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

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Abstract

Bull trout distribution, abundance and habitat quality have declined range wide and several local extirpations have been documented. As a result, the Columbia River Distinct Population Segment of bull trout was listed as threatened under the Endangered Species Act in June 1998. Mainstem Snake and Columbia River dams have the potential to impact migratory bull trout. Use of the Columbia River by bull trout from the Walla Walla Basin is unknown and the need for further research is identified in the U.S. Fish and Wildlife Service Draft Recovery Plan. A full stream width passive integrated transponder (PIT) detection array was maintained in the lower Walla Walla River and used to monitor use of the Columbia River by bull trout from the Walla Walla Basin from October 2006 through September 2007. A second detection array with a different design was installed approximately 25 m upstream from the existing array in October 2006 and operated until May 2007. The U.S. Fish and Wildlife Service PIT tagged 12 bull trout in the mainstem Walla Walla River from May through September 2007. Additional bull trout tagged by other agencies in Mill Creek (tributary to the Walla Walla River), the South Fork Walla Walla River, and the Touchet River were also available for detection. One PIT tagged bull trout from the Walla Walla Basin was detected moving through the lower Walla Walla River toward the Columbia River in January 2007. This is the first empirical evidence of Walla Walla Basin bull trout using the Columbia River. Additional PIT tagged bull trout may have passed the array undetected when detection efficiencies were relatively low. Since only a small proportion of Walla Walla Basin migratory bull trout are PIT tagged, this single detection likely represents some larger number of bull trout exhibiting a similar pattern of movement. No PIT tagged bull trout were detected at McNary or Ice Harbor dams during the year.

Acknowledgements

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Introduction

Bull trout distribution, abundance and habitat quality have declined range wide and several local extirpations have been documented. As described in Gallion and Anglin (2009), the Columbia River Distinct Population Segment (DPS) of bull trout was listed as threatened under the Endangered Species Act in June 1998 (63 FR 31647). Declines in bull trout distribution and abundance are the results of the combined effects of habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, entrainment into diversion channels, and introduced nonnative species (U.S. Fish and Wildlife Service 2002a).

Mainstem Snake and Columbia River dams have the potential to impact migratory bull trout. It is not known if adequate conditions are present for bull trout passage at the mainstem dams, but elsewhere, dams have created barriers to migration and isolated previously connected populations (Nerass and Spruell 2000). Dams and associated reservoirs also alter the natural hydrograph (U.S. Fish and Wildlife Service 1998) and riverine habitat used by migratory bull trout. Bull trout have the potential to be entrained at dams and suffer mortality or injury associated with turbines (Skarr et al. 1996). Reservoirs create warm water habitats that not only are unfavorable to bull trout, but also provide favorable conditions for exotic predators and competitors (Harza 2000).

In 2002, the U.S. Fish and Wildlife Service (FWS) issued a Draft Recovery Plan for the Umatilla–Walla Walla Recovery Unit (U.S. Fish and Wildlife Service 2002a) which described conditions within the Unit, defined recovery criteria, and identified recovery actions. The Umatilla–Walla Walla Recovery Unit is one of 22 Recovery Units in the Columbia River DPS. The FWS Recovery Plan identifies three Core Areas within the Umatilla–Walla Walla Recovery Unit; the Umatilla River Core Area, the Walla Walla River Core Area, and the Touchet River Core Area. The Columbia River between the Umatilla Core Area and the Walla Walla and Touchet Core Areas is identified as an area of research need due to uncertainty about its current or potential use by bull trout as rearing, overwintering, and/or migration habitat. In addition, the Yakima and Tucannon Core Areas are also within close proximity to the Walla Walla Basin Core Areas. Within the Walla Walla River Core Area, both Mill Creek and Upper Walla Walla River local populations are known to support migratory fish, but it is unknown whether they use the Columbia or Snake rivers, or if they migrate to adjacent Core Areas such as the Umatilla Core Area. Consequently, a first step to assess the potential impacts mainstem dams and reservoirs may have on migratory bull trout is to determine the timing and level of use of the Columbia and Snake rivers.

The objectives of this project during the reporting period were to:

1. Determine the number of PIT tagged bull trout from the Walla Walla Basin that enter the Columbia River;

2. Determine when PIT tagged bull trout from the Walla Walla Basin enter and return from the Columbia River.

Background

Migratory bull trout make up a portion of the total bull trout populations in most Core Areas, including the Core Areas in the Walla Walla Basin. Bull trout migrations have been studied in the Walla Walla Basin using radio telemetry (Mahoney 2003, Mahoney et al. 2006) and PIT tag detection arrays (Anglin et al. 2008a, Anglin et al. 2008b, Gallion and Anglin 2009). Studies in Mill Creek by Hemmingsen et al. (2002) investigated movements of adult bull trout, and Weeber et al. (2007) investigated movements of subadult bull trout. Neither study found evidence of bull trout emigrating from Mill Creek. Mahoney et al. (2006) investigated movements of adult bull trout in the Walla Walla River, and results indicated overwintering migratory adult bull trout moved downstream from October through December, and the lower limit of the winter distribution was near the Oregon (OR)/Washington (WA) state line. Limitations of these and other radio telemetry studies include relatively small numbers of tagged individuals, and radio tag life spans that are relatively short (e.g. <2years). In comparison, PIT tags can be used to monitor movements of large numbers of bull trout for long time periods. Bull trout as small as approximately 70 mm can be PIT tagged due to the small tag size (12 mm) and weight (~0.102 g), the tags remain active for the life of the fish, and the implantation procedure is less invasive. PIT tags are also less expensive than radio tags, which allows a larger proportion of the population to be marked for a given cost.

Recent research efforts have resulted in a significant number of PIT tagged bull trout in the Walla Walla Basin (Table 1). Tagging data were queried from the Columbia Basin PIT Tag Information System (PTAGIS) database for all agencies except for the U.S. Geological Survey-Utah Cooperative Fish and Wildlife Research Unit (USGS-USU) which were taken from Budy et al. (2003, 2004, 2005, 2006, 2007).

Table 1. Number of bull trout PIT tagged in the Walla Walla Basin by reporting year (October - September) and agency.

Year	USGS-USU	USFS[a]	ODFW[b]	FWS	CTUIR[c]	WDFW[d]	Total
2001			68			25	93
2002	211		140			11	362
2003	468		67			41	576
2004	410		67		9	55	541
2005	417		618		3	39	1077
2006	221	1220	2	11	2	37	1493

[a]-U.S. Forest Service
[b]-Oregon Department of Fish and Wildlife
[c]-Confederated Tribes of the Umatilla Indian Reservation
[d]-Washington Department of Fish and Wildlife

Between 2002 and 2006, the FWS installed several PIT detection arrays in the Walla Walla Basin to determine the temporal and spatial aspects of bull trout movement, distribution, and connectivity between local populations (Anglin et al. 2008a, 2008b). In 2005, we installed the Oasis Road Bridge (ORB) PIT detection array (Gallion and Anglin 2009) to examine movement into or out of the Columbia River. New PIT detection arrays installed during 2007 included the

Burlingame Diversion (dam notch, fish ladder, diversion canal, fish bypass) on the Walla Walla River, the U.S. Army Corps of Engineers Division Works fish ladder on Mill Creek, and upper and lower Yellowhawk Creek instream detection arrays (Figure 1).

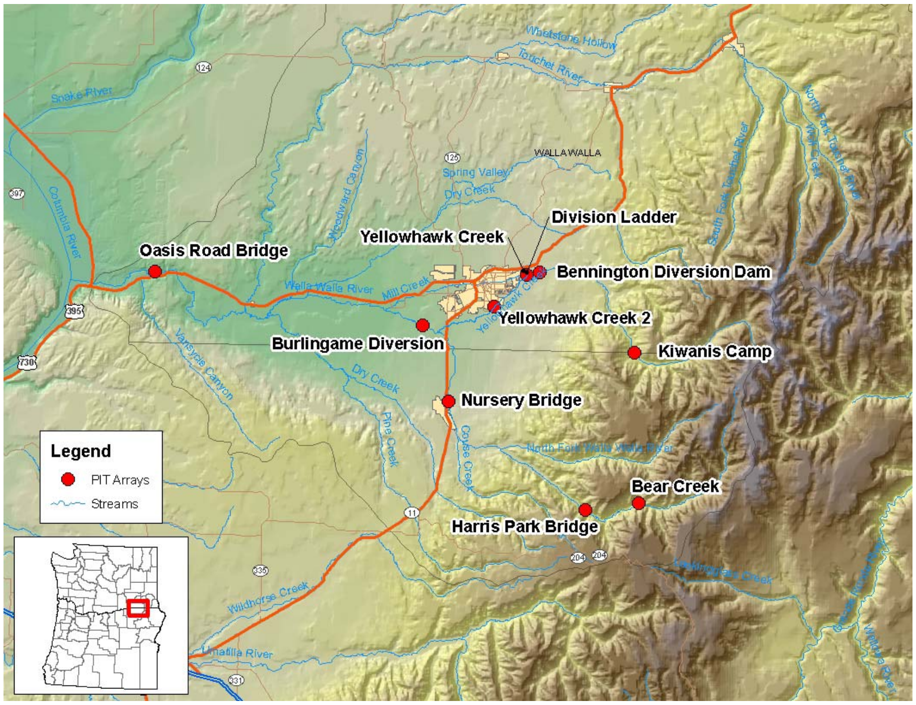

Figure 1. Locations of PIT detection arrays in the Walla Walla Basin.

Methods

PIT Detection Array Operation and Maintenance

Monitoring use of the Columbia River by Walla Walla Basin bull trout continued during the reporting period. The FWS continued operation and maintenance of the PIT tag detection site at Oasis Road Bridge in the lower Walla Walla River (Figure 1). The original site configuration consisted of a pass through (PT) detection array comprised of six individual antennas. The PT antennas detect most PIT tagged fish when they pass through the inner space of the antenna structure (Figure 2). The floating design of our PT antennas maximizes the proportion of the water column monitored, but it is susceptible to damage from high flows and debris accumulation. We installed a second array in October 2006 as a backup to the original PT array should it be damaged by high flows or debris, and to acquire direction of fish travel. The second array is a pass over (PO) detection array, also comprised of six antennas, and it was installed approximately 25 m upstream from the initial array (Figure 3). The antennas are strapped flat to the river substrate which reduces the potential for damage from high flows and debris. Although the orientation of the antennas greatly reduces the potential for damage, the detection efficiency is reduced, and the proportion of the water column monitored is small in comparison to the PT antennas.

Figure 2. Oasis Road Bridge pass through (PT) PIT detection array near the confluence of the Walla Walla River and Columbia River.

Figure 3. Oasis Road Bridge pass over (PO) PIT detection array located approximately 25 m upstream from the PT PIT detection array near the confluence of the Walla Walla River and Columbia River.

Although the PO array was located to minimize interference with the PT array, ambient electrical noise increased when both arrays were operating. Each antenna array is controlled by a multiplexor which is configured to supply power to the array, set data collection protocols, and record PIT tags. Electrical noise is generated when the multiplexor energizes the antenna array to read PIT tags. When both arrays were energized at the same time, electrical noise from the respective multiplexors interfered with one another. To reduce or eliminate this conflict, we configured each multiplexor to read on alternating temporal cycles on the scale of milliseconds.

Data from the multiplexors were also recorded on a portable computer at the site, and regularly uploaded to the regional PTAGIS database via satellite modem. Routine inspection and maintenance of the antenna arrays was conducted when streamflows allowed to repair broken antennas and cables, and to remove debris from the antennas.

Detection Efficiency

Detection efficiency calculations for the PT PIT detection array based on physical factors (e.g. streamflow) and antenna performance were described in the 2005/2006 Annual Report for this project (Gallion and Anglin 2009). These calculations included two factors:

- Site functionality status, and
- Individual antenna and overall PT array efficiency.

Since we added the second, PO PIT detection array in October 2006, a third factor was introduced that could affect detection efficiency:

- The effect of electrical interference between the two detection systems.

<u>Site Functionality</u> – The ORB site now consists of two PIT detection arrays (PT, PO) and each array is comprised of six, separate antennas. Individual antennas can cease to operate efficiently for several reasons including; blown out by high flows, leakage and short circuit, antenna cable broken or chewed off, power supply interruption, and tuning. All of these factors contribute to the temporal detection efficiency of each array, and of the ORB site overall.

<u>Antenna, PT/PO Array, and Overall Site Efficiency</u> – Detection efficiency is affected by two, primary factors; streamflow magnitude, and the coverage of the electromagnetic field within and/or around each antenna. High streamflows depress the PT antennas and cause water to flow over the tops and around the bank antennas. High streamflows also increase the depth of the water column over the PO antennas. Fish that pass in these areas may not be detected. Coverage of the electromagnetic field for the PT antennas was discussed in Gallion and Anglin (2009), and was nearly always 100% within the pass through area. Electromagnetic field coverage for the PO antennas extended up into the water column approximately 30 cm from the antenna which was attached to the bottom of the river. Thus, detection efficiency is best for bottom-oriented fish, and near zero for surface oriented fish.

Electrical Interference – With two complete and separate PIT detection arrays and the respective antennas and multiplexors, electrical noise and interference became a factor. We adjusted multiplexor configuration settings to allow each array (PT, PO) to scan for PIT tags during a different time interval. "Staggered" array scanning was implemented to reduce or eliminate interference. Tests conducted at the time of installation suggested the electrical noise did not decrease the efficiency of the PT array (i.e. 100%), but we continued occasionally testing the array because the ambient electrical noise fluctuates, and we wanted to assure that we weren't reducing the efficiency of the PT array over the range of these fluctuations.

We considered using PIT tagged bull trout to estimate detection efficiency directly for the PT array, but abundance was too low to obtain sufficient numbers fish. Conducting the efficiency tests with Chinook salmon or summer steelhead smolts was another option, however, the disparity between outmigrant anadromous fish behavior with 12 mm PIT tags and bull trout behavior with 23 mm PIT tags was too great to be of much value. As a result, we used the same method described in Gallion and Anglin (2009) that was used in 2005/06 which was based on site functionality, streamflow magnitude, and antenna efficiency. This method included evaluation of the following variables on a daily basis:

- Site functionality was determined (using remote satellite communications) by identifying individual antennas in the array that were missing or broken. In addition, the multiplexor creates interrogation files that provide diagnostics for each of the antennas. These diagnostics establish the operational status (including electrical interference) of the antennas and contribute to efficiency estimates.
- Average daily stage at USGS gage #14018500 on the Walla Walla River near Touchet was used to estimate stage height at the array.
- Cross sectional area of the stream at the array was calculated based on stage height.
- The percent coverage of the water column was calculated for each antenna.
- The detection efficiency (percent of the stream cross section monitored) of the array (all antennas) was calculated.

These data were combined and averaged for monthly estimates of antenna functionality and efficiency, and monthly detection efficiency for the entire PT array.

Individual PT antenna performance measurements (efficiency) were conducted in October 2006, and February, April, and May 2007. During months when individual antenna performance was not measured, we assumed, based on repetitive measurements conducted from 2005-2007, that PT antenna performance was 100%, or coverage was complete within each individual antenna (i.e. there were no holes).

Detection efficiency for the PO array was relatively constant since water depth was always sufficient to allow the 30 cm electromagnetic field to be in place. This monitoring range did not change as water depth increased, however, the resulting proportion of the water column monitored decreased. We considered developing a detection efficiency monitoring protocol for the PO array, however, we opted to conduct additional tests to evaluate noise levels and the effect of the PO array on the PT array before developing a protocol.

Following the installation of the PO antenna array, we adjusted multiplexor configuration settings as described previously. However, noise levels were still higher compared to operation of only the PT array. As a result, we conducted tests to evaluate the effect of the higher noise levels on the detection efficiency of our PT array. Since the PT array was our primary array, we did not want to compromise it's detection efficiency. We compared PT detection efficiencies under two scenarios; 1) both the PO and PT arrays operating, and 2) only the PT array operating. For this evaluation of the effect of noise levels, we used PIT tagged Chinook and steelhead (12 mm PIT tags) released by the CTUIR approximately 150 m upstream from the arrays. Test 1 with both arrays operating was conducted from May 5-11, 2007, and test 2 with only the PT array operating was conducted from May 12-25, 2007.

Bull Trout Sampling/PIT Tagging

Our goal continued to be focused on sampling and PIT tagging bull trout that were likely to migrate downstream, through the Walla Walla Basin and into the Columbia River. Radio telemetry and PIT detections indicated that bull trout downstream dispersals occur primarily during the spring with some additional activity during the fall. Sampling was conducted from February through June, and September 2007 in mid- to lower-Basin areas. No sampling was conducted in July or August because water temperatures exceeded our sampling threshold of 18^{o}C. We discontinued dip net sampling because no bull trout were captured in 2006, and because suitable sites were scarce. Hook and line sampling was conducted primarily in pools from approximately rkm 82, upstream from Nursery Bridge, to rkm 60 near the Burlingame Diversion facility on the Walla Walla River, and from rkm 18 near Bennington Diversion Dam on Mill Creek to rkm 17 at the confluence with Yellowhawk Creek. Fyke nets were deployed in the fish bypass return channel at the Little Walla Walla Diversion facility (rkm 76) upstream from Nursery Bridge on the Walla Walla River and below the head gate at the confluence of Mill Creek and Yellowhawk Creek. See Figures 1 and 4 for locations. Fyke nets were typically deployed for continuous 24-hour periods while in the field, and checked each morning and evening. Beach seine sampling was also conducted near the Burlingame Diversion facility.

Other fish sampling efforts in the Basin (Figure 4) resulted in additional PIT tagged bull trout. The CTUIR operated a screw trap in the Walla Walla River near rkm 79 just upstream from Milton-Freewater, OR. This effort was conducted primarily for Chinook salmon and steelhead, but when bull trout of sufficient size were captured, they were PIT tagged. The USFS operated a screw trap, primarily for bull trout, in upper Mill Creek, USGS-USU electro-seined for bull trout in the upper South Fork Walla Walla River, and WDFW operated a screw trap and weir trap in the Touchet River near Dayton, WA for multiple species.

Captured bull trout were anesthetized with MS-222 (tricaine methanesulfonate), scanned for PIT tags, and measured. A 23 mm PIT tag was applied to any untagged bull trout. The PIT tag was inserted into the abdomen through a 3-4 mm incision made with a scalpel. Fish were recovered for 30 minutes and released on site. All other species were enumerated and released.

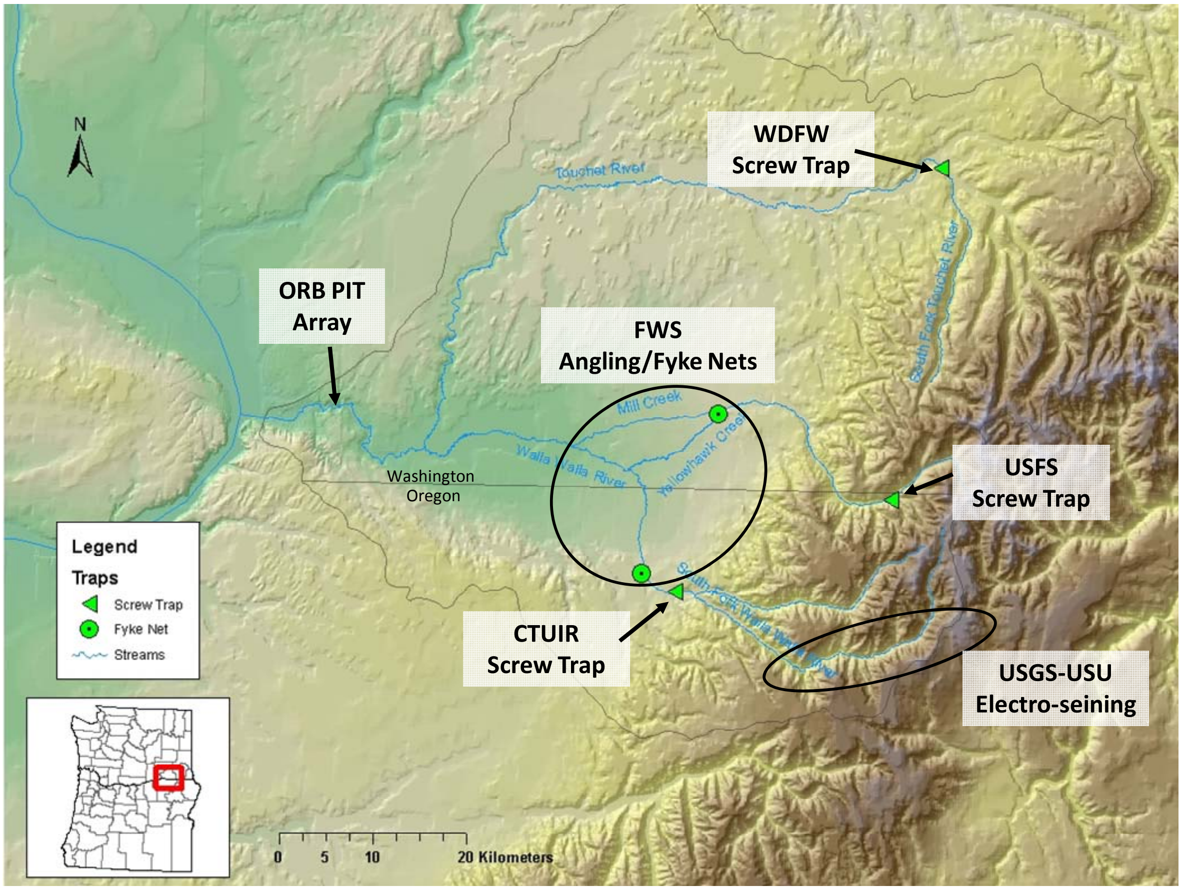

Figure 4. Bull trout PIT tagging locations in the Walla Walla Basin.

PIT Detections

Detections of PIT tagged fish at ORB were recorded on the laptop computer at the site and uploaded daily along with detection array operational data via satellite modem to the PTAGIS database. Bull trout detections were compared to streamflow and water temperature for the relevant time period. Detections of PIT tagged Chinook and steelhead were summarized by month. In addition to being detected at the ORB PIT array, PIT tagged bull trout have the potential to be detected at mainstem Columbia or Snake river dams. The PTAGIS database was regularly queried for detections of bull trout at McNary and Ice Harbor Dam fish ladders and juvenile bypass systems.

Results and Discussion

PIT Detection Array Operation and Maintenance

The ORB PIT detection array was partially or fully operational for the majority of time between October 2006 and September 2007. Site visits every other week were sufficient to control debris on the array except during high spring flows. Remote access to the site via satellite modem provided operational data from the multiplexor that allowed us to determine when antennas were damaged or not present. When antennas were not functional, the most common causes were damaged or removed by high streamflows, antenna cable between multiplexor and antenna was unplugged, or antenna cable had been chewed off, which usually included beaver tracks nearby.

Non-functional antennas reduced site efficiency below 80% from December 2006 through April 2007 (Table 2). A power outage during the first half of July 2007 caused the entire site to be down for half of the month. For the remaining six months, site efficiency was greater than 80%, and for five months, it was near 100%. Details regarding site efficiency are discussed further in the following section.

We also added the second PO detection array in October 2006 as described earlier. This array was disconnected in June 2007 following the efficiency tests described in the following section.

Detection Efficiency

Individual PT antenna performance and PT array efficiency are described in Table 2. When antenna efficiency tests were conducted (October 2006; February, April, May 2007), the 23 mm PIT tag was detected throughout the entire area of each of the individual antenna fields. As discussed previously, during months when no tests were conducted, efficiency for antennas that were present was assumed to be 100%. No detection efficiency data were developed for the PO array because we decided to disconnect it to eliminate the electrical interference problems.

Overall, PT array detection efficiency ranged from 47% to 99% (Table 2). Detection efficiency never reached 100% because there are gaps between the antennas where fish can pass undetected. From November 2006 through April 2007 detection efficiency was 47-84% when one or more antennas were missing, or the antenna cables were disconnected or broken. Repairs were made during April and stream coverage increased to 99% in May. July detection efficiency dropped to 48% as a result of power failure from June 30-July 16, 2007. Following completion of repairs in July, detection efficiency increased to 96% in August and 98% in September. Detection efficiency may have been less than the values reported in Table 2 because of the random and unknown effect of debris accumulation between site visits. The accumulation of debris may have caused the antennas to “sink” due to the increased resistance from the debris in the current, thereby reducing the proportion of the water column monitored.

Table 2. Percent area monitored for individual antennas and average monthly percent detection efficiency at the ORB PIT detection array. NC=antenna efficiency measurements not conducted; NP=antennas were damaged or not present.

Date	Antenna						Detection Efficiency
	1	2	3	4	5	6	(%)
October 2006	100%	100%	100%	100%	100%	100%	99
November 2006	NC	NC	NP	NC	NC	NP	84
December 2006	NC	NC	NP	NP	NC	NC	54
January 2007	NC	NC	NP	NP	NC	NC	47
February 2007	100%	100%	100%	NP	100%	100%	68
March 2007	NC	NC	NP	NP	NC	NC	56
April 2007	100%	100%	NP	100%	100%	100%	75
May 2007	100%	100%	100%	100%	100%	100%	99
June 2007*	NC	NC	NC	NC	NC	NC	96
July 2007*	NC	NC	NC	NC	NC	NC	48
August 2007	NC	NC	NC	NC	NC	NC	96
September 2007	NC	NC	NC	NC	NC	NC	98

*The site was off from June 30-July 16 due to power failure

Results of the tests conducted during May 2007 to determine the effect of electrical noise on detection efficiency of the PT array are presented in Table 3.

Table 3. Detection efficiency of the PT detection array with and without the PO detection array operating. Tests were conducted with Chinook and steelhead tagged with 12 mm PIT tags.

Operational Scenario	# Fish Released	# Detections on PT Array	Detection Efficiency (%) of the PT Array
Both PT and PO Arrays	254	89	35.0
Only PT Array	138	67	48.6

Detection efficiency of the PT array was reduced by approximately 28% when the PO array was operating. The PT array provides overall greater detection efficiency for the site than the PO array because of the limited water column coverage associated with the PO array. These tests showed that operation of both arrays resulted in a significant reduction in the site detection efficiency because of electrical interference. Thus, our decision to disconnect the PO array. Our original goals for installing the PO array were for a backup system for the PT array, and to acquire direction of fish travel. Since we disconnected, but did not remove the PO array, the backup function still exists. Determining direction of fish travel will not be possible with only the PT array operating. However, we may still be able to determine direction of travel based on bull trout life history stage, and/or previous detection history.

Bull Trout Sampling/PIT Tagging

We captured and PIT tagged 11 bull trout using primarily hook and line sampling and fyke nets. Nine of these fish were captured and tagged at the Little Walla Walla Diversion (rkm 76) and Nursery Bridge Dam (rkm 74) near Milton-Freewater, OR. Two additional bull trout were captured and tagged at Pepper Bridge (rkm 66) near the OR/WA state line, and near the Burlingame Diversion facility at rkm 60. No bull trout were captured in Mill Creek. Nine bull trout were captured using hook and line, and two were captured with fyke nets. Beach seine sampling was also conducted, but no bull trout were captured. Ten of the bull trout were captured during May and June, 2007, and one was captured in September 2007. Fish size ranged from 139-350 mm, with a mean length of 238 mm. Bull trout captured in May and June included both subadults (generally <300 mm) that may have been dispersing to downstream areas to rear, and adults migrating upstream to spawning grounds. The individual captured in September was a rearing subadult. A total of 19 bull trout were captured and PIT tagged by the CTUIR in their screw trap near Milton-Freewater, OR at rkm 82 (Figure 4). These results indicate that hook and line, and the screw trap are the most efficient sampling methods for bull trout.

In addition to the 30 bull trout captured and PIT tagged from our work and CTUIR sampling in these mid-Basin areas, 1,471 bull trout were captured and PIT tagged during 2007 in upper Basin areas by other researchers (Table 4). These bull trout will also be available for detection at the ORB array, although the proportion that are migratory is unknown.

Table 4. Total number of bull trout PIT tagged in 2007 by different agencies in headwater areas of the Walla Walla Basin.

Agency	Location	PIT Tagged Bull Trout
USFS	Upper Mill Creek	1079
USGS-USU	South Fork Walla Walla River	374
WDFW	Touchet River near Dayton, WA	18
Total		**1471**

PIT Detections

One PIT tagged bull trout was detected during the year at ORB on January 31, 2007, and it represents the first empirical evidence of Walla Walla Basin bull trout using the Columbia River. The bull trout was PIT tagged in upper Mill Creek at the USFS screw trap (Figure 4) on September 17, 2006 with a fork length of 203 mm (Table 5). This fish was subsequently detected at the Kiwanis Camp Bridge detection array (Figure 1) on October 1, 2006. Thus, it took two weeks to move 7 km between these two sites. Mill Creek streamflow ranged from 25–44 cfs during this time period, which is similar to summer base flow. Water temperatures ranged from 6.5 – 11.5°C during this time period, which is suitable for migrating or rearing bull trout. The rate of movement over this 7 km stream reach (two weeks), and the size of this fish (203 mm) suggest that it was a rearing subadult dispersing downstream. Mill Creek flows increased to over 600 cfs in early November, and it is likely this rearing bull trout moved downstream through Mill Creek to the mainstem Walla Walla River during these high flows.

The next detection for this fish was at ORB on January 31, 2007. From November 2006 through January 2007, Walla Walla River flows varied between 100 and 4,000 cfs, and water temperatures varied between 11.4 and 0.1°C. Thus, streamflows were sufficient for passage, and water temperatures were suitable. This migration to the mouth of the Walla Walla River included 35 km down Mill Creek, and 44 km down the Walla Walla River over the course of 123 days. The resulting migration rate of 0.64 km/day, again suggests that this is a subadult bull trout dispersing downstream to the Columbia River to rear. This single detection of a PIT tagged bull trout at ORB represents a larger number of untagged bull trout that likely passed the array, but we do not have sufficient information to determine the tagging rate for an estimate of the total number of fish.

Table 5. Tagging and detection details for the PIT tagged bull trout detected at the Oasis Road Bridge PIT detection array in 2007.

Tag Code	Tagging/Detection Location	Length (mm)	Tagging/Detection Date
3D9.1BF1FD0CA6	Mill Creek (rkm 42) City Water Intake Dam	203	09-17-06
	Mill Creek (rkm 35) Kiwanis Camp Bridge		10-01-06
	Walla Walla River (rkm 10) Oasis Road Bridge		01-31-07

The ORB PIT detection array recorded 771 detections of Chinook salmon and 2,531 detections of summer steelhead. Steelhead and Chinook salmon were detected from November 2006 through June 2007. The majority of the detections (99%) occurred in April (25%) and May (74%). The large numbers of steelhead and Chinook salmon detections during April and May corresponded with releases of hatchery steelhead and Chinook salmon smolts (PTAGIS).

PTAGIS queries conducted for PIT tagged bull trout at McNary and Ice Harbor dams did not reveal any detections.

Future Plans

During 2008 we will continue to refine sampling sites under fall, winter, and spring flow conditions. We will continue fyke net and hook and line sampling. We plan to continue monitoring and evaluating performance of the ORB PT PIT detection array. The CTUIR has been operating a screw trap near rkm 9 and have agreed to release steelhead tagged with 23 mm PIT tags upstream of the ORB detection array. Detection efficiencies calculated from these fish may more accurately represent detection efficiencies of bull trout tagged with 23 mm PIT tags. We will also continue to calculate detection efficiency based on physical parameters including site functionality and stream stage height.

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