rates, please see **Figures 13-14** and **Table 9**.

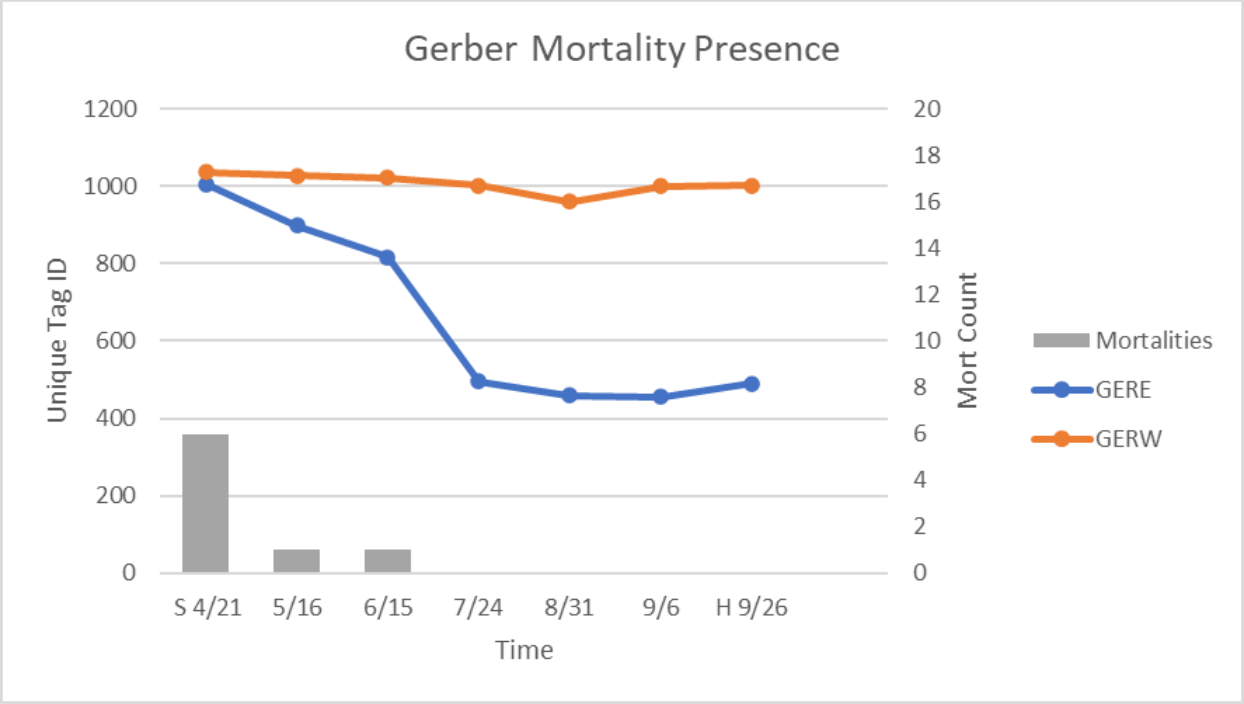

Figure 13 – Passive Integrated Transducer (PIT) tag array mortality and presence detections of suckers in the Gerber net pens located at Gerber Reservoir, near Bonanza, Oregon, during the 2023 growing season. The S stands for stocking on 4/21 and the H for harvest on 9/26. The Mort Count were fish mortalities observed or counted on each site visit date. Reduced detections are possibly the result of the holes in the net that fish escaped through.

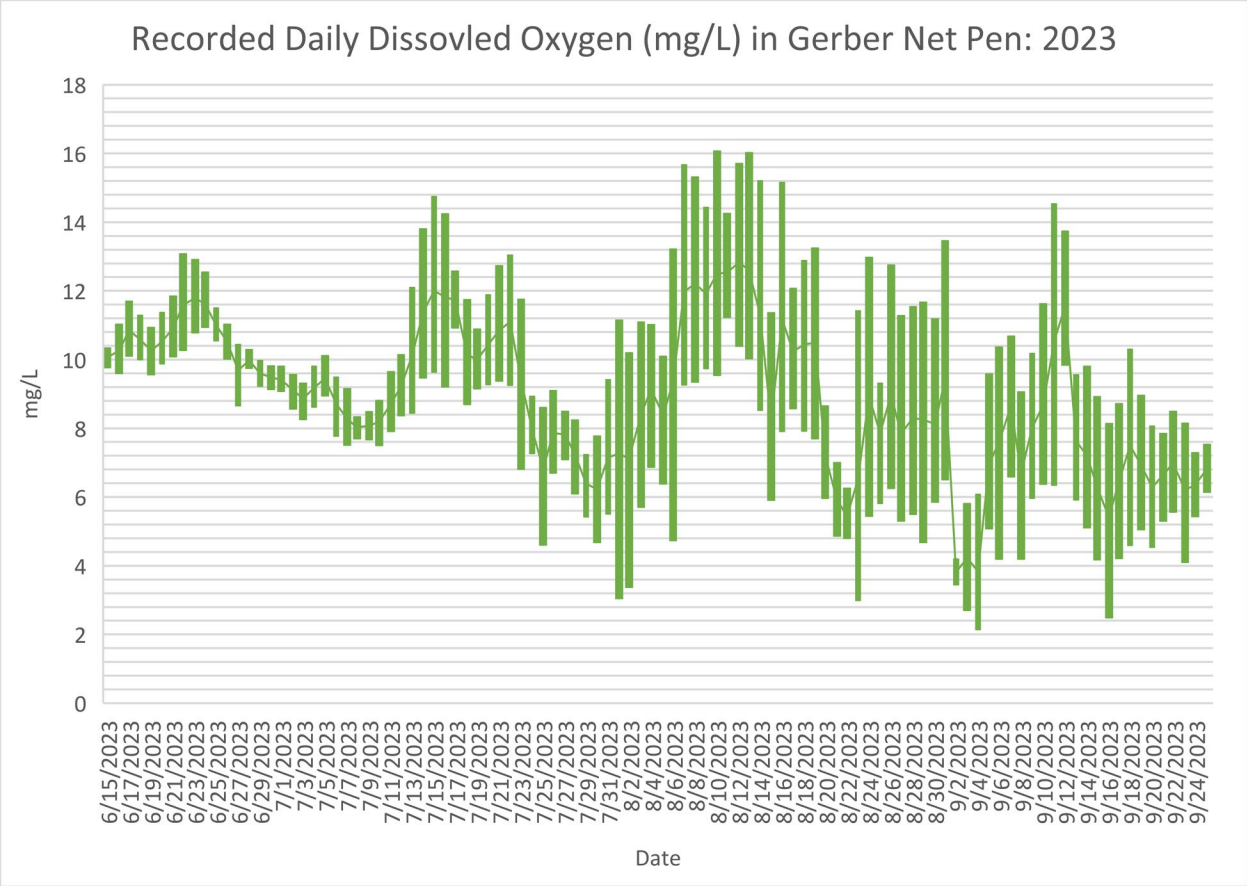

Figure 14 – Dissolved oxygen readings from a water quality sonde deployed, at a depth of about 2-3' below the water surface, at the Gerber net pens located at Gerber Reservoir, near Bonanza, Oregon, during the 2023 growing season.

Table 9 – Historical survival rates from the Gerber Reservoir net pens since the initial deployments, near Bonanza, Oregon.

Operation Year	Year Class	Pen ID	# Stocked	TL (mm)	# Harvested	TL (mm)	Survival (%)
2021	2019	GERE	100	235	97	269	97.0
2021	2020	GERE	898	140	827	174	92.1
2021	2019	GERW	150	230	146	265	97.3
2021	2020	GERW	1331	138	1105	173	83.0
2022	Low Water - Not Operational						
2023	2021	GERE	1005	170	454	225	45.2
2023	2021	GERW	1036	171	1000	214	96.5
Overall			**4520**		**3629**		**80.3**

As was already briefly discussed above, serious considerations should be given to what the future operations of the Gerber net pens will look like. At present, the current location of the net pens is only operable when there are ample amounts of water in the lake. Also, since the irrigational discharges in the summer can completely dry the south-central part of the lake, the current location of the net pens, they need to be relocated to a portion of the lake where the pens could provide growout space even at dead pool levels once irrigation discharges are halted. The ideal location would likely be as close the dam as practical and in the deepest part of the channel. It would also be desirable if the UKL net pen from Four Mile Canal in Agency Lake could also be relocated to this area as well. Then, the future success of net pen culture of Klamath suckers could be surer and more predictable into the future. Thus, these growout pens could provide a significant number of acclimated suckers, perhaps as many as 4-6,000, for repatriation into UKL annually.

Fish Distribution

Since the inception of the SARP program, suckers have been released in the spring of each year, when fish are 22-24 months old. Starting in 2020, there have also been fall releases of fish that grew faster and had gotten close to the production target size of 200 mm total length by as early as 17-18 months old, with the smaller fish being graded out for growout during a second winter before release the following spring. However, during the fall of 2022, after ponding approximately 7,100 of such smaller fish, winter rearing space was exhausted, due to vacating the B-series ponds for demolition and construction of the new hatchery building, and we began releasing production fish regardless of size, without grading, in mid-November 2022. As pond space would also diminish in the fall of 2023, with the vacating of the A-series ponds for demolition for Phases 3 and 4 of construction to continue, all production fish were released during the fall without grading fish. Hence, the average size of fish released declined during both of these years. In addition to the normal stocking of PIT tags in our production fish, larger fish were graded and set aside for the Recovery Team to do their first release of a multi-year acoustic and radio telemetry study in the spring of 2022. Thereafter, a second cohort of fish with only radio telemetry tags were released in the fall of 2022. Telemetry stockings also occurred again during the spring and fall of 2023 to continue a multiyear monitoring effort.

In total, for the fiscal year of 2023, dating from October 1, 2022 through September 30, 2023, approximately 17,399 production fish were released, both from the rearing ponds and the fish stocked from net pen operations, 15,892 and 1,507 respectively. In addition, there were approximately 15,614 fingerlings and 14,928 fry released during this time as well. This brings the total number of suckers released and/or transferred to approximately 48,377 for the entire fiscal year of 2023. Additionally 9,134 production sized fish were released during the fall of 2023, between October 1, 2023 through December 31, 2023, which was actually the start of fiscal year 2024 but included for reporting the most up to date information on fish distributions from the KFNFH. For more information on historic and current fish distributions, please see **Table 1** and **Tables 10-11**.

The production sized fish released during fiscal year 2023 were very similar in average total length, at approximately 194 mm, compared to the average total length in fiscal year 2022 at 193 mm. Fiscal year 2023 also had the largest release of fish in terms of sheer numbers for both production sized fish and fingerlings and this was significant in view of having to scale back production, as many of our ponds had to be vacated and demolished for new construction to progress. Since the beginning of the fiscal year in the fall of 2022, we had to vacate 24 of our 0.03 acre B-series ponds for demolition, resulting in a net loss of 0.72 acres of rearing space. And during the start of the current fiscal year in the fall of 2023, we had to vacate four of our 0.25 acre A-series ponds for demolition, resulting in a net loss of 1.0 acres of rearing space. The only space currently left moving into 2024 are 22 of our 0.03 acre P-series ponds, with a total pond space of 0.66 acres. And this remaining pond space requires 8-10 ponds for broodstock management, leaving only 12-14 ponds for production growout and larval collection rearing. While there may be a possibility that some of the new pond space could be online in the spring for use for larval collections, such is not obligated under the Phase 1 contract until the end of the summer in 2024. Needless to say, production will likely reach a recent low in fiscal year 2025 before seeing steady increases thereafter, especially as each phase of construction is completed. But fortunately, we are off to a good start for fiscal year 2024, with a total of 9,134 stocked at an average total length of 222 mm during the fall of 2023, thus fulfilling our basic stocking obligation for the up and coming fiscal year.

Table 10 – Summary of all fish distributions for repatriation or transfer from the Klamath Falls National Fish Hatchery during the fiscal year of 2023, dating from October 1, 2022 through September 30, 2023.

Date	Species	Lot	#	Weight (lb.)	Actual TL (mm)	#/lb.	Projected TL (inches)	Projected TL (mm)	From Ponds	Stocking Location
10/6/2022	LRS	2021	627	77.35	189	8.11	7.3	186	A3	ODOT Pond
10/6/2022	SNS	2021	176	31.23	203	5.64	7.9	200	A3	ODOT Pond
10/12/2022	LRS	2021	176	9.47	145	18.59	5.6	141	UKLW Net Pen	Agency Lake @ 4-Mile Canal
10/12/2022	SNS	2021	771	44.57	143	17.30	5.4	137	UKLW Net Pen	Agency Lake @ 4-Mile Canal
10/13/2022	LRS	2021	297	18.11	154	16.40	5.8	147	UKLE Net Pen	Agency Lake @ 4-Mile Canal
10/13/2022	SNS	2021	600	46.27	155	12.97	6.0	151	UKLE Net Pen	Agency Lake @ 4-Mile Canal
10/21/2022	LRS	2021	611	66.86	181	9.14	7.0	179	P17, P18, P20	Agency Lake @ Henzel Ramp
10/21/2022	SNS	2021	269	35.44	182	7.59	7.1	181	P17, P18, P20	Agency Lake @ Henzel Ramp
10/28/2022	LRS	2019	23	16.44		1.40	13.2	334	P3	Agency Lake @ Henzel Ramp w/ Telemetry Fish
10/28/2022	SNS	2019	19	13.58		1.40	12.5	318	P3	Agency Lake @ Henzel Ramp w/ Telemetry Fish
10/28/2022	LRS	2021	1380	195.38	196	7.06	7.7	195	P18, B1, B3, B5, B7, B9, B11, B13, B15, B17	Agency Lake @ Henzel Ramp w/ Telemetry Fish
10/28/2022	SNS	2021	590	103.66	200	5.69	7.8	199	P18, B1, B3, B5, B7, B9, B11, B13, B15, B17	Agency Lake @ Henzel Ramp w/ Telemetry Fish
11/2/2022	LRS	2019	25	17.87		1.40	13.2	334	P3	Williamson River @ TNC w/ Telemetry Fish
11/2/2022	SNS	2019	21	15.01		1.40	12.5	318	P3	Williamson River @ TNC w/ Telemetry Fish
11/2/2022	LRS	2021	541	79.36	197	6.82	7.8	197	P17, P19, P20, B19, B21, B23	Williamson River @ TNC w/ Telemetry Fish
11/2/2022	SNS	2021	166	29.3	201	5.67	7.8	199	P17, P19, P20, B19, B21, B23	Williamson River @ TNC w/ Telemetry Fish
11/4/2022	LRS	2021	213	32.42	196	6.57	7.9	200	B20, B23, B24	Williamson River @ TNC
11/4/2022	SNS	2021	184	32.72	197	5.62	7.9	200	B20, B23, B24	Williamson River @ TNC
11/9/2022	LRS	2021	215	19.31	167	11.13	6.6	167	B18	Sycan River @ Partners BDA Project
11/9/2022	SNS	2021	281	37.24	179	7.55	7.1	181	B18	Sycan River @ Partners BDA Project
11/10/2022	LRS	2021	618	52.06	164	11.87	6.4	164	B12, B16, B22	Upper Klamath Lake @ Odessa Spring
11/10/2022	SNS	2021	1035	124.98	175	8.28	6.9	176	B12, B16, B22	Upper Klamath Lake @ Odessa Spring
11/17/2022	LRS	2021	980	105.85	176	9.26	7.0	178	B2, B4, B6, B8, B10, B14	Sprague River @ Beatty Gap
11/17/2022	SNS	2021	1483	214.46	183	6.92	7.3	187	B2, B4, B6, B8, B10, B14	Sprague River @ Beatty Gap
12/15/2022	Unknown	2022	1514	21.93		69.04	3.6	91	A2	Lakeside Farms but diverted to Williamson River @ SRR
12/20/2022	Unknown	2022	8140	117.9		69.04	3.6	91	A2	Transfer to Klamath Tribes Hatchery
12/20/2022	LRS	2022	243	9.06	119	26.82	4.9	125	A-Canal Forebay Salvage	Williamson River @ SRR
12/20/2022	SNS	2022	158	7.87	125	20.08	5.1	131	A-Canal Forebay Salvage	Williamson River @ SRR
12/20/2022	Unknown	2022	35	0.88	104	39.77	4.3	109	A-Canal Forebay Salvage	Williamson River @ SRR
3/9/2023	LRS	2019	38	24.49	319	1.55	12.7	323	A1	Williamson River @ SRR
3/9/2023	SNS	2019	40	24.21	295	1.65	12.4	316	A1	Williamson River @ SRR
3/9/2023	Unknown	2019	2	1.06	277	1.89	11.9	302	A1	Williamson River @ SRR
3/9/2023	LRS	2020	246	60.9	229	4.04	9.2	235	A1	Williamson River @ SRR
3/9/2023	SNS	2020	698	227.74	235	3.06	10.1	257	A1	Williamson River @ SRR
3/9/2023	Unknown	2020	7	2.02	222	3.47	9.7	247	A1	Williamson River @ SRR
3/16/2023	SNS	2020	9	3.38	243	2.66	10.6	270	A1	Link River Below Dam w/ Telemetry Fish
4/12/2023	LRS	2021	437	42.24	171	10.35	6.8	172	A3	ODOT Pond
4/12/2023	SNS	2021	72	8.06	171	8.93	6.7	171	A3	ODOT Pond
4/12/2023	Unknown	2022	509	7.41		68.71	3.6	91	P18	ODOT Pond
4/13/2023	Unknown	2022	154	1.53		100.65	3.2	80	A4	Lakeside Farms
4/13/2023	Unknown	2022	845	13.38		63.14	3.7	94	P18	Lakeside Farms
4/15/2023	LRS	2023	10543	0.176		59903.41	0.4	10	East Side Springs	Sheepy Lake- Unit 2
4/18/2023	LRS	2021	365	33.45	170	10.91	6.6	168	A3	Sycan River @ Partners BDA Project
4/18/2023	SNS	2021	58	6.44	170	9.01	6.7	171	A3	Sycan River @ Partners BDA Project
4/18/2023	Unknown	2021	239	22.97	170	10.40	6.7	171	A3	Sycan River @ Partners BDA Project
4/19/2023	LRS	2021	996	88.5	169	11.25	6.6	167	A3	Sprague River @ Beatty Gap
4/19/2023	SNS	2021	236	25.2	169	9.37	6.6	169	A3	Sprague River @ Beatty Gap
4/19/2023	Unknown	2021	50	5.05	168	9.90	6.9	174	A3	Sprague River @ Beatty Gap
4/19/2023	LRS	2023	4385	0.073		60068.49	0.4	10	East Side Springs	Sheepy Lake- Unit 2
4/26/2023	Unknown	2022	4002	39.74		100.69	3.2	80	A4	Sheepy Lake Unit 2
4/28/2023	LRS	2020	5	0.90	206	5.55	8.3	211	P4	Bare Island w/ Telemetry
4/28/2023	SNS	2020	83	21.21	221	3.91	9.3	237	P4	Bare Island w/ Telemetry
4/28/2023	Unknown	2020	1	0.31	241	3.19	10.0	254	P4	Bare Island w/ Telemetry
4/28/2023	LRS	2021	563	51.29	196	10.98	6.6	168	A3,P6,P21	Bare Island w/ Telemetry
4/28/2023	SNS	2021	432	48.56	196	8.90	6.8	172	A3,P6,P21	Bare Island w/ Telemetry
4/28/2023	Unknown	2021	14	1.57		8.92	7.1	180	A3,P6,P21	Bare Island w/ Telemetry
6/13/2023	LRS	2023	45	0.064		703.13	1.7	42	P7	Stauton Ponds- SP1
6/13/2023	Unknown	2022	405	8.232		49.20	4.0	102	A3	Stauton Ponds- SP2
9/26/2023	LRS	2021	1178	225.86	215	5.22	8.5	215	GERE, GERW Net Pens	Agency Lake @ Henzel Ramp
9/26/2023	SNS	2021	265	72.98	227	3.63	9.1	231	GERE, GERW Net Pens	Agency Lake @ Henzel Ramp
9/26/2023	Unknown	2021	11	2.53	220	4.35	9.0	229	GERE, GERW Net Pens	Agency Lake @ Henzel Ramp
9/27/2023	LRS	2021	25	6.14	222	4.07	9.2	234	4 Mile Canal Net Pens	Agency Lake @ 4 Mile Canal
9/27/2023	SNS	2021	28	7.82	220	3.58	9.1	232	4 Mile Canal Net Pens	Agency Lake @ 4 Mile Canal
Fall 2022	**LRS**	**2019**	**48**	**34.31**		**1.40**	**13.15**	**334**		
Summary	**SNS**	**2019**	**40**	**28.59**		**1.40**	**12.51**	**318**		
	LRS	**2021**	**5658**	**656.17**		**8.62**	**7.17**	**182**		
	SNS	**2021**	**5555**	**699.87**		**7.94**	**7.01**	**178**		
	Unknown	**2022**	**9654**	**139.83**		**69.04**	**3.59**	**91**		
Salvage	**LRS**	**2022**	**243**	**9.06**		**26.82**	**4.92**	**125**		
Salvage	**SNS**	**2022**	**158**	**7.87**		**20.08**	**5.15**	**131**		
Salvage	**Unknown**	**2022**	**35**	**0.88**		**39.77**	**4.31**	**109**		
	Total	**Production**	**11301**	**1418.94**		**7.96**	**7.4**	**187**		
	Total	**Fingerling**	**9654**	**139.83**		**69.04**	**3.6**	**91**		
	Total	**Salvage**	**436**	**17.81**		**24.48**	**5.1**	**129**		
Fall 2022	**Total**	**Overall**	**21391**	**1576.58**						
Spring 2023	**LRS**	**2019**	**38**	**24.49**		**1.55**	**12.71**	**323**		
Summary	**SNS**	**2019**	**40**	**24.21**		**1.65**	**11.84**	**301**		
	Unknown	**2019**	**2**	**1.06**		**1.89**	**11.91**	**302**		
	LRS	**2020**	**251**	**61.80**		**4.06**	**9.22**	**234**		
	SNS	**2020**	**790**	**252.34**		**3.13**	**9.57**	**243**		
	Unknown	**2020**	**8**	**2.33**		**3.43**	**9.76**	**248**		
	LRS	**2021**	**2361**	**215.48**		**10.96**	**6.62**	**168**		
	SNS	**2021**	**798**	**88.26**		**9.04**	**6.72**	**171**		
	Unknown	**2021**	**303**	**29.59**		**10.24**	**6.78**	**172**		
	Unknown	**2022**	**5915**	**70.30**		**84.14**	**3.36**	**85**		
	LRS	**2023**	**14928**	**0.25**		**59951.81**	**0.38**	**10**		
	LRS	**2023**	**45**	**0.06**		**703.13**	**1.65**	**42**		
	Total	**Production**	**4591**	**699.56**		**6.56**	**7.86**	**200**		
	Total	**Fingerling**	**5960**	**70.36**		**84.71**	**3.35**	**85**		
	Total	**Fry**	**14928**	**0.25**		**59951.81**	**0.38**	**10**		
Spring 2023	**Total**	**Overall**	**25479**	**770.17**						
Fall 2023	**LRS**	**2021**	**1203**	**232.00**		**5.19**	**8.50**	**216**		
	SNS	**2021**	**293**	**80.80**		**3.63**	**9.11**	**231**		
	Unknown	**2021**	**11**	**2.53**		**4.35**	**9.01**	**229**		
	Total	**Production**	**1507**	**315.33**		**4.78**	**8.73**	**222**		
Fall 2023	**Total**	**Overall**	**1507**	**315.33**						
FY 2023	**Total**	**Production**	**17399**	**2433.83**		**7.15**	**7.64**	**194**		
	Total	**Fingerling**	**15614**	**210.19**		**74.28**	**3.50**	**89**		
	Total	**Fry**	**14928**	**0.25**		**59951.81**	**0.38**	**10**		
	Total	**Salvage**	**436**	**17.81**		**24.48**	**5.07**	**129**		
FY 2023	**Total**	**Overall**	**48377**	**2662.08**						

Table 11 – Summary of all fish distributions for repatriation or transfer from the Klamath Falls National Fish Hatchery during the fiscal year of 2024, dating from October 1, 2023 through September 30, 2024.

Date	Species	Lot	#	Weight (lb.)	Actual TL (mm)	#/lb.	Projected TL (inches)	Projected TL (mm)	From Ponds	Stocking Location
10/3/2023	Unknown	Salvage	26	58.66	433.19	0.44	18.35	466	LKNWR	Williamson River @ TNC
10/3/2023	LRS	Salvage	5	27.05	631.2	0.18	25.83	656	LKNWR	Williamson River @ TNC
10/3/2023	SNS	Salvage	152	265.17	383.23	0.57	17.71	450	LKNWR	Williamson River @ TNC
10/17/2023	LRS	Mixed	238	98.69	270	2.41	10.97	279	A1	North Refuge Pond
10/17/2023	SNS	Mixed	169	91.77	279	1.84	11.42	290	A1	North Refuge Pond
10/18/2023	LRS	2022	208	25.82	185	8.06	7.34	186	P17	ODOT Pond
10/18/2023	SNS	2022	296	46.04	184	6.43	7.53	191	P17	ODOT Pond
10/18/2023	LRS	Mixed	163	65.41	269	2.49	10.85	276	A1	South Refuge Pond
10/18/2023	SNS	Mixed	161	67.41	254	2.39	10.47	266	A1	South Refuge Pond
10/18/2023	LRS	2022	918	117.66	185	7.80	7.42	188	P17, A2	Sprague River @ Beatty Gap
10/18/2023	SNS	2022	1039	166.92	192	6.22	7.61	193	P17, A2	Sprague River @ Beatty Gap
10/19/2023	LRS	2022	837	107.74	186	7.77	7.43	189	A2	Odessa Springs
10/19/2023	SNS	2022	1492	241.10	192	6.19	7.62	194	A2	Odessa Springs
10/24/2023	LRS	2022	556	85.10	195	6.53	7.87	200	P9, P11, P13, P15	Henzel Boat Ramp
10/24/2023	SNS	2022	1049	213.10	209	4.92	8.23	209	P9, P11, P13, P15	Henzel Boat Ramp
10/26/2023	LRS	2022	625	120.17	213	5.20	8.49	216	P10, P12, P14, P16	Williamson River @ TNC
10/26/2023	SNS	2022	1046	224.52	212	4.66	8.38	213	P10, P12, P14, P16	Williamson River @ TNC
10/27/2023	LRS	Mixed	100	59.48	307	1.68	12.37	314	A1	Bare Island - Telemetry Fish
10/27/2023	SNS	Mixed	237	183.58	317	1.29	12.85	326	A1	Bare Island - Telemetry Fish
11/22/2023	Unknown	Salvage	5	0.19		26.32	4.70	119	J-Canal Salvage	Malone Springs
	LRS	**2022**	**3144**	**456.49**		**6.89**	**7.73**	**196**		
	SNS	**2022**	**4922**	**891.68**		**5.52**	**7.92**	**201**		
	LRS	**Mixed**	**501**	**223.58**		**2.24**	**11.24**	**286**		
	SNS	**Mixed**	**567**	**342.76**		**1.65**	**11.83**	**301**		
	LRS	**Salvage**	**5**	**27.05**		**0.18**	**25.83**	**656**		
	SNS	**Salvage**	**152**	**265.17**		**0.57**	**16.84**	**428**		
	Unknown	**Salvage**	**31**	**58.85**		**0.53**	**18.22**	**463**		
	Total	**Production**	**9134**	**1914.51**		**4.77**	**8.74**	**222**		
	Total	**Salvage**	**188**	**351.07**		**0.54**	**18.12**	**460**		
Fall 2023	**Total**	**Overall**	**9322**	**2265.58**						

Applied Research

The long term diet trial started in May 2022 and continued until October 2023. This diet trial was aiming to discover the effects of 4 commercially available diets on Lost River and shortnose suckers comparing the growth, body condition, and survival during the different life stages these wild caught larvae experience at the hatchery: larval, fingerling (early juvenile), and juvenile. The 4 commercial diets were Bozeman Razorback (RZB), Bozeman June (JUN), Rangen Shrimp (SHP), and Rangen Sturgeon (STR). (**Table 12**)

Table 12 - Nutrition of the four commercial diets used in the long term feed diet trial.

NUTRITION COMPARISON				
Diet	**Protein %**	**Fat %**	**Fiber %**	**Ash %**
Razorback	40	13	<2.5	<10
June	43	17	<3	NA
Shrimp	>40	>8	<3	<9
Sturgeon Soft Moist	45	19	<2	<9
Sturgeon EXTR450	43	14	<2	<9

There could be no conclusions drawn from the larval stage as this stage had to be ended early due to an increase in mortality from possible high temperatures and losing larval fish to tank overflow issues. The larval fish were put in ponds after 22 days in tanks where they stayed for 221 days. Only 2 replicate ponds per diet were used due to space availability during the fingerling stage. Two weeks before the juvenile feed trial began, ponds were fertilized with alfalfa pellets and Hi-Yield Super Phosphate per hatchery procedures. Initial densities were about 24,700 fish/acre which is below the normal densities that the hatchery uses; this was primarily done to prevent density dependent factors on growth during this life stage. Feed rates varied from 5%BW to 1%BW, depending upon the water temperature. A mid-stage sample was taken in November 2022 to assess progress and pellet size was increased as the fish progressed. Sporadic mortality started being observed in one of the razorback ponds in November 2022. The USFWS California/Nevada Fish Health Centers sampled suckers from this pond and found the following in the low condition fish: extreme gill hyperplasia, and little to no feeding, poor visceral fat stores, and loss of protein in the urine. The razorback feed was tested and was not rancid, nor any other issues of concern found. An ANOVA was performed to analyze the weight to diet relationship. There was significant difference between the June and Razorback diet, and June and Shrimp diet. Razorback and June also had a significant difference when analyzing the relationship between total length and diet. (**Table 13**)

For the juvenile stage, fish were placed back into the same pond that they were reared in for the fingerling stage and held for 238 days. Densities were thinned out to about 500 fish per pond, which equates to 16,000 fish/acre. Belt feeders were used beginning in April of 2023 and the feed rate for this stage was consistent at 2% of the total calculated body weight. Hoop nets were set up overnight in summer months to estimate growth and recalibrate feed amounts. The catch per unit effort (CPU) dropped significantly after 2 months of sampling monthly, and sampling was put on hold until the fall

harvest. Ponds were harvested in October 2023 and species were identified using morphological indicators. Pairwise T-test showed there was no significant difference in total length between JUN/RZB (p=0.11) while there was significant difference in weight (p=0.005). There was a significant difference between all other diets when analyzing the relationship between diet and total length, and diet and weight. Shrimp diet performed the poorest, producing the smallest and lightest fish, and lowest survival. Sturgeon diet had the highest survival at 95%. (**Figure 15** and **Table 14**)

Table 13 – Comparison of performance between the 4 diets at the completion of the fingerling stage. Included are the mean and standard deviation for total length and weight, and the condition factor and percent survival are also included.

End of Fingerling Stage Results				
Treatment Diet	RZB	JUN	SHP	STR
TL (mm) + S.D.	98.75 ± 8.51	110.33 ± 7.88	100.56 ± 6.92	105.38 ± 9.71
Weight (g) + S.D.	9.79 ± 2.84	13.56 ± 2.98	9.92 ± 2.25	11.80 ± 2.91
Condition Factor (K)	1.01275	1.0092	0.9756	1.0084
Survival %	86	87	87	73

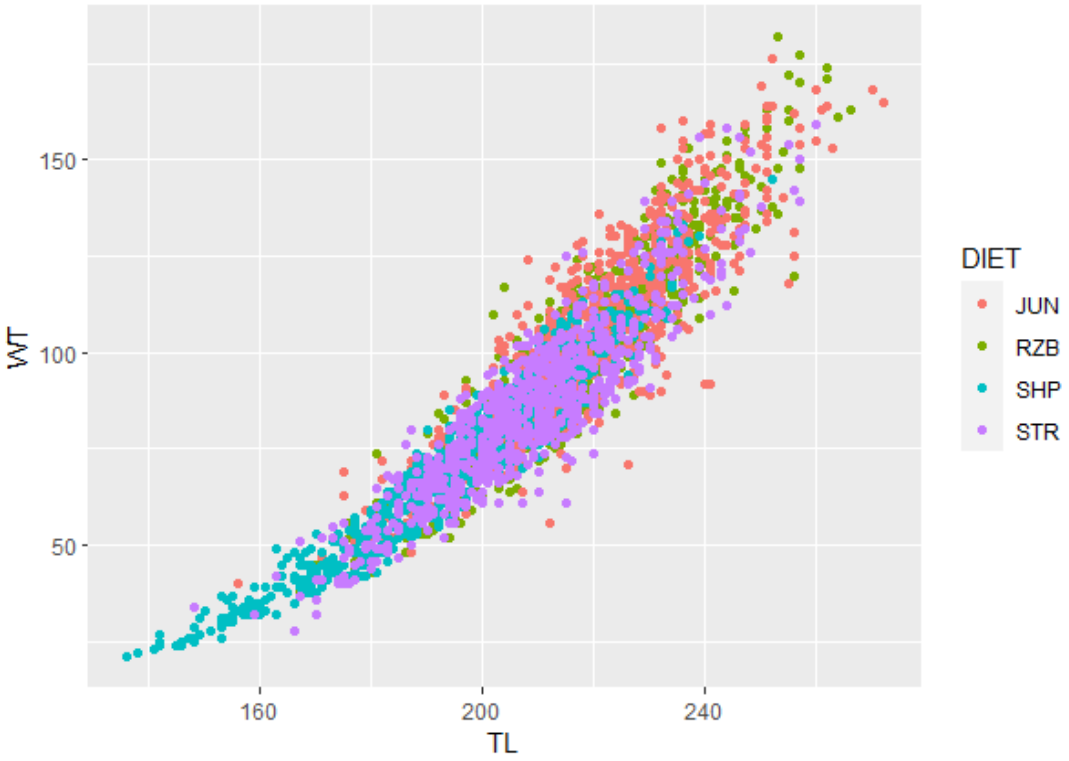

Figure 15 – Length to weight ratio between diets at the end of the juvenile stage. Outliers and fish with observed deformities were removed from this data.

Table 14 – Comparison of performance between the 4 diets at the completion of the juvenile stage. Included are the mean and standard deviation for total length and weight, and the condition factor and percent survival are also included.

End Results of Juvenile Stage				
Treatment Diet	RZB	JUN	SHP	STR
TL (mm) +S.D.	216.18 ± 17.94	218.36 ± 16.87	192.24 ± 20.78	206.48 ± 17.46
Weight (g) + S.D.	99.26 ± 25.13	104.35 ± 24.40	68.87 ± 22.81	84.19 ± 22.28
Condition Factor (k)	0.983	1.002	0.969	0.956
Survival %	90	91	89	95

Reared threatened and endangered fish species can be vulnerable to nutrition deficiencies which can lead to skeletal deformities. Analyzing observed deformities can be a quick and cost-effective method to determine whether a commercial diet is beneficial or deleterious. When processing suckers we recorded a range of abnormalities, including skeletal deformities, fin degradation, hemorrhaging, and scale loss. While the final analysis showed there was no difference between diets and deformities, the June diet had the lowest percentage of observed deformities. The sturgeon diet had the highest survival in the juvenile stage at 95% but also experienced the highest number of recorded deformities at 6.1%. You can also see the spike of recorded deformities from the fingerling stage to the juvenile stage. (**Table 15**)

Table 15 – Percent of population at the end of each stage that had observed deformities. Scale loss and hemorrhaging not included in analysis.

Percent of Population with Possible Nutrition Related Abnormalities				
Treatment Diet	RZB	JUN	SHP	STR
Fingerling	4.3	1.1	3.7	1.8
Juvenile	4.8	2.0	4.1	6.1

The June sucker diet outperformed the other diets during the fingerling and juvenile growout stages. The hatchery will move forward in feeding June sucker diet to fingerlings and juveniles. Razorback feed will be added in and supplemented to larger broodstock as it performed just behind the June diet in the juvenile stage. Manufacturers are covered under the blanket purchase agreement, they have a mid-range cost, and are readily available. However, the downside with these two diets is that they are limited in the available sizes for each, with only 1.0mm for JUN and 3.0mm and 4.0mm for RZB. These are preliminary results and future efforts therefore will be to compare performance between the fingerling and juvenile stages, and to compare performance between species is in the plan for analysis, to gain a full picture of the diet trial.

Facility Construction

After several years of planning, environmental compliance, permitting, finalizing conceptual designs for various phases of construction, and developing bid packages, the first two phases of construction were awarded to contractors in fiscal year 2022 to do initial site grading, building 11 ponds, adding underground infrastructure, and building a hatchery and maintenance building. Phases 3 and 4 of construction were awarded to contractors in fiscal year 2023 and will entail doing more site grading, building 21 additional ponds, adding more underground infrastructure, and drilling a new primary geothermal well. In addition to these contracts being awarded, numerous modifications have also been made and awarded to date, with nearly $27 million obligated so far from both Fisheries and Aquatic Conservation funding (1311) for hatchery operations and Bipartisan Infrastructure Law funding (BIL). It is also anticipated that Phase 5 of construction will be awarded in fiscal year 2024 and will include site work, underground infrastructure, and construction of the last four ponds needed. One or two additional phases of construction may be needed to compete the hatchery infrastructure, perhaps with a performance period running from 2025 to 2026 or 2027.

The new hatchery will consist of a one-acre head pond water supply influent retention pond (IRP), a bank of Tier-1 ponds (C1-C6 and B1-B4) consisting of six quarter-acre and four eighth-acre production ponds for fry and fingerling production, a lower bank of Tier-2 ponds (C9-C14 and D1-8), capable of serial reuse of water from Tier-1 ponds, consisting of six quarter-acre and eight half-acre production ponds for juvenile production, another lower bank of broodstock ponds (A1-A6) consisting of six twelfth-acre ponds, a hatchery and maintenance building, a half-acre effluent retention pond (D10), an additional bank of lease area 2 ponds (D11 and A7 and A8) consisting of one half-acre and two twelfth-acre isolation/production ponds, as well as an additional third-acre head pond water supply for lease area 2. In addition to this, the facility will have a hatchery and administrative building, a maintenance shop and storage garage, a feed and chemical storage building, a wide array of underground utilities and water works running to all the infrastructure, including power to each pond kettle, cooled and geothermal water supply and drain line from each pond, telecommunication conduit for internet and remote monitoring, and fencing around the entire site. For more information on the different phases of construction, please see **Figure 16**.

Phase 1 Construction, which is 1311 funded and awarded to Morello Construction in the summer of 2022, is well underway, with tentative completion by the end of summer in 2024. All major site grading and below ground piping and conduit is complete and the above ground geothermal water supply piping from the well is nearing completion in the spring of 2024. The IRP head pond has been lined and is complete. Kettles have been poured in the four smaller Tier-1 ponds (B1-4) and work is currently underway with pouring kettles in the six larger ponds for this tier (C1-C6) and then all ten ponds will likely be lined by the spring of 2024 for use by April or May. The large retaining wall separating Tier-1 and Tier-2 ponds is nearing completion and looks great. Electrical service has not been completed yet but should be done by the summer of 2024 to wrap up the remaining parts of this contract. The completion dates will be weather dependent and the effects on site conditions which will determine how much work can be done over the course of the 2023/2024 winter months.

Phase 2 Construction, which is BIL funded and awarded to RJS Construction in the fall of 2022, is slow out of the gate but now underway, with tentative completion of the hatchery buildings likely being delayed until the spring of 2025 due to changes in the soil designation conditions onsite, requiring major

engineering delays on the building foundation requirements; the original contract performance period was to complete all work by the fall of 2024, within 24 months for the performance period. All major site grading to the utility elevations are done and they are in the process of installing the septic sanitation system. Next, they will bring the site for the two new buildings to finish grade and the building foundations will likely be poured in the spring of 2024. Thereafter, the maintenance building will be erected in the late spring of 2024, the parking lot will be paved in the summer, and the erection of the hatchery building will commence in the fall of 2024, with the goal of getting it dried in before winter. There will also be the installation of a feed storage building and a chemical storage building once the parking lot is paved. Then crews will be able to complete the hatchery building work through the winter indoors for completion by the following spring. Likely the contract will have to be extended to at least about 6-8 months.

Phase 3 Construction, which is BIL funded and awarded to Diversified Contractors in the summer of 2023, is well underway, with tentative completion by the summer of 2025. Already, the basic forming of many of the fourteen Tier-2 ponds (C9-C14 and D1-8) is underway and the demolition of the old A-pond series from the old infrastructure, is complete to make way for the remaining pond construction to progress. The forming of these fourteen ponds will continue into the spring of 2024 to get them close to finish grading, and tentatively, by March of 2024, they will begin pouring concrete kettles and getting the bedding materials ready to line all fourteen of the ponds by July or August of 2024. In addition, the effluent retention pond (D10) will be constructed after the demolition of eight of our old P-series ponds occurs, which may not be until the fall of 2024. Thereafter, some of these ponds should be available for production by the fall of 2024 or the spring of 2025. Work will likely commence on forming the six broodstock ponds for completion by the spring or summer of 2025, which will wrap up the last of the contract tasks.

Phase 4 Construction, which is BIL funded and awarded in the summer of 2023, includes the drilling of a new primary geothermal well. Currently, the 6” test well has been drilled to 240’ and they have hit hot water. Electronic logging of data was collected through the end of 2024 to calculate water availability and quality at this depth. Additional test drilling will occur in the spring of 2024 if needed and thereafter the 18” production well will be drilled and installed based on the data collected. Then, we will await the necessary permitting with the state of Oregon to operate this new well; this permit paperwork has already been in the queue for approval for over one and a half years but will hopefully be complete by the time the new well is operational. Thereafter, an additional backup well may be installed thereafter under this contract through a modification of needs and additional permit paperwork will be submitted in 2024 for this point of diversion as well.

Phase 5 Construction, which will be BIL funded, is currently being planned in the design stage so that a solicitation package can be put on the street during either the spring or early summer of 2024. The timing on this is contingent upon when the FY2024 BIL funds get released but we hope to have the design and solicitation packages ready by February or March of 2024. Phase 5 will include the last of the pond construction on the second lease area to include site grading on this parcel, including the demolition of the remaining 14 P-ponds and the greenhouse building, and the construction of three additional production ponds and rehabilitation of the existing head pond supply on this parcel. During this phase, an reroute of a portion of the geothermal water supply piping will also be included to match the new site elevations. Additional tasks on this contract may also include the installation of a SCADA system for the entire facility, as well as additional installations of security systems across the facility.

Lastly, additional needs that are identified in the coming months will likely be included in this phase for completion by the summer of 2026 or may be placed in one or two more future phases of construction, which will likely be 1311 funded and awarded in 2025 for completion by 2027.

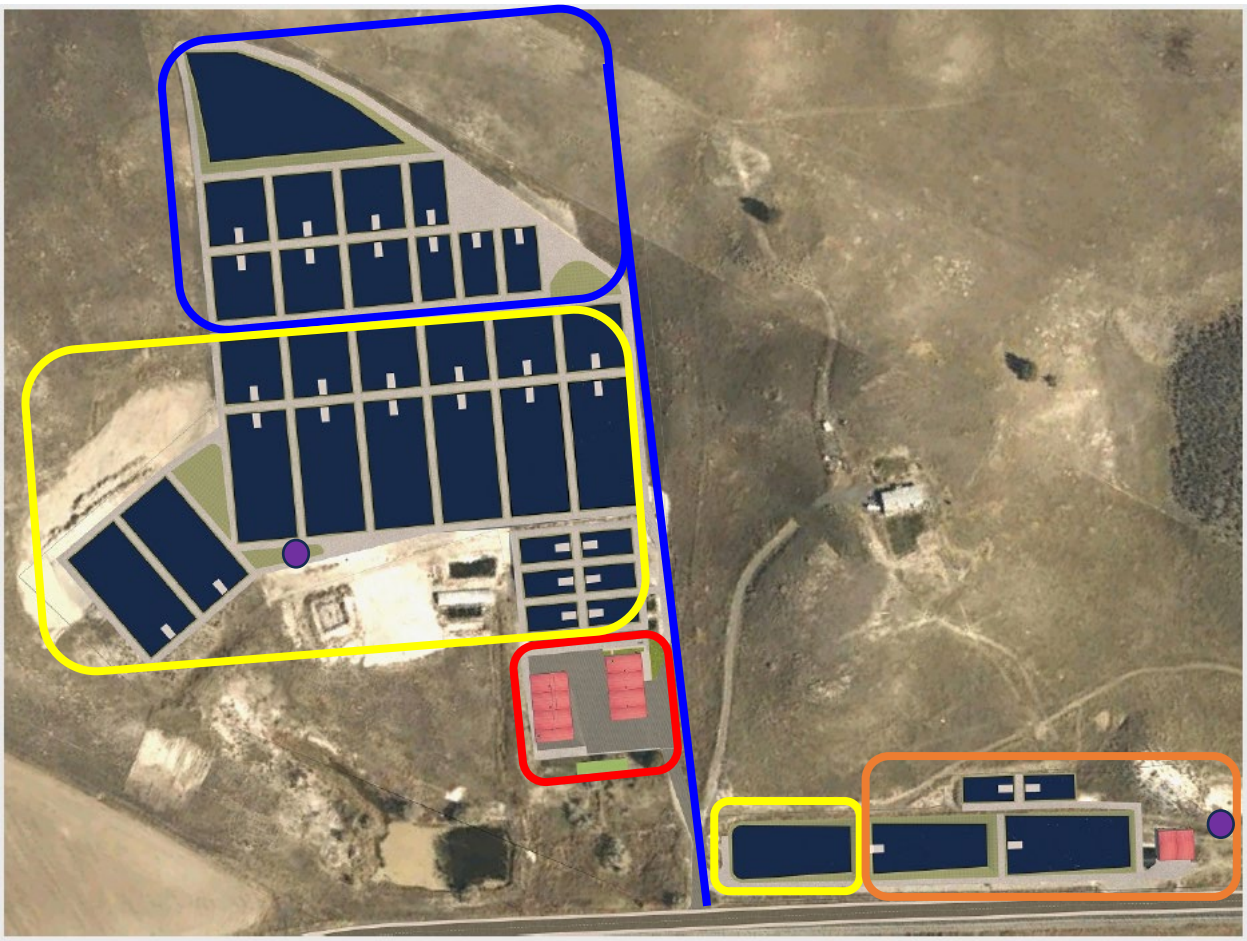

Figure 16 – Conceptual aerial overlay of the full buildout of the Klamath Falls National Fish Hatchery. Phase 1 construction (blue) will include a 1.0-acre influent retention pond at the top, followed by six 0.25-acre and four 0.12-acre fry and fingerling ponds in the Tier-1 series of juvenile ponds below. Phase 2 construction (red) will include the maintenance building, the hatchery building and office, and a feed and chemical storage building. Phase 3 construction (yellow) will include six 0.25-acre and eight 0.5-acre juvenile production ponds in the Tier-2 series below the Tier-1 series, followed by six 0.08-acre broodstock ponds below that, and lastly the 0.5-acre effluent retention pond. Phase 4 construction (purple dots) will include a new primary geothermal well by the Tier-2 series of ponds and possibly a new backup geothermal well on the lower lease parcel by the road. Phase 5 construction (orange) is currently being planned and will also include two 0.08-acre and one or two 0.5-acre quarantine ponds on the lower lease parcel by the road.

Future Work

The following is a list of various priority activities that will be cared for by the Hatchery staff during fiscal year 2024. While not all things may be achieved fully, this outlines planned projects beyond our normal hatchery operations and potential outcomes for each project.

Hatchery Construction Management (All Year)

- Monitor progress of the existing four phases of construction currently awarded and underway.
    - Phase 1 – Completion of the new head ponds, ten tier-1 production ponds, and utility and plumbing installations in 2024.
    - Phase 2 – Completion of the hatchery, maintenance, feed storage, and chemical storage buildings and associated structures utilities, and plumbing installations around the building sites in 2024 or 2025.
    - Phase 3 – Completion of fourteen tier-2 production ponds, six broodstock ponds, and one effluent retention pond, along with utility and plumbing installations in 2025.
    - Phase 4 – Completion of a test well and connections to a functional production well from the geothermal aquifer under the site, along with the potential for an additional backup production well.
- Assisting with the development of a 100% design package and solicitation contract to award for Phase 5 construction to include the construction of three production ponds and one head pond on Lease Parcel 2, as well as perimeter fencing around the site, utility and plumbing installations, possibly a separate pad or building for large circular and trough installation, and SCADA and security installations.
- Possibly assisting with the development of a 100% design package and solicitation contract to award for Phase 6 construction, which may include a mop up effort to finish unfunded work needed in earlier phases.

PIT Tag Array Construction and Deployment in UKL (Winter/Spring 2024)

- Construct/Assemble existing portable arrays for Recovery Team that were purchased the past couple years but still haven't been used.
- Consult with Abernathy Tech Center on fixed array construction and placement techniques.
- Attend the PTAGIS Meeting in Washington to learn valuable techniques and technologies.
- Purchase materials for two fixed arrays, construct/assemble array components, and deploy arrays at two proven sites.
- Monitor fixed and portable arrays for detections of suckers.
- Prepare a proposal for upscaling fixed array construction/assembly, installation, and monitoring for FY25 to be submitted to the Recovery Team in the Spring of 2024.

Review and Edit the Comprehensive SOPs for the Klamath Falls NFH (Winter/Spring 2024)

- Review, edit, and refine the various SOPs currently drafted for the Klamath Falls NFH, so that the documents represent the operation of the current and/or new infrastructure used to date.
- Include in these SOP documents ample amounts of pictures of infrastructure and staff performing various tasks to allow continuity of operations and to help prevent loss of institutional knowledge about methodologies used in the event of staff turnover.
- Finalize a copy of the comprehensive SOPs by individual chapters and print for a binder so sections can be updated, created, and/or included as needed. Include redundant copies of this document to be kept at the hatchery, the office, by local and RO leadership, and for interested partners.

Process PIT Tag Array SARP Detections (Winter/Spring 2024)

- Develop repeatable methods to extract SARP PIT tag detections from the USGS data file released in August 2023 and subsequent data releases and correlate SARP PIT tag detections to the Klamath Falls NFH master release file to determine the total number of unique detections and a length frequency plot for all unique detections to date.
- Correlate SARP PIT tag detections to the Klamath Falls NFH master release file to compile a table of unique detections by year for each release year of fish to look at persistence in the system over time.
- Correlate SARP PIT tag detections to the Klamath Falls NFH master release file to compile a table or matrix of unique detections to answer various questions, such as stocking season (spring versus fall releases), stocking locations by release year, and/or spawning ground utilization.

Draft Feed Study Summary Report (Winter 2024)

- Compile study data from the previous two years of production and draft a technical report.
- From the final technical report, draft a manuscript for peer review and journal submission.
- Prepare a poster/presentation of study results for use at a conference.

Harvest, Process, Stock Production Lots for Grow Out (February / March 2024)

- Perform annual spring harvest and inventory work to include redistributing production lots to new ponds for the growing season.
- Possibly cull out some of the CY20202, CY2021, and CY2022 broodstock to production ponds to allow further room for broodstock growth.
- Prepare pond space, tanks, and incubation systems for larval rearing season.
- Assist the Klamath Tribes with pond harvest and fish processing work for the spring season.

Gerber Reservoir Net Pen Operations (April-September/October 2024)

- Pending adequate water levels and conditions for net pen rearing at the site selected, stocking 2022 year class holdover fish from ponds P10, P11, and/or P12 into the Gerber Reservoir net pens in April for growout through September or October.
- Possibly disassemble and move the net pen from Agency Lake to Gerber Reservoir for additional growout space in the future.
- Harvest net pens in September or October, process fish, and repatriate fish to Upper Klamath Lake and/or its tributaries.
- Compile data from the net pen rearing and draft a technical report and presentation for the Sucker Science Symposium.

Spawning East Side Springs LRS / Incubation (April 2024)

- Collect and fertilize wild LRS gametes from the East Side Springs, utilizing at least four males to every female, to produce a minimum of 48 family groups across three to four weeks of the spawn.
- Transport, disinfect, enumerate, and incubate eggs from each family group in a separate hatching jar, which will be pooled by each weekly collection for hatching into a common trough after individual jars are inventoried upon hatch.
- Excess eggs may be used for incubation trials to assess water quality parameters.
- Viable larval fish will be ponded from each family group cross for broodstock and possibly limited production rearing. Excess fish may be used for larval feed trials during the spring or stocked to backwater growout locations.

Spawning Williamson/Sprague Rivers SNS / Incubation (April/May 2024)

- Collect and fertilize wild SNS gametes from the Williamson/Sprague Rivers, utilizing at least four males to every female, to produce as many family groups as possible across three to four weeks of the spawn.
- Transport, disinfect, enumerate, and incubate eggs from each family group in a separate hatching jar, which will be pooled by each weekly collection for hatching into a common trough after individual jars are inventoried upon hatch.
- Excess eggs may be used for incubation trials to assess water quality parameters.
- Viable larval fish may be ponded from each family group cross for limited production rearing. Excess fish may be used for larval feed trials during the spring or stocked to backwater growout locations.

Spawning Captive Broodstock SNS / Incubation (May 2024)

- Collect and fertilize wild SNS gametes from the captive broodstock at Klamath Falls NFH, at least four males to every female, to produce as many family groups as possible across three to four weeks of the spawn.
    - This will likely require the use of HGC hormone injections to help ovulation but ripeness checks will occur at least once each week or every other week if handling needs to be limited.

    - Most gravid fish from the 2017, 2018, and 2019 year classes will be pooled into a clean pond in several large floating net pen structures for ease of handling for hormone injections and ripeness checks.
    - Some gravid fish from the 2017, 2018, and 2019 year classes will be put in tanks to administer hormone injections and ripeness checks.
- Transport, disinfect, enumerate, and incubate eggs from each family group in a separate hatching jar, which will be pooled by each weekly collection for hatching into a common trough after individual jars are inventoried upon hatch.
- Excess eggs may be used for incubation trials to assess water quality parameters.
- Viable larval fish may be used for larval feed trials during the spring but no fish are planned for production or release unless decided appropriate by Abernathy geneticists and management.

Incubation Water Chemistry Trials (April/May 2024)

- Utilizing small batches of fertilized sucker eggs, perhaps initially from the East Side Springs LRS spawning, performing various incubation trials with different water chemistry parameters, perhaps altering various hardness levels, temperature, etc., with replication, to assess the effects on larval development, hatch rates, and post hatch condition and survival.
- Compile study data from these incubation trials and draft a technical report.
- From the final technical report, possibly draft a manuscript for peer review and journal submission.
- Prepare a poster/presentation of study results for use at a conference.

Larval Feed Trials (April/May 2024)

- Utilizing small batches of hatched larval fish, perhaps initially from the East Side Springs LRS spawning, performing various early rearing feed trials with different commercial and live diets, and/or durations of onset of feeding post hatch, with replication, to assess the effects on larval development, growth, and post hatch condition and survival.
    - Comparison of artemia feeding 3-4X/day with constant feed using peristaltic pumps; assessing difference associated with extended feeding regime.
    - New feed trial with Otohime and June sucker diet, perhaps other diets, Copenhagen diet used at Willow Beach NFH and June Sucker State Facility, Gemma Wean? Possibly conduct on just one or with both species.
    - Long term intensive rearing trial. Development of domesticated lineages for intensive rearing purposes, broodstock, etc.
    - Effects of light on rearing fish in tanks. – Would like to have timers, at least to mitigate negligence in turning on or off.
    - Bioassay studies for chemical toxicity, formalin, copper sulfate, etc.
- Compile study data from these incubation trials and draft a technical report.
- From the final technical report, possibly draft a manuscript for peer review and journal submission.
- Prepare a poster/presentation of study results for use at a conference.

Extending and Cryopreservation of Milt (April/May 2024)

- Collect milt from the various spawning efforts from both LRS and SNS.
- Perform motility checks over time using milt extender solutions for both LRS and SNS.
- Cryopreserve milt from both LRS and SNS for post thaw motility checks.
- Fertilize SNS eggs with thawed SNS milt and incubate to assess fertilization, development, and hatch rates.
- Cryopreserve milt from both LRS and SNS for banking at the Warm Springs National Fish Hatchery & Technology Center in Georgia.

Wild Larval Collection of LRS and SNS in Williamson River (May/June 2024)

- Collect at least 40-50,000 wild caught larval suckers from the Williamson River in May/June for production purposes using active methods, such as dip netting, as well as passive methods, such as drift netting.
- Transporting and enumerating larval suckers to the Klamath Falls NFH isolation building for disease treatment and monitoring, as well as early rearing.

Early Rearing LRS and SNS to Ponding (May-July 2024)

- Perform initial prophylactic treatments and early rearing techniques to pond at least 25-30,000 wild caught larval suckers from the Williamson River in May/June for production purposes.
- Possibly stock excess larval suckers directly into backwater locations upon collection.

Compiling Past Data for Growth and Conversion Estimates (July-September 2024)

- Compiling feed, sample, and growth data to assess growth and feed conversion trends from all the available data from the SARP program's inception.
- Update the hatchery SOP documents to optimize current and future practices.
- Possibly prepare a summary report on findings and develop a presentation on the subject.

Development and Implementation of an Integrated Pest Management (IPM) (July-September 2024)

- Have key staff attend trainings and/or study for testing and certification for public pesticide applicators license, to include at minimum aquatic and general use endorsements.
- Perform an Intra-Service Section 7 Consultation to identify and approve best management practices and SOPs for work around the hatchery and listed species.
- Perform bioassays on desired aquatic and terrestrial chemicals needed to control fish diseases and noxious weeds on station.