U.S. Fish and Wildlife Service

Clackamas River Bull Trout Reintroduction Project

2022 Annual Report

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U.S. Fish and Wildlife Service

Columbia River Fish and Wildlife Conservation Office

On the cover: *Small adult Bull Trout moving through the Pinhead Creek video weir, Clackamas River Subbasin (Photo by M. Barrows, USFWS)*

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CLACKAMAS RIVER BULL TROUT REINTRODUCTION PROJECT 2022 ANNUAL REPORT

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Bull Trout (*Salvelinus confluentus*) were last documented in the Clackamas River in 1963. Over four decades later, a 2007 feasibility study determined the Clackamas River Subbasin to be a promising candidate for Bull Trout reintroduction. In 2011, the first phase of a multi-agency reintroduction effort began, with the overall goal of re-establishing a self-sustaining population of spawning adults by the year 2030. Releases of translocated Bull Trout from the Metolius River Subbasin to the upper Clackamas River and select tributaries began in 2011 and continued through 2016. The primary objectives during the twelfth year of the project (second phase) were to monitor and evaluate the reintroduction effort. After multiple years of navigating the lingering impacts associated with the COVID-19 global pandemic and road access issues resulting from wide-ranging 2020 forest fires, we made progress toward the project's goal during 2022. Bull Trout reproduction, movement, seasonal distribution and the potential impacts to Endangered Species Act-listed salmon and Steelhead (*Oncorhynchus mykiss*) in the subbasin were assessed. A video monitoring weir with an adult trap and passive integrated transponder (PIT) antennas were employed to assess the spawning population in Pinhead Creek. A total of 36 individual Bull Trout were captured or observed while moving upstream of the weir, of which 28 (78%) were female and 8 (22%) were male. Ten (36%) females and six (75%) of the males possessed PIT tags. PIT-tagged individuals were translocated fish that had been released as juveniles and subadults in 2012 – 2016, confirming their survival and recruitment into the spawning adult population. Thirteen migratory fish, ranging in size from 495 – 810 mm in total length, were subsampled at the weir trap, of which eight were female and five were male. Five of the females and all five of the males captured were previously PIT-tagged. The three smallest females were untagged and tissue samples were collected for genetic analysis. Since all translocated fish were PIT-tagged, the presence of untagged fish may suggest a portion of the spawners were born locally. Despite 64% of the females lacking PIT tags, the low percentage of untagged males suggests recruitment of locally-born individuals into the Pinhead Creek spawning population may be low. However, seven small (300 – 400 mm TL), untagged Bull Trout adults moved through the weir video chute, supporting the possibility of natural recruitment into the spawning population. Redd counts increased to a high of 89 during 2017 but declined to 24 in 2022. Twenty-seven tissue samples from untagged fish collected at the weir trap from 2017 – 2022 were submitted for parentage analysis and to confirm the recruitment of locally-born progeny into the spawning population. Recently instituted monthly eDNA sampling in Pinhead Creek throughout Bull Trout spawning and early rearing areas will help to further describe temporal and spatial occupancy of Bull Trout in Pinhead Creek. Results will be compared with monthly eDNA samples from control (Cougar and Jack) creeks to determine how occupancy patterns are related to instream hatch and post-hatch periods. Thus far, monitoring efforts have not provided definitive evidence of locally-born post-emergent juveniles, or recruitment into the spawning population, both of which are major benchmarks for the reintroduction effort. Implementation and monitoring of the reintroduction project will continue in 2023 and the reintroduction strategy will be evaluated annually and adaptively managed.

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Introduction

Bull Trout (*Salvelinus confluentus*) are native to the Pacific Northwest and Canada. A widespread decline in abundance across their native range compelled the U.S. Fish and Wildlife Service (USFWS) to list Bull Trout as threatened under the Endangered Species Act (ESA) in 1999 (64FR 58910). Bull Trout also require very specific habitat conditions including clean and cold water with complex, connected habitats (Rieman and McIntyre 1995; Selong et al. 2001; USFWS 2015a). Bull Trout exhibit a very complex continuum of life histories involving movements, migrations, spawning, rearing and foraging on time scales ranging from daily to annually or longer, and over different spatial scales (Schaller et al. 2014). A range of human activities, including but not limited to habitat degradation, migration barriers and the introduction of non-native species have negatively influenced Bull Trout populations (Fraley and Shepard 1989; Leary et al. 1993; Schaller et al. 2014). At the time of listing in 1999, Bull Trout were estimated to occupy only 40 percent of their historical range within Oregon, Washington, Idaho, Montana and Nevada (USFWS 2002a).

The primary goal in the USFWS's Final Bull Trout Recovery Plan (USFWS 2015a) is to reestablish self-sustaining populations in watersheds where Bull Trout have been extirpated. In some watersheds, natural recolonization is unlikely or insufficient due to connectivity impairments (e.g., instream barriers, distance, etc.). In some cases, translocation and reintroduction efforts from more robust populations may be necessary in some watersheds to establish populations at sustainable levels (Dunham et al. 2014). Bull Trout have been extirpated in multiple Willamette River subbasins, including the Clackamas River (Figure 1). As in other basins, Bull Trout recovery efforts in the Willamette River Basin have focused primarily on reducing the threats affecting Bull Trout and their habitat. Due to widespread extirpations across the expansive basin with multiple hydrosystem projects, natural recolonization may be unlikely, thus necessitating reintroduction in some areas to establish self-sustaining populations. One or more reestablished Bull Trout local populations through a successful reintroduction effort will expand Bull Trout distribution and may increase population connectivity within the Coastal Recovery Unit (USFWS 2015b).

Progress in the twelfth year (2022) of the joint effort between the Oregon Department of Fish and Wildlife (ODFW), USFWS, U.S. Forest Service (USFS), and other collaborators (i.e., the Confederated Tribes of Warm Springs Reservation [CTWSR], National Marine Fisheries Service [NMFS], Portland General Electric [PGE], and the U.S. Geological Survey [USGS]) to reintroduce Bull Trout into the Clackamas River is detailed in this report. This project was implemented following publication of a final rule establishing a nonessential experimental population of Bull Trout in the Clackamas River under section 10(j) of the ESA (76 FR 35979 on June 21, 2011). Bull Trout were translocated to the Clackamas River Core Area from healthy populations in the Metolius River Subbasin from 2011 through 2016 (ODFW 2012; Barrows et al. 2016). During this timeframe, 2417 juvenile, 371 subadult and 80 adult Bull Trout were released into the upper Clackamas River and select tributaries (Table 1). No additional Bull Trout translocations to the Clackamas River Subbasin are currently planned.

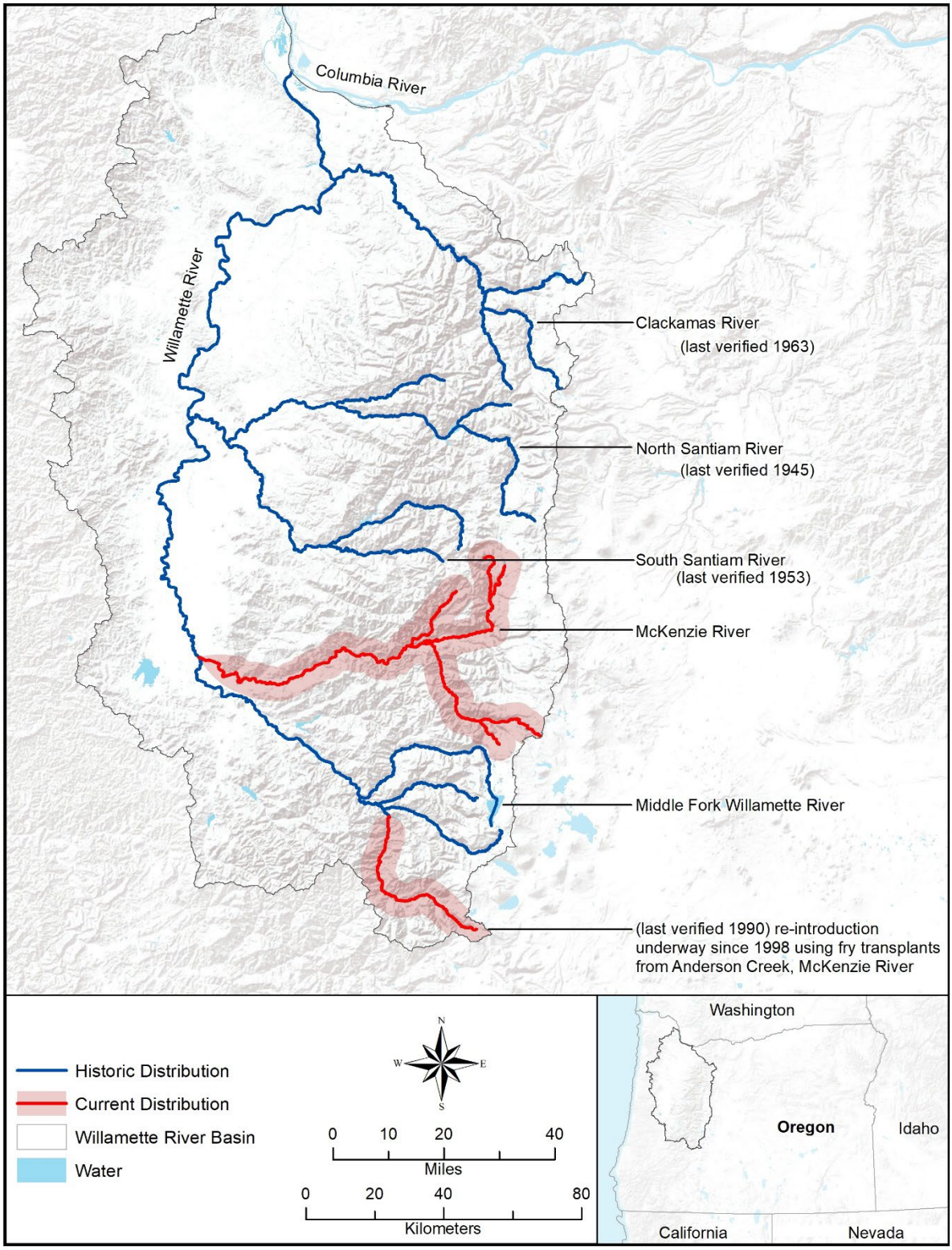


Figure 1. Historical and current Bull Trout distribution in the Willamette River Basin.

Table 1. PIT-tagged Bull Trout translocated from the Metolius River Subbasin to the Clackamas River Subbasin during the first phase of the reintroduction project. Lifestage was defined by the size classes 70-250 mm (juvenile), 251-450 mm (subadult), 451-650 mm (adult). Table is from Clackamas River Bull Trout Reintroduction Project: Characterizing status and thermal habitat suitability in 2017 with census redd counts, PIT tag technology, eDNA surveys, and water temperature data loggers (Table 1 in Starcevich 2018).

Year	Location	Juvenile	Subadult	Adult	Date (Min)	Date (Max)
2011	Clackamas River	0	0	11	30-Jun	30-Jun
	Clackamas River 1	0	14	3	30-Jun	30-Jun
	Clackamas River 2	0	11	21	30-Jun	15-Jul
	Last Creek	42	0	0	30-Jun	15-Jul
	Pinhead Creek	16	0	0	21-Jul	21-Jul
	2011 Subtotal	*58*	*25*	*35*		
2012	Clackamas River 1	0	9	1	14-Jun	14-Jun
	Clackamas River 2	2	34	16	14-Jun	12-Jul
	Last Creek	151	0	0	3-May	28-Jun
	Pinhead Creek	364	0	0	10-May	31-May
	2012 Subtotal	*517*	*43*	*17*		
2013	Clackamas River	3	30	3	6-Jun	13-Jun
	Clackamas River 1	0	60	5	6-Jun	27-Jun
	Last Creek	338	0	0	11-Apr	27-Jun
	Pinhead Creek	283	0	0	2-May	30-May
	2013 Subtotal	*624*	*90*	*8*		
2014	Berry Creek	296	0	0	24-Apr	29-May
	Clackamas River 1	26	45	7	5-Jun	25-Jun
	2014 Subtotal	*322*	*45*	*7*		
2015	Berry Creek	287	1	0	10-Apr	5-Jun
	Clackamas River 1	13	73	7	15-May	5-Jun
	2015 Subtotal	*300*	*74*	*7*		
2016	Clackamas River 1	95	94	6	20-May	13-Jun
	Clackamas River 5	501	0	0	8-Apr	13-May
	2016 Subtotal	*596*	*94*	*6*		
	Total	***2417***	***371***	***80***	***Grand total***	**2868**

The overall goal of the Clackamas River Bull Trout reintroduction is to re-establish a self-sustaining Bull Trout population of 300 – 500 spawning adults in the Clackamas River Subbasin by 2030. For this project, a self-sustaining population is defined as one that maintains an annual spawning abundance greater than 100 adults, exhibits a level of genetic diversity similar to the donor stock, and requires no additional translocations. The amount of suitable habitat within the Clackamas River Subbasin suggests there is the necessary habitat to support a population of 300 – 500 spawning adults. However, even in core areas with abundant suitable habitat, distribution is often patchy; thus, the actual capacity of the Clackamas River Subbasin for Bull Trout is not known. The goal of 300-500 spawning adults originated with recovery planning targets set in the Bull Trout Draft Recovery Plan (USFWS 2002b) for the abundance necessary to achieve these

characteristics. Accomplishing this goal will help achieve conservation and recovery goals within the Coastal Recovery Unit (USFWS 2015b).

This report summarizes the results of operating a video weir, adult trap and PIT detection antennas to estimate the abundance and composition (tagged or untagged) of the fluvial Bull Trout spawning population in Pinhead Creek during 2022. The relationship between the population estimate and 2022 redd counts in Pinhead Creek were used to estimate the spawner to redd ratio in Pinhead Creek. Additionally, monthly eDNA sampling throughout the spawning and early rearing area was initiated in September 2021 and completed in 2022 to determine its efficacy as a tool to document the natural production of Bull Trout.

Study Area

The study area includes the Clackamas River Subbasin upstream of River Mill Dam (Figure 2).

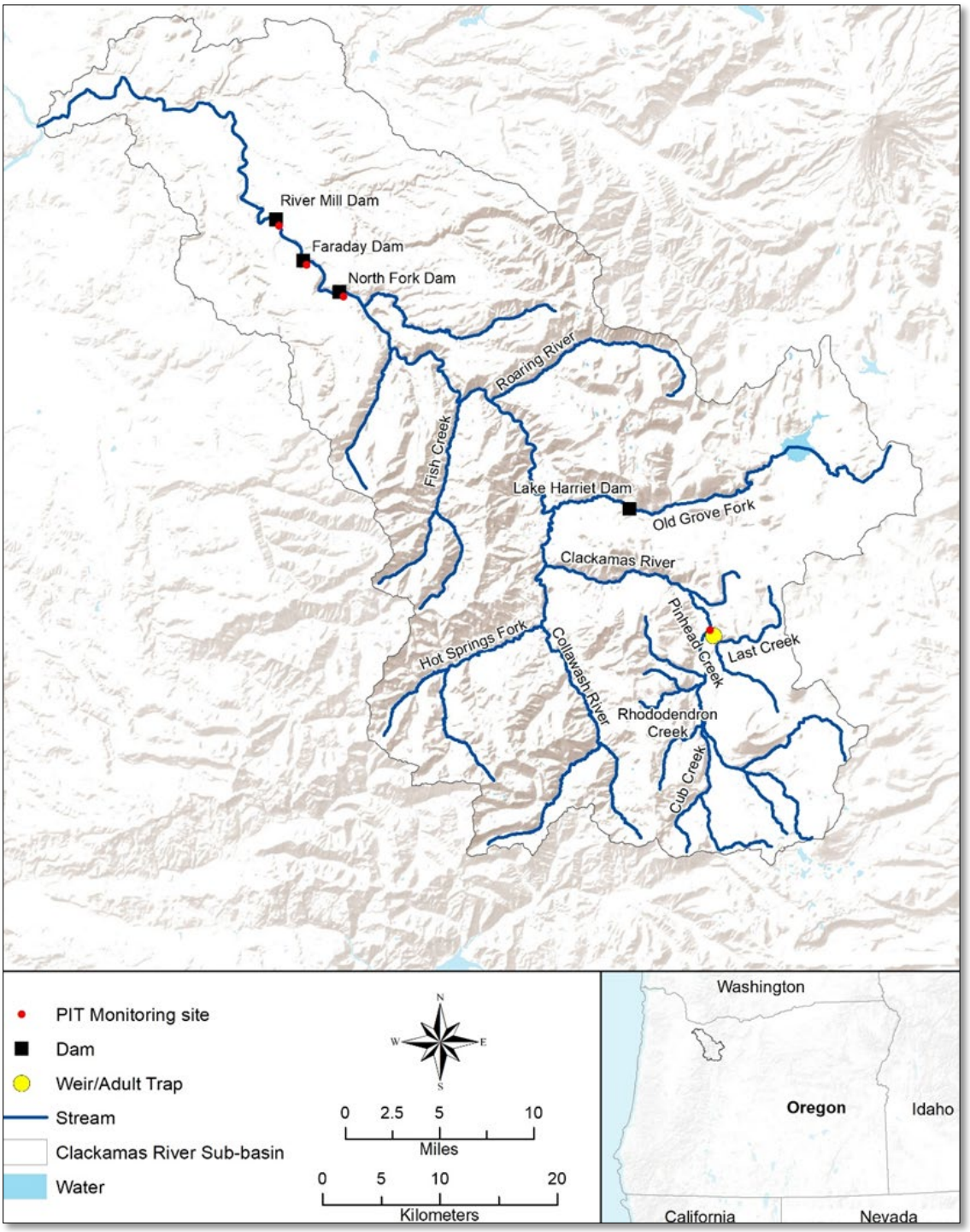


Figure 2. Locations of current monitoring sites in the study area. Multiple PIT monitoring antennas are located throughout PGE's hydro power facilities. A PIT tag monitoring site was installed with the Pinhead Creek weir and was operational from mid-July through early October 2022.

Methods

Pinhead Creek Spawning

Throughout the reintroduction effort, Pinhead Creek has been the primary spawning tributary for Bull Trout in the Clackamas River Subbasin. A video weir and an incorporated adult trap were operated to monitor and assess the spawning Bull Trout population in Pinhead Creek. Census redd surveys were also used to monitor the spawning Bull Trout population in Pinhead Creek and other known spawning tributaries and reaches within the Clackamas River Subbasin in 2022 (Starcevich 2022). During 2022, the following objectives were addressed:

1. Estimate the number of Bull Trout spawners in tributaries and select reaches in the upper Clackamas River.

2. Determine the spawner/redd ratio for Pinhead and Last creeks.

3. Document natural production in Pinhead Creek.

Video Weir and Adult Trap

Since 2017, a two-way fixed picket weir and underwater video detection system has been operated in Pinhead Creek, a tributary to the Clackamas River during the spawning season. The weir was installed between Last Creek and the NF-46 bridge, about 150 m upstream from the mouth of Pinhead Creek on July 28, 2022 (Figure 2). The weir layout in 2022 closely resembled the design used from 2017 – 2021 (Barrows et al. 2018, 2019, 2020, 2021, 2022). The video chute and upstream trap box were positioned in parallel on river right and both picket leads were angled to direct fish to the chute and trap box (Figure 3). During periods when fish were not sampled via the trap box, fish were able to migrate in either direction through the video chute. A PIT antenna was attached to the upstream opening of the video chute to monitor movements of individual PIT-tagged fish. A channel-spanning HDX PIT tag antenna was installed just below the Pinhead Creek video weir as well. When the upstream trap box was set (i.e., open), an exclusion gate (Figure 4) was added to the video chute to prevent fish from moving upstream while allowing fish to migrate downstream unimpeded and be monitored. The leads were constructed using schedule 40 aluminum pipe strung together with two 9.5 mm (3/8 inch) cables with 19 mm (¾ inch) spacers between each picket (Figure 5). T-posts were used to support the leads while sandbags were placed along the bottom of each of the leads and along the banks to make the weir fish-tight. One modification for the 2022 season involved the installation of a velocity break just downstream of the video chute and trap entrance. This created an area of slower velocity where a fish could stage before moving into the trap or upstream through the video chute.

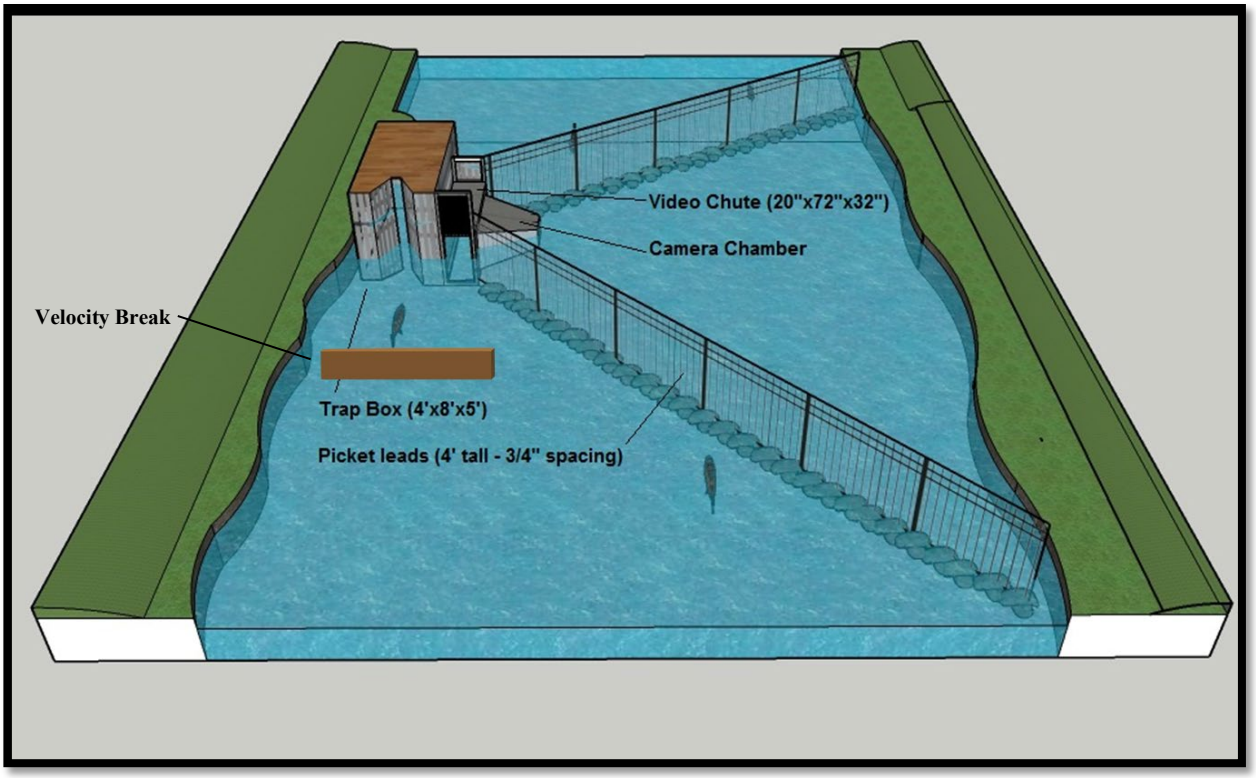


Figure 3. Schematic of the Pinhead Creek weir and trap.

Figure 4. Exclusion gate for video chute.

Figure 5. Photo depicting the aluminum picket leads, video chute and trap box deployed in Pinhead Creek.

The underwater video system that was used from 2017 through 2021 was again employed in 2022 (Barrows et al. 2018, 2019, 2021, 2022). However, the system was upgraded to incorporate a full HD (1920 x 1080P) stainless steel bullet camera with a Sony Exmor CMOS image sensor with a 3.6-mm megapixel lens and two 12-V LED pond lights were mounted inside a video chamber made of aluminum sheeting and attached to the video chute (Figure 6). A pane of safety glass was sealed to the camera chamber to form the interface between the chamber and the video chute. The camera chamber was filled with water to provide clear viewing into the video chute. The backdrop inside the video chute was constructed with white plastic secured to plywood. Video images were recorded on a Paramont DVR from InVid Technologies (model: PD1A-42TB) with four channels and two TB of memory. The DVR was equipped with motion detection calibrated to record fish movement. A color monitor was used to review video footage when in the field and the office. Video footage was reviewed and PIT antennas were tested regularly during site visits (from two to five times each week) to ensure the equipment was functioning properly. The system was powered by two battery banks, one to operate the video equipment and the other to power the PIT detection antennas. The battery bank for the video equipment consisted of four 12-V DC batteries (connected in parallel) with a combined 400 Ampere-hours. The PIT detection equipment was powered by a bank of three 12-V DC batteries with a combined 300 Ampere-hours.

Figure 6. Photo depicting the camera chamber (right), video chute (middle) and trap box (left).

An upstream trap was used to sample a portion of the adult Bull Trout spawners that used Pinhead Creek during 2022. The fyke of the trap box and the exclusion gate were set every Monday through Friday between August 29, 2022 and September 30, 2022. The trap was checked daily to ensure no fish were held in the box more than 24 hours. The Bull Trout were removed from the trap by dip net and anesthetized for sampling in a river water bath that contained 40 mg/l of tricaine methanesulfonate (MS-222) buffered with 80 mg/L sodium bicarbonate. All Bull Trout were scanned for PIT tags. Sampling consisted of recording their PIT ID (if previously tagged), determining their sex (phenotypic characteristics) and measuring their total length to the nearest 1 mm (Barrows et al. 2014). If a Bull Trout without a tag was encountered, a 23-mm long PIT tag was inserted subcutaneously through a 3-mm incision made with a surgical scalpel anterior to the pelvic girdle (Barrows et al. 2014). In addition, a tissue sample (upper lobe of the caudal fin) was collected and preserved in a vial containing alcohol for DNA analysis. All Bull Trout recovered following sampling in a large cooler circulated with aerated river water. After recovering to an upright position, Bull Trout were released to an area with slow water velocity upstream of the weir.

Bull Trout presence and movement was monitored by a channel-spanning HDX PIT tag antenna installed approximately 150 meters upstream from the Pinhead-Clackamas confluence, 10 meters downstream of the Pinhead Creek video weir (Figures 2 and 7). In addition to the instream PIT antenna, a second antenna was installed around the upstream end of the video chute. Operating these two antennas allowed us to match individual fish images to their unique PIT tag, as well as confirm passage direction if the video system was not functioning. Both antennas were powered by a bank of 12-volt batteries and an Oregon RFID Multi-Antenna HDX Reader. Both antennas became operational on July 28, 2022. The video chute antenna was no longer operational when

the weir was removed on October 4, 2022. However, the channel-spanning antenna remained operational until October 31, 2022.

Figure 7. Channel-spanning HDX PIT tag antenna located 150 meters upstream from the Pinhead-Clackamas confluence, approximately 10 m below the Pinhead Creek weir.

Spawning Population Estimate

The abundance of the spawning population in Pinhead Creek has been previously estimated from 2017 through 2021 (Barrows et al. 2018, 2019, 2021, 2022). As in past years, data from the adult trap, video observations and PIT tag monitoring were used to estimate the number of spawners that moved upstream of the Pinhead Creek weir in 2022.

Documenting Natural Production

Spawning by locally-spawned progeny of translocated individuals is a primary indicator of a successful translocation project. Locally spawned Bull Trout have not been detected during past electrofishing and minnow-trapping efforts (Barrows et al. 2017; Barrows et al. 2016; Barry et al. 2014). Similarly, juveniles have not been observed in previous night snorkel surveys (Starcevich 2019a, 2019b, 2020). This apparent absence of juvenile Bull Trout in the system suggests at best very low natural recruitment and has hindered our ability to assess recruitment into the spawning population. Therefore, we used environmental DNA (eDNA) occupancy sampling, PIT tag redetection of fish that encountered the weir, and genetic samples to address the following questions:

1. Is there evidence of locally-spawned progeny rearing in Pinhead Creek?

2. Is there evidence of the recruitment locally-spawned progeny into the spawning population?

3. Are unknown origin Bull Trout (non-tagged) moving past the weir fish that were translocated from the Metolius River Subbasin, or locally-spawned progeny recruited into the spawning population?

4. Which translocation strategy (e.g., life stage, year, location) was the most successful?

5. Which individuals (and release groups) produced offspring?

Monthly eDNA Samples

Fluvial adult Bull Trout have been documented in Pinhead and Last creeks from July through October (Barrows et al. 2022; Starcevich 2021). However, temporal occupancy of Pinhead and Last creeks by subadult and juvenile Bull Trout is largely unknown. From September 2021 through September 2022, we collected monthly eDNA samples at multiple strategic locations within Pinhead and Last creeks when accessible (Figure 8 and Table 2) to observe how patterns in Bull Trout occupancy change after spawning adults presumably leave the system. Samples were collected at each location following established methods described in Carim et al. (2015). A total of five samples were collected at each site to evaluate the variability between samples taken at each site. Three samples were collected within the river right 1/3 of the stream channel, the fourth sample was taken from the approximate middle 1/3 of the stream, and the fifth sample was collected from the river left 1/3 of the channel. Following collection, samples were stored in a freezer at -15 ℃ before being sent to the Rocky Mountain Research Station in Missoula, Montana for analysis. In addition, monthly eDNA samples were collected in two control streams, Jack Creek (Metolius River Subbasin) and Cougar Creek (Lewis River Subbasin) with stable Bull Trout populations for comparison.

Table 2. Collection sites for eDNA samples within Pinhead and Last creeks (Clackamas River Subbasin), Jack Creek (Metolius River Subbasin), and Cougar Creek (Lewis River Subbasin).

Stream	Site Description	Easting	Northing
Pinhead Creek	Near Clackamas River Confluence	588227	4981461
Pinhead Creek	Upstream of Last Creek Confluence	588566	4980251
Last Creek	Downstream of NR-42 Bridge	588566	4980251
Jack Creek	NF-12 Road Crossing	604712	4927354
Cougar Creek	PacifiCorp Property near Cougar, WA	588227	4981461

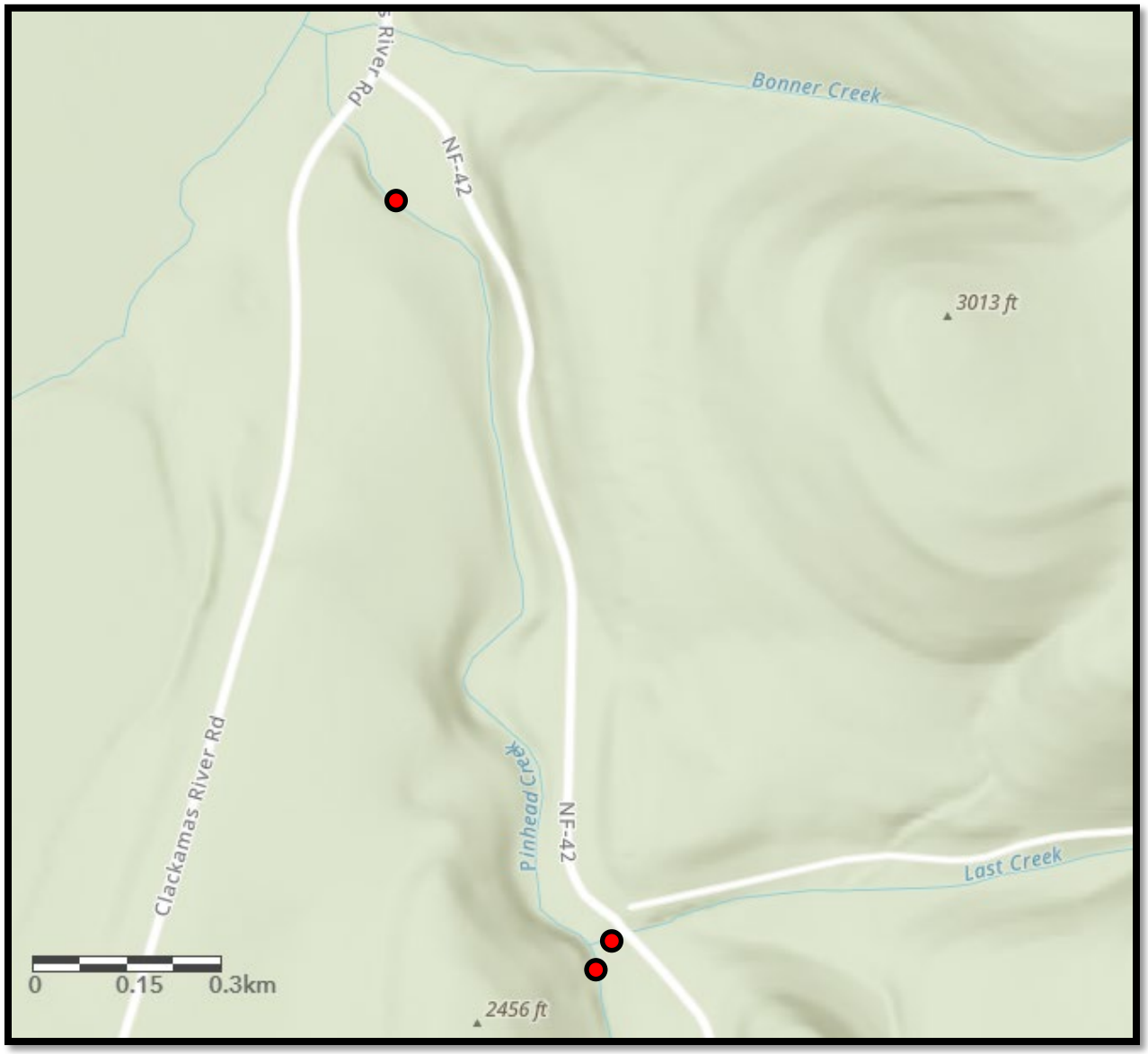


Figure 8. Locations of monthly eDNA sampling sites in Pinhead and Last creeks from September 2021 through September 2022.

Tag Retention and Redetection

Monitoring studies of translocated Bull Trout rely heavily upon PIT tag detection. We examined the proportion of the Bull Trout in the Pinhead Creek spawning population that did not have PIT tags. Since all translocated fish were PIT-tagged, untagged fish passing through the weir may be translocated fish that have previously shed their tag, or locally born individuals that were naturally recruited into the spawning population. We also examined the disparities in tag encounter rates between male and female fish to understand if tag shedding in translocated fish is related to the sex of the fish. Relatively high tag encounter rates in male fish could be evidence

that untagged fish are a result of tag shedding in female fish rather than locally produced offspring, since female spawning often results in shedding of abdominally implanted PIT tags (Elizabeth et al. 2016).

Genetic Analysis

The goal was to use genetic markers to document natural reproduction of Bull Trout within the system. Fin clips were collected from every translocated individual prior to release. Tissue samples were also collected for genetic analysis from untagged Bull Trout captured at the weir from 2017 through 2022. These samples were analyzed to determine whether genotypes of untagged individuals matched any of those for translocated individuals. If they match, they are translocated fish that had simply shed their PIT tag. If they did not match the genotypes of translocated fish, a parentage analysis was performed to document within-basin reproduction and to confirm recruitment of locally-born individuals into the spawning population.

Redd Surveys

Census redd surveys were led by ODFW and conducted by experienced personnel in potential Bull Trout spawning habitat in several major upper Clackamas River tributaries. During 2022, surveys were conducted every three weeks from the middle of September until the end of October (Steve Starcevich, ODFW, pers. comm. 2022).

Movement and Seasonal Distribution

Similar to many other Bull Trout populations, Clackamas River Bull Trout exhibit a migratory life history involving movements, foraging, rearing and spawning over varying temporal and spatial scales. Due to an abundance of literature noting the piscivorous nature of this species, it is important to monitor the spatiotemporal distribution of Bull Trout throughout the system, including their presence where native salmonids may be vulnerable to increased predation. North Fork Reservoir and other areas within PGE's Clackamas River hydro project facilities constitute a High Vulnerability Zone (HVZ). In years following the termination of the radio-telemetry program in 2014, our ability to monitor Bull Trout movements and seasonal distribution throughout the subbasin has been limited and we can no longer detect when translocated Bull Trout have entered the HVZ, nor can we determine the total time each fish spent in the HVZ. However, detections of Bull Trout at Clackamas Hydro Project PIT antennas and observations at the adult sorting facility were used to help infer when Bull Trout entered North Fork Reservoir and other areas within PGE's hydro project facilities (Figure 2). We used PGE's PIT tag monitoring sites to document the behavior, movement and seasonal distribution of juvenile, subadult and adult fish (see Figures 2 and 9). These data help to address the following broad questions identified in the IM&E Plan (USFWS 2011a):

1. What are the seasonal movement patterns and distribution of Bull Trout in the Clackamas River Subbasin?

2. Do translocated Bull Trout remain in the upper Clackamas River Subbasin (above River Mill Dam), and if they leave the study area, do they return?

3. Do Bull Trout occupy areas in High Vulnerability Zones (HVZs) in which they could impact listed salmon and Steelhead?

High Vulnerability Zone

Bull Trout in the Clackamas River originated from largely adfluvial populations in the Metolius River Subbasin and have continued a migratory life history following translocation (Barrows et al. 2017, 2018, 2019, 2021, 2022). Thirteen PIT detection arrays were operated by PGE at various facilities associated with the Clackamas Hydro Project (Figure 9). Eight of the arrays (9 antennas) were operated with KarlTek (KLK5000) PIT tag readers and five (12 antennas) with Oregon RFID readers. Table 3 is a summary of the PIT detection arrays at the Clackamas Hydro Project.

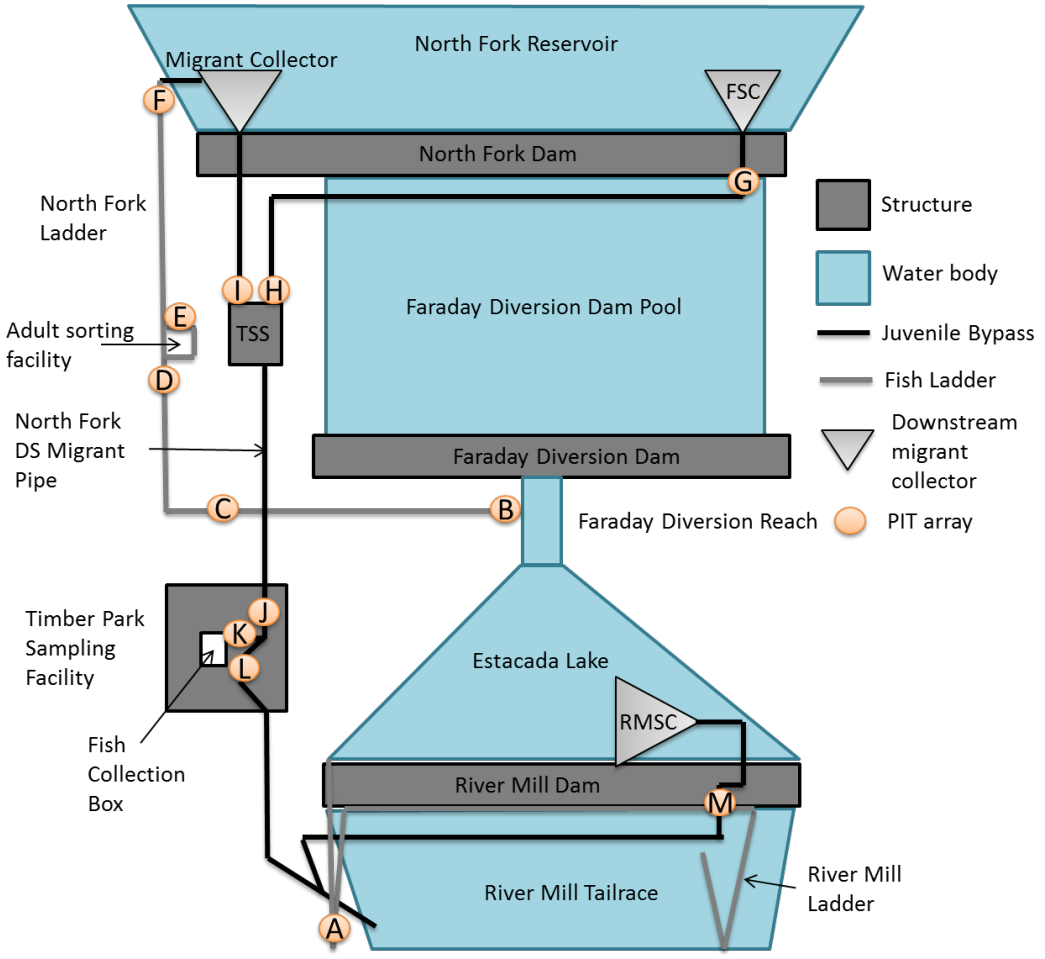


Figure 9. Schematic of PIT antenna array at the Clackamas Hydro Project. FSC = Floating surface collector; TSS = Tertiary screen structure; RMSC = River Mill surface collector. (Figure provided by Portland General Electric.) Also see Figure 2 for locations of these facilities within the Clackamas Subbasin.

Table 3. PIT detection arrays at the Clackamas Hydro Project. (Information provided by Portland General Electric)

Array	Datalogger	Operated Since	Antennas	Site Purpose
A	KarlTek KLK5000	Apr 2013	2	Detect fish passing through the River Mill ladder.
B	Oregon RFID	May 2015/16	2	Detect fish at the entrance of the North Fork fish ladder.
C	OregonRFID	May 2013	4	Detect fish near (upstream and downstream) the old adult sorting facility (North Fork ladder).
D	OregonRFID	Apr 2017	2	Detect fish approaching the adult sorting facility
E	OregonRFID	May 2016	1	Detect fish exiting the adult sorting facility.
F	OregonRFID	May 2015	3	Detect fish exiting the North Fork ladder.
G	KarlTek KLK5000	Oct 2015	1	Detect fish from the FSC just downstream of the flow control structure.
H	KarlTek KLK5000	Oct 2015	1	Detect fish from the FSC just upstream of the tertiary screen structure.
I	KarlTek KLK5000	Oct 2015	1	Detect fish from the North Fork migrant collector just prior to entering the tertiary screen structure.
J	KarlTek KLK5000	Dec 2011	1	Detect fish in flume entering Timber Park.
K	KarlTek KLK5000	Dec 2011	1	Detect fish diverted into the sampling box at Timber Park.
L	KarlTek KLK5000	Dec 2011	1	Detect fish bypassed back to the pipeline at Timber Park.
M	KarlTek KLK5000	Jan 2013	1	Detect fish in the River Mill Surface Collector.

Stepwise Impact Reduction Plan Thresholds

In accordance with BiOp Term and Condition 1b (NMFS 2011), through monitoring that PGE conducts outside the scope of the Bull Trout reintroduction project, counts of adult and juvenile Coho Salmon (*Oncorhynchus kisutch*), Chinook Salmon (*Oncorhynchus tshawytscha*) and Steelhead are annually recorded through the hydro project. Data were summarized and compared to minimum thresholds identified in Table 2 within the Stepwise Impact Reduction Plan (USFWS 2011).

Results and Discussion

Pinhead Creek Spawning

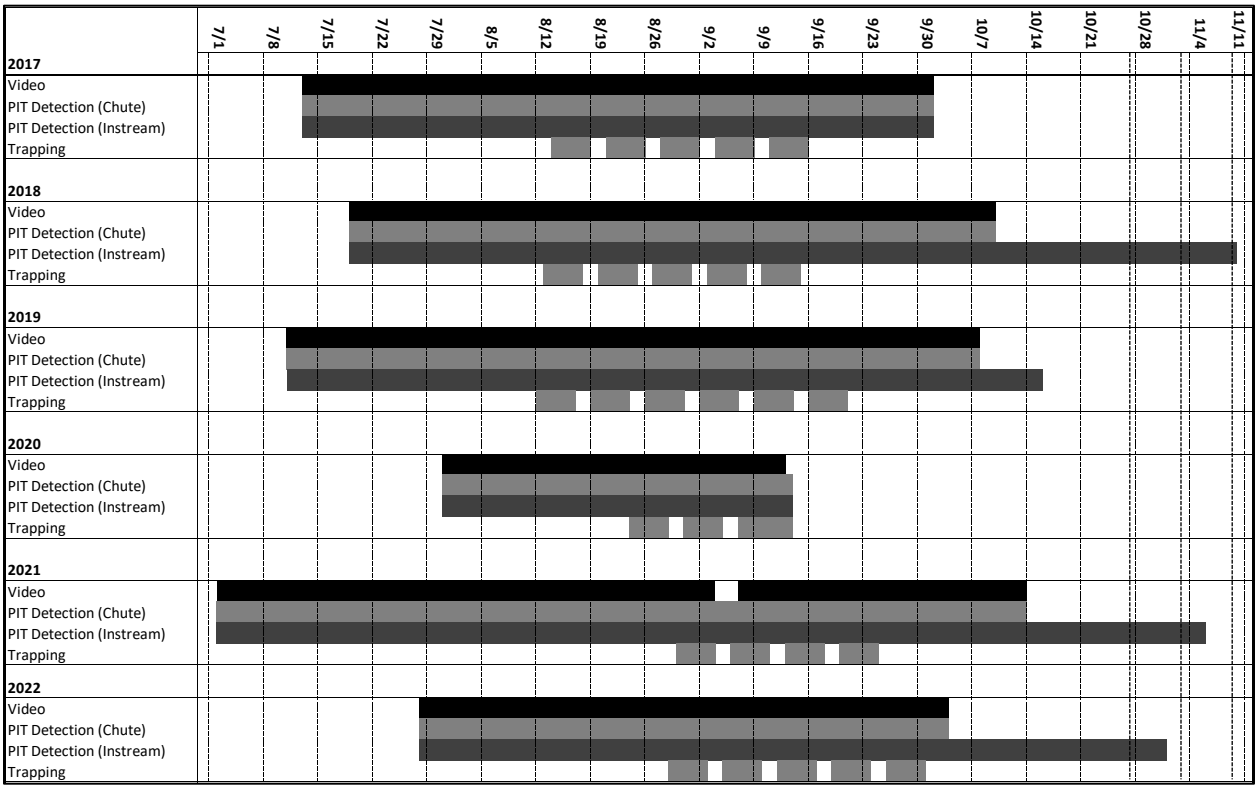
Translocated adult Bull Trout in the Clackamas River exhibit a migratory life history and utilize habitat in the mainstem Clackamas River and lower subbasin reservoirs (e.g., North Fork

Reservoir) for foraging and overwintering before migrating to upper-subbasin tributaries to spawn (Barrows et al. 2018, 2019, 2021). Video observations, PIT tag detections, trap captures and redd counts were used to describe Bull Trout spawning in Pinhead Creek.

Video Weir and Adult Trap

The Pinhead Creek weir was installed on July 28, 2022 and fish passing through the video chute were monitored via video until October 4, 2022 (Table 4). The PIT antenna in the video chute was operational from July 28, 2022 until the weir was removed on October 4, 2022. However, the channel spanning PIT antenna was operated from July 28, 2022 through October 31, 2022. The upstream adult trap was operated Monday through Friday beginning on August 29, 2022 and ending on September 30, 2022.

Table 4. Pinhead Creek weir operation periodicity table from 2017 through 2022.



During 2022, there were a total of 80 (30 upstream and 50 downstream) video observations of Bull Trout at the Pinhead Creek weir (Table 5). There were also 86 video observations (44 upstream and 42 downstream) of Chinook Salmon moving through the weir. In addition, there was one Coho Salmon that passed upstream of the weir. Many individual Bull Trout were observed moving both upstream and downstream past the weir multiple times. Some fish were also captured in the trap before or after being observed on video passing the weir. After a single female Bull Trout moved upstream of the weir in early August, no other Bull Trout were observed moving upstream of the weir until August 24, 2022. Upstream Bull Trout observations peaked in mid-September and ended in early October (Figures 10 and 11).

Table 5. Video observations of Bull Trout, Coho Salmon and Chinook Salmon passing the Pinhead Creek video weir during 2022.

Species (Sex)	Upstream	Downstream	Total
Bull Trout (Male)	11	19	30
Bull Trout (Female)	24	26	50
Coho Salmon	1	0	1
Chinook Salmon	44	42	86

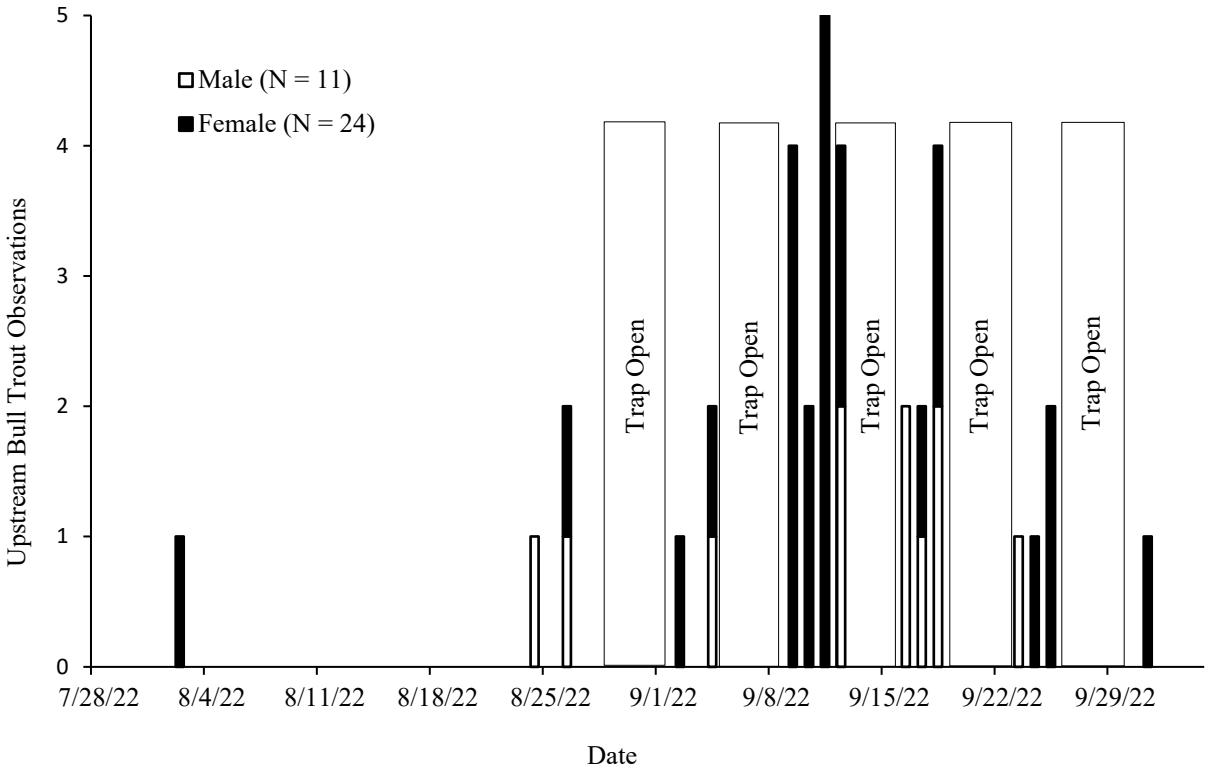


Figure 10. Upstream video observations of male and female Bull Trout at the Pinhead Creek weir during 2022.

Ten individual PIT-tagged Bull Trout were detected passing upstream through the video chute PIT antenna during 2022 (Table 6). Seventeen individual untagged Bull Trout were observed passing upstream through the video chute. Seven of the untagged fish were much smaller than we have typically seen move through the weir in past seasons, approximately 300 – 400 mm in length. Of these seven smaller individuals, five appeared to be females and two appeared to be males. No additional PIT-tagged Bull Trout were detected by the instream PIT antenna after the video weir was removed.

Table 6. Individual Bull Trout observed moving upstream through the video chute at the Pinhead Creek weir during 2022.

Sex	Video Observations (PIT-tagged)	Video Observations (Untagged)	Totals
Male	4	2	6
Female	6	15	21
Totals	**10**	**17**	**27**

Thirteen individual Bull Trout were captured in the trap at the Pinhead Creek weir of which three were captured more than once. The first fish was captured on August 30, 2022 and the last Bull Trout was captured on September 22, 2022 (Figure 11). Of the 13 unique Bull Trout captured, 8 were females and 5 were males. All five males had been PIT-tagged previously and five of the eight females had been previously tagged. Tissue samples from the three untagged females were collected for future genetic analysis.

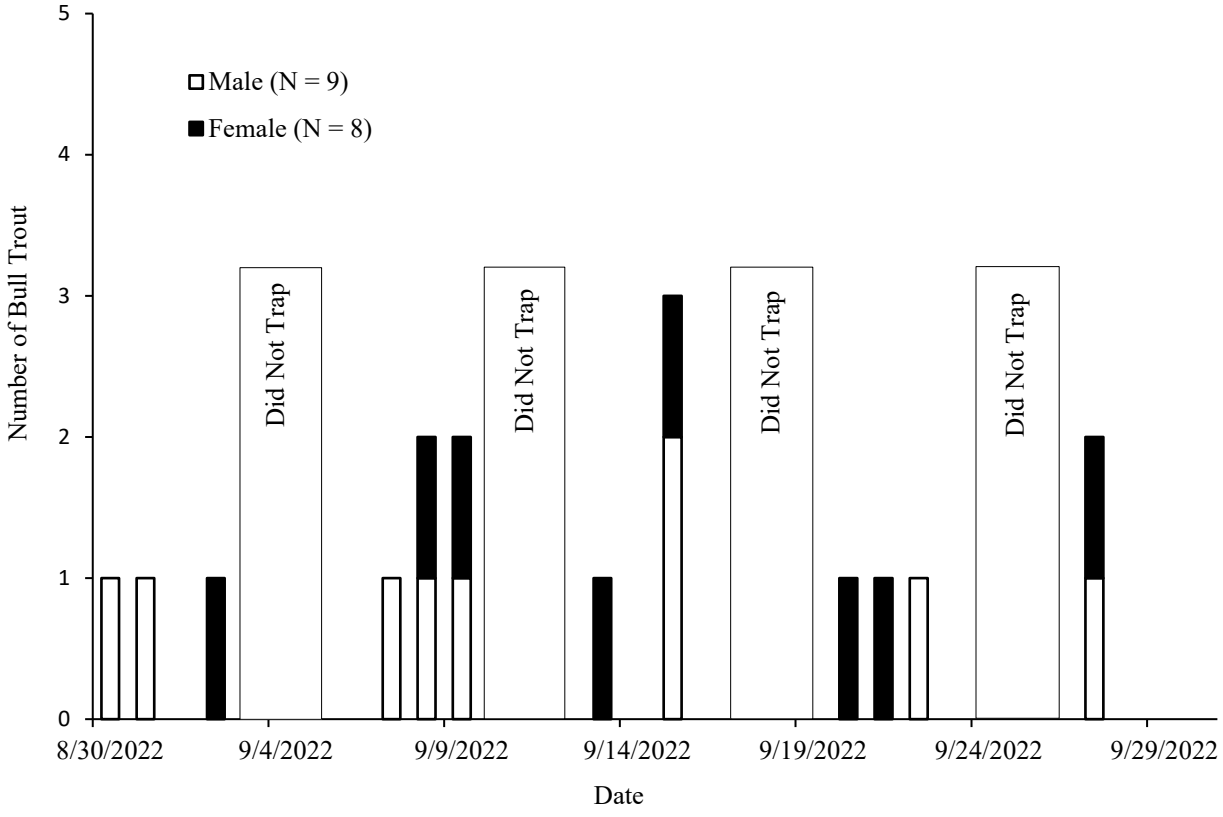


Figure 11. Bull Trout trapped by date and sex at the Pinhead Creek weir during 2022.

The Bull Trout captured in the trap were large, migratory fish and ranged in length from 495 – 810 mm TL. Female Bull Trout (mean, 628 mm TL; range, 495 – 810 mm TL) were on average smaller in length than the males (mean, 683 mm TL; range, 615 – 765 mm TL). All but three of the females captured in the trap during 2022 had been previously PIT-tagged, indicating they were either translocated fish or individuals that were tagged at the trap during previous years. The mean length of the untagged females was notably less than that of the tagged females. Lengths of Bull Trout captured in the trap are summarized in Figure 12 and Table 7.

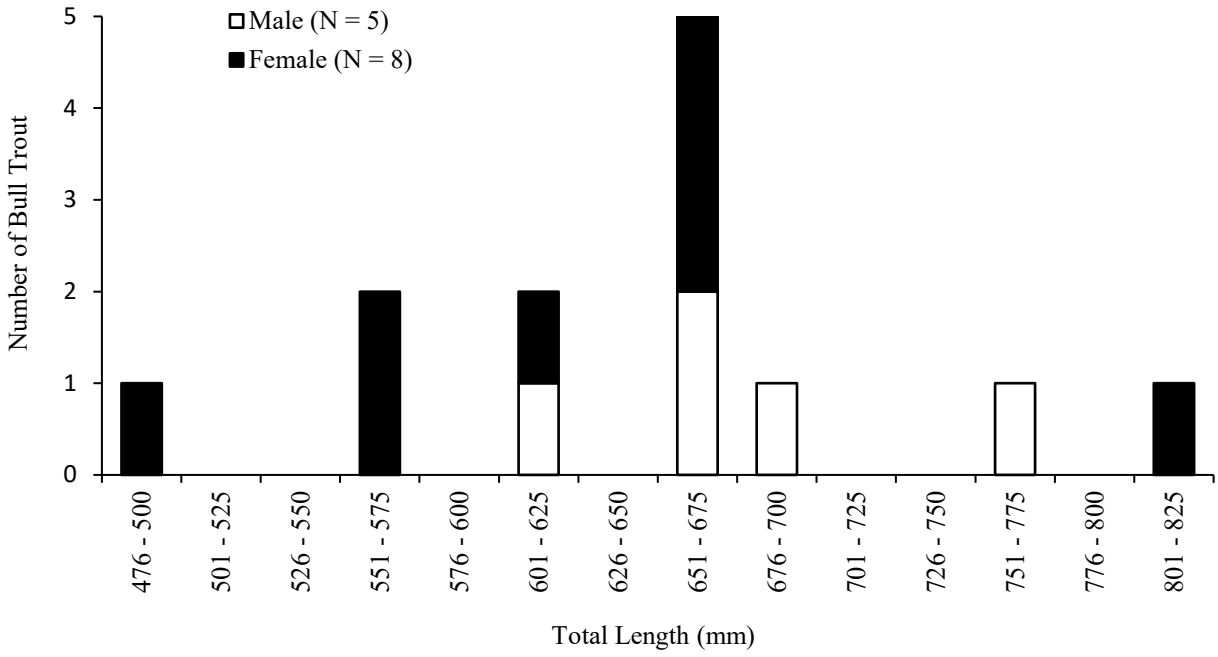


Figure 12. Total lengths by sex of Bull Trout captured at the Pinhead Creek weir during 2022.

Table 7. Lengths of Bull Trout captured in the trap at the Pinhead Creek weir during 2022.

Sex (Tagged/Untagged)	Total Length (mm)		
	Min	**Max**	**Mean**
Males (Tagged)	615	765	683
Females (Tagged)	603	810	681
Males (Untagged)*	*	*	*
Females (Untagged) *	495	570	540

* No untagged male Bull Trout were captured during 2022.

Operating a weir and adult trap for multiple years in Pinhead Creek has provided the opportunity to observe trends in the population. Fish length often correlates with age of individuals in a population. As a population matures, mean lengths would be expected to trend upward. If younger (i.e., smaller) individuals were recruited into the adult population, we would expect to see mean lengths trend downward. We examined mean lengths for tagged and untagged male and female Bull Trout sampled from 2017 to 2022 in the Pinhead Creek weir trap (Figure 13). As expected, we found that mean lengths for tagged male and female Bull Trout trended upward, indicating these fish are primarily older (and therefore larger) translocated individuals. We also found that mean lengths for untagged fish trended upward. However, in 2022 the mean length for untagged females was notably lower, not following the trend from previous years. This may simply be an anomaly, or it may suggest younger, untagged females (i.e., naturally produced fish) may have been recruited into the spawning population.

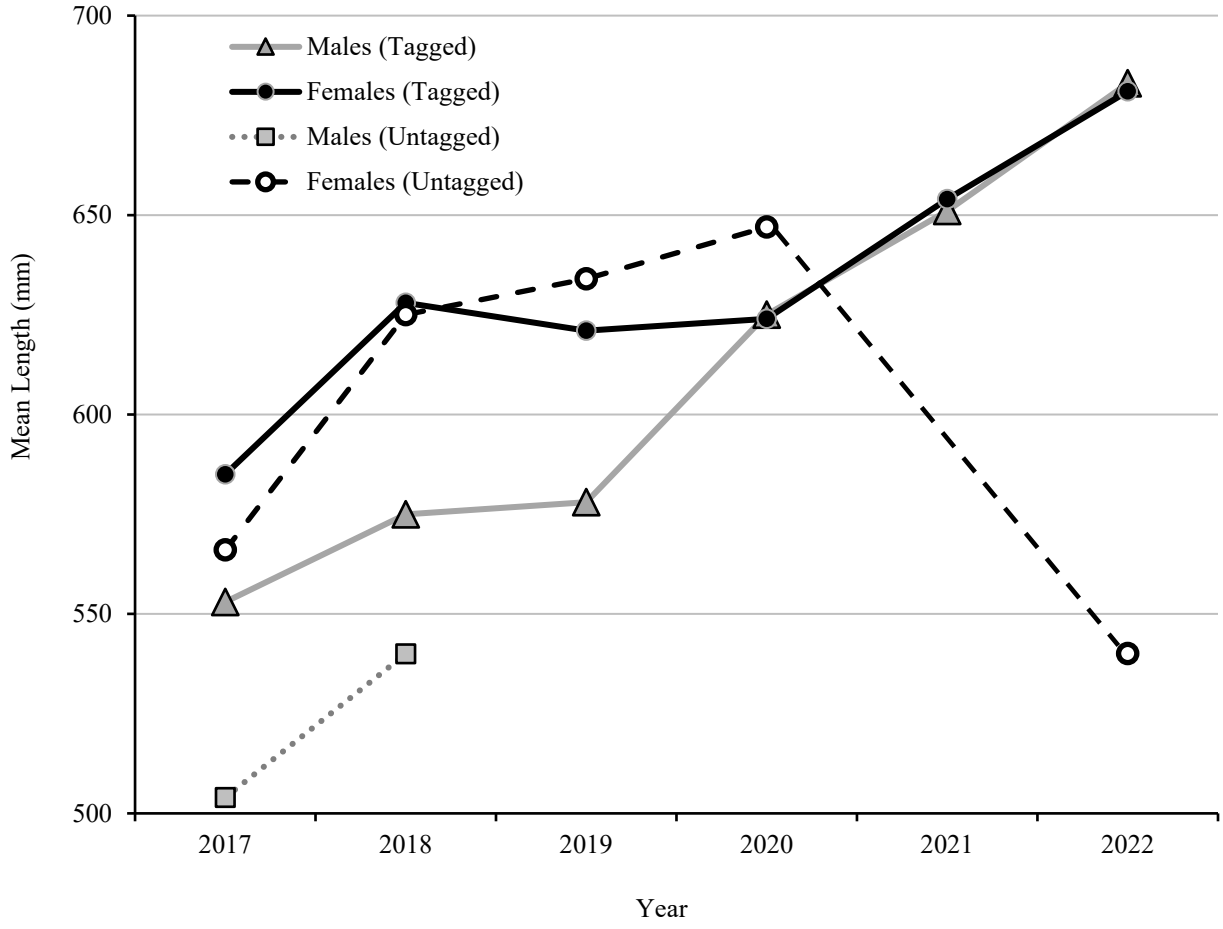


Figure 13. Mean lengths of tagged and untagged male and female Bull Trout sampled at the Pinhead Creek weir from 2017 to 2022.

In 2022, most adult Bull Trout detected passing the weir were released as juveniles (< 251 mm) and subadults (251 – 450 mm) from 2012 – 2016 into the mainstem Clackamas River, Pinhead

Creek or the upper Clackamas River (Table 8). No translocated fish released as adults and no juveniles released into Berry Creek were detected in 2022. Most fish detected at the weir were released as subadults (50%) into the mainstem Clackamas and a large portion (50%) of the translocated fish were from releases in the final year of the translocations (2016). This is not surprising given that more Bull Trout were translocated during 2016 than in any year of the reintroduction effort (Starcevich 2021). We also detected three untagged adults (> 450 mm) of unknown origin that were PIT-tagged and released at the Pinhead Creek adult trap from 2018 – 2019 in addition to the three PIT-tagged adults released at the weir during 2022.

Table 8. Release years and locations by life stage of PIT-tagged Bull Trout detected via PIT antennas at the Pinhead Creek video weir or captured in the adult trap during 2022.

Release Location	Lifestage	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Totals
Clack. R.	Juvenile	0	0	0	0	1	NA	NA	NA	NA	NA	NA	**1**
Clack. R.	Subadult	1	0	2	2	4	NA	NA	NA	NA	NA	NA	**9**
Clack. R.	Adult	0	0	0	0	0	NA	NA	NA	NA	NA	NA	**0**
Pin./Last Cr.	Juvenile	0	1	0	0	0	NA	NA	NA	NA	NA	NA	**1**
Up.Clack.	Juvenile	0	0	0	0	1	NA	NA	NA	NA	NA	NA	**1**
Berry Cr.	Juvenile	0	0	0	0	0	NA	NA	NA	NA	NA	NA	**0**
Pin. Weir	Adult	NA	NA	NA	NA	NA	0	1	2	0	0	3	**6**
	Totals	**1**	**1**	**2**	**2**	**6**	**0**	**1**	**2**	**0**	**0**	**3**	**18**

Spawning Population Estimate

A total of 36 individual Bull Trout were captured, observed or detected passing the weir, of which 28 were female and 8 were male (Table 9). There were two distinctly different size classes of adults observed moving upstream of the weir in 2022. This dichotomy has not been observed in the past six years of operating the weir in Pinhead Creek. There were 29 large adults, of which 6 were male and 23 were female. All of the large males (100%) were previously tagged and 10 (43%) of the large females were tagged. Of the seven small adults that were observed, two were determined to be male, five were female and none had PIT tags. It should be noted that determining the sex of the small adults was difficult in some cases. The spawning population estimate of 36 was the same as in 2021, but was notably less than estimates for previous years (Figure 14). Our spawning population estimate and census redd count data suggest a spawner/redd ratio of 1.5 in 2022, which was higher, but similar to past seasons that ranged from 1.0 to 1.3 (Figure 15). A reason for the decline in adult spawners from a high of 101 in 2018 was not apparent. However, the number of males in the population is much lower than the number of females (Table 9) and there continues to be indications that recruitment of naturally produced fish to the spawning population is low (see Documenting Natural Production results and discussion).

Table 9. Tagged and untagged individual male and female Bull Trout captured at the trap and observed on video at the Pinhead Creek weir in 2022.

Sampling Method	Male (Tagged)	Female (Tagged)	Male (Untagged)	Female (Untagged)	Combined
Large Adults (> 450 mm)	6	10	0	13	29
Small Adults (300 – 450 mm)	0	0	2	5	7
Totals	**6**	**10**	**2**	**18**	**36**

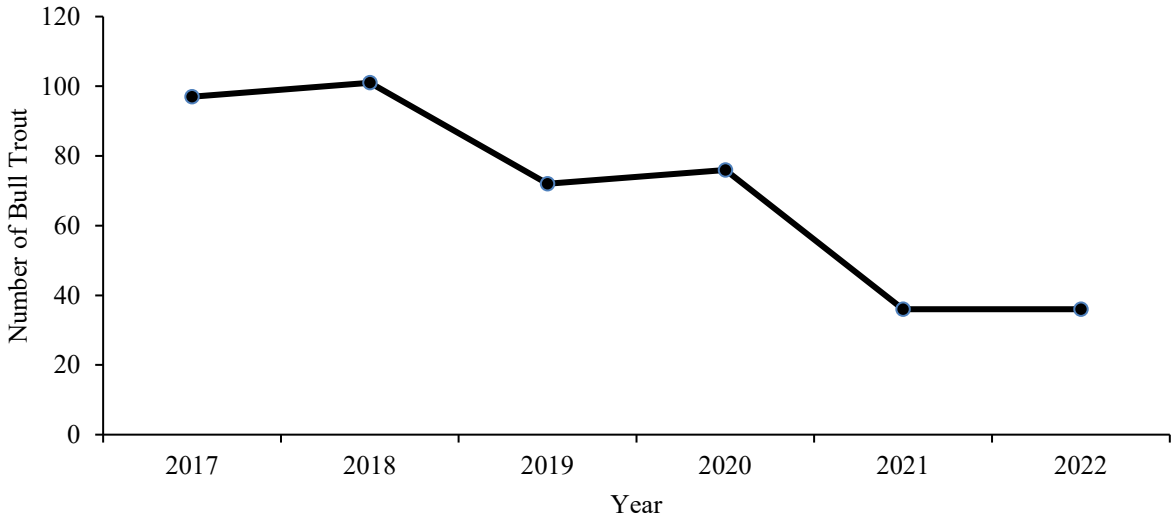


Figure 14. Pinhead Creek spawning population estimates from 2017 through 2022.

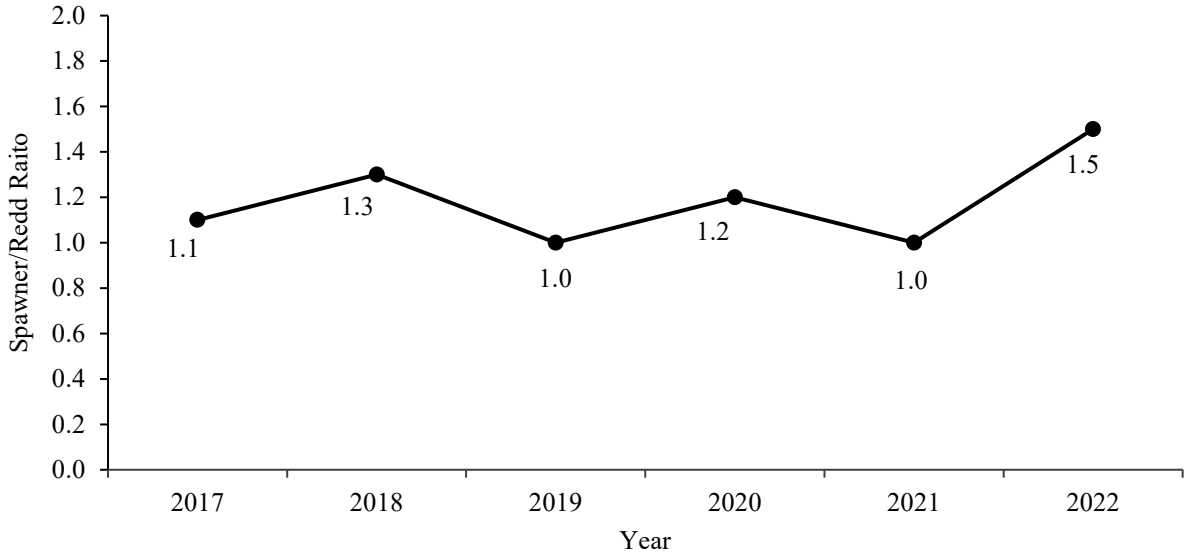


Figure 15. Pinhead Creek spawning/redd ratios from 2017 through 2022.

Documenting Natural Production

Monthly eDNA Samples

All eDNA samples were sent to Rocky Mountain Research Station in Missoula, Montana for analysis. We will report the findings once samples from all months are processed and the analysis is completed (i.e., 2023 annual report).

Tag Retention

Thirty-six individual Bull Trout were captured in the adult trap or observed on video during 2022. Twenty of these fish were untagged prior to capture or observation. Of the eight males observed, six (75%) were previously PIT-tagged. This was the first year since 2018 that male Bull Trout without PIT-tags were observed. It should be noted that both of the untagged males were from the group of seven very small adults (approximately 300 – 400 mm) observed on video, which were more difficult to sex than larger adults. Ten of the 28 females (36%) observed were previously PIT-tagged. All five of the small female adults did not have tags. The observations of untagged individuals passing the weir suggests locally-born individuals may have been recruited into the spawning population. However, the disparity in tagged to untagged ratios for male and female fish observed at the weir between 2017 and 2022 (Barrows et al. 2018, 2019, 2021, 2022), could result from substantially lower tag retention for females. Meyer et al. (2011) and Prentice et al. (1990) had previously documented significantly lower PIT tag retention rates in female salmonids. For this reason, the true percentage of locally-born individuals in the spawning population may be better represented by the males, suggesting very few locally-born individuals may been recruited into the adult population in Pinhead Creek. The

proportions of tagged to untagged males and females in 2022 were lower than findings from 2019 through 2021 (Table 10). However, if the seven small untagged adults were excluded from the analysis, the percentages of tagged males (100%) and females (43%) would be more similar to past seasons (Figure 16). The lower overall percentage of PIT-tagged individuals observed in 2022 together with the presence of small untagged adults, may indicate the beginning of a trend toward fewer untagged individuals and the possiblity of natural recruitment into the spawning population.

Table 10. Tagged and untagged male and female Bull Trout captured at the trap and observed on video at the Pinhead Creek weir from 2017 to 2022.

Year	Males (Tagged)	Males (Untagged)	Females (Tagged)	Females (Untagged)	Males (% Tagged)	Female (% Tagged)
2017	44	3	11	9	94	55
2018	42	5	27	27	88	50
2019	25	0	31	15	100	67
2020*	14*	0*	14*	9*	100*	61*
2021	9	0	15	8	100	65
2022	6	2	10	18	75	36

* Monitoring season was shortened due to COVID-19 restrictions and forest fires in the subbasin.

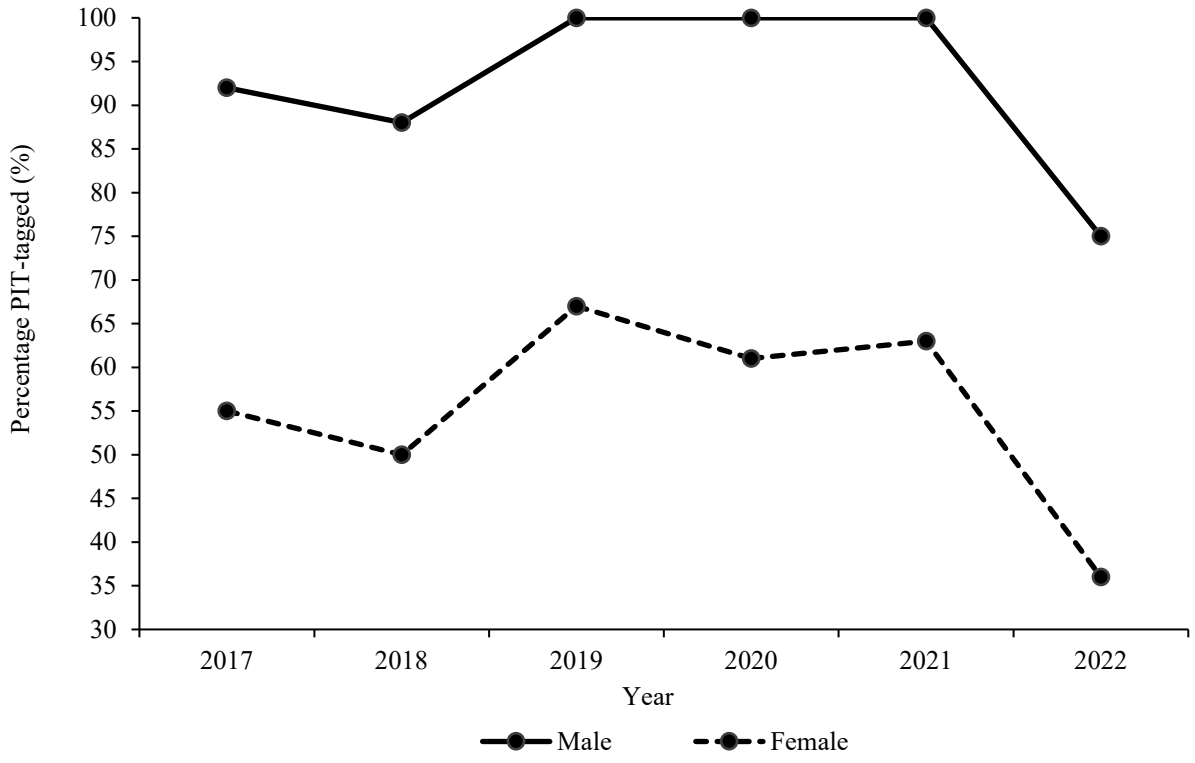


Figure 16. Percentage of PIT-tagged adult Bull Trout observed at the Pinhead Creek weir from 2017 through 2022.

Genetic Analysis

Caudal fin tissue samples were collected from the 27 untagged Bull Trout captured at the weir during from 2017 through 2022 for genetic analysis to determine if they were locally-born progeny or translocated fish that had shed their tags (Table 11). These samples have been sent to the Abernathy Fish Technology Center (U. S. Fish and Wildlife Service) for genetic analysis. In future years, if locally-born individuals are captured, genetic analysis would be used to determine which individuals and release groups produced offspring.

Table 11. Caudal fin tissue samples collected from untagged Bull Trout captured at the Pinhead Creek weir from 2017 to 2022.

Year	Males	Females	Totals
2017	1	5	6
2018	2	3	5
2019	0	9	9
2020	0	4	4
2021	0	0	0
2022	0	3	3
Totals	**3**	**24**	**27**

Redd Surveys

The number of Bull Trout redds recorded in the Clackamas River Subbasin has ranged from just 5 in 2011 to a high of 89 in 2017 (Starcevich 2021). Since the beginning of the reintroduction project, most of the redds counted during census spawning surveys were recorded in Pinhead Creek, Last Creek and the upper Clackamas River. However, 13 redds were counted in Berry Creek during 2019 (Starcevich 2020). Pinhead Creek remained the primary spawning tributary for Bull Trout during 2022.

A total of 24 presumed Bull Trout redds were observed in 2022, a marked decrease from a total of 64 redds in 2020 and 38 redds in 2021 (Starcevich 2023; Barrows et al. 2022). All 24 of the redds were found in Pinhead Creek downstream of the Last Creek confluence (Figure 17). No redds were found in Last Creek during 2022. The Pinhead Creek spawner/redd ratio for 2022 is discussed in the *Spawning Population Estimate* section of this report.

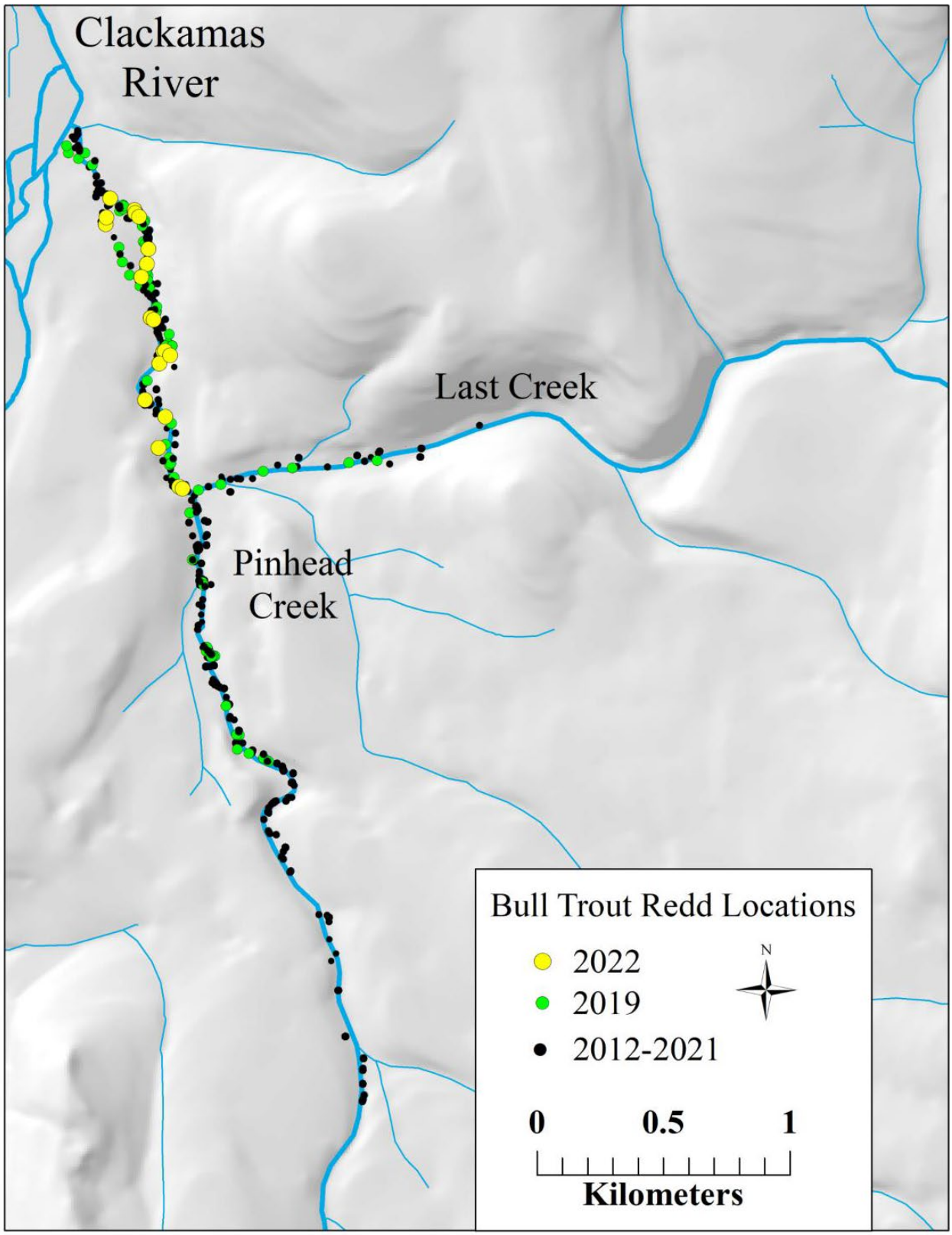


Figure 17. Georeferenced redds in Pinhead and Last creeks 2022. Bull Trout redds observed during 2022 are depicted as yellow circles. (Figure from Clackamas Bull Trout Update [Starcevich 2023]).

Movement and Seasonal Distribution

High Vulnerability Zone

Bull Trout are known to use North Fork Reservoir and frequent areas in the vicinity of PGE's hydro projects (Barrows et al. 2017, 2018, 2019, 2021, 2022). Monitoring efforts have been limited following the end of the reintroduction project's radio-telemetry program in 2014 and occupancy of the HVZ during 2022 is largely unknown. However, the detection histories of PIT-tagged Bull Trout detected at various PIT antennas at PGE's hydro project facilities in recent years have provided some degree of insight into when and where Bull Trout occupy habitat in the Clackamas River extending from downstream of River Mill Dam to North Fork Reservoir. As the numbers of PIT-tagged Bull Trout remaining in the system decline, fewer detections reduce our ability to infer occupancy timing in the HVZ.

Bull Trout opportunistically forage on juvenile Steelhead, salmon and other species when in the vicinity of PGE's hydro project facilities, so it is important to know how long Bull Trout reside there. It is often unclear how long an individual Bull Trout has occupied a given area prior to its detection at PIT antennas throughout the hydro project, but in some instances, occupancy timing can be inferred through examining detection histories. There was only a single Bull Trout (PIT ID 0000_0000000177419068) detected at PGE facilities during late June and early July during 2022. However, data from previous years indicate Bull Trout have encountered PGE facilities and may occupy the HVZ during all months (Barry et al. 2014; Barrows et al. 2016, 2017, 2018, 2019, 2021, 2022).

From 2016 – 2022 there have been a total of 30 Bull Trout detected or observed at PGE facilities (Table 12). A comprehensive detection/observation history of the fish detected during 2022 is summarized in Table 13. This fish had been translocated as a subadult (308 mm TL) and released in the Clackamas River near the 4650 bridge on June 3, 2016. It was detected and observed multiple times following release, including presumed spawning runs in 2020, 2021 and 2022 into Pinhead Creek and it was captured in the Pinhead Creek adult trap during 2020 but was quickly released without being measured due to an advancing forest fire in the area. Pre-spawn video images of this large, migratory female were recorded as it moved upstream and downstream of the Pinhead Creek weir during 2021(Figure 18). During 2022, this fish was detected moving downstream through the North Fork Dam migrant collector on June 30, 2022 before ascending the fish ladder and returning upstream of North Fork Dam on July 4, 2022. Fifty-three days later, this fish moved upstream of the Pinhead Creek weir to spawn before returning back downstream of the weir on September 8, 2022.

Table 12. The number of Bull Trout detected or observed at PGE facilities from 2016 – 2022.

Year	Bull Trout Detected/Observed
2016	6
2017	5
2018	9
2019	12
2020	4
2021	3
2022	1
Total	**30**

Table 13. Comprehensive detection history for the Bull Trout detected at PGE facilities during 2022.

Telemetry Code	PIT Tag Code	Size at Tagging or Recapture (TL)	Date Released (*), Detected or Recaptured	Location Released (*), Detected, or Recaptured
NA	**0000_0000000177419068**	**308 mm**	**6/03/2016***	**4650 Bridge***
			9/09/2020	Capture - Pinhead Creek Adult Trap
			9/04/2021	Video Observation – Pinhead Weir (US)
			9/12/2021	Video Observation – Pinhead Weir (DS)
			6/30/2022	PIT Detect - N. F. Migrant Collector
			7/02/2022	PIT Detect - River Mill Ladder
			7/03/2022	PIT Detect – N.F. Old Sorting Facility
			7/03/2022	Observation – N.F. Adult Sorting Facility
			7/04/2022	PIT Detect - North Fork Ladder Exit
			8/26/2022	Video Observation – Pinhead Weir (US)
			9/08/2022	Video Observation – Pinhead Weir (DS)

Figure 18. Video image of female Bull Trout (PIT ID 0000_0000000177419068) as it moved upstream through the Pinhead Creek video weir on September 4, 2021.

The detection history of this Bull Trout from 2022, together with the multiple detections of fish from previous years, indicate there have been ample opportunities for Bull Trout to interact with anadromous salmonids in the HVZ. It should be noted that PIT detections signify a moment in time at a very specific location. In addition, they may only represent an unknown portion of the actual number of Bull Trout occupying the HVZ. Bull Trout may be using unmonitored areas or encountering PGE facilities undetected due to tag loss and the possible existence of untagged, locally-born individuals.

Stepwise Impact Reduction Plan Thresholds

This summary is not intended to be an analysis of trends in salmon and Steelhead life stage metrics, given the changes in how monitoring has been conducted by PGE over time (Nick Ackerman, PGE, pers. comm.), and is not intended to fulfill any reporting requirements of PGE. Rather, the information provided by PGE is summarized below (Table 11) relative to the Stepwise Impact Reduction Plan (USFWS 2011) and the minimum thresholds identified in Table 2 therein. During 2022, all metrics for Coho Salmon, Spring Chinook Salmon and Steelhead were above thresholds identified in the Stepwise Impact Reduction Plan (Table 14). All counts have exceeded minimum thresholds in all years since the implementation of the Bull Trout reintroduction project, suggesting the presence of Bull Trout in the system may not expressively impact salmon and Steelhead populations.

Table 14. Summary of adult, juvenile and smolt/adult counts for Coho Salmon, Spring Chinook Salmon and Steelhead through the PGE hydro facility on the Clackamas River, Oregon, relative to thresholds identified in the Stepwise Impact Reduction Plan (USFWS 2011b).

Species	Metric	Threshold	2022*
Coho	Adult	2,160	The adult counts were above the threshold for the tenth year (2013-2022) since implementation of this project.
	Juvenile	54,431	The juvenile counts were above the threshold and have exceeded the threshold in all years since implementation of this project.
	Smolts/adult	38.1	The estimated smolts/adults were above the threshold and have exceeded the threshold in all years since implementation of this project.
Spring Chinook	Adult	780	The adult counts were above the threshold and have exceeded the threshold in all years since implementation of this project.
	Juvenile	6,237	The juvenile counts were above the threshold and have exceeded the threshold in all years since implementation of this project.
	Smolts/adult	3.1	The estimated smolts/adults were above the threshold and have exceeded the threshold in all years since implementation of this project.
Steelhead	Adult	600	The adult counts were above the threshold and have exceeded the threshold in all years since implementation of this project.

	Juvenile	20,374	The juvenile counts were above the threshold and have exceeded the threshold in all years since implementation of this project.
	Smolts/adult	10.2	The estimated smolts/adults were above the threshold and have exceeded the threshold in all years since implementation of this project.

* Annual data provided by Nick Ackerman, PGE.

Findings

Bull Trout populations are known to exhibit life histories involving movements, migrations, spawning, rearing and foraging over a range of temporal and spatial scales (Schaller et al. 2014). An understanding of these fundamental characteristics is required to inform future management actions and for continued progress toward the project's goal of re-establishing a self-sustaining Bull Trout population in the Clackamas River Subbasin. Since this project's inception, numerous important milestones have been achieved. The most notable have been the recruitment of translocated fish into the spawning population and the confirmation of viable embryos and healthy alevins in redds (Barrows et al. 2018). Another encouraging finding was the first observations of redds in Berry Creek during 2019 (Starcevich 2020) However, there continue to be notable uncertainties and indicators that may be cause for concern. For example, efforts to provide definitive evidence of post-emergent juveniles have been unsuccessful to date. Adults without PIT tags have been observed and captured at the weir in Pinhead Creek and at the North Fork Dam sorting facility, however, data suggest there may be an elevated rate of tag shedding in the female portion of the translocated population indicating many of the untagged fish may not be Clackamas-born individuals. Confirmation of locally-born progeny and their recruitment into the spawning population are benchmarks that are crucial to the overall goal of establishing a self-sustaining population of Bull Trout in the Clackamas River Subbasin and may be achieved over time as the reintroduction effort progresses and the population develops. The following is a summary of findings from monitoring activities conducted during 2022:

Bull Trout began moving into Pinhead Creek to spawn on August 2, 2022, appeared to peak in mid-September, and the last fish moved upstream on October 1, 2022. Migration timing in 2022 was similar to previous years.

Whenever a weir is operated within a stream, it is safe to assume it will result in some level of delay as upstream migrating fish search for the passage route. The installation and operation of the weir during 2022 was nearly identical to past years, so passage was not evaluated in detail. However, all PIT-tagged Bull Trout that encountered the weir during 2022 successfully passed upstream, no fish were observed congregating downstream of the weir, no Bull Trout redds were observed downstream of the weir and each fish captured in the trap was held for less than 24 hours before being passed upstream. For these reasons, we believe passage to upstream spawning grounds for most fish was minimally influenced by the weir in 2022. Since 2017, there have been no indications that the Pinhead Creek weir has negatively influenced salmonid access to upstream spawning grounds (Barrows et al. 2018 – 2022).

Our estimate of the spawning population in 2022 was 36 fish, resulting in an estimated spawner/redd ratio of 1.5. This value is slightly higher, but similar to estimates from 2017 – 2021 that ranged from 1.0 to 1.3, suggesting consistency in population estimates and census redd counts.

The percentage of females in the Pinhead Creek spawning population has consistently increased from 52% in 2017 to 78% in 2022. This increasing disparity between the percentage of females and males was notable and appears to be a continuing trend.

The surviving translocated individuals in the system are currently all mature adults. Increased redd counts are expected as locally-born offspring (if they exist) continue to mature and recruit into the spawning population. However, the downward trend in redd counts observed since 2017 in Pinhead and Last creeks runs counter to these expectations.

From 2017 – 2022, mean lengths for tagged (translocated) individuals have trended upward. Prior to 2022, mean lengths for untagged fish have trended upward as well, suggesting they may be translocated fish that have shed their PIT tags. However, in 2022 the mean length for untagged females was notably lower, not following the trend from previous years. This suggests younger (i.e., naturally produced fish) may have recruited into the 2022 spawning population.

The presence of seven small (approximately 300 – 400 mm), untagged adult Bull Trout, together with the lower overall percentage of PIT-tagged individuals, may also indicate natural recruitment into the 2022 spawning population.

Prior to 2022, there had been no untagged male Bull Trout observed at the Pinhead Creek weir since 2018, strongly suggesting a lack of recruitment of locally-born individuals into the spawning population. However, the two small, untagged males observed in 2022 again suggest the possibility of natural recruitment.

The 27 tissue samples from untagged Bull Trout captured at the weir from 2017 through 2022 have been sent to the Abernathy Fish Technology Center for analysis. Results will confirm if the fish were locally-born individuals, or if they were simply translocated fish that had shed their tags.

Results from the monthly eDNA sampling effort from Pinhead and control (Jack and Cougar) creeks will help describe how temporal and spatial patterns in Bull Trout occupancy are related to incubation and post-hatching time periods in these creeks.

The detection history of the PIT-tagged Bull Trout detected at PIT antennas throughout PGE's hydro project facilities during 2022 confirmed that Bull Trout were in the vicinity of the hydro power facilities during June and July. However, data from past years indicate Bull Trout may be present during all months.

Bull Trout use of the North Fork Reservoir during 2022 was largely unknown, but it is reasonable to assume they foraged on vulnerable juvenile anadromous salmonids pooling in

forebays while occupying the HVZ. Regardless, minimum passage thresholds for juvenile salmon and Steelhead were exceeded in 2022.

Only one adult Bull Trout returned to the study area upstream of North Fork Dam during 2022. It was subsequently detected (and presumably spawned) in Pinhead Creek during the spawning season. As the population has declined, instances of these migration patterns have become less common in recent years.

Future Plans

In cooperation with our partners in the Clackamas River Subbasin, we intend to continue monitoring the effectiveness of the Bull Trout reintroduction program during 2023. We anticipate that the spawning population will continue to be monitored via redd counts and by operating a video weir near the mouth of Pinhead Creek in 2023. Continuing these activities will ensure the goals and objectives of the reintroduction project are met.

Acknowledgments

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