Bull Trout Distribution, Movements and Habitat Use in the Umatilla and John Day River Basins

2008 Annual Progress Report

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February 21, 2009

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Abstract

The goal of the U.S. Fish and Wildlife Service's studies in the Umatilla and John Day basins is to provide information that can be used to develop recovery actions for bull trout (*Salvelinus confluentus*) listed as threatened under the Endangered Species Act. In 2008, we focused on gaining a better understanding of the seasonal distribution and movement of subadult bull trout in the Umatilla Basin and of the abundance and distribution of adult bull trout in the John Day Basin. In the Umatilla Basin, we operated a screw trap in the upper Umatilla River in spring to capture subadults for radio or passive integrated transponder (PIT) tagging. We also maintained a PIT tag detection array in the North Fork Umatilla River (UM1) near its mouth, and another 15 km downstream in the Umatilla River (UM2). We radio tagged 10 of the 13 subadults captured in the screw trap and PIT tagged one other. Two had been previously PIT tagged in the North Fork by researchers from Utah State University. Seven of the radio-tagged subadults moved downstream 0.4 to 24.0 km (mean = 7.8 km) and reached their lowermost location in a maximum of 3 to 45 d. All were distributed upstream from Thornhollow (rkm 120). One of the radio-tagged subadults remained in the pool where it was released, and two were never located following their release. Seven and four bull trout that were subadult sized when tagged in the North Fork Umatilla River by researchers from Utah State University were detected at UM1 and UM2, respectively. The detections at UM1 occurred in April, August, October, and November. Detections peaked in November, but the antennas at UM1 were inoperable for most of the spring and early summer. Detections at UM2 occurred in October and December and peaked in October. Three of the four antennas at UM2 were inoperable from May through mid-September. Two of the fish detected at UM2 were also detected at UM1 in the fall. They took 5 and 20 d to travel between the two sites. In the John Day Basin, we conducted spawning ground surveys in the North Fork John Day River and its tributary Baldy Creek. We counted only six redds in the North Fork and two redds in Baldy Creek, one of which appeared to have been made by a fluvial female. These and past counts, along with past angling and trapping efforts in the North Fork, indicate the abundance of fluvial adults was exceedingly small.

Introduction

Bull trout (*Salvelinus confluentus*) were officially listed as a Threatened Species under the Endangered Species Act (ESA) in 1998. The U.S. Fish and Wildlife Service (FWS) subsequently issued a Draft Recovery Plan (U.S. Fish and Wildlife Service 2002) which included chapters for the John Day Recovery Unit (Chapter 9) and the Umatilla-Walla Walla Recovery Unit (Chapter 10). The two chapters were updated in 2004 (U.S. Fish and Wildlife Service 2004a, 2004b) and are the current guide for recovery actions in the Umatilla and John Day basins. The goal of bull trout recovery planning by the FWS is to describe courses of action necessary for the ultimate delisting of this species, and to ensure the long-term persistence of self-sustaining, complex interacting groups of bull trout distributed across the species' native range (U.S. Fish and Wildlife Service 2004a, 2004b).

Bull trout are native to the Umatilla and John Day basins, and they exhibit two different life history strategies in those systems. Fluvial bull trout spawn in headwater streams and juveniles rear in these streams for one to four years before migrating downstream as subadults to larger mainstem areas, and possibly to the Columbia River, where they grow and mature, returning to the tributary stream to spawn (Fraley and Shepard 1989). Downstream migration of subadults generally occurs during the spring, although it can occur throughout the year (Hemmingsen et. al. 2001a, 2002). These migratory forms occur in areas where conditions allow for movement from upper watershed spawning streams to larger downstream waters that contain greater foraging opportunities (Dunham and Rieman 1999). Stream-resident bull trout also occur in the two basins, and they complete their entire life cycle in the tributary streams where they spawn and rear. Resident and migratory forms of bull trout may be found living together for portions of their life cycle, but it is unknown if they can give rise to one another (Rieman and McIntyre 1993). Bull trout size is variable depending on life history strategy. Resident adult bull trout tend to be smaller than fluvial adult bull trout (Goetz 1989). Under appropriate conditions, bull trout regularly live to 10 years, and under exceptional circumstances, reach ages in excess of 20 years. They normally reach sexual maturity in four to seven years (Fraley and Shepard 1989; McPhail and Baxter 1996).

When compared to other North American salmonids, bull trout have more specific habitat requirements. The habitat components that shape bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrates, and migratory corridors (U.S. Fish and Wildlife Service 1998). Throughout their lives, bull trout require complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989; Watson and Hillman 1997). Juveniles and adults frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). McPhail and Baxter (1996) reported that newly emerged fry are secretive and hide in gravel along stream edges and in side channels. They also reported that juveniles are found in pools, riffles, and runs where they maintain focal sites near the bottom, and that they are strongly associated with instream cover, particularly overhead cover. Bull trout have been observed over-wintering in deep beaver ponds or pools containing large woody debris (Jakober et al. 1998). Habitat degradation and fragmentation (Fraley and Shepard 1989), barriers to migration (Rieman and McIntyre 1995), and reduced instream flows have all contributed to the decline in bull trout populations in the Columbia River Basin.

In summary, bull trout need adequate stream flows and temperatures and the corresponding habitat for each of the different life history functions at specific times of the year in order to persist. Habitat conditions must be adequate to provide spawning, rearing, and migration opportunities, cover, forage, seasonal movement, and over-wintering refuges.

The goal of FWS studies in the Umatilla and John Day basins is to develop information and analyses to assist in assessing the relative merit of potential action strategies in making progress towards meeting the requirements outlined in the Umatilla-Walla Walla and John Day Day Recovery Unit chapters of the Draft Recovery Plan (U.S. Fish and Wildlife Service 2004a, 2004b) for the recovery and delisting of bull trout. Specifically FWS studies were designed to address the following recovery plan objectives:

- Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies, and

- Conserve genetic diversity and provide opportunity for genetic exchange.

The habitat objective should be accomplished through a series of steps designed to restore and maintain suitable habitat conditions for all bull trout life history stages and strategies. The first step should consist of defining the physical conditions that comprise suitable bull trout habitat. The second step should be application of these habitat "criteria" to current conditions to determine the extent of the relevant stream that currently provides suitable habitat. The third step should consist of determination of the changes required to improve habitat in areas indicated in the recovery plan that do not currently provide suitable conditions. The fourth step should consist of implementing changes to restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.

The genetic diversity objective should be accomplished by maintaining connectivity among local populations of bull trout to facilitate gene flow and genetic diversity. As the recovery plan discusses, connectivity consists of maintaining the fluvial component of each local population which includes providing conditions that allow fluvial adults to effectively move between spawning and wintering areas, and ensuring that movement of both fluvial adult and subadult bull trout can occur, at least seasonally, between local populations within each core area in the recovery unit. This includes establishing the physical conditions necessary for up- and down-stream fish passage, and providing a continuum of suitable physical habitat to ensure the persistence of fluvial life stages and provide the opportunity for genetic interchange between local populations within each core area.

The approach FWS used to plan studies in the two basins consisted of the following steps:

- Identify information needed to assess if criteria for recovery objectives are being achieved;

- To that end, design and implement studies to describe bull trout distribution, movement, and seasonal habitat use patterns;

- Use this information and results from these studies to assist in guiding actions that will make progress towards bull trout recovery.

We previously described what was known about the abundance, distribution, and migratory patterns of bull trout and potentially limiting physical conditions in the Umatilla Basin when we initiated our study there in 2004 (Anglin et al. 2008). To summarize, at that time, the only viable population of bull trout appeared to occur in the North Fork Umatilla River, and it appeared to be relatively small. Telemetry studies had shown fluvial adult bull trout did not migrate extensively, remaining within the upper Umatilla River and the North Fork to complete their life cycle (Sankovich et al. 2003, 2004; Oregon Department of Fish and Wildlife [ODFW], unpublished report). Little was known about the movement and seasonal distribution of subadults, but the available evidence suggested they also were not prone to undertake extensive migrations. Five bull trout had been captured in a ladder at Three Mile Falls Dam in the lower Umatilla River at river kilometer (rkm) 6 between 1995 and 2004. These fish were 254 to 330 mm in fork length (FL), indicating they were either subadults or first-time maturing adults when captured. Thus, assuming these fish originated in the Umatilla Basin, it appeared at least a small number of subadults produced there continued to migrate to and use the lower Umatilla and Columbia rivers. Although there were human impacts to the upper basin due to development, agriculture, and forest management, the major impacts occurred in the lower basin where there were six irrigation dams and diversions and sections of the river were sometimes dewatered seasonally. All but one of the diversion dams had ladders, but the ladders were designed for passage of salmon and steelhead, and it was not known if bull trout could negotiate them.

Between 2004 and 2008, the conditions in the Umatilla Basin that held the potential to negatively impact bull trout remained relatively unchanged. The small population in the North Fork appeared to be stable or declining based on redd counts and mark-recapture abundance estimates (Budy et al. 2004, 2005, 2006, 2007; P.M.S. unpublished data). Because fluvial adult bull trout migrations had been studied previously and subadult migrations remained largely un-described, we chose to focus on the latter when we began our study in the basin. Through 2007, we used a combination of trapping, snorkeling, telemetry, and fixed passive integrated transponder (PIT) tag detection sites to determine the subadult population was small and individuals exiting the North Fork (i.e., individuals migrating as subadults for the first time) remained within the upper 40 km of the Umatilla River during their first summer in the Umatilla River. We also determined some of these subadults, and older ones rearing in the upper Umatilla River, undertook staged downstream migrations, for example, emigrating from the North Fork in spring and rearing in the Umatilla River for several months before again initiating downstream migration in fall. We observed no subadults utilizing the heavily impacted lower river. As a result, we were unable to describe the timing of use, seasonal distribution, and movement of subadults in the lower river and determine how subadults might be negatively affected by conditions there. Because of the small size of the subadult population, our sample size was small each year, and we potentially had not fully described the migratory behavior and distribution of subadult bull trout in the basin. Our objective in 2008, therefore, was to continue to study the subadults.

Bull trout in the John Day Basin inhabit the Middle Fork, North Fork, and upper John Day River drainages. When we initiated our study in the basin in 2005, we chose to focus on bull trout from the North Fork. Few migratory individuals remained in the Middle Fork system and those in the upper John Day River and its tributaries had been studied extensively by ODFW from 1997 to 2001.

There are no dams on the North Fork John Day River and water withdrawals from it are limited to the lower 24 km, where several irrigation pumps are operated. In all but extreme drought years (e.g., 1977), the lower river has sufficient flow to provide fish passage during the irrigation season (T. Unterwegner, ODFW, personal communication). The Pete Mann Ditch is the only other significant water diversion in the sub-basin. It traverses a number of tributaries to Clear Creek and diverts varying portions of their flow into the Powder River Basin. Because fluvial bull trout are no longer present in the Clear Creek system, the Pete Mann Ditch currently has the potential to impact only resident bull trout and their localized movements.

The major factor limiting the distribution and movement of bull trout in the North Fork John Day River Sub-basin appears to be high summer stream temperatures (Columbia-Blue Mountain Resource Conservation and Development Area 2005). The high stream temperatures are attributed to a lack of streamside shade, increases in fine sediments, altered hydrologic patterns, losses of pool habitat, and low amounts of in-stream wood (Umatilla National Forest and Walla Walla National Forest 1997a and 1997 b cited in Columbia-Blue Mountain Resource Conservation and Development Area 2005). These conditions are a product of past and, to a lesser extent, continuing forest management practices (e.g., logging and fire suppression), grazing, placer and dredge mining, and road construction (Columbia-Blue Mountain Resource Conservation and Development Area 2005). The lower sub-basin's semi-arid climate and loss of forest canopy due to extensive wildfires might also be important naturally-occurring contributing factors. The elevated stream temperatures presumably force bull trout to seek out and remain in colder headwater reaches of the main stem and its tributaries, or any coldwater refuges downstream, during summer. They might also form a thermal block to migration for individuals that fail to ascend the river system in a timely manner.

Although high summer stream temperatures have been proposed as the major factor limiting bull trout in the North Fork John Day River Sub-basin (Columbia-Blue Mountain Resource Conservation and Development Area 2005), a more detailed description of the migratory behavior of the sub-basin's bull trout is needed to support this contention and determine where thermal barriers or other factors might be restricting the movement and distribution of those fish. Information on both fluvial adult and subadult migrations was limited when we initiated work in the North Fork John Day River in 2005, but we elected to begin by studying the adults. While angling and operating an upstream migrant trap in the North Fork to capture fish for radio tagging in 2005-07, we captured only eight large-bodied (>300 mm FL) char, three of which appeared to be brook trout (*Salvelinus fontinalis*) x bull trout hybrids rather than pure bull trout. We tagged seven of these fish, including the apparent hybrids. All remained in the upper 79 km of the 180 km-long North Fork throughout the lives of their two-year tags, and none appeared to encounter impediments to their movement. Based on our lack of success in capturing fluvial adults, and the low number of redds we counted in the North Fork and its tributaries Baldy and South Fork Desolation creeks in 2005-07, it became evident the

abundance of fluvial adult bull trout in the system was exceedingly low. In 2008, therefore, we did not attempt to capture and tag fish. Instead, our objective was simply to conduct spawning ground surveys in the North Fork and Baldy Creek to continue to assess the status of the populations in those streams.

Umatilla River Basin

Methods

Radio Telemetry

We used telemetry to monitor the movement of subadult bull trout. To capture subadults for tagging, we operated a 1.5-m diameter rotary screw trap in the Umatilla River just below the mouth of the North Fork (Figure 1). The trap operated for 52 of 68 d from 23 April to 30 June 2008. Most (12) of the days the trap did not operate occurred in May due to high flows and large amounts of in-river debris. The trap was fished out of the thalweg in presumably less efficient

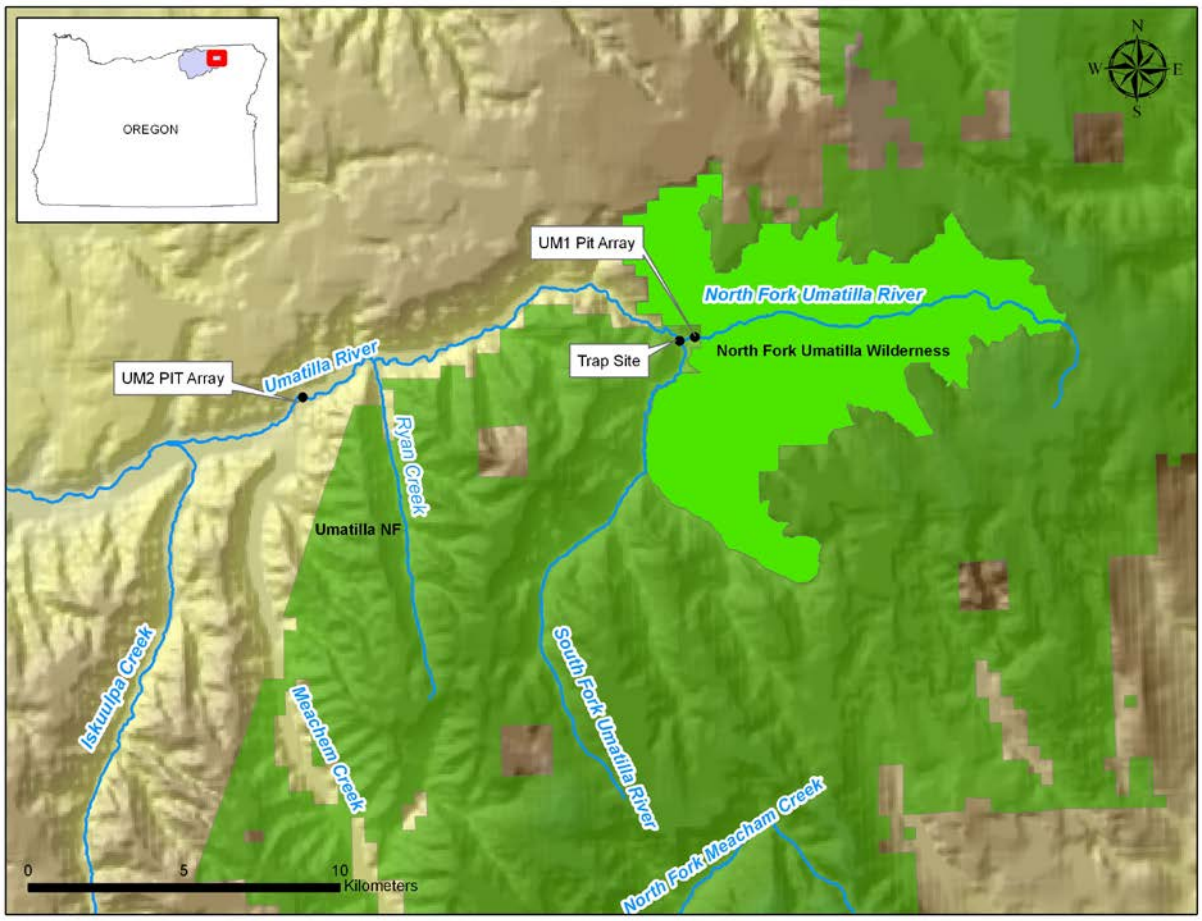

Figure 1. Map of the Umatilla River Basin showing the location of the screw trap and two PIT tag detection arrays.

positions during much of the remainder of that month.

Captured individuals of most non-target species were simply counted and released. Steelhead or rainbow trout (*Oncorhynchus mykiss*) were also assigned to 50-mm size categories (e.g., 0-49 mm, 50-99 mm) based on visual estimation of their fork lengths. All bull trout were anesthetized in an aerated bath containing 50-70 mg/L tricaine methanesulfonate (MS-222) buffered with 120 mg/L sodium bicarbonate. They were then weighed (nearest 0.1 g), measured (nearest 1 mm), and PIT or radio tagged. The PIT tags were 23 mm long and were inserted into the abdomen through an approximately 4-mm long incision made with a surgical blade anterior to the pelvic girdle and slightly off the mid-line. Our radio tagging methods followed those described by Sankovich (2003) and Anglin et al. (2008). We used model NTC-M-3 tags (Lotek Wireless Fish and Wildlife Monitoring) that weighed 0.55 g in air, had an 8 s burst rate, and a warranty life of 45 d. For the fish that were tagged, the tags averaged 1.4% and ranged from 0.8 to 2.0% of the host's weight, following Winter's (1996) "2% rule." All tagged fish were released in a pool downstream from the screw trap following their recovery from anesthesia.

We tracked the radio-tagged fish by road and by foot and airplane in areas not accessible by road. We tracked weekly or every other week depending on whether the fish were moving or had taken up stations. During tracking, fish positions were recorded using a GPS unit. The coordinates were later entered into a mapping program (MAPTECH's Terrain Navigator) to determine the location, in river kilometers, of each individual.

PIT Tag Detection Arrays

Bull trout movements were also monitored using two PIT tag detection arrays, one near the mouth of the North Fork (UM1) and another at rkm 129 on the Umatilla River (UM2), just upstream from the intake to the Imeques acclimation facility (Figures 1, 2, and 3). The two arrays were brought on-line in October 2004 and August 2007, respectively. Each consisted of a full duplex interrogation system (Destron Fearing FS1001A), an antenna array custom built for this application, and a laptop computer equipped with Minimon software (Pacific States Marine Fisheries Commission). Power at the UM1 site was supplied with a combination of solar panels, batteries, and a generator. Remote data upload was accomplished using satellite communications (Figure 3). The UM2 site was powered through a hard wire connection. Data collected there were downloaded manually.

The PIT tag detection arrays enabled passive monitoring of the movement of bull trout that were PIT tagged in the North Fork in summer 2003-08 as part of an ongoing population assessment study (Budy et al. 2004, 2005, 2006, 2007). Subadults captured and PIT tagged at our screw trap in spring and early summer 2005-08 were also available for detection. The relatively efficient passive monitoring using PIT tag detection arrays together with the ongoing comprehensive tagging effort is an important part of our goal to better understand migratory bull trout life history, and the temporal and spatial aspects of their distribution and movements.

Routine inspection and maintenance of the PIT tag detection arrays were conducted to ensure reliable data collection and system operation. Antenna detection efficiency tests were conducted periodically to estimate the proportion of the antenna field that consistently detected a

Figure 2. PIT tag detection array in the North Fork Umatilla River (UM1). On the left is the shed that houses the electronics, computer, and generator. Solar panels and satellite dish are visible on the roof. On the right the antenna array can be seen mounted to a bridge.

Figure 3. PIT tag detection array in the Umatilla River at rkm 128 (UM2).

PIT tag that passed through the apparent field. Methods used to conduct efficiency tests were described in Anglin et al. (2008).

Results

Radio Telemetry

The screw trap in the Umatilla River captured 13 bull trout, 889 *O. mykiss*, 187 juvenile Chinook salmon (*O. tshawytscha*), 5 speckled dace (*Rhinichthys osculus*), 4 sculpin (*Cottus spp.*), and 5 larval Pacific lamprey (*Lampetra tridentata*). All but one of the bull trout were captured in June (Figure 4). They ranged from 137 to 180 mm and averaged 158 mm in fork length (Figure 5). We radio tagged 10 of them and PIT tagged one other (Table 1). The

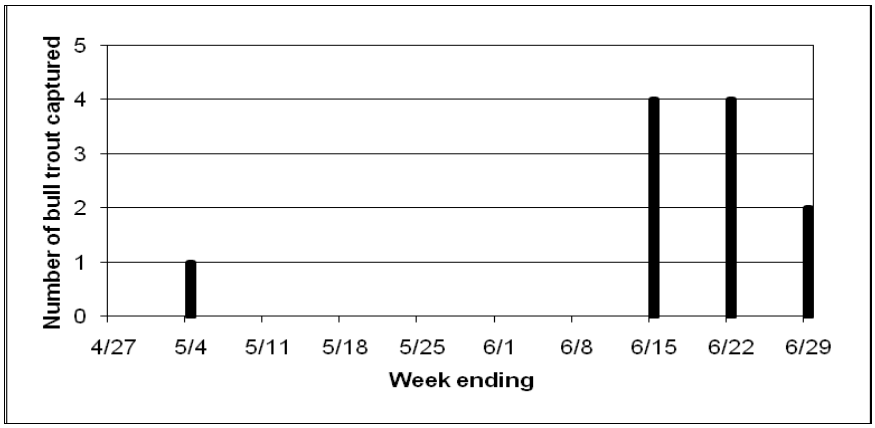

Figure 4. Number and timing of bull trout captured in a screw trap in the Umatilla River (rkm 144) in spring and early summer 2008

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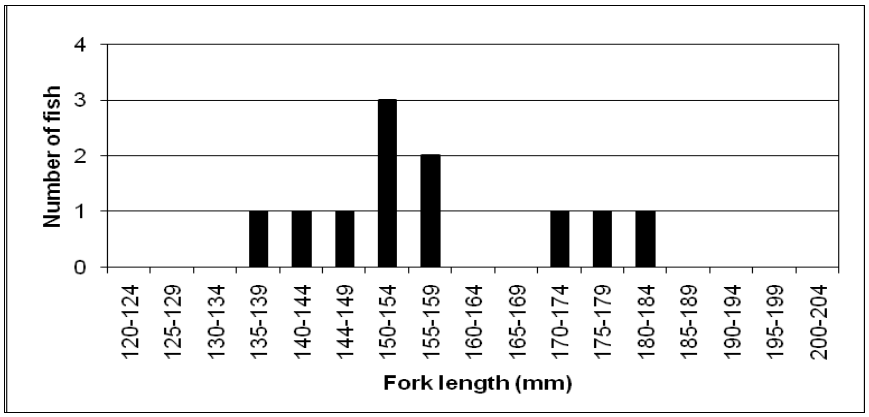

Figure 5. Length frequency distribution of bull trout captured in a screw trap in the Umatilla River (rkm 144) in spring and early summer 2008.

Table 1. Date of tagging, radio tag code, PIT tag code, and length and weight of bull trout captured in a screw trap in the Umatilla River in 2008.

Date	Radio tag code	PIT tag code	FL (mm)	WT (g)
4/28/08	5		146	34.4
6/9/08	6		157	42.7
6/11/08	7		154	38.8
6/14/08	8		142	33.8
6/14/08	9		180	68.3
6/16/08	10		159	40.9
6/16/08	11		154	39.5
6/16/08	12		137	27.2
6/19/08	13		152	36.7
6/27/08	14		170	51.9
6/27/08		3D9.1BF1B29C4A	176	63.7

remaining two bull trout had been PIT-tagged previously by researchers from Utah State University (USU).

We located 8 of the 10 radio-tagged subadults following their release. Seven moved downstream and one (code 5) remained in the pool where it was released (Figure 6, Appendix Table A1). The fish that moved downstream took a maximum of 3 to 45 d to reach their lowermost locations. The distance between those locations and the release site ranged from 0.4 to 24.0 km and averaged 7.8 km (Figures 6; Appendix Table A1). The fish that moved the farthest downstream (code 12) was near Thornhollow at rkm 120. Stream temperatures there when this fish was last found on 31 July ranged from 15 to 22°C and averaged 18°C. The remaining tagged fish were in areas where stream temperatures were more suitable for bull trout.

PIT Tag Detection Arrays

The PIT tag detection array in the North Fork Umatilla River (UM1) detected 10 bull trout that had been tagged and released in the North Fork by researchers from USU (Table 2). Three of these fish were fluvial adult sized (425-531 mm FL) when tagged. One of these was tagged in summer 2008 and passed UM1 in early October 2008, presumably after spawning. The other two were tagged in 2007 and had previously exited the North Fork and passed the PIT tag array in the Umatilla River near the Imeques acclimation facility (UM2) in fall before returning to the North Fork in July 2008. The remaining fish detected at UM1 were smaller (136-232 mm FL) when tagged and for the most part probably were subadults rather than adults when detected. They passed UM1 for the first time during April, October, and November (Figure 7). They represented less than 1% of the bull trout that were <300 mm FL (i.e., smaller than fluvial adult size) when tagged in the North Fork in 2003-08 (n=495). To date, only 48 (10%) of such fish have been detected at UM1. It is important to note, however, that 80 and 64 bull trout <300 mm FL were tagged in the North Fork in 2003 and 2004, respectively, and some of those fish could have exited the North Fork before UM1 became operational in October 2004. In addition, the antennas at UM1 were inoperable for most of the spring and early summer in 2008 due to their having been washed out by high flows.

Four tagged bull trout were detected at UM2 in 2008 (Table 2). One was fluvial adult sized (445 mm FL) when tagged in the North Fork in July 2007. Based on its detection history, it moved downstream past UM2 in November 2007. In 2008, it entered the North Fork in July, exited it in September, and passed UM2 in October. Two of the bull trout were 232 and 190 mm FL when tagged in July 2008 and were probably subadults when detected at UM2 in October and December. They took 5 and 20 d to travel the 15 km of stream between UM1 and UM2. The remaining bull trout was 131 mm FL when tagged in July 2007. It was detected at UM2 in October 2008, 464 d after being tagged, and may or may not have been a subadult. Three of the four antennas at UM2 were inoperable from May through mid-September in 2008. Thus, any tagged fish passing UM2 during that period would have had a reduced likelihood of being detected.

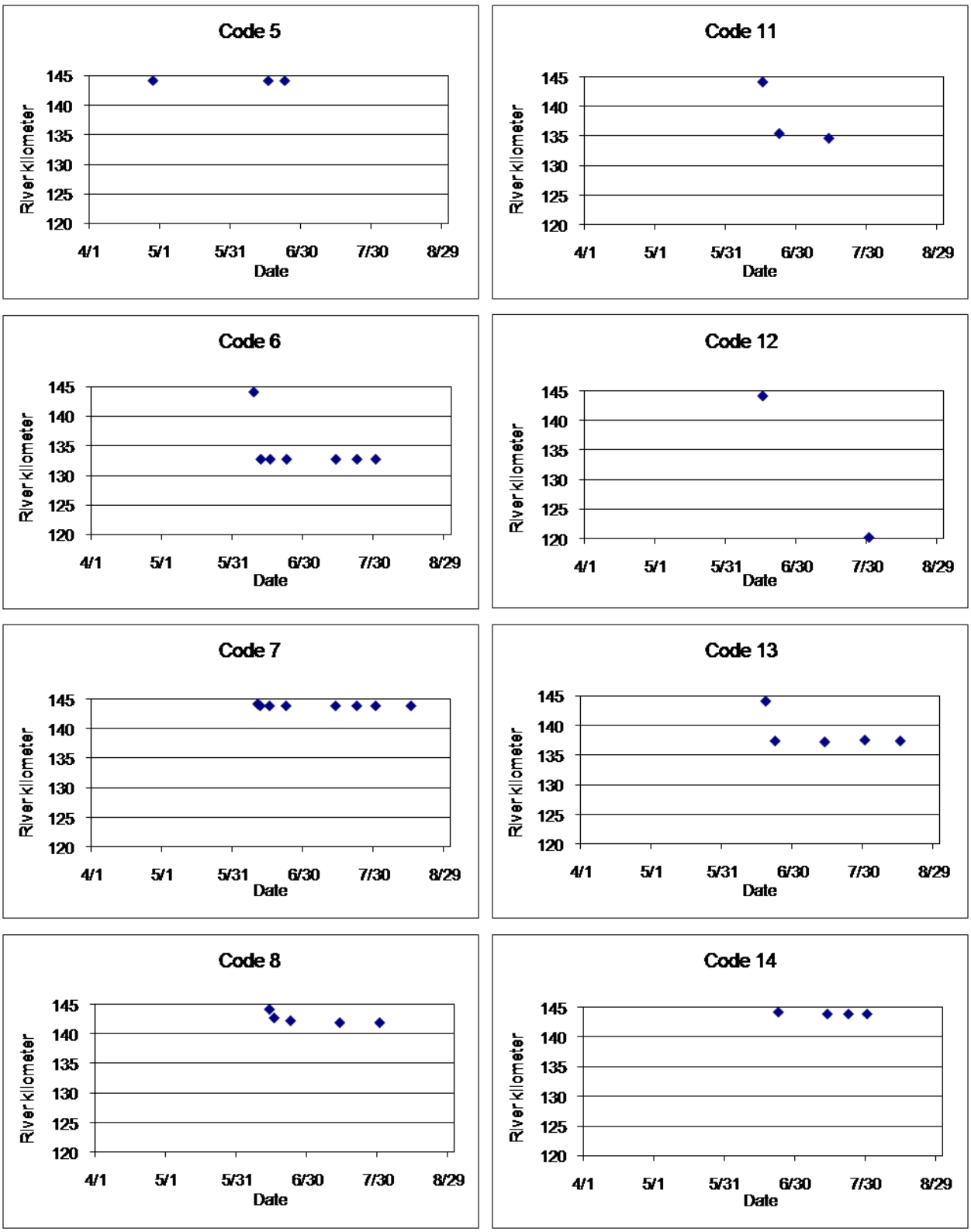

Figure 6. Tracking data for radio-tagged subadult bull trout in the Umatilla River in spring and early summer 2008. River kilometers are continuous from the mouth of the Umatilla River upstream to the confluence of the North and South forks at rkm 144.2.

Table 2. Tagging data, detection histories, and elapsed time from tagging to initial detection or between detections for bull trout PIT-tagged and released in the North Fork Umatilla River in 2003-08 and detected at PIT tag detection arrays in the North Fork Umatilla (UM1) and Umatilla (UM2) rivers in 2008.

Tag ID	Date tagged	Length at tagging (mm)	Date of detection UM1	Date of detection UM2	Elapsed time (d)
3D9.1BF1B2D981	08/04/06	206	12/09/06		127
			08/12/07		246
				10/19/07	68
			10/04/08		350
3D9.1BF1B2AE04	07/17/07	158	11/15/08		487
3D9.1BF1FDC4EE	07/17/07	181	04/30/08		288
3D9.1BF1FD957D	07/19/07	136	04/30/08		286
			08/27/08		118
3D9.1BF1B2AD3D	07/19/07	131		10/23/08	464
3D9.1BF1B2A979	07/19/07	531	08/15/07		27
				10/20/07	66
			07/02/08		256
3D9.1BF1B2A626	07/20/07	445		11/12/07	115
			07/14/08		244
			09/26/08		74
				10/24/08	29
3D9.1C2C54FC25	08/04/08	190	11/16/08		104
				12/06/08	20
3D9.1C2C550120	08/04/08	193	11/23/08		111
3D9.1C2C54F9BC	08/07/08	232	10/04/08		58
				10/10/08	5
3D9.1C2C55044D	08/07/08	425	10/05/08		59

Discussion

Radio Telemetry

The subadult bull trout in the Umatilla River moved similar distances to those in Mill Creek (P. Howell, USFS, personnel communication) and far less extensively than those in the Flathead River system (Muhlfeld and Marotz 2005). The relatively short migrations of our study fish could have been a result of low subadult density in the upper Umatilla River. The North Fork Umatilla River bull trout population is small (Budy et al. 2004, 2005, 2006, 2007), so subadults currently might not have to migrate far to find unoccupied rearing sites. Another factor might have been the unsuitably high summer stream temperatures that have existed for many years in all but the upper portion of the Umatilla River. Those conditions perhaps have

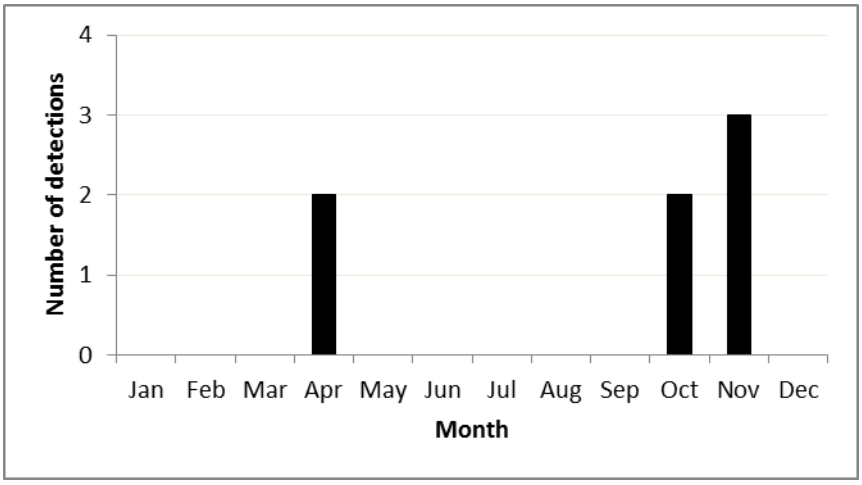

Figure 7. Number and timing of detections of PIT-tagged bull trout at a PIT tag detection array in the North Fork Umatilla River (UM1) in 2008. Data for bull trout that were fluvial adult sized (≥300 mm FL) when tagged are not included.

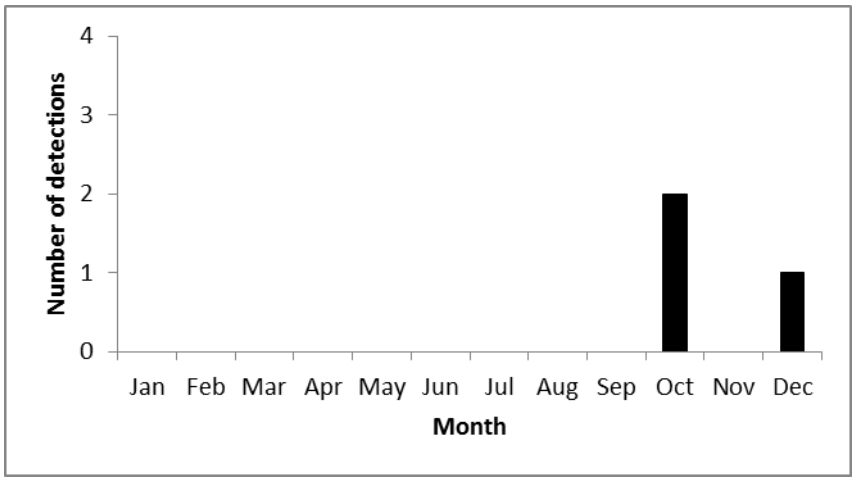

Figure 8. Number and timing of detections of PIT-tagged bull trout at a PIT tag detection array in the Umatilla River (UM2) in 2008. Data for bull trout that were fluvial adult sized (≥300 mm FL) when tagged are not included.

selected against farther migrating individuals. There is support for this idea in that conditions in Mill Creek are similar, whereas the Flathead River system contains extensive interconnected summer rearing areas.

Our description of subadult migrations has been limited thus far primarily to the initial movements relatively small, presumably younger, individuals make upon exiting the North Fork. We have yet to adequately describe what these fish do prior to reaching maturity and returning to the North Fork Umatilla River to spawn. The limited information we have collected on larger (older) radio-tagged subdults (n=3) captured in the upper Umatilla River has shown they may remain at a single site from fall through early summer (Anglin et al. 2008) or begin to move

downstream as stream temperatures decrease in the fall (Sankovich and Anglin 2007, 2008). We have not documented use of the lower Umatilla River by subadults, although there is evidence it occurs. For example, seven bull trout have been trapped in the ladder at Three Mile Falls Dam since in 1995. Assuming these fish originated in the Umatilla Basin, some, if not all, would have migrated downstream through the lower Umatilla River as subadults, given they ranged in fork length from 250-385 mm (from large subadult to small adult size) when they were captured at Three Mile Falls Dam. Describing subadult movement in the lower Umatilla River will be difficult given the small size of the bull trout population in the North Fork Umatilla River and the apparently low frequency with which individuals from that population migrate downstream into the lower river.

PIT Tag Detection Arrays

The timing of downstream movement of subadult bull trout in the North Fork Umatilla in 2008, as indicated by PIT tag detections at UM1, was somewhat atypical of that in previous years and in other systems (Hemmingsen et al. 2001a, 2001b; Muhlfeld and Marotz 2005; Downs et al. 2006; Sankovich and Anglin 2006, 2007, 2008) in that the peak in detections occurred in fall rather than spring; however, the sample was small (n=7) and the antennas at UM1 were inoperable for most of the spring and early summer. Subadult production appeared to have been low in 2008, as in prior years, based on detection rates of fish that were <300 mm FL when PIT tagged and released in the North Fork. It was probably not as low as indicated, however, because UM1 was inoperable for an extended period as noted above.

In the past, we documented staged downstream movement by some subadults exiting the North Fork (Sankovich and Anglin 2008). These fish emigrated from the North Fork in spring or summer and passed UM2 in fall. We did not observe this type of movement in 2008, possibly because the detection capability at UM2 was reduced to one antenna out of four between May and mid-September. Instead, we for the first time documented subadults emigrating from the North Fork in fall and passing UM2 shortly afterward. Stream temperatures at and downstream from UM2 are unsuitable for bull trout in summer (P.M.S., unpublished data). Through continued monitoring at this site, we will determine how prevalent movement by subadults into the seasonally inhospitable area is, and whether subadults residing there when stream temperatures are suitable return upstream as they become unsuitable.

Plans for 2009

We will continue to radio and PIT tag subadults but will shift to capturing them in the lower Umatilla River to more fully describe their seasonal movement and distribution. We will also radio and PIT tag any bull trout captured at Three Mile Falls Dam to further our understanding of the fate of such fish, collect water temperature data at relevant locations to aid in interpreting the movements of radio- and PIT-tagged bull trout in the basin, and assist ODFW's district fish biologist in conducting spawning ground surveys on the North Fork Umatilla River.

John Day Basin (North Fork John Day Sub-basin)

Methods

We conducted spawning grounds surveys on the North Fork John Day River and Baldy Creek (Figure 9) three times during September-October. The North Fork was surveyed from Peavy Cabin upstream to a 10-m long cascade in the headwaters at about rkm 178. Baldy Creek was surveyed from its mouth upstream 5 km. This reach included an ODFW index area (Section 2; between the first and third trail crossings) and the reach of stream below it to the mouth (Section 1). Section 1 was surveyed only once in late September.

When conducting the spawning ground surveys, we flagged redds with surveyor's tape as they were discovered and gave them a unique number that was written on the flagging along with the date. We also recorded this information in a notebook along with our impression of whether each redd was made by a fluvial or resident female based on its size and the size of the substrate.

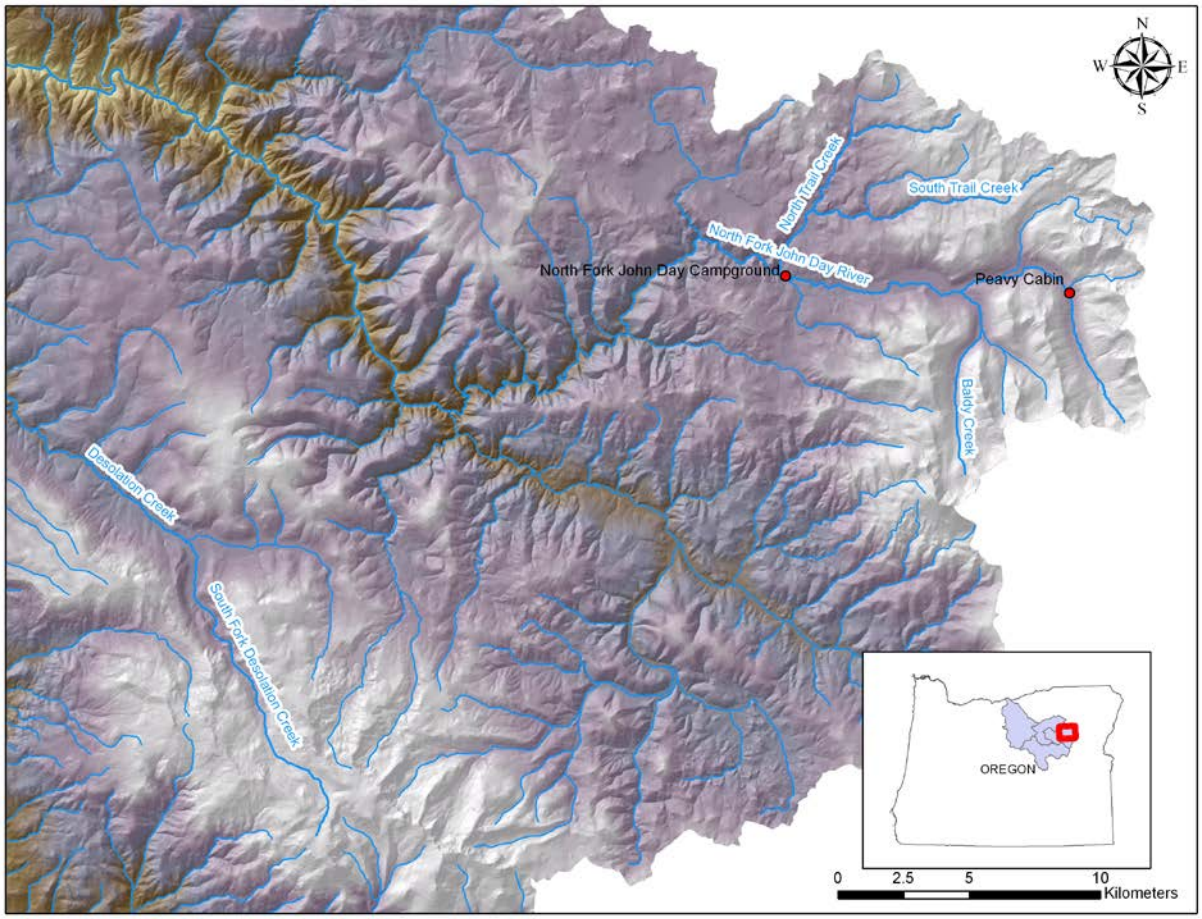

Figure 9. Map showing the North Fork John Day River and relevant tributaries and landmarks.

Results

During the spawning ground surveys, we counted six redds in the North Fork John Day River and two redds in Baldy Creek (Table 3). Based on their size and the size of the substrate, it appeared only one redd, in Baldy Creek, was made by a fluvial female.

Table 3. Redd counts in the North Fork John Day River (NFJD) and Baldy Creek in 2008. Section descriptions are provided in the Methods section.

		New redds		
Stream	Date	Section 1	Section 2	Total redds
NFJD	23 Sep		3	3
	7 Oct		3	3
	28 Oct		0	0
				6
Baldy Cr.	19 Sep	1	1	2
	9 Oct		0	0
	26 Oct		0	0
				2

Discussion

Based on our results from angling in 2005 (Sankovich and Anglin 2006), trapping in 2006 and 2007 (Sankovich and Anglin 2007, 2008), and the spawning ground surveys in 2005-08 (Sankovich and Anglin 2006, 2007, 2008), it is evident the abundance of fluvial adult bull trout in the North Fork John Day River and Baldy Creek is extremely low. There also appears to be a low abundance, if not absence, of fluvial adults in South Fork Desolation Creek based on the redd counts there in 2006 and 2007. This finding is consistent with results from snorkeling surveys conducted in South Fork Desolation Creek in August 2003 (I. Tattam, Oregon State University, personal communication). Our telemetry data were too limited to determine if there are any passage problems in the migratory corridor that might be contributing to the low abundance of fluvial adults. No bull trout were tracked through an annual cycle of movement. One apparent brook trout x bull trout hybrid was, and there appeared to be no impediments to its movement within the upper 79 km of the North Fork.

Our count of resident redds in the North Fork and Baldy Creek was probably not an accurate reflection of the abundance of resident adult bull trout in those streams. Drawing inferences from the count of resident-sized redds is complicated by the presence of brook trout spawners in the North Fork and Baldy Creek, and by the potential for the count to have been negatively biased, as is often the case when dealing with resident redds (Hemmingsen et al. 2001b; Starcevich et al. 2005). The presence of brook trout spawners is a less relevant issue given we counted only five resident-sized redds. Whether brook trout made all or none of them,

the number belonging to bull trout would have been exceedingly small. Surveyor bias, on the other hand, could have been a significant problem. Hemmingsen et al. (2001b) counted only 21 redds in a stream supporting an estimated 885 mature resident bull trout. Starcevich et al. (2005) found surveyor bias to be less substantial in another stream, but it was still high, with 45% of the redds made by resident bull trout going undetected. Although the magnitude of any bias in our count is unknown, it is worth noting the North Fork, Baldy Creek, and the stream in Hemmingsen et al.'s study contain large amounts of fine granitic substrate, unlike the stream in Starcevich et al.'s study (P.M.S., personal observation). Small redds built in fine granitic substrate are difficult to detect. Therefore, we might expect any bias in our count to be more in line with that evident in Hemmingsen et al.'s study.

Plans for 2009

Given the low abundance of fluvial adult bull trout in the North Fork John Day River system, we will shift our focus in 2009 to studying the seasonal distribution and movement of subadults. We will operate a screw trap in the North Fork in spring and fall to capture subadults for radio tagging. We will also radio tag any bull trout captured incidentally by personnel from ODFW operating screw traps and seining in the Middle Fork John Day and John Day rivers to expand our knowledge of the migratory patterns of bull trout in the John Day Basin. Temperature recorders will be deployed at relevant locations to obtain data that can be used to interpret the behavior of tagged bull trout.

Acknowledgements

Funding for this study was provided by the U.S. Fish and Wildlife Service. We thank the personnel from the Oregon Department of Fish Wildlife's Northeast Oregon Fish Research and Development Section and Darren Gallion, Marshall Barrows, Ryan Koch, and Courtney Newlon of the U.S. Fish and Wildlife Service for their assistance in the field, and Oregon Departement of Fish and Wildlife District Fish biologists Bill Duke and Tim Unterwegner for supporting our work in their districts.

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Appendix Table A1. Locations of radio-tagged subadult bull trout in the Umatilla River during tracking events from April to August 2008. River kilometers are continuous from the mouth of the Umatilla River upstream to the confluence of the North and South forks at rkm 144.2.

	Radio tag code									
Date	5	6	7	8	9	10	11	12	13	14
4/28/08	144.2									
6/9/08		144.2								
6/11/08			144.2							
6/12/08		132.7	143.8							
6/14/08				144.2	144.2					
6/16/08	144.2	132.7	143.8	142.7		144.2	144.2	144.2		
6/19/08									144.2	
6/23/08	144.2	132.7	143.8	142.2			135.5		137.4	
6/27/08										144.2
7/14/08		132.7	143.8	141.9			134.7		137.2	143.8
7/23/08		132.7	143.8							143.8
7/31/08		132.7	143.8	141.9				120.2	137.6	143.8
8/15/08			143.8						137.4	