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Oregon Department of Fish and Wildlife**

Clackamas River Bull Trout Reintroduction Project

FY 2014 Annual Report



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**U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office**

**Oregon Department of Fish and Wildlife
Native Fish Investigations Program**

**U.S. Forest Service
Mount Hood National Forest**

On the cover: *The confluence of Pinhead Creek with the Clackamas River (Photo by C. Allen, USFWS).*

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CLACKAMAS RIVER BULL TROUT
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2014 ANNUAL REPORT

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CLACKAMAS BULL TROUT REINTRODUCTION PROJECT 2013 ANNUAL REPORT

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Bull trout were last documented in the Clackamas River in 1963. A 2007 feasibility study indicated the Clackamas River could biologically support bull trout and would be a good candidate for a reintroduction effort. Implementation of the bull trout reintroduction program began in 2011, with the goal of establishing a naturally reproducing population of between 300 – 500 spawning adults by the year 2030. In 2014, we continued efforts to reintroduce bull trout into the Clackamas basin by collecting and transferring 305 juveniles, 46 subadults, and 7 adults from the Metolius Basin. Monitoring and evaluation were conducted to 1) ensure that the proposed action does not threaten the donor stock population, 2) assess the effectiveness of the reintroduction strategy for re-establishing a self-sustaining bull trout population, and 3) evaluate the effects of the reintroduction on Endangered Species Act-listed salmonids that currently occupy the Upper Clackamas River Subbasin. To meet these objectives, we obtained redd count data for the donor population and monitored the behavior and survival of tagged fish in the Clackamas using fixed and mobile radio telemetry and fixed passive integrated transponder tag interrogation. Through the first four years of the project, 1) the donor population has remained healthy (>900 spawning adults); 2) transferred bull trout have dispersed throughout the upper Clackamas, all but one subadult and one adult have remained in the Clackamas and its tributaries, and some bull trout have exhibited spawning behavior; and 3) bull trout have generally not occupied areas of the Portland General Electric Clackamas River hydroelectric project in which anadromous smolts may be vulnerable to predation. Implementation and monitoring of the reintroduction project will be evaluated on an annual basis and the reintroduction strategy will be adaptively managed.

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1) Introduction

Bull trout (*Salvelinus confluentus*) are native to the Pacific Northwest, and currently occupy habitat in Oregon, Washington, Idaho, Montana, Nevada, and Canada. Bull trout prefer cold, clean water in complex stream habitats, and populations have been negatively affected by several factors including habitat degradation (e.g., Fraley and Shepard 1989), barriers to migration (e.g., Rieman and McIntyre 1995), and the introduction of non-native trout species (e.g., Leary et al. 1993). As a result, the abundance of bull trout has declined in many populations across their native range (Rieman et al. 1997) leading to their listing under the Endangered Species Act in 1999 (64 FR 58910).

The restoration of bull trout to historic habitat is one of the primary recovery goals in the U.S. Fish and Wildlife Service's (USFWS) Draft Recovery Plan (USFWS 2002a), and is particularly relevant to habitats in the western portion of the species' range due to the extensive loss of distribution and the documented extirpation of multiple bull trout populations. The Willamette River, a tributary of the lower Columbia River, has experienced extirpations of bull trout from four major subbasins, including the Clackamas River (Figure 1). Although the overall recovery strategy is to reduce and minimize threats affecting bull trout and their habitat in the Willamette River Basin, the establishment of self-sustaining populations will likely require reintroduction into some areas given the size of the basin and low probability of natural recolonization following widespread extirpations. Reintroduction of bull trout in the Clackamas River will help to achieve distribution in the Clackamas River core habitat (defined as habitat that contains, or if restored would contain, all of the essential physical elements to provide for the security of and allow for the full expression of life history forms of one or more local populations of bull trout) (draft recovery criterion 1 and recovery objective 1) and will increase abundance of adult bull trout in the Willamette River Recovery Unit (draft recovery criterion 2 and recovery objective 2; USFWS 2002b).

This report documents the progress in the fourth year (2014) of the joint effort between the State of Oregon, 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. The implementation phase of the project began 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). Following publication of the 10(j) rule, the first transfers of bull trout to the Clackamas Basin occurred during the spring and summer of 2011 (ODFW 2011). This report format will be structured, where appropriate, to answer the questions listed in sections 3.2 and 3.3 of the Implementation, Monitoring, and Evaluation Plan developed by the USFWS Oregon Fish and Wildlife Office and Columbia River Fisheries Program Office (2011). Additional project background on the reintroduction and project management strategy can be found in that plan (www.fws.gov/oregonfwo/Species/Data/BullTrout/Documents/ClackamasBT_IME_Plan.pdf).

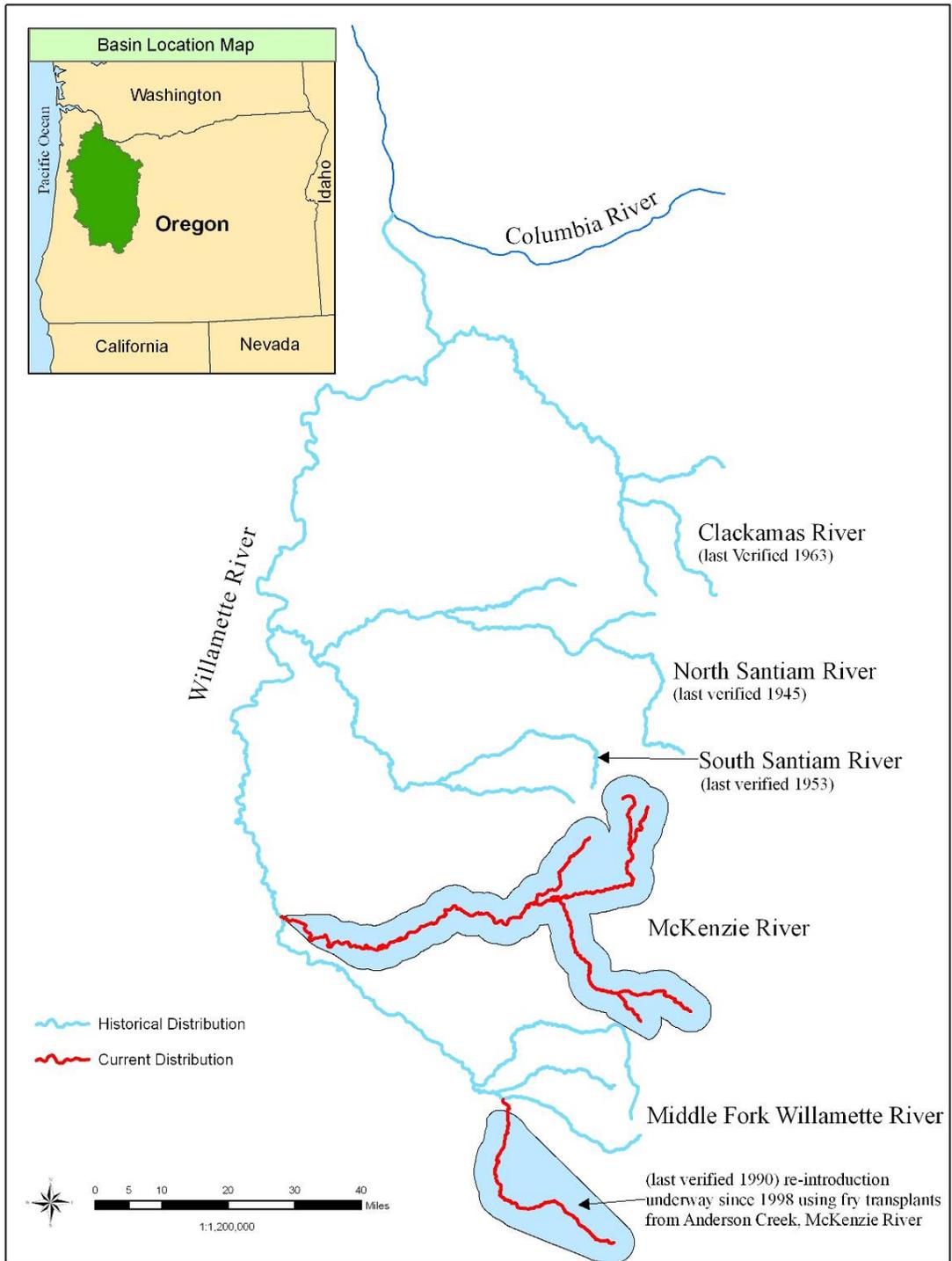


Figure 1. Historical and current bull trout distribution in the Willamette Basin.

The goal of the project is to re-establish a self-sustaining bull trout population of 300 – 500 spawning adults in the Clackamas River by 2030. If successful, this project will contribute to the conservation and recovery of bull trout in the Willamette Basin and to the overall recovery criteria outlined in the Draft Bull Trout Recovery Plan (USFWS 2002b). We define a self-sustaining population as one that maintains a minimum adult annual spawning abundance of 100 individuals, contains a level of genetic diversity representative of the donor stock, and requires little or no additional transfers. The numerical goal of 300-500 spawning adults is consistent with existing draft recovery planning targets for the abundance necessary to achieve these characteristics. Although the amount of suitable habitat in the Clackamas River suggests there is sufficient capacity to support a population of this size, bull trout distribution across the species' range, even within areas of suitable habitat, is patchy; thus, the true capacity of the Clackamas River Subbasin for bull trout is unknown.

The actions described in the remainder of this report are intended to address the following three objectives:

- (1) Ensure that the proposed action does not threaten the donor stock population;
- (2) Monitor and evaluate the effectiveness of the bull trout reintroduction strategy for re-establishing a self-sustaining bull trout metapopulation in the Clackamas River; and
- (3) Evaluate the effects of bull trout reintroduction on ESA-listed salmonids that currently occupy the Upper Clackamas River Subbasin.

2) Methods

2.1) Study Area

The study area for the purposes of this report includes the Clackamas River basin upstream of River Mill Dam (Figure 2).

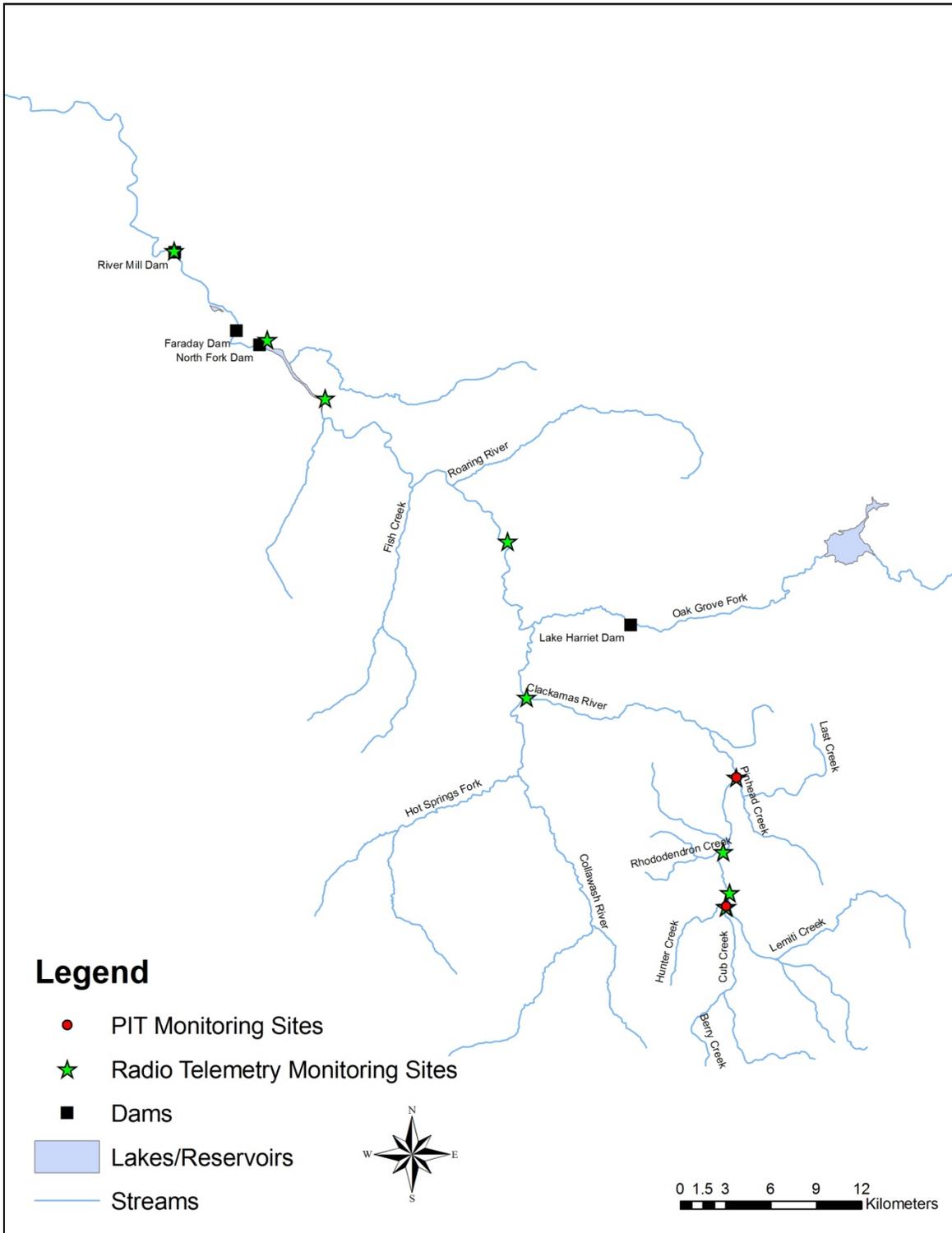


Figure 2. Study area, illustrating the location of fixed monitoring sites that were active in 2014. See Table 1 for site descriptions and operational dates of each station.

2.2) Implementation

2.2.1) Donor stock availability

Oregon Department of Fish & Wildlife conducted an annual redd count survey in fall 2013 on the Metolius River and its tributaries (Jack Creek, Heising Springs, Canyon Creek/Roaring Creek, Candle Creek, Jefferson Creek, and the Metolius River; see Harrington and Wise 2012). The threshold for determining whether the donor population is sufficiently healthy to allow transfers to the Clackamas (as determined through redd counts) is currently 800 spawning individuals (USFWS 2011).

2.2.2) Pathogen screening

Per agreement in the Clackamas Bull Trout Reintroduction Implementation, Monitoring and Evaluation Plan (IM&E Plan) protocols (USFWS and ODFW 2012), bull trout fry (n = 150) were collected by PGE at the Monty screw trap between March and April, 2014. In 2014, we collected 60 bull trout juveniles (70 – 250 mm) from the Monty Screw trap (courtesy of PGE). Screening for pathogens was conducted by ODFW (fry) and USFWS (juveniles). Additionally, USFWS Fish Health staff obtained samples from adult bull trout captured in Lake Billy Chinook during spring 2014. Fish health staff screened for IHNV, IPNV, VHSV, OMV, ISAV, and *M. cerebralis*, as well as other treatable pathogens and parasites (Barry et al. 2014).

2.2.3) Donor stock collection

Juveniles - Juvenile (70 – 250 mm TL) bull trout were collected between April 20 and June 23, 2014. The principal method of collection was with 1.5 m rotary screw traps in Jack (10T 0607241 4927765 – NAD 83), Canyon (10T 0606994 4928695 – NAD 83), and Candle (10T 0608209 4935732 – NAD 83) creeks. The rotary screw traps were checked Monday through Thursday by a crew from the ODFW and catch was enumerated daily, sorted by year class (e.g., 1, 2, and 3 year old), and placed into perforated cages (one cage per year class) that were placed in-stream in proximity to the screw trap. Bull trout fry and all by-catch were enumerated and immediately released. Juvenile bull trout were also incidentally captured in the trap nets during subadult and adult collection efforts (see below).

Subadults and Adults - Subadult (251 – 450 mm TL) and adult (451 – 650 mm TL) bull trout were captured using a variety of methods to maximize the likelihood of capturing both sufficient individuals and putative different life history forms. The principal method of collection was Oneida trap nets that were set and checked Monday, Tuesday, and Wednesday each week from June 2 – June 23 in the Metolius arm of Lake Billy Chinook (downstream of the Eyerly property). Fish were also collected via angling by ODFW from the Metolius arm of Lake Billy Chinook. Following capture, bull trout were transported in oxygen-supplemented tanks to the Round Butte Fish Isolation Facility where they were held in circular tanks (2,500 L) supplied with flow through water from Lake Billy Chinook (10 – 11 °C). Each fish was checked for injury before being placed in the tanks and fish of the appropriate size (251 – 650 mm TL) were

held for a minimum 48 h depuration period as a precaution against transfer of New Zealand mud snails that have been recently documented in Lake Billy Chinook. Bull trout that exhibited injury or other prior trauma after visual inspection by USFWS Fish Health staff on site at Round Butte Isolation Facility were returned later the same day to their original capture location and released, or sacrificed and necropsied by USFWS Fish Health.

2.2.3.a Tagging

Each Tuesday or Wednesday during the collection period, the bull trout were tagged with PIT tag. All bull trout were PIT-tagged using a half-duplex (HDX) tag (ORFID, Portland, USA and Biomark, Boise, USA). Fish were anesthetized using Aqui-S 20E (20 – 25 ppm). Individuals ≥ 300 mm (total length) received a dorsal sinus implant of a 23 mm tag, bull trout 151 – 299 mm received an abdominally implanted 23 mm tag, and bull trout 70 – 150 mm received an abdominally injected 12 mm HDX PIT tag. All tags were sanitized in ethanol and betadine, then rinsed with distilled water prior to insertion. The bull trout were also administered a prophylaxis of 20 mg/kg azithromycin and all subadults and adults were administered an additional prophylaxis of 20 mg/kg oxytetracycline via intraperitoneal injection.

Following tag insertion, the fish were allowed to recover for 18 – 48 h before being transported to the Clackamas River.

2.2.3.b Transport

We transferred the fish to release sites in the upper Clackamas River using a 700 – 1,100 L water tank with supplemental oxygen and 4.5 – 4.9 ppm of Aqui-S 20E. During June, juveniles were transported concurrently with subadults and adults but held in 15 L buckets with small holes drilled in the sides and top to allow water exchange. The buckets were suspended in the transport tanks to prevent injury to any fish. The fish were netted from their holding tanks in the morning and transported for 2~5 h by highway to the release sites. Water temperature was monitored in transit with an Oakton Temp 5 thermistor thermometer. Frozen blocks of Lake Billy Chinook water were added to the transport tank periodically during transport to ensure that the temperature did not increase and to slowly acclimate fish to the temperature at the release location. The Clackamas River was always within 1.5°C of holding temperatures at the Round Butte Fish Isolation Facility.

2.2.4) Release locations and timing

All juvenile bull trout were released in habitat identified in the Feasibility Assessment (Shively et al. 2007) as suitable for spawning and early juvenile rearing (Patch 4 in Figure 3). Subadult and adult bull trout were released in the Big Bottom area (Figure 4). Juveniles were released into Berry Creek (Figure 3).

Subadults and adults were transferred individually from the transport tank to the river using a rubber bagged dip net. Every effort was made to release fish in slow moving water in close

proximity to cover (large woody debris) and fish were given as much time as needed (usually 2 – 10 s) to recover from the mild anesthesia (4.5 – 4.9 ppm Aqui-S 20E) used in transport before being released from the net. Fish were never out of the water for more than several seconds.

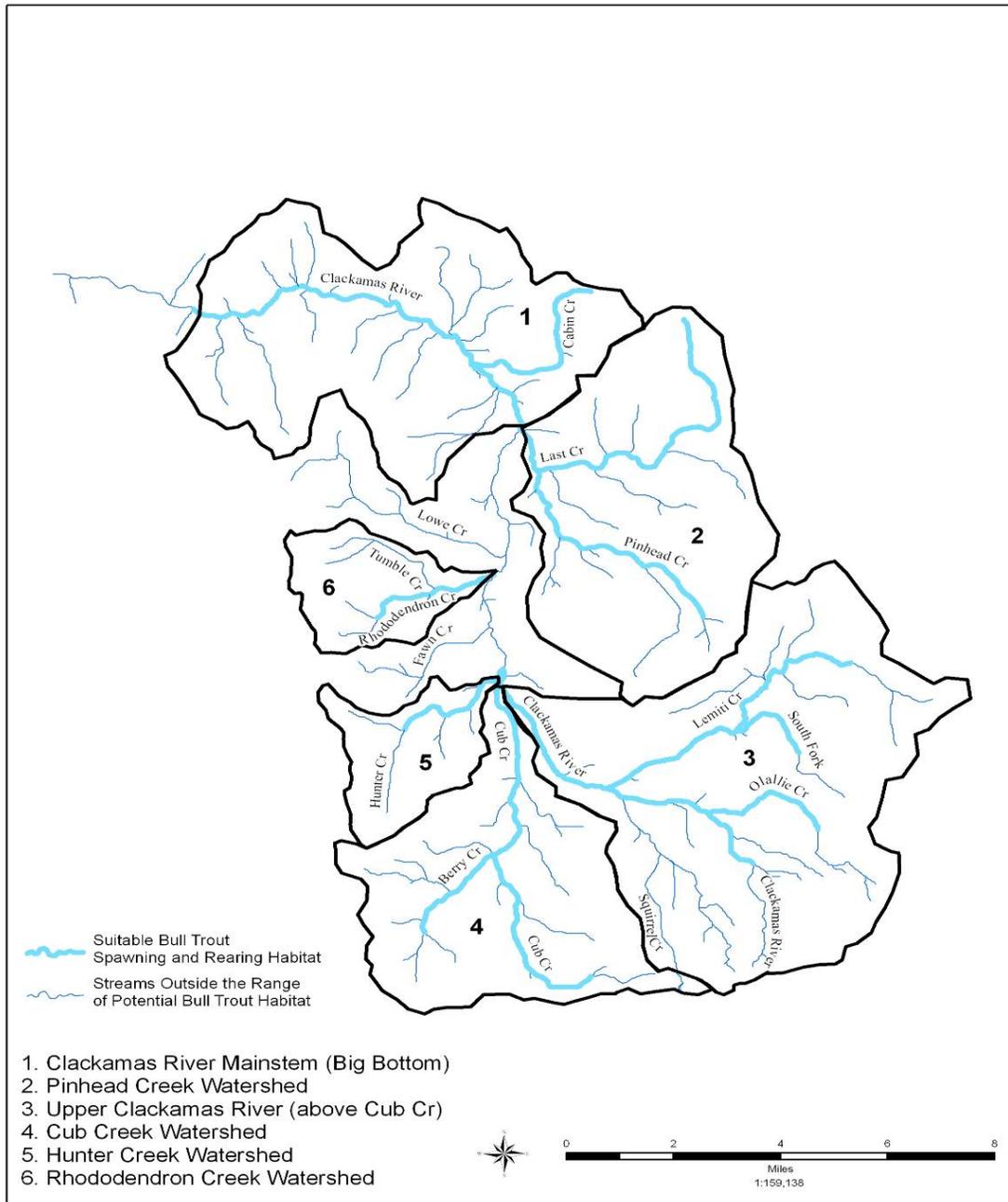


Figure 3. Suitable habitat patches for spawning and juvenile rearing based on Shively et al. 2007.

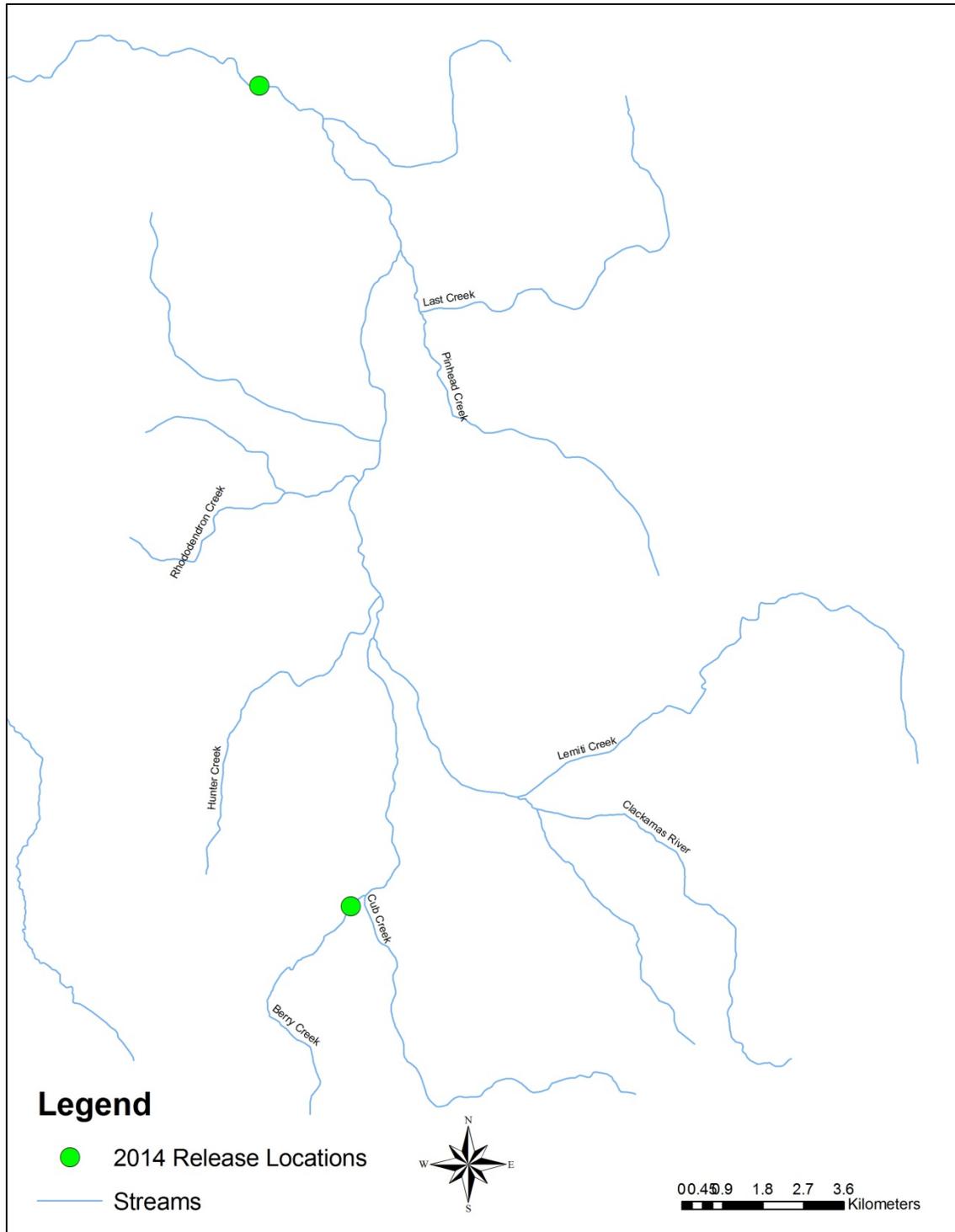


Figure 4. Release locations for bull trout in the upper Clackamas River in 2014. Most juveniles were released into Berry Creek at the Berry Creek bridge (Table 4). Adult/subadults were released approximately 100 m downstream of the FR 4650 bridge in the Big Bottom area of the mainstem upper Clackamas River.

2.3) Monitoring and Evaluation

2.3.1) Bull trout reintroduction effectiveness

We used a combination of fixed monitoring sites and mobile tracking to document the survival, behavior, and retention of juvenile, subadult, and adult fish to address the following questions (IM&E Plan, USFWS and ODFW 2011):

- 1) Do translocated subadult and adult bull trout remain in the upper Clackamas Basin (above River Mill Dam)?
 - 1a) If yes, what is their seasonal distribution?
 - 1b) If yes, is there evidence of spawning activity? If no, does changing the release timing/location provide a different result?
 - 1c) If no, do they return?
- 2) Is there successful production of progeny?
 - 2a) If yes, which life stage(s) produced them?

Fixed radio telemetry and PIT tag monitoring sites were operated throughout the Clackamas River Subbasin from the most downstream site, River Mill Dam, upriver to the Cub Creek confluence (Figure 2). Sites were chosen to adequately cover the expected distribution of subadult and adult bull trout in the Clackamas River (Table 1), and to determine whether there was spatial overlap between anadromous salmonids and radio-tagged bull trout in proximity to the hydro-system. Each fixed monitoring site was powered by AC power (Rivermill, North Fork, and Promontory Park sites), or DC power when AC power was unavailable. All sites were housed in waterproof environmental enclosures and logged data continuously. Two DC powered sites (Pinhead and Collawash) consisted of two 12-V 104 Amp hour (Ah) batteries that had enough stored power to run for approximately 21 days in the absence of power generation. Battery banks were charged via hydroelectric generators and/or photo voltaic charging systems. Four DC powered sites (Cub, Rhododendron, Hunter, and Upper Clackamas) consisted of one 12-V 104 Amp hour (Ah) battery with no external charging capability and were switched out on a regular basis. Each site was visually checked at least once per week during the period of July-October to minimize data loss or monitoring interruption. Each battery charge was also checked at that time using a hand-held voltmeter to ensure there was an adequate charge to run until the next weekly service check. During the expected peak outmigration of anadromous salmonids (e.g., October 15 – December 15 and April 15 – June 15) the fixed telemetry sites in the High Vulnerability Zones (HVZs) were checked and downloaded once weekly to determine whether bull trout were overlapping in space with smolts migrating from the upper Clackamas River, as required by the Stepwise Impact Reduction Plan (SIRP, NMFS 2011; USFWS and ODFW 2011).

Table 1. Site names, brief rationale of site inclusion, operational dates, and distribution of fixed telemetry sites in the Clackamas River watershed.

Site name	Site purpose	Operational dates	Clackamas River kilometer
River Mill Dam	River emigration/risk to anadromous salmonids	June 30, 2011 – Present	37
North Fork Dam	Risk to anadromous salmonids	June 30, 2011 – Present	48
Promontory Park	Reservoir occupancy	June 30, 2011 – Present	51
Oak Grove Powerhouse	Downstream/upstream occupancy	June 30, 2011 – Present	77
Collawash/Clackamas river confluence	Downstream/upstream occupancy	June 30, 2011 – Present	92
Pinhead Creek	Downstream/upstream occupancy, spawning indication	June 30, 2011 – Present	109
Cub/Berry creek confluence	Downstream/upstream occupancy, spawning indication	August 25, 2011 – October 19, 2011	125 ¹
Rhododendron Creek	Downstream/upstream occupancy, spawning indication	August 15, 2013 – November 16, 2013; July 15, 2014 – Present	115
Hunter Creek	Downstream/upstream occupancy, spawning indication	August 8, 2013 – November 14, 2013; July 15, 2014 – Present	118
Cub Creek	Downstream/upstream occupancy, spawning indication	August 4, 2013 – November 19, 2013; July 15, 2014 – Present	119
Upper Clackamas River	Downstream/upstream occupancy, spawning indication	August 4, 2013 – November 19, 2013; July 15, 2014 – Present	119

¹This is a calculated linear measurement for descriptive purposes from the confluence of the Clackamas and Willamette rivers (see Figure 2).

During 2014, PIT monitoring sites were operated at two locations: One at the mouth of Pinhead Creek and the other at the confluence of Cub Creek with the upper Clackamas River. Sites

consisted of an Oregon RFID Multi-Antenna Half Duplex Reader running up to four antennas. Sites were powered by 12 volt battery banks which were charged by solar panels. Solar power was routed through a Xantrex (XW-MPPT60-150) solar charge controller. To reduce electromagnetic noise during charging, battery banks were isolated from the reader by a West Fork Environmental battery switcher (WFE-1c-AV) set to switch every 2 hours. After installation, sites were visited once per week to download data and insure proper function until the end of the monitoring season.

The Pinhead PIT array was operational on March 27, 2014. Pinhead Creek flows into the Clackamas River through two channels; a mainstem and a side channel directly to the south. The site consisted of four antennas total with two antennas monitoring the mainstem and two antennas monitoring the side channel directly above the confluence with the Clackamas River. All four antennas were installed in a pass through orientation. The site was shut down on November 20, 2014.

The Cub Creek/Clackamas River PIT array was operational on April 10, 2014. The site originally consisted of a single antenna in Cub Creek orientated in a pass over configuration and located just upstream from the confluence with the Clackamas River. On April 22, a second pass over antenna was installed in Cub Creek directly upstream from the first. On June 19, the upstream antenna was taken offline to improve the read range on the first and a pass over antenna was installed on the Clackamas River just above the confluence with Cub Creek. Both the Cub Creek and Clackamas River antennas were run by the same reader. The site was shut down on November 20, 2014.

2.3.1a Adult life stage retention

Determination of whether subadult and adult fish remained in the study area was based on the detection of radio tagged individuals below River Mill Dam either at fixed sites (Rkm 37; Table 1) or by mobile detection of fish below River Mill Dam. Fish that passed below River Mill Dam but were later detected re-entering the study area were classified as having remained in the study area for the purposes of the reintroduction.

2.3.1b Subadult/adult seasonal distribution

We monitored the seasonal distribution of radio-tagged fish using the fixed sites (Table 1; see above) and by mobile tracking from a truck and on foot. A location census of radio-tagged individuals was conducted at least bi-weekly during the putative spawning season (late August – October). This census was typically made by driving from the downstream most point in the study area (North Fork Reservoir), to the upstream most point in the study area (upper Cub Creek and upper Clackamas River) in an attempt to locate each radio-tagged individual. Tributaries searched for the presence of radio tagged individuals included the Collawash River, the Hot Springs Fork of the Collawash River, the upper Clackamas River above its confluence with Cub Creek, Pinhead, Rhododendron, and Fish creeks. Tributaries not surveyed included the

Oak Grove Fork of the Clackamas River, Roaring River, Cabin, Last, Lemiti, Olallie, Squirrel, Cub, Berry, Hunter, Fawn, Lowe, and Kansas creeks.

In addition to radio tracking, bull trout detections at PIT arrays were used to further analyze seasonal distribution. Detection histories, length at tagging, and time since tagging were all scrutinized to determine if bull trout were adults or subadults at the time of detection on the PIT arrays. Bull trout were considered adults if evidence of a spawning migration could be established through tag detection histories, or length at tagging was ≥ 450 mm, or enough time had elapsed to allow the fish to mature (e.g., juveniles and subadults released in previous years). Conversely, bull trout were considered subadults if their migration patterns showed a lack of a spawning migration, or not enough time had elapsed to allow the fish to mature since release.

2.3.2) Juvenile life stage retention and seasonal distribution

Translocated juveniles were available for detection during movement past PIT arrays. Juveniles released in Cub and Pinhead creek watersheds were monitored for emigration into the mainstem Clackamas River by the PIT antennas at the confluence of each stream. Since no juveniles were released into the Pinhead watershed during 2014, the size of outmigrants released in previous years were unknown. Thus, these individuals were categorized as subadults/juveniles. No detection efficiencies were calculated during 2014 for either PIT array.

We monitored patch-level occupancy of juvenile bull trout in the Pinhead Creek patch using the approach identified in the bull trout reintroduction IM&E plan (USFWS and ODFW 2011). This approach used the protocol that has been developed (USFWS 2008) and implemented (USFS 2009) for monitoring the recovery of bull trout. In the case of the Clackamas reintroduction this protocol was useful, in part, due to limited resources for monitoring distribution and occupancy and because sample effort can reflect acceptable levels of confidence (e.g., 80%). Alternative, relatively labor intensive approaches (including the American Fisheries Society, Western Division's bull trout sampling protocol) may be necessary to achieve maximum statistical rigor. Briefly, in 2014 the sample design consisted of surveying randomly selected, spatially-balanced 50 m reaches. Reaches were sampled using minnow traps and from bottom to top by electrofishing using a Smith-Root LR-24. Voltage, frequency, and duty cycle were dependent on water temperature and conductivity. A minimum of ten baited (cured salmon eggs) minnow traps were placed within sampling reaches in 10 cm minimum water depth. Traps were retrieved after 24 hours. Minnow trapping occurred May 21-June 26 and electrofishing efforts July 14-31, 2014 in the Pinhead/Last creeks patch. Sampling occurred in 10 reaches with minnow traps and 17 reaches with electrofishing (Figure 5). All of these reaches were sampled in previous years. In addition to reach sampling, additional electrofishing efforts included areas between sample reaches in Pinhead and Last Creeks and in Fall Creek (Figure 5).

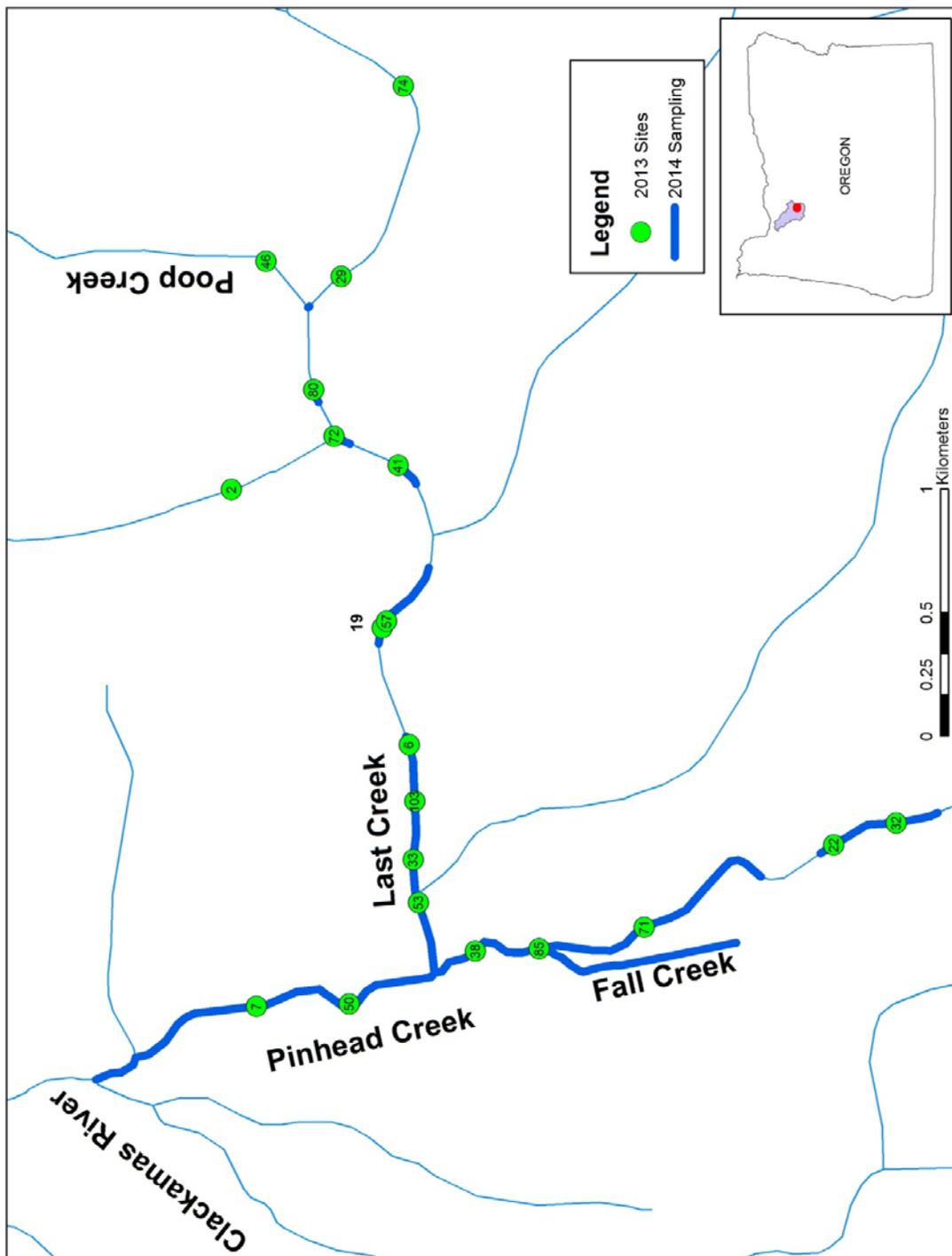


Figure 5. Sampling that occurred in previously monitored 50 m reaches (numbered green dots) in 2014 (minnow traps – reaches 7, 38, 71, 22, 32, 33, 6, 19, 41, 29; electrofishing – reaches 7, 50, 38, 85, 71, 22, 32, 53, 33, 103, 6, 19, 57, 41, 72, 80, 29). Additional electrofishing occurred between these reaches in the sections identified by bold blue lines.

2.3.3) Reproduction

Foot surveys were conducted in tributaries in which bull trout were suspected of spawning based on observations of radio-tagged fish. Prior to the putative spawning season, a zero count pass was conducted in Pinhead and Last creeks and the upper Clackamas River to mark anything that might be suspected of being a bull trout redd on subsequent surveys. During the suspected peak (based on observations of Clackamas spawning bull trout in 2011, 2012, and 2013) of spawning and after the suspected conclusion of spawning, the upper Clackamas River upstream of the Cub Creek confluence, and Pinhead Creek and its tributaries were surveyed for the presence of redds by single pass counts on September 17 and October 15, respectively, by crews of two to four individuals per reach or stream looking for redds, live bull trout spawning, or bull trout carcasses. Bull trout redds were identified by: 1) observed presence of bull trout via radio telemetry and/or visual observation or 2) by size. Surveys were conducted after bull trout had likely concluded spawning for the year but while coho and Chinook salmon were still spawning. Due to the temporal and spatial overlap among bull trout and salmon redds, we used redd size to help differentiate bull trout and salmon redds. Redds that ranged in size from 0.3 – 0.7 m in length measured from the upstream margin of the excavated pit to the downstream end of the depositional mound were considered bull trout redds whereas redds 1 – 2 m in length or larger were considered coho or Chinook salmon redds.

2.3.4) Genetics

Caudal fin tissue (approximately 1 cm²) was collected from each bull trout transferred to the Clackamas. These samples have been archived at the USFWS Abernathy Fish Technology Center (Longview, Washington). This sample archive will provide the opportunity for a parentage analysis in subsequent years of the reintroduction project.

2.3.5) Impacts to listed salmon and steelhead

The total time each subadult and adult bull trout spent in HVZ areas was monitored using fixed and mobile telemetry, as described above.

3) Results

3.1) Implementation

3.1.1) Donor stock availability

In 2014 a total of 540 bull trout redds were documented in the Metolius Basin (Mike Riehle, US Forest Service pers. comm.). Assuming an average of 2.3 adult bull trout/redd (a ratio which falls within the range of those found by Dunham et al. 2001), the estimated adult abundance of spawning adults was approximately 1,242 in 2014 (Figure 6), again satisfying the criteria (>800 spawning adults) to continue transfers to the Clackamas in 2015.

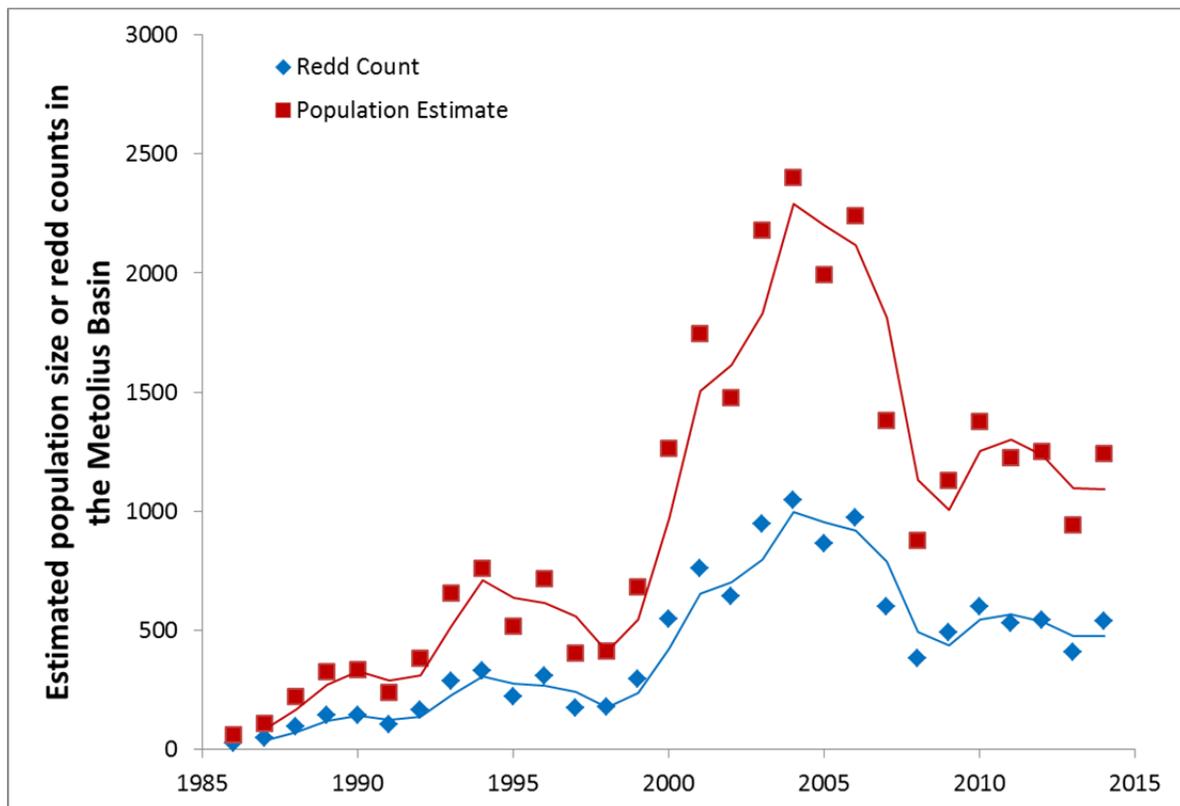


Figure 6. Raw redd counts and population estimates through 2014 for the Metolius bull trout population. Population estimates were calculated by multiplying redd counts by 2.3 (Dunham et al. 2001).

3.1.2) Pathogen screening

All samples screened in 2014 tested negative for IHN, IPN, VHS, paramyxo, and aquareo virus. However, all 60 juveniles tested positive for *Renibacterium salmoninarum*, the causative agent of bacterial kidney disease (BKD). All transplanted fish were treated with a prophylaxis of azithromycin to mitigate for the effects of BKD.

3.1.3) Donor stock collection

A total of 57 subadult and adult bull trout (251 – 650 mm TL) were captured for translocation (7 via angling, 43 via trap net, and 7 of unknown origin (either trap net or angling)) (Table 4). Of these, 4 were not used for various reasons (e.g., previously PIT tagged by another research project, scars from apparent raptor interaction, hook injury, deformed jaw, missing fins, blind in both eyes, opercle deformity, scale loss, >650 mm, mortality prior to tagging, etc.). We translocated 46 subadult and 7 adult bull trout to the Clackamas River (Table 5).

We translocated 305 PIT tagged juveniles (70 – 250 mm TL) to the Clackamas River (Berry Creek). In addition, 17 juveniles died during collection efforts on April 23, April 30, May 14, May 21, and May 28 (all prior to transport) that were not included in the total (Table 6). To date, more than 1,750 bull trout have been translocated from the Metolius to the Clackamas River (Table 5).

Table 2. Origin of subadult and adult bull trout collected in the Metolius River system for transport to the Clackamas River. Fish were either collected by angling for fish in the upper Metolius arm of Lake Billy Chinook, or from Oneida trap nets set in the upper Metolius arm of Lake Billy Chinook.

Capture dates (2014)	Angling	Trap Nets	Unknown
June 2 – 3	0	15	0
June 9 – 10	5	14	0
June 16 – 17	0	3	7
June 22 – 23	6	3	

Table 3. Count by year and life stage of bull trout captured in the Metolius River Basin and translocated to the Clackamas River Basin.

Life stage	Count Translocated				
	2011	2012	2013	2014	Total
Juvenile	58	509	615	305	1,487
Subadult	24	43	91	46	204
Adult	36	17	8	7	68

Table 4. Dates, number released, capture source in the Metolius drainage, and release location of juvenile bull trout in the Clackamas drainage in 2014. Juveniles were captured in 1.5 m rotary traps deployed near the mouth of Jack, Canyon, and Candle creeks (Metolius River tributaries) or Oneida trap nets in the Metolius arm of Lake Billy Chinook.

Release Date	Juvenile count by collection location (Jack Cr/Canyon Cr/Candle Cr)	Count transferred	Release location
April 24	14/34/4	53	Berry Creek Bridge
April 31	35/48/0	83	Berry Creek Bridge
May 8	0/8/0	8	Berry Creek Bridge
May 15	42/25/15	82	Berry Creek Bridge
May 22	10/9/5	24	Berry Creek Bridge
May 29	16/3/11	30	Berry Creek Bridge
June 5	4 Lake Billy Chinook	4	100 m downstream of 4650 bridge
June 12	7 Lake Billy Chinook	7	100 m downstream of 4650 bridge
June 19	7 Lake Billy Chinook	7	100 m downstream of 4650 bridge
June 25	8 Lake Billy Chinook	8	100 m downstream of 4650 bridge
Source	Jack Creek	117	
Totals:	Canyon Creek	127	
	Candle Creek	35	
	Lake Billy Chinook	26	
	Total translocated to Clackamas:	305	

3.1.4) Release locations and timing

There were ten releases of juvenile and four releases of subadult and adult bull trout in 2014 (Tables 6 and 7; Figures 3 and 4). Juvenile outplanting was spread over a ten week period. Subadults and adults were released over a four week period.

Table 5. Date of release, quantity by capture method, total released, and release location of subadult and adult bull trout in 2014. All fish were collected in the Metolius arm of Lake Billy Chinook in Oneida trap nets or by angling in the Metolius arm. All fish were released in the Clackamas River in slow moving water 100 m downstream of the 4650 bridge (Figure 4).

Release Date	Subadult/adult count and collection method	Count transferred	Release Location
June 5	15 subadults trap net	15	100 m downstream of 4650 bridge
June 12	12/2 subadults/adults trap net; 3/2 subadults/adults angling	19	100 m downstream of 4650 bridge
June 19	2/1 subadults/adults trap net; 5/2 subadults/adults unknown	10	100 m downstream of 4650 bridge
June 25	9 subadults trap net	9	100 m downstream of 4650 bridge

3.2) Monitoring and Evaluation

3.2.1) Bull trout reintroduction effectiveness

3.2.1a Adult life stage retention:

Zero individuals from the 2011, 2012, 2013, or 2014 cohorts were detected leaving the study area in 2014.

Table 6. Counts of radio tagged individuals released (n = 180).

	Release cohort							
	2011		2012		2013		2014	
	subadult	adult	subadult	adult	subadult	adult	subadult	adult
Radio tagged individuals released	24	36	43	17	52	8	0	0
Count of active tags during summer 2014	2	1	0	0	31	6	-	-
Number of tags detected in 2014	2	1	-	-	26	5	-	-

3.2.1b Seasonal Distribution

During the summer of 2014, the majority (87%) of radio tagged individuals detected were observed throughout the mainstem Clackamas River from North Fork Reservoir upstream to the confluence of Pinhead Creek and the Clackamas River. Additionally, one fish was detected in the Collawash River and three fish were detected in North Fork Reservoir. Fish started to exhibit movement indicative of upstream spawning migrations beginning primarily in August, and one fish was observed exhibiting staging behavior at the mouth of Pinhead Creek as early as July 19. Detections of bull trout were primarily limited to the mainstem Clackamas River and Pinhead Creek, however, one individual was detected entering Rhododendron Creek on August 23 (occupancy = 3 hrs). Additionally, two fish were detected entering the upper Clackamas above its confluence with Cub Creek (occupancy = 13-20 d). Bull trout that did not enter suspected spawning areas during the putative spawning season (August – October) remained largely dispersed throughout the mainstem Clackamas River. Spawning could occur in the Clackamas mainstem, but we have not evaluated that to date.

Two bull trout moved through the hydroelectric facility downstream of North Fork Reservoir in 2014. One fish was detected moving downstream through the migrant pipe June 6, and was later detected returning back upstream through the River Mill ladder on June 13. This same fish was later detected re-entering the Upper Clackamas basin as it passed the North Fork adult sorting facility on June 15. This fish was released as an adult in June 2013 (FL = 530 mm). Upon detection in the fish ladder, it measured 550 mm (FL; .05 mm/day average growth rate). The second fish was detected moving upstream through the hydro project in May. This fish was released as a juvenile in May 2013 (FL = 157 mm). Upon detection in the fish ladder, it measured 345 mm (FL; .51 mm/day average growth rate). Neither of these fish has subsequently been detected. To date only two bull trout have left the study area through volitional emigration (in 2011).

Thirty-one individual subadult/juvenile bull trout were detected at the Pinhead Creek PIT array (Figure 7). Some fish were detected in multiple months. Detections of subadult/juvenile bull trout peaked in August and September. All subadult/juvenile detections were from juvenile (≤ 200 mm TL at release) outplants in 2012, 2013, and 2014. A single bull trout released in Berry Creek (Cub Creek tributary) in May at 121 mm TL, was detected entering Pinhead Creek in August (Table 7). The antennas did not monitor full time during the months of April, June, July, and November, therefore tagged fish may have passed the antennas undetected.

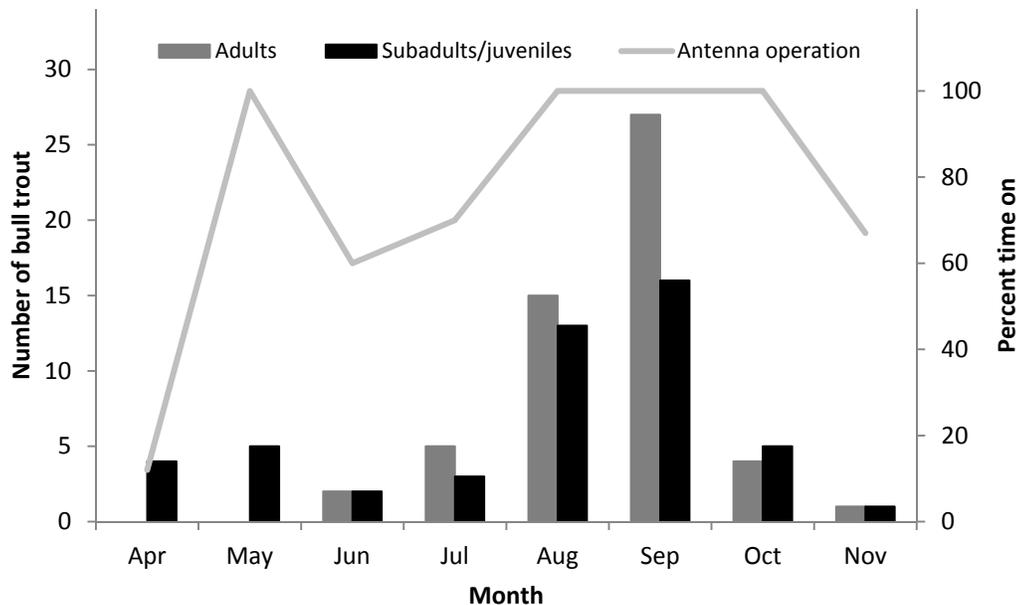


Figure 7. Detections of PIT tagged bull trout at the Pinhead Creek PIT array. Array operational status is displayed in percentage of hours per month the array was on and functioning.

Table 7. Release location and year of subadult/juvenile bull trout detected at the Pinhead PIT array in 2014.

Release site	Release year		
	2012	2013	2014
Pinhead Creek	5	0	0
Last Creek	3	6	0
South Fork Pinhead Creek	2	0	0
Berry Creek	0	0	1
Unknown (Pinhead watershed)	0	14	0
Totals	10	20	1

Thirty-six individual adult bull trout were detected at the Pinhead Creek PIT array during all months of operation (Figure 2). Some fish were detected multiple months. Adults began entering the mouth of Pinhead Creek in June and July most likely to stage. Detections of adults peaked in September which coincides with timing of peak spawning in other bull trout populations. Bull trout from all four release years were detected entering Pinhead Creek during 2014 (Table 8). Of the 36 adult bull trout detected at the Pinhead PIT array, 30 were released as subadults or adults. The remaining six were released as juveniles in Last Creek during 2011.

Table 8. Release location and year of adult bull trout detected at the Pinhead PIT array in 2014.

Release site	Release year			
	2011	2012	2013	2014
Last Creek	8	0	0	0
4670 side channel	0	5	0	0
4670 bridge	0	4	0	0
4650 bridge side channel	0	1	0	0
Lower 4650 bridge	0	0	9	4
Downstream of Austin H.S.	0	0	5	0
Totals	8	10	14	4

A total of six adult bull trout were detected on the Clackamas River and Cub Creek antennas. All detections were in September. Three adults were detected entering the upper Clackamas River, one adult was detected entering Cub Creek, and two adults were detected on both antennas. All fish were released as subadults (range 342-396 mm TL) during 2012 (1) and 2013 (5) in the mainstem Clackamas River near the Big Bottom area. Three of these adults were also detected on the Pinhead Creek array with one fish moving back and forth throughout September.

3.2.2) Juvenile life stage retention and seasonal distribution

Twenty individual juvenile bull trout were detected leaving Cub Creek during 2014 (Figure 8). Some fish were detected in multiple months. Detections peaked in May when 13 fish moved past the array. All fish detected leaving were from releases into Berry Creek during 2014. After no detections during the summer months, downstream migration out of Cub Creek resumed in September. Four juveniles were detected swimming upstream into the upper Clackamas River in October and November. Some migrants may have passed antennas undetected due to site failures throughout the monitoring season.

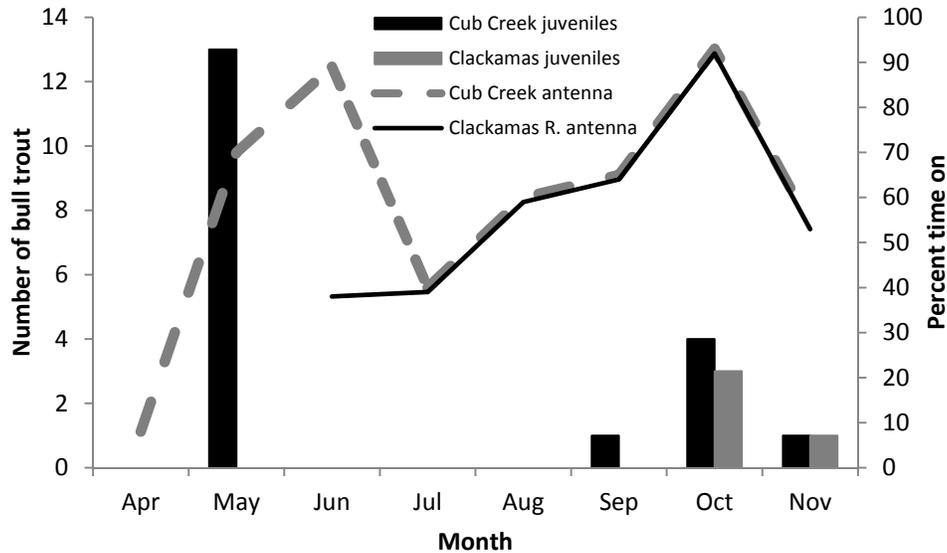


Figure 8. Detections of PIT tagged bull trout at the Cub Creek and Clackamas River PIT antennas. Antenna operational status is displayed in percentage of hours per month the array was on and functioning.

In the summer of 2014, the Pinhead Creek patch was occupied by translocated bull trout. Three translocated bull trout were captured during electrofishing efforts. These fish were all captured in Pinhead Creek. Captures occurred in stream areas between reaches 85 and 71, between reaches 71 and 22, and between the FR 46 bridge and reach 7 (Figure 5). All three of these recaptured bull trout were translocated to Pinhead Creek in spring 2013. Growth rates of these fish averaged .04, .08, and .09 mm/day between release and recapture. No bull trout were captured within 50 m sample reaches during electrofishing or minnow trapping.

Additional species collected in 2014 include 208 coastal cutthroat trout, 28 juvenile coho salmon, 5 sculpin during minnow trapping and 308 coastal cutthroat trout, 92 juvenile coho salmon, 4 *O. mykiss* and 1657 sculpin during electrofishing efforts. Coastal cutthroat trout ranged from 25 to 222 mm fork length. Coho salmon ranged from 32 to 101 mm fork length. *O. mykiss* ranged from 72 to 184 mm fork length. Lengths were not collected from sculpin.

3.2.3) *Reproduction*

No bull trout spawning behavior or redd construction was observed on the zero count survey on August 6, 2013, however one adult bull trout was seen and identified by a surveyor in Pinhead Creek. We observed 36 presumed bull trout redds in 2014, 9 during subsequent spawning surveys and 3 while surveying for radio tagged fish. This is the highest count since the reintroduction began in 2011. Consistent with past years, adults were observed actively spawning in Pinhead and Last creeks in September and October.

3.2.4) *Genetics*

Tissues were collected from 375 bull trout in 2014. All samples were archived at the USFWS operated Abernathy Fish Technology Center (Abernathy, Washington).

3.2.5) *Impacts to listed salmon and steelhead*

Documented occupancy of the HVZ by presumed live bull trout remained low in 2014. Two of the 2013 cohort of bull trout were detected in the HVZ in 2014. During the spring monitoring period (April 15 – June 15), one individual (150.390 code 42, 530 mm adult outplanted 6/6/13) was detected passing downstream of North Fork Dam on 10 Jun and was subsequently detected at Rivermill Dam the same day. This fish remained in range of the Rivermill site until 13 June before moving upstream, and was briefly detected at North Fork Dam on 20th June before moving rapidly upstream past Promontory Park. This fish revisited the reservoir for a single day (30 sept) in fall 2014 but then moved back upstream past Promontory Park and was not observed in the HVZ during the fall monitoring period. This pattern of behavior appears to represent exploratory behavior rather than a feeding migration associated with anadromous salmonid outmigration. A second individual (150.390 code 56; 355 mm subadult outplanted 6/11/13) has been present in North Fork Reservoir since shortly after release in 2013. Although subjective, the pattern of detection suggests this fish may have died soon after outplanting. It was detected passing Promontory Park 8 days after release and took 2 days to pass this point. Thereafter, it was detected by mobile tracking in proximity to the log booms throughout the summer. In Dec 2013, the tag was detected by the receiver at North fork continuously from Dec 2 to Feb 9 (2014) but generally at very low power readings-indicative of a tag that is either very deep or at some distance from the receiver. The tag was also detected by the North fork receiver periodically and with generally low power readings in Aril and May 2014. Then again from Oct 2014-Jan 2015. Since release, this individual has never been detected above Promontory Park and has not made a spawning migration in either 2013 or 2014, though it might reasonably have been expected to (particularly in 2014). The low power readings also suggest that this individual is not in close proximity to North Fork dam itself. We speculate that this may be a mortality. In addition to these two individuals, two bull trout that were spilled during high flow events in previous years are present in Faraday Diversion pool-but assumed dead based on lack of movement for several years, the tags emitting a mortality code, and the manner of their passage.

4) Conclusions

Monitoring and evaluation of project effectiveness relative to bull trout has revealed that recently reintroduced subadult and adult bull trout have largely remained in the Clackamas River within the study area. Of particular note, some of the subadult and adult outplants from all years remained in the subbasin and migrated into Pinhead Creek more than one year after being translocated from the Metolius River, presumably to spawn. Some of these individuals were outplanted as juveniles and subadults that were not sexually mature upon release and may have reached sexual maturity in the Clackamas River Subbasin. Overall, only two subadult and adult bull trout have been observed emigrating from the system.

The fate of most translocated juveniles is unknown. Juvenile bull trout were once again captured during an electrofishing survey in Pinhead Creek, all from the prior year's transplant, suggesting that at least some are remaining in this tributary to rear. A better understanding of bull trout survival in Pinhead Creek will provide insight to whether or not a resident component to the population is being established

We have documented evidence suggestive of spawning in each year since implementation of the reintroduction. The majority of spawning activity has been observed in Pinhead Creek. Furthermore, there is additional evidence of repeat spawning behavior between years. Mobile and fixed telemetry data suggest that spawning may be occurring in other areas as well (e.g., Upper Clackamas River and Cub Creek patches). No wild progeny have been captured to date. If successful spawning has occurred in every year since 2011, it is possible that we have three generations of F1 wild bull trout in the Clackamas River but they would likely be in low abundance.

The effects to salmon and steelhead predation to this point can only be inferred from bull trout distribution data. There has been little bull trout residence of High Vulnerability Zones in which anadromous smolts are deemed vulnerable to predation by bull trout. Further, annual counts of outmigrating smolts and juvenile anadromous salmonids (have indicated no correlated reductions in population abundance since implementation of the reintroduction project in 2011.

The results of the annual pathogen screening suggest that there was low risk for transferring pathogens of concern to the Clackamas basin. In 2014, we repeated the 2013 pathogen screening protocols (150 fry lethally sampled, and 60 juveniles lethally sampled) because of concern for the potential negative effect of handling spawning adults. Lethal testing of the juvenile bull trout life stage was continued in lieu of non-lethal seminal and ovarian fluids collected from gravid adults. Given the healthy status of the Metolius bull trout population and the relatively high abundance of the juvenile life stage, the annual sacrifice of 60 juveniles, in addition to the 150 fry, is expected to have no measurable impact on the overall Metolius population. The Metolius spawning population for fall 2014 is estimated at > 1,200 spawning individuals.

Overall, the reintroduction effort is showing signs of potential success in reaching the project's goal. Bull trout are staying in-basin, presumably recruiting into the adult population, and exhibiting spawning behavior in increasing numbers. Data gaps include evidence of successful natural production, survival from egg to juvenile life stages, and any potential impacts to listed salmon and steelhead both inside and outside of High Vulnerability Zones.

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