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Clackamas River Bull Trout Reintroduction Project:
Census spawning surveys, 2015

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Clackamas River Bull Trout Reintroduction Project: Census Spawning Surveys, 2015

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Abstract. We assessed the feasibility of integrating a census bull trout redd survey of the upper Clackamas River basin with habitat surveys currently conducted by ODFW’s Aquatic Inventories Project. We counted 59 presumed bull trout redds in this basin in 2015. This was a 59% increase relative to the count in 2014 and more than a three-fold increase since 2013. The majority of redds were observed in Pinhead Creek (N=47). Bull trout redds were observed in lower Oak Grove Fork (N=1), the Clackamas River section known as “Big Bottom” (N=6), and in the upper reaches of Clackamas River (N=4). During surveys, no bull trout were seen spawning or holding on redds. Coho salmon were not observed in the basin during the surveys, however, many Chinook salmon were seen spawning in Big Bottom, which added a potentially confounding factor to bull trout spawning surveys in these reaches. Stream temperatures taken during surveys suggest that most of the upper Clackamas River surveyed provided thermally suitable habitat during the typical bull trout spawning period. To reduce sampling error, spawning surveys should be conducted at most three weeks apart and cover the entire potential spawning period (August 15-November 1), especially in the Pinhead Creek watershed and suitable reaches of the Clackamas River. Temperature loggers should be used next year to further evaluate potential bull trout spawning habitat and inform future monitoring activities in the upper Clackamas River basin.

Introduction

Bull trout were extirpated from the Clackamas River basin by the 1960s. Following completion of a reintroduction feasibility assessment in 2007, annual transfers of bull trout from the Metolius River basin began in 2011 and have continued through 2015. The goal of the reintroduction is to establish a self-sustaining population of 300-500 adult spawners. The reintroduction was divided into three phases of approximately 6-7 years each (see USFWS 2011). Phase one involved active transfers of fish into the basin and intensive monitoring using radio telemetry, PIT tags, e-fishing, and redd surveys. Phase two is scheduled to begin in 2017 and will involve continued monitoring of progress towards the reintroduction goal. During this phase, we anticipate that spawner abundance will be tracked using annual redd surveys. The surveys to date have been conducted by an *ad hoc* group of volunteers and have not consistently covered the entire sample frame of potential spawning habitat. Additionally, redd surveys have several potential sources of bias (see Dunham et al. 2001) that have not been addressed by the current approach (e.g., timing, observer bias). Our objective was to 1) evaluate the feasibility of incorporating a census redd survey of all potential bull trout spawning habitat into existing habitat monitoring conducted by ODFW, 2) refine the sample frame to focus surveys in areas where bull trout may spawn (temperature, substrate, barriers), and 3) identify the optimal revisit interval during the spawning season.

Methods

A 5-person crew conducted spawning surveys in the upper Clackamas River and several major tributary basins (Figure 1). We conducted a zero-count in early August, prior to the start of bull trout spawning. The zero-count was used to train field crews in bull trout redd identification by analyzing characteristics of old redds (i.e., redds constructed prior to August) and flagging areas that could be mistaken for new redds; and to assess the time and logistics required to complete the census. Further field training in identifying new bull trout redds (i.e., August-October) was conducted during the first census survey in Pinhead Creek. We identified a new bull trout redd by its pocket-mound structure, smaller gravel size relative to substrate in Chinook salmon redds, and light coloration of redd gravel relative to darker surrounding substrate matrix. A census spawning survey was completed in each of the following time periods: 1) August 31 to September 15, and 2) September 24 to October 14. Additional surveys were conducted on October 22 by Chinook salmon spawning surveyors (ODFW) in Reach 2 and 3 of the Clackamas River and on November 4 by Chris Allen (USFWS) and Jack Williamson (USFS) in Last Creek.

The field crew georeferenced and recorded observations of three main features in field data books: new redds, bull trout, and potential upstream passage barriers. Additionally, in stream reaches deemed by a field crew to contain little spawning habitat, patches of potential spawning

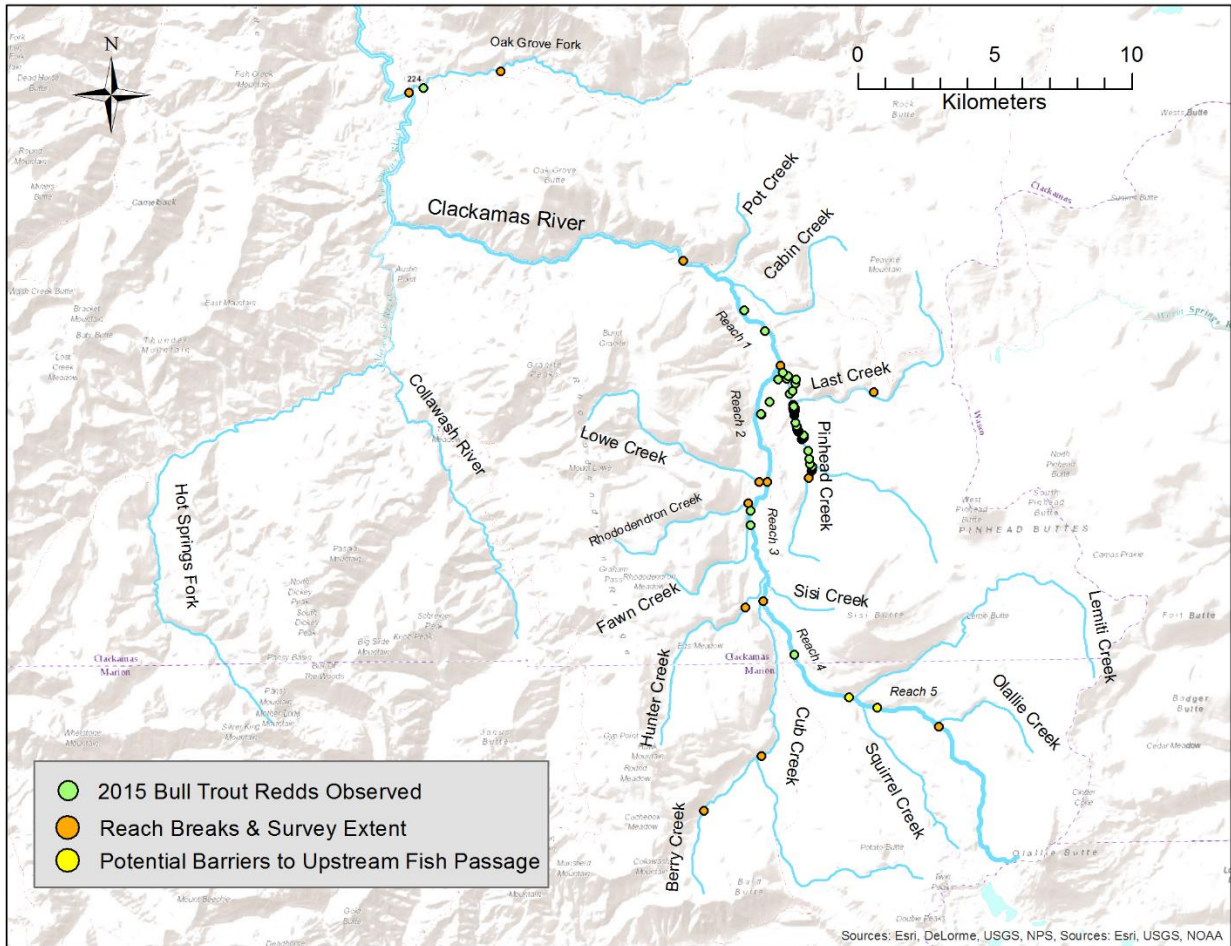


Figure 1. Map of survey extent, potential barriers, and bull trout redds observed in the upper Clackamas River Basin, 2015.

gravel were measured, georeferenced, and recorded. When a new bull trout redd was observed, the crew recorded the maximum length and width and flagged the site – the flag included the redd number, survey code, date, surveyor name, and redd location if the flag was some distance from the redd. Observations of Chinook salmon spawning were recorded as a feature or reach note. At the start and end of each survey reach, stream temperature and time was recorded, and upstream and downstream photos were taken.

An Access database was created for storing data from the census surveys of 2015 and for previous surveys for which field data records were found. Each year spawning surveyors recorded observations of some bull trout redds described as “potential”, “possible”, “likely”, “test dig?” or some other variant registering uncertainty in their observations. All bull trout redd observations recorded by spawning surveyors were entered in this database and descriptions of uncertainty were included as a feature note. (See Appendix I for dataset from 2015.)

Results and Discussion

We counted 59 bull trout redds in the upper Clackamas River Basin in 2015 (Table 1, Appendix I). This was a 59% increase relative to the count in 2014 and more than a three-fold increase since 2013. Most the bull trout redds were observed in the Pinhead Creek watershed (N=48). Partial carcasses of two adult bull trout (a 65 cm male and a female) were found during the upper Pinhead Creek survey on August 31; they likely were preyed upon by otters. Their heads were collected and stored in a freezer for potential genetic and otolith analysis. Lower Pinhead Creek (Reach 1) has several sections with high habitat complexity, including three or more channels. We surveyed with 4-5 experienced observers to cover these complex sections. Even still, there was evidence that the redd detection of this large field crew was substantially less than 100%. An experienced observer, following behind the crew and taking photos of redds and habitat, surveyed a shorter section of lower Pinhead Creek and found three new redds that had not been flagged. It is not clear if the crew missed these new redds or saw these areas and judged them not to be new redds; nevertheless, the potential for experienced surveyors to miss new redds in complex areas like lower Pinhead Creek suggests that the census survey likely represents a minimum redd count.

Table 1. Number of bull trout redds counted in the upper Clackamas River basin since surveys began in 2011. In certain years, some streams and reaches were not surveyed (*NS*) or the field data were not available (*NA*). These counts included redds described by surveyors in their field data records as “potential”, “possible”, or “likely.”

Stream	Reach	Redd Count					Reach Description
		2015	2014	2013	2012	2011	
Pinhead Creek	1	13	21	10	9	<i>NA</i>	To Last Cr.
Pinhead Creek	2	34	14	2	5	<i>NA</i>	Last Cr.-FS140 Road
Last Creek	1	1	2	3	2	<i>NA</i>	To Camp Cr.
Clackamas River	1	1	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	FS4650-Pinhead Cr.
Clackamas River	2	5	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	Pinhead Cr.-Lowe Cr.
Clackamas River	3	2	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	Lowe Cr.-Cub Cr.
Clackamas River	4	2	<i>NS</i>	1	<i>NS</i>	<i>NS</i>	Cub Cr.-Lemiti Cr.
Clackamas River	5	0	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	Lemiti Cr.-Ollalie Cr.
Oak Grove Fork	1	1	<i>NS</i>	2	<i>NS</i>	<i>NS</i>	First 2.5 km
Lowe Creek	1	0	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	First 1 km
Rhododendron Cr.	1	0	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	First 1 km
Hunter Creek	1	0	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	First 1.5 km
Cub Creek	1	0	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	To Berry Cr.
Cub Creek	2	0	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	First 2.5 km
Berry Creek	1	0	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	First 3 km
TOTAL		59	37	18	16	5	

Bull trout redds were also observed in the Clackamas River (N=10) and Oak Grove Fork (N=1) (Figure 1, Table 1), where no bull trout were observed spawning. Many Chinook salmon were observed actively spawning throughout this part of the survey area. These redds were identified as those of bull trout mainly because the spawning gravel was substantially smaller than the substrate in the Chinook salmon redds observed during the survey and because these redds were located adjacent to instream cover (e.g., undercut bank, instream large wood, boulders) and relatively lower velocity flow, which is more typical of bull trout spawning behavior. One bull trout redd identified during the first survey was not visible during the second survey because of the superimposition of a large Chinook salmon redd. A Chinook salmon spawning surveying crew noted on October 22 that four of the five flagged bull trout redds in Reach 2 of the Clackamas River were more typical of Chinook salmon redds (Sara Akin, ODFW, personal communication). The Chinook crew did not measure the redds so we could not compare redd dimensions to determine if these observations may have resulted from redd superimposition or enlargement by Chinook salmon, and we did not attempt to evaluate observer error of either crew. Bull trout redd identification in the first three reaches of the Clackamas River could be confounded by the spatial and temporal overlap of Chinook salmon spawning and the potential for redd superimposition and Chinook test digs to increase observer error. This increased chance of observer error contributes to greater uncertainty in bull trout redd observations in this part of the sample frame.

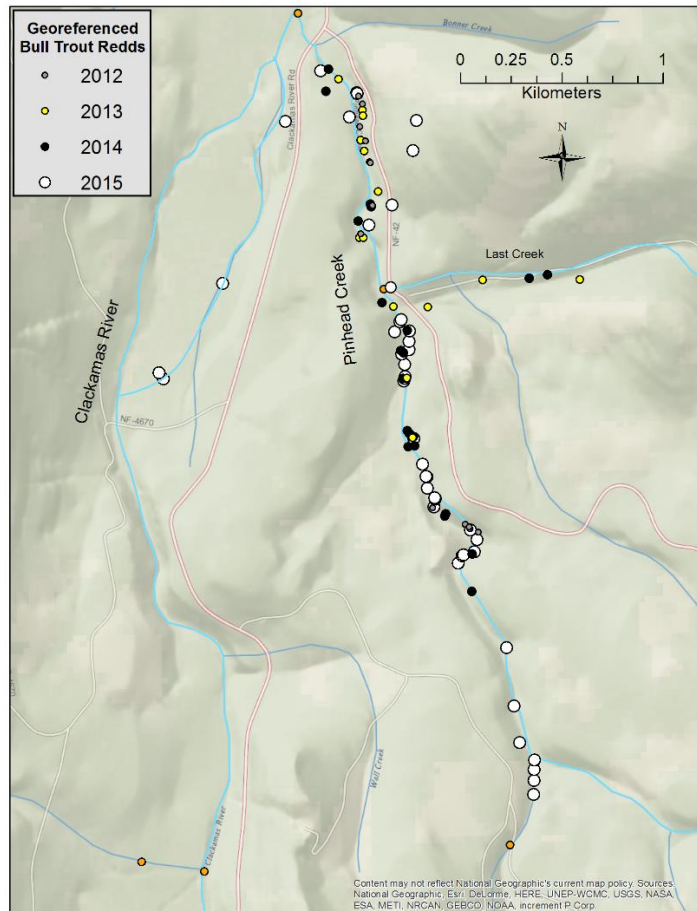


Figure 2. Bull trout redd distribution in Pinhead Creek, Last Creek, and Reach 2 of the Clackamas River for 2012-2015. Some redds in each year were not georeferenced, only redds that were georeferenced are shown. Redds coordinates have not been snapped to the stream.

The sampling schedule in 2015 contributed to increasing the chance of observer error and bias toward undercounting redds in three ways. First, we noted that some of the new redds observed during the survey on August 31 looked like old redds by the final survey on October 14. If redds

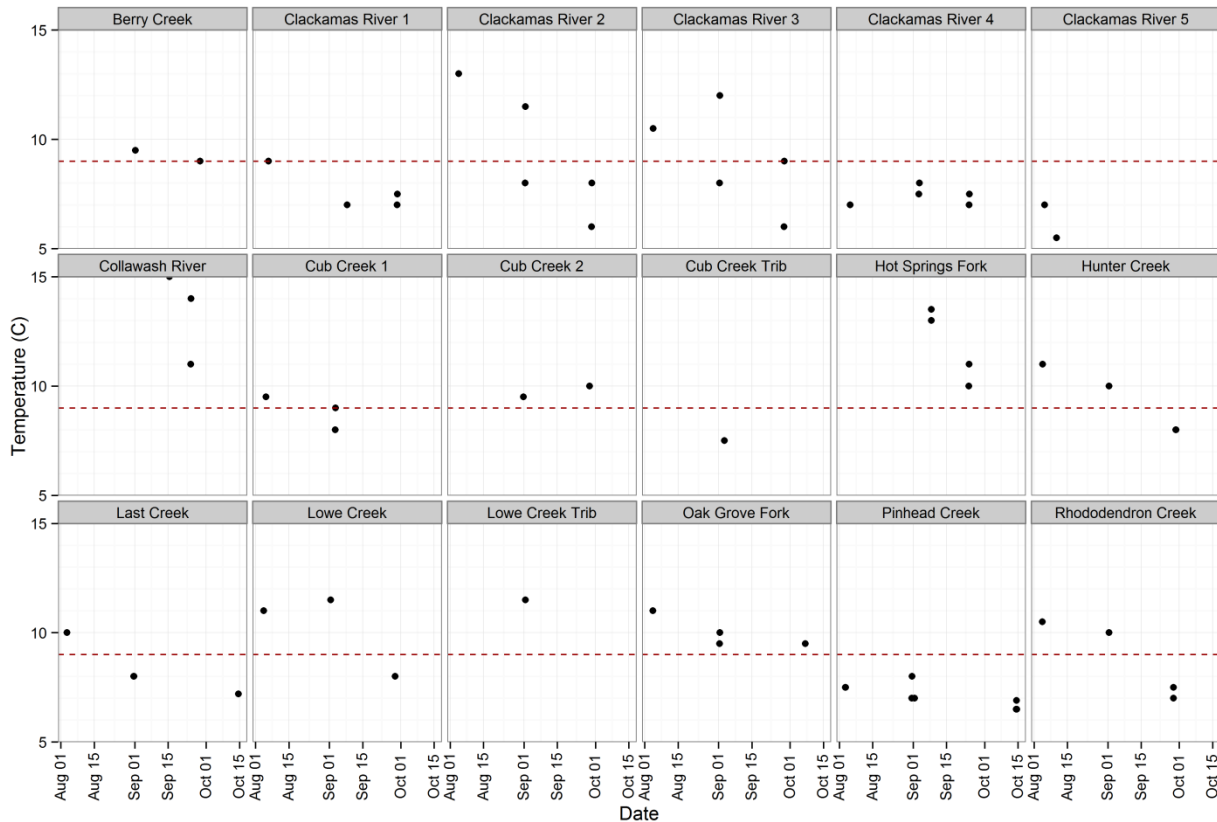


Figure 3. Stream temperatures (C) recorded during bull trout spawning surveys in the upper Clackamas River Basin, 2015. Red dotted line represents the 9 C threshold considered to be the temperature below which bull trout will begin spawning. Temperature measurements were not taken in every survey.

were missed during the first survey, the 44 days between surveys would preclude observers from correcting some of the errors of omission committed in the first survey and thus negatively bias the redd count. Second, there were several redds noted by the crew that were judged to be old redds even though they displayed some characteristics of a new redd (e.g., pocket-mound structure and brighter coloration of the substrate). There is at least some chance that these were new redds that were either missed during the first survey or constructed in early September and then aged enough by the second survey to be more ambiguous and difficult for observers to identify as new. If some of these ambiguous redds were indeed new bull trout redds, then this would contribute to a bias to undercount in 2015. Third, without knowledge of bull trout spawning timing in this sample frame, the last surveys were scheduled to be completed by October 14 even though bull trout are capable of spawning into early November in other parts of their geographical distribution. Indeed, spawning surveyors for the Clackamas River Chinook salmon project observed two new bull trout redds in the Clackamas River on October 22 and observers on a November 4 survey of Last Creek also counted a new bull trout redd. Three changes to the survey protocol would ameliorate at least some of the observer error and bias toward undercounting redds: 1) conduct a zero count that thoroughly attempts to identify these

areas of ambiguity, 2) census surveys should be no more than three weeks apart, 3) the survey schedule should span the entire potential spawning period (August 15 – November 1) until actual spawning timing in the upper Clackamas River basin is better understood. These changes would remove some of the ambiguity in identifying new redds and likely give the crew another chance at identifying new redds that were missed during the previous survey.

The sample frame for spawning surveys was expanded in 2015 to include the upper Clackamas River and more of its tributaries. We gained information about the adequacy and accessibility of spawning habitat for bull trout using stream temperatures recorded during surveys and georeferencing the location of potential passage barriers, respectively.



Figure 4. Potential barriers to upstream fish passage in the upper Clackamas River (Reach 5).

Bull trout are thought to begin spawning as stream temperature drop below 9 C (see Pratt 1992). We can use this temperature threshold to assess when there would be potential for bull trout spawning in individual reaches of the sample frame (Figure 3). Reaches that were below 9 C throughout the bull trout spawning season (i.e. August 15 – November 1) were Pinhead Creek, Last Creek, Reaches 1, 4, and 5 of the Clackamas River, and a small unnamed tributary of Cub Creek. Reaches that were below 9 C by October 1 were Reaches 2 and 3 of the Clackamas River, lower Cub Creek, Hunter Creek, Lowe Creek, and Rhododendron Creek. Sections that bordered this temperature threshold were Berry Creek, Oak Grove Fork, and upper Cub Creek. The Collawash River and Hot Springs Fork may not provide thermally suitable habitat during the typical bull trout spawning season. These temperature data represent only a snapshot of the thermal conditions in this sample frame and suggest that a better thermal picture may be useful for making monitoring decisions such as where and when to conduct bull trout spawning surveys. This could be done by deploying temperature loggers from June through October in several locations in the upper Clackamas River and its major tributaries.

Two potential barriers to upstream fish passage have been identified, both in the upper Clackamas River (Figures 1 and 4). These potential barriers are comprised of a 2-2.5 m bedrock step with no jump pools and no distinct thalweg. High velocity, turbulent flow hits the angled

surfaces of several basalt columns within the step and deflects flow at various angles. When seen in person, it is difficult to understand how adult fish would get upstream of these steps. Water samples have been taken upstream of these site and will be analyzed for bull trout eDNA. Two surveys upstream of these sites, Reach 5 of the Clackamas River, were conducted and no redds were observed. Further evaluation of these steps as fish passage barriers is warranted because substantial high-quality bull trout habitat exists upstream of these steps.

Acknowledgements

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Appendix I. All bull trout redds observed in the upper Clackamas River basin in 2015.

Stream	Reach	Date	Feature_ID	Utm_east	Utm_north	Feature_note	Temp.C
Clackamas River	2	9/29/2015	1B	587396	4979952	not far downstream (~12 m from potential redd "A2", marked by DP, very likely a BT redd	6
Clackamas River	2	9/1/2015	A2	587374	4979981	bt redd, or chk test dig	8
Clackamas River	2	9/1/2015	A1	587690	4980423	Potential bull trout redd, test dig 1.5 m us, both look like bt redds, in areas where bt would spawn; however, possible confounding with chk test digs	8
Clackamas River	2	9/29/2015	2B	588000	4981225	pretty small substrate, very likely bull trout redd	6
Clackamas River	2	9/29/2015	B1	587515	4982998	bull trout redd	7
Clackamas River	3	10/22/2015	C1	586982	4975922	small gravels, smaller than a CHK redd, not a CHK location (lower flow velocity)	NA
Clackamas River	3	10/22/2015	C2	587000	4976448	small gravels, smaller than a CHK redd, not a CHK location (lower flow velocity)	NA
Clackamas River	4	9/24/2015	B1	588585	4971188	Bull trout redd	7
Clackamas River	4	9/24/2015	B2	588585	4971188	Possible 2nd redd, maybe test dig, small	7
Clackamas River	1b	9/8/2015	A1	586759	4983759	bull trout redd in side channel	7
Last Creek	1	11/4/2015	C1	588571	4980301	Small, well-defined redd	NA
Oak Grove Fork	1	10/7/2015	B1	575057	4991858	left, adj to boulder margin, not obvious redd, gravel suitable for BT, not ChK	9.5
Pinhead Creek	1	10/14/2015	B2jc	588541	4980184		6.9
Pinhead Creek	1	10/14/2015	B3ca	588413	4980712		6.9
Pinhead Creek	1	10/14/2015	B1jc	588527	4980811		6.9
Pinhead Creek	1	10/14/2015	B2ca	588631	4981079		6.9
Pinhead Creek	1	10/14/2015	B1ca	588648	4981228		6.9

Stream	Reach	Date	Feature_ID	Utm_east	Utm_north	Feature_note	Temp.C
Pinhead Creek	1	10/14/2015	B2dp	588317	4981246		6.9
Pinhead Creek	1	10/14/2015	B1ss	588264	4981427	b1ss, b2ss on same gravel bar pool tailout, 1 m apart	6.9
Pinhead Creek	1	10/14/2015	B2ss	588624	4981427	b1ss, b2ss on same gravel bar pool tailout, 1 m apart	6.9
Pinhead Creek	1	10/14/2015	B1dp	588174	4981475	between mouth and 46 bridge	6.9
Pinhead Creek	1	10/14/2015	B1tc	NA	NA	150 m ds of "chk"sized redd, it was small, lost databook	6.9
Pinhead Creek	1	10/14/2015	B2tc	NA	NA	15 m us of "chk" sized redd	6.9
Pinhead Creek	1	10/14/2015	B3tc	NA	NA	50-100 m us "chk"	6.9
Pinhead Creek	1	10/14/2015	B4tc	NA	NA	100m us of pinch point	6.9
Pinhead Creek	2a	8/31/2015	A10	588854	4979040		8
Pinhead Creek	2a	8/31/2015	A9	588875	4979076		8
Pinhead Creek	2a	8/31/2015	A8	588881	4979080		8
Pinhead Creek	2a	8/31/2015	A7	588934	4979096	possible duplicate (unique coordinates)	8
Pinhead Creek	2a	10/14/2015	B18	588948	4979156		6.5
Pinhead Creek	2a	10/14/2015	B17	588915	4979203		6.5
Pinhead Creek	2a	10/14/2015	B16	588735	4979318		6.5
Pinhead Creek	2a	10/14/2015	B15	588740	4979356		6.5
Pinhead Creek	2a	10/14/2015	B14	588740	4979360		6.5
Pinhead Creek	2a	10/14/2015	B13	588739	4979362	small redd, test?	6.5
Pinhead Creek	2a	10/14/2015	B12	588703	4979411		6.5
Pinhead Creek	2a	10/14/2015	B11	588700	4979466		6.5
Pinhead Creek	2a	8/31/2015	P2A2	588695	4979468		8
Pinhead Creek	2a	8/31/2015	A5	588679	4979528	2 potential test digs nearby	8
Pinhead Creek	2a	10/14/2015	B10	588635	4979656		6.5
Pinhead Creek	2a	10/14/2015	B8	588585	4979940	redds are consecutive us/ds right at trib mouth	6.5
Pinhead Creek	2a	10/14/2015	B9	588585	4979940	redds are consecutive us/ds right at trib mouth	6.5
Pinhead Creek	2a	10/14/2015	B7	588589	4979953	same spot as potential redd flag 4a from 2014	6.5
Pinhead Creek	2a	10/14/2015	B6	588593	4979961		6.5
Pinhead Creek	2a	10/14/2015	B4	588590	4980023		6.5
Pinhead Creek	2a	10/14/2015	B5	588590	4980023		6.5
Pinhead Creek	2a	8/31/2015	A4	588576	4980074		8

Stream	Reach	Date	Feature_ID	Utm_east	Utm_north	Feature_note	Temp.C
Pinhead Creek	2a	10/14/2015	B3	588611	4980096		6.5
Pinhead Creek	2a	10/14/2015	B2	588612	4980136	potential? Small, likely test dig	6.5
Pinhead Creek	2a	10/14/2015	B1	588614	4980188	not positive, likely	6.5
Pinhead Creek	2a	8/31/2015	A3	588567	4980234		8
Pinhead Creek	2a	8/31/2015	A2	588572	4980243		8
Pinhead Creek	2b	9/1/2015	A11	589227	4977895	margin, under log	7
Pinhead Creek	2b	9/1/2015	A12	589229	4977965		7
Pinhead Creek	2b	9/1/2015	A13	589229	4978018	mid-channel	7
Pinhead Creek	2b	9/1/2015	A14	589232	4978065	under yew branches	7
Pinhead Creek	2b	9/1/2015	A15	589159	4978152	beautiful long redd	7
Pinhead Creek	2b	9/1/2015	A16	589131	4978333	nice redd, slightly old, needs gps location, flagged	7
Pinhead Creek	2b	10/14/2015	B1PIN2	589094	4978622	bright gravel, but mound a little flattened	6.5

