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

Annual Report 2009
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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. Little is known about use of the Columbia River by bull trout from the Walla Walla Basin and the need for further research is identified in the U.S. Fish and Wildlife Service Draft Recovery Plan. From October 2008 through September 2009, use of the Columbia River by Walla Walla Basin bull trout was investigated by operating a passive integrated transponder (PIT) detection array to monitor fish movements between the Walla Walla and Columbia rivers, tagging bull trout in the Walla Walla River with PIT tags, and querying PTAGIS for detections at the mouth of the Walla Walla River and at the Columbia and Snake river dams. The full stream width PIT detection array was maintained near Oasis Road Bridge in the lower Walla Walla River. A total of 210 bull trout from the middle and lower Walla Walla Basin were captured with screw traps, beach seines, fyke nets, and by angling and were subsequently PIT tagged in 2009. Additional bull trout PIT tagged by other agencies in Mill Creek (tributary to the Walla Walla River), the South Fork Walla Walla River, and the Touchet River contributed to the pool of potentially detectable fish. Thirteen PIT tagged bull trout were detected at the Oasis Road Bridge PIT detection array during the year; twelve were detected moving downstream in the Walla Walla River toward the Columbia River from November through February, and one was detected moving upstream in the Walla Walla River past the array in June. This was the first empirical evidence of a bull trout returning to the Walla Walla River after overwintering in the Columbia River. Additional PIT tagged bull trout may have passed the PIT array undetected when detection efficiencies were relatively low. Estimated detection efficiency at the PIT array was relatively high (>80%) from October through December, 2008, but declined to <35% from January through September, 2009 following damage to the array from high streamflow events. Since only a small proportion of Walla Walla Basin bull trout are PIT tagged, these 13 detections likely represent some larger number of bull trout exhibiting a similar pattern of movement. Three bull trout PIT tagged in the Walla Walla River were detected at Columbia River dams in 2009. Two fish were detected at McNary Dam; one moving downstream in the juvenile bypass, and one in the Oregon shore adult ladder. One fish was detected moving upstream through the adult ladder at Priest Rapids Dam. These PIT detections at mainstem dams indicate Walla Walla River bull trout are using the Columbia River as a migratory corridor, and for rearing and overwintering.

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 irrigation diversion canals, and the effects of 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 for bull trout passage are present 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. 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 addition to possible passage delays at mainstem dams, bull trout also have the potential to be entrained into the turbines which may result in injury or mortality (Skarr et al. 1996).

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 2002b) 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. In addition, the Yakima and Tucannon Core Areas are also within close proximity to the Walla Walla Basin Core Areas. 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 migration habitat. Within the Walla Walla River Core Area, both Upper Mill Creek and Upper Walla Walla River local populations are known to support migratory fish, but until recently, it was unknown if these migratory bull trout used the Columbia or Snake rivers.

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, Mendel et al. 2003, Mahoney et al. 2006, Anglin et al. 2008a) and PIT tag detection arrays (Anglin et al. 2008a, Anglin et al. 2008b, Gallion and Anglin 2009, Anglin et al. 2009a, Anglin et al. 2009b). 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. < 2 years). In comparison, PIT tags can be used to monitor movements of large numbers of bull trout for long time periods. In addition, relatively small bull trout can be PIT tagged because of the small tag size (12 mm, 23 mm) and light weight (~0.10 g, ~0.62 g). PIT tags remain active for the life of the fish, the implantation procedure is less invasive, and PIT tags are less expensive than radio tags, which allow a larger proportion of the population to be marked for a given cost.

Current and past research projects, including this project, have resulted in a substantial 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 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, 2008, 2009). PIT tagged fish from these groups that have not been lost to mortality are available for detection at the Oasis Road Bridge detection array, although it is not possible to estimate the proportion of the total that may be long range migrants.

Table 1. Number of bull trout PIT tagged in the Walla Walla Basin by reporting year (October 1 through September 30) 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
2007	374	1079		11	23	18	1505
2008	603	813		158	39	112	1725

[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 2008, the FWS installed a number of 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; Anglin et al. 2009a, 2009b). The 10 detection arrays (Figure 1) installed in mid- and upper-basin areas (Harris Park, Bear Creek, Nursery Bridge, Kiwanis Camp, Bennington Diversion, Division Ladder, Yellowhawk Creek, Yellowhawk Creek 2, Burlingame, Lowden) allowed us to determine distribution and movements of migratory bull trout that originate in headwater spawning and early rearing areas (upper South Fork Walla Walla River, upper Mill Creek). The next step in our research was to determine distribution and movements for longer range migrants that may have been using the lower Walla Walla River and Columbia River.

In 2005, The U.S. Army Corps of Engineers (ACOE) funded the FWS for a five year study to determine use of the mainstem Columbia and Snake rivers by Walla Walla Basin bull trout. A primary component of the study was installation of the PIT detection array at Oasis Road Bridge (ORB) on the lower Walla Walla River at rkm 10.1 (Gallion and Anglin 2009). No bull trout were detected at this array in 2005 or 2006. The first evidence of bull trout using the Columbia River was a detection at ORB on January 31, 2007 (Anglin et al. 2009a). We continued to PIT tag bull trout in 2008, and focused tagging efforts on lower Basin areas to increase the number of tagged fish that would potentially move out of the Walla Walla Basin. In 2008, six bull trout were detected at the ORB PIT detection array moving toward the Columbia River from November 2007 to January 2008, providing further evidence of bull trout use of the Columbia River (Anglin et al. 2009b). The increase in detections at ORB was primarily a function of increased FWS tagging efforts and success in the lower Walla Walla Basin. In addition to these detections, it is likely that additional PIT tagged bull trout passed the array undetected when detection efficiency was low. An unknown number of untagged bull trout also likely passed the array, since only a portion of the migratory population is PIT tagged.

We also monitored the PTAGIS database for detections of Walla Walla Basin bull trout at mainstem hydro projects from 2005 – 2008. One bull trout that was PIT tagged in the Touchet River was detected passing downstream through the John Day Dam juvenile fish bypass in 2008.

Our goals during 2009 were to maintain the ORB PIT detection array and to continue to PIT tag migratory bull trout, with a focus on lower Basin areas to increase the number of tagged fish that would potentially move out of the Walla Walla Basin and into the mainstem Columbia River (i.e. McNary Pool). Further defining the timing and level of use of the Columbia River is the first step to assess the potential impacts mainstem dams and reservoirs may have on migratory bull trout. In addition, if observations of migratory bull trout from the Walla Walla Basin using the Columbia River continue, their presence at upstream and downstream hydro projects should be investigated.

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.

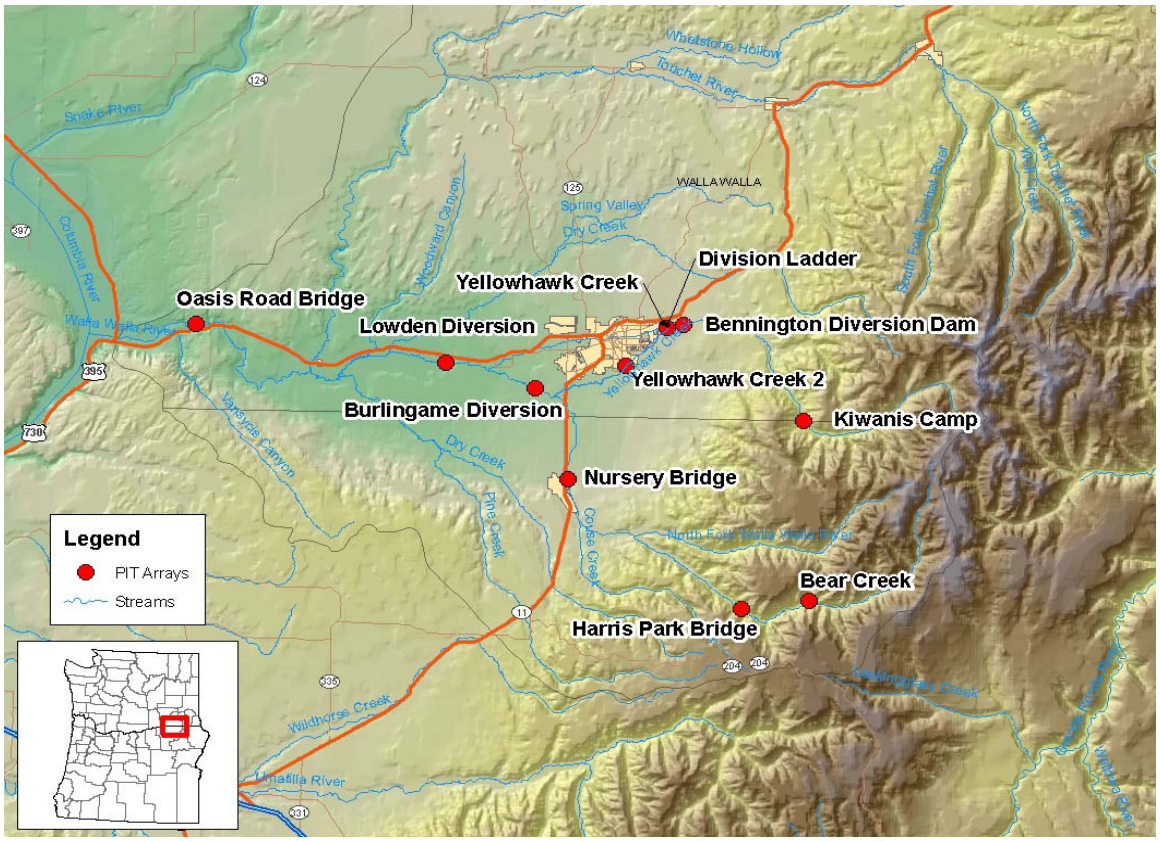

Figure 1. Locations of PIT detection arrays in the Walla Walla Basin.

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 array at Oasis Road Bridge in the lower Walla Walla River (Figure 1). The site configuration consisted of a primary detection array, comprised of six individual pass through (PT) antennas (Figure 2) and a backup array of six pass over (PO) antennas (Figure 3). The PT antennas detect most PIT tagged fish when they pass through the inner space of the antenna structure. 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. The backup PO array was installed approximately 25 m upstream from the initial array. The PO 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. As described in Anglin et al. (2009a), results of simultaneous operation of both arrays were not satisfactory. As a result, during 2009, the antennas from the PO array were only used as a backup for damaged or missing PT antennas.

Data from the multiplexors that control the antennas and record detections into a buffer were also recorded on a portable computer at the site, and regularly uploaded to the regional PTAGIS

database using a Wi-Fi wireless local area network. Routine inspection and maintenance of the antenna arrays were conducted when streamflows allowed to repair broken antennas and cables, and to remove debris from the 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.

Detection Efficiency - Physical

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

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

The PT and PO arrays were located 25 meters apart and PO antennas that were used to back up damaged PT antennas do not monitor the same physical space. Therefore, it is possible for a PIT tagged fish to pass the PT array in a different location in the river cross section than where it passes the PO array. As a result, physical detection efficiency is only calculated for the PT array and does not include efficiency estimates for PO antennas used in place of damaged PT antennas.

Site Functionality – The PT array is comprised of six, separate antennas. 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, and tuning. In addition, if the power supply to the site is down, none of the antennas will operate. All of these factors determine the proportion of time that the site was partially or fully functional.

Individual Antenna and Overall Site Efficiency – Physical detection efficiency is affected by two primary factors; streamflow magnitude and the coverage of the electromagnetic field within and/or around each PT antenna. High streamflows depress the antennas and cause water to flow over the tops and around the bank 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 Anglin et al. (2009a), and was nearly always 100% within the pass through area of the antennas. Individual antenna efficiency tests were not conducted in 2009 as they had been from 2005-2007. We assumed, based on repetitive measurements conducted from 2005-2007, that antenna performance was 100%, or coverage was complete within each individual antenna (i.e. there were no holes).

We used the same method in 2009 that was described in Gallion and Anglin (2009) and Anglin et al. (2009a) for physical efficiency estimates. This method was based on site functionality, streamflow magnitude, and antenna efficiency. Evaluation of the following variables on a daily basis provided the data for efficiency estimates:

- Site functionality was determined (using remote 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 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 physical 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 physical detection efficiency for the entire array. Biological detection efficiency, which was estimated in 2008, was not evaluated during 2009.

Bull Trout Sampling/PIT tagging

Bull trout sampling was conducted with the overall goal of tagging migratory bull trout that were likely to enter the Columbia River. We used the results of previous years sampling along with detection data from our PIT detection array sites to determine the timing and location of our sampling efforts (Figure 4). We continued to increase sampling frequency, and sampled all months during 2009 with the exception of February and April. Angling was the primary method used for sampling, but we also sampled with beach seines and fyke nets. We calculated the catch per unit effort (CPUE) for each sampling method to determine which method was the most efficient.

Hook and line sampling was conducted primarily in pools from Joe West Bridge (rkm 82) to the Old Lowden Diversion facility (rkm 51) on the Walla Walla River, and from the Mill Creek Diversion Dam (rkm 18) on Mill Creek to the confluence with Yellowhawk Creek (rkm 17). Hook and line sampling was also conducted in upper Yellowhawk Creek. Artificial lures with pinched barbs were used.

Beach seining was conducted near Summers Lane, south of the OR/WA border (Figure 4). After bull trout were located by snorkeling, a 7.6 m beach seine was used to isolate the channel unit which was usually a pool. The snorkeler then attempted to "herd" bull trout towards the seine, and the seine was pulled.

A fyke net was deployed below the head gate at the upper end of Yellowhawk Creek (Figure 4). The fyke net was typically deployed for continuous 24-hour periods while in the field, and checked each morning and evening.

Other fish sampling efforts in the Basin resulted in additional PIT tagged bull trout by cooperating agencies. The CTUIR operated four screw traps in the Walla Walla Basin (Figure 4). These efforts were conducted primarily for Chinook salmon and steelhead, but when bull trout of sufficient size were captured, they were PIT tagged. As in previous years, a screw trap was operated at Joe West Bridge, just upstream from Milton-Freewater, OR. Another screw trap was operated at Pierce's RV Park (rkm 9) below the ORB PIT array. There were also screw traps operated in lower Mill and Yellowhawk creeks. 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 all untagged bull trout of sufficient size

(>120 mm). An approximate 4 mm abdominal incision was made with a scalpel that was just deep enough to pierce the skin. The PIT tag was then inserted in a subcutaneous position. Fish were recovered for 30 minutes and released on site. All other species were enumerated and released. No sampling was conducted when water temperatures exceeded 18°C.

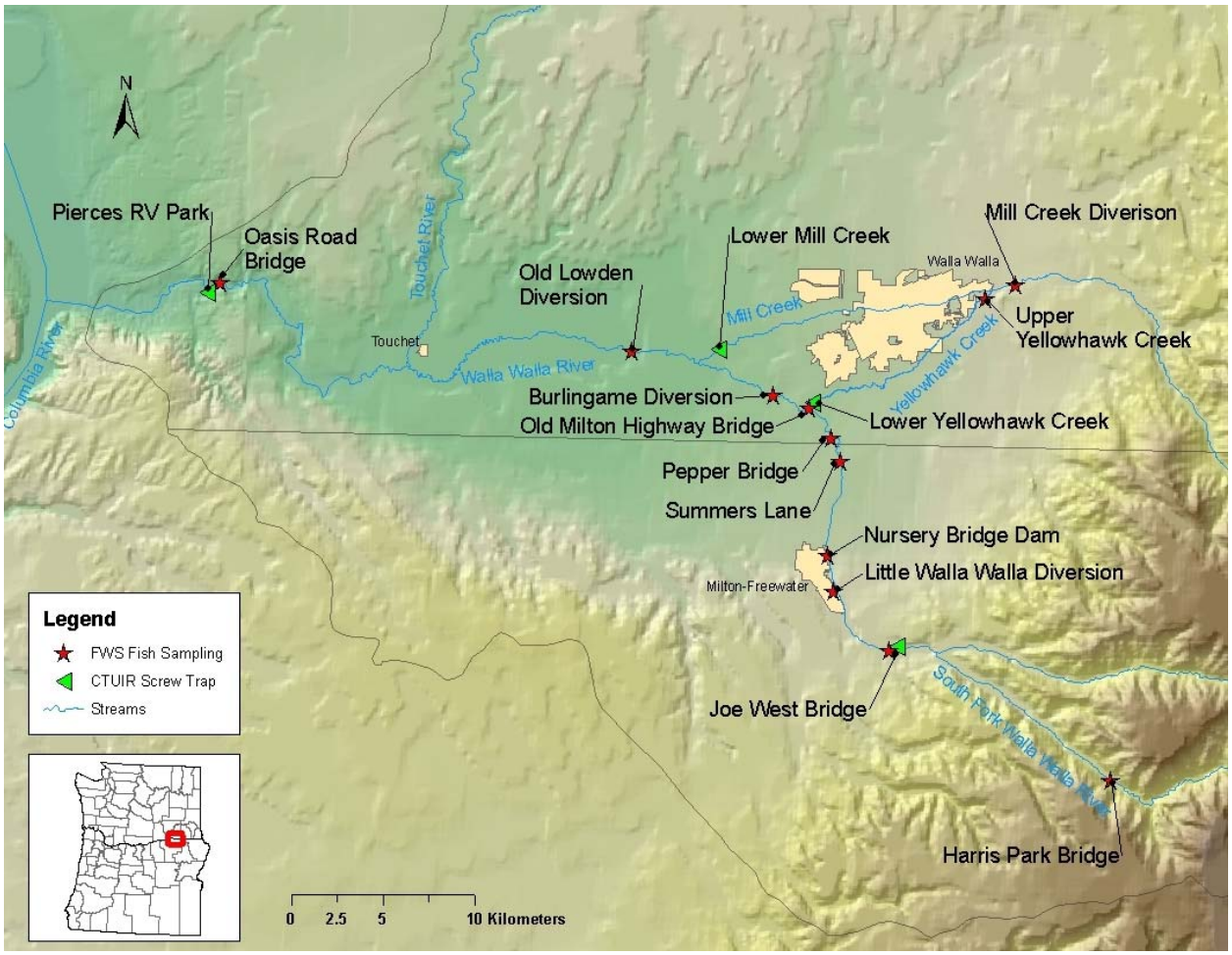

Figure 4. Bull trout sampling locations in the Walla Walla Basin.

PIT Detections

Detections of PIT tagged fish and site-specific operational data from ORB were recorded to the multiplexor buffer, archived on a laptop computer and automatically uploaded daily via a wireless internet connection to the regional PTAGIS database. Bull trout detections were compared to streamflow, water temperature, and the physical detection efficiency calculated 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 Walla Walla Basin bull trout in the 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.

Results and Discussion

PIT Detection Array Operation and Maintenance

The ORB PT detection array was only partially operational for the majority of time between October 2008 and September 2009. Although the array was fully or nearly fully operational in October and November, three of six PT antennas or antenna cables were damaged between December 19 and 29, 2008. Three antennas from the backup PO array were plugged into the multiplexor on January 9, 2009 as a back up to the damaged PT antennas. Subsequently, two additional PT antennas were damaged on April 6, 2009 and two additional PO antennas were used as back-ups for the damaged PT antennas. Repairs to the PT array were not possible during most of January through May due to high streamflows. From June through September we expected bull trout passing ORB would be adults migrating upstream and we assumed the backup PO antennas and single remaining PT antenna would be sufficient for detection of any of these adults that might be PIT tagged. As a result, repair of the PT array was postponed until September 25, 2009.

Site visits every other week during October through December were sufficient to control debris on the array. It was not possible to remove debris from the antennas during most of January through May due to high streamflows. Remote access to the site via wireless internet provided operational data from the transceiver that allowed us to determine if antennas were present throughout the year. River discharge and the corresponding stage height exceeded the monitoring height of the array at times from November 2008 through May 2009.

Detection Efficiency - Physical

Individual antenna performance and the overall monthly physical detection efficiency of the PT array are shown in Table 2. Based on repetitive measurements conducted from 2005-2007, individual antenna performance was assumed to be 100%.

Overall array detection efficiency based on site functionality, streamflow magnitude, and antenna efficiency ranged from 14% to 99% during 2009 (Table 2). Although all six antennas were functional during October, detection efficiency never reached 100% because there is a small space between antennas where fish can pass undetected. Detection efficiency was less than 99% when antennas were damaged and/or stream stage exceeded the monitoring height of the array. When detection efficiency was less than 99% (Figure 5), it is likely that additional PIT tagged bull trout passed the ORB PIT array undetected. Following is a monthly summary of the factors that reduced physical detection efficiency to less than 99%:

November 2008 – One antenna was not operational for 7 days due to a damaged cable which reduced efficiency of the entire array to 93%.
December 2008 – Three antennas were damaged in late December, and streamflows exceeded the height of the array for three days, reducing efficiency to 80%.
January 2009 – Three damaged antennas and streamflows exceeding the height of the array for approximately three quarters of the month reduced efficiency to 28%.

February 2009 – Three damaged antennas and streamflows exceeding the height of the array for approximately one quarter of the month reduced efficiency to 35%.
March 2009 – Three damaged antennas and streamflows exceeding the height of the array for nearly the entire month reduced efficiency to 28%.
April 2009 – Two additional damaged antennas (five of six total) and streamflows that exceeded the height of the array for the entire month reduced efficiency to 16%.
May 2009 – Five damaged antennas, streamflows that exceeded the height of the array for the entire month, and a multiplexor malfunction reduced efficiency to 14%.
June 2009 – Five damaged antennas reduced efficiency to 28%.
July 2009 – Five damaged antennas reduced efficiency to 27%.
August 2009 – Five damaged antennas reduced efficiency to 25%.
September 2009 – Five damaged antennas and site shutdown for five days for repairs reduced efficiency to 22%.

Table 2. Percent area monitored for individual antennas and average monthly percent physical detection efficiency at the ORB pass through PIT detection array. NP=antennas were damaged or not present for at least part of the month.

	Antenna						Detection Efficiency
Date	1	2	3	4	5	6	(%)
October 2008	100%	100%	100%	100%	100%	100%	99
November 2008	100%	100%	100%	100%	NP	100%	93
December 2008#	100%	NP	100%	NP	NP	100%	80
January 2009#	100%	NP	100%	NP	NP	100%	28
February 2009#	100%	NP	100%	NP	NP	100%	35
March 2009#	100%	NP	100%	NP	NP	100%	28
April 2009#	NP	NP	100%	NP	NP	NP	16
May 2009*#	NP	NP	100%	NP	NP	NP	14
June 2009	NP	NP	100%	NP	NP	NP	28
July 2009	NP	NP	100%	NP	NP	NP	27
August 2009	NP	NP	100%	NP	NP	NP	25
September 2009	NP	NP	100%	NP	NP	NP	22

*The site was off line for 28% of the month due to a multiplexor malfunction.
#Stream stage height exceeded the monitoring height of the array at times.

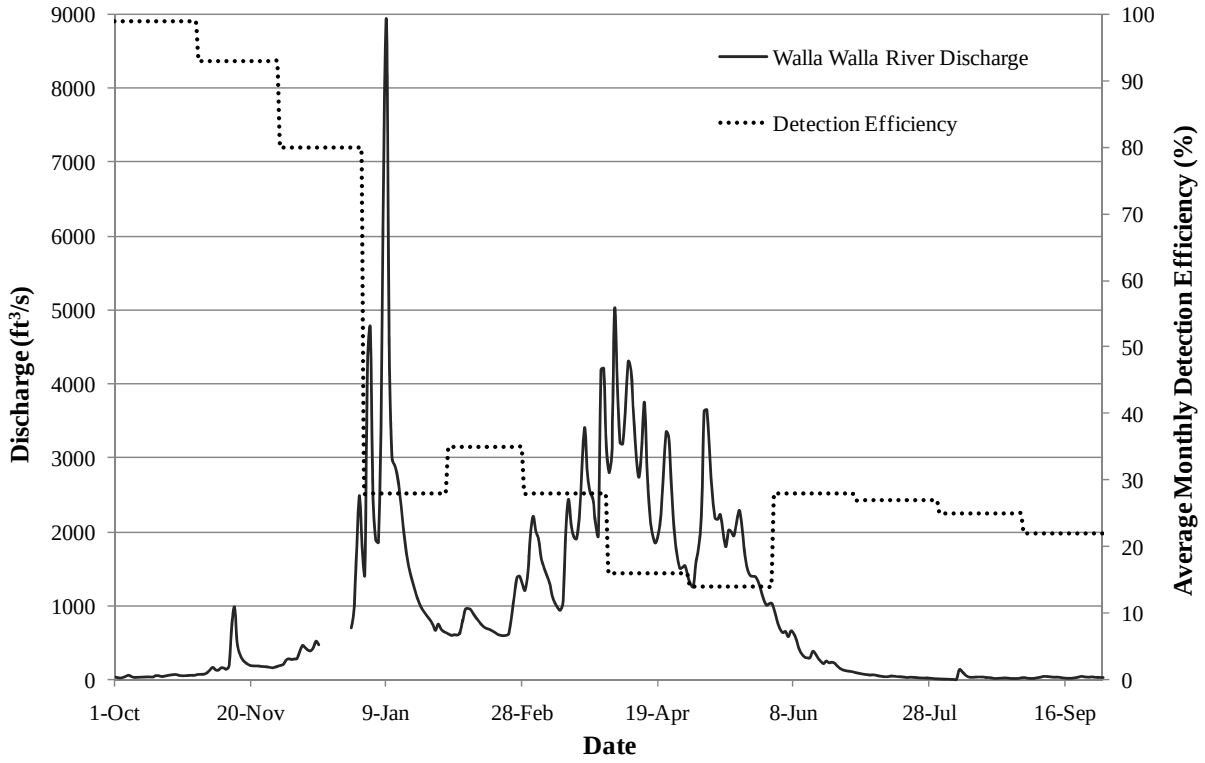

Figure 5. Walla Walla River discharge from USGS gage #14018500 on the Walla Walla River near Touchet, and detection efficiency at the Oasis Road Bridge PIT array from October 1, 2008 to September 30, 2009.

Detection efficiency may have been less than the values reported in Table 2. High streamflows did not allow debris removal from antennas during site visits for most of January through May. Accumulation of debris between site visits from October through May when debris could not be removed 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. Lastly, sometime during the spring freshet, PT antenna 3 was partially buried by a layer of silt. The layer of silt fixed the position of the antenna near the stream bottom until June 3, when it was loosened from the substrate and allowed to float freely. As a result, the proportion of water column monitored by antenna 3 was likely reduced for an unknown length of time prior to June 3.

Bull Trout Sampling/PIT Tagging

We captured and PIT tagged a total of 210 bull trout during the year (Table 3). Bull trout fork length ranged from 151 mm to 565 mm, with a mean length of 260 mm (Figure 6). Hook and line sampling was the most productive, yielding 198 bull trout. Beach seine sampling produced 10 bull trout. No bull trout were captured with the fyke net. Fyke net sampling effort was reduced in 2009 to focus more effort on hook and line sampling, which was our most efficient sampling method. CPUE (fish/hour) was calculated for each sampling method, and for three time periods during the year to determine which method was the most efficient. CPUE was 2.86 for the beach seine, which was the most efficient method. Suitable sites were few, and only 3.5 hours of effort were expended with this gear type. CPUE for hook and line sampling was 1.40.

This sampling method was not as efficient as the beach seine, however, it could be conducted over a larger area, at higher flows, and at many more sites which allowed us more spatial and temporal coverage. Even though we expended almost 66 hours of effort fishing the fyke net, no fish were caught for a CPUE of 0.0.

Table 3. Number of bull trout captured and PIT tagged by the FWS at locations in the Walla Walla Basin by month between October 2008 and September 2009. See Figure 4 for locations.

	Burlingame Diversion	Summers Lane	Nursery Bridge Dam	Little Walla Walla Diversion	Joe West Bridge	Harris Park Bridge	Mill Creek Complex*	Total Bull Trout
Oct-08	1	0	12	32	6	1	0	52
Nov-08	13	0	13	16	0	1	4	47
Dec-08	25	0	2	4	0	0	0	31
Jan-09	0	0	0	0	0	0	0	0
Feb-09	0	0	0	0	0	0	0	0
Mar-09	0	0	0	0	0	0	0	0
Apr-09	0	0	0	0	0	0	0	0
May-09	0	0	0	0	0	0	3	3
Jun-09	0	1	3	0	0	0	14	18
Jul-09	0	10	8	8	1	1	6	34
Aug-09	0	0	0	5	0	0	0	5
Sep-09	0	0	4	15	1	0	0	20
Total	**39**	**11**	**42**	**80**	**8**	**3**	**27**	**210**

*Includes sampling in upper Yellowhawk Creek, above and below Division Dam, and below Diversion Dam

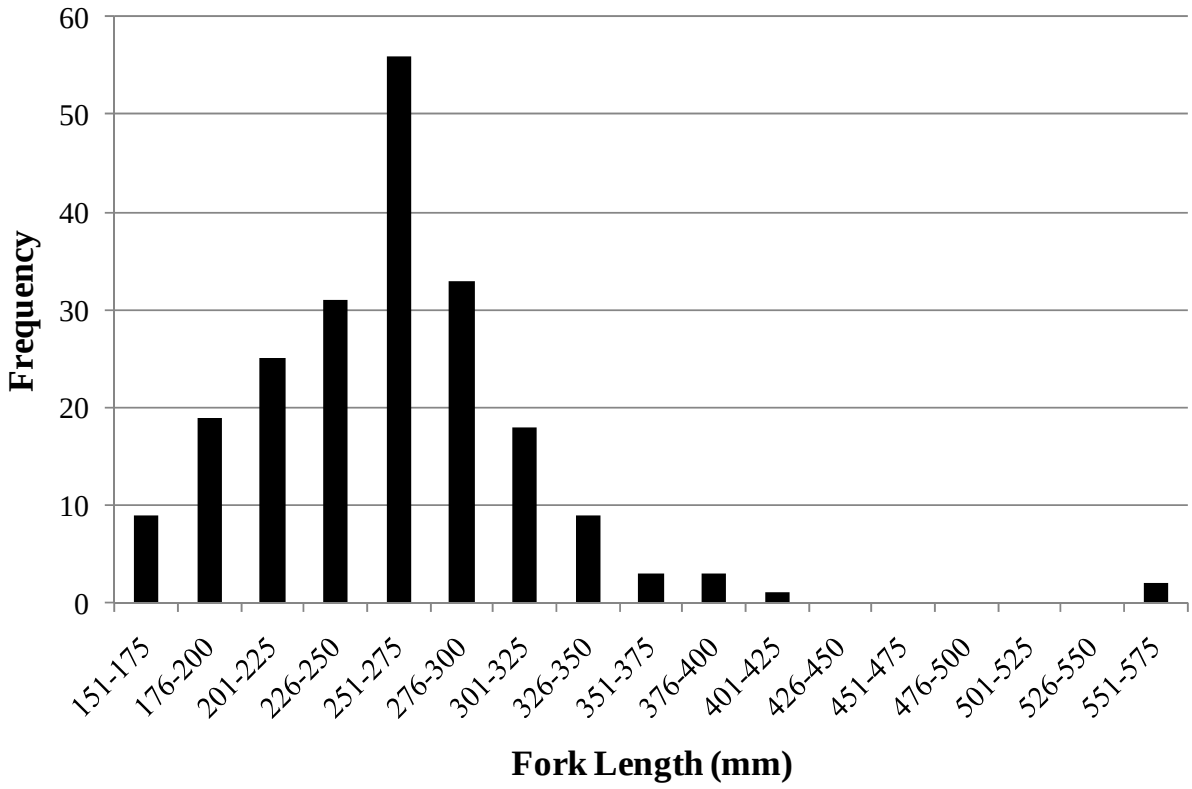

Figure 6. Length frequency for bull trout captured and PIT tagged by FWS in the Walla Walla Basin from October 1, 2008 through September 30, 2009.

CPUE (all sampling methods) was highest (1.92) during the fall (October-December). Bull trout are actively dispersing during the fall, water temperatures are cool, and streamflows are low to moderate, all of which contribute to more efficient sampling. CPUE was much lower (0.56) during the spring/summer (May-September). During much of this time period, bull trout are restricted to areas upstream from Milton-Freewater, OR because of high water temperatures and low streamflows in downstream areas. The restricted sampling area was the primary factor that reduced CPUE. CPUE was 0.0 from January through March. During this time period, most migratory bull trout are either near the mouth of the Walla Walla River transitioning into the Columbia River, or not moving within the Walla Walla River. Colder water temperatures reduce bull trout feeding activity and movement, and higher streamflows during part of this time period reduce sampling efficiency.

Other research in the Basin resulted in 995 additional bull trout being PIT tagged and available for detection at the ORB PIT detection array (Table 4). Four screw traps were operated by the CTUIR that resulted in 37 bull trout being PIT tagged, 11 of which were tagged below ORB and could possibly be detected returning from the Columbia River.

Table 4. Total number of bull trout PIT tagged by other agencies in the Walla Walla Basin between October 2008 and September 2009.

Agency	Location	PIT Tagged Bull Trout
CTUIR	Multiple Sites in Basin	37
USFS	Upper Mill Creek	368
USGS-USU	South Fork Walla Walla River	546
WDFW	Touchet River near Dayton, WA	44
Total		**995**

PIT Detections – Walla Walla River

For the third consecutive year of this study, bull trout from the Walla Walla Basin were detected moving through the lower Walla Walla River toward the Columbia River. For the first time during this study, a PIT tagged bull trout was detected moving upstream, likely returning to the Walla Walla River after overwintering in the Columbia River. Twelve PIT tagged bull trout were detected at the ORB PIT array moving toward the Columbia River from November 19, 2008 through February 28, 2009, and the upstream migrant was detected on June 8, 2009 (Table 5). All of these bull trout were originally PIT tagged in the Walla Walla River.

Table 5. Tagging and detection history details for PIT tagged bull trout detected at the ORB PIT detection array in 2009.

Bull Trout # (fork length)	Date Tagged (*) / Detected	Elapsed Time (days)	Location Tagged (*) / Detected
Bull trout 1	11/06/2008*	N/A	Burlingame Diversion (rkm 60)*
(323 mm)	11/12/2008	6	Burlingame Diversion (rkm 60)
	11/19/2008	7	Oasis Road Bridge (rkm 10)
Bull trout 2	04/26/2008*	N/A	Joe West Bridge (rkm 82)*
(156 mm)	07/08/2008	73	Nursery Bridge (rkm 74)
	11/04/2008	119	Nursery Bridge (rkm 74)
	11/05/2008	1	Burlingame Diversion (rkm 60)
	11/12/2008	7	Burlingame Diversion (rkm 60)
	11/20/2008	8	Oasis Road Bridge (rkm 10)
Bull trout 3	10/23/2008*	N/A	Nursery Bridge (rkm 74)*
(279 mm)	11/09/2008	17	Nursery Bridge (rkm 74)
	11/12/2008	3	Burlingame Diversion (rkm 60)
	11/13/2008	1	Burlingame Diversion (rkm 60)
	11/21/2008	8	Oasis Road Bridge (rkm 10)
Bull trout 4	11/06/2008*	N/A	Burlingame Diversion (rkm 60)*
(291 mm)	11/13/2008	7	Burlingame Diversion (rkm 60)
	11/21/2008	8	Oasis Road Bridge (rkm 10)

Bull trout 5	10/23/2008*	N/A	Nursery Bridge (rkm 74)*
(290 mm)	10/31/2008	8	Nursery Bridge (rkm 74)
	11/04/2008	4	Burlingame Diversion (rkm 60)
	11/09/2008	5	Burlingame Diversion (rkm 60)
	11/22/2008	13	Oasis Road Bridge (rkm 10)
Bull trout 6	10/23/2008*	N/A	Little Walla Walla Diversion (rkm 76)*
(313 mm)	10/26/2008	3	Nursery Bridge (rkm 74)
	10/30/2008	4	Burlingame Diversion (rkm 60)
	11/12/2008	13	Burlingame Diversion (rkm 60)
	11/23/2008	11	Oasis Road Bridge (rkm 10)
Bull trout 7	11/04/2008*	N/A	Little Walla Walla Diversion (rkm 76)*
(241 mm)	11/09/2008	5	Nursery Bridge (rkm 74)
	11/11/2008	2	Burlingame Diversion (rkm 60)
	11/12/2008	1	Burlingame Diversion (rkm 60)
	11/23/2008	11	Oasis Road Bridge (rkm 10)
	11/28/2008	5	Oasis Road Bridge (rkm 10)
Bull trout 8	11/05/2008*	N/A	Nursery Bridge (rkm 74)*
(303 mm)	11/29/2008	24	Burlingame Diversion (rkm 60)
	12/08/2008	9	Burlingame Diversion (rkm 60)
	12/31/2008	23	Oasis Road Bridge (rkm 10)
Bull trout 9	12/02/2008*	N/A	Burlingame Diversion (rkm 60)*
(255 mm)	12/29/2008	27	Burlingame Diversion (rkm 60)
	01/26/2009	28	Oasis Road Bridge (rkm 10)
Bull trout 10	12/02/2008*	N/A	Burlingame Diversion (rkm 60)*
(275 mm)	12/03/2008	1	Burlingame Diversion (rkm 60)
	02/05/2009	63	Oasis Road Bridge (rkm 10)
Bull trout 11	10/21/2008*	N/A	Little Walla Walla Diversion (rkm 76)*
(256 mm)	11/16/2008	26	Nursery Bridge (rkm 74)
	11/23/2008	7	Burlingame Diversion (rkm 60)
	12/02/2008	9	Burlingame Diversion (rkm 60)
	02/15/2009	75	Oasis Road Bridge (rkm 10)
Bull trout 12	07/08/2008*	N/A	Little Walla Walla Diversion (rkm 76)*
(190 mm)	11/11/2008	126	Nursery Bridge (rkm 74)
	11/19/2008	8	Burlingame Diversion (rkm 60)
	02/28/2009	101	Oasis Road Bridge (rkm 10)
Bull trout 13	11/03/2008*	N/A	Little Walla Walla Diversion (rkm 76)*
(268 mm)	11/12/2008	9	Nursery Bridge (rkm 74)
	11/18/2008	6	Burlingame Diversion (rkm 60)
	12/08/2008	20	Burlingame Diversion (rkm 60)
	06/08/2009	182	Oasis Road Bridge (rkm 10)
	06/10/2009	2	Lowden Diversion (rkm 51)
	06/15/2009	5	Burlingame Diversion (rkm 60)
	06/19/2009	4	Nursery Bridge (rkm 74)
(recaptured at 377 mm)	10/06/2009	109	Little Walla Walla Diversion (rkm 76)

* Initial tagging date and location

Bull trout #2 and #12 (Table 5) were tagged in April and July, respectively, and reared during the summer months (192 days and 126 days, respectively) in the Walla Walla River near the city of Milton-Freewater, OR. These fish resumed their downstream movement (i.e. detected at Burlingame in November) during the typical fall dispersal time period (October-December) as water temperatures and streamflow became more suitable. The other ten downstream migrant bull trout were PIT tagged in mid-Basin areas at the Burlingame Diversion, Nursery Bridge, and the Little Walla Walla Diversion between October 21 and December 2, 2008 and subsequently moved downstream when streamflow and water temperatures were suitable during the typical fall dispersal period. Water temperatures during the time period when these bull trout were moving down the mainstem Walla Walla River towards ORB were suitable, ranging from 11°C to slightly above 0°C (Figure 7). Streamflows were variable, but were suitable for migration during most of this time period except during early November (Figure 7).

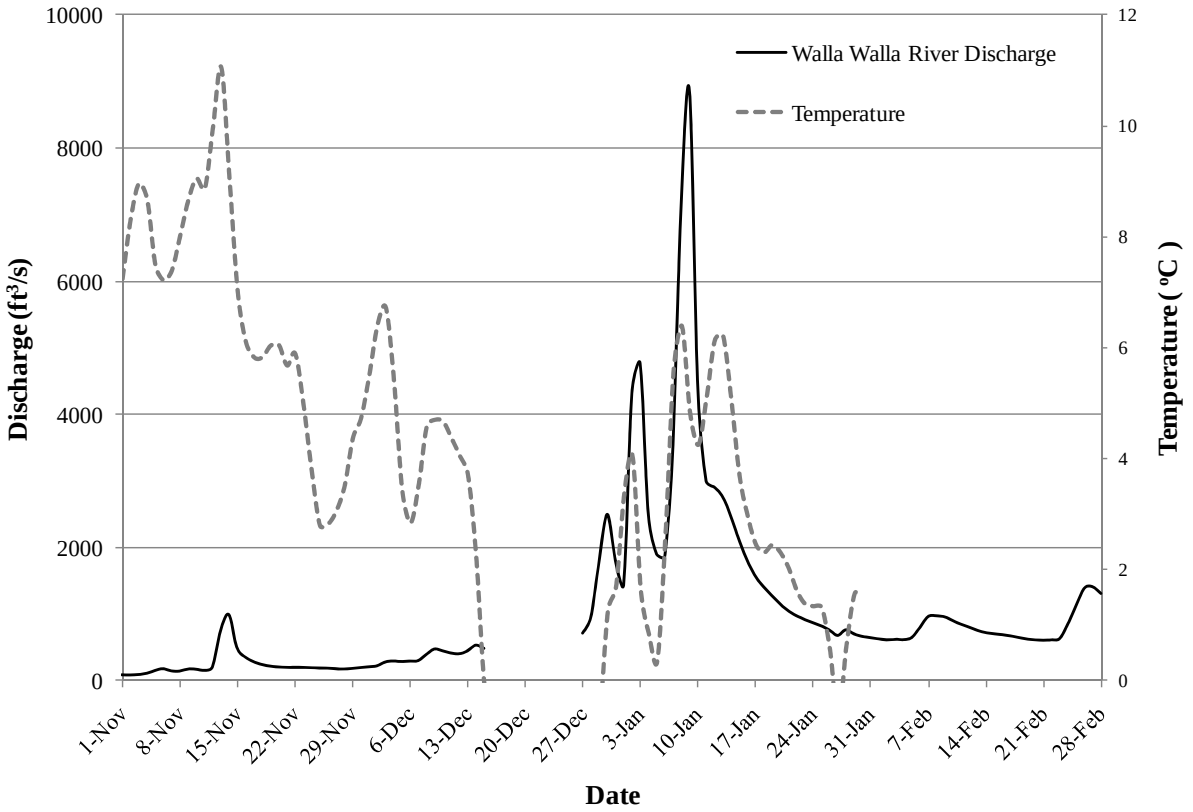

Figure 7. Walla Walla River discharge from USGS gage #14018500 on the Walla Walla River near Touchet, and Walla Walla River water temperature from the FWS thermograph at the ORB PIT detection array from November 1, 2008 to February 28, 2009.

All of the PIT tagged bull trout detected at ORB were also previously detected 50 rkm upstream at the Burlingame Diversion PIT array from November 9 to December 29, 2008. Detections at the Burlingame PIT array appear to be associated with the onset of periods of increased streamflow in mid-November and again in early December (Figure 8). There appear to be two groups of dispersing bull trout. The first group (bull trout #1, #2, #3, #4, #5, #6, #7) passed the Burlingame PIT array when streamflows increased from November 9 to November 13, 2008 (Figure 8) and dispersed rapidly downstream to ORB. The average rate of movement for this group of fish to reach ORB was 5.55 rkm/day, and all of their detections occurred at the ORB

array from November 19 to November 28, 2008 (Figure 9). The second group of fish detected at the Burlingame Diversion PIT array (bull trout #8, #10, #11, #13) passed the array during the onset of increased streamflows from December 2 through December 8, 2008. Three of these four fish (#8, #10, #11) dispersed to ORB less rapidly than the first group of fish (1.21 rkm/day), arriving at the ORB array between December 31, 2008 and February 15, 2009. The fourth bull trout (#13) was not detected moving downstream past the ORB array. Exceptionably cold water temperatures during portions of December and January (Figure 7) may have contributed to a slower rate of dispersal for the second group of fish.

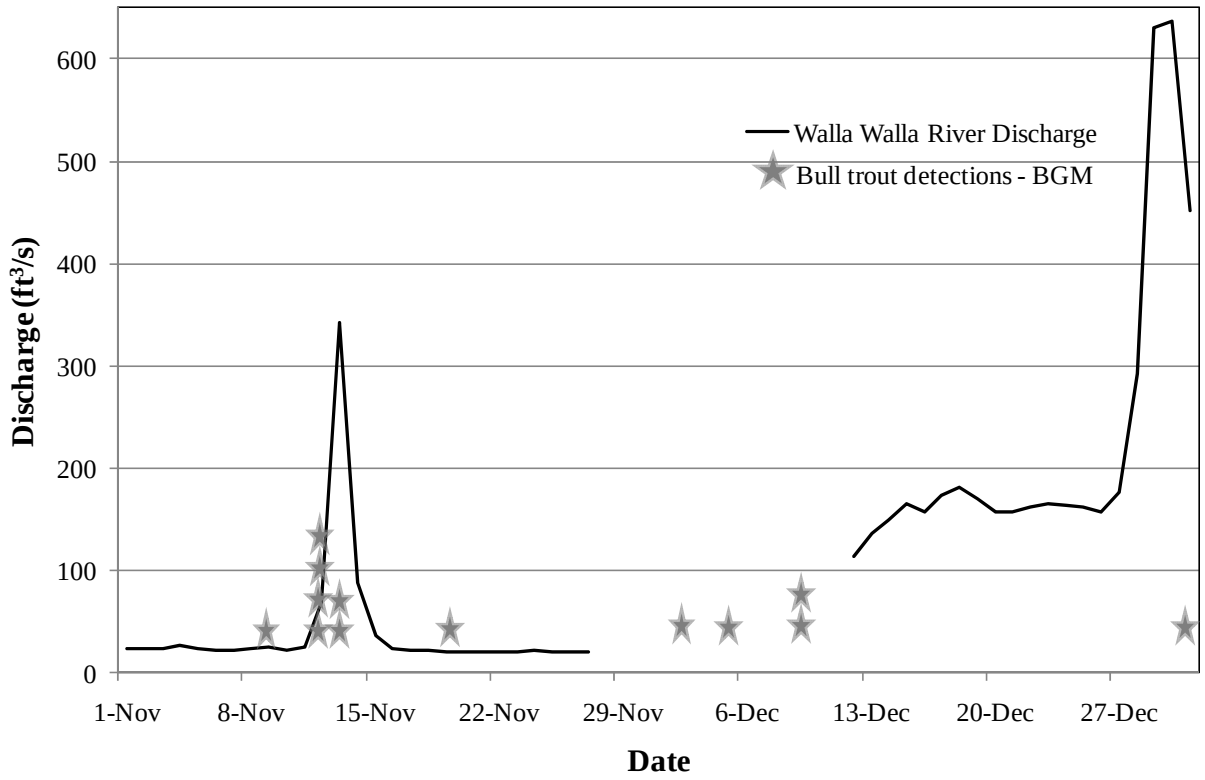

Figure 8. Walla Walla River discharge from WDOE gage #32A105 on the Walla Walla River at Beet Road, and bull trout PIT detections at the Burlingame Diversion PIT detection array (BGM) from November 1, 2008 to December 31, 2008.

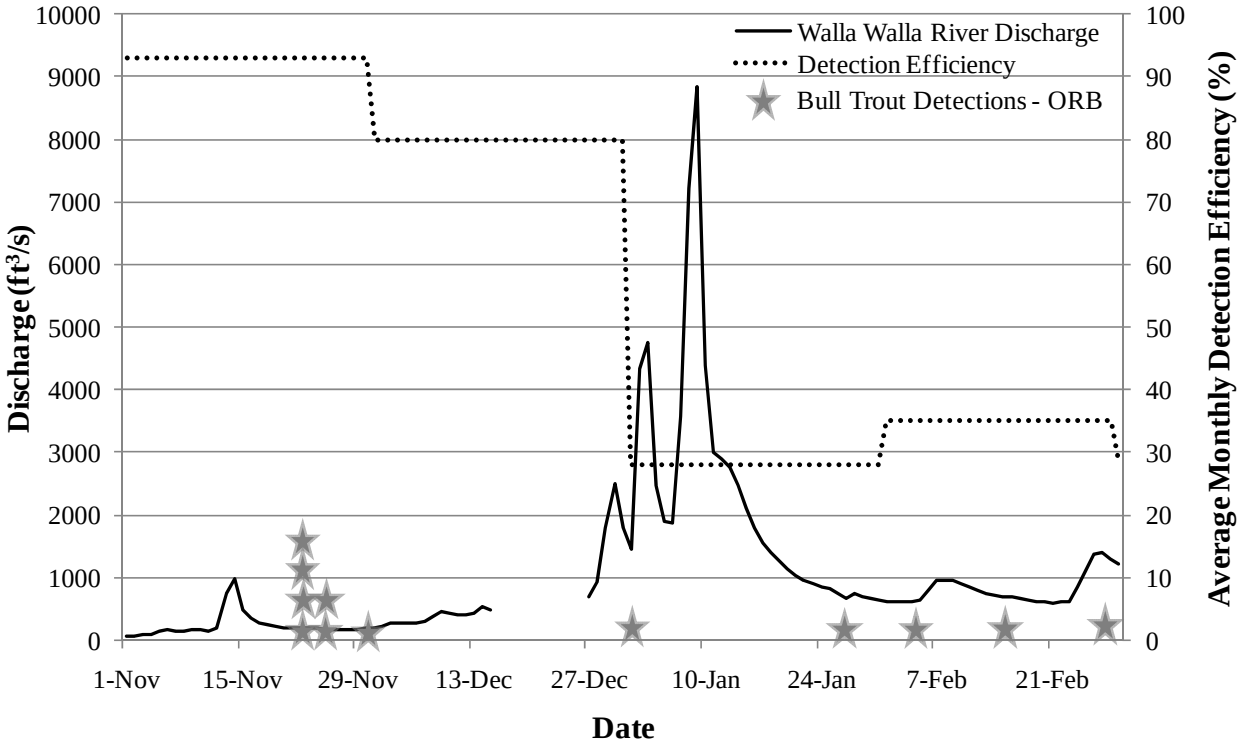

Figure 9. Walla Walla River discharge from USGS gage #14018500 on the Walla Walla River near Touchet, bull trout PIT detections at the Oasis Road Bridge PIT detection array (ORB), and physical detection efficiency from November 1, 2008 to March 1, 2009.

Streamflow in the mainstem Walla Walla River was at base flow in early November, followed by a brief increase on November 13/14, before returning to near base flow until the end of November (Figure 8 and Figure 9). Fish passage in the Walla Walla River is severely impaired at base flow upstream from the Touchet River, and most of the downstream movement of these PIT tagged bull trout likely occurred after the increase in discharge on November 13 and again in early December. We have observed movement patterns in the past that suggested low fall streamflows (i.e. base flow) inhibited movement, and as soon as streamflows increased, detections at downstream arrays occurred. The detection histories in Table 5 suggest this likely happened during fall 2008. Muhlfeld and Marotz (2005) also determined that subadult bull trout began downstream migrations in response to increased flows and as water temperatures declined in the fall and winter.

The upstream migrant bull trout (bull trout #13) was detected at the ORB array on June 8, 2009 and was confirmed to be moving rapidly upstream by the subsequent detection history (Table 5). This fish was initially PIT tagged in November 2008 during the typical fall dispersal, and it's movement pattern downstream to the Burlingame Diversion PIT array was similar to the other fish in Table 5. However, it was not detected when it passed ORB moving towards the Columbia River. It may have moved past ORB after late December when detection efficiency was low. The ORB detection in June coincides with the timing for the migratory bull trout spawning run to headwaters of the Walla Walla River or Mill Creek. Streamflows were dropping rapidly during the period of time this fish was ascending the Walla Walla River (Figure 10), but base flows did not occur prior to movement past Nursery Bridge, and passage was likely unimpeded. Water temperatures during this time period were increasing rapidly, and exceeded

20°C by the time this bull trout passed Nursery Bridge (Figure 10). This water temperature is near the criteria of 16°C (7 day average daily maximum) recommended by the U.S. Environmental Protection Agency (2003) for adult bull trout foraging and migration. This fish was subsequently recaptured near the Little Walla Walla Diversion in the fall of 2009 (Table 5) via hook and line, confirming successful migration and continued survival.

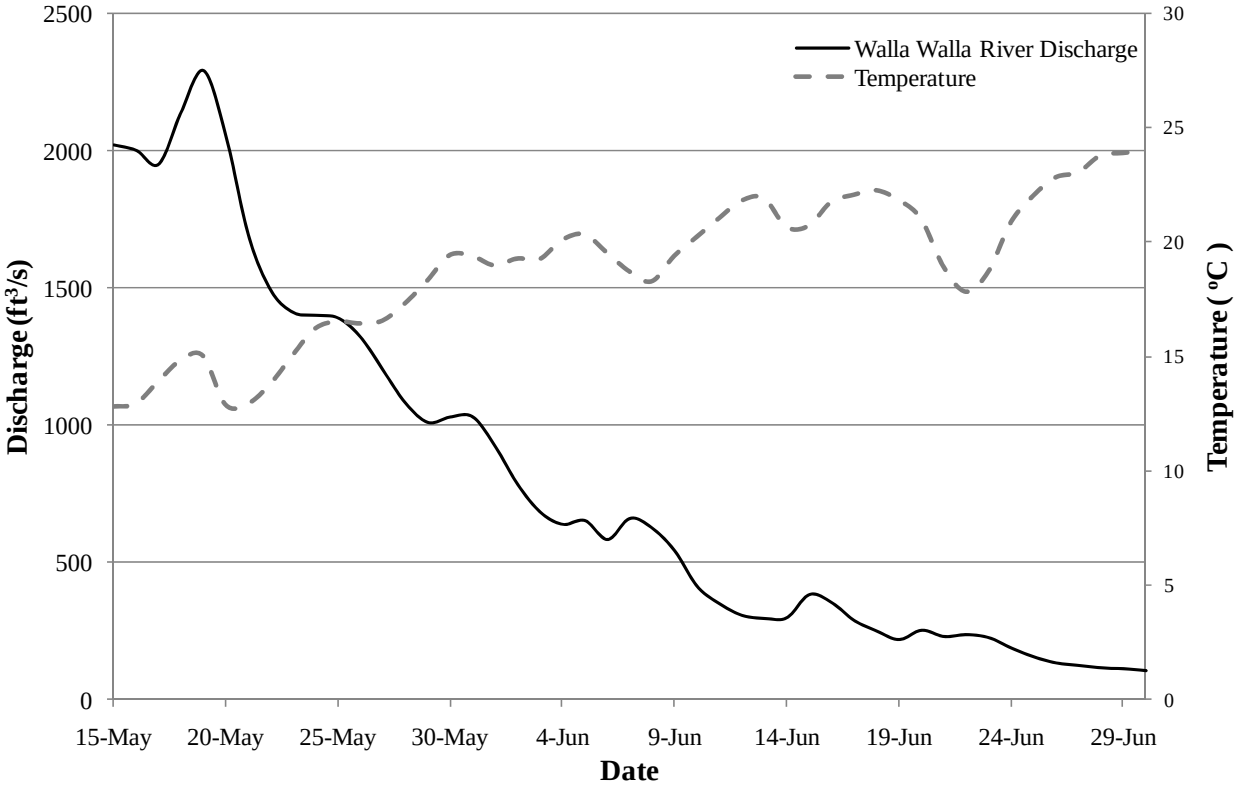

Figure 10. Walla Walla River discharge from USGS gage #14018500 on the Walla Walla River near Touchet, and Walla Walla River water temperature from the FWS thermograph at the ORB PIT detection array from May 15, 2009 to June 30, 2009.

The ORB PIT array recorded 98 detections of Chinook salmon and 354 detections of summer steelhead. Steelhead and Chinook salmon were detected from October 2008 through September 2009. The majority of the detections occurred from January through June (93%), and corresponded with releases of hatchery steelhead and Chinook as well as the outmigration of wild anadromous salmonid smolts (PTAGIS).

In addition to the aforementioned detections, it is also likely that additional PIT tagged bull trout, steelhead, and Chinook passed the ORB PIT array undetected. Physical detection efficiency was 35% or less from January through the summer of 2009 (Figure 9 and Figure 5). This time period includes the fall/winter dispersal period for bull trout, the outmigration period for anadromous smolts, and the upstream migration period for migratory bull trout spawners.

PIT Detections – Columbia River

Bull trout PIT tagged in the Walla Walla Basin that subsequently move into the Columbia River have the potential to be detected at mainstem Columbia or Snake River dams. In 2009, three bull trout PIT tagged in the Walla Walla River were detected at two different Columbia River dams (Table 6). Bull trout #1 was originally PIT tagged on July 30, 2008 at the Little Walla Walla Diversion in the Walla Walla River, and was subsequently detected on April 15, 2009 at the McNary Dam juvenile bypass. This bull trout moved 76 rkm down the Walla Walla River to the Columbia River, and 36.4 rkm down the Columbia to McNary Dam, for a total distance of 112.4 rkm. The corresponding rate of movement was 0.4 rkm/day. Coil details from the McNary juvenile bypass PIT detection array indicated this fish was moving in a downstream direction through the full flow bypass. This bull trout was not detected at the ORB PIT array, and likely passed between December 23, 2008 and April 15, 2009 when detection efficiency was less than 35% (Figure 9 and Figure 5).

Bull trout #2 was originally PIT tagged on October 23, 2008 at Nursery Bridge Dam in the Walla Walla River and was detected at the McNary Dam Oregon shore adult ladder in May and June, 2009 (Table 6). This bull trout migrated 74 rkm down the Walla Walla River to the Columbia River, and 36.4 rkm down the Columbia to McNary Dam, for a total distance of 110.4 rkm. The corresponding rate of movement was 0.5 rkm/day. This bull trout was not detected at the ORB detection array. Similarly to bull trout #1, this fish likely passed the array between December 28, 2008 and February 11, 2009 when detection efficiency was less than 35% (Figure 9). On February 11, 2009, this bull trout was recaptured in the CTUIR screw trap at Pierce's RV Park located one rkm downstream from the ORB PIT array. Fork length had increased 29 mm over the previous 111 days since this fish was tagged. On May 25, 2009 this bull trout was present for approximately 17 hours near the counting window at the McNary Dam adult ladder, and it was detected on both antennas on either side of the window. The direction of movement appeared to be upstream, which would suggest the fish eventually exited the ladder upstream of the dam. It was detected 25 days later on June 19 and 20, 2009 at PIT antennas in the lower ladder. This fish could have passed McNary Dam via spring spill, or through the turbines. The coil detection history in the ladder indicated this bull trout passed upstream through the arrays before falling back and being detected on a downstream antenna. The final disposition of this bull trout is currently unknown.

Bull trout #3 was originally captured and PIT tagged in the CTUIR screw trap on January 28, 2009 at Pierce's RV Park located one rkm downstream from the ORB PIT array, and was subsequently detected moving upstream at the Priest Rapids Dam adult ladder on July 5, 2009. This bull trout moved 9 rkm down the Walla Walla River to the Columbia River, and 130 rkm up the Columbia to Priest Rapids Dam, for a total distance of 139 rkm. The corresponding rate of movement was .88 rkm/day. Coil details from the Priest Rapids adult ladder PIT detection array showed the bull trout moving in an upstream direction.

Table 6. Tagging and detection history details for PIT tagged bull trout detected at mainstem Columbia River dams in 2009.

Bull Trout # (length)	Date Tagged (*) / Detected	Elapsed Time (days)	Location Tagged (*) / Detected
Bull trout 1	07-30-08*	N/A	Little Walla Walla Diversion (rkm 76)*
(249 mm)	12-06-08	129	Nursery Bridge (rkm 74)
	12-22-08	16	Burlingame Diversion (rkm 60)
	12-23-08	1	Burlingame Diversion (rkm 60)
	04-15-09	113	McNary Dam Juvenile Bypass (rkm 470)
Bull trout 2	10-23-08*	N/A	Nursery Bridge (rkm 74)*
(269 mm)	11-08-08	16	Nursery Bridge (rkm 74)
	11-09-08	1	Nursery Bridge (rkm 74)
	11-14-08	5	Burlingame Diversion (rkm 60)
	12-28-08	44	Burlingame Diversion (rkm 60)
(recaptured at 298 mm)	02-11-09	45	Pierce's RV Park (rkm 9)
	05-25-09	103	McNary Dam Adult Ladder (rkm 470)
	06-19-09	25	McNary Dam Adult Ladder (rkm 470)
	06-20-09	1	McNary Dam Adult Ladder (rkm 470)
Bull trout 3	01-28-09*	N/A	Pierce's RV Park (rkm 9)*
(272 mm)	07-05-09	158	Priest Rapids Dam Adult Ladder (rkm 639)

Future Plans

Funding to monitor and evaluate performance of the ORB PIT detection array, and to capture and PIT tag bull trout ended on December 31, 2009. We continued to calculate physical detection efficiency based on physical parameters including site functionality and stream stage height through the end of the calendar year. We also continued to capture and PIT tag migratory bull trout in mid and lower basin areas through December, and we continued to monitor the ORB PIT detection array and Columbia and Snake river dams for detections of PIT tagged Walla Walla Basin bull trout. Results of work conducted through September, 2009 are included in this report. A synopsis of the results for all five years of this study (2005-2009), including the last three months from October 1 through December 31, 2009 will be presented in a final report to the COE.

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