Use of the Mainstem Columbia River by Walla Walla Basin Bull Trout

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FINAL

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Abstract

A significant gap in our knowledge of migratory bull trout *Salvelinus confluentus* life history is associated with their use of the mainstem Columbia River. Very little data is available regarding movements within the mainstem, the use of mainstem habitats, or bull trout presence and/or passage at the mainstem dams. Columbia and Snake River dams have the potential to not only impact connectivity within migratory corridors, but also the connectivity between bull trout core areas (metapopulations). This connectivity is required to maintain genetic diversity of the core area metapopulations in the Columbia River Distinct Population Segment, and for re-colonization of areas where local populations have been extirpated by natural stochastic events or impacts from human-related activities. From 2005-2009, the U.S. Army Corps of Engineers (COE) funded the U.S. Fish and Wildlife Service (FWS) to evaluate use of the mainstem Columbia River by Walla Walla Basin bull trout (Study Code: BT-W-05-6). This study utilized full duplex ISO 134 passive integrated transponder (PIT) detections at an instream PIT detection array to describe bull trout migration timing, and to quantitatively estimate that 192 bull trout may have migrated from the Walla Walla Basin to the Columbia River from 2007 to 2009. In 2010, the COE funded the FWS to further study bull trout use of the Columbia River by initiating an acoustic telemetry study to monitor migratory bull trout movements, habitat use, and presence/passage at Columbia River mainstem dams. Acoustic transmitters and monitoring equipment were acquired in January 2010 and were tested for functionality. The results of testing were used to develop the tracking methodology that would be used to monitor acoustic-tagged bull trout as they exit the Walla Walla River and move throughout the Columbia River. Various fish sampling techniques including a rotary screw trap, fyke nets, angling, and beach seines were used in an attempt to capture migratory bull trout in the lower portion of the Walla Walla River. No bull trout were captured or tagged from mid-January through May 2010, therefore no monitoring was conducted. Six PIT tagged bull trout were detected at the instream PIT detection array near the mouth of the Walla Walla River moving toward the Columbia River from October to December 2009 indicating that the majority of emigration occurred prior to study commencement in mid-January 2010. No PIT tagged bull trout from the Walla Walla Basin were detected at mainstem dams during the reporting period. During FY2011, we plan to conduct our sampling effort for bull trout during the October through February time period when most of the emigration from the Basin occurs, and we hope to capture and tag a number of individuals that will allow us to track movements in the mainstem Columbia River.

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Introduction

A general decline in bull trout *Salvelinus confluentus* abundance across their native range resulted in the listing of all populations in the Columbia River Distinct Population Segment as threatened under the Endangered Species Act in June 1998 (63 FR 31647). The U.S. Fish and Wildlife Service (FWS) Biological Opinion (USFWS 2000) and Draft Recovery Plan for the Umatilla-Walla Walla Recovery Unit (USFWS 2002) identifies the action of improving connectivity between populations of Columbia River bull trout as a necessary step to help protect against localized extinctions. Both documents specifically discuss the need for monitoring and research on bull trout use of the Columbia River. Mainstem Columbia and Snake River dams have the potential to impact both bull trout connectivity within migratory corridors as well as the connectivity between core areas (metapopulations). Dams lacking sufficient passage for bull trout create barriers for migration and may isolate historically connected populations. Bull trout also have the potential to be entrained at dams and suffer mortality or injury associated with turbine passage. Dams and their respective reservoirs alter the natural hydrograph and the riverine habitats that were historically used by migratory bull trout, and they create unnatural slow-moving warm water “reservoirs” which are more favorable for exotic predators and competitors, and may affect migration timing (Williams et al. 2005; Ferguson et al. 2005).

Walla Walla Basin Bull Trout

The Walla Walla Basin is comprised of five bull trout local populations and two core areas. Three local populations are located in the Touchet River Subbasin (Touchet River Core Area), and two local populations are located in the Walla Walla River Subbasin (Walla Walla River Core Area). The FWS-funded research on the Mill Creek and Walla Walla River local populations is focused on bull trout life history, population dynamics, and habitat requirements. The FWS is cooperating with the Oregon Department of Fish and Wildlife (ODFW), Washington Department of Fish and Wildlife (WDFW), and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) on bull trout life history studies in the Basin. The CTUIR are also engaged in spring Chinook salmon re-introduction and steelhead life history research. As part of this research, the CTUIR cooperatively tags bull trout captured by their screw traps with passive integrated transponder (PIT) tags provided by FWS.

In the Walla Walla Basin, most of the detailed data on migratory bull trout life history and distribution has been obtained from the FWS network of instream PIT tag detection arrays deployed throughout the basin. In addition, a basin-wide, multi-agency PIT tagging effort maintains a tagged population for detection at each of the arrays. Full duplex 12 mm and 23 mm ISO 134 PIT tags and compatible detection arrays are the foundation of this work. The detection array infrastructure has been developed incrementally over the last seven years, including the addition of the U.S. Army Corps of Engineers (COE)-funded Oasis Road Bridge site in 2005 near the mouth of the Walla Walla River at river kilometer (rkm) 10. Life history and distribution information has also been obtained from other fish sampling efforts throughout the basin.

Each of the bull trout local populations in the Walla Walla River Core Area has a resident and migratory (fluvial) component. Resident bull trout complete their entire life cycle in the headwater streams in which they spawn and rear. Migratory bull trout spawn in headwater streams along with resident bull trout, and their juveniles rear from one to four years before migrating downstream as subadults to mainstem river habitats (Fraley and Shepard 1989; Goetz 1989). Adult bull trout return to headwater spawning areas in September and October, followed by a downstream migration to overwintering areas in October through December. Resident and migratory forms may be found together, and either form may give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). Both subadult and adult bull trout use the lower Walla Walla River during the fall, winter, and spring for rearing and overwintering. Recently, use of the mainstem Columbia River by migratory adults and subadults has also been documented (Anglin et al. 2009a, 2009b, 2010, 2010a).

Bull Trout Use of the Mainstem Columbia River

A significant gap in our knowledge of migratory bull trout life history is associated with use of the mainstem Columbia and Snake rivers. The numbers of bull trout using the mainstem are few when compared to anadromous salmonids. Nearly all of the wild and hatchery-produced salmon and steelhead smolts eventually migrate downstream, through the system to the ocean. A much smaller proportion (i.e. migratory) of the total population of bull trout produced in the Walla Walla Basin actually migrates into the mainstem. Nonetheless, the migratory bull trout that use the mainstem corridors are essential for maintaining gene flow between core area metapopulations and for recolonizing areas where local populations have been extirpated by stochastic events.

In 2005, the COE funded the FWS to evaluate use of the mainstem Columbia River by Walla Walla Basin bull trout (Study Code: BT-W-05-6). Over five years, this study, the resulting data located on the PTAGIS website (www.ptagis.org), and the annual and final reports (Anglin et al. 2009a, 2009b, 2010, 2010a) documented Walla Walla Basin bull trout migrations into and out of the mainstem Columbia River. Monthly PIT tag detections at the Oasis Road Bridge PIT detection array were adjusted for monthly detection probability, and monthly estimates of mark proportions were applied to estimate that a total of 192 bull trout may have left the Walla Walla Basin for the Columbia River from 2007-2009 (Anglin et al. 2010a).

Little information is available regarding movements within the mainstem Federal Columbia River Power System (FCRPS), the use of mainstem habitats, or bull trout presence and/or passage at the mainstem dams. Current knowledge regarding the distribution of migratory bull trout in the mainstem consists primarily of observations at adult fish ladder counting stations and juvenile fish bypass facilities at the mainstem hydro projects, and more recently, PIT tag detections at these projects (USACE 2010; Fish Passage Center 2010; Anglea et al. 2004). From 1999 through 2009, there have been at least 175 confirmed bull trout observations in the adult ladders at mainstem hydro projects. At three of the four lower Snake River projects (Lower Monumental, Little Goose, Lower Granite), 169 bull trout have been observed in the fish ladders. The remaining six bull trout were observed at three of the four lower Columbia River projects (Bonneville, John Day, McNary). Over this same time period, there have been at least 123 confirmed observations of bull trout from the juvenile bypass systems of these same projects (three from the lower Columbia projects and 120 from the lower Snake projects). There have been only five detections of PIT tagged bull trout at mainstem projects (Table 1), four of which are a result of PIT tagging migratory bull trout in the Walla Walla Basin in 2008 and 2009.

Table 1. Migratory bull trout PIT detections at mainstem Columbia River projects.

Tagging/Detection Location	Tagging--Detection Date
Touchet River/John Day juvenile bypass	04/24/08--05/12/08
Walla Walla River/McNary juvenile bypass	07/30/08--04/15/09
Walla Walla River/McNary adult ladder (Oregon)	10/23/08--05/25/09, 06/19/09
Walla Walla River/Priest Rapids adult ladder (east)	01/28/09--07/05/09
Entiat River/Priest Rapids adult ladder (east)	11/16/08--11/21/09

PIT tagged bull trout have been detected dispersing into the Columbia River during the fall and winter (Anglin et al. 2009a, 2009b; 2010; 2010a), which generally coincides with the shutdown of the juvenile fish bypass systems at the FCRPS projects. The movements and disposition of bull trout that enter the Columbia River are largely unknown, including the specific temporal and spatial aspects of migration through McNary Reservoir. Details regarding movements around, or passage through the mainstem hydropower projects are also largely unknown. There are two primary routes of passage at mainstem dams during the winter; 1) adult ladders which are primarily designed for upstream passage, and 2) turbines which are not monitored for PIT tags. It is unknown if bull trout attempt to pass the dams and fail, if they pass successfully but undetected, or if they are fatally injured while attempting to pass. Acoustic telemetry may be a useful tool to help describe bull trout migration patterns and habitat use in McNary Reservoir, and movement patterns around mainstem FCRPS hydropower projects. These data could then be used to determine if there are impacts associated with these projects, and if there is a need for physical or operational changes to avoid adverse impacts to bull trout.

Study Area

Walla Walla Basin

The Walla Walla Basin in Northeastern Oregon and Southeastern Washington is a tributary of the Columbia River that drains an area of 4,553 km^2 (NPCC 2004). The Basin is comprised of the Touchet River Subbasin, the Mill Creek Subbasin, and the Walla Walla River Subbasin. The primary headwater tributaries originate in the Blue Mountains and include the North and South Forks of the Walla Walla River, upper Mill Creek, and the North Fork, South Fork, and Wolf Fork of the Touchet River (Figure 1). The Walla Walla Basin historically supported a number of anadromous and resident, native salmonid populations including; spring and fall Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), redband trout (*O. mykiss* subpopulation), bull trout (*S. confluentus*), mountain whitefish (*Prosopium williamsoni*), and summer steelhead (*O. mykiss*) (NPCC 2004). Currently, *O. mykiss* are the only remaining native anadromous salmonid in the Walla Walla Basin. In 2000 however, a supplementation program for spring Chinook salmon was initiated by the CTUIR in the South Fork Walla Walla River using outplanted adults to initiate spawning. The current plan is to continue supplementation using spring releases of hatchery raised smolts. Populations of native redband trout and mountain whitefish still persist in the Walla Walla Basin.

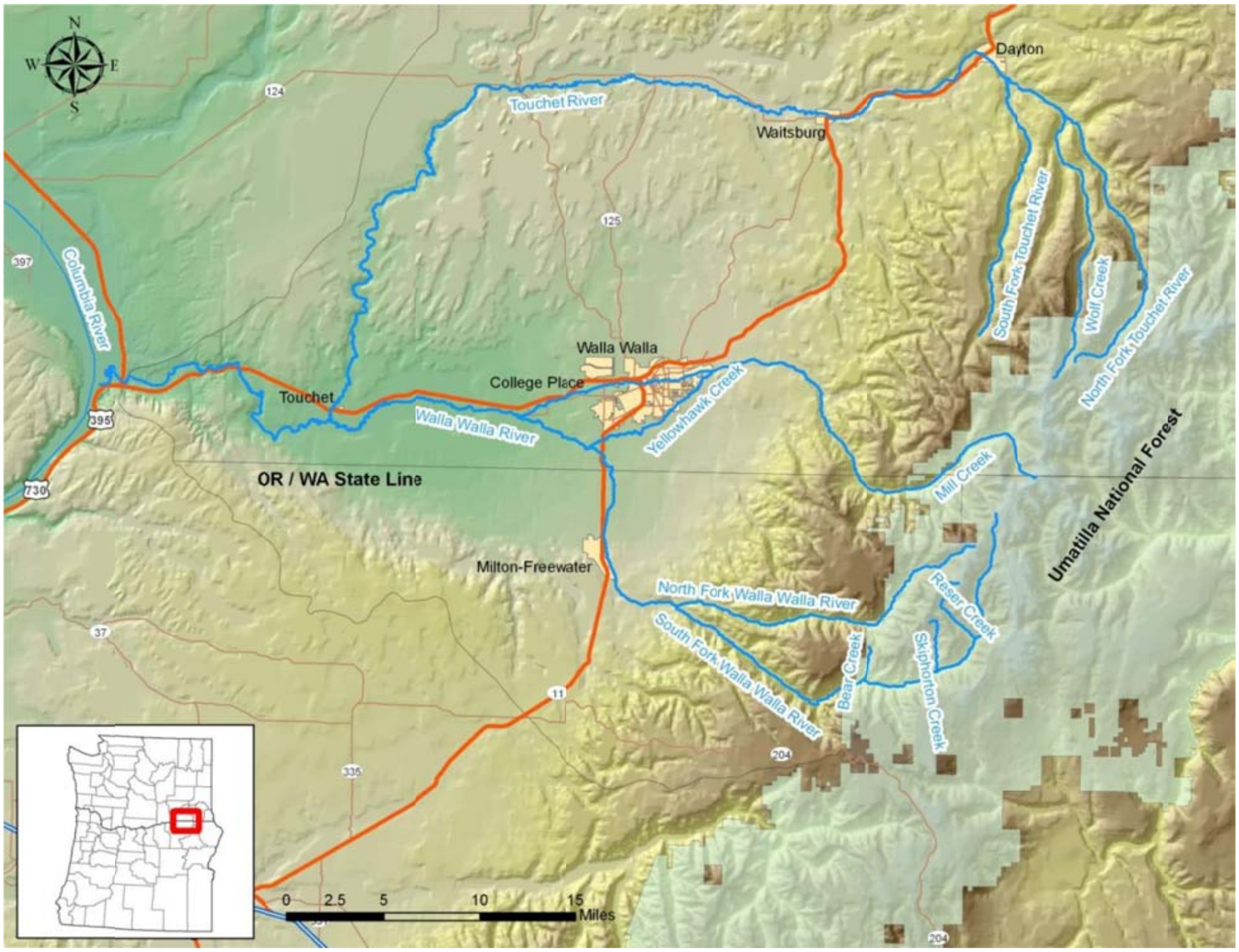

Figure 1. Walla Walla Basin depicting the Touchet River, Mill Creek, and Walla Walla River subbasins.

Mainstem Columbia River

The targeted study area is the portion of the mainstem Columbia River known as Lake Wallula, which is the reservoir formed by McNary Dam (Figure 2). McNary Dam is located 470 rkm upstream from the Pacific Ocean and 52 rkm downstream of the confluence of the Columbia and Snake rivers. Lake Wallula extends 98 rkm upstream from McNary Dam to the Hanford Reach on the Columbia River, and impounds 16 rkm of the Snake River upstream to Ice Harbor Dam (Evans et al. 2010).

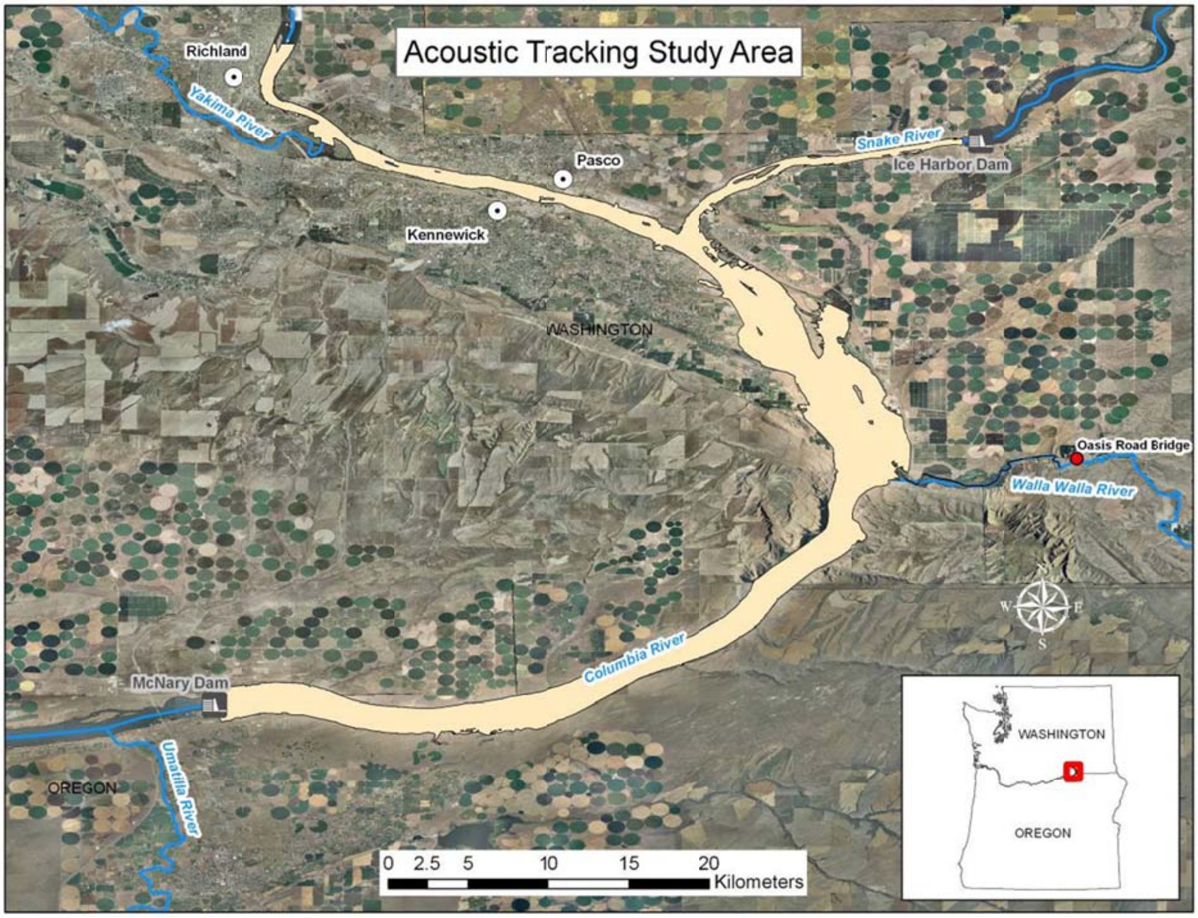

Figure 2. Mainstem Columbia River study area depicting Lake Wallula (McNary Reservoir).

Methods

Equipment Acquisition and Testing

At the initiation of the project in December 2009, we reviewed the available options for acoustic telemetry equipment that were appropriate for both passive and active monitoring of migratory bull trout as they exit the Walla Walla River and move throughout the Columbia River. Transmitter size and life expectancy were the primary factors considered during equipment review and acquisition. Based on previous migration timing data (Anglin et al. 2010a), there was little time remaining to capture and tag bull trout before the end of the migration season for the current study year. As a result, equipment availability and projected delivery date became important factors. In mid-January 2010, we received acoustic monitoring equipment and transmitters. The two sets of acoustic monitoring equipment each included a USR-08 receiver, DH-4 directional hydrophone, waterproof pelican case, external speaker, professional-grade headphones, and a test transmitter. We also acquired two TH-2 towable, omnidirectional hydrophones. These equipment components comprised our mobile tracking system for Lake Wallula. In addition to the mobile tracking equipment, we acquired a single Submersible

Ultrasonic Receiver (SUR) to be deployed at the mouth of the Walla Walla River for passive monitoring of acoustically tagged bull trout as they moved into the Columbia River. We received 20 acoustic transmitters comprised of three different sizes to accommodate the range of bull trout sizes we expected to capture. The transmitters included two PT-3 sub-miniature Pico Tags, 15 PT-4 sub-miniature Pico Tags, and three miniature IBT tags. Transmitter specifics are summarized in Table 2.

Table 2. Manufacturer (Sonotronics Inc.) specifications for acoustic transmitters.

Model	PT-3	PT-4	PT-4	IBT-96-9-I
Transmitter Weight in Air (g)	2.2	4.0	4.0	8.8
Transmitter Length (mm)	19.0	25.0	25.0	47.0
Tag Diameter (mm)	7.8	9.0	9.0	10.5
Ping Rate (s)	20	10	20	3
Frequency (kHz)	75.0	75.0	75.0	75.0
Transmitter Life Expectancy (days)	60	170	270	270
Quantity Acquired	2	8	7	3

Transmitter function was verified by activating each tag in water and briefly monitoring the signal with the receiver and the omnidirectional hydrophone. In addition, we confirmed that each transmitter decoded to its uniquely assigned aural interval and associated code. We also deployed a test tag at depths of 1.5 m and 14 m in a fixed location to determine if water depth affected our ability to detect a deployed transmitter. We monitored each deployment with the receiver and the omnidirectional hydrophone. All settings on the receiver remained consistent during testing, and we monitored from a distance of 100 meters.

In addition, we tested both the detectable and decodable ranges for each of the different sizes of acoustic transmitters. First, we activated and deployed one of the PT-3 transmitters in a stationary location. We then monitored the transmitter from stationary positions at 50-meter increments using the receiver and the omnidirectional hydrophone until the signal could no longer be reliably detected. This exercise was repeated for both the PT-4 and IBT transmitters. We also repeated the testing with the directional hydrophone.

We tested the feasibility of boat tracking at differing speeds with the receiver and the directional and omnidirectional hydrophones, and compared detectable and decodable ranges to the results from stationary testing. We deployed a test transmitter at a stationary location, then attempted to detect and decode the transmitter by motoring along specific transects at slower and faster speeds.

Results from hydrophone and transmitter testing activities were used to develop appropriate mobile tracking methods for monitoring acoustic-tagged bull trout in the mainstem Columbia River.

The SUR was intended to passively monitor acoustic-tagged bull trout as they exit the Walla Walla River and enter the Columbia River. We tested the SUR to confirm functionality near the mouth of the Walla Walla River. We first synchronized the SUR's internal clock with field staff watches and ensured the settings were appropriate for detecting our acoustic transmitters. We then tethered the SUR with an anchor and ¼ inch wire rope to a bridge pillar in the center of the river and attached a weight to ensure the unit maintained the recommended vertical deployment. The SUR was deployed at a depth of approximately 2 m to ensure it would remain fully submerged during water surface elevation changes. We anchored the boat 40 m upstream of the SUR deployment site and turned off the motor. A distance of 40 m was chosen because a tagged bull trout would have to swim well within that range to pass downstream of the SUR based on channel width measurements. We activated two PT-3 and three PT-4 transmitters and deployed each individually for approximately four minutes, recording the start time and stop time of each deployment. We then downloaded the SUR and compared detections to ensure the transmitters were decoded.

Bull Trout Sampling and Tagging

Bull Trout Sampling

Numerous techniques were tested to capture migratory bull trout as they moved through the lower Walla Walla River en route to the Columbia River. The CTUIR had operated a rotary screw trap at an established trapping site (rkm 8) as part of their ongoing anadromous salmonid monitoring program, and they continued the screw trapping during 2010. When stream discharge in the Walla Walla River was insufficient to effectively fish an 8-foot rotary screw trap, a 5-foot trap was used. If a bull trout was captured, CTUIR field staff planned to obtain a weight, fork length, scan the fish for an existing PIT tag, and place it into a perforated holding vessel inside the screw trap live well. CTUIR field staff planned to contact FWS field staff via cell phone and arrange for experienced personnel to tag the bull trout in a timely manner.

Fyke nets with attached leads were used in the backwatered portion of the lower Walla Walla River (approximately rkm 6.5) as another method to capture downstream migrating bull trout. Each fyke net was composed of two rectangular conduit frames measuring 0.9 m tall by 1.5 m wide, five steel hoops, two throats, and two 7.5 m leads. They were constructed with 1.3 cm knotless netting. Fyke nets were deployed horizontally across the river channel from a boat and were anchored in the current by 3 m anchor pipes driven into the substrate. The fyke nets were checked at least once each day to remove fish and debris and to ensure proper function.

We also attempted angling with artificial lures fitted with barbless hooks to capture bull trout in the lower Walla Walla River. When river flows were conducive to bank angling, we utilized access points along the river to sample for bull trout. When river flows were not conducive to bank angling, we angled from a boat in the lower, backwatered portion of the Walla Walla River.

Lastly, a beach seine was tested to determine if it would be a practical method for capturing bull trout in the lower, backwatered portion of the Walla Walla River. We used a beach seine that was 23 m long and 2.5 m deep, constructed with 1.3 cm knotless netting, floats and a weighted lead line. The seine was deployed by positioning one person on the riverbank to anchor one end of the net, and then extending the full length of the net out to the center of the river with a boat. The boat then motored back to the bank approximately 15 m downstream from the starting point. The net was pulled onto the bank taking care to keep the lead line sealed to the substrate, and fish were removed, identified, and enumerated.

Bull Trout Tagging

Bull trout were to be anesthetized for tagging in a bath containing 40 mg/l of tricaine methanesulfonate (MS-222) buffered with sodium bicarbonate at a concentration of 80 mg/l. Bull trout were to be measured to the nearest mm (fork length), weighed to the nearest 0.1 g, and tagged with both a PIT tag and an acoustic transmitter. The PIT tags were approximately 23 mm long, and would be inserted subcutaneously at the abdomen through a shallow 3-mm incision made with a surgical scalpel slightly off the mid-line and anterior to the pelvic girdle. Our acoustic tagging methods closely followed, and were adapted from radio tagging methods described by Sankovich et al. (2003). Three sizes of acoustic transmitters were acquired for this study (Table 2) to accommodate a range of bull trout sizes. Based on a length/weight relationship developed for bull trout in the South Fork Walla Walla by Budy et al. (2004), we estimated that the PT-3, PT-4, and IBT tag models in combination with a 23-mm PIT tag (0.38 g), would be appropriate for bull trout with minimum fork lengths of 210, 253, and 320 mm, respectively, at 3% of the host fish weight. We exceeded the "2% rule" described in Winter (1996) because no justification was offered for it, and Brown et al. (1999) indicated that host fish (rainbow trout) with tag sizes exceeding a tag to weight ratio of 2% demonstrated normal swimming performance. By tagging at 3% of the host fish weight, it enabled us to tag a wider range of fish sizes while achieving shorter ping rates and attaining longer tag lives. Following surgery, tagged bull trout would be allowed to recover from anesthesia in an aerated bath of river water and released in an area of reduced water velocity near the capture site.

Monitoring of Acoustic-tagged Bull Trout

Fixed Hydrophone Station

The SUR was to be deployed at the mouth of the Walla Walla River to passively monitor for acoustic tagged bull trout migrating to and from the Columbia River. After the initial deployment date, the SUR would be downloaded and redeployed bi-weekly. The SUR would be operated continuously as long as deployed transmitters were determined to be active.

Mobile Tracking Surveys

Mobile tracking surveys were expected to be conducted bi-weekly by boat, commencing when acoustic transmitters were first deployed and ceasing upon tag expiration. During 2010, tracking was expected to span January through July in both the lower, backwatered portion of the Walla Walla River (~6.5 rkm), and in the mainstem Columbia River (Lake Wallula). To assure systematic sampling of the Columbia River study area, a grid pattern of monitoring points was established using ArcGIS, and incorporating a sufficient acoustic signal overlap distance (Figure 3). Monitoring point spacing of 350 m was derived from a minimum detectable range of 200 m determined during equipment testing activities. Field staff would navigate via GPS to each monitoring point in a survey boat. When the point is reached, the boat is brought to a low idle, and the omnidirectional hydrophone is deployed approximately one meter below the keel of the boat. Field staff listened through headphones for the sound of an activated acoustic transmitter for a period of 45 seconds to ensure multiple iterations for audible detection. If no transmitter is audibly detected, the hydrophone is retracted and the boat operator navigates to the next monitoring point. If a transmitter is detected, field staff deploys the directional hydrophone to decode the signal and more accurately locate the tagged bull trout. A GPS position, date, time, and physical habitat metrics were to be recorded at the location of the acoustic tag signal. Habitat metrics to be measured and recorded included depth, substrate/cover characteristics, water temperature, and a velocity profile. The velocity profile was to be recorded with an acoustic Doppler current profiler (ADCP).

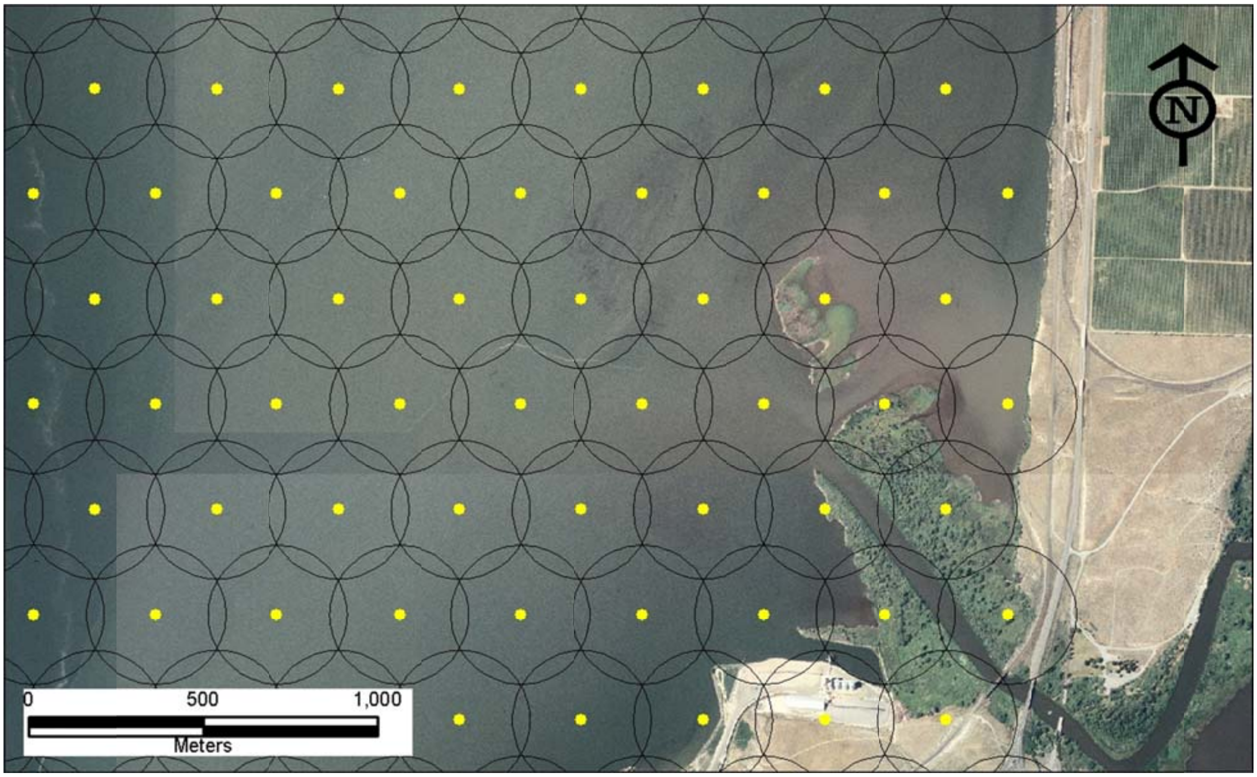

Figure 3. Example of grid pattern of monitoring points established in ArcGIS.

Walla Walla River PIT Detection Arrays

We elected to continue the maintenance and operation of the Oasis Road Bridge PIT detection array near the mouth of the Walla Walla River (rkm 10) to provide bull trout timing data for PIT tagged fish moving downstream toward the Columbia River. These data are useful to help establish movement trends for emigrating bull trout, thus helping to focus bull trout sampling effort. In addition, since all bull trout will be tagged with a PIT tag in addition to an acoustic transmitter, monitoring the Oasis Road Bridge PIT detection array as well as other PIT detection sites throughout the Walla Walla Basin may provide additional movement data in the case of transmitter failure, shedding, or tag life expiration. Since fish will be double tagged (i.e. acoustic, PIT), estimates of the efficiency or detection probability for the Oasis Road Bridge PIT detection site may be improved.

Columbia River PIT Detections

The PTAGIS database was queried regularly for detections of Walla Walla Basin bull trout in the adult fish ladders and juvenile bypass systems at Bonneville, The Dalles, John Day, McNary and Priest Rapids dams on the Columbia River, and Ice Harbor Dam on the Snake River. No additional dams above Ice Harbor on the Snake River or above Priest Rapids on the Columbia River were queried. The adult ladders at Priest Rapids and Ice Harbor are highly efficient and it is likely any PIT tagged bull trout migrating upstream through those facilities would be detected.

Results and Discussion

Equipment Acquisition and Testing

When tested, each of the acoustic transmitters functioned correctly. Upon activation, it was confirmed that each tag emitted an acoustic signal at a frequency of 75 kHz that was detectable by the USR-08 receiver and omnidirectional hydrophone and decoded to its uniquely assigned aural interval and associated code.

Water depth did not affect our ability to detect a deployed acoustic transmitter. There were no audible differences between transmitters deployed at a depth of 1.5 m when compared to a deployment depth at 14 m. This testing was sufficient to give us some level of confidence that water depth would not factor into our ability to detect acoustic tagged bull trout during mobile tracking activities in the mainstem Columbia River.

Detectable and decodable read ranges for each of the three sizes of acoustic transmitters by both the directional and omnidirectional hydrophones were determined. Both the PT-3 and PT-4 transmitters were audibly detected with the directional hydrophone from a distance of 600 m and decoded at approximately 400 m (Table 3). The IBT transmitter was detected as far as 700 m and decoded at approximately 500 m. The PT-3 and PT-4 transmitters were only detectable at a distance of 200 m and decoded at approximately 150 m during testing with the omnidirectional hydrophone. The detection and decodable read ranges for the IBT transmitter were 350 m and 100 m, respectively. Numerous variables including, but not limited to wind, rain, water velocity, ambient noise and turbidity may have affected the detectable and decodable read ranges of our acoustic transmitters. Further testing will be conducted to more accurately determine the expected detectable ranges of our acoustic transmitters over a wide range of ambient conditions.

Table 3. Detectable and decodable read ranges for PT-3, PT-4, and IBT acoustic transmitters by both the DH-4 directional and TH-2 omnidirectional hydrophones.

	DH-4 Directional Hydrophone		TH-2 Omnidirectional Hydrophone	
Model	Detectable Range (m)	Decodable Range (m)	Detectable Range (m)	Decodable Range (m)
PT-3	600	400	200	150
PT-4	600	400	200	150
IBT	700	500	350	100

Attempting to detect a transmitter while actively motoring with the deployed directional and omnidirectional hydrophones was both difficult and ineffective, regardless of boat speed. It became apparent that the hydrodynamic design of the directional hydrophone is intended for stationary tracking and not conducive to deployment in water while moving. The omnidirectional hydrophone was deployable at a slow motoring speed but could only detect the deployed transmitter from a distance of approximately 90 m. The transmitter was not decoded while moving. When the omnidirectional hydrophone was deployed at a faster motoring speed, the transmitter was neither detected nor decoded. The difficulty detecting and decoding the transmitter was likely due to interference from water moving over the hydrophone, and from acoustic frequencies emitted by the boat motor. Testing results underscored the need to be stationary while monitoring transmitters in the field.

The SUR successfully decoded all five transmitters during the four minute deployments from a distance of 40 m (Table 4). Although each transmitter was decoded during deployment, the time to first detection, number of detections, and time between detections varied widely. One source of variation was the 20 second ping rate detections (codes 217, 37, and 22) compared to the 10 second ping rate detections (codes 172 and 187). However, there is no current explanation for the variability in time to first detection, and time between detections, particularly for transmitters with the same ping rates. We plan to conduct a more rigorous evaluation of the SUR that will include different SUR and acoustic tag deployment strategies.

Table 4. Results from Submersible Ultrasonic Receiver (SUR) testing near the mouth of the Walla Walla River.

Model / Code	Ping Rate (s)	Deployment Time (hh:mm:ss)	Detection Times (hh:mm:ss)	Retrieval Time (hh:mm:ss)	Time to Detection/Retrieval from Deployment (mm:ss)
PT-3 / 22	20	10:26:00	10:29:50		03:50
			10:30:15		04:15
				10:30:20	04:20
PT-3 / 37	20	10:21:00	10:21:51		00:51
			10:22:59		01:59
			10:24:07		03:07
			10:25:15		04:15
				10:25:20	04:20
PT-4 / 172	10	10:11:00	10:12:42		01:42
			10:12:59		01:59
				10:15:00	04:00
PT-4 / 187	10	10:16:00	10:16:52		00:52
			10:17:35		01:35
			10:18:19		02:19
			10:19:02		03:02
			10:19:46		03:46
				10:20:00	04:00
PT-4 / 217	20	10:06:00	10:06:17		00:17
			10:06:41		00:41
			10:07:06		01:06
			10:07:54		01:54
				10:10:00	04:00

Bull Trout Sampling and Tagging

Bull Trout Sampling

PIT detection data at the Oasis Road Bridge PIT array from previous work (Anglin et. al. 2010a) indicated that bull trout movement into the Columbia River occurs from October through February. When our sampling commenced in January with a rotary screw trap (operated by the CTUIR), submerged fyke nets, angling, and beach seines, Oasis PIT detections had been recorded in October, November, and December 2009 (Figure 4). We anticipated that sampling during the winter and early spring months could still result in the capture of bull trout in the lower Walla Walla River. Sampling was conducted from mid-January through March with the exception of the screw trap, which the CTUIR continued to fish through May. A single bull trout was captured, and no bull trout were tagged.

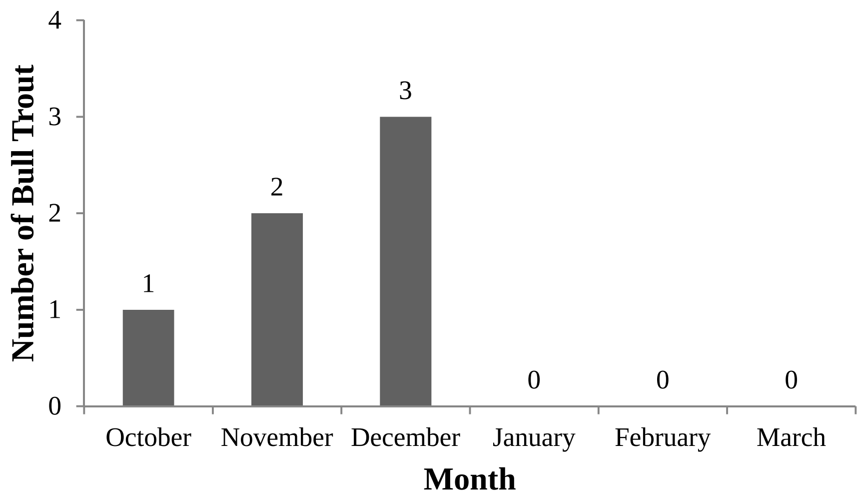

Figure 4. Bull trout PIT detections at the Oasis Road Bridge PIT detection array from October through December, 2009.

Screw trap sampling was conducted by the CTUIR near the mouth of the Walla Walla River from 10 January through 25 May 2010 at Pierce's RV Park. Both salmonids (Table 5) and non-salmonids (Appendix A) were captured during all months. A single bull trout was captured on 19 January 2010, just prior to receiving our acoustic transmitters. No other bull trout were captured for the remainder of the sampling period. We anticipated that bull trout would still be emigrating at least through February, and we hypothesized that low screw trap efficiency may have contributed to the low numbers of salmonids captured, and the absence of bull trout captures during this time period. We eventually updated the detections at the Oasis PIT detection site, and saw that no bull trout had been detected from January through March (Figure 4). Our lack of success in capturing bull trout may have been a function of several factors including a low level of emigration during the winter months of 2010 and low sampling efficiency. During future sampling, we intend to install leads and reposition the screw trap to increase efficiency.

Table 5. Monthly summary of salmonids captured at the Pierce's RV park screw trap operated by the CTUIR.

Month/Year	Bull Trout	Juvenile Chinook	Juvenile Steelhead	Hatchery Chinook	Hatchery Steelhead	Juvenile Coho
Jan 2010	1	4	1	0	0	0
Feb 2010	0	16	5	0	0	0
Mar 2010	0	80	8	0	0	0
Apr 2010	0	405	503	1677	1533	1
May 2010	0	403	1886	1658	1735	2
Total	1	908	2403	3335	3268	3

Deploying submerged fyke nets in the lower, backwatered portion of the Walla Walla River was a new method we had not previously used. Initial testing suggested that an array of properly designed and deployed fyke nets could be fished with a high level of sampling efficiency, particularly for bottom-oriented species. Although samples collected during February and March included several bottom oriented species, only a single salmonid was captured (Table 6). Submerged fyke nets appear to have the potential to capture bull trout if they are deployed during the active migration period.

Table 6. Monthly summary of fish captured in the lower Walla Walla River using fyke nets.

Month/Year	Juvenile Steelhead	Tadpole Madtom	*Lepomis* spp.	Peamouth	Sucker	Chiselmouth
Feb 2010	1	5	3	0	0	0
Mar 2010	0	17	10	5	2	1
Total	1	22	14	5	2	1

Angling for bull trout in the lower Walla Walla River was limited by access points, and streamflows were not conducive to effective angling much of the time. We were able to use this sampling method in the lower 8 kilometers of the Walla Walla River upstream from the mouth, but high streamflows and low water clarity may have reduced our sampling efficiency for bull trout. By late March, no bull trout had been captured, and spring Chinook and steelhead smolt emigration made angling for bull trout a futile endeavor.

Beach seining was ineffective for collecting any species of fish, and ambient conditions were not suitable for this gear type. Relatively deep water and steep, muddy banks made utilizing a beach seine difficult, ineffective, and inefficient. A single *Lepomis* sp. and one adult American shad were captured. This capture method will no longer be used unless conditions change.

Bull Trout Tagging

No bull trout were tagged during any of our sampling efforts from mid-January through May, 2010. The single bull trout that was captured in the CTUIR rotary screw trap was not tagged with an acoustic transmitter because we had not yet received the tags from the manufacturer. CTUIR staff PIT tagged and released the bull trout.

Monitoring of Acoustic-tagged Bull Trout

Fixed Hydrophone Station

The remote SUR was deployed at the mouth of the Walla Walla River for testing, but since no acoustic transmitters were deployed during the reporting period, the instrument was retrieved and was not redeployed. During 2011, we plan to conduct a full season of sampling, and if acoustic transmitters are deployed, passive monitoring with the SUR will resume at the mouth of the Walla Walla River.

Mobile Tracking Surveys

Mobile tracking was not required during the reporting period since no acoustic transmitters were deployed. During 2011, we plan to conduct a full season of sampling, and if acoustic transmitters are deployed, mobile tracking will be conducted to describe migration routes and physical habitat used as bull trout move from the Walla Walla River into the mainstem Columbia River.

Walla Walla River PIT Detection Arrays

Since no bull trout were tagged with either an acoustic transmitter or a PIT tag during the reporting period, no study-related fish were detected at PIT detection arrays within the Walla Walla Basin. We monitored the Oasis Road Bridge PIT detection array near the mouth of the Walla Walla River (rkm 10) to maintain movement timing data for previously PIT tagged bull trout moving downstream towards the Columbia River. PIT tagged bull trout were detected at the array from October through December 2009 (Figure 4). No PIT tagged fish were detected migrating downstream later than 31 December 2009. As discussed previously, this may have indicated a lower abundance of emigrants during January and February relative to previous years, or a shift in emigration timing to earlier in the season during the current year.

Columbia River PIT Detections

Since no bull trout were tagged with either an acoustic transmitter or a PIT tag during the study period, no study-related fish were detected at mainstem dams. We conducted queries of the PTAGIS database for all bull trout detections at mainstem dams, and no Walla Walla Basin bull trout were detected in any of the adult ladders or the juvenile bypass systems from October 2009 through September 2010.

Plans for FY2011

We plan to conduct the migratory bull trout sampling program during all months of the migration season in FY2011, including October through March. The CTUIR has no further plans to operate a rotary screw trap at the Pierce's RV Park trap site, so we will take over all sampling activities at the site. We will sample with fyke nets and angling when river conditions allow. We will continue to refine sampling techniques and adjust our efforts under varying flow conditions to improve sampling efficiency for bull trout in lower-basin areas. Immediately following acoustic transmitter deployment, we will begin bi-weekly mobile tracking activities. We hope to continue the maintenance and operation of the Oasis Road Bridge PIT detection array near the mouth of the Walla Walla River to provide bull trout timing data for PIT tagged fish moving downstream toward the Columbia River. We will also query the PTAGIS database regularly for detections of Walla Walla Basin bull trout in the adult fish ladders and juvenile bypass systems at Bonneville, The Dalles, John Day, McNary and Priest Rapids dams on the Columbia River, and Ice Harbor Dam on the Snake River.

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Appendix A

Non-salmonids Captured in the Rotary Screw Trap, January-May 2010

Table A1. Monthly summary of non-salmonids sampled at the Pierce's RV park screw trap site operated by the CTUIR. Sampling was conducted from 10 January through 25 May 2010.

Month	Sucker spp.	Small Mouth Bass	Chisel mouth	Channel Catfish	Tadpole Madtom	Shiner spp.	Dace spp.	Northern Pike Minnow	Pumpkin seed	Bluegill	Common Carp	Sculpin spp.	Western Brook Lamprey
January	993	197	43	25	8	0	4	40	23	15	3	0	0
February	151	33	2	6	7	0	2	1	4	1	0	0	1
March	218	48	4	11	31	9	4	3	8	1	0	1	1
April	1178	583	150	33	43	37	34	23	2	1	2	2	0
May	4117	2085	688	68	21	61	58	7	20	4	1	0	0
Total	6657	2946	887	143	110	107	102	74	57	22	6	3	2