

2014 Bull Trout Redd Monitoring in the Wallowa Mountains



**Prepared by:
Gretchen Sausen
U.S. Fish and Wildlife Service
La Grande Field Office
July 2015**

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ABSTRACT

Bull trout were listed as threatened under the Endangered Species Act in 1998 due to declining populations. The U. S. Fish and Wildlife Service (Service) recommends monitoring populations in subbasins where little is known, including the Grande Ronde and Imnaha subbasins. Spawning survey data is important for determining relative abundance and distribution trends in bull trout populations. This report summarizes the 2014 bull trout spawning data collected in the Wallowa Mountains of NE Oregon and compares this with past years' data. Bull trout spawning surveys have been conducted on similar index areas for selected Grande Ronde and Imnaha River streams from 1999 to 2014. These surveyed streams are located within the Wallowa River/Minam River and Imnaha River bull trout core areas. Surveys in 2014 were conducted by fisheries consultants, the Service, Nez Perce Tribe (NPT), the Oregon Department of Fish and Wildlife (ODFW), U.S. Forest Service (USFS), Freshwater Trust, Anderson Perry Inc., and a volunteer. Objectives of the survey included; locate bull trout spawning areas, determine redd characteristics, determine bull trout timing of spawning, collect spawning density data, determine and compare the spatial distribution of redds along the Lostine River in 2006 through 2014, and over time use all of the data to assess local bull trout population trends and the long-term recovery of bull trout. Timing of spawning, total redds, redd sizes, and redd locations are documented in the report. The local bull trout populations were relatively stable for the survey period (1999-2014) and there was an increase in redd numbers on the Lostine River, Big Sheep Creek, and Bear/Goat Creek in 2014 compared to 2013, and a decrease in redd numbers on the Imnaha (excluding Cliff Creek a resident stream) in 2014, compared to 2012. 2013 data for the Imnaha is not comparable due to less stream miles/reaches surveyed that year. The Imnaha population is one of the strongholds within the Imnaha Subbasin. Big Sheep Creek and Little Sheep Creek populations within the Imnaha River core area are of concern for long-term viability due to issues with stream flows, fish passage, and connectivity. The Lostine River and Bear Creek contain brook trout and hybridization is likely occurring (the Lostine has had documented bull trout and brook trout pairing up for spawning).

ACKNOWLEDGMENTS

The Service has, for the past eleven years, provided staff time necessary for the coordination, implementation, and analysis and report summarization of this project. Prior to Service support of this project, the Wallowa-Whitman National Forest, Wallowa Mountains Office (WMO) had secured previous years' funding and support, and was responsible for the coordination, implementation, and analysis and report summarization. Due to a lapse in federal appropriations and associated furlough of government staff in 2013 (Oct 1-16th), the Nez Perce Tribe stepped up to coordinate during this time period.

This project would not have been possible without the dedication, hard work, funding, and assistance provided by all the partners. Oregon Watershed Enhancement Board (OWEB) funding from 2007-2014 allowed the use of Del Sol Wilderness Adventures (2008-2014) for a horse/mule packer to pack our gear in and out of the Upper Imnaha to conduct our annual spawning survey in that drainage. The WMO in 2005 through 2007 and other commercial packers in past years provided this service. I would like to thank the partners in 2014 which included; the NPT, ODFW, consultants, the USFS, OWEB, GRMW, the Service, Freshwater Trust, Anderson Perry, Inc., and a volunteer. Special thanks to the people who walked the streams, helped with scheduling surveys and surveyors, provided access to private property, packed us into remote areas to survey, assisted with the OWEB grants, or summarized the data. These included: Gary Miller (Service); Jon Rombach (volunteer extraordinaire), Jamie Ratliff (USFS), Barry and Shirley Cox, Paul Arentsen, and Todd Kruger (Del Sol Wilderness Adventures Horse/Mule Packers and Winding Waters River Expeditions); Jeff Oveson, and Mary Estes (Grande Ronde Model Watershed); Lynne Price and Caitlyn Ecklund (consultants); Montana Pagano, Ian Wilson, Eric Shoudel, Brian Simmons, Mary Edwards, and Jim Harbeck (NPT); Kyle Bratcher, Jeff Yanke, Mike Lance, Elizabeth OsierMoats, Ryan Seal, and Joel Ophoff (ODFW); Jack Woods, Nancy Clarke, Stewart and Susan Coleman (landowners that provided access to private properties near the Lostine River); Aaron Maxwell (Freshwater Trust); and Sue Brady (Anderson Perry, Inc.).

INTRODUCTION

Bull trout were listed as threatened under the Endangered Species Act in 1998 due to declining populations. The Service recommends monitoring populations in subbasins where little is known including the Grande Ronde and Imnaha subbasins (USFWS 2002). Spawning survey data is important for determining relative abundance and distribution trends in bull trout populations. A minimum of 15 years is needed for determining bull trout population trends (Maxwell 1999). Without adequate funding, it has been difficult to find sufficient numbers of experienced bull trout surveyors and packers for surveys in the back-country, and to obtain adequate supplies to get the work accomplished. OWEB funding for the project supported the continued survey of bull trout spawning areas in years 2007 through 2014 in the Wallowa Mountains of northeast Oregon. Bull Trout redd counts (spawning surveys) have been conducted annually on the Wallowa Valley, Hells Canyon National Recreation Areas (HCNRA), and Eagle Cap districts of the USFS and along some sections of private property of the Lostine River by the Service, NPT, contractors, ODFW, USFS, and volunteers for the past 14 to 16 years. Objectives of the bull trout spawning surveys include:

- Locate bull trout spawning areas.
- Determine redd (spawning nest) characteristics.
- Determine bull trout timing of spawning.
- Collect spawning density data.
- Map the location of the bull trout spawning reaches.
- Determine and compare the spatial distribution of redds along the Lostine River in 2005 through 2014. Collect UTM spatial redd data on Big Sheep, Lick Creek, and Middle Imnaha to compare at a later date.
- Assess population trends for local bull trout populations.
- Use this information for helping assess the long-term recovery of bull trout.

LOCATION

The Service and multiple partners conducted bull trout spawning surveys in 2014 on selected streams in the Grande Ronde and Imnaha Sub-Basins. These streams are located within the Wallowa River/Minam River and Imnaha River bull trout core areas. Stream systems surveyed in 2014 for bull trout redds included; the Lostine River, Bear and Goat Creeks, the Imnaha River, Big Sheep Creek and Lick Creek (Figure 1). In 2014, exploratory surveys were conducted on tributary streams to the Wallowa River upstream of Wallowa Lake, the West Fork and East Fork Wallowa Rivers commencing at Wallowa Lake and surveying to the upstream waterfall on the West Fork Wallowa River and surveying the East Fork Wallowa River from the confluence with the West Fork Wallowa River upstream to the first waterfall.

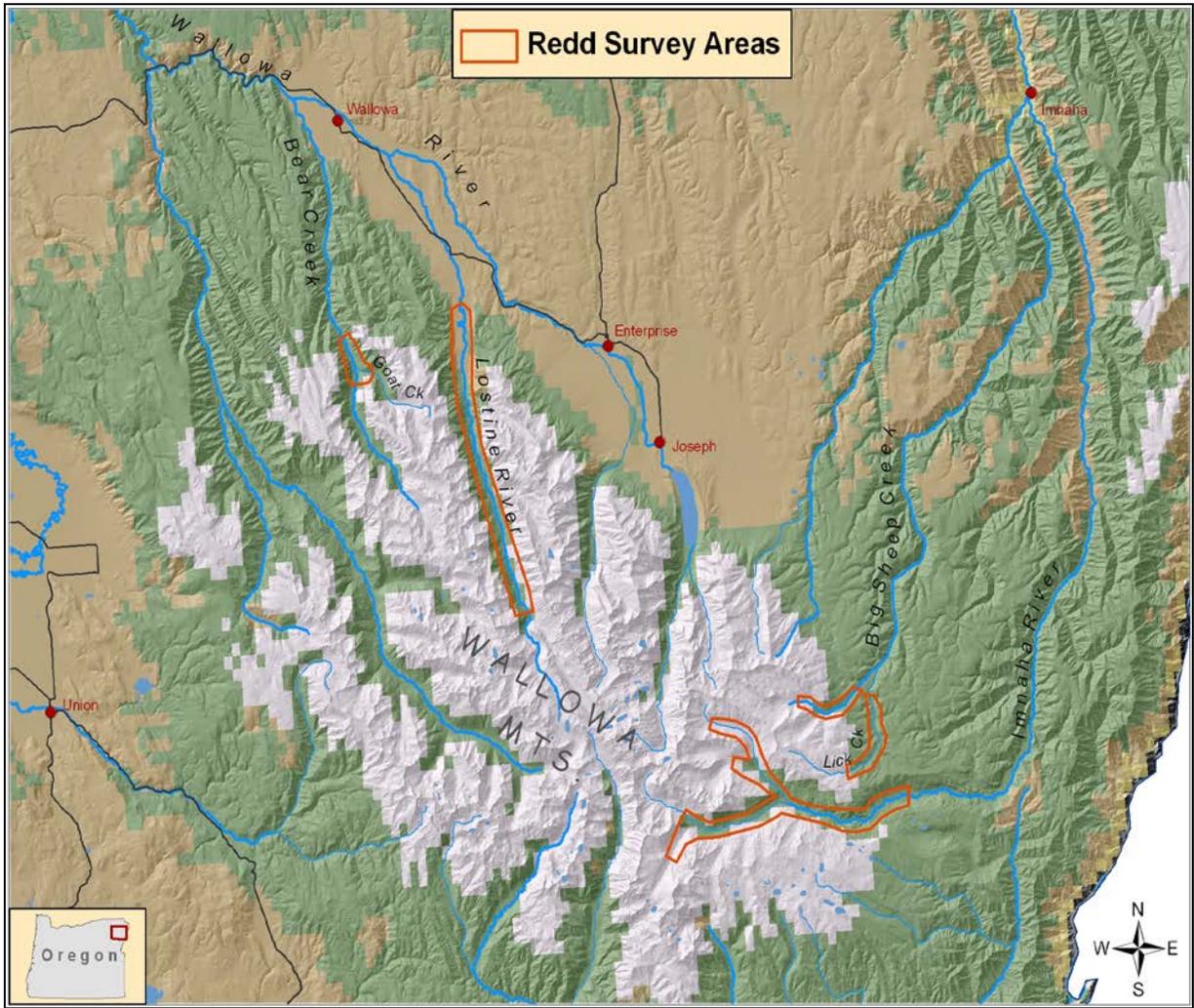


Figure 1. Wallowa Mountain Bull Trout Redd Survey Areas.



Lostine River, French Camp to Bowman Reach, with view of nearby mountains, Photo taken in 2010

METHODS

Bull trout spawning surveys on large rivers require as many as ten to twelve people in one day, to complete the surveys during the spawning period. Surveyors walk the rivers through the selected “index areas” to locate bull trout redds. Index areas in this report refer to known bull trout spawning reaches that have been surveyed in the same consistent locations on an annual basis.

This project is part of a larger effort in NE Oregon and SE Washington that occurs during September through October, the bull trout spawning period. Due to the lack of available experienced surveyors to conduct these surveys, we have had to increase our survey days on the accessible sections of the Lostine and Imnaha Rivers to two days, conducting half of the survey length one day and the other half the following day. Surveys were conducted twice (mid and late bull trout spawning season) on the Lostine River, Big Sheep Creek, Lick Creek, Middle Imnaha (Blue Hole to Indian Crossing), and Bear and Goat Creeks. One-time surveys were conducted late in the spawning season in 2014, on the Upper Imnaha River and tributaries, due to access and funding limitations. An exploratory survey was conducted on East Fork and West Fork Wallowa Rivers, upstream of Wallowa Lake in 2014 for approximately 2.0 total stream miles. Appendix B, Table 1 compares survey data and survey frequency for 1999-2014 bull trout spawning surveys on selected Grande Ronde and Imnaha River streams. Stream miles surveyed (not including repeat surveys) for the above streams totaled 41.3 in 2007, 46.3 in 2008, 41.8 in 2009, 41.1 in 2010, 41.7 in 2011, 40.9 in 2012, 35.0 in 2013, and 42.3 in 2014. In

2013, there were less stream miles surveyed in the Upper Imnaha due to lack of personnel and weather conditions. Total redd numbers are all redds documented, and not necessarily comparable river miles (refer to Appendix B, Table 2a-2d for comparable reaches and redd counts for those sections).

The survey protocol (in addition to repeat surveys, or one-time late surveys where feasible) included; 1) visits to known bull trout redds and review of survey form prior to redd count survey, 2) experienced bull trout redd count surveyor(s) paired with inexperienced surveyor (on the job training), 3) bull trout redds measured, data recorded, and redds flagged during survey, and 4) all stream flagging removed post-surveys.



Bull trout fluvial pair spawning in the Lostine River in 2014
Photo by Lynne Price

Data recorded during the bull trout spawning surveys included; 1) date of survey, 2) stream location, 3) size of redds, 4) visibility of redds, 5) number of redds, and 6) approximate number and sizes of bull trout observed during surveys. In past years, reach locations (upstream and downstream boundary UTM coordinates) were documented. In 2009 through 2014, in addition to the above, bull trout redd UTM locations on the Lostine River, Big Sheep Creek, Lick Creek, and Middle Imnaha within the “index areas” also was collected. Information collected during the bull trout spawning surveys is compiled by the Service and made available to other agencies (i.e., this report).



Montana Pagano of NPT, measuring a bull trout redd on the Upper Imnaha River in 2012



**Lynne Price (fisheries consultant) near spawning bull trout, Lostine River 2013
Photo taken by Sue Brady, Anderson Perry, Inc (AP).**

RESULTS

Location of Bull Trout Spawning Habitat Areas Surveyed

Bull trout spawning surveys have been conducted on similar index areas for selected Grande Ronde and Imnaha River streams from 1999 to 2014. These surveyed streams are located within the Wallowa River/Minam River and Imnaha River bull trout core areas. During these years, bull trout spawning areas have been established for these streams, in particular, the Lostine and Imnaha Rivers. Redd characteristics also have been measured on these streams. The Middle Imnaha, consisting of the Imnaha River from the fish weir below Gumboot confluence to Indian Crossing, was not surveyed in 2005 through 2014, but this area was surveyed from 1999 to 2004 and is considered bull trout spawning habitat. This portion of known bull trout spawning habitat on the Imnaha was not surveyed for the past ten years because of limited funding, a lack of experienced surveyors, and a minimal number of redds documented in this area in past years. Bear Creek and Goat Creek were surveyed as in past years but the survey area of Bear Creek and Goat Creek increased from 1.9-3.8 total miles between 1999-2006 to 7.2 in 2007, and the survey frequency increased from generally once during the years 1999-2006 and twice in 2007. Although the survey area increased in 2007, the redd numbers did not increase substantially, especially in the lowermost survey reaches. In 2008 through 2014 the surveys were conducted twice in the spawning season and an additional 1.4 miles of Bear Creek was surveyed upstream of the comparable reach for a total of 3.2 miles. In 2014, a survey for approximately 1.3 miles of stream was conducted on West Fork Wallowa River and approximately 0.7 miles of stream was surveyed on the East Fork Wallowa River. These are tributaries to the Wallowa River located upstream of Wallowa Lake.



Sue Brady (AP) surveying with author on Lostine River, 2014

Timing of Bull Trout Spawning

Timing of bull trout spawning for our surveyed streams, in general, is approximately September 1 through October 15, and as early as August 15 in the Imnaha River system. The Lostine River has been very consistent or predictable, with commencement of spawning documented in 2006 as early as the first week in September, but the Imnaha, a much larger system, has been less predictable. The above information is based on documentation during bull trout spawning surveys and chinook surveys where bull trout were spawning.

We are not certain when spawning commences and ends within the Upper Imnaha, which includes; the mainstem, North Fork, South Fork, and Cliff Creek (a resident tributary). There are questions as to what time of the year, dependent on annual flows, bull trout pass over the falls. Some years we have seen fluvial size bull trout spawning in the South Fork Imnaha in mid-late September to early October and in recent years we have not. But in 2013, there were a few redds not measured in the South Fork Imnaha and Imnaha River, from the Upper Falls to Lower Falls, due to the redds still in progress. ODFW observed large fluvial bull trout spawning in the South Fork Imnaha River in mid-August 2005 (B. Knox, ODFW, pers. comm., 2005). ODFW has also observed fluvial bull trout spawning as early as mid-August, during chinook surveys, below the Imnaha falls and as late as early October, during our bull trout surveys, in several years (B. Smith, ODFW, pers. comm., 2005). In 2011, Upper Imnaha had smaller sized redds reported than in previous years, which could be a factor of smaller fish, but the documented fish sizes suggest fluvial fish; or that due to weather and stream conditions the fish are spawning later and these redds are incomplete. The Upper Imnaha survey is a one-time late September survey, so the total count is not expected. Cliff Creek, a resident bull trout tributary stream to South Fork Imnaha, had several redds that were still in progress at the time of the 2012 survey and in 2014, 63 out of a total of 87 or 72 percent of the redds in Cliff Creek were unoccupied (older redds). In 2014, the majority of redds on the Imnaha (Blue Hole upstream to Cliff Creek) were completed prior to the Sept 25, 29, 30, and Oct 1 survey dates. Additional years of observation and data are needed to fully understand bull trout spawning and adult movement in the Imnaha Sub-Basin, and Big Sheep and Bear Creek Watersheds.

Bull trout that were radio-tagged in the Snake River began moving into the lower Imnaha River in late-April, and continued upstream through May, June, and July, with all reaching the upper river by August as they escaped increasing water temperatures in the lower river (Idaho Power Company 2015). By late-July/early-August, almost all fluvial bull trout have moved upstream of the Imnaha Satellite Facility (ODFW, unpubl. capture data).

After spawning, adult bull trout soon move back downstream (Ringel et al. 2014). In the Imnaha River, downstream outmigration begins in September and continues through November (Idaho Power Company 2015).



Bull Trout on the Lostine River, 2012
Photo taken by Mary Edwards Photography for FWS LFO



Bull Trout on the Lostine River, 2012
Photo taken by Mary Edwards Photography for FWS LFO

Total Number of Bull Trout Redds

Lostine River

Refer to Appendix B; Table 3a and 3b for bull trout redd count summary data for 2014. Forty-four total bull trout redds for 10.1 miles of survey, including Pole Bridge to Six Mile Bridge, were documented in 2014 on the Lostine River. The Pole Bridge to Six Mile Bridge section has not been surveyed every year. The following data for the Lostine River compares consistently surveyed index areas on the Lostine River (8.5 miles) from 1999 to 2014, excluding the Pole Bridge to Six Mile section (Figure 2). The Lostine River had a low of 19 redds in 2011, and a high of 70 redds in 2003. Redd numbers decreased again in 2004 but had been increasing through 2008. Redd numbers decreased in 2009 through 2011, with the lowest redd count in 2011, and increased in 2012 and decreased again in 2013, with a slight increase in 2014, compared to 2013. The fifteen-year average from 1999 to 2014 (subtracting out 2003, which had an outlier of 70 redds) for the Lostine River is 35.5 redds, approximately 71.1 percent of the high of fifty redds found in 2008 and 2012. The highest bull trout redd numbers (“the bread and butter”) within the Lostine River has consistently been observed and recorded in the headwaters, from Shady Campground to Bowman, at approximately River Mile (RM) 24.5 to RM 22. In 2014, as in most years, the densities were greatest in the uppermost reach, from Shady Campground to French Camp, which is upstream of the chinook spawning index areas.

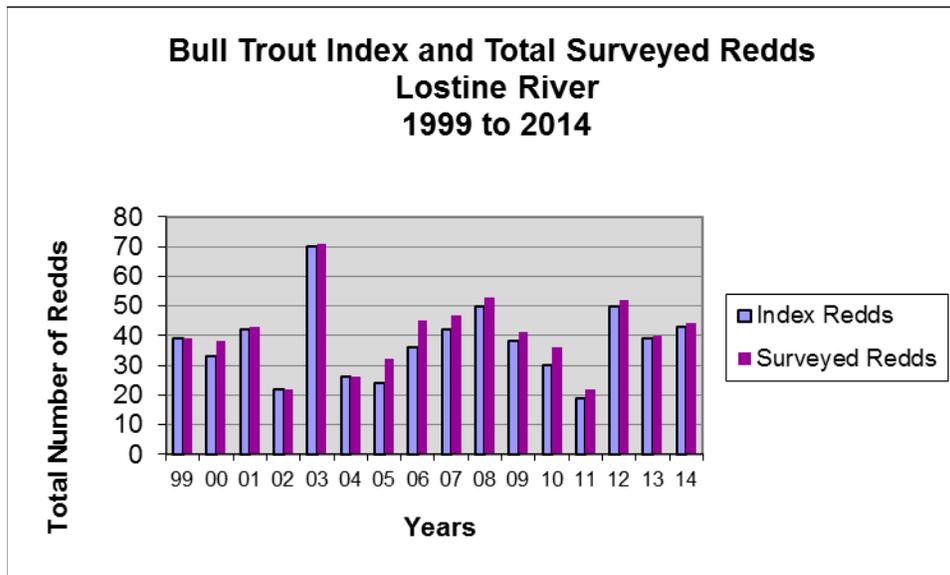


Figure 2. Comparison of bull trout surveyed redds and index redds (comparable miles) documented from 1999 to 2014 on the Lostine River.

During the September 16, 2014, Lostine River, French Camp to Shady Campground reach survey, near the top of the reach, a bull trout pre-spawning mortality was documented. Refer to photo below.



Bull trout pre-spawn mortality recorded on the Lostine River, in the upper reach of French Camp to Shady Campground. Photo taken on September 16, 2014 by Kyle Bratcher, ODFW

Bear Creek

Seventeen total bull trout redds for 3.2 miles of survey were documented in 2014 on Bear Creek (including Goat Creek). The following data for Bear Creek compares consistently surveyed index areas on Bear Creek and Goat Creek (1.9 miles) from 1999 to 2014 (Figure 3). Redd counts on Bear Creek and Goat Creek had a low of 5 redds in 2000 and a high of 19 total redds in 2011, which is the highest count for the index area. The sixteen-year average from 1999 to 2014 is 10.5 redds for Bear and Goat Creeks. Bear Creek/Goat Creek spawning data collected from 1999 to 2006 is restricted in scope due to access and funding limitations, and surveys in 2007 were expanded to help identify total spawning area for bull trout in Bear and Goat Creeks. Although the survey area increased in 2007, the redd numbers did not increase substantially, especially in the lowermost survey reaches. In 2008 through 2014, the surveys were conducted twice in the spawning season and an additional 1.4 miles of Bear Creek was surveyed upstream of the comparable reach for a total of 3.2 miles. The highest bull trout redd counts for the survey sections on Bear/Goat Creeks have been recorded in Goat Creek, from the mouth to the waterfall, (RM 0 to RM 0.9), except in 2008, when more redds were documented in Bear Creek than in Goat Creek.

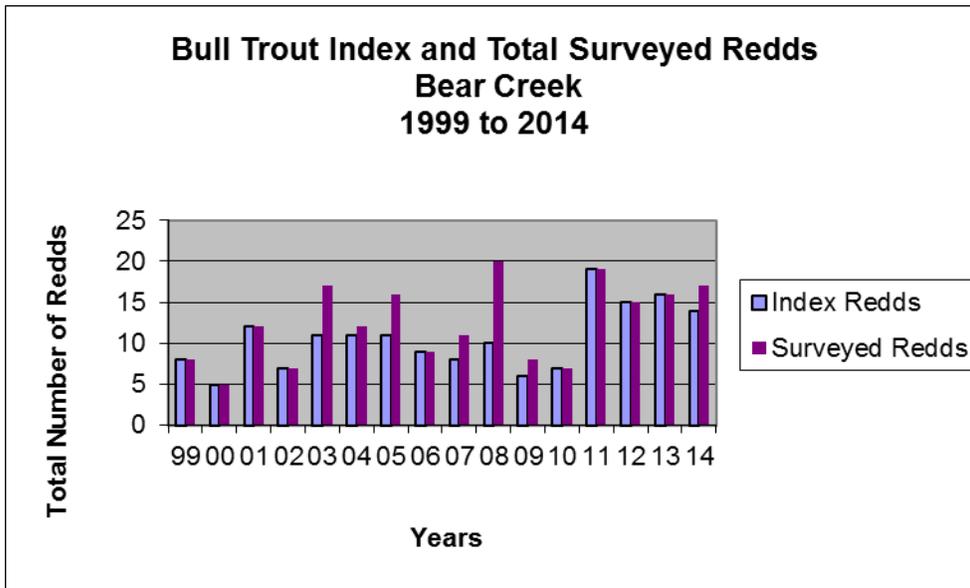


Figure 3. Comparison of bull trout surveyed redds and index redds (comparable miles) documented from 1999 to 2014 on Bear Creek, including Goat Creek.

The local bull trout population in the Lostine and Bear Creek surveys appears to be relatively stable for the survey period (1999-2014). Lostine River redd numbers increased slightly in 2014 compared to 2013, but still lower than 2012 and Bear Creek redd numbers had a high of 19 redds and in 2011 and in 2014 had the second highest redd number for the survey period, (17 redds).

East Fork and West Fork Wallowa Rivers

In 2014, a survey for approximately 1.3 miles of stream was conducted on West Fork Wallowa River and approximately 0.7 miles of stream was surveyed on the East Fork Wallowa River. These are tributaries to the Wallowa River located upstream of Wallowa Lake. The surveys were conducted twice in 2014 and no bull trout or redds were documented on the West Fork Wallowa River and one resident size redd and nine bull trout were observed on the East Fork Wallowa River.

Imnaha River

One hundred and ninety-nine total bull trout redds for 19.4 miles of survey were documented in 2014 on the Imnaha River, from Indian Crossing to Blue Hole and upstream. In 2014, Indian Crossing to Blue Hole was surveyed twice, mid and late spawning season, and upstream areas were surveyed once, mid spawning season. The following data for the Imnaha River compares consistently surveyed index areas on the Imnaha River (17.5 miles) from 2001 to 2014 (Figure 4a). The thirteen-year average from 2001 to 2012, and 2014 was 187 redds for the Imnaha River system. Total redd numbers on the Imnaha ranged from 101-262 within that period. The highest bull trout redd counts for the Imnaha River from 2001 to 2012 was recorded in the Upper Imnaha from Blue Hole to Cliff Creek, including Upper Imnaha tributaries. In 2006 through 2008, there was a significant shift in documented spawning distribution from past years.

In 2006 through 2008, the majority of the spawning bull trout were located from the Innaha falls to Indian Crossing, whereas, in past years the distribution had higher numbers above the Blue Hole, which is located two miles upstream of Indian Crossing, as well as distribution of spawning bull trout in the upper tributary streams (South Fork and North Fork Innaha River). In 2014, the distribution was fairly evenly distributed between all Innaha reaches; 17 redds in the Blue Hole reach, 29 redds in the Upper Innaha above the Blue Hole, 30 redds in the NF Innaha, 36 redds in the SF Innaha, and 87 redds in Cliff Creek.

In 2009, Cliff Creek, a resident bull trout tributary to South Fork Innaha, had the greatest total number of redds at 164 redds. But in 2010, 2011, and 2012 the redd count in this stream decreased to 45, 46, and 65, respectively. This lower count in Cliff Creek created a large decrease in the total count for the Innaha count during 2010 and 2011. Sixty nine percent of the total redds counted on the Innaha in 2009 were from Cliff Creek and in 2010 and 2011 this percentage decreased to 34 percent. In 2012, 175 redds, (73%) of the total redds documented on the Innaha, were fluvial and resident redds as compared to 71 redds (30%) in 2009. There was an upward trend in the Innaha River population in 2012 and downward trend in the population in 2014. If you subtract the resident Cliff Creek population from the Upper Innaha redd counts, there is a substantial downward trend from 2009 through 2011. One hundred and twelve bull trout redds for 16.9 miles of survey were documented in 2014 on the Innaha River, from Indian Crossing to Blue Hole and upstream (excluding resident Cliff Creek). The thirteen-year average from 2001 to 2012, and 2014 was 155 redds for the Innaha River system (excluding Cliff Creek). Total redd numbers (minus resident Cliff Creek) for fluvial/resident bull trout on the Innaha ranged from 71-234 within that period. Cliff Creek and several other Upper Innaha reaches were not surveyed in 2013 (Figure 4b).

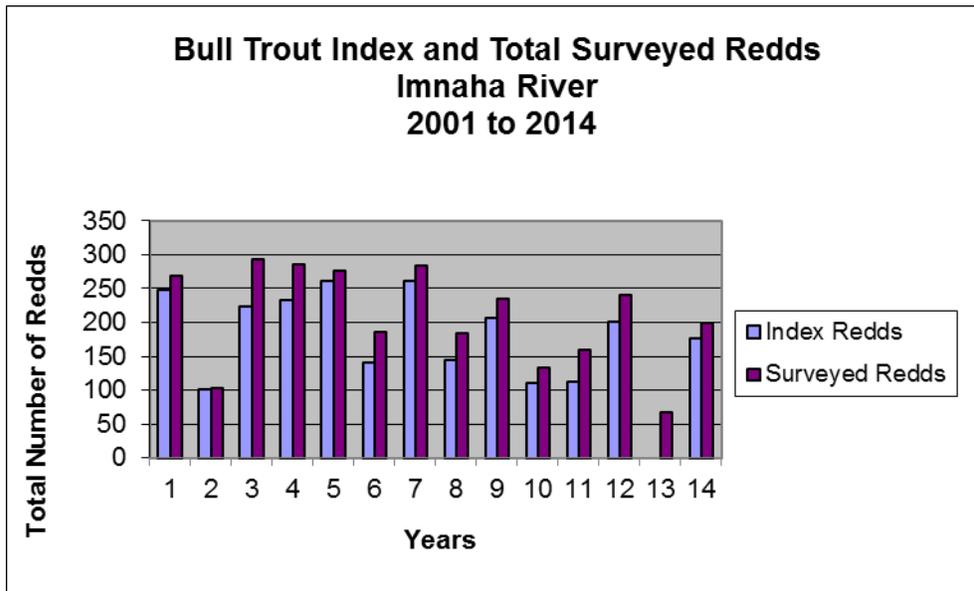


Figure 4a. Comparison of bull trout surveyed redds and index redds (comparable miles) documented from 2001 to 2012, and 2014 on the Innaha River. Index redds are not shown in 2013, since locations and miles are not comparable to past years.

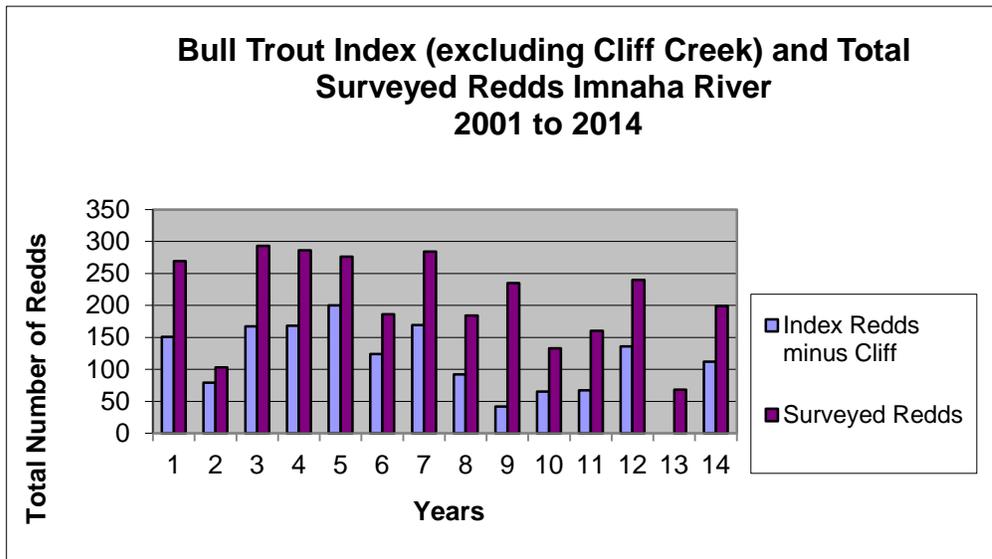


Figure 4b. Comparison of bull trout surveyed redds and index redds (comparable miles excluding Cliff Creek) documented from 2001 to 2012, and 2014 on the Imnaha River. Index redds are not shown in 2013, since locations and miles are not comparable to past years and Cliff Creek not surveyed in 2013.

Big Sheep Creek/Lick Creek

In 2014, twenty-five total bull trout redds for 7.6 miles of survey were documented for Big Sheep Creek and Lick Creek. These areas were surveyed twice in 2014, mid to late spawning season. The following data for Big Sheep Creek compares consistently surveyed index areas on Big Sheep and Lick Creek (7.6 miles) from 2000 to 2014 (Figure 5). The fifteen-year average from 2000 to 2014 was 20.7 redds for the Big Sheep system. Total redd numbers within the Big Sheep system ranged from 8-38 within that period; with the highest redd count of 38 in 2011. Redd surveys for bull trout in the Big Sheep system have been limited; in miles of survey, 7.6 to 14.1 miles from 2000 to 2014, and in frequency. Surveys in 2000-2001 were conducted once late season, and in 2002, 2003, and 2005-2013, surveys were conducted twice, mid and late season, except for lower Lick Creek survey area that was monitored only once in 2010, due to lack of surveyors. In 2004, the survey was conducted once late season for Big Sheep and twice, mid and late season for Lick Creek.

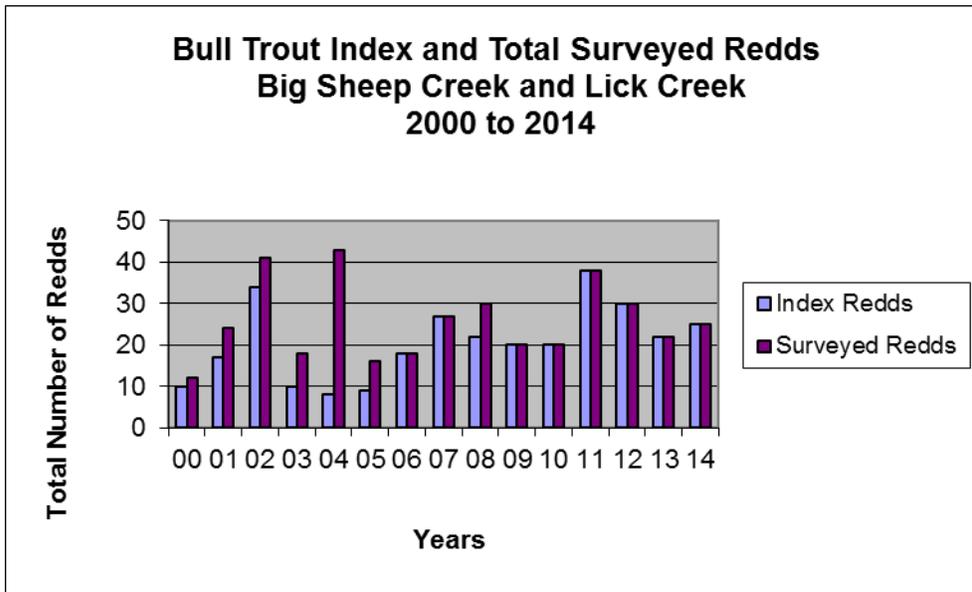


Figure 5. Comparison of bull trout surveyed redds and index redds (comparable miles) documented from 2000 to 2014 on Big Sheep and Lick Creeks.

The local bull trout population, in Big Sheep and Lick Creeks appear to be relatively stable for the survey period (2000-2014), with an increase in redd numbers in Big Sheep in 2011 and decreases in 2012 and 2013, with a slight increase in 2014 compared to 2013.

Sizes of Bull Trout Redds

Bull trout redds were measured using the same methodology in 2004 through 2014 and comparison of bull trout redd sizes, by mean redd area (m²), for these years is illustrated below (Figures 6 & 7). There is a relationship between the size of a female salmonid and the size of the redd; large fish make large redds (Bjornn and Reiser 1991; P. Sankovich, Service, pers. comm., 2006; Howell and Sankovich 2012). In addition, length/frequency distributions of mature resident bull trout and mature fluvial bull trout do not overlap; therefore, there is little overlap in size of redds (P. Sankovich, pers. comm., 2006).

Howell and Sankovich (2012) report that redd surveys that include estimates of redd area and spawner lengths, could be used to sort migratory versus resident forms, which are useful attributes in assessing the status of populations. Bull trout redd size data is shown below for the Lostine/Bear and Imnaha systems comparing resident and migratory forms annually for these streams.

Lostine/Bear/Goat

Figure 6 compares bull trout redd sizes for the Lostine River, Bear Creek, and Goat Creek in 2004-2014. Mean redd area (m²) ranged from 0.9-2.3 for the Lostine, 0.3-0.9 for Goat Creek, and 0.2-1.0 for Bear Creek. In 2011, the Lostine River had the largest mean redd area (m²) of 2.3 documented for this stream to date. In 2014, the mean redd area documented was 1.2 (fluvial size redd dominant). The Bear Creek sample area was expanded in miles surveyed in 2007. In past years the redd area was smaller and more typical of resident redds, but in 2007 the redd area was larger and more typical of fluvial size bull trout redds. Bull trout redds were not observed or documented in Bear Creek within the index area in 2006, a single redd was documented in 2013, and five redds were documented in 2014 with a mean redd area of 0.6 (showing a fluvial/resident size dominance). In 2010, one bull trout redd was documented in Bear Creek. This single redd was much larger than typical, 4.8 mean redd area, and was found among Chinook redds. The survey crew stated that this redd or two redds were superimposed among Chinook redds. It was reported as one fluvial bull trout redd. Brook trout are thought to be abundant in Bear Creek due to historical stocking in the headwater lakes. The Lostine River contains brook trout, but for most survey years, brook trout spawning with bull trout was not observed. This changed in 2008 and more recently in 2012 where they appeared to be spawning together and hybrid fish were observed. To date, reporting of genetic sample data for bull trout/brook trout in the Lostine and in Bear Creek has not occurred. Future genetic sampling in the Lostine will need to be conducted to confirm what percentage of the bull trout in the population are pure and which percentage are brook trout/bull trout hybrids.

Goat Creek is limited in available spawning habitat, but it appears to be the best available spawning habitat for fluvial fish in the Bear/Goat Creek system during drought years. Several miles of upper Bear Creek were dry due to low snowpack and summer drought conditions. It appears from the data in 2004-2014 that redds in Goat Creek were a combination of resident and fluvial fish, and in 2011, 2012, and 2013 dominated by more resident size redds, and in 2014 dominated by fluvial size redds. Two bull trout that were observed occupying one redd on Goat Creek in 2004 were less than 12 inches (<300 ml) and were on a redd that had an area of 0.3 m²; therefore, this size of redd is resident, due to the fish size. The redd sizes in both the Lostine River and Bear Creek in 2011, 2012, and 2014 were dominated by fluvial size fish. More years of data collection on these streams should help us better understand the resident and fluvial life histories of bull trout in this area, relative to fish and redd sizes.

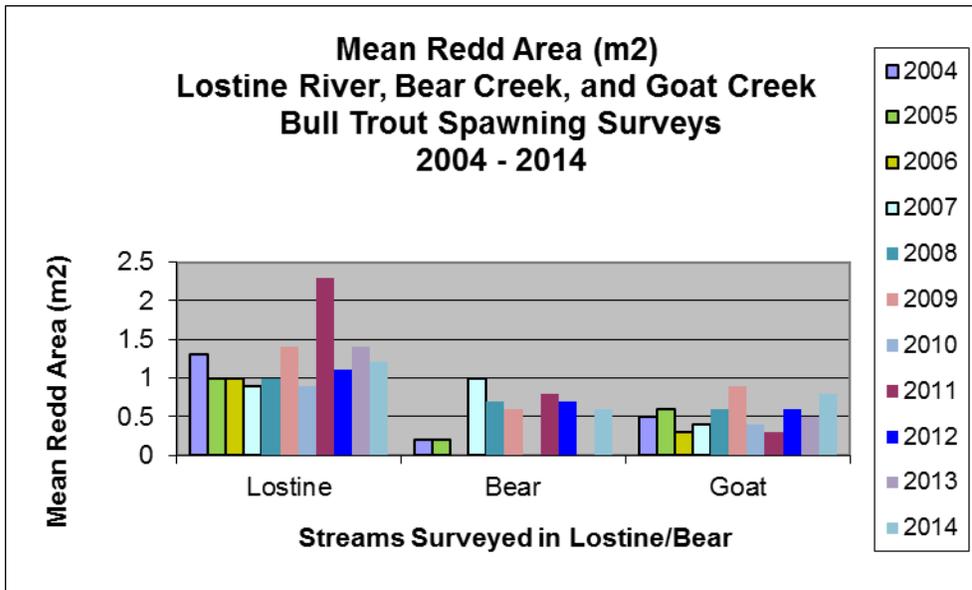


Figure 6. Comparison of bull trout redd sizes [mean redd area (m²)] for Lostine River, Bear, and Goat Creeks sampled during bull trout spawning surveys, 2004-2014.

Footnote: Bull trout redds were not observed in the index area of Bear Creek in 2006 and one extremely large fluvial redd was observed in 2010 (not included on graph, considered an outlier).

Imnaha and Big Sheep

Figure 7 compares bull trout redd sizes for the sampled streams in the Imnaha system in years 2004-2014. Mean redd area (m²) ranged from 0.3-1.0 for Lick Creek, 0.1-0.8 for Big Sheep, 0.4-2.6 for Middle Imnaha, 0.8-1.8 for Upper Imnaha, 0.3-1.2 for N.F. Imnaha, 0.4-1.3 for S.F. Imnaha, and 0.1-0.4 for Cliff Creek. As shown in Figure 7, very large redds produced by large fluvial bull trout were documented on the Middle Imnaha in 2008. Redd numbers decreased in the Middle Imnaha in 2009 and 2010, to two redds for 2009 and four for 2010; and increased to nine redds in 2011 with a primarily fluvial component. Redds decreased to four in 2012 and increased to six redds in 2013 in the Middle Imnaha. Several redds documented in the Middle Imnaha were noted as a complex in 2013 and only two redds were measured. In 2014, the mean redd size was 0.8 (fluvial dominant) with 17 redds documented in the Middle Imnaha. Over the 11-year period (2004-2014), redd sizes have been both fluvial and resident, with a dominance towards fluvial, but the number of redds in this reach has varied through the years with 2014 having many (17) redds in this 2.0 mile reach, whereas in 2009 and 2010 redd numbers were as low as two, and four, respectively.

Overlap of bull trout and chinook redds in Lick Creek and the Imnaha River may make it difficult to differentiate between the two species spawning nests. In 2014, the mean redd area (m²) for Lick Creek was 0.5 (fluvial/resident dominant). During the 2004-2014, 11-year sample period, approximately 55 percent (6 out of 11 years) the redds have been resident size dominant, 27 percent (3 out of 11 years) the redds have been fluvial/resident dominant, and approximately 18 percent (2 out of 11 years) the redds have been fluvial dominant. By comparison, Big Sheep Creek was dominated by resident redds in all years sampled, except in 2009 with only one fluvial size and one resident redd. In 2014, the mean redd area (m²) for Big Sheep as 0.3 (resident size).

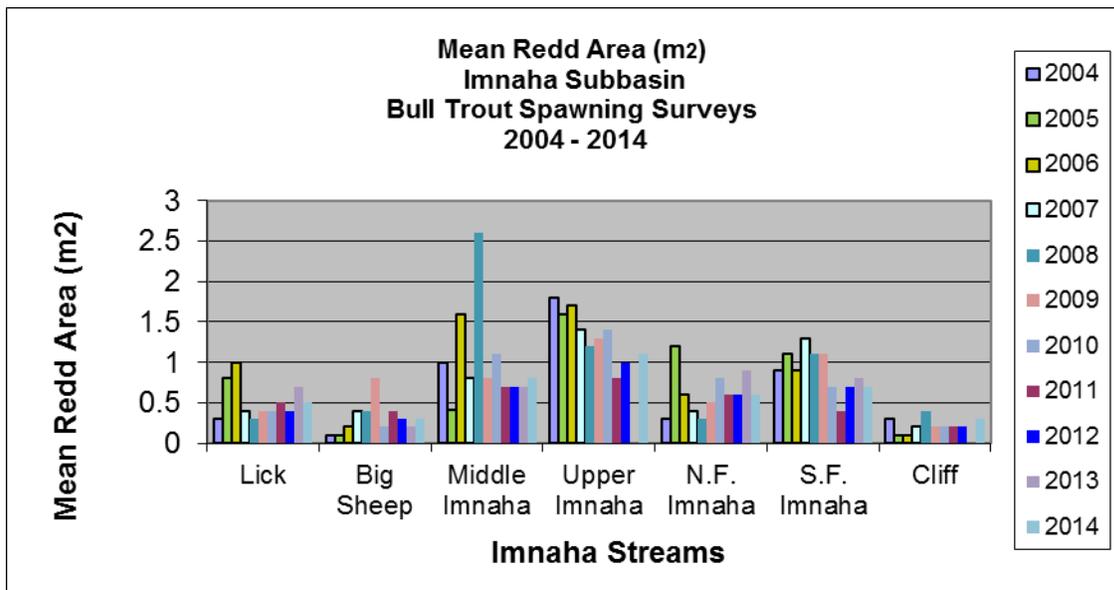


Figure 7. Comparison of bull trout redd sizes [mean redd area (m²)] for sampled streams in the Imnaha Subbasin, 2004-2014. (In 2013, no redd size data for Upper Imnaha and Cliff Creek. NF. Imnaha missing upper reach data in 2014).

In 2012, a large fluvial adult was holding downstream of the Wallowa Valley Improvement Canal (WVIC) diversion which had dewatered a portion of stream and limited available spawning and rearing habitat in this survey reach. One fluvial size redd was documented in Big Sheep during 2012). In 2014, Upper Imnaha and S.F. Imnaha had redds sizes with a fluvial dominance, 1.1 and 0.7 mean redd area (m²), respectively. Through the 10 year period, 2004-2012, and 2014), Upper Imnaha and South Fork Imnaha contained a majority of fluvial redds with fluvial redds smaller in 2011. The Upper Imnaha was largely not surveyed in 2013 and SF Imnaha data was largely fluvial and sizes similar to 2012. North Fork Imnaha in 2014 had a redd size reflecting fluvial/resident dominance, 0.6 mean redd area (m²). Comparing 10 years of data on N.F. Imnaha from 2004-2012, and 2014, approximately 50 percent (5 out of 10 years) the redds have been fluvial/resident size dominant, 30 percent (3 out of 10 years) the redds have been resident dominant, and approximately 20 percent (2 out of 10 years) the redds have been fluvial dominant.

Cliff Creek is a known resident system with a waterfall near the mouth. In 2014, the mean redd area (m²) for Cliff Creek was 0.3 (resident). The survey on Cliff Creek in 2004 included a large fluvial size redd near the confluence with the South Fork Imnaha and therefore the mean redd size was higher than in 2005 and 2006, when no fluvial redds were observed in Cliff Creek below the waterfall. In 2011 and 2012, surveyors reported several redds in progress on Cliff Creek. Cliff Creek had a mean redd size of 0.2 m² in 2012. Mean redd size was greater in 2004 (0.3 m²) as a result of a fluvial redd near the mouth and potential superimposition of redds above the barrier. The 2007 mean redd size included a few larger redds below the falls and near the mouth, which are presumed to be fluvial redds. The 2008 mean redd size was greatest above the falls, likely due to superimpositions of redds above the barrier. In 2008, not all of the redds were measured above the falls (31 of 52 total redds, 59.6%) and all redds were measured below the falls (1 of 1, 100%). The sample size in 2008 was large enough to get a good

estimate of sizes of redds above and below the falls and at the same time completing the survey in a reasonable amount of time, while redds were still visible during daylight. Cliff Creek was not surveyed in 2013. In 2014, 51 out of 87 (58.6 %) of redds were measured, and redds below the falls were not measured or documented as either resident or fluvial size. In 2014, as in previous years, the redd sizes above the falls included some large resident redds, likely superimposed redds, but measured as one redd. Refer to Tables 4a and 4b in Appendix B for additional information on 2013 bull trout redd characteristics.

Bull Trout Redd Distribution on the Lostine River

The bull trout spawning surveys on the Lostine River in years 2005 through 2014 included collection of UTM coordinate data on the spatial distribution of the bull trout redds observed. Bull trout redds on the Lostine River, as well as in other surveyed streams, were often arranged in complexes (several redds located in close proximity to each other). Redds were primarily located in the French Camp to Shady Falls and Bowman to French Camp reaches along the Lostine River in 2005, 2006; 2007, 2010, 2011, 2012, 2013, and 2014 and several miles (approximately 10 miles) downstream of these reaches at the Six Mile Bridge to Pole Bridge reach. High site fidelity is documented by the overlapping of bull trout redds from 2005-2014, especially in the upper reaches of the Lostine River. In 2014, redd distribution was spread over the majority of the survey area but had the highest numbers in the upper reaches, French Camp to Shady, Bowman to French Camp, and Williamson to Walla Walla. In 2005-2007, and 2010-2013 few redds, 0-3 were documented in the Williamson to Walla Walla Reach. In 2008, 2009, and 2014, densities of bull trout redds were higher in the Williamson to Walla Walla Reach location where several redds, 13, 8, and 7, respectively were documented during these years (Sausen 2013 and Figure 8). In 2014, 21 redds (47.7%) were observed in the French Camp to Shady reach, 14 redds (31.8%) in the Bowman to French Camp reach, seven redds (15.9 %) in the Williamson to Walla Walla reach, one redd (2.5 %) in the Six Mile Bridge to Pole Bridge Reach, and one redd (2.3 %) in the OC Ranch to Lundquist Bridge reach, with redds in this reach typically found upstream and slightly downstream of the acclimation facility (Figure 8).

Sections of the Lostine River were not surveyed during the survey period of years (1999-2014) due to; insufficient spawning gravels, boulder and cobble being the dominant substrate, and difficult access. These non- surveyed areas included: Bowman to Walla Walla, for approximately 2.2 miles; and Williamson to Pole Bridge, approximately 3.5 miles in length. Downstream of Westside Ditch on the Lostine River, for approximately 9 miles, is private property that is not surveyed due to lack of bull trout spawning gravels, higher stream temperatures, and low flows associated with irrigation withdrawal.

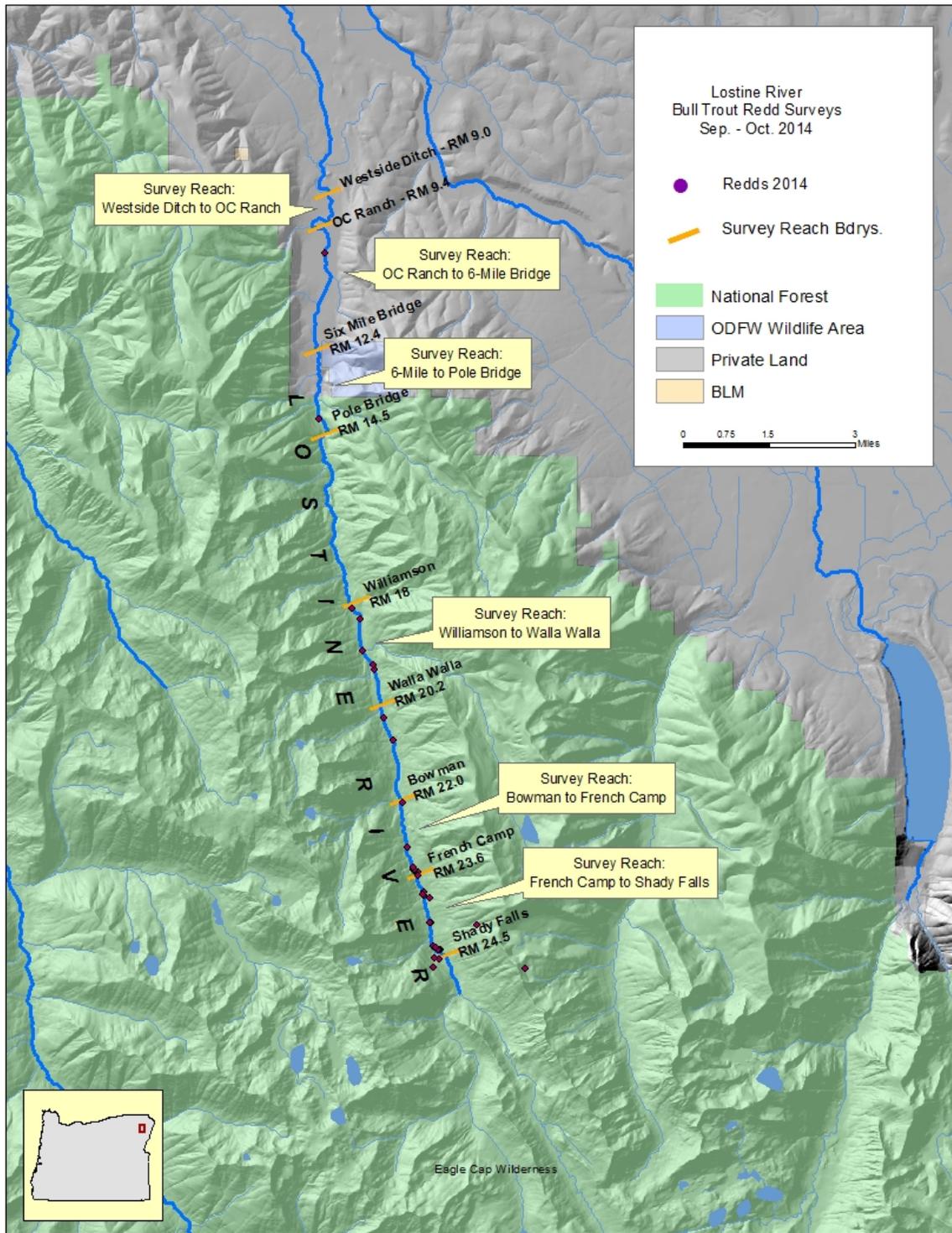


Figure 8. Map of the Lostine River showing bull trout redd survey reaches and bull trout redd locations in 2014.

Footnote: Due to topography and shade in Shady Falls vicinity, some of the GPS points recorded are showing above the stream, these should be near upstream reach boundary.

DISCUSSION

Future Needs

Bull trout redd monitoring in the Wallowa Mountains was accomplished from 1999 to 2014 using skilled bull trout redd surveyors (a mix of experienced paired with inexperienced). Skilled surveyors will continue to be needed for future redd surveys. Several studies (Howell and Sankovich 2012; Dunham et al. 2001) point out the importance of using skilled surveyors to reduce measurement error. Training and retaining skilled surveyors to conduct these surveys has been a challenge and will likely remain a challenge into the future.

In the future, we recommend an exploratory survey be conducted in the headwaters of Bear Creek to obtain some baseline information on locations and densities for resident bull trout redds in this upper reach. At the same time, observations of densities of brook trout and any potential concerns for interbreeding could be initially assessed.

Deer Creek had surveys conducted in 2009-2013 which were conducted twice from the Rd. 8920 culvert to 0.8 miles upstream and proved to be worth the walk in 2010 and 2011. Twelve resident-size redds and thirty-nine bull trout in 2010 and nine resident-size redds and twenty-three bull trout in 2011 were reported in this Deer Creek survey reach. Only one bull trout redd was documented on this survey in 2012 and none in 2013, most likely due to low flows. As mentioned in the 2014 report (2013 data), we recommend that this reach of Deer Creek be surveyed in future years by the USFS, dependent on flows and available surveyors and funding. It is not a priority to survey as part of this effort due to difficulty of access below the culvert and lack of sufficient flows above the culvert in recent years.

Currently, there is no bull trout redd data available for the mainstem Minam River (and tributaries, excluding the Little Minam River). The author recommends future exploratory redd surveys in the Minam River and upper tributaries to obtain some baseline information on locations and densities of redds in this system.

We also recommend continued surveys of bull trout in the Oregon side of the Wenaha with the continued help of ODFW chinook surveyors and potentially a second, later (October) survey; if funds, surveyors, access and weather make this feasible.

The East Fork Wallowa River, upstream of Wallowa Lake, was surveyed by the author in 2011 for 0.8 miles of stream, to assist PacifiCorp Energy with bull trout spawning data collection as part of the relicense for Wallowa Falls Hydroelectric Project. No redds were located during this survey. PacifiCorp had surveyed the East Fork Wallowa River previously in 2010 and found two fluvial bull trout paired up on one redd (PacifiCorp 2013). In 2014, the West Fork and East Fork Wallowa Rivers were surveyed from their confluences upstream to barrier falls. All redds were resident size and located in the EF Wallowa River. We recommend that PacifiCorp, the USFS, ODFW, and/or the Service continue to survey this stream in the future, as part of data for the new license and to further understand the bull trout spawning population upstream of Wallowa Lake.

During the Big Sheep Survey, the survey crew consisting of ODFW and a contractor noted a potential fish passage barrier on Big Sheep Creek (old bypass return) downstream of the WVIC diversion fish barrier. Refer to photo below. We recommend this barrier be fixed in the near future, as it was noted by ODFW as an “easy fix”.



**Fish barrier (old bypass return), 2014
Downstream of WVIC diversion on Big Sheep Creek
Kyle Bratcher in photo, photo by Lynne Price, contractor**

Overall, future needs for this project include continued funding and support from all involved parties (Service, ODFW, NPT, USFS, private land owners, volunteers, and others) for conducting and reporting bull trout redd counts in the Wallowa Mountains. OWEB Phase II Wallowa Mountains Bull Trout Redd Monitoring (2010-2011) was submitted for funding in October 2009 and received funding for 2010, 2011, and funding was extended into 2012. A Phase III Wallowa Mountains Bull Trout Redd Monitoring (2012-2013) was submitted for OWEB funding in October 2011 and was funded. This Phase III OWEB funding supports these surveys in 2012, 2013, 2014, and we received permission for an extension into 2015.

At least 15 years (consecutive years) of bull trout redd data are needed for trend data (Maxwell 1999) and for bull trout recovery data needs. Caution must be exercised in using the above bull trout spawning data for adult population trends until at least 15 years of data have been collected. However, dependent on the stream, we have met this goal or we are very close! To date, we have comparable bull trout redd data; 16 years completed on Lostine River and Bear Creek; 15 years completed on Big Sheep Creek; and 14 years completed on the Innaha River. Surveys in 2015 will give us a minimum of 15 years comparable data on each of these streams.

CONCLUSION

The local bull trout populations were relatively stable for the survey period (1999-2014) and there was an increase in redd numbers on the Lostine River, Big Sheep Creek, and Bear/Goat Creek in 2014 compared to 2013, and a decrease in redd numbers on the Imnaha (excluding Cliff Creek a resident stream) in 2014, compared to 2012. 2013 data for the Imnaha is not comparable due to less stream miles/reaches surveyed that year.

The Imnaha population is one of the strongholds within the Imnaha Subbasin as it has multiple age classes, contains fluvial fish, has an anadromous prey base and connectivity with the Snake River, and bull trout are distributed throughout the habitat. Primary spawning activity on the Imnaha River has been documented to occur in the headwaters which lie within wilderness. Both fluvial and resident life history forms are present. The Imnaha River is rated at low risk of extinction, and Big Sheep is rated “of special concern” (Buchanan et al. 1997). The Recovery goals are to keep the local populations viable within this entire Imnaha core area and allow the local populations to be connected (within themselves) and to one another. The Imnaha weir located downstream of the confluence with Gumboot, is a partial fish passage barrier to bull trout (USFWS 2015). Adult bull trout need to migrate upstream past the weir to access primary spawning grounds. Lick Creek has no barriers to passage and has a functioning resident and fluvial population. Big Sheep and Little Sheep have some issues with flows, fish passage, and connectivity and loss of fish due to WVIC; as well as fish passage concerns associated with two USFS culverts on Little Sheep Creek. The canal system (WVIC) in Big Sheep and Little Sheep watersheds (within the Imnaha bull trout core area) contributes to the loss of bull trout out of this core area and into the Grande Ronde and most likely to their loss, due to diversions downstream (Whitesel and Hudson, pers.comm 2013).

The Lostine River is considered a moderately-strong population within the Grande Ronde Sub basin. Our results are consistent with Buchanan et al. (1997). Lostine River and Bear Creek contain brook trout and the degree of hybridization is unknown; although 2010 and 2012 photos by Mary Edwards (NPT) and 2012 spawning data suggests bull trout pairing with brook trout and hybridization much more likely than past information has shown. The Lostine River had a slight increase in redd counts in 2014 (44 compared to 40 in 2013). Many of the spawning fish observed in 2012 appeared to have brook trout hybrid phenotypic characteristics, which is alarming. This was not documented in 2013 or 2014, but no underwater photos were taken during this time. Limited redd count data is available on Bear Creek and this portion of the Lostine River/Bear Creek local population has been listed as a special concern by Ratliff and Howell (1992). Future genetic analysis of bull trout and brook trout is critically needed, especially in the Lostine River to help determine the significance of this threat.

Dehaan et al. (2009) studied hybridization between bull trout and brook trout in the Malheur River system and suggest that relative abundance of brook trout and habitat quality are important factors to consider when evaluating the threat of hybridization to bull trout populations. The Lostine River, especially in the spawning reaches, has good habitat quality. So, hopefully this overall good quality spawning habitat in the upper Lostine River will benefit the bull trout and help minimize the odds of hybridization with brook trout in the long-term.



Underwater photo of a pair of fish on the Lostine River, 2012
In front, appears to be a bull trout/brook trout hybrid and in back appears to be a pure bull trout
Photo taken by Mary Edwards Photography for the FWS LFO



Underwater photo of a pair of bull trout on the Lostine River, 2012
Photo taken by Mary Edwards Photography for the FWS LFO

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APPENDIX A – PHOTOS TAKEN AT SURVEY LOCATIONS



**Upper Imnaha crew (author taking photo)
Left to right; Todd Kruger, Eric Shoudel, Lynne Price, Jon Rombach, Caitlyn Ecklund, Brian
Simmons, and Montana Pagano
NF Imnaha Camp, 2014**



**Bull Trout on the Lostine River, 2014.
Photo by Kyle Bratcher, ODFW.**



**Fluvial adult bull trout, Lostine River
Photo taken by Kyle Bratcher, ODFW**



**Bull trout spawning on the Lostine, French Camp to Shady Campground
Photo taken by Kyle Bratcher, ODFW, in 2014**



**Bull trout on the EF Wallowa River
Photo by Ian Wilson, NPT, 2014**



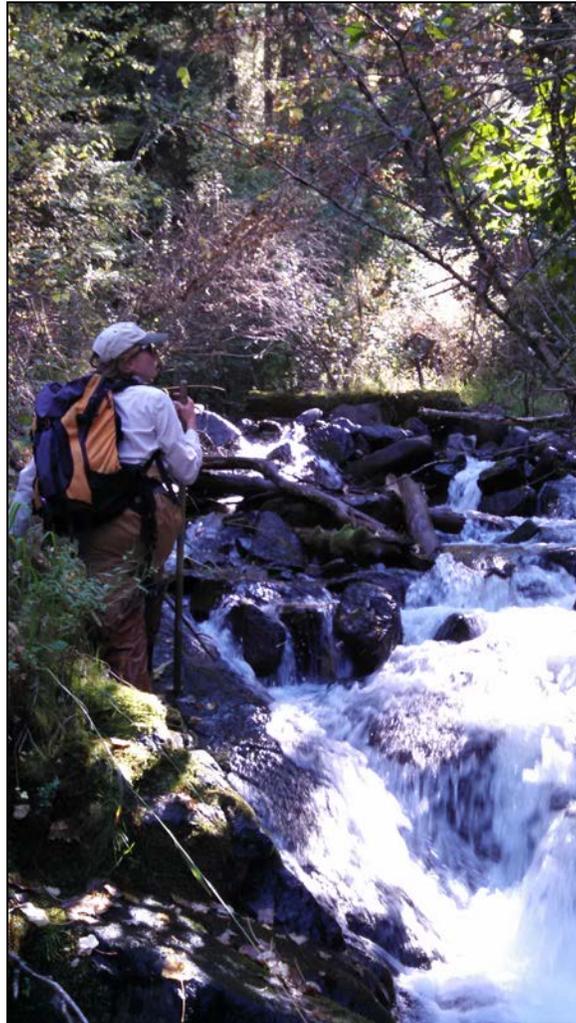
**Brook trout and bull trout on the EF Wallowa River
Photo by Ian Wilson, 2014**



**West Fork Wallowa River view downstream near temporary tailrace barrier
Photo taken by Elizabeth OsierMoats, ODFW, 2014**



**Caitlyn Ecklund surveying at East Fork Wallowa River
At start of survey at waterfall/fish barrier
Photo by Elizabeth OsierMoats, ODFW, 2014**



**EF Wallowa River, upper reach,
Caitlyn Ecklund in photo surveying
Photo by Elizabeth OsierMoats, 2014**



**WWIC diversion/fish passage barrier on Big Sheep
Kyle Bratcher, ODFW in photo
Photo by Lynne Price, 2014**



**Fluvial bull trout in pool below WWIC diversion
Photo by Lynne Price
September 17, 2014**



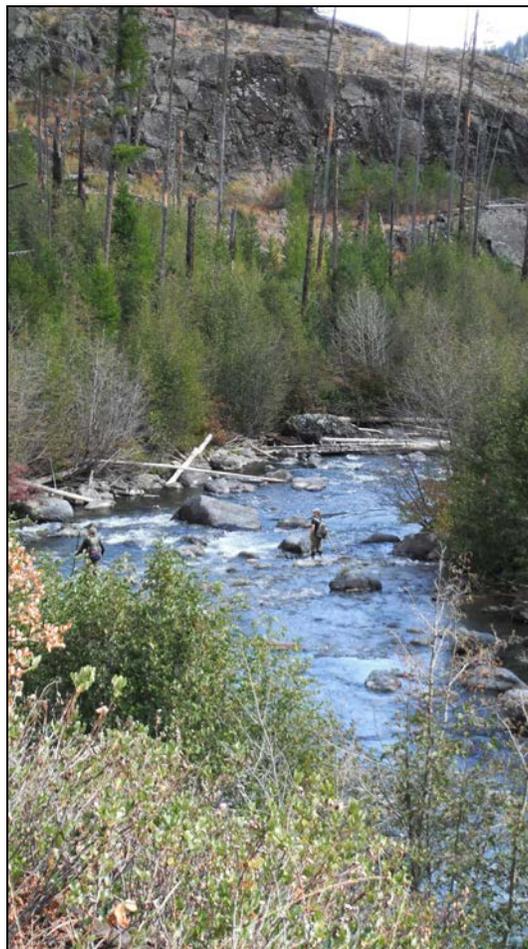
View downstream of WVIC diversion on Big Sheep, Photo by Lynne Price, 2014



**Big Sheep survey with Caitlyn Ecklund
Photo by Lynne Price, 2014**



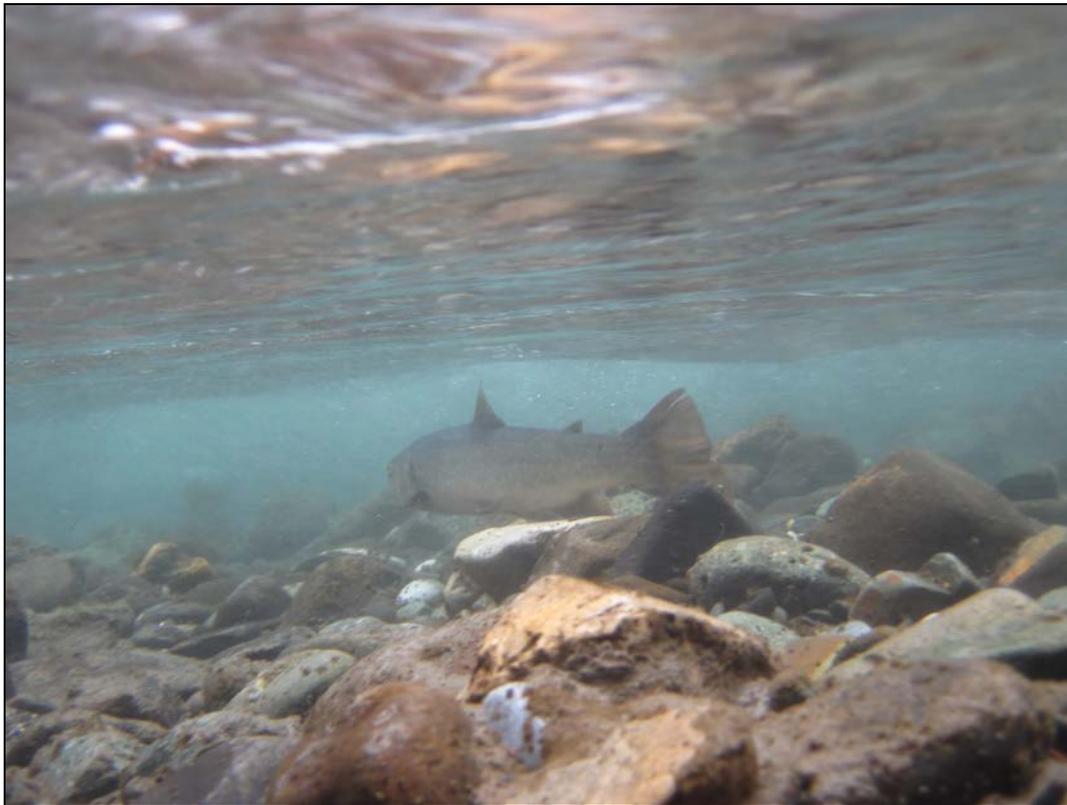
**Aaron Maxwell, Freshwater Trust
Lostine River, 2014**



**Eric Shoudel and Brian Simmons (NPT)
Surveying the Upper Innaha, 2014**



Log Jam upstream of Blue Hole within the Upper Imnaha, view from trail, 2014



**Fluvial size bull trout in the North Fork Imnaha
Photo by Eric Shoudel, (NPT), 2014**



**Bull trout redd documented by author on Lick Creek in the meadow
Livestock use heavy (post-holing and slumping stream banks nearby)
Oct 2014**



**Spring chinook spawning female near chinook redd on Lick Creek within the meadow
September 19, 2014**

APPENDIX B – TABLES

Table 1 – Bull Trout Spawning Surveys and Survey Frequencies for selected Grande Ronde River and Imnaha River Streams, 1999-2014

Stream	Year	Dates	Survey Frequency	Total Redds	Total Miles	Total Redds/Mile
Lostine River	1999	9/16,9/23,10/12	3 Times	39	9.75	4.0
	2000	9/21,9/28,10/12	3 Times	38	13.74	2.8
	2001	9/17-18,10/11-12	Twice	43	14.4	3.0
	2002	9/23-24,10/7-8	Twice	22	10.7	2.1
	2003	9/23-24,10/6-7	Twice	71	10.5	6.8
	2004	9/14-15,10/5-6	Twice	26	8.5	3.1
	2005	9/15, 9/21-22, 10/3-10/4	Twice, and 3 Times in Turkey Flat and Shady Campground areas	32	10.5	3.0
	2006	9/14, 9/20-21, 10/2-10/4	Twice, and 3 Times in Turkey Flat and Shady Campground areas	45	10.5	4.3
	2007	9/19-9/20, 10/3-10/4	Twice	47	10.1	4.7
	2008	9/17, 10/1-10/2, 10/9-10/10	Twice, and 3 Times in Turkey Flat and Shady Campground	53	10.1	5.3
	2009	9/11, 9/23-24, 10/7-10/8	Twice, and 3 Times in French Camp to Bowman	41	10.1	5.2
	2010	9/22, 10/6, 10/7	Twice	36	10.1	3.6
	2011	9/21-9/22, Oct 5-6	Twice	22	10.1	2.2
	2012	9/17, 9/19, Oct 3-4	Twice	52	10.1	5.2
2013	9/16, 9/18, 9/24, Oct 7-8	Twice	28	10.1	2.8	
2014	9/16, 9/23, Oct 6-7	Twice	44	10.1	4.4	
Bear Creek (including Goat Cr)	1999	9/7,9/22	Once Bear, Twice Goat	6	1.8	3.3
	2000	10/18	Once	5	1.8	2.8
	2001	10/16	Once	12	2.3	5.2
	2002	10/15	Once	7	2.3	3.0
	2003	10/16	Once	17	3.8	4.5

Table 1 (Continued)– Bull Trout Spawning Surveys and Survey Frequencies for Selected Grande Ronde River and Imnaha River Streams, 1999-2014

Stream	Year	Dates	Survey Frequency	Total Redds	Total Miles	Total Redds/Mile
Bear Creek	2004	10/1	Once	11	2.3	4.8
	2005	10/11	Once	16	2.8	5.7
	2006	10/10	Once	9	1.9	4.7
	2007	9/17, 10/9	Twice, Exploratory (more reaches than past years)	11	7.2	1.5
	2008	9/30, 10/7	Twice	20	3.2	6.3
	2009	9/22, 10/13	Twice	8	3.2	2.5
	2010	9/16, 10/13	Twice	7	3.2	2.2
	2011	9/20, 10/11	Twice	19	3.2	5.9
	2012	9/20, 10/10	Twice	15	3.2	4.7
	2013	9/19, 10/10	Twice	16	3.2	5.0
	2014	9/18, 10/9	Twice	17	3.2	5.3
Deer Creek	2009	10/14	Once	0	1.5	0
	2010	9/17, 10/4	Twice	12	0.8	15
	2011	9/19, 10/12	Twice	9	0.8	11.3
	2012	9/21, 10/12	Twice	1	0.8	1.0
	2013	9/23, 10/15	Twice	0	0.8	0
EF Wallowa	2011	10/9	Once	0	0.7	0
	2014	9/24, 10/14	Twice	1	0.7	0.5
WF Wallowa	2014	9/24, 10/14	Twice	0	1.3	0
Imnaha River	1999	9/20,28,10/11	Middle = Thrice	14	15.2	0.9
	(excluding Big Sheep)	2000	9/20,22,25,26,27,10/11	Upper = Once, Middle = Twice	92	29.1
	2001	9/20,21,10/1,2,3,9,10	Upper = Once, Middle = Twice	291	31.3	9.3
	2002	9/25,26,9/30,10/1-2,10/10-11	Upper = Once, Middle = Twice	113	30.5	3.7
Middle=Blue Hole	2003	9/25-26,9/29-30,10/1,10/8-9	Upper = Once, Middle = Twice	291	31.3	9.3
to Indian 2005-2010	2004	9/15-9/16,9-27,28,29,10/7-8	Upper = Once, Middle = Twice	292	31.6	9.2

Table 1 (Continued)– Bull Trout Spawning Surveys and Survey Frequencies for Selected Grande Ronde River and Imnaha River Streams, 1999-2013

Stream	Year	Dates	Survey Frequency	Total Redds	Total Miles	Total Redds/Mile	
Imnaha River	2005	9/26-28, 10/7	Once Upper and Middle	276	19.4	14.2	
	2006	9/25-28, 10/5	Upper = Once, Middle = Twice	186	19.4	9.6	
	2007	9/24-27, 10/5	Upper = Once, Middle = Twice	284	19.4	14.6	
	2008	9/22-25, 10/6	Upper = Once, Middle = Twice	190	19.4	9.8	
	2009	9/28-30, 10/1, 10/9	Upper = Once, Middle = Twice	235	19.4	12.1	
	2010	9/27-29, 9/30, 10/8	Upper = Once, Middle = Twice	133	19.4	6.9	
	2011	9/26-28, 9/29, 10/7	Upper = Once, Middle = Twice	160	19.4	8.2	
	2012	9/24-26, 9/27, 10/11	Upper = Once, Middle = Twice	240	19.4	12.4	
	2013	10/1, 10/2, 10/3, 10/11	Once Upper and Middle	68	13.3	5.1	
	2014	9/25, 9/29, 10/1, 10/10	Upper = Once, Middle = Twice	199	19.4	10.3	
	Big Sheep [(including Lick, and Salt). Salt Cr. not surveyed post 2003, and Upper Big Sheep exploratory in 2004].	1999	9/21, 29, 30, 10/18, 19	Once	20	14.2	1.4
		2000	10/13-10/16	Once	12	8.4	1.4
		2001	10/14, 10/17	Once	24	8.4	2.9
		2002	9/30, 10/1, 10/14-15	Twice	41	9.3	4.4
2003		9/22, 10/14	Twice	18	9.3	1.9	
2004		9/20, 9/28-9/29, 9/30, 10/4, 10/19	Once Big Sheep, Twice Lick	43	14.1	3.0	
2005		9/19-20, 10/6	Twice	16	8.6	1.9	
2006		9/19, 10/4	Twice	18	7.6	2.4	
2007		9/21, 10/2	Twice	27	8.6	3.1	
2008		9/29, 10/1, 10/10	Twice except once exploratory Quartz creek tributary to Lick and once Lick Creek 39 Rd to meadow	30	9.1	3.3	
2009	9/16, 10/6	Twice	20	7.6	2.6		
Big Sheep	2010	9/15, 10/5	Twice except once Lick Creek 39 Rd. to Meadow	20	7.6	2.6	
	2011	9/15, 10/4	Twice	38	7.6	5.0	
	2012	9/11, 9/18, 10/9	Twice	30	7.6	3.9	

	2013	9/10, 9/17, 10/9	Twice	22	7.6	2.9
	2014	9/17, 10/8	Twice	25	7.6	3.3

Table 2a–Bull Trout Spawning Surveys for the Lostine River Comparing 1999 to 2014 Surveys

Lostine	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Reaches (miles surveyed)																
Lundquist Bridge to OC Ranch (2.8)	1	0	2	3	3	5	0	5	4	5	0	1	1	1	1	1
Williamson to Walla Walla (2.2 miles)	0	2	1	0	6	1	3	0	2	13	8	2	0	3	1	7
Bowman to French Camp (1.6 miles)	18	19	16	11	18	3	9	9	5	12	7	6	3	18	10	14
French Camp to Shady Falls (1.5)	20	12.0	23	8	43	17	12	22	31	20	23	21	15	28	27	21
Lostine Total Redds (Comparable Reaches)	39	33	42	22	70	26	24	36	42	50	38	30	19	50	39	43
Lostine Total Miles of Comparable Stream	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
Lostine Redds/Mile Comparable Stream	4.6	3.9	4.9	2.6	8.2	3.1	2.8	4.2	5.2	6.2	4.7	3.7	2.3	6.2	4.8	5.3
Total Redds For Year	39	38.0	43.0	22.0	71.0	26.0	32.0	45	47	53	41	36	22	52	40	44
Total Miles Surveyed For Year	9.8	13.7	14.4	10.7	10.5	8.5	10.5	10.5	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
Total Redds/Mile For Year	4.0	2.8	3.0	2.1	6.8	3.1	3.0	4.3	4.6	5.2	4.1	3.6	2.2	5.2	4.0	4.4

Notes: The Lostine was surveyed three times in 1999 and 2000. Survey years 2001-2014, the Lostine was surveyed twice, (except Shady Campground and Turkey Flat areas were surveyed three times in 2005, 2006, and 2008 and Turkey Flat was surveyed three times in 2009). Dates of Lostine bull trout spawning surveys generally commenced as early as the second or third week in September and the last survey was conducted in the first or second week in October.

Table 2b – Bull Trout Spawning Surveys for Bear and Goat Creeks Comparing 1999 – 2014 Surveys

Stream	Survey Years															
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Bear Creek																
			Redds	Surveyed												
Reaches (miles surveyed)																
Bear: Goat Confluence to Wilderness Boundary (1mile)	0	2	3	1	2	3	5	0	1	6	1	1	4	3	0	2
Goat Creek: Mouth to Falls (0.9)	8	3	9	6	9	8	6	9	7	4	5	6	15	12	15	12
Bear (and Goat) Total Redds (Comparable Reaches)	8	5	12	7	11	11	11	9	8	10	6	7	19	15	15	14
Bear Creek Total Miles of Comparable Stream	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Bear Creek Redds/Mile Comparable Stream	4.2	2.6	6.3	3.7	5.8	5.8	5.8	4.7	4.2	5.3	3.2	3.2	10	7.9	7.9	7.4
Total Redds For Year	8	5	12	7	17	12	16	9	11	20	8	7	19	15	16	17
Total Miles Surveyed For Year	1.9	1.9	2.3	2.3	3.8	2.3	2.8	1.9	7.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Total Redds/Mile For Year	4.2	2.6	5.2	3.0	4.5	5.2	5.7	4.7	1.5	6.3	2.5	2.2	5.9	4.7	5.0	5.3

Notes: These surveys were conducted once from 1999-2006, usually late in the spawning season, the first or second week in October [except in 1999, surveys were conducted in September (on 9/7 and 9/22)]. In 2007, the surveys included several additional “experimental” miles and were conducted twice in the spawning season, once in mid-September and once in early October. In 2008 - 2014 the surveys were conducted twice in the spawning season and an additional 1.4 miles of Bear Creek was surveyed upstream of the comparable reach.

Table 2c – Bull Trout Spawning Surveys for the Imnaha River, Comparing 2001 – 2014 Surveys

Stream	Survey Years												2013	2014	
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012			
	Redds Surveyed														
Reaches (miles surveyed)															
South Fork Imnaha and tributaries:															
Cliff Creek, mouth to 2.5 miles (2.5 miles)	96	22	57	65	61	17	93	52	164	45	46	65	Not surveyed	87	
South Fork Imnaha, NF to Soldier (1.5 miles)	6	7	14	12	44	9	30	6	7	2	10	28	Not surveyed	9	
South Fork Imnaha, Soldier to Cliff (3.1 miles)	33	18	37	29	55	26	37	15	8	27	13	54	41	27	
North Fork Imnaha:															
North Fork, above Middle Fork (4.1 miles)	49	18	40	68	39	18	30	17	2	4	6	9	5	25	
North Fork, below Middle Fork to mouth (2.1 miles)	2	8	15	9	21	6	7	5	3	12	2	11	6	1	
Middle Fork, mouth to falls (0.8 miles)	12	0	12	6	24	7	17	8	7	5	2	3	3	4	
Imnaha River:															
Imnaha River, NF to Falls (0.6 miles)	0	3	5	1	2	3	2	1	0	0	0	6	0	0	
Imnaha River, Falls to lower falls (0.8 miles)	41	18	35	40	13	37	28	12	13	11	25	21	7	7	
Imnaha River, Blue Hole to Indian Crossing (2.0 miles)	8	7	9	3	2	18	18	28	2	4	9	4	6	17	
Imnaha Total Redds (Comparable Reaches)	247	101	224	233	261	141	262	144	206	110	113	201	n/a*	177	
Imnaha Total Miles of Comparable Stream	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	n/a	17.5	
Imnaha Redds/Mile	14.1	5.8	12.8	13.3	14.9	8.1						11.5			

Comparable Stream							15.0	8.2	11.8	6.3	6.5		n/a	10.1
Total Redds For Year	269	103	293	286	276	186	284	184	235	133	160	240	68	199
Total Miles Surveyed For Year	19.4	18.3	42.8	41.2	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	13.4	19.4*
Total Redds/Mile For Year	13.9	5.6	6.8	6.9	14.2	9.6	14.6	9.5	12.1	6.9	8.2	12.4	5.1	10.3

Notes: All reaches except Blue Hole to Indian Crossing were surveyed once in years 2001-2014. The Blue Hole to Indian Crossing was surveyed twice in September and October from 2001-2014, except in 2005 and 2013, it was surveyed once. Due to government shut-down and furlough, and poor late season weather conditions in 2013, fewer personnel were available which caused less miles to get accomplished. S.F. Imnaha Cliff to Soldier was surveyed differently in 2013, the number of redds is for more miles than in past years. N.F to Soldier did not get surveyed in 2013. NF above MF did not get fully surveyed in 2013. Cliff creek did not get surveyed in 2013. The gorge sections of the Upper Imnaha did not get surveyed in 2013. N/A was documented for comparable reaches, as reaches not comparable to past years. Total stream miles surveyed in 2013 (13.4) is estimated.

Table 2d – Bull Trout Spawning Surveys for Big Sheep Creek and Lick Creek, Comparing 2001 – 2014 Surveys

Stream	Survey Years														
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Big Sheep Creek (including Lick Creek)															
	Redds Surveyed														
Reaches (miles surveyed)															
Big Sheep, canal to 39 rd. (1.9 miles)	2	6	17	2	3	5	6	12	3	2	8	28	13	16	13
Lick Creek, Meadow to 39 rd. (1.5 miles)	0	6	3	0	1	3	5	3	4	5	7	4	4	3	5
Lick Creek, 39 rd. to Quartz Creek (4.2 miles)	8	5	14	8	4	1	7	12	15	13	5	6	13	3	7
Big Sheep Total Redds (Comparable Reaches)	10	17	34	10	8	9	18	27	22	20	20	38	30	22	25
Big Sheep Creek Total Miles of Comparable Stream	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
Big Sheep Creek Redds/Mile Comparable Stream	1.3	2.2	4.5	1.3	1.1	1.2	2.4	4.6	2.9	2.6	2.6	5	3.9	2.9	3.3
Total Redds For Year	12	24	41	18	43	16	18	27	30	20	20	38	30	22	25
Total Miles Surveyed For Year	8.4	8.4	9.3	9.3	14.1	8.6	7.6	8.6	9.6	7.6	7.6	7.6	7.6	7.6	7.6
Total Redds/Mile For Year	1.4	2.9	4.4	1.9	3.0	1.9	2.4	3.1	3.1	2.6	2.6	5	3.9	2.9	3.3

Notes: Survey frequency varied by year, surveys were conducted once in mid to late October in years 2000 and 2001 for both Big Sheep and Lick Creek, and surveys were conducted twice, once in September and once in October in years 2002-2014, except for Big Sheep which was surveyed once in 2004.

**Bull Trout Spawning Surveys
For Some Grande Ronde Tributaries, 2014
USFWS, La Grande Field Office**

Grande Ronde Basin		Kilometers	Miles		Redds				Total	Bull Trout Observed (mm)			
Stream Reach, Section	Date(s)	Surveyed	Surveyed	Occ	Unocc	Total	Per km	Per Mile	But obs	<6"(150mm)	<12" (~300mm)	<18"(450mm)	>18"(450mm)
Bear Creek													
Goat Cr (Mouth to Falls)	18-Sep	1.4	0.9	2.0	2.0	4.0	2.8	4.4	11.0	1.0	6.0	4.0	0.0
Goat Cr (Mouth to Falls)	9-Oct			0.0	8.0	8.0	5.5	6.1	0.0	0.0	0.0	0.0	0.0
Bear Creek (Standley Trail to USFS Cabin)	18-Sep	1.4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bear Creek (Standley Trail to USFS Cabin)	9-Oct			0.0	3.0	3.0	2.1	2.3	3.0	0.0	2.0	1.0	0.0
Bear Creek (USFS Cabin to Goat Creek)	18-Sep	0.8	0.5	0.0	0.0	0.0	0.0	0.0	10.0	8.0	2.0	0.0	0.0
Bear Creek (USFS Cabin to Goat Creek)	9-Oct			0.0	0.0	0.0	0.0	0.0	4.0	1.0	2.0	0.0	1.0
Bear Creek (Goat Creek to Wilderness Boundary)	18-Sep	1.4	0.9	1.0	1.0	2.0	1.4	2.2	5.0	0.0	4.0	0.0	1.0
Bear Creek (Goat Creek to Wilderness Boundary)	9-Oct			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bear Creek Total		5.1	3.2	3.0	14.0	17.0	3.3	5.3	33.0	10.0	16.0	5.0	2.0
Lostine River													
Lundquist Bridge to OC Ranch	7-Oct	4.4	2.8	0.0	1.0	1.0	0.2	0.4	6.0	0.0	0.0	2.0	4.0
Pole Bridge to 6 Mile Bridge	23-Sep	3.2	2.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0
Pole Bridge to 6 Mile Bridge	7-Oct			0.0	1.0	1.0	0.3	0.5	0.0	0.0	0.0	0.0	0.0
Williamson to Walla Walla	23-Sep	3.5	2.2	1.0	2.0	3.0	0.8	1.4	1.0	0.0	0.0	0.0	1.0
Williamson to Walla Walla	7-Oct			0.0	4.0	4.0	1.1	1.8	0.0	0.0	0.0	0.0	0.0
Bowman to French Camp	16-Sep	2.6	1.6	0.0	8.0	8.0	3.1	5.0	0.0	0.0	0.0	0.0	0.0
Bowman to French Camp	6-Oct			0.0	6.0	6.0	2.3	3.8	1.0	0.0	1.0	0.0	0.0
French Camp to Shady Falls	16-Sep	2.4	1.5	6.0	13.0	19.0	7.9	12.7	25.0	0.0	12.0	5.0	8.0
French Camp to Shady Falls	6-Oct			0.0	2.0	2.0	0.8	1.3	0.0	0.0	0.0	0.0	0.0
Lostine River Total		16.2	10.1	7.0	37.0	44.0	2.7	4.4	35.0	0.0	15.0	7.0	13.0
Wallowa River Upstream of Wallowa Lake													
EF Wallowa River, falls to mouth at WF Wallowa River	24-Sep	2.1	1.3	1.0	0.0	1.0	0.5	0.8	2.0	0.0	2.0	0.0	0
EF Wallowa River, falls to mouth at WF Wallowa River	14-Oct			0	0	0.0	0.0	0.0	9.0	5	4	0	0
WF Wallowa River, lake confluence to upstream falls	24-Sep	1.1	0.7	0	0	0.0	0.0	0.0	0.0	0	0	0	0
WF Wallowa River, lake confluence to upstream falls	14-Oct			0	0	0.0	0.0	0.0	0.0	0	0	0	0
Wallowa River Upstream of Wallowa Lake Total		3.2	2.0	1.0	0.0	1.0	0.3	0.5	11.0	5.0	6.0	0.0	0.0
Grande Ronde Basin Total													

Table 2b
 Bull Trout Spawning Surveys
 For the Imnaha River, 2014
 USFWS, La Grande Field Office

Imnaha Basin Stream Reach, Section	Date(s)	Kilometers Surveyed	Miles Surveyed	Occ	Redds			Per km	Per Mile	Total But obs	Bull Trout Observed (mm)			
					Unocc	Total					<6"(150mm)	<12" (~300mm)	<18"(450mm)	>18"(450mm)
Upper Imnaha System														
South Fork Tributaries														
Cliff Cr., mouth to 3.6 km*	30-Sep	4.0	2.5	24.0	63.0	87.0	21.8	34.8	47.0	20.0	26.0	1.0	0.0	
South Fork Tributaries Total		4.0	2.5	24.0	63.0	87.0	0.0	34.8	47.0	20.0	26.0	1.0	0.0	
North Fork														
Middle Fork., mouth to falls	30-Sep	1.3	0.8	0.0	4.0	4.0	3.1	5.0	2.0	0.0	2.0	0.0	0.0	
N. Fk., above M. Fk. (reach 3-7)	29-Sep	6.6	4.1	8.0	17.0	25.0	3.8	6.1	15.0	10.0	4.0	1.0	0.0	
N. Fk., below M. Fk. (reach 1-2)	30-Sep	3.4	2.1	0.0	1.0	1.0	0.3	0.5	1.0	0.0	0.0	1.0	0.0	
North Fork Total		11.3	7.0	8.0	22.0	30.0	2.7	0.4	18.0	10.0	6.0	2.0	0.0	
South Fork														
S. Fk., North Fork to Soldier Cr.	29-30 Sep	2.4	1.5	0.0	9.0	9.0	3.8	6.0	0.0	0.0	0.0	0.0	0.0	
S. Fk., Soldier to Cliff Cr.	29-30 Sep	5.0	3.1	0.0	27.0	27.0	5.4	8.7	0.0	0.0	0.0	0.0	0.0	
South Fork Total		7.4	4.6	0.0	36.0	36.0	4.9	7.8	0.0	0.0	0.0	0.0	0.0	
Upper Imnaha														
Upper Imnaha Falls to North Fork	29-Sep	1.0	0.6	0.0	0.0	0.0	0.0	0.0	11.0	0.0	2.0	5.0	4.0	
Upper Imnaha Falls to lower falls	1-Oct	1.3	0.8	1.0	6.0	7.0	5.4	8.7	6.0	0.0	1.0	1.0	4.0	
Falls downstream .67 mi. to beg. of gorge*	1-Oct	1.1	0.7	1.0	20.0	21.0	19.1	30.7	14.0	0.0	4.0	8.0	2.0	
Lower end of gorge to next gorge (.25 mi)*	1-Oct	0.4	0.2	0.0	1.0	1.0	2.5	4.0	0.0	0.0	0.0	0.0	0.0	
Canyon above slide to canyon just above slide*	1-Oct	1.5	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Upper Imnaha Total		5.3	3.3	2.0	27.0	29.0	5.5	8.8	31.0	0.0	7.0	14.0	10.0	

Table 2b
 Bull Trout Spawning Surveys
 For the Imnaha River, 2014
 USFWS, La Grande Field Office

Page 2 of 2

Imnaha Basin Stream Reach, Section	Date(s)	Kilometers Surveyed	Miles Surveyed	Redds			Per km	Per Mile	Total But obs	Bull Trout Observed (mm)			
				Occ	Unocc	Total				<6"(150mm)	<12" (~300mm)	<18"(450mm)	>18"(450mm)
Middle Imnaha													
Blue Hole to Indian Crossing	25-Sep	3.2	2.0	1.0	16.0	17.0	5.3	8.5	11.0	0.0	2.0	6.0	3.0
Blue Hole to Indian Crossing	10-Oct			0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	3.0	7.0
Middle Imnaha Total		3.2	2.0	1.0	16.0	17.0	5.3	8.5	21.0	0.0	2.0	9.0	10.0
Big Sheep System													
Big Sheep, Canal to Rd. 39	17-Sep	3.1	1.9	5.0	2.0	7.0	2.3	3.7	44.0	21.0	21.0	2.0	0.0
Big Sheep, Canal to Rd. 39	8-Oct			2.0	4.0	6.0			45.0	6.0	34.0	4.0	1.0
Lick Cr. Meadow to 39 rd.	17-Sep	2.4	1.5	1.0	2.0	3.0	0.8	1.3	2.0	1.0	1.0	0.0	0.0
Lick Cr. Meadow to 39 rd.	8-Oct			1.0	1.0	2.0			1.0	1.0	0.0	0.0	0.0
Lick Cr. 39 Rd. to Quartz Cr.	17-Sep	6.8	4.2	0.0	7.0	7.0	1.0	1.7	6.0	0.0	4.0	2.0	0.0
Lick Cr. 39 Rd. to Quartz Cr.	8-Oct			0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0
Big Sheep System Total		12.3	7.6	9.0	16.0	25.0	2.0	3.3	98.0	29.0	60.0	8.0	1.0
Imnaha Basin Total (Page 1)													
		28.0	17.4	34.0	148.0	182.0	6.5	10.5	96.0	30.0	39.0	17.0	10.0
Imnaha Basin Total (Page 2)													
		15.5	9.6	10.0	32.0	42.0	2.7	4.4	119.0	29.0	62.0	17.0	11.0
Imnaha Basin Total Pages 1 & 2)													
		43.5	27.0	44.0	180.0	224.0	5.1	8.3	215.0	59.0	101.0	34.0	21.0

**Table 4a –
Summary of Measured Bull Trout Redds, Grande Ronde River Basin
Lostine River and Goat Creek 2014**

Stream	n*1		Length (M)	Width (M)	Area (m2)	Length/Width ratio
Lostine	42	mean	1.3	0.8	1.2	1.7
		sd	0.5	0.3	0.7	0.5
		max	2.3	1.6	3.3	3.3
		min	0.3	0.3	0.1	0.8
Bear	5	mean	0.9	0.6	0.6	1.7
		sd	0.3	0.2	0.4	0.6
		max	1.5	0.9	1.3	2.6
		min	0.6	0.4	0.3	1.1
Goat	10	mean	1.2	0.6	0.8	2.0
		sd	0.4	0.2	0.5	0.6
		max	1.8	1.1	1.9	3.2
		min	0.5	0.4	0.2	1.3

*n = number of redds observed and measured (sample size).

Table 4b – Summary of Measured Bull Trout Redds, Imnaha River Basin 2014

Stream	n*1		Length (M)	Width (M)	Area (m2)	Length/Width ratio
Lick Creek	17	mean	0.8	0.5	0.5	1.7
		sd	0.2	0.1	0.2	0.5
		max	1.8	1.0	0.9	2.3
		min	0.4	0.3	0.2	0.8
Big Sheep Creek	12	mean	0.8	0.4	0.3	2.0
		sd	0.4	0.1	0.2	0.7
		max	0.9	0.5	0.8	3.9
		min	0.3	0.2	0.1	1.3
Middle Imnaha	15	mean	1.2	0.6	0.8	2.5
		sd	0.2	0.2	0.4	0.4
		max	1.7	1.0	1.4	3.0
		min	0.7	0.4	0.3	1.2
N.F. Imnaha	28	mean	1.0	0.4	0.6	2.5
		sd	0.6	0.3	0.7	0.9
		max	3.0	1.4	3.4	5.4
		min	0.3	0.1	0.1	1.3
S.F. Imnaha	36	mean	1.0	0.6	0.7	1.4
		sd	0.5	0.2	0.5	0.8
		max	2.6	1.1	2.6	5.4
		min	0.5	0.2	0.1	0.9
Upper Imnaha	28	mean	1.3	0.8	1.1	1.7
		sd	0.5	0.3	0.7	0.9
		max	2.3	1.7	3.0	5.4
		min	0.5	0.3	0.1	0.9
Cliff Creek	51	mean	0.7	0.4	0.3	1.8
		sd	0.2	0.2	0.2	0.5
		max	1.6	1.0	1.3	3.0
		min	0.4	0.2	0.1	1.1

Footnote 1: n = number of redds observed and measured (sample size).