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

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Abstract

A full stream width passive integrated transponder (PIT) detection array was installed in the lower Walla Walla River and used to monitor bull trout presence/passage and possible movement into the Columbia River from April 2005 through September 2006. The U.S. Fish and Wildlife Service captured and PIT-tagged eleven bull trout in the mainstem Walla Walla River from June through July 2006. Additional bull trout tagged by other agencies in Mill Creek (tributary to the Walla Walla River), the South Fork Walla Walla River and the mainstem Walla Walla River were available for detection at the monitoring site in the lower Walla Walla River. No PIT-tagged bull trout from the Walla Walla Basin were detected moving through the lower Walla Walla River toward the Columbia River during the monitoring period, however the PIT detection array was only partially functional during that time period.

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Introduction

A general decline in bull trout abundance across their range resulted in the listing of all subpopulations in the Columbia River Distinct Population Segment (DPS) as threatened under the Endangered Species Act in June 1998 (63 FR 31647). The U.S. Fish and Wildlife Service (FWS) currently recognizes 141 subpopulations (metapopulations) of bull trout in the Columbia River Basin (U.S. Fish and Wildlife Service 2000). Migratory forms of bull trout from these populations are a particular concern, because they are thought to be close to extirpation (U.S. Fish and Wildlife Service 2000). Descriptions of the genetic population structure of bull trout suggest these salmonids fit well within the metapopulation concept (Rieman and McIntyre 1993, Nerass and Spruell 2000). Local populations of bull trout appear to be connected via gene flow associated with a migratory life history. Disruption of migratory corridors causes habitat fragmentation, and potentially eliminates important gene flow (Nerass and Spruell 2000). Further, this disruption physically isolates populations making them more susceptible to extinction (Rieman and McIntyre 1993). Persistent disruption of the migratory patterns of bull trout may result in the loss of the migratory form from local populations (U.S. Department of Agriculture 1993). Such a loss increases the vulnerability of populations to local extinction events (Nerass and Spruell 2000). Improving connectivity between populations of Columbia River bull trout is a necessary action identified in the FWS Biological Opinion (Biop) on Effects to Listed Species from Operations of the Federal Columbia River Power System (FCRPS) (U.S. Fish and Wildlife Service 2000). Although bull trout are known to occur in the mainstem Columbia and lower Snake rivers, little information is available on their use of these areas. Therefore, the primary requirements of the Biop for FCRPS facilities in these areas are to 1) require monitoring to better determine presence of bull trout, 2) ensure upstream and downstream passage for bull trout is not impeded, 3) determine the effect of flow fluctuations on stranding or entrapment of bull trout, and 4) minimize uncontrolled spill and the effects of total dissolved gas on the species.

Mainstem Snake and Columbia River dams have the potential to impact migratory bull trout. Mainstem dams without adequate passage for bull trout create barriers to migration and may isolate 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. 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). Bull trout also have the potential to be entrained at dams and suffer mortality or injury associated with turbines (Skarr et al. 1996).

The Umatilla – Walla Walla Recovery Unit is one of 22 Recovery Units in the Columbia River DPS. The FWS Draft Recovery Plan for this Unit (U.S. Fish and Wildlife Service 2002) identifies three Core Areas; the Umatilla River Core Area in the Umatilla Basin, and the Walla Walla River Core Area and Touchet River Core Area in the Walla Walla Basin. The Columbia River between the Umatilla Core Area and the Walla Walla and Touchet Core Areas was 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. Both Walla Walla Basin Core Areas are known to support migratory bull trout, however, use of the

Columbia or Snake rivers by these bull trout has not been documented. Consequently, a first step to assess the potential impacts mainstem hydro projects and their reservoirs may have on bull trout is to determine the timing and level of use of the Columbia and Snake rivers by migratory bull trout.

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 bull trout from the Walla Walla Basin enter and return from the Columbia River.

Background

The Walla Walla Basin in Northeastern Oregon (OR) and Southeastern Washington (WA) is a subbasin of the Columbia River that drains an area of 4,553 km^2 (Northwest Power and Conservation Council 2004). The Walla Walla Basin is comprised of the Touchet River, Mill Creek, and Walla Walla River subbasins. The primary headwater tributaries originate in the Blue Mountains and include the North Fork and South Fork Walla Walla rivers, Mill Creek, and the North Fork, South Fork, and Wolf Fork of the Touchet River (Figure 1).

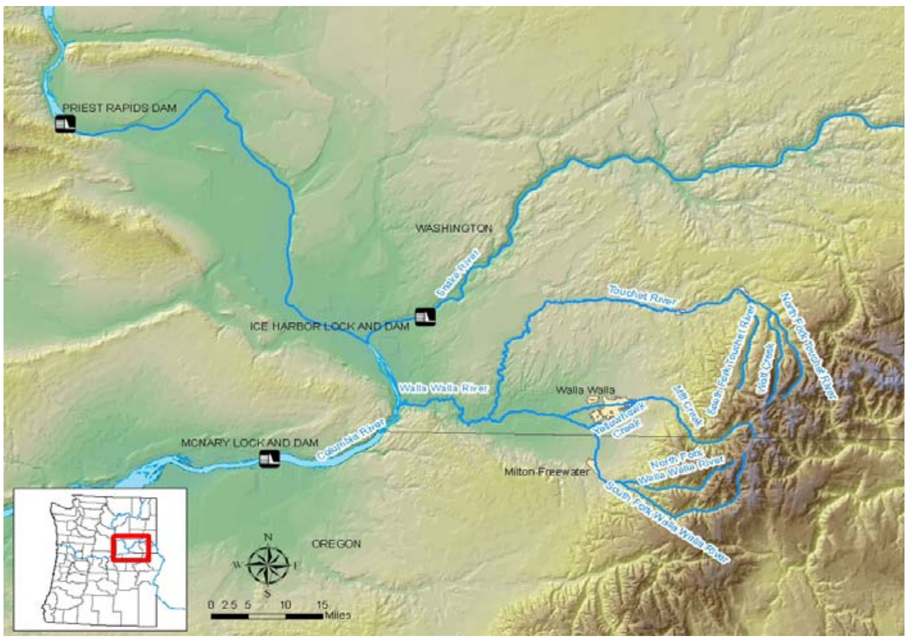

Figure 1. Regional view of the Walla Walla Basin.

Bull trout research has been ongoing in the Walla Walla Basin since 1994 (Weeber et al. 2007, Mahoney et al. 2006, Hemmingsen et al. 2002). Telemetry studies of the seasonal movement and distribution of bull trout in the Basin have been conducted, however, information gaps remain because those studies focused on adult bull trout and included a relatively small number of individuals. Passive integrated transponder (PIT) tag technology is one alternative to radio telemetry as a research tool. Some advantages of this technology include small tag sizes so smaller fish (≥120 mm FL) can be tagged and monitored, 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. Lastly, PIT tag interrogation systems (detection arrays) continuously sample under a wide range of environmental conditions. One disadvantage to this alternative is the cost of installation and maintenance of the detection arrays. Challenging instream conditions and remote site power and communication issues can be rather costly and labor intensive at times. Overall however, PIT technology has the potential to provide insight into distribution and migration patterns of bull trout that would be difficult to determine using other methods.

Between 2002 and 2006, the FWS installed several PIT detection arrays in the Walla Walla River and Mill Creek (Figure 2) to determine the temporal and spatial aspects of bull trout movement, distribution and connectivity between local populations (Anglin et al. 2008). In addition, recent research efforts have resulted in a significant PIT tagging effort in Mill Creek and the South Fork Walla Walla River. The U.S. Forest Service (USFS) has tagged nearly 1800 bull trout in Mill Creek since 2005 (Moore et al. 2006; Weeber et al. 2007). The U.S. Geological Survey-Utah Cooperative Fish and Wildlife Research Unit has been conducting population studies in the South Fork Walla Walla River for the FWS since 2002, and more than 1700 bull trout have been PIT tagged (Budy et al. 2003, 2004, 2005). Detections of these PIT tagged bull trout have helped to describe the details of bull trout distribution and movement within the Basin. During 2005 and 2006, adult and subadult bull trout were detected passing downstream from the Mill Creek Diversion (MCD) and Nursery Bridge Dam (NBD) PIT detection arrays. It is unknown if bull trout disperse further downstream and into the Columbia River from Mill Creek and the South Fork Walla Walla River. The installation of a PIT detection array at Oasis Road Bridge (ORB) near the mouth of the Walla Walla River (Figure 2) will complement the existing arrays in the Basin and may provide detections of PIT tagged bull trout moving into the Columbia River from the ongoing tagging efforts in the South Fork Walla Walla River and Mill Creek and the new tagging effort by the FWS in the mainstem Walla Walla River.

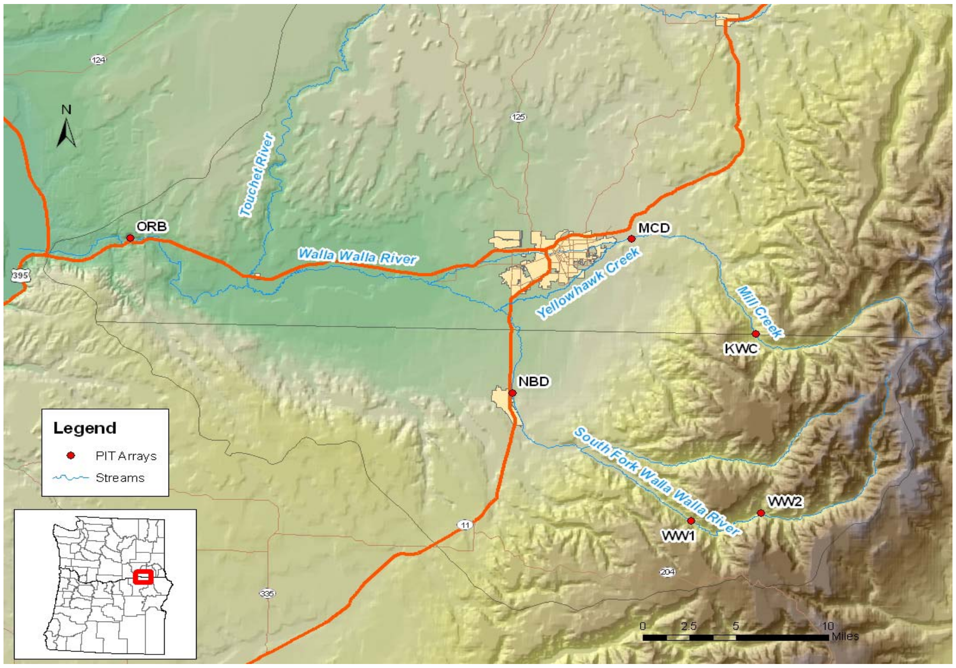

Figure 2. Locations of PIT detection arrays in the Walla Walla River and Mill Creek.

Methods

PIT Detection Array Installation and Operation

To investigate use of the mainstem Columbia River by Walla Walla Basin bull trout, the FWS installed a full duplex PIT detection array (Zydlewski et al. 2003) using a Destron Fearing 1001M multiplexing transceiver. The site was established in the Walla Walla River at Oasis Road Bridge, 10.1 km upstream from the mouth. Due to the relatively close proximity to the mouth, we assumed bull trout passing this location were either moving upstream from, or downstream to the Columbia River. Locating the PIT detection array at the mouth of the Walla Walla River would likely have resulted in relatively low detection efficiencies due to increased stream width and depth resulting from the backwater caused by McNary Pool. We chose to install the site at ORB because it was the farthest downstream location where detection efficiency would not be affected by McNary Pool, basalt bedrock was present to anchor the antennas, and the bridge could be used to fix the top of the antennas. Road access at ORB also allowed delivery of the propane required to fuel the thermoelectric generators planned for the site.

Even though the site was upstream from McNary Pool backwater effects, a new antenna design (dual loop) was developed because water levels during winter and spring were too high to efficiently operate an array of standard antennas. The dual loop pass through design divided the antenna into two smaller electromagnetic fields, essentially allowing us to monitor twice the area of a standard antenna while maintaining a similar detection efficiency. A single 1.8 x 3.3 m dual loop pass through antenna was installed in the thalweg at ORB to test the new design under spring flow conditions. Aluminum angle brackets were bolted to the basalt substrate, and the bottom of the antenna was secured to the brackets using nylon webbing. The top of the antenna was attached to the bridge with rope. Data collection began on April 15, 2005. The antenna remained intact and as spring flows subsided, three more 1.8 x 3.3 m dual loop pass through antennas were added to the site on June 17, 2005 using similar installation methods. Lastly, two 0.9 x 2.1 m pass through bank antennas were installed on December 6, 2005 to complete the array (Figure 3). A laptop computer equipped with Minimon software (Pacific States Marine Fisheries Commission) was installed at the site on September 12, 2005. Data were typically uploaded monthly to the PTAGIS website by FWS biologists.

Figure 3. Oasis Road Bridge dual loop pass through PIT detection array.

High streamflows during December 2005 damaged four of the six antennas leaving only the two bank antennas operational. We were unable to replace the damaged antennas until streamflows dropped in early summer 2006. Several changes were made in the construction and installation of the antennas in an attempt to keep them in place under high flow conditions. The antenna cable plug-ins were moved from the top of the antenna to the bottom, near the substrate, to reduce debris accumulation, and the tops of the antennas were no longer secured to the bridge, leaving them free to float near the water's surface. This type of installation was intended to allow debris to pass over the antenna array (Figure 4).

Figure 4. Oasis Road Bridge dual loop pass through PIT detection array showing antenna cable plug-ins near the bottom of the river, and the new, free-floating design.

Routine inspection and maintenance of the antenna array was performed to ensure reliable data collection and system operation. Interrogation performance was measured for individual antennas and the antenna array as a whole within the water column. Individual antenna evaluations were typically conducted monthly beginning in July 2005. During individual antenna evaluations, the percent of the total area monitored by each antenna was determined by placing a TX1415BE, 23 mm PIT tag, perpendicular to and in the center of the antenna. If the PIT tag was detected in the center of the antenna, the detection efficiency was 100%. If the PIT tag was not detected in the center of the antenna, the tag was placed along the sides of the antenna and moved to the center of the antenna until the tag was no longer detected. The proportion of the electromagnetic field that detected the tag was then calculated.

The temporal performance of the antenna array was determined by calculating the monthly proportion of water column monitored for each antenna. The monthly proportion of water column monitored was calculated by averaging the daily proportion of water column monitored. The daily proportion of water column monitored was determined from the daily area monitored by the array and the daily cross sectional area of the stream at the array. The functional status of the antennas (operational, not operational, not present), the percent area monitored by each antenna, and water stage height were used to determine the daily proportion of water column monitored. The daily functional status of the antennas was determined by examining status reports from the transceiver. The antennas were designed to detect PIT tags throughout the entire pass-through area of the antenna. If monthly measurements were not conducted, we assumed the area monitored by the antenna was 100%.

The average daily stage data at USGS gage #14018500 (Walla Walla River near Touchet) was used to represent stage height at the array. The gage is located 15 km upstream from the array. There are no major tributaries between the gage and the array, and observations suggested stage heights at ORB responded similarly to stage heights at the USGS gage over a range of streamflows. Observations suggested that the river came into contact with bank antennas 1 and 6 (Figure 5) when the USGS gage height was approximately 0.9 m, and flows exceeded the height of all of the antennas when the USGS gage height exceeded approximately 1.6 m. We used stream width and stage height to calculate the total cross sectional area of the river, and compared this to the cross sectional area of the entire array to determine the proportion of the river cross section that was monitored at the array. Since there were gaps between several of the antennas, those areas were not included in calculations of the area monitored. Although river width typically varied with stage height, when flows were at or near a minimum (h_{min}) and stage height was $\leq$ 0.9 m we assumed the width of the river was equal to 13.3 m (W_4) (Figure 5). When the stage height was > 0.9 m, we assumed the width of the river was equal to 18.0 m (W_5). The following specific calculations were conducted to estimate the monthly proportion of the river cross section monitored by the antenna array:

1) Calculate the area monitored by each antenna;
2) Calculate the area monitored by the array each day;
3) Calculate the total river cross sectional area each day;
4) Calculate the daily proportion of the river cross sectional area monitored;
5) Average the daily proportion of the river cross sectional area monitored for monthly estimates.

1) The area monitored by each antenna was calculated using the following equations;

$$A_{1,6} = (F\ x\ P\ x\ E\ x\ I\ x\ (h_d - h_{min}))$$
$$A_{2-5} = (F\ x\ P\ x\ E\ x\ h_d)$$

where,

$A_{1,6} = the\ area\ monitored\ by\ antennas\ 1\ and\ 6,$
$A_{2-5} = the\ area\ monitored\ by\ antennas\ 2, 3, 4\ and\ 5,$

$F\begin{cases} = 1\ if\ the\ antenna\ is\ functional \\ = 0\ otherwise \end{cases},$

$P = percent\ area\ monitored\ by\ each\ antenna\ based\ on\ monthly\ measurements,$
$E = electromagnetic\ field\ width,$

$I\begin{cases} = 1\ if\ h_d > 0.9 \\ = 0\ otherwise \end{cases},$

$h_d\begin{cases} = h_d\ if\ h_d < 1.6 \\ = 1.6\ otherwise \end{cases},$

$h_{min} = 0.9$

2) The area monitored ($Area\ Monitored_d$) each day was then calculated using the following equation;

$$Area\ Monitored_d = A_1 + A_2 + A_3 + A_4 + A_5 + A_6$$

3) The total river cross sectional area at the array ($Total\ Area_d$) each day was calculated using the following equation;

$$Total\ Area_d = \ [h_d(\ W_4)] + \ I(W_5 - W_4\ ) \times (h_d - h_{min})$$

where,

$h_d = daily\ river\ stage\ height,$
$h_{min} = 0.9,$
$W_4 = 13.3,$
$W_5 = 18.0,$

$$I \begin{cases} = 1\ if\ h_d > \ 0.9 \\ = 0\ otherwise \end{cases}$$

4) The daily proportion of river cross section monitored was calculated using the following equation;

$$Daily\ proportion\ of\ cross\ section\ monitored\ = \frac{Area\ Monitored_d}{Total\ Area_d}$$

5) The mean monthly proportion of river cross section monitored was calculated by averaging the daily proportion of cross section monitored.

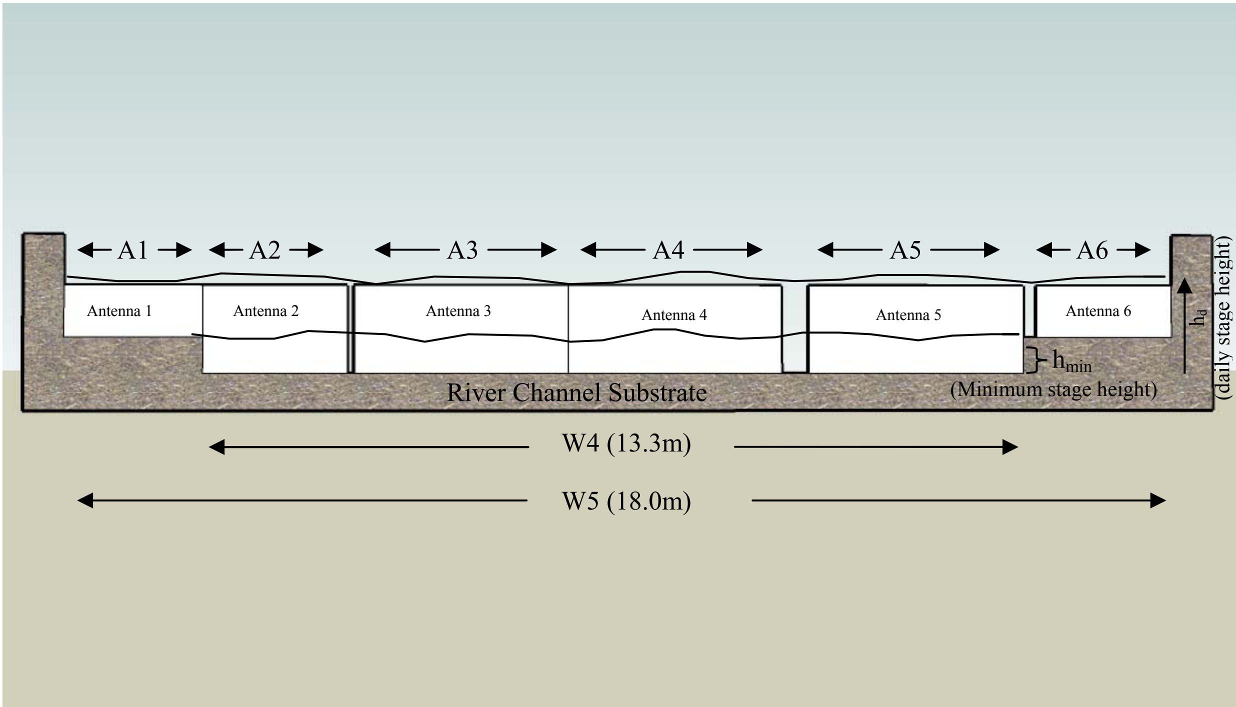

Figure 5. Cross-sectional diagram of the six antennas at the Oasis Road Bridge PIT detection array and depiction of the variables used to calculate the proportion of the river cross section monitored.

Bull Trout Sampling/PIT Tagging

Our goal was to capture bull trout that were likely to migrate downstream, through the Walla Walla Basin and into the Columbia River. Previous data indicated the Walla Walla bull trout local populations consisted of both resident and migratory fish, and that the migratory fish used different spatial scales to fulfill their life history. We reviewed dispersal and migration data to determine the appropriate time periods to sample migratory bull trout, and planned our field sampling for locations lower in the Basin to increase the likelihood that PIT tagged bull trout would include those "longer range" migrants that were more likely to use a spatial scale that included the Columbia and/or Snake rivers.

Past studies (Budy et al. 2003, 2004, 2005) showed that bull trout PIT tagged in the South Fork Walla Walla River were detected moving downstream past the WW1 PIT detection array (Figure 2) during both spring and fall time periods. Screw trap sampling near Milton-Freewater, OR also indicated a spring dispersal period for subadult bull trout (Anglin et al. 2008). In addition, results from a past telemetry study indicated overwintering migratory adult bull trout move downstream from October through December, and the lower limit of the winter distribution was near the OR/WA state line (Mahoney et al. 2006). No evidence existed to suggest that either adult or subadult bull trout moved further downstream to areas near the mouth of the Walla Walla River. Since the data discussed above included only bull trout that had been tagged or sampled in the upper reaches of the Walla Walla River or Mill Creek, we hypothesized that a sampling and tagging effort further downstream during the appropriate time periods (spring, fall) might result in migrants that were more likely to use lower reaches of the Walla Walla River and possibly the Columbia River. Bull trout in nearby Recovery Units migrate considerable distances when habitat conditions allow. In the Upper Columbia Recovery Unit, adult bull trout from the Entiat, Wenatchee, and Methow Core Areas regularly use the Columbia River. Radio tagged bull trout from the Upper Entiat River out-migrated an average distance of 75.7 km to overwintering locations (Nelson and Nelle 2008). In the Snake River Recovery Unit, bull trout from the Tucannon Core Area have been documented using the Snake River (Faler et al. 2006). Habitat conditions in the mainstem Walla Walla River become highly impacted near Milton-Freewater, OR from irrigation withdrawals and channel modifications for flood control. Low streamflows downstream from Milton-Freewater, OR, particularly during late spring through early fall, may affect observed dispersal and migration patterns of bull trout. Therefore, our efforts to capture and PIT tag bull trout were focused near Milton-Freewater, OR and downstream, to target fish that had already migrated a substantial distance downstream in the system, and would potentially be more likely to use the mainstem Columbia River.

We sampled for bull trout using dip nets, hook and line, and a beach seine between May 10 and July 19, 2006. Sampling was conducted at several locations between Milton-Freewater, OR and the OR/WA state line. Sampling was terminated for the summer after July 19 because water temperatures exceeded 18^{o}C, creating a risk of stress and mortality to the fish. Captured bull trout were anesthetized with tricaine methanesulfonate (MS 222) and tagged with a 23 mm PIT tag. The tag was inserted into the body cavity through a 5 mm ventral incision. The incision was then sealed with Nexaband, a topical tissue adhesive.

PIT Detections

Detections of PIT tagged fish at ORB were logged on either the transceiver or the laptop computer at the site. In addition to bull trout, spring Chinook salmon and summer steelhead are also PIT tagged in the Walla Walla Basin. Detections of PIT tagged fish and other operational data from the site were uploaded monthly to the PTAGIS database.

PIT tagged fish that moved into the Columbia and/or Snake rivers also 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 fish bypass systems.

Results and Discussion

PIT Detection Array Installation and Operation

The percent area monitored by each antenna at the ORB PIT detection array was typically estimated monthly. Percent area monitored by each antenna, the number of antennas that were actually present, river stage height, and the daily operational status of the site and/or antennas were used to determine the average monthly proportion of the river cross section that was monitored (detection efficiency) (Table 1). When tests were conducted using a 23 mm PIT tag, the tag was detected throughout the entire area of each individual antenna field in all but two tests involving antennas 2 and 3 on November 18, 2005. When tests were not conducted, we assumed individual antenna efficiency was 100%.

Table 1. Percent area monitored for individual antennas and average monthly percent detection efficiency at the ORB PIT detection array. NC=antenna efficiency not measured; NP=antennas were damaged or not present.

	Antenna						
Date	1	2	3	4	5	6	Detection Efficiency
April 2005	NP	NP	NP	NP	NC	NP	22%
May 2005	NP	NP	NP	NP	NC	NP	19%
June 2005	NP	100%	100%	100%	100%	NP	53%
July 2005	NP	100%	100%	100%	100%	NP	67%
August 2005	NP	100%	100%	100%	100%	NP	95%
September 2005	NP	100%	NP	100%	100%	NP	74%
October 2005	NP	100%	100%	100%	100%	NP	77%
November 2005	NP	97%	90%	100%	100%	NP	98%
December 2005	100%	100%	100%	100%	100%	100%	86%
January 2006	NP	NP	NP	NP	NP	NC	2%
February 2006	NP	NP	NP	NP	NP	100%	5%
March 2006	NP	NP	NP	NP	NP	100%	5%
April 2006	100%	NP	NP	NP	NP	100%	6%
May 2006	100%	NP	NP	NP	NP	100%	10%
June 2006	100%	NP	NP	NP	NP	100%	11%
July 2006	NP	NP	100%	100%	100%	100%	74%
August 2006	100%	100%	100%	100%	100%	100%	93%
September 2006	NC	NC	NC	NC	NC	NC	99%
October 2006	100%	100%	100%	100%	100%	100%	99%

Detection efficiency ranged from 2.3% to 99% over the 19-month sampling period. Detection efficiency decreased to near zero following a December 2005 high flow event that washed out antennas 1, 2, 3, 4, and 5. As a result, stream coverage was at or below 11% from January through June 2006. We completed antenna replacement in June and July, 2006, and detection efficiency increased to 74% - 99% from July through October. Detection efficiency may have been less than the values reported here due to the random accumulation of debris on the antennas between site visits. The accumulation of debris likely would have caused the antennas to "sink" due to the increased resistance from the debris in the current, thereby reducing the proportion of the river cross section monitored.

Bull Trout Sampling/PIT Tagging

We captured and PIT tagged 11 bull trout using dip nets and hook and line sampling between June 26 and July 19, 2006. Water temperatures increased to unsafe sampling levels after July 19. No fish were captured using a beach seine. All of the bull trout were captured in the vicinity of Milton-Freewater, OR. Fish size ranged from 153-250 mm with an average size of 199 mm. Screw trap captures reported by Anglin et al. (2008) suggest a downstream movement of similar sized bull trout during the same time period. Therefore, these fish were likely subadults that were dispersing downstream to rear.

PIT Detections

No bull trout were detected at the ORB PIT detection array during the sampling period. Untagged bull trout could have passed the array at anytime and PIT tagged bull trout could have passed the array undetected, particularly during time periods when detection efficiency was relatively low. Steelhead and Chinook salmon detections peaked during April and May in 2005 and 2006 even though detection efficiency was relatively low (≤22%) during those months (Figure 6). Increased detections of steelhead and Chinook during April and May corresponded with peak outmigration from the Walla Walla Basin (Mahoney et al. 2006).

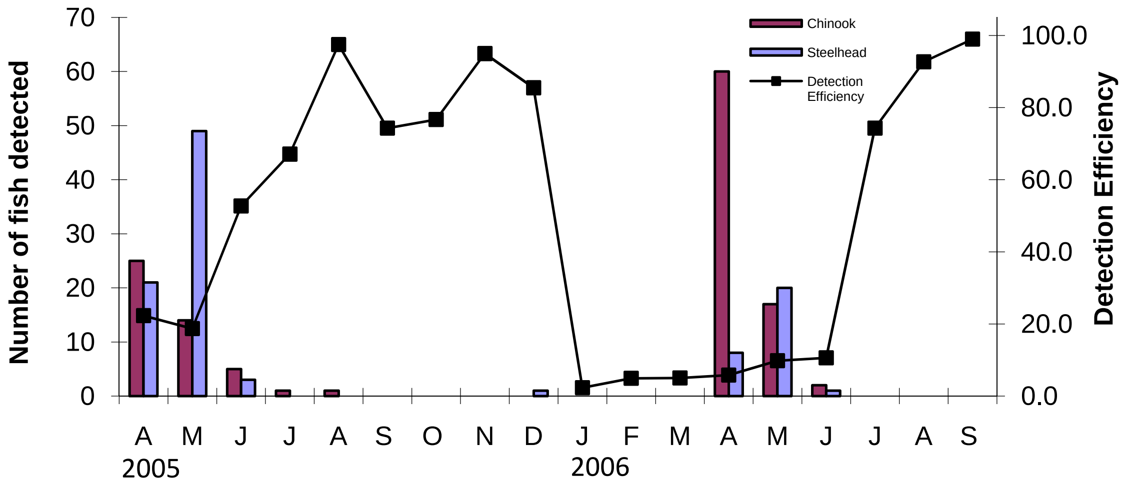

Figure 6. Monthly distribution of PIT tagged fish detections and detection efficiency of the PIT tag detection array at Oasis Road Bridge.

Queries of the PTAGIS database did not reveal any detections of bull trout at McNary or Ice Harbor dams during the reporting period.

Future Plans

During 2007, we plan to evaluate antenna detection efficiencies using PIT-tagged juvenile Chinook salmon or steelhead. The CTUIR has been operating a screw trap near rkm 9 and have agreed to release PIT-tagged smolts upstream of the ORB PIT detection array. Although these fish will be tagged with 12 mm PIT tags, they will provide a relative indication of antenna performance. Most bull trout in the Walla Walla Basin have been PIT tagged with 23 mm tags which have considerably better read ranges compared to the 12 mm tag.

We will continue to sample for bull trout using dip nets, beach seines, and hook and line until the most efficient method is identified. We will also add fyke traps as a sampling method in locations that are appropriate (e.g. fish bypasses). We will expand our sampling efforts into lower river areas with a goal of PIT tagging bull trout that are more likely to be "long range" migrants.

References

Anglin, D. R., D. G. Gallion, M. Barrows, C. Newlon, P. Sankovich, T. J. Kisaka, and H. Schaller. 2008. Bull trout distribution, movements and habitat use in the Walla Walla and Umatilla River Basins. 2004 Annual Progress Report.

Budy, P., R. Al-Chokhachy, and G. P. Thiede. 2003. Bull trout population assessment and life-history characteristics in association with habitat quality and land use in the Walla Walla River Basin: a template for recovery planning. Annual Progress Report for 2002. USGS Utah Cooperative Fish and Wildlife Research Unit. Utah State University, Logan, Utah.

Budy, P., R. Al-Chokhachy, and G. P. Thiede. 2004. Bull trout population assessment and life-history characteristics in association with habitat quality and land use: a template for recovery planning. Annual Progress Report for 2003. USGS Utah Cooperative Fish and Wildlife Research Unit. Utah State University, Logan, Utah.

Budy, P., R. Al-Chokhachy, and G. P. Thiede. 2005. Bull trout population assessment in northeastern Oregon: a template for recovery planning. Annual Progress Report for 2004. USGS Utah Cooperative Fish and Wildlife Research Unit. Utah State University, Logan, Utah.

Faler, M., G. Mendel, C. Fulton. 2006. Evaluate Bull Trout Movements in the Tucannon and Lower Snake Rivers. 2005 Annual Report. Project No. 200200600. Bonneville Power Administration, Portland, Oregon.

Harza 2000. Lower Clark Fork River Fish Transport Plan. Final Report to Avista Corp. Portland, Oregon. 32 pgs.

Hemmingsen, A. R., S. L. Gunckel, P.M. Sankovich, and P. J. Howell. 2002. Bull trout life history, genetics, habitat needs, and limiting factors in central and northeast Oregon. 2001 Annual Report. Project Number 199405400. Bonneville Power Administration, Portland, Oregon.

Mahoney, B.D., M.B. Lambert, T.J. Olsen, E. Hoverson, P. Kissner, and J.D.M. Schwartz. 2006. Walla Walla Basin Natural Production Monitoring and Evaluation Project Progress Report, 2004 - 2005. Confederated Tribes of the Umatilla Indian Reservation. Report submitted to Bonneville Power Administration, Project No. 2000-039-00.

Moore, T., S. Starcevich, S. Jacobs, and P. Howell. 2006. Migratory Patterns, Structure, Abundance, and Status of Bull Trout Populations from Subbasins in the Columbia Plateau and Blue Mountain Provinces. 2005 Annual Report. Project No. 199405400. Bonneville Power Administration, Portland, Oregon.

Nelson, M.C and R.D. Nelle. 2008. Seasonal movements of adult fluvial bull trout in the Entiat River, WA, 2003-2006. U.S. Fish and Wildlife Service, Leavenworth, WA.

Nerass, L.P. and P. Spruell. 2000. Genetic analysis of bull trout from the lower Clark Fork basin and Cabinet Gorge Dam. Report WTSGL00-101, Wild Trout and Genetics Laboratory, University of Montana, Missoula, MT.

Northwest Power and Conservation Council. 2004. Walla Walla Subbasin Plan. *In* Columbia River Basin Fish and Wildlife Program. Portland, Oregon.

Rieman, B.E. and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. General Technical Report INT-302. Ogden, Utah. U.S. Forest Service, Intermountain Research Station. 38 pgs.

Skarr, D., J. Deshazer, L. Garrow, T. Ostrowski, and B. Thornburg. 1996. Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Montana Department of Fish, Wildlife, and Parks and Bonneville Power Administration. Project 83-467 Completion Report. Kalispell, MT.

U.S. Department of Agriculture. 1993. Draft bull trout habitat conservation assessment. U.S. Department of Agriculture, Forest Service, Region 1, Missoula, MT. 29 pgs.

U.S. Fish and Wildlife Service. 1998. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Klamath River and Columbia River Distinct Population Segments of Bull Trout. Federal Register 63 (111): 31647-31674. June 10, 1998.

U.S. Fish and Wildlife Service. 2000. Biological Opinion on the effects to listed species from operations of the Federal Columbia River Power System. U.S. Fish and Wildlife Service, Region 1 and 6. Portland, OR. 97 pgs.

U.S. Fish and Wildlife Service. 2002. Chapter 10, Draft Umatilla-Walla Walla Recovery Unit, Oregon and Washington. 149 p. *In*: U.S. Fish and Wildlife Service. Bull Trout (Salvelinus confluentus) Recovery Plan. Portland, Oregon.

Weeber, M.A., S.J. Starcevich, S. Jacobs and P. Howell. 2007. Migratory Patterns, Structure, Abundance, and Status of Bull Trout Populations from Subbasins in the Columbia Plateau and Blue Mountain Provinces. 2006 Annual Report. Project Number 199405400, Bonneville Power Administration, Portland, Oregon.

Zydlewski, Gayle, Christiane Winter, Dee McClanahan, Jeffrey Johnson, Joseph Zydlewski, and Sean Casey. 2003. 'Evaluation of Fish Movements, Migration Patterns, and Population Abundance with Streamwidth PIT Tag Interrogation Systems. Final Report 2002. Project No. 2001-01200. Bonneville Power Administration, Portland, Oregon.