UPPER-COLUMBIA RIVER STEELHEAD KELT RECONDITIONING PROJECT:

2020 ANNUAL REPORT
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1 Introduction

Steelhead *Oncorhynchus mykiss* display a variety of life history strategies that may allow the preservation of population genetics in the face of potential environmental changes (Behnke 1992). Iteroparity, the ability to repeat spawn, is one such life history. Iteroparity in steelhead is unique among anadromous Pacific salmonids. It is thought that iteroparity may allow steelhead populations to retain genetic diversity and increase lifetime reproductive success (Seamons and Quinn 2010).

Upper Columbia River (UCR) steelhead are listed as "Threatened" under the ESA, and naturally-spawning populations currently exist at threshold levels. The incidence of iteroparity in the Columbia Basin appears to be negatively correlated with distance from the ocean and rates of iteroparity for UCR steelhead populations are extremely low. Low rates of repeat spawning are likely due to high mortality imposed by such factors as extreme energetic demand, degraded habitat quality, and post-spawning migration through the Columbia River hydropower system.

The artificial reconditioning of post-spawn natural-origin steelhead, known as kelts, holds special promise for UCR populations subject to high mortality rates that depress productivity and iteroparity. Kelt reconditioning is defined as culturing post-spawn steelhead for 6-10 months in a captive environment where they reinitiate feeding, grow, and redevelop mature gonads. It is believed that kelt reconditioning may help counter the selective forces against iteroparity imposed by the hydroelectric power systems and provide benefits in addressing the population demographic and genetic issues in steelhead recovery (Hatch et al. 2002, 2003, and 2012).

The Yakama Nation (YN) is currently implementing a kelt reconditioning project within the Upper Columbia consistent with FCRPS BiOp requirements and the Columbia Basin Anadromous Fish Accords. Early work for the project has focused primarily in the Methow River Basin. The general objective of the Upper Columbia River Steelhead Kelt Reconditioning Project (UCKRP) is to test whether the abundance of naturally-produced UCR steelhead on natural spawning grounds can be increased through the use of long-term kelt reconditioning methods. The program has three objectives:

Objective 1: *Recondition UCR steelhead kelts using long-term methods at existing facilities.*

Objective 2: *Evaluate kelt survival and effectiveness of reconditioning methods.*

Objective 3: *Collaborate with ongoing M&E studies to document the reproductive success of kelts released from the reconditioning program.*

This report will provide a summary of the steelhead kelt reconditioning efforts undertaken by this project in 2020. Topics address will include: kelt collection efforts, kelt reconditioning efforts, monitoring and evaluation efforts, and future project direction.

2 Kelt Collection

Identifying reliable places to collect natural origin (NOR) steelhead kelts has been critically important to the success of the UCKRP. Unlike kelt reconditioning projects in the Yakima River in Washington and Clearwater River in Idaho, the Methow River does not have an in-basin collection or trapping location for downstream migrating adult salmonids. Instead of pursing a large scale collection effort at a single location, the UCKRP chose to pursue smaller kelt collection opportunities at a variety of locations. The three collection methods chosen were live-spawning of NOR steelhead broodstock collected for Methow Basin conservation hatchery programs, the application of temporary tributary traps, and collection at Rock Island Dam.

Regionally, spawning of anadromous salmonids in a hatchery setting has almost exclusively applied lethal spawning techniques, with the exception of a small number coastal steelhead programs. Lethal spawning practices insured that all available gametes could be harvested and fish carcasses could be sampled for pathogens. Prior to the spring of 2012 all Upper Columbia steelhead hatchery programs lethally spawned all broodstock regardless of fish origin. The UCKRP conducted a study in 2011 in which demonstrated that live-spawning did not negatively impact the number of eyed eggs collected (Abrahamse and Murdoch 2012). Following this study, an agreement was reached with US Fish and Wildlife Service (USFWS) to begin live-spawning the NOR female steelhead broodstock at Winthrop National Fish Hatchery (WNFH) and allow for their inclusion into the UCKRP starting in the spring 2012. The successful live-spawning of broodstock at WNFH was instrumental in discussions with Washington Department of Fish and Wildlife (WDFW and Douglas County Public Utility District (DCPUD) regarding live-spawning NOR female broodstock from their Twisp River conservation program. Fish from this program were of particular interest due to the ongoing reproductive success study in the Twisp River and the potential to include reconditioned kelts included in that study. YN felt that this represented the best opportunity to address the project's Objective 3: Collaborate with ongoing M&E studies to document the reproductive success of kelts released from the reconditioning program. An agreement was reached with WDFW and DCPUD in November of 2013 and live-spawning at Methow Salmon Hatchery (MSH) began in the spring of 2014. All live-spawning has been conducted at WNFH since 2017, due to an agreement among co-managers and regulatory agencies comprising the Wells HCP Hatchery Committee to combine the broodstock for the two conservation hatchery programs.

The collection of NOR kelts that have spawned in the natural environment has been a priority for the UCKRP. It is unclear if genetics, fish condition, or some combination of the two drives a fish to iteroparity. Whatever cause, these fish attempting to out migrate have the necessary drive. The most prolific reconditioning programs to date have been able to collect large numbers of kelts that appear as by-catch in juvenile bypass traps at diversion and hydropower dams. The UCKRP has chosen to attempt to collect kelts in the natural environment using multiple traps in small tributaries in the Methow Basin.

Rock Island Dam is the only main stem facility in the UCR suitable for capturing downstream migrating kelts. The dam is located on the Columbia River about 12 miles downstream from the city of Wenatchee. Kelts captured at this facility would have spawned in the Methow, Okanogan, Entiat, and Wenatchee Rivers, or small tributaries to the Columbia River. Kelts have historically been encountered incidentally during Chelan County Public Utility District (CPUD) juvenile sampling at Rock Island. An arrangement was reached in 2014 with CPUD to allow kelts trapped during their normal spring sampling period to be included in the UCKRP.

This section will provide a summary of kelt collection activities in 2020. Several of the kelt and kelt data collection efforts were altered in 2020 due to restrictions associated with the COVID-19 pandemic. YN leadership instructed fisheries staff to limit activities to those necessary to keep fish alive and to maintain baseline project goals.

2.1 Methods

2.1.1 Live-Spawning

Steelhead live-spawned at WNFH were collected by hatchery staff. USFWS staff collected fish through the use of hook-and-line, assisted by YN when requested. WDFW collected Twisp origin broodstock at the Twisp Weir and transported them to WNFH. Pre-spawn fish care, preparation, and assessment of female gravidity were conducted by hatchery personnel.

Air spawning was chosen as the method for live-spawning based on literature review (Shrable et al 1999; Orr et al 1999) and personal communications with fish culture professionals identifying it as the most effective live-spawning method. Fish were anesthetized using Tricaine methanesulfonate (MS 222) prior to air spawning. Female steelhead were held by one person with one hand near the head and the other just anterior to the tail. A16-gauge hypodermic needle with a 1-inch tip, attached to a small air compressor via a rubber hose was then inserted ½ inch into the body cavity just posterior to the pelvic girdle by a second person. Then 5-7 psi of compressed air was injected into the body cavity to expel the eggs.

Once all the eggs were collected, each fish was taken to a water filled tank to expel remaining air in the body cavity. The fish were held vertically in the water with the head at the bottom of the tank. Gentle hand pressure was applied to the fish's abdomen just posterior of the operculum and drawn towards the tail to expel any air remaining in the body cavity.

Data was collected from all steelhead kelts following the expulsion of air. It was decided that because COVID-19 restrictions limited the number of personnel allowed in the spawning building, only the minimum amount of data would be collected. Data collection efforts focused on obtaining fish weight, needed to calculate feed requirements, enumerating copepods, needed for participating in the SLICE medicated feed INAD (see Appendix A) and scanning for PIT tags. Fork length data was acquired from USFWS bio sampling data collected following hook-and-line collection.

Kelts were transferred to the MSKF for reconditioning following data collection.

2.1.2 Weir Trapping

We did not operate weir traps in 2020 due to the COVID-19 pandemic. Multiple agency shutdowns prevented the project from acquiring necessary permits and the availability of staff to operate traps was limited.

2.1.3 Rock Island Dam

Kelts were encountered by CPUD during their operation of the Rock Island Dam juvenile bypass trap. Kelts suitable for reconditioning were retained in an aerated tank onsite to until UCKRP staff were able to transport the kelts back to the MSKF for reconditioning. CPUD fisheries personnel were given a list of criteria by YN outlining which kelts were to be retained for transport and which kelts were to be released back into the fish ladder. Kelts that were retained possessed no hatchery marks, had little to no fungus on the body, and had no major wounds or descaling. Kelts meeting the criteria were collected during normal sampling at Rock Island Dam. CPUD staff would hold the kelts in a large flow-through tank for no more than 24 hours. YN staff transport all Rock Island Dam collected kelts to the MSKF.

2.2 Results

2.2.1 Live Spawning

Spawning activities began at Winthrop NFH on April 15, 2020 and concluded May 20, 2020. A total of 54 NOR females were live-spawned in 2020. No hatchery origin (HOR) females were live-spawned. There was one post-spawn mortality.

Table 1 – Females live-spawned at WNFH and MSH in 2020.

	NOR	HOR
WNFH	54	0
MORT	1	0
TOTAL	53	0

2.2.2 Weir Trapping

Weir traps were not operated in 2020 due to the COVID-19 pandemic.

2.2.3 Rock Island

Thirteen NOR kelts were collected from the Rock Island Dam juvenile bypass facility in 2020.

Table 2 – Summary of NOR kelt collection numbers 2020.

Collection Location	# Collected
Winthrop NFH (Live-Spawn)	54
Rock Island Dam Juvenile Bypass	13
Total	**67**

2.3 Discussion

In 2020, we collected a total of 67 NOR kelts through a combination of live-spawning, and the Rock Island Dam bypass trap (Table 2). The NOR female broodstock live spawned at WNFH have continued to be an important part of the project. The fish come to the reconditioning project in good condition because they have not sustained injuries spawning in the natural environment, and they are treated with formalin while being held prior to spawning at the hatchery which reduces the spread of external fungal infections.

Collections at Rock Island Dam vary annually. Annual variations in the number of kelts collected are linked to a combination of factors, including: timing of peak stream discharge, the magnitude of stream discharge, and the size of the NOR spawning population above Rock Island Dam. However, the cooperation and coordination with CPUD at Rock Island allows us to collect kelt opportunistically. The project's collection efforts are directly proportional to the number of kelts being captured at Rock Island Dam.

3 Kelt Reconditioning

The UCKRP implements long-term kelt reconditioning techniques in pursuit of its project objectives. Long-term recondition has been determined to be more effective at improving kelt survival than either short-term reconditioning or transporting unfed kelts (Hatch et al. 2012). Long-term reconditioning is the process where steelhead kelts are collected through live-spawning or during their seaward migration, held and cultured in large tanks, and released in fall to coincide with the return of maiden spawners from the ocean. Prior to 2016, all kelts were released after approximately six months of reconditioning, regardless of their maturation status. Beginning in 2016, the UCKRP modified of its reconditioning practices to better address the different life history strategies observed in naturally occurring kelts, consecutive repeat spawners and skip repeat spawners.

Consecutive repeat spawners are those that return to spawn in the same calendar year as their outmigration. Skip repeat spawners are those that return the calendar year after their outmigration. It has been observed that steelhead populations that travel further upstream to spawn (i.e. Upper Columbia and Snake rivers and their tributaries) have a higher prevalence of skip repeat spawners (Keefer et al 2008).

3.1 Methods

Methow Steelhead Kelt Facility

The MSKF was constructed on Winthrop National Fish Hatchery grounds in 2011. The facility was constructed by YN specifically for the UCKRP. The building is a pre-engineered, all-steel building, 70 ft. long and 27 ft. wide. The facility contains four circular, fiberglass tanks. The tanks are 12 ft. in diameter and 4 ft. in depth. Each tank has 340 ft^3 of rearing volume and has a

maximum rearing capacity of 34 adult steelhead. The facility has a total adult capacity of 136 adults.

To prevent the spread of pathogens from the NOR steelhead held at the MSKF to the surrounding watershed, all effluent was sterilized. The MSKF has a UV sterilization system capable of treating a maximum of 200 gallons/minute. The system consists of a concrete settling basin to separate solids and three UV units. The three units allow for two units to be operated in concert and one available as a backup in case maintenance is required on one unit. Additional bio-security measures were taken to ensure that pathogens are not carried out of the MSKF by humans. Foot baths at facility exits were maintained to contain pathogens. Vehicle and foot traffic access was limited through the parking lot outside the fenced hatchery rearing area.

Treatment

Emamectin Benzoate

Kelts held for an extended period time in a captive environment are susceptible to severe infestation of parasitic copepods of the genus *Salmonicola*. These copepods attach to the gill lamellae and can inhibit oxygen uptake and gas exchange at the gill lamelle/water surface interface. When untreated, copepods can proliferate and infestations can have an impact on fish growth, survival, and may impact maturation of gametes.

Prior to 2020, all kelts coming into the reconditioning program received an injection of emamectin benzoate for the treatment of parasites. Treatment through injection is preferable to medicated feed for the project because of the unique needs of steelhead kelts. It can take 4 to 6 weeks of a kelt to reinitiate feeding and reach the recommended 2% body weight feed ration. The extended reinitiating period combined with a prolonged intake period means it can be several months feeding response reaches a point where medicated feed could be administered with confidence.

Emamectin injections are not FDA approved but the UCKRP was permitted to administer them through a Threatened and Endangered Species (T&E) regulatory discretion to the Investigation of New Animal Drugs (INAD). However, a policy change in late 2019 discontinued T&E approval for drugs that had an existing INAD, which included emamectin benzoate. The UCKRP chose to participate in the INAD 11-370 under study number 11-370-20-027.

As a result of the 2019 policy change, in 2020 Emamectin benzoate was administered to kelts through medicated feed. The normal feed ration was top coated with SLICE premix to provide a dosage of 50µg/kg of biomass per day. Medicated feed was administered from August 7 to August 13, a period of seven days.

A description of the results of UCKRP's participation in this study can be found in Appendix A of this report.

Formalin

Kelts are particularly susceptible to fungal infections due to the presence of dermal abrasions, lesions, or lacerations. Kelts have a weakened immune system and untreated fungal infections can be lethal. Fungal infections can be difficult to treat once established. To prevent the establishment of fungus the kelt tanks were drip treated with formalin at 167 ppm for one hour. Treatments were administered approximately every other day from the beginning of the reconditioning process until December 1st.

Salt

Kelts come into the reconditioning project in a weakened and stressed state due to the combination of the upstream migration, long periods without active feeding, and spawning activities. Salt is thought to reduce the stress of maintaining osmotic balance and potentially encourage feeding. Salt bath treatments were given on days when formalin treatments were not administered. Additional treatments were given after potentially stress inducing events such as tank cleaning and the removal of mortalities. Salt baths were given at an average concentration of 322 ppm for 60 minutes.

Feeding

The kelts were initially offered parboiled, flash frozen Antarctic krill in 6 to 8 small feedings per day. Krill was fed to satiation for approximately six weeks. After six weeks the kelts were slowly transitioned to a modified Moore-Clark pellet feed designed to have a sink rate comparable to the krill. Each tank was fed a minimum of 2% of the total pre-reconditioning fish weight. The percent body weight fed was increased to 2.5% of the total pre-reconditioning fish weight as fish demonstrate increased feeding response and to approximate weight gain. Initially a mixture of 75% krill and 25% pellets are fed for one to two weeks. The ratio was then shifted to include 50% krill and 50% pellets for another one to two weeks, 25% krill and 75% pellets for one to two weeks, and 10% kill and 90% pellets which was fed for the remainder of the reconditioning period.

Mortalities

Any kelt mortalities were immediately removed from the tank. Date collected from mortalities included fork length in millimeters, POH length in millimeters, weight in grams, origin (natural or hatchery), sex, fish condition (good- lack of any wounds or descaling; fair- lack of any major wounds and/or descaling; poor- major wounds and/or descaling), color (bright, medium, and dark), percent fungus coverage, presence of parasites, and maturation status. All fish were scanned for the presence of PIT tags and the data was included in the database.

Prior to 2016, project survival rate was calculated for the period between the date of collection of the first kelt and the date of release. From 2016 onward, survival rate will be calculated from the

previous reporting period's release date to the release date of the current reporting period. This will allow inclusion of skip-spawners retained at MSKF in annual survival rate calculations.

Pre-Release Sampling

All kelts surviving to September were sampled to assess reconditioning effectiveness and maturation status. Data collected included: fork and POH lengths, weight, body fat percentages, and blood samples.

Muscle lipid levels were measured using a Distell Fish Fatmeter model 692. Two readings were taken (locations 1 and 2; Figure 3.1) and the results averaged.

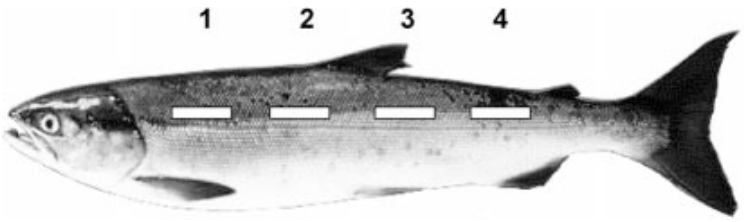

Figure 3.1 - Fatmeter reading locations. Readings are taken at locations 1 and 2

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Blood sampling occurred while the fish were anesthetized. The fish were held on a board with their head in the water. A heparinized syringe was inserted along the ventral midline between the anal fin and the tail (Figure 3.2) and approximately 2 ml of blood was drawn. The syringe was then removed and gentle pressure applied to the puncture site to stop blood flow. Blood was dispensed from the syringe into microcentrifuge tubes and stored on ice. The samples were then placed into a centrifuge and spun for 5 minutes at 1000g to separate the plasma. The plasma was then collected and frozen until it could be sent to the University of Idaho to be analyzed for the concentration of estradiol to determine the fishes' maturation status. Blood plasma analysis was done according to methods described in Pierce et al. (2016).

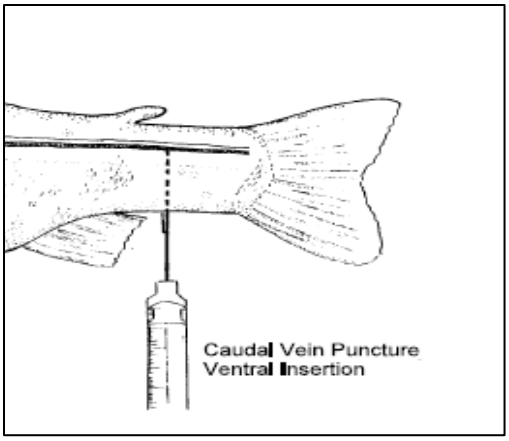

Figure 3.2 - Blood sampling location.

Blood samples were sent to the University of Idaho where CRITFC physiologists measured concentrations of plasma estradiol to assess the maturation status of reconditioned kelts. Blood plasma analysis was done according to methods described in Pierce et al. (2016). Female kelts were divided into three categories based on the concentration of estradiol concentration: maturing (>3,162 pg/ml), borderline (<3,162 pg/ml but >1,000 pg/ml), and not maturing (<1,000 pg/ml). These categories were used to determine if kelts would be released or retained for additional reconditioning.

Length and weight data was used to calculate Fulton Condition Factor (K). K and body fat percentage were used as indices of available energy. One-way ANOVA was applied to compare K values and body fat percentage among sample years. If differences between groups were found with ANOVA, Tukey's test was used to identify where differences originated. All tests were done using an alpha level of 0.05. Mean fork length at collection was also calculated and used as an index of fish age.

Release and Tracking

Female kelts determined to be maturing and borderline through blood plasma estradiol analysis were released into the river basins from which they were collected. Male kelts were not tested and all surviving males were released. Kelts collected from Winthrop NFH were released into the Methow River. Kelts collected at Rock Island Juvenile Bypass were released in to the Columbia River upstream of Rock Island Dam at river kilometer 742 (near Wenatchee, WA). Kelts determined not to be maturing were retained for additional reconditioning.

All kelts were scanned for existing PIT tags prior to release. If scanning revealed a kelt had lost its existing tag, a new tag was inserted into the pelvic girdle. Movements of the kelts post release were monitored using the existing PIT tag antenna arrays operating through the Methow and Columbia River basins.

3.2 Results

The UCKRP completed its 2020 reconditioning activities in November, when maturing kelts were released. The project began the reconditioning process with a total of 67 NOR steelhead kelts collected in 2020 and 14 skip-spawners retained from the 2019 collections (Table 3).

Table 3 – Number of kelts collected, released, and retained by the UCKRP in 2020.

Collection Location	Collected	Released	Retained
Winthrop NFH	56	5	11
Rock Island Dam Juv. Bypass	13	3	6
2019 Skip-Spawners	14	9	0
Total	**83**	**17**	**17**

A total of 34 kelts survived until release. Total survival rate for kelts in 2020 was 41%. The 2020 survival rate was below the eight-year project average (Table 4). Twenty-five of the 69 kelts collected in 2020 survived to release, a group survival rate of 36.2%. Nine of the 14 skip-spawner kelts held over from 2019 survived to release, a group survival rate of 64.3%. Mean fork length at time of collection was 670 mm, greater than the project mean.

Blood plasma estradiol analysis revealed that 17 of the 34 surviving female kelts were maturing or borderline. Overall maturation rate for 2020 was 50.0%. Eight of the 25 surviving kelts collected in 2020 were maturing, a maturation rate of 32.0%. All 9 surviving skip-spawners from 2019 were determined to be maturing. All maturing kelts were released into the Methow River.

Table 4 – Summary of project survival and maturations for project years 2013-2020**.**

Project Year	# Collected	$\bar{X}$ FL (mm)[1]	# Surviving	Survival Rate	# Maturing	Maturation Rate
2013	9	-	6	66.7%	4	66.7%
2014	76	618	58	76.3%	31	53.4%
2015	58	669	30	51.7%	19	63.3%
2016	69	630	53	76.8%	32	60.4%
2017	88	705	46	52.3%	29	63.0%
2018	103	605	56	54.4%	32	57.1%
2019	86	651	35	40.7%	21	60.0%
2020	83	670	34	41.0%	17	50.0%
Mean	**70**	**650**	**40**	**54.4%**	**23**	**59.2%**

[1] Mean fork length at collection (FL) was included as an index of fish age. Greater may FL be correlated with survival rate.

One-way ANOVA analysis indicated that mean K and body fat percentage of kelts released in 2020 was not significantly different than kelts released in in previous years. A summary of the mean values and 95% confidence intervals can be found in Table 5.

Table 5 – Summary of condition factor (K) and body fat percentage in reconditioned kelts released by UCKRP from 2014 to 2020**.**

	K		Fat %	
Project Year	Mean	95% CI	Mean	95% CI
2014	1.17	(1.13, 1.20)	5.2	(4.7, 5.8)
2015	1.17	(1.13, 1.22)	5.8	(5.2, 6.3)
2016	1.19	(1.15, 1.23)	4.9	(4.5, 5.4)
2017	1.09	(1.05, 1.13)	5.0	(4.4, 5.5)
2018	1.12	(1.08, 1.16)	5.4	(4.9, 5.9)
2019	1.15	(1.11, 1.18)	5.2	(4.5, 5.9)
2020	1.15	(1.01, 1.30)	4.4	(3.5, 5.3)

All maturing kelts of Methow Basin origin were released into the Methow River on November 10, 2020. The kelts were released at river kilometer 1 (near Pateros, WA). Of the kelts released in the Methow, 5 were collected in 2020 and 9 were skip-spawners collected in 2019. Three kelts collected at Rock Island Dam in 2020 were released into the Columbia River.

The remaining 17 kelts, 50.0% of those surviving to release, were determined not to be maturing. These fish were considered skip-spawners and were retained at the MSKF to undergo an additional year of reconditioning.

3.3 Discussion

Overall project survival in 2020 was among the lowest observed since the project moved to full performance. We believe the switch from injectable emamectin to medicated feed contributed greatly to the below average survival in 2020. We had to wait for several months until feeding response was sufficient to administer an effective dose of medicated feed instead of treating upon entrance into the reconditioning project. Treatment was further delayed by agency shutdowns and restrictions that resulted in the project receiving the SLICE premix by almost a month. Maturation rates and percent body fat were also below average, likely the result of copepod infestation. In the future, we hope to improve fish survival and maturation through earlier medicated feed treatment, additional salt treatments, increased tank flow, more frequent tanks cleanings, and the continued research into alternative treatment options.

Changes in copepod treatment cannot solely be to blame for below average survival in 2020. There continue to be a high proportion of larger, older age-class females in Upper Columbia steelhead runs. Analysis conducted in 2019 indicated that kelts which survive through the reconditioning process have significantly smaller mean fork length, POH length, and weight than kelts that do not survive. The surviving kelts are also significantly younger than those that do

not survive. A full description of these analyses can be found in the 2019 annual report for this project "Upper-Columbia River Steelhead Kelt Reconditioning Project: 2019 Annual Report" (Abrahamse and Murdoch 2020).

The results of reconditioning skip-spawners continue to be variable. Survival of 2019 skip-spawners reconditioned in 2020 was 64.3% and represented an improvement over skip-spawner survival in 2018 and 2019 which was 40% and 20.8 percent respectively. Survival of skip spawners in 2020 was below the 85.7% observed in 2017. It is likely that survival rate for these fish would likely have been even lower if the skip-spawners were not held for additional reconditioning. Only 18% of the skip-spawners released before 2016 were ever detected at PIT tag arrays following release. The majority of the detections that were made indicated that these fish were likely attempting to return to the ocean without having spawned (Appendix B).

4 Monitoring and Evaluation

Ongoing monitoring and evaluation (M&E) efforts are being conducted to evaluate the efficacy of long-term reconditioning to aide as a recovery tool for UCR steelhead. The focus of these M&E efforts in 2020 was addressing two questions:

(1) Are reconditioned kelts surviving to a second spawn at a rate lesser than, equal to, or greater than non-reconditioned kelts?
(2) Are reconditioned kelts reproductively successful?

The UCKRP continued answering these questions by examining post-release movement and survival of reconditioned kelts and reproductive success of reconditioned kelts. A study comparing maturation status and available energy between reconditioned kelts and maiden spawning steelhead was completed in 2018. A description of the study can be found in the 2018 annual report (Abrahamse and Murdoch 2019).

4.1 Movement and Survival

The demonstration of improved survival of iteroparous steelhead in the Upper Columbia is important to understanding the contribution of kelt reconditioning to steelhead recovery. True comparisons of the survival rates of reconditioned kelts and non-reconditioned kelts calculated on a year to year basis are likely beyond the budget and scope of the UCKRP. However, standardized indices may be developed and used to assess temporal trends in the survival rates of reconditioned and non-reconditioned kelts. These indices may be applied to assess the potential for reconditioning to increase the survival of steelhead kelts over a no-action alternative.

4.1.1 Methods

An in-river reference group was developed to evaluate the extent of benefits of reconditioning to survival and repeat spawning rates. This reference group was made up of non-reconditioned kelts identified through PIT tag data. The PTAGIS database was used to identify known UCR steelhead demonstrating downstream migration consistent with iteroparous life history. Two

criteria were used in choosing steelhead for the reference group: (1) tagged or recapture as adults in the Upper Columbia and (2) demonstrated downstream movement in the Columbia River following spawning.

The advance reporting tool in the PTAGIS database was used to identify PIT tag codes of all steelhead tagged or recaptured as adults at two sites in the Upper Columbia. These sites were chosen because the primary focus of projects operating during the designated time frames is to identify and enumerate adult steelhead. The two sites and time periods queried in PTAGIS were:

(1) Twisp River weir (TWISPW) – March 1- June 30 of the maiden spawn year (MY),
(2) Wells Dam fish ladders (WEL) – July 1- October 31 of the year previous to the MY, and

These queries were used to create a list tag codes from the known adult steelhead spawning in the Upper Columbia in a given year. The list of known steelhead spawners was then cross referenced with the list of tag codes of steelhead detected moving downstream through the Rocky Reach Dam juvenile bypass system (RRJ) between March 1 and July 31 of the MY. Steelhead appearing in both the known steelhead spawner and kelts at RRJ lists were included in the in-river reference group for a given year.

The in-river reference group PIT tag codes are queried in PTAGIS for two years following their MY to account for the two distinct iteroparous life histories, consecutive spawning and skip spawning. Consecutive spawning kelts are kelts that return to spawn the year following their maiden spawn. Skip spawning kelts are kelts that return to spawn the second year following their maiden spawn. Both types of kelts will be enumerated and the data will be used to calculate the rate of survival to return index and rate of survival to repeat spawning index. Rate of survival to return index (S_r) will be calculated as:

$$S_r = \frac{Q_r + P_r}{C_r} * 100$$

whereas Q_r is defined as the number of consecutive spawners kelts detected at a Upper Columbia site the summer/fall following their maiden spawn year, P_r is defined as the number of skip-spawners kelts detected at a Upper Columbia site summer/fall two years following their MY, and C_r is the number of kelts in the in-river reference group. The rate of survival to repeat spawn index (S_s) will be calculated as:

$$S_s = \frac{Q_s + P_s}{C_s} * 100$$

where $Q_s$is defined as the number of kelts detected in the Methow Basin the spring following their MY, P_s is defined as the number of kelts detected in the Methow Basin the spring two years following their MY, and C_s is the number of kelts in the in-river reference group.

The rate of survival to return index will be compared against the rate of survival to release for reconditioned kelts from the UCKRP. The rate of survival to repeat spawn index will be compared against the survival to repeat spawn for reconditioned kelts from the UCKRP.

4.1.2 Results

The number of fish in the reference group and reconditioned kelt group for each MY can be found in Table 6. S_r calculations have been completed for the MY 2013 through MY 2019 reference groups. The results of the calculations and their comparison to reconditioned kelt survival indices can be found in Table 6.

S_r calculations have not been completed for MY 2020 reference group (Table 6). S_r calculations will be completed in the fall of 2021. Once complete, the S_r values for MY 2020 will be compared to the 8 kelts surviving to release in 2020 and the number of surviving skip spawners to be released in 2021.

Table 6 – Summary of rate of survival to return index (Sr) data for in-river reference groups and comparisons with survival to release rates for kelts reconditioned by UCKRP.

	In-River Reference Group				Project Group			
Maiden Year	Q_r	P_r	C_r	S_r	Collected (C_r)	Released (Q_r)	Skips Released (P_r)	Survival % (S_r)
2013	0	0	40	0.0	9	6	NA	66.7
2014	3	0	103	2.9	76	58	NA	76.3
2015	0	0	48	0.0	58	30	NA	51.7
2016	0	0	53	0.0	69	32	18	72.5
2017	0	0	47	0.0	67	11	8	28.4
2018	0	0	56	0.0	83	24	5	34.9
2019	0	0	267	0.0	62	16	9	40.3
2020	1	-	144	-	69	8	17[1]	-

[1] The number of 2020 skip-spawners released (marked with *) will be updated in the 2021 annual report if mortalities are observed.

S_s calculations have been completed for the MY 2013 to 2018 reference groups. The results of the calculations and their comparison to reconditioned kelt survival metrics can be found in Table 7.

S_s calculations for the MY 2019 reference group will be completed in 202 (Table 7). No reference group kelts were detected returning in spring 2019. Twenty-five reconditioned kelts collected in 2019 have been released. Twelve of the 16 MY19 kelts released by the UCKRP

were detected in the UCR in the spring of 2020. The skip spawners collected in MY 19 and released in 2020 will be included in the analysis once detections are made in the spring of 2021.

Table 7 – Summary of rate of survival to spawn index (S_s) data for in-river reference groups and comparisons with survival to spawn rates for kelts reconditioned by UCKRP.

	In-River Reference Group				Project Group			
Maiden Year	Q_s	P_s	C_s	S_s	Released (C_s)	Detected (Q_s)	Skips Detected (P_s)	Survival % (S_s)
2013	0	0	40	0.0	5	1	0	20.0
2014	1	0	103	0.9	58	31	2	56.9
2015	0	0	48	0.0	30	13	0	43.3
2016	0	0	53	0.0	50	23	10	64.0
2017	0	0	47	0.0	19	4	2	31.6
2018	0	0	56	0.0	29	20	2	75.9
2019	0	-	267	-	25	12	-	-
2020	-	-	144	-	8	-	-	-

To date, 48.6% of reconditioned kelts released from the UCKRP have been detected at least once in the UCR during the spring spawning period. Many of these kelts have upstream and downstream detections whose timing and pattern are indicative of spawning events (Appendix B).

4.1.3 Discussion

Ongoing monitoring data continues to suggest that long-term reconditioning efforts improve indices of survival to return and survival to spawn. Repeat spawning of non-reconditioned kelts in the upper Columbia appears to be uncommon. We recognize that PIT tag detections alone are not sufficient to make definitive claims on the ability of steelhead kelt reconditioning to contribute to steelhead recovery in the UCR. However, when these data are view alongside other metrics, such as reproductive success, we are able to infer the contribution of the UCKRP to steelhead populations compared to a no-action alternative.

4.2 Reproductive Success

The documentation of the reproductive success of reconditioning kelts has been a key goal of the project since its inception, as is demonstrated by the project's Objective 3. YN acknowledges that tracking the kelts to the spawning ground may indicate a spawning event, but will not confirm that the success of the spawning event. Documentation of living offspring from reconditioned kelts spawning in the wild is an important step in the assessment of long term reconditioning as a contributor to steelhead recovery in the UCR.

WDFW is currently operating a multi-generational relative reproductive success (RRS) study on steelhead in the Twisp River. This study will be operational from 2009-2025 and will quantify

the relative reproductive success of natural and hatchery-produced fish at three life stages (parr, smolt, and adult) (Goodman et al 2018). The Twisp RRS study documents living offspring. It uses genetic testing to assign parents to juvenile steelhead collected in the Twisp.

The UCKRP has prioritized the collection, reconditioning, and release of Twisp River origin steelhead kelts to coincide with this ongoing study. The reconditioning and release of Twisp River-origin kelts will allow their inclusion in the Twisp RRS study when they return to the Twisp to spawn, thus providing a direct means to document the reproductive viability of reconditioned kelts. The steelhead RRS study in the Twisp River is the only such study in the UCR Basin which plans to include reconditioned kelts in the analysis of relative reproductive success of steelhead in the natural environment.

4.2.1 Methods

A description of the protocols used by WDFW for the Twisp RRS can be found in at https://www.monitoringresources.org/Document/Protocol/Details/121.

Descriptions of reconditioning and release methodologies can be found in Section 3 of this report.

4.2.2 Results

Between 2014 and 2019, nearly 30 successfully reconditioned (Table 8), Twisp River origin kelts have been released. Most of these fish were lived spawned broodstock from the Douglas County PUD Twisp River Steelhead Program. Twisp River origin fish collected at the Little Bridge Creek weir and Rock Island Dam have also been released.

Table 8 – The number of Twisp River origin reconditioned kelts released and included in the Twisp Reproductive Success Study.

Release Year	N Released	N Twisp RRS
2014	10	6
2015	5	2
2016	4	3
2017	0	0
2018	5	5
2019	3	2
2020	0	-

Results from the Twisp RSS have been received for fish that spawned in 2015 and 2016. Eight reconditioned kelts released in 2014 (N=6) and 2015 (N=2) were sampled by WDFW and included in the Twisp RRS. The WDFW found evidence that all eight reconditioned kelts produced age-1 offspring. Reconditioned kelts produced an average of 13.5 age-1 offspring per spawner. The average age-1 offspring produced by reconditioned kelts was greater than the average of maiden spawning NOR females (11.48 age-1 offspring per spawner), HOR females

(6.1 age-1 offspring per spawner), and one natural NOR female kelt (0 age-1 offspring) (Ben Goodman et al 2020). A summary of the 2015 and 2016 Twisp RRS study results can be found in Table 9.

Table 9 – Summary of the results for 2015 and 2016 of the Twisp RRS study.

Group	N	$\bar{X}$	SD	95% CI
HOR Maidens	37	6.11	8.65	(3.32, 8.65)
NOR Maidens	46	11.48	15.00	(7.15, 15.80)
Recond. Kelts	8	13.50	9.98	(6.58, 20.40)
Natural Kelts	1	0	-	-

Three reconditioned kelts released in 2016 were sampled by WDFW in 2017 and included in the Twisp RRS study. No kelts released in 2017 were included in the Twisp RRS study. Five reconditioned kelts released in 2018 were sampled by WDFW in 2019 and included in the Twisp RRS study. There is currently a backlog of samples at the state genetics labs, which has been exacerbated by COVID-19 shutdowns, and results from these release groups are forthcoming.

No known Twisp origin kelts were released in 2020.

4.2.3 Discussion

Continued documentation of living offspring from reconditioned kelts in the UCR is valuable evidence that project fish may be contributing to productivity of the natural population. The mean number of age-1 offspring produced was higher for reconditioned kelts than both NOR and HOR maiden female spawners in 2015 and 2016.[1]

Analysis comparing the relative reproductive success of maiden spawners and reconditioned kelts is in the preliminary stages. Interpretation of the data may continue to change as additional year-classes are sampled and the sample size of reconditioned kelts increases.

A greater sample size of reconditioned kelts and their progeny are needed before the relative reproductive success of reconditioned kelts, and both NOR and HOR maiden spawners can be compared with a higher degree of certainty. However, the documentation of reproductive success for a reconditioned kelt is significant and likely indicates that life-time reproductive success of repeat spawning reconditioned kelts is higher than steelhead which are only able to complete a single spawning event. Live-spawning of NOR females from the Methow/Twisp River Steelhead Programs will continue for the foreseeable future, however recent changes in

[1]This is contrary to what was reported in the 2018 annual report (Abrahamse and Murdoch 2019). Data documenting age-1 offspring of reconditioned kelts became available after the previous year's reporting had been concluded.

hatchery program management will likely reduce the number of Twisp specific broodstock available for reconditioning.

It is important to note that, regardless of any similarities or differences in relative reproductive success quantified through ongoing monitoring, successful spawning by reconditioned kelts adds juveniles to the population that would be otherwise absent. Most, if not all, of the reconditioned kelts released by this project would not have survived to repeat spawn. Comparison of indices of survival between reconditioned kelts and an in-river reference group can be found in Section 4.1 of this report. Reconditioning can increase the lifetime reproductive success of an individual fish beyond what would be allowable without intervention (Seamons and Quinn 2010).

5 Addressing ISRP Qualifications

In 2014, the UCKRP had a check in with the Independent Scientific Review Panel (ISRP). At this time the project was given a list of qualifications that need to be addressed in subsequent proposals and reports. These qualifications include:

1) The prior recommendation, by the ISRP, to establish methods to assess how kelt reconditioning may benefit population growth, abundance, spatial structure, and diversity still needs to be addressed.
2) Some modeling and a power analysis need to be conducted to clarify how many juvenile and F_1 adults should be sampled to detect meaningful differences in the breeding and reproductive success of HOR, NOR, and reconditioned NOR females.
3) Methods to assess the fat levels, maturation timing, fecundity, egg size, and gamete viability of the project's reconditioned kelts need to be developed and implemented. The fate of non-maturing or skip-repeat reconditioned fish also should be disclosed.
4) Viable plans are needed to monitor the homing and straying rates of reconditioned kelts released by the project.
5) Experiments are needed to discover the best geographic locations and times of year for release of the project's reconditioned fish.

The UCKRP has begun to address these qualifications within the scope of its project objectives. This section will summarize the steps the project has taken to date towards addressing these qualifications and its plans for future action.

5.1 Qualification #1

The prior recommendation, by the ISRP, to establish methods to assess how kelt reconditioning may benefit population growth, abundance, spatial structure, and diversity still needs to be addressed.

In this qualification, the ISRP is asking the UCKRP to track changes in Viable Salmonid Population (VSP) parameters. There is a combined effort to collect data for all VSP parameters in the Methow Basin involving multiple projects and agencies. The difficult task of attributing population level change to any one project is outside the scope of this project.

A combination of analyses is being applied to assess the potential contribution of kelt reconditioning to UCR steelhead populations. The project is applying standardized indices of survival rate for both reconditioned and non-reconditioned kelts to determine if reconditioning results in an increase of repeat spawners on the spawning grounds when compared to the no action alternative. Details of the project's progress in this area can be found in Section 4.1 of this report. The project is documenting the reproductive success of reconditioned kelts in the Twisp River. If sufficient sample size is obtained, the project will compare the relative reproductive success of reconditioned kelts with NOR and HOR maiden spawners. Details of the project's progress in this area can be found in Section 4.2 of this report.

5.2 Qualification #2

Some modeling and a power analysis need to be conducted to clarify how many juvenile and F_1 adults should be sampled to detect meaningful differences in the breeding and reproductive success of HOR, NOR, and reconditioned NOR females.

These analyses are being conducted as part of the WDFW's Twisp RRS study and will be included in Section 4.2 of our report when the analysis is complete. There are varying degrees of reproductive success information that may be collected through the Twisp RRS study. At a minimum the study has documented offspring produced by a multiple reconditioned kelts. Ideally the study may quantify the average number of offspring produced by reconditioned kelts and life-time reproductive success. If sufficient data is collected a comparison of relative reproductive success between reconditioned kelts and both NOR and HOR maiden spawners may be possible. Results will largely depend on the WDFW's ability to capture and detect offspring as well as the natural variability in the data.

5.3 Qualification #3

Methods to assess the fat levels, maturation timing, fecundity, egg size, and gamete viability of the project's reconditioned kelts need to be developed and implemented. The fate of non-maturing or skip-repeat reconditioned fish also should be disclosed.

The UCKRP has begun to address many aspects of this qualification either directly or indirectly. A study designed to assess the maturation timing and available energy stores of reconditioned kelts and compare them to NOR and HOR maiden spawners was initiated in 2015 and concluded in 2018. A detailed description of this study can be found in the 2018 annual report for this project (Abrahamse and Murdoch 2019). Gamete viability will be indirectly assessed through the Twisp RRS study described in Section 4.2

Assessments of fecundity and egg size have been determined not to be feasible. These measures would require holding reconditioned kelts overwinter on well water that has a higher mean temperature than river water. This rearing temperature difference would have a high likelihood of altering the maturation timing and create bias in any comparisons to maiden spawners.

Prior to 2016, non-maturing fish have been released at the same time as maturing fish. Of the non-maturing fish released in the fall of 2014, 10 were detected the following spring. Many of these fish were detected moving downstream through the Columbia River hydropower system

(Appendix B). This indicates that these non-maturing fish overwintered in the Methow River or UCR and continued downstream during high water conditions in the spring.

Retaining non-maturing kelts has become standard practice in recondition programs in recent years (Hatch et al 2016). The UCKRP have been retaining non-maturing kelts for additional reconditioning. All of the surviving kelts held determined to be maturing and have been released. Survival of non-maturing kelts during the additional reconditioning period has been variable. This practice will continue to be evaluated by this project and other kelt reconditioning programs throughout the Columbia River basin for the next several years.

5.4 Qualification #4

Viable plans are needed to monitor the homing and straying rates of reconditioned kelts released by the project.

All reconditioned kelts released from the project are marked with a PIT tag with a unique code. There is an intensive system of PIT tag detection arrays in Methow River and other basins in the Upper Columbia. Many of these antennas, particularly in the smaller tributaries, were installed as one of the primary means of determining adult steelhead spawning distribution and abundance. PIT tag detections will be the primary means for tracking kelt movement. Information on where kelts originally spawned often completely unknown and, if known, only in a general location. It is unlikely that homing and straying rates can be quantified in any significant way. However, any unusual detection data suggesting that a kelt may be straying outside its natal basin will be noted in this report.

The WDFW conducted a two year steelhead radio telemetry study in 2015 to verify the accuracy of the PIT arrays for steelhead abundance and distribution data. Nine reconditioned kelts from the Twisp River were radio tagged prior to release in collaboration with that study. None of these fish were observed straying outside the Methow Basin during the spawning period.

5.5 Qualification #5

Experiments are needed to discover the best geographic locations and times of year for release of the project's reconditioned fish.

Uncertainty over the best release locations and time period has primarily linked to attempts to avoid an active fall steelhead fishery in the UCR and Methow River. The majority of fall fishing pressure occurs in the first 50 rkm. Since 2014, reconditioned kelts have either been released near the mouth of Methow River at rkm 1 or near rkm 50.

We used PIT tag data to compare the potential effect of release location on overwinter survival. Kelt releases from 2014 to 2016 were categorized into two groups. One group contained reconditioned kelts released near the mouth of the Methow. The other group contained reconditioned kelts released near rkm 50. We queried the PTAGIS data base to determine if kelts in each group were detected between February 1st and June 30th. Kelts were then categorized as either detected or undetected. Chi-Square analysis was then used to determine if

there was a significant difference in the frequency with which kelts were detected based on where they were released.

Chi-Square analysis demonstrated that kelts released near rkm 50 were more frequently detected than those released near the mouth, p=0.03. However, this is likely due to differences in detection efficiency between the PIT tag arrays at near the two release sites and not differences in survival.

The project has determined that it will release kelts near the mouth of the Methow River whenever possible. This will allow kelts to have greater volition in choosing their overwintering sites. Releases will be made near rkm 50 in years in which a fall steelhead fishery is active, to limit the fishes' exposure to angling.

6 Future Activities

6.1 Kelt Collection

6.1.1 Live-spawning

All NOR females used as broodstock by WNFH and DCPUD continue to be live-spawned in a combined effort by the YN and USFWS staff. WNFH is planning on spawning 56 NOR pairs of steelhead in 2021. In 2021, the Douglas County PUD Twisp River conservation hatchery program will conduct its steelhead spawning at WNFH. This program will include 6 pair of NOR steelhead. Up to 56 NOR females could be available for live spawning and reconditioning.

6.1.2 Temporary tributary weirs

The project has decided to give lower priority to the use of weirs as a collection method due to the low number of kelts collected compared to other collection methods. Weirs may still be employed in areas of special interest, such as those with ongoing reproductive success studies or populations not represented through other means of collection, if conditions allow and there are personnel available to operate them.

Weirs may be operated in Little Bridge Creek and Beaver Creek in 2021. Traps will be installed as early as possible in the spring relative to run timing for a specific year.

6.1.3 Rock Island Dam

The collaboration with CPUD is expected to continue in 2021. The number of kelts collected at Rock Island Dam has varied during the seven years the project has used it as a collection site. The number of kelts collected at Rock Island Dam is likely linked various factors, including: timing of peak stream discharge, the magnitude of stream discharge, and the size of the NOR spawning population above Rock Island Dam. Regardless of the cause, the number of kelts collected at Rock Island Dam will likely vary year to year. However, the cooperation and coordination with CPUD at Rock Island allows us to collect kelt opportunistically. The project's

collection efforts are directly proportional to the number of kelts being observed at Rock Island Dam, thus yearly variation is not a concern.

6.2 Kelt Reconditioning and Release

This activity will continue in 2021 as it had the past seven years. It is expected that the UCKRP will begin reconditioning with 60 to 100 in 2021. Based on survival rates at the reconditioning facility seen to date, YN could expect to see 30 and 75 reconditioned kelts surviving to released.

Retaining skip spawning kelts has become standard practice in recondition programs in recent years (Hatch et al 2016). The UCKRP has been retaining non-maturing kelts for additional reconditioning since 2016. This practice will continue to be evaluated by this project and other kelt reconditioning programs throughout the Columbia River basin for the next several years.

6.3 Monitoring and Evaluation

All reconditioned kelts will continue to be PIT tagged. The existing PIT-tag arrays will continue to be used to track the movements and survival of the reconditioned kelts. YN will continue to monitor indices of survival of an in-river reference groups

The YN will continue to live-spawn and trap, reconditioning, and release Twisp River-origin steelhead in an effort to get reconditioning kelts included in the Twisp River RRS study. The YN will collaborate with WDFW in documenting any progeny of reconditioning kelts in the RRS study.

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Appendix A – Summary of INAD Study #11-370-20-027

The goal of the Yakama Nation's (YN) Upper Columbia Steelhead Kelt Reconditioning Project (UCKRP) is to apply long term kelt reconditioning techniques to increase the number of natural origin (NOR) steelhead spawning in tributaries to the upper Columbia River. Post-spawn steelhead kelts are collected through trapping throughout the Upper Columbia and live spawning at Winthrop National Fish Hatchery (WNFH) during the months of April to June. Upon collection kelts are brought to the Methow Steelhead Kelt Facility (MSKF), located on WNFH grounds. Kelts are held for 4 to 6 months in the MSKF receiving feed and pathogen treatment. After 4 to 6 months the kelts are evaluated for maturation status. Maturing kelts are released in October or November. Non-maturing kelts are held for an additional year of reconditioning.

One of the challenges kelts face during long term reconditioning is infestation of parasitic copepods of the genus Salmonicola. A small number of copepods are often observed on individual fish during intake sampling. Copepods can proliferate in captive environments and infestations can have an impact on fish growth, survival, and may impact maturation of gametes when left untreated.

No FDA approved injectable copepod treatment currently exists for use in aquaculture. However, prior to 2020, all kelts were administered an injection of emamectin benzoate upon intake into the project using Threatened and Endangered regulatory discretion to the Investigation of New Animal Drugs (INAD) (also known as the T&E exemption) was applied. Treatment through injection was considered preferable to medicated feed because of the unique needs of steelhead kelts. Steelhead that reach the kelt stage have spent an extended period without feeding. The first 4 to 6 weeks a kelt is in the reconditioning program are spent attempting reinitiate feeding and reaching the recommend 2% body weight feed ration. This extended feeding reinitiation period, combined with the protracted intake period, can mean it may take several months before medicated feed can be administered effectively.

In 2020 the USFWS discontinued granting T&E exemptions for drugs that had on-going INAD. INAD #11-370 for SLICE, a medicated feed containing emamectin benzoate, is currently ongoing. As a result, the UCKRP discontinued injections elected to participated in INAD #11-370 in 2020 under study number 11-370-027.

As the UCKRP is somewhat unusual when compared to most aquaculture operations, this summary is intended to provide additional information beyond what was included on the AADAP INAD Online Data Reporting website.

Methods

Treatment was initiated on August 7 and continued through August 13, 2020. Treatment and study designs were done in accordance with the assigned protocols.

https://www.fws.gov/fisheries/aadap/inads/study_protocols/SLICE-study-protocol.pdf

Parasite data was collected from steelhead kelts during three distinct periods: intake sampling, sampling of mortalities, and pre-release sampling. The intake sampling period occurred from April 15, 2020 to June 26, 2020. There were 61 kelts included in the intake sample. Mortality sampling took place between the start of intake and the pre-release sampling event. There were 39 kelts included in the mortality sample. Of the mortalities, 36 were sampled prior to treatment with SLICE medicated feed, one mortality was sampled during the treatment period, and two mortalities were sampled post treatment. Pre-release sampling took place on September 24, 2020; 42 days after the completion of the medicated feed treatment. There were 24 kelts included in the pre-release sample.

The number of copepods on each kelt were estimated by visual count during intake and mortality sampling events. Samples were grouped into 11 bins of five parasite increments and enumerated.

The number of copepods observed during pre-release sampling could not be estimated through visual count with any degree of confidence. Most gill tissue observed had significant scarring and discoloration and we felt the additional handling of fish to enumerate the copepods could increase the risk of mortality. Fish were instead grouped into categories based on gill condition. The three categories were: poor, moderate, and good. Fish categorized as poor presented gills with extensive tissue damage and/or 15+ copepods present. Fish categorized as moderate had a moderate amount of damage and/or 6 to 10 copepods present. Fish categorized as good had little to no tissue damage and/or 0 to 5 copepods present.

Results

The mean number of copepods observed on steelhead kelts during intake sampling was 10.2 with a range of 0 to 40. A frequency histogram was created to illustrate the number of copepods observed during intake sampling (Figure 1).

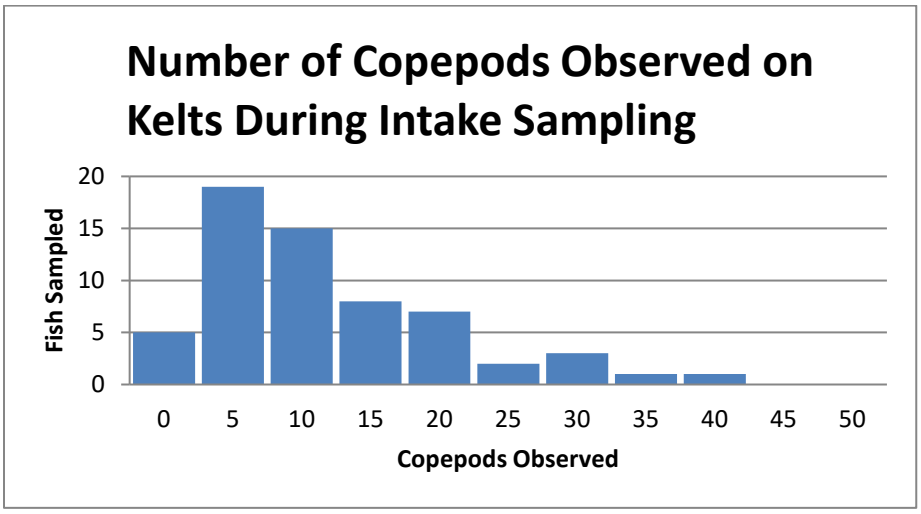

Figure 1 - The number of fish observed during intake sampling. Copepod abundance was group into bins of 5 and a range of 0 to 50 parasites.

The mean number of copepods observed on steelhead kelts during mortality sampling was 17.4 with a range of 0 to 50. A frequency histogram was created to illustrate the number of copepods observed during mortality sampling (Figure 2).

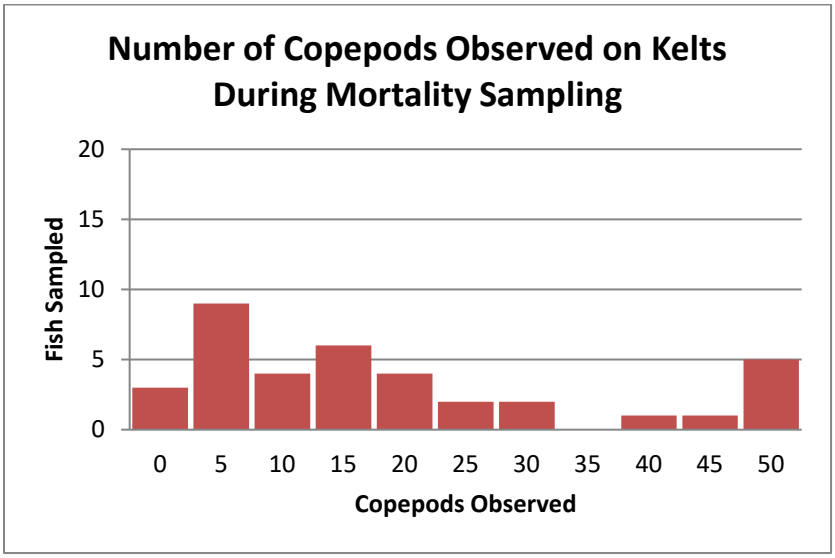

Figure 2 - The number of fish observed during Morality sampling. Copepod abundance was group into bins of 5 and a range of 0 to 50 parasites.

During pre-release sampling, 7 fish were categorized as poor (Figure 3), 10 were categorized as moderate (Figure 4), and 7 were categorized as good (Figure 5).

Figure 3 – Example of a kelt categorized as having poor gill condition during pre-release sampling.

Figure 4 - Example of a kelt categorized as having moderate gill condition during pre-release sampling.

Figure 5 - Example of a kelt categorized as having good gill condition during pre-release sampling.

Discussion

Treating steelhead kelts with SLICE medicated feed appears to have been partially successful. An increase in mortalities in the weeks leading up to the SLICE treatment appears to have been abated with treatment. However, the amount of gill tissue damage and the portion of fish that appeared have severe parasite infestation 42 days after treatment had ceased is concerning, especially as these were not issues when injectable emamectin was used under a previous T&E exemption.

Improved condition at pre-release time could possibly be achieved by initiating treatment earlier. However, this is somewhat complicated by the extended intake timeframe and extended period to reinitiate feeding associated with kelt reconditioning. The project will also look at additional therapies to help improve fish condition and welcomes any input on improving treatment.

Appendix B – Summary of post-release PIT detections of all released kelts

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2013	NO	384.3B2399AA58	11/01/13	Release	Methow River
2013	NO	384.3B2399F131	11/01/13	Release	Methow River
			11/21/13	Observation	LMR - Lower Methow River
2013	NO	384.3B239A393F	11/01/13	Release	Methow River
2013	YES	384.3B239AA629	11/01/13	Release	Methow River
			04/11/14	Observation	CRW - Chewuch River above Winthrop
			04/23/14	Observation	CRW - Chewuch River above Winthrop
2013	NO	3D9.1C2D73DFAF	11/01/13	Release	Methow River
2014	YES	384.36F2B4A078	10/11/14	Release	Methow River
			04/22/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2014	NO	384.36F2B4A35A	10/01/14	Release	Methow River
2014	YES	384.3B23ADF01C	10/11/14	Release	Methow River
			05/06/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2014	NO	3D9.1BF1AC542B	10/01/14	Release	Columbia River
2014	NO	3D9.1BF1AC6840	10/01/14	Release	Columbia River
			10/22/14	Observation	LWE - Lower Wenatchee River
			03/31/15	Observation	LWE - Lower Wenatchee River
2014	YES	3D9.1C2D732EDE	10/11/14	Release	Methow River
			03/18/15	Observation	MRW - Methow River at Winthrop
2014	NO	3D9.1C2D733B2F	10/01/14	Release	Columbia River
2014	YES	3D9.1C2D733EA6	10/01/14	Release	Columbia River
			11/03/14	Observation	RRF - Rock Reach Fishway
			11/12/14	Observation	WEA - Wells Dam Adult Ladders
			03/15/15	Observation	FST - Foster Creek
			03/19/15	Observation	FST - Foster Creek
			03/24/15	Observation	FST - Foster Creek
			03/25/15	Observation	FST - Foster Creek
			03/29/15	Observation	TNK - Tunk Creek, Okanogan Basin
			04/01/15	Observation	TNK - Tunk Creek, Okanogan Basin
			05/16/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
			06/01/15	Observation	BCC - Bonneville Dam Corner Collector
2014	NO	3D9.1C2D7344E2	10/01/14	Release	Columbia River
			04/30/15	Observation	BCC - Bonneville Dam Corner Collector
2014	YES	3D9.1C2D734B1F	10/11/14	Release	Methow River
			03/22/15	Observation	CRW - Chewuch River above Winthrop
			04/17/15	Observation	CRW - Chewuch River above Winthrop
2014	NO	3D9.1C2D7398AF	10/01/14	Release	Columbia River
			05/19/15	Observation	BCC - Bonneville Dam Corner Collector
2014	YES	3D9.1C2D739A01	10/11/14	Release	Methow River
			03/12/15	Observation	CRW - Chewuch River above Winthrop
2014	NO	3D9.1C2D73B098	10/01/14	Release	Columbia River
2014	NO	3D9.1C2D73B2DE	10/01/14	Release	Columbia River
			05/21/15	Observation	BCC - Bonneville Dam Corner Collector

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2014	YES	3D9.1C2D73BAA9	10/01/14	Release	Columbia River
			10/21/14	Observation	LWE - Lower Wenatchee River
			03/14/15	Observation	PES - Peshastin Creek, Wenatchee Basin
			04/04/15	Observation	PES - Peshastin Creek, Wenatchee Basin
2014	YES	3D9.1C2D73BE5A	10/11/14	Release	Methow River
			10/21/14	Observation	MRT - Methow River at Twisp
			10/24/14	Observation	CRW - Chewuch River above Winthrop
			03/11/15	Observation	CRW - Chewuch River above Winthrop
			04/02/15	Observation	CRW - Chewuch River above Winthrop
2014	NO	3D9.1C2D73CAD9	10/01/14	Release	Columbia River
			06/22/15	Observation	RRF - Rock Reach Fishway
			07/10/15	Observation	WEA - Wells Dam Adult Ladders
			03/23/16	Observation	ENL - Lower Entiat River
			03/31/16	Observation	ENL - Lower Entiat River
			04/06/16	Observation	MAD - Mad River, Entiat Basin
2014	YES	3D9.1C2D73D1C8	10/11/14	Release	Methow River
2014	NO	3D9.1C2D73D2C0	10/01/14	Release	Columbia River
2014	YES	3D9.1C2D73D51E	10/01/14	Release	Columbia River
			10/23/14	Observation	LWE - Lower Wenatchee River
			03/07/15	Observation	PES - Peshastin Creek, Wenatchee Basin
			04/06/15	Observation	PES - Peshastin Creek, Wenatchee Basin
			05/18/15	Observation	BCC - Bonneville Dam Corner Collector
2014	NO	3D9.1C2D73D569	10/01/14	Release	Columbia River
2014	YES	3D9.1C2D73D746	10/11/14	Release	Methow River
			05/25/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2014	NO	3D9.1C2D73D807	10/11/14	Release	Methow River
2014	NO	3D9.1C2D73E484	10/01/14	Release	Columbia River
2014	YES	3D9.1C2D73EB2A	10/11/14	Release	Methow River
			04/29/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2014	NO	3D9.1C2D73EB54	10/11/14	Release	Methow River
2014	YES	3D9.1C2D73EBB3	10/01/14	Release	Columbia River
			03/02/15	Recapture	Twisp River Weir
			03/20/15	Observation	TWR - Twisp River
2014	NO	3D9.1C2D73EE8A	10/11/14	Release	Methow River
			10/20/14	Observation	LMR - Lower Methow River
2014	YES	3D9.1C2D743279	10/11/14	Release	Methow River
			03/23/15	Observation	CRW - Chewuch River above Winthrop
			04/24/15	Observation	CRW - Chewuch River above Winthrop
2014	NO	3D9.1C2D743711	10/11/14	Release	Methow River
2014	YES	3D9.1C2D74376F	10/11/14	Release	Methow River
			04/08/15	Observation	CRW - Chewuch River above Winthrop
2014	NO	3D9.1C2D743D67	10/01/14	Recapture	Methow River
			05/22/15	Observation	JDJ - John Day Dam Juvenile Bypass

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2014	YES	3D9.1C2D744057	10/01/14	Release	Columbia River
			10/26/14	Observation	RRF - Rock Reach Fishway
			10/30/14	Observation	WEA - Wells Dam Adult Ladders
			11/05/14	Observation	LMR - Lower Methow River
			03/28/15	Observation	TWR - Twisp River
			04/30/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2014	YES	3D9.1C2D744268	10/01/14	Release	Columbia River
2014	YES	3D9.1C2D7442F9	10/11/14	Release	Methow River
			03/14/15	Observation	CRW - Chewuch River above Winthrop
			04/05/15	Observation	CRU - Upper Chewuch River
			04/11/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2014	YES	3D9.1C2DF5CDB3	10/01/14	Release	Columbia River
			03/02/15	Recapture	Twisp River Weir
			03/25/15	Observation	TWR - Twisp River
			05/30/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2014	YES	3D9.1C2DF62C18	10/01/14	Release	Columbia River
			03/02/15	Recapture	Twisp River Weir
			03/14/15	Observation	TWR - Twisp River
			03/17/15	Recapture	Twisp River Weir
2014	NO	3D9.1C2DF64BDE	10/11/14	Release	Methow River
			04/21/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
			04/22/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2014	YES	3D9.1C2DF6D35E	10/11/14	Release	Methow River
2014	NO	3D9.1C2DF75115	10/11/14	Release	Methow River
			05/04/15	Observation	BCC - Bonneville Dam Corner Collector
2014	YES	3D9.1C2DF7C1E9	10/11/14	Release	Methow River
			02/21/15	Observation	CRW - Chewuch River above Winthrop
2014	YES	3D9.1C2DF7D9E3	10/11/14	Release	Methow River
			03/24/15	Observation	GLC - Gold Creek, Methow Basin
			03/26/15	Observation	GLC - Gold Creek, Methow Basin
2014	YES	3D9.1C2E0A38F1	10/11/14	Release	Methow River
			03/08/15	Observation	CRW - Chewuch River above Winthrop
			06/07/15	Observation	BCC - Bonneville Dam Corner Collector
2014	YES	3D9.1C2E0A88EA	10/11/14	Release	Methow River
2014	NO	3DD.003BC49A31	10/01/14	Release	Methow River
2014	YES	3DD.003BC49A4D	10/01/14	Release	Methow River
			03/02/15	Recapture	Twisp River Weir
			03/15/15	Recapture	TWR - Twisp River
			03/28/15	Observation	TWR - Twisp River
			06/02/15	Observation	BCC - Bonneville Dam Corner Collector
			06/04/15	Observation	TWX - Columbia River Estuary Towed Array
2014	NO	3DD.003BC49A54	10/11/14	Release	Methow River
2014	YES	3DD.003BC49A5C	10/01/14	Release	Columbia River
			03/02/15	Recapture	Twisp River Weir
			04/19/15	Observation	TWR - Twisp River
			05/11/15	Observation	TWR - Twisp River

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2014	YES	3DD.003BC49A81	10/01/14	Release	Columbia River
			03/21/15	Observation	TWR - Twisp River
			04/27/15	Observation	TWR - Twisp River
			05/07/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2014	YES	3DD.003BC49E35	10/11/14	Release	Methow River
2014	NO	3DD.003BC49E6A	10/11/14	Release	Methow River
			08/04/15	Recapture	Wells Dam East Fish Ladder
			09/05/15	Observation	PRA - Priest Rapids Adult Fishway
			09/17/15	Observation	RIA - Rock Island Dam Adult Fishway
			10/23/15	Observation	RRF - Rock Reach Fishway
			10/26/15	Observation	WEA - Wells Dam Adult Ladders
			10/27/15	Observation	WEA - Wells Dam Adult Ladders
2014	NO	3DD.003BC49E73	10/11/14	Release	Methow River
			05/18/15	Observation	BCC - Bonneville Dam Corner Collector
2014	NO	3DD.003BC49E7B	10/11/14	Release	Methow River
			04/03/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
			04/29/15	Observation	BCC - Bonneville Dam Corner Collector
			07/28/15	Observation	BO3 - Bonneville Dam WA Fish Ladder
2014	NO	3DD.003BC4A0DC	10/11/14	Release	Methow River
2014	YES	3DD.003BC4A0E8	10/01/14	Release	Columbia River
			03/07/16	Recapture	Twisp River Weir
			03/20/16	Observation	MRC - Methow River at Carlton
			04/01/16	Observation	TWR - Twisp River
			11/02/16	Recapture	Methow River
			12/21/16	Observation	MRC - Methow River at Carlton
2014	YES	3DD.003BC4A0F4	10/01/14	Release	Columbia River
			03/02/15	Recapture	Twisp River Weir
			03/28/15	Observation	TWR - Twisp River
			05/11/15	Observation	MWF - Methow River, Whitefish Side Chan.
			05/15/15	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2014	NO	3DD.003BC4A105	10/01/14	Release	Columbia River
2014	NO	3DD.003BC4A127	10/01/14	Release	Columbia River
2015	YES	3D9.1C2D625F7C	10/08/15	Release	Methow River
			11/15/15	Observation	WEA - Wells Dam Adult Ladders
			11/20/15	Observation	WEA - Wells Dam Adult Ladders
			03/07/16	Recapture	Twisp River Weir
			03/09/16	Observation	LMR - Lower Methow River
			03/22/16	Observation	MRC - Methow River at Carlton
			03/24/16	Observation	TWR - Twisp River
2015	NO	3D9.1C2D73276A	10/08/15	Release	Methow River
2015	YES	3D9.1C2D734CD7	10/08/15	Release	Methow River
			01/24/16	Observation	LMR - Lower Methow River
			03/05/16	Observation	MRC - Methow River at Carlton

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2015	YES	3D9.1C2D736B89	10/08/15	Release	Methow River
			03/07/16	Observation	LMR - Lower Methow River
			03/21/16	Observation	MRC - Methow River at Carlton
			03/22/16	Observation	MRC - Methow River at Carlton
			03/24/16	Observation	LMR - Lower Methow River
			03/27/16	Observation	MRC - Methow River at Carlton
			04/01/16	Observation	MRW - Methow River at Winthrop
2015	NO	3D9.1C2D73AEC0	10/08/15	Release	Methow River
			08/13/16	Observation	TD1 - The Dalles Dam E. ladder
			08/17/16	Observation	MC1 - McNary Dam ladder
2015	YES	3D9.1C2D73B1FF	10/08/15	Release	Columbia River
			11/09/15	Observation	RRF - Rock Reach Fishway
			11/21/15	Observation	WEA - Wells Dam Adult Ladders
			11/29/15	Observation	LMR - Lower Methow River
			12/05/15	Observation	LMR - Lower Methow River
2015	YES	3D9.1C2D73BA6A	10/08/15	Release	Methow River
			11/04/15	Observation	LMR - Lower Methow River
			11/14/15	Observation	LMR - Lower Methow River
			12/25/15	Observation	MRC - Methow River at Carlton
			01/05/16	Observation	MRC - Methow River at Carlton
			04/05/16	Observation	CRW - Chewuch River above Winthrop
			04/10/16	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2015	YES	3D9.1C2D73C8B6	10/08/15	Release	Methow River
			11/10/15	Observation	LMR - Lower Methow River
			11/15/15	Observation	LMR - Lower Methow River
2015	YES	3D9.1C2D73F109	10/08/15	Release	Methow River
2015	YES	3D9.1C2D744821	10/08/15	Release	Columbia River
			11/11/15	Observation	RRF - Rock Reach Fishway
			11/23/15	Observation	WEA - Wells Dam Adult Ladders
			04/06/16	Observation	ENL - Lower Entiat River
			04/15/16	Observation	ENS - Upper Entiat River at rkm 35
			04/16/16	Observation	ENF - Upper Entiat River at rkm 40
			05/19/16	Observation	ENF - Upper Entiat River at rkm 40
2015	YES	3D9.1C2E0A77FD	10/08/15	Release	Columbia River
			03/14/16	Recapture	TUM - Tumwater Dam, Wenatchee Bain
			03/31/16	Observation	TUF - Tumwater Dam Adult Fishway
2015	NO	3DD.003BC452B7	10/08/15	Release	Methow River
			11/05/15	Observation	LMR - Lower Methow River
			03/28/16	Observation	LMR - Lower Methow River
			04/06/16	Observation	MRC - Methow River at Carlton
			04/08/16	Observation	TWR - Twisp River
			05/05/16	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2015	YES	3DD.003BC452DC	10/08/15	Release	Methow River
			12/10/15	Observation	LMR - Lower Methow River
			01/23/16	Observation	LMR - Lower Methow River
			01/30/16	Observation	MRC - Methow River at Carlton
			01/31/16	Observation	MRC - Methow River at Carlton

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2015	YES	3DD.003BC452F9	10/08/15	Release	Methow River
2015	YES	3DD.003BC45324	10/08/15	Release	Methow River
2015	YES	3DD.003BC45329	10/08/15	Release	Methow River
			11/09/15	Observation	LMR - Lower Methow River
			03/05/16	Observation	MRC - Methow River at Carlton
			03/13/16	Observation	MRT - Methow River at Twisp
			03/27/16	Observation	CRW - Chewuch River above Winthrop
2015	YES	3DD.003BC4535D	10/08/15	Release	Methow River
			02/15/16	Observation	LMR - Lower Methow River
			02/23/16	Observation	LMR - Lower Methow River
			03/21/16	Observation	MRC - Methow River at Carlton
			04/06/16	Observation	MRW - Methow River at Winthrop
2015	NO	3DD.003BC4537B	10/08/15	Release	Methow River
2015	NO	3DD.007752C04B	10/08/15	Release	Methow River
			11/17/15	Observation	LMR - Lower Methow River
			11/19/15	Observation	LMR - Lower Methow River
			11/20/15	Observation	LMR - Lower Methow River
2015	YES	3DD.0077534573	10/09/15	Release	Columbia River
			05/03/16	Observation	BCC - Bonneville Dam Corner Collector
2015	NO	3DD.007754E568	10/08/15	Release	Methow River
			04/09/16	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2015	NO	3DD.00775524B0	10/08/15	Release	Methow River
2015	NO	3DD.0077552C7A	10/08/15	Release	Methow River
			03/13/16	Observation	LMR - Lower Methow River
2015	YES	3DD.0077553AD9	10/08/15	Release	Methow River
			03/26/16	Observation	MRC - Methow River at Carlton
			04/04/16	Observation	TWR - Twisp River
2015	NO	3DD.00775546F0	10/08/15	Release	Methow River
2015	YES	3DD.007755656F	10/08/15	Release	Methow River
2016	YES	3D9.1C2D733B66	11/16/16	Release	Columbia River
2016	YES	3D9.1C2D733CCD	11/16/16	Release	Columbia River
			11/19/16	Observation	RRF - Rock Reach Fishway
			04/13/17	Observation	ENL - Lower Entiat River
			05/29/17	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2016	BORDERLINE	3D9.1C2D733F00	11/16/16	Release	Columbia River
			11/18/16	Observation	RRF - Rock Reach Fishway
			11/23/16	Observation	WEA - Wells Dam Adult Ladders
			11/23/16	Observation	WEA - Wells Dam Adult Ladders
			11/25/17	Observation	OKL - Lower Okanogan River
			03/21/18	Observation	SA1 - Salmon Cr., Okanogan Basin
			04/04/18	Observation	SA0 - Salmon Cr., Okanogan Basin
			04/13/18	Observation	SA0 - Salmon Cr., Okanogan Basin
			04/13/18	Observation	SA1 - Salmon Cr., Okanogan Basin
			05/08/18	Observation	RRJ - Rocky Reach Dam Juvenile Bypass

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2016	YES	3D9.1C2D73AE3C	11/16/16	Release	Columbia River
			11/19/16	Observation	RRF - Rock Reach Fishway - Rocky Reach Fishway
			11/21/16	Observation	WEA - Wells Dam Adult Ladders
			11/29/16	Observation	LMR - Lower Methow River
			04/13/17	Observation	CRW - Chewuch River above Winthrop
			05/02/17	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
			05/03/17	Recapture	RIS - Rock Island Dam
2016	YES	3D9.1C2D73B543	11/16/16	Release	Columbia River
2016	YES	3D9.1C2D73D37B	11/16/16	Release	Columbia River
			11/17/16	Observation	RRF - Rock Reach Fishway
			11/22/16	Observation	WEA - Wells Dam Adult Ladders
			11/26/16	Observation	LMR - Lower Methow River
			03/15/17	Observation	MRC - Methow River at Carlton
			05/12/17	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2016	YES	3D9.1C2D73E73D	11/16/16	Release	Columbia River
			11/18/16	Observation	RRF - Rock Reach Fishway
			11/20/16	Observation	WEA - Wells Dam Adult Ladders
			12/02/16	Observation	LMR - Lower Methow River
			02/19/17	Observation	MRC - Methow River at Carlton
2016	YES	3D9.1C2D73E9BA	11/16/16	Release	Columbia River
			11/18/16	Observation	RRF - Rock Reach Fishway
			03/12/17	Observation	ENL - Lower Entiat River
			03/18/17	Observation	ENA - Upper Entiat River at rkm 17.1
			03/20/17	Observation	ENM - Middle Entiat River
			03/26/17	Observation	ENM - Middle Entiat River
			04/05/17	Observation	ENS - Upper Entiat River at rkm 35
			04/05/17	Observation	ENS - Upper Entiat River at rkm 35
			04/10/17	Observation	ENS - Upper Entiat River at rkm 35
			04/12/17	Observation	ENS - Upper Entiat River at rkm 35
			05/01/17	Observation	ENL - Lower Entiat River
2016	YES	3D9.1C2D73EDF6	11/16/16	Release	Columbia River
			11/17/16	Observation	RRF - Rock Reach Fishway
			11/20/16	Observation	WEA - Wells Dam Adult Ladders
			03/20/17	Observation	MRC - Methow River at Carlton
			04/01/17	Observation	CRW - Chewuch River above Winthrop
			04/29/17	Observation	CRW - Chewuch River above Winthrop
2016	YES	3D9.1C2D7430C1	11/16/16	Release	Columbia River
			11/17/16	Observation	RRF - Rock Reach Fishway
			11/19/16	Observation	WEA - Wells Dam Adult Ladders
			03/15/17	Observation	MRC - Methow River at Carlton
			05/05/17	Observation	JDJ - John Day Juvenile Bypass

Release Year	Maturing?	Tag Code	Date	Event Type	Event Site
2016	YES	3D9.1C2D74392B	11/16/16	Release	Columbia River
			04/20/17	Observation	MCL - Mission Creek, Wenatchee Basin
			04/21/17	Observation	MCL - Mission Creek, Wenatchee Basin
			05/08/17	Observation	PES - Peshastin Creek, Wenatchee Basin
			05/14/17	Observation	PES - Peshastin Creek, Wenatchee Basin
			05/16/17	Observation	PES - Peshastin Creek, Wenatchee Basin
			05/20/17	Observation	PES - Peshastin Creek, Wenatchee Basin
			05/21/17	Observation	PES - Peshastin Creek, Wenatchee Basin
			05/27/17	Observation	PES - Peshastin Creek, Wenatchee Basin
2016	YES	3DA.1A19B041AE	11/02/16	Release	Methow River
			01/05/17	Observation	LMR - Lower Methow River
			01/05/17	Observation	LMR - Lower Methow River
			01/07/17	Observation	LMR - Lower Methow River
			01/07/17	Observation	LMR - Lower Methow River
			03/14/17	Observation	MRC - Methow River at Carlton
			04/02/17	Observation	CRW - Chewuch River above Winthrop
2016	YES	3DA.1A19B04701	11/02/16	Release	Methow River
			11/04/16	Observation	MRC - Methow River at Carlton
			04/21/17	Observation	CRW - Chewuch River above Winthrop
			04/23/17	Observation	MRC - Methow River at Carlton
2016	YES	3DA.1A19B04790	11/02/16	Release	Methow River
			02/23/17	Observation	LMR - Lower Methow River
			03/17/17	Observation	LMR - Lower Methow River
2016	BORDERLINE	3DA.1A19B04A64	11/02/16	Release	Methow River
2016	YES	3DA.1A19B063F0	11/02/16	Release	Methow River
			11/03/16	Observation	LMR - Lower Methow River
			11/03/16	Observation	LMR - Lower Methow River
			11/10/16	Observation	MRC - Methow River at Carlton
2016	YES	3DA.1A19B0649D	11/02/16	Release	Methow River
			11/16/16	Observation	LMR - Lower Methow River
			12/13/16	Observation	LMR - Lower Methow River
			01/03/17	Observation	LMR - Lower Methow River
			01/03/17	Observation	LMR - Lower Methow River
			03/23/18	Observation	CRW - Chewuch River above Winthrop
			04/06/18	Observation	CRU - Upper Chewuch River
			04/16/18	Observation	CRU - Upper Chewuch River
2016	YES	3DA.1A19B10E17	11/02/16	Release	Methow River
			03/14/17	Observation	MRC - Methow Riverow River at Carlton
2016	YES	3DA.1A19B135B4	11/02/16	Release	Methow River
2016	YES	3DA.1A19B1387A	11/02/16	Release	Methow River
			03/22/17	Observation	MRC - Methow River at Carlton
			04/07/17	Observation	CRW - Chewuch River above Winthrop
			04/14/17	Observation	CRU - Upper Chewuch River
			05/02/17	Observation	CRU - Upper Chewuch River
			05/02/17	Observation	CRW - Chewuch River above Winthrop
2016	YES	3DA.1A19B1537A	11/02/16	Release	Methow River
			03/25/17	Observation	MRC - Methow River at Carlton

Release Year	Maturing?	Tag Code	Date	Event Type	Event Site
2016	YES	3DD.003BC44E13	11/02/16	Recapture	Methow River
			01/24/17	Observation	LMR - Lower Methow River
			04/01/17	Observation	MRC - Methow River at Carlton
			04/07/17	Observation	TWR - Twisp River
			04/17/17	Recapture	Twisp River Weir
2016	YES	3DD.003BC4A0E8	11/02/16	Recapture	Methow River
			12/21/16	Observation	MRC - Methow River at Carlton
2016	YES	3DD.003BD8EFAA	11/02/16	Recapture	Methow River
			11/03/16	Observation	MRC - Methow River at Carlton
			04/03/17	Observation	MRC - Methow River at Carlton
			04/06/17	Observation	TWR - Twisp River
			04/23/17	Recapture	Twisp River Weir
2016	YES	3DD.003BD8EFB1	11/02/16	Recapture	Methow River
			12/03/16	Observation	MRC - Methow River at Carlton
			04/02/17	Observation	TWR - Twisp River
			04/18/17	Observation	WFC - Wolf Creek, Methow Basin
			05/03/17	Observation	WFC - Wolf Creek, Methow Basin
2016	YES	3DD.003BD8EFF9	11/02/16	Recapture	Methow River
			11/03/16	Observation	MRC - Methow River at Carlton
			04/01/17	Observation	TWR - Twisp River
			04/10/17	Recapture	Twisp River Weir
2016	YES	3DD.003BD8F038	11/02/16	Release	Methow River
			11/15/16	Observation	LMR - Lower Methow River
			11/27/16	Observation	LMR - Lower Methow River
			11/28/16	Observation	LMR - Lower Methow River
			11/28/16	Observation	LMR - Lower Methow River
			12/16/16	Observation	LMR - Lower Methow River
			12/16/16	Observation	LMR - Lower Methow River
2016	YES	3DD.0077526747	11/02/16	Recapture	Methow River
			12/02/16	Observation	MRC - Methow River at Carlton
			03/27/17	Observation	CRW - Chewuch River above Winthrop
			04/12/17	Observation	CRW - Chewuch River above Winthrop
2016	YES	3DD.0077535E01	11/02/16	Recapture	Methow River
			03/16/17	Observation	MRC - Methow River at Carlton
			04/19/17	Observation	CRU - Upper Chewuch River
			04/19/17	Observation	CRU - Upper Chewuch River
			04/23/17	Observation	CRW - Chewuch River above Winthrop
2016	YES	3DD.0077553B4F	11/02/16	Recapture	Methow River
			03/17/17	Observation	MRC - Methow River at Carlton
			05/23/17	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
			05/23/17	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
			05/23/17	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2016	YES	3DD.007790A376	11/16/16	Recapture	Methow River
			11/17/16	Observation	RRF - Rock Reach Fishway
			11/19/16	Observation	WEA - Wells Dam Adult Ladders
			03/16/17	Observation	LMR - Lower Methow River
			03/24/17	Observation	MRC - Methow Riverow River at Carlton

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2016	YES	3DD.007791609F	11/02/16	Recapture	Methow River
			04/12/17	Observation	MRC - Methow River at Carlton
			04/18/17	Observation	EWC - Early Winters Cr., Methow Basin
2017	YES	3D9.1C2D192A26	10/12/17	Release	Methow River
			11/23/17	Observation	MRC - Methow River at Carlton
			02/08/18	Observation	MRC - Methow River at Carlton
			04/04/18	Observation	CRW - Chewuch River above Winthrop
			04/16/18	Observation	CRW - Chewuch River above Winthrop
2017	BORDERLINE	3D9.1C2D286859	10/12/17	Release	Methow River
			03/29/18	Observation	LMR - Lower Methow River
2017	YES	3D9.1C2D73970F	10/12/17	Release	Columbia River
			11/19/17	Observation	RRF - Rock Reach Fishway
			11/21/17	Observation	WEA - Wells Dam Adult Ladders
			11/21/17	Observation	WEA - Wells Dam Adult Ladders
2017	YES	3D9.1C2D739FBA	10/12/17	Release	Columbia River
			11/21/17	Observation	RRF - Rock Reach Fishway
			01/06/18	Observation	WEA - Wells Dam Adult Ladders
			02/04/18	Observation	LMR - Lower Methow River
			03/01/18	Observation	MRC - Methow River at Carlton
			03/14/18	Observation	CRW - Chewuch River above Winthrop
			03/28/18	Observation	CRW - Chewuch River above Winthrop
2017	YES	3D9.1C2D73BC5F	10/12/17	Release	Columbia River
			11/22/17	Observation	RRF - Rock Reach Fishway
2017	YES	3D9.1C2D73C825	10/12/17	Release	Columbia River
			11/18/17	Observation	RRF - Rock Reach Fishway
			11/20/17	Observation	WEA - Wells Dam Adult Ladders
			03/29/18	Observation	LMR - Lower Methow River
2017	YES	3D9.1C2D73D0CA	10/12/17	Release	Columbia River
			11/17/17	Observation	RRF - Rock Reach Fishway
			11/18/17	Observation	WEA - Wells Dam Adult Ladders
			11/18/17	Observation	WEA - Wells Dam Adult Ladders
			03/15/18	Observation	SA1 - Salmon Creek, Okanogan Basin
			03/18/18	Observation	SA0 - Salmon Creek, Okanogan Basin
			03/19/18	Observation	SA0 - Salmon Creek, Okanogan Basin
2017	BORDERLINE	3D9.1C2D73D6E1	10/12/17	Release	Columbia River
			11/17/17	Observation	LWE - Lower Wenatchee River
2017	YES	3D9.1C2D73E3AB	10/12/17	Release	Columbia River
			11/17/17	Observation	RRF - Rock Reach Fishway
			03/01/18	Observation	ENL - Lower Entiat River
			03/05/18	Observation	ENL - Lower Entiat River
2017	YES	3D9.1C2D743180	10/12/17	Release	Columbia River
			02/09/18	Observation	PES - Peshastin Creek, Wenatchee Basin
			03/25/18	Observation	PES - Peshastin Creek, Wenatchee Basin
			04/10/18	Observation	PES - Peshastin Creek, Wenatchee Basin

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2017	YES	3D9.1C2D743E88	10/12/17	Release	Columbia River
			11/17/17	Observation	RRF - Rock Reach Fishway
			11/18/17	Observation	RRF - Rock Reach Fishway
			11/20/17	Observation	WEA - Wells Dam Adult Ladders
			11/21/17	Observation	WEA - Wells Dam Adult Ladders
			11/23/17	Observation	OKL - Lower Okanogan River
			05/04/18	Observation	OMK - Omak Creek, Okanogan Basin
2017	YES	3D9.1C2DD85FC4	10/12/17	Recapture	Methow River
			11/16/17	Observation	MRC - Methow River at Carlton
			01/29/18	Observation	MRC - Methow River at Carlton
			03/18/18	Observation	TWR - Twisp River
			03/31/18	Observation	TWR - Twisp River
2017	YES	3D9.1C2DEC3E50	10/12/17	Recapture	Methow River
			11/16/17	Observation	MRC - Methow River at Carlton
			11/17/17	Observation	MRC - Methow River at Carlton
2017	YES	3DA.1A19B0420B	10/12/17	Release	Methow River
			02/05/18	Observation	MRC - Methow River at Carlton
			03/07/18	Observation	MRC - Methow River at Carlton
			03/13/18	Observation	MRC - Methow River at Carlton
			03/28/18	Observation	CRW - Chewuch River above Winthrop
2017	YES	3DA.1A19B063FA	10/12/17	Release	Methow River
			11/16/17	Observation	MRC - Methow River at Carlton
			01/10/18	Observation	MRC - Methow River at Carlton
			01/21/18	Observation	MRC - Methow River at Carlton
2017	YES	3DA.1A19B0649F	10/12/17	Release	Methow River
			12/05/17	Observation	MRC - Methow River at Carlton
2017	YES	3DA.1A19B064DA	10/12/17	Release	Methow River
			11/19/17	Observation	MRC - Methow River at Carlton
			02/08/18	Observation	MRC - Methow River at Carlton
			03/12/18	Observation	MRW - Methow River at Winthrop
2017	YES	3DA.1A19B06651	10/12/17	Release	Methow River
			03/12/18	Observation	MRC - Methow River at Carlton
			03/30/18	Observation	CRW - Chewuch River above Winthrop
2017	YES	3DA.1A19B14848	10/12/17	Release	Methow River
			02/08/18	Observation	MRC - Methow River at Carlton
			03/22/18	Observation	CRW - Chewuch River above Winthrop
			04/14/18	Observation	CRW - Chewuch River above Winthrop
2017	YES	3DA.1A19B14A70	10/12/17	Release	Methow River
			11/16/17	Observation	MRC - Methow River at Carlton
2017	YES	3DD.003BDCD761	10/12/17	Release	Methow River
2017	YES	3DD.0077531B0D	10/12/17	Release	Methow River
			11/16/17	Observation	MRC - Methow River at Carlton
			11/17/17	Observation	MRC - Methow River at Carlton
2017	YES	3DD.0077535321	10/12/17	Release	Methow River
			12/10/17	Observation	MRC - Methow River at Carlton

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2017	YES	3DD.0077537A09	10/12/17	Release	Methow River
			01/09/18	Observation	MRC - Methow River at Carlton
			01/16/18	Observation	MRC - Methow River at Carlton
			02/03/18	Observation	MRC - Methow River at Carlton
			02/04/18	Observation	MRC - Methow River at Carlton
			03/28/18	Observation	CRW - Chewuch River above Winthrop
			03/30/18	Observation	MRC - Methow River at Carlton
2017	YES	3DD.00775E7525	10/12/17	Release	Methow River
			03/14/18	Observation	MRC - Methow River at Carlton
			03/24/18	Observation	MRW - Methow River at Winthrop
2017	YES	3DD.00779181B3	10/12/17	Release	Methow River
2017	YES	3DD.007791B435	10/12/17	Release	Methow River
			12/03/17	Observation	LMR - Lower Methow River
			12/08/17	Observation	ENL - Lower Entiat River
			12/15/17	Observation	ENL - Lower Entiat River
2017	YES	3DD.007791DCFD	10/12/17	Release	Methow River
2017	YES	3DD.0077924A98	10/12/17	Release	Methow River
			11/16/17	Observation	MRC - Methow River at Carlton
2018	YES	3D9.1C2D733FC2	11/06/18	Release	Methow River
			11/06/18	Observation	MRC - Methow River at Carlton
			11/07/18	Observation	MRC - Methow River at Carlton
2018	YES	3D9.1C2D734011	11/08/18	Release	Columbia River
			03/01/19	Observation	LWE - Lower Wenatchee River
			12/01/19	Observation	RIA - Rock Island Dam Adult Fishway
			03/07/20	Observation	LWE - Lower Wenatchee River
2018	YES	3D9.1C2D739357	11/08/18	Release	Columbia River
			11/19/18	Observation	RRF - Rock Reach Fishway
			04/08/19	Observation	ENL - Lower Entiat River
			04/11/19	Observation	ENA - Upper Entiat River at rkm 17.1
			04/23/19	Observation	ENS - Upper Entiat River at rkm 35
2018	BORDERLINE	3D9.1C2D73EC59	11/06/18	Release	Methow River
			04/03/19	Observation	LMR - Lower Methow River
2018	YES	3D9.1C2D7431FE	11/06/18	Release	Methow River
			03/27/19	Observation	LMR - Lower Methow River
			04/02/19	Observation	MRC - Methow River at Carlton
			04/13/19	Observation	TWR - Twisp River
			04/19/19	Recapture	Twisp River Weir
			04/22/19	Recapture	Twisp River Weir
2018	YES	3D9.1C2D743451	11/08/18	Release	Columbia River
2018	YES	3DA.1A19AF411B	11/06/18	Release	Methow River
			11/24/18	Observation	LMR - Lower Methow River
2018	YES	3DA.1A19B14545	11/06/18	Release	Methow River
			11/28/18	Observation	LMR - Lower Methow River

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2018	YES	3DA.1A19B193E3	11/06/18	Release	Methow River
			11/07/18	Observation	MRC - Methow River at Carlton
			11/09/18	Observation	MRC - Methow River at Carlton
			11/29/18	Observation	MRC - Methow River at Carlton
			12/14/18	Observation	MRC - Methow River at Carlton
			03/29/19	Observation	MSH - Methow Salmon Hatchery outfall
			03/30/19	Observation	MSH - Methow Salmon Hatchery outfall
			04/22/19	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2018	BORDERLINE	3DA.1A19B19E56	11/06/18	Release	Methow River
			05/13/19	Observation	BCC - Bonneville Dam Corner Collector
			07/27/19	Observation	BO1 - Bonneville Dam Bradford Is. ladder
			07/27/19	Observation	BO1 - Bonneville Dam Bradford Is. ladder
			09/02/19	Observation	TD1 - The Dalles Dam E. ladder
			09/03/19	Observation	JO1 - John Day S. ladder
			09/07/19	Observation	MC1 - McNary Dam OR ladder
			09/15/19	Observation	PRA - Priest Rapids adult fishway
			09/18/19	Observation	RIA - Rosk Island Dam Adult Fishway
			09/20/19	Observation	RRF - Rock Reach Fishway
			09/22/19	Observation	WEA - Wells Dam Adult Ladders
			03/02/20	Observation	LMR - Lower Methow River
			03/08/20	Observation	MRC - Methow River at Carlton
			05/13/20	Observation	BO1 - Bonneville Dam Bradford Is. ladder
2018	YES	3DA.1A19B1A2C7	11/06/18	Release	Methow River
			11/06/18	Observation	MRC - Methow River at Carlton
			12/07/18	Observation	MRC - Methow River at Carlton
			04/04/19	Observation	CRW - Chewuch River above Winthrop
			05/08/19	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
			05/19/19	Observation	BCC - Bonneville Dam Corner Collector
2018	YES	3DA.1A19B1FD83	11/06/18	Release	Methow River
2018	YES	3DA.1A19B20123	11/06/18	Release	Methow River
2018	YES	3DA.1A19B20672	11/06/18	Release	Methow River
			03/21/19	Observation	MRC - Methow River at Carlton
			03/31/19	Observation	CRW - Chewuch River above Winthrop
			04/15/19	Observation	CRW - Chewuch River above Winthrop
2018	YES	3DA.1A19B2113A	11/06/18	Release	Methow River
			11/06/18	Observation	MRC - Methow River at Carlton
			11/08/18	Observation	MRC - Methow River at Carlton
			03/25/19	Observation	TWR - Twisp River
			04/04/19	Recapture	Twisp River Weir
			04/13/19	Observation	TWR - Twisp River
			05/01/19	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
			05/22/19	Observation	BCC - Bonneville Dam Corner Collector
2018	YES	3DA.1A19B213CD	11/06/18	Release	Methow River
			03/23/19	Observation	MRC - Methow River at Carlton
			03/28/19	Observation	CRW - Chewuch River above Winthrop
			04/15/19	Observation	CRW - Chewuch River above Winthrop
			05/26/19	Observation	BCC - Bonneville Dam Corner Collector

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2018	YES	3DA.1A19B226B3	11/06/18	Release	Methow River
			03/23/19	Observation	LMR - Lower Methow River
			03/31/19	Observation	MRC - Methow River at Carlton
			04/18/19	Observation	TWR - Twisp River
			04/22/19	Recapture	Twisp River Weir
2018	YES	3DD.003BF70F7A	11/06/18	Release	Methow River
2018	YES	3DD.003BF70F87	11/06/18	Release	Methow River
			12/01/18	Observation	LMR - Lower Methow River
			03/23/19	Observation	LMR - Lower Methow River
			03/26/19	Observation	MRC - Methow River at Carlton
			04/02/19	Observation	TWR - Twisp River
			04/10/19	Recapture	Twisp River Weir
			04/18/19	Recapture	Twisp River Weir
			04/28/19	Recapture	Twisp River Weir
2018	YES	3DD.003BF70FBB	11/06/18	Release	Methow River
2018	YES	3DD.003BF71197	11/06/18	Release	Methow River
			03/22/19	Observation	LMR - Lower Methow River
			03/26/19	Observation	MRC - Methow River at Carlton
			04/04/19	Observation	CRW - Chewuch River above Winthrop
			04/12/19	Observation	CRU - Upper Chewuch River
2018	YES	3DD.003BF711B9	11/06/18	Release	Methow River
			04/12/19	Observation	LMR - Lower Methow River
			04/13/19	Observation	LMR - Lower Methow River
			04/21/19	Observation	GLC - Gold Creek
			04/23/19	Observation	GLC - Gold Creek
			04/30/19	Observation	GLC - Gold Creek
2018	YES	3DD.003D285212	11/06/18	Release	Methow River
			11/06/18	Observation	MRC - Methow River at Carlton
			12/26/18	Observation	MRC - Methow River at Carlton
			03/28/19	Observation	CRW - Chewuch River above Winthrop
			04/15/19	Observation	CRW - Chewuch River above Winthrop
			05/08/19	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
			05/11/19	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2018	YES	3DD.003D285218	11/06/18	Release	Methow River
			11/08/18	Observation	MRC - Methow River at Carlton
			04/18/19	Observation	MRW - Methow River at Winthrop
			04/24/19	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
			05/13/19	Observation	BCC - Bonneville Dam Corner Collector
2018	YES	3DD.0077923C57	11/06/18	Release	Methow River
2018	YES	3DD.007792816B	11/06/18	Release	Methow River
			12/22/18	Observation	WEJ - Wells Dam Bypass
			01/20/19	Observation	WEA - Wells Dam Adult Ladders
			03/26/19	Observation	WEA - Wells Dam Adult Ladders
			03/27/19	Observation	WEA - Wells Dam Adult Ladders
			04/27/19	Observation	MAD - Mad River, Entiat Basin
			05/08/19	Observation	MAD - Mad River, Entiat Basin
			05/08/19	Observation	RRJ - Rocky Reach Dam Juvenile Bypass

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2018	YES	3DD.00779FB4B9	11/06/18	Release	Methow River
2018	YES	3DD.00779FC26A	11/06/18	Release	Methow River
			11/06/18	Observation	MRC - Methow River at Carlton
			03/01/19	Observation	MRC - Methow River at Carlton
			03/28/19	Observation	TWR - Twisp River
			04/05/19	Recapture	Twisp River Weir
			05/10/19	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2018	YES	3DD.0077A0395A	11/06/18	Release	Methow River
			11/06/18	Observation	MRC - Methow River at Carlton
			05/06/19	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2018	YES	3DD.0077A097C6	11/06/18	Release	Methow River
			03/23/19	Observation	MRC - Methow River at Carlton
			04/04/19	Observation	CRW - Chewuch River above Winthrop
			04/11/19	Observation	CRU - Upper Chewuch River
			04/22/19	Observation	CRU - Upper Chewuch River
			05/04/19	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2018	YES	3DD.0077A0AC7C	11/06/18	Release	Methow River
			11/06/18	Observation	MRC - Methow River at Carlton
			03/22/19	Observation	CRW - Chewuch River above Winthrop
2018	YES	3DD.0077A11F6E	11/06/18	Release	Methow River
			02/27/19	Observation	LMR - Lower Methow River
			02/27/19	Observation	LMR - Lower Methow River
			02/27/19	Observation	MRC - Methow River at Carlton
			03/27/19	Observation	CRW - Chewuch River above Winthrop
			04/10/19	Observation	CRU - Upper Chewuch River
			04/20/19	Observation	CRU - Upper Chewuch River
			05/08/19	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2019	YES	3D9.1C2D73E076	11/05/19	Release	Methow River
2019	YES	3DA.1A19B1B15D	11/05/19	Release	Methow River
			11/15/19	Observation	LMR - Lower Methow River
2019	YES	3DA.1A19B1F6C1	11/05/19	Release	Methow River
			03/04/20	Observation	LMR - Lower Methow River
2019	YES	3DA.1A19B1F8B5	11/05/19	Release	Methow River
			02/15/20	Observation	LMR - Lower Methow River
2019	YES	3DA.1A19B1FF6F	11/05/19	Release	Methow River
			03/20/20	Observation	LMR - Lower Methow River
			03/24/20	Observation	LMR - Lower Methow River
			03/28/20	Observation	MRC - Methow River at Carlton
			04/05/20	Observation	CRW - Chewuch River above Winthrop
			04/15/20	Observation	CRU - Upper Chewuch River
			04/20/20	Observation	CRU - Upper Chewuch River
			04/20/20	Observation	CRW - Chewuch River above Winthrop
			04/27/20	Observation	RRJ - Rocky Reach Dam Juvenile Bypass
2019	YES	3DA.1A19B20177	11/05/19	Release	Methow River
			03/05/20	Observation	LMR - Lower Methow River
			04/09/20	Observation	LMR - Lower Methow River
			03/22/20	Observation	MRC - Methow River at Carlton

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2019	YES	3DA.1A19B20B46	11/05/19	Release	Methow River
			03/21/20	Observation	LMR - Lower Methow River
			04/06/20	Observation	MRC - Methow River at Carlton
			04/13/20	Observation	CRW - Chewuch River above Winthrop
2019	BORDERLINE	3DA.1A19B21542	11/05/19	Release	Methow River
2019	YES	3DA.1A19B2233B	11/05/19	Release	Methow River
			04/16/20	Observation	LBC - Libby Creek
			03/06/20	Observation	LMR - Lower Methow River
			04/07/20	Observation	MRC - Methow River at Carlton
			04/11/20	Observation	MRC - Methow River at Carlton
			04/12/20	Observation	MRC - Methow River at Carlton
2019	YES	3DA.1A19B22743	11/05/19	Release	Methow River
			03/21/20	Observation	LMR - Lower Methow River
			03/29/20	Observation	MRC - Methow River at Carlton
			04/10/20	Observation	TWR - Twisp River
			04/19/20	Recapture	Twisp River Weir
			04/26/20	Recapture	Twisp River Weir
			05/04/20	Recapture	Twisp River Weir
2019	YES	3DA.1A19B228A7	11/05/19	Release	Methow River
			03/05/20	Observation	LMR - Lower Methow River
2019	YES	3DA.1A19B229C3	11/05/19	Release	Methow River
			03/02/20	Observation	LMR - Lower Methow River
			03/10/20	Observation	MRC - Methow River at Carlton
			04/05/20	Observation	TWR - Twisp River
			04/11/20	Recapture	Twisp River Weir
			04/19/20	Recapture	Twisp River Weir
			05/02/20	Observation	TWR - Twisp River
2019	BORDERLINE	3DD.003D28A40D	11/05/19	Release	Methow River
2019	YES	3DD.003D28A43D	11/05/19	Release	Methow River
2019	BORDERLINE	3DD.003D3ABDD5	11/05/19	Release	Methow River
2019	YES	3DD.0077A03384	11/05/19	Release	Methow River
			01/26/20	Observation	LMR - Lower Methow River
			03/03/20	Observation	MRC - Methow River at Carlton
			03/21/20	Observation	TWR - Twisp River
2019	YES	3DD.0077A0AC37	11/05/19	Release	Methow River
			03/12/20	Observation	LMR - Lower Methow River
2019	YES	3DD.0077A0ADE9	11/05/19	Release	Methow River
			03/13/20	Observation	LMR - Lower Methow River
			03/22/20	Observation	MRC - Methow River at Carlton
2019	YES	3DD.0077A0E07E	11/05/19	Release	Methow River
			03/13/20	Observation	LMR - Lower Methow River
			03/21/20	Observation	MRC - Methow River at Carlton
			04/05/20	Observation	CRW - Chewuch River above Winthrop
			04/13/20	Observation	CRW - Chewuch River above Winthrop
			04/16/20	Observation	LMR - Lower Methow River
			04/23/20	Observation	RRJ - Rocky Reach Dam Juvenile Bypass

Release Year	Maturing	Tag Code	Date	Event Type	Event Site
2019	YES	3DD.0077A0FD62	11/05/19	Release	Methow River
			11/06/19	Observation	LMR - Lower Methow River
			03/20/20	Observation	MRC - Methow River at Carlton
			04/03/20	Observation	CRW - Chewuch River above Winthrop
			04/10/20	Observation	CRU - Upper Chewuch River
			04/21/20	Observation	CRU - Upper Chewuch River
			04/22/20	Observation	CRW - Chewuch River above Winthrop
2019	BORDERLINE	3DD.0077A10923	11/05/19	Release	Methow River
2019	YES	3DD.0077BA83F2	11/05/19	Release	Methow River