

# **2008 Bull Trout Redd Monitoring in the Wallowa Mountains**



(Photo courtesy of Jake Kimbro, ODFW)

**Prepared by: Gretchen Sausen  
U.S. Fish and Wildlife Service  
La Grande Field Office  
August 2009**

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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. The Bull Trout Redd Monitoring in the Wallowa Mountains report summarizes the 2008 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 2008. Surveys were conducted by the Oregon Department of Fish and Wildlife (ODFW), U.S. Forest Service (USFS), Service, Nez Perce Tribe (NPT), National Marine Fisheries Service (NMFS), Anderson Perry, fisheries consultants, and volunteers. 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 2005 through 2008, and over time use this 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. The Imnaha population is one of the strongholds within the Imnaha Subbasin. The Lostine River and Bear Creek contain brook trout and hybridization may be occurring.

## **ACKNOWLEDGMENTS**

The Service has, for the past four 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.

This project would not have been possible without the dedication, hard work, funding, and assistance provided by all the partners. Del Sol Wilderness Adventures provided an invaluable service in 2008 by providing 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 1999 - 2008 which included; the WMO, ODFW, NPT, the Service, NOAA, and Anderson Perry and Associates (Anderson Perry),

consultants, and volunteers. Special thanks to the people who walked the streams (including surveys conducted in 1999-2008), helped with scheduling surveys and surveyors, provided access to private property, assisted in mapping, or summarized the data. These included: Gary Miller, Brad Smith, Alan Miller, Ken Bronec, Peter Cleary, Marisa Meyer, Everett Leach, Jeff Nehls, Maria Shepherd, Cindy Sloan, Rick Christian, Michelle Cregger, Jeff Yanke, Ian Wilson, Jake Kimbro, Shelly Schmidt, Sue Brady, Kyle Bratcher, Jamie McClure, Dave Bright, Suzanne Nostrant, Shivonne Nesbit, John Stephenson, Keith Paul, Max Hoffman, Andrew McClay, Mary Hawkins, Don Hair, Dana McCosky, Dave Kwasniewski, Ari Martinez, Rachel Rounds, Tiffany Tumelson, Greg Silver, Jennifer Lord, Jody Delavan, Lynne Price, Mac Huff, Tim Whitesel, Paul Sankovich, Dana Orrick, Jim Harbeck, Sue Womack, Jennifer Poirier, Tim Plawman, Darren Gallion, Paul Wilson, Al Hemmingsen, Levi Pinkham, Pete McHugh, Shane Vatland, Megan Lucas, Troy Baker, John Brunzell, Phil Howell, Ed Bowles, Susanna Allen, Brad Lovatt, Erin Hanson, Mark Robertson, Debbie Barkow, Dale Hanson, Krischele Hampton, Pat Kinery, Susan Lindstedt, Erin Barry, Dwayne Shotton, Jason Haubelt, Rochelle Rusczyk, Vince Tranquilly, Jon Rombach, Patrick Vichit, and Patrick Bishop.

## **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). 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, ODFW, USFS, NPT, contractors, and volunteers for the past seven to eight years.

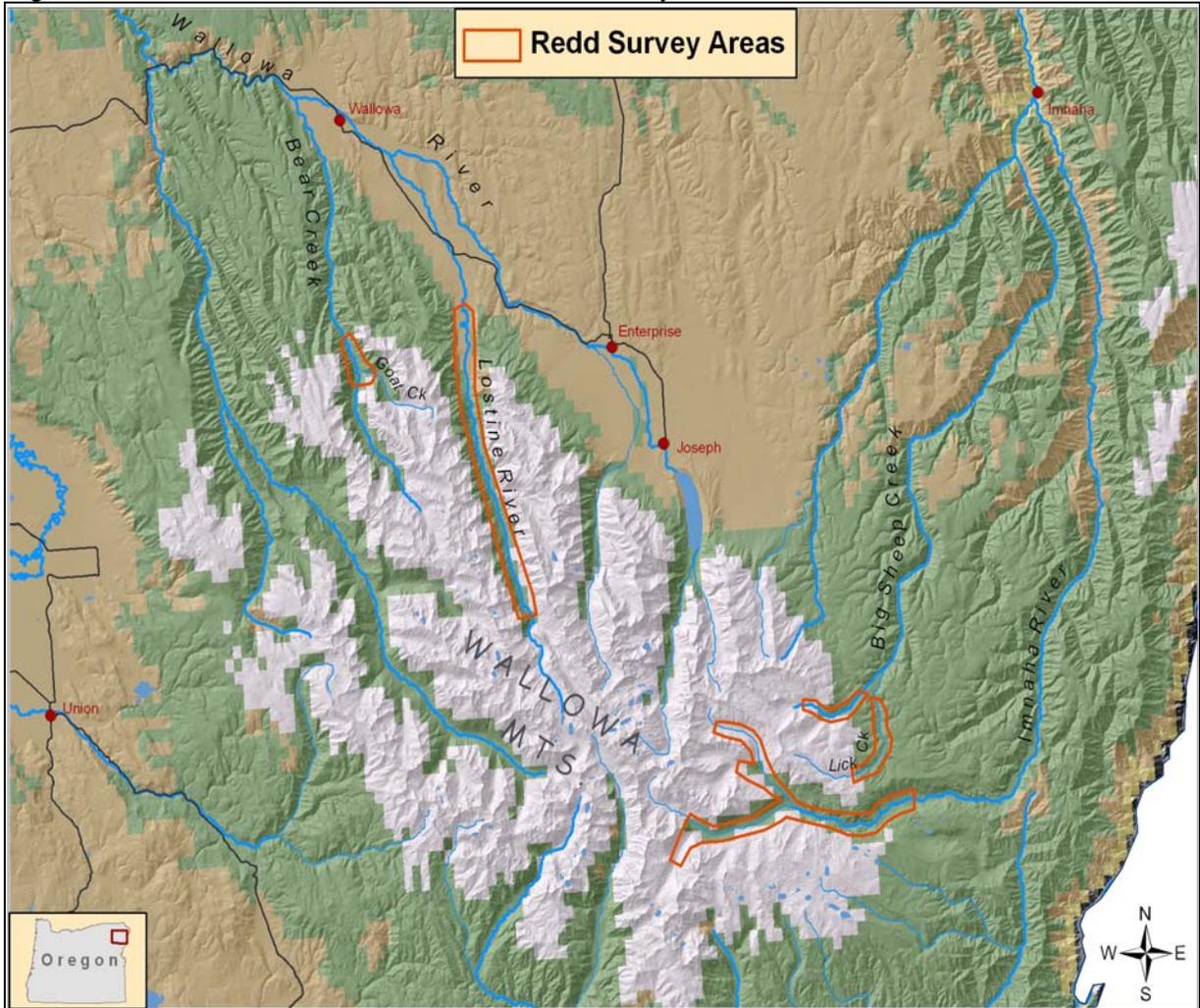
Objectives of the bull trout spawning surveys included:

- Locate bull trout spawning areas.
- Determine redd 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 2008. Collect first year UTM spatial redd data on Big Sheep, Lick Creek, and Middle Imnaha.
- 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 several partners conducted bull trout spawning surveys in 2008 on selected streams in the Grande Ronde and Imnaha Sub-Basins. Stream systems surveyed in 2008 for bull trout redds included; the Lostine River, Bear and Goat Creeks, the Imnaha River, Big Sheep Creek and Lick Creek (Figure 1).

Figure 1. Wallowa Mountain Bull Trout Redd Survey Areas.



## METHODS

Spawning surveys for bull trout require as many as ten to twelve people in one day (for complete surveys on large rivers) to complete the surveys during the spawning time. As mentioned above, this project would not be possible without the cooperative effort of partners. Surveyors walk the rivers through the selected “index areas” to locate the bull trout redds.

This project is part of a larger effort in NE Oregon and SE Washington that Occurs during spawning (September – October). Due to the lack of available experienced surveyors to conduct these river surveys, we have had to increase our survey days on the accessible sections of the Lostine and Imnaha Rivers to 2 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 2008, on the Upper Imnaha River and tributaries, due to access and funding limitations. Refer to Appendix B, Table 1 comparing survey data and survey frequency for 1999-2008 bull trout spawning surveys on selected Grande Ronde and Imnaha River streams. 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) visit to known bull trout redd 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 Spawning Trio on Redd, Lostine River (Photo courtesy of U.S.F.S.).

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 2008, 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 were documented.

Information collected during the bull trout spawning surveys is compiled by the Service and made available to other agencies (i.e., this report).



Shelly Schmidt and Sue Brady of Anderson Perry, Inc surveying a bull trout redd on the Lostine River within the Turkey Flat campground, 2008.

## 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 2008. From 1999 to 2008 bull trout spawning areas have been established (in particular, the Lostine and Imnaha Rivers) for these streams. Redd characteristics also have been measured on these streams. The Middle Imnaha (Imnaha River from the fish weir below Gumboot confluence to Indian Crossing) was not surveyed in 2005 through 2008, (this area was surveyed in 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 four 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 (1.9-3.8 total miles between 1999-2006 versus 7.2 in 2007) and the survey frequency increased (generally once from 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, 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.



North Fork Imnaha at the headwaters, Alan Miller (USFS) in photo, 2008. (Photo courtesy of Jake Kimbro, ODFW).

## **Timing of Bull Trout Spawning**

Bull trout timing of 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), with the Imnaha (being a much larger system) being less predictable. The above information is based on documentation during bull trout spawning surveys and chinook surveys where bull trout were spawning.

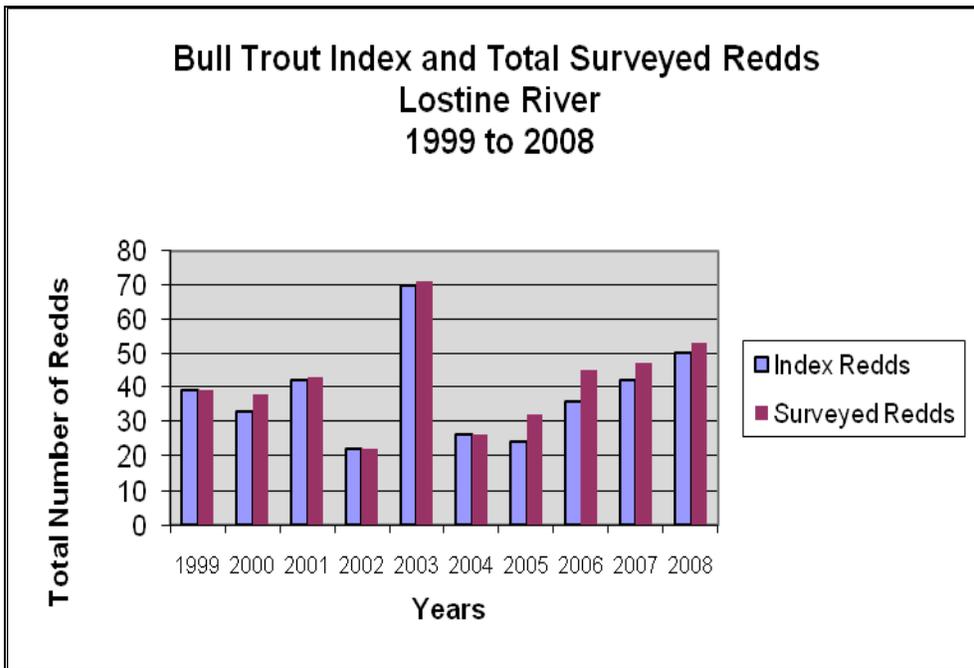
We are not exactly certain of when spawning commences and ends within the Upper Imnaha (within the mainstem, North Fork, South Fork, and Cliff Creek [a resident tributary]). There are questions as to what time of the year, dependent on annual flows, bull trout pass over the falls. Some years we have seen fluvial size bull trout spawning in the South Fork Imnaha in mid-late Sept/early October and in recent years we have not. ODFW observed large fluvial bull trout spawning in South Fork Imnaha in mid August 2005 (B. Knox, ODFW, pers. comm., 2005). ODFW has 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). More years of observation and survey data are needed to understand bull trout spawning and adult movement in the Imnaha Sub-Basin, and Big Sheep and Bear Creek Watersheds.

## **Total Number of Bull Trout Redds**

### *Lostine River*

Refer to Appendix B, Table 3a and 3b for bull trout redd count summary data for 2008. Fifty-three total bull trout redds for 10.1 miles of survey (including Pole Bridge to Six Mile Bridge) were documented in 2008 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 2007 excluding the Pole Bridge to Six Mile section (Figure 2). The Lostine River had a low of 22 redds in 2002 to a high of 70 redds in 2003. There has been an increasing trend in redd numbers since 2004, although numbers have not reached the 2003 totals. The nine-year average from 1999 to 2008 for the Lostine River is 38 redds, approximately half of the 2003 total. 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 [approximately River Mile (RM) 24.5 to RM 22]. In 2008, as in most years, the densities were greatest in the uppermost reach (Shady to French Camp) which is upstream of the chinook spawning index areas.

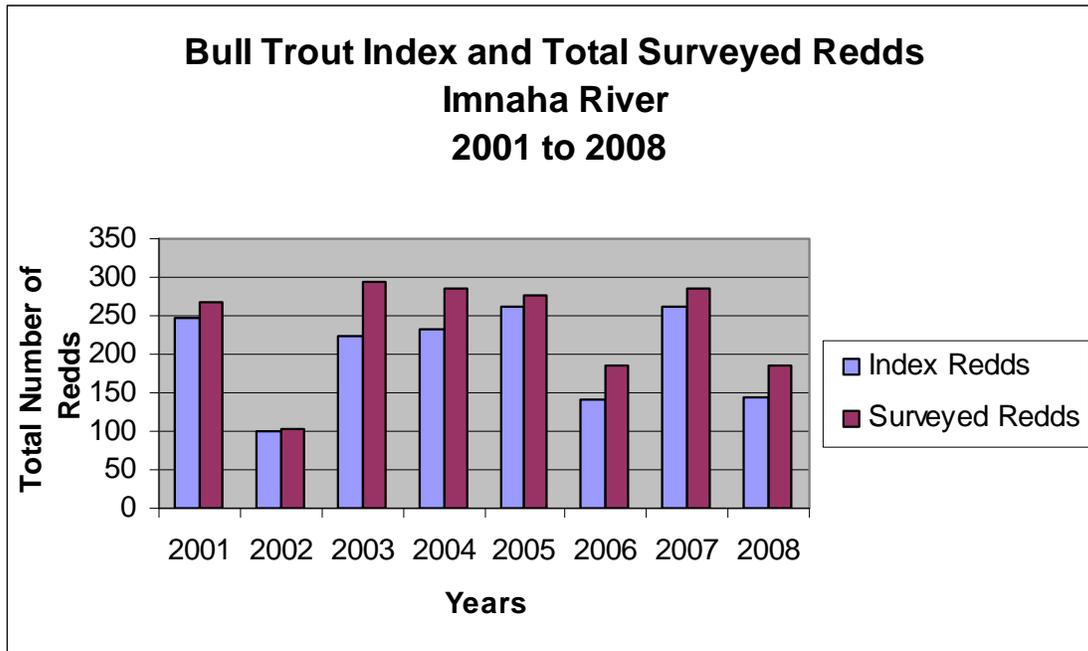
**Figure 2. Comparison of bull trout surveyed redds and index redds (comparable miles) documented from 1999 to 2008 on the Lostine River.**



*Imnaha River*

One hundred and eighty four total bull trout redds for 19.4 miles of survey were documented in 2008 on the Imnaha River (from Indian Crossing to Blue Hole and upstream). Indian Crossing to Blue Hole was surveyed twice (mid to late spawning season) and upstream areas were surveyed once (mid spawning season) in 2008. The following data for the Imnaha River compares consistently surveyed index areas on the Imnaha River (17.5 miles) from 2001 to 2008 (Figure 3). The eight-year average from 2001 to 2008 was 202 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 2008 was recorded in the Upper Imnaha from Blue Hole to Cliff Creek, including Upper Imnaha tributaries. In 2006 and 2007, 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 Imnaha falls to Indian Crossing, whereas, in past years the distribution had higher numbers above the Blue Hole (two miles upstream of Indian Crossing), as well as in the upper tributary streams (S.F. and N.F. Imnaha).

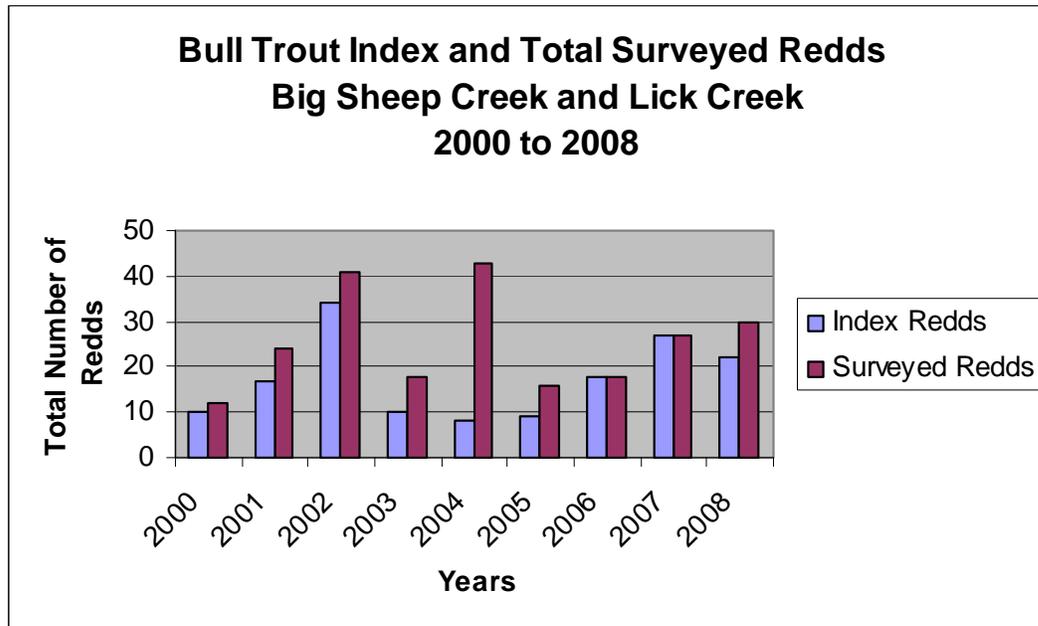
**Figure 3. Comparison of bull trout surveyed redds and index redds (comparable miles) documented from 2001 to 2008 on the Imnaha River.**



*Big Sheep Creek*

Thirty total bull trout redds for 9.6 miles of survey were documented in 2008 on Big Sheep Creek and Lick Creek. These areas were surveyed twice in 2008, 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 2008 (Figure 4). The nine-year average from 2000 to 2008 was 17 for the Big Sheep system. Total redd numbers within the Big Sheep system ranged from 8-34 within that period. Redd surveys for bull trout in the Big Sheep system have been limited in miles of survey (8.4 to 14.1 miles from 2000 to 2008) and in frequency, (2000-2001 surveys were conducted once late season, and in 2002, 2003, and 2005-2008, surveys were conducted twice, mid and late season). In 2004, the survey was conducted once late season for Big Sheep and twice, mid and late season for Lick Creek.

**Figure 4. Comparison of bull trout surveyed redds and index redds (comparable miles) documented from 2000 to 2008 on Big Sheep and Lick Creeks.**



The local bull trout populations in the Imnaha and Big Sheep and Lick Creek appear to be relatively stable for the survey period (2000-2008); although, a minimum of 15 years is needed to determine population trends.

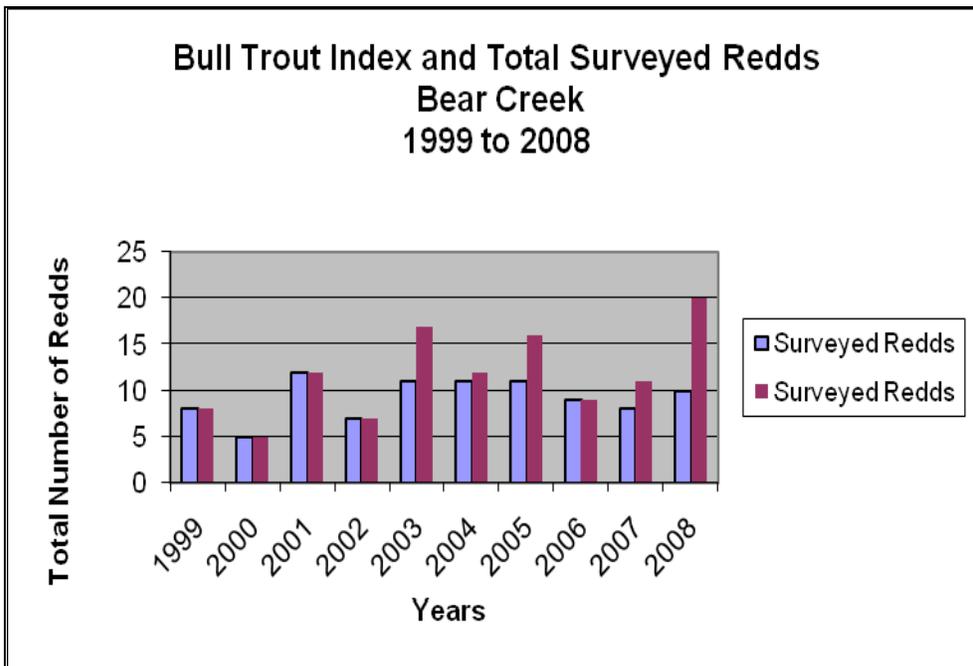
The Imnaha population is one of the strongholds within the Imnaha Subbasin as it has multiple age classes, contains fluvial fish, has an anadromous prey base, has connectivity with the Snake River, and bull trout are distributed throughout the habitat. Primary spawning activity on the Imnaha River has 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).

## Bear Creek

Twenty total bull trout redds for 3.2 miles of survey were documented in 2008 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 2008 (Figure 5). Redd counts on Bear Creek and Goat Creek had a low of 5 redds in 2000 to a high of 12 total redds in 2001, and decreasing to 10 redds in 2008. The ten-year average from 1999 to 2008 is 9 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 2007 was 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, 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 (mouth to waterfall, RM 0 to RM 0.9), except in 2008 where more redds were documented in Bear Creek than in Goat Creek.

**Figure 5. Comparison of bull trout surveyed redds and index redds (comparable miles) documented from 1999 to 2008 on Bear Creek (including Goat Creek).**



## Sizes of Bull Trout Redds

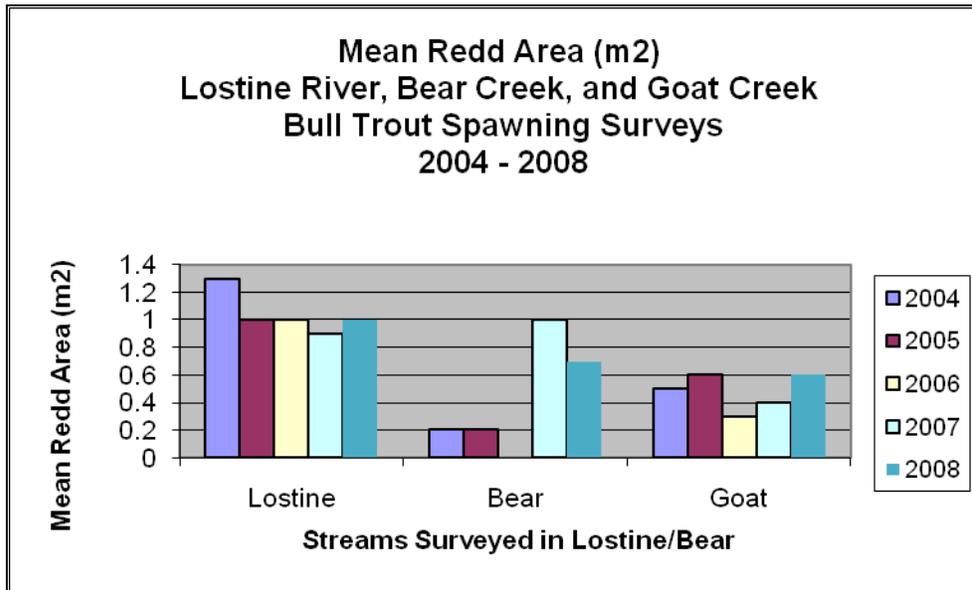
Bull trout redds were measured using the same methodology in 2004 through 2008 and comparison of bull trout redd sizes (mean redd area (m<sup>2</sup>)) for these years is illustrated below. There is a relationship between size of female salmonid and size of redd; large fish make large redds (Bjornn and Reiser 1991, and P. Sankovich, Service, pers. comm.,

2006). 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).

#### *Lostine/Bear/Goat*

Figure 6 compares bull trout redd sizes for the Lostine River, Bear Creek, and Goat Creek in 2004-2008. Mean redd area ( $m^2$ ) ranged from 0.9-1.3 for the Lostine, 0.3-0.6 for Goat Creek, and 0.2-1.0 for Bear Creek. 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, in 2007 the redd area was larger and more typical of fluvial size bull trout redds). Brook trout are thought to be abundant in Bear Creek (due to historical stocking in the headwater lakes). Bull trout redds were not observed or documented in Bear Creek within the index area in 2006. The Lostine River contains brook trout, but for most survey years, we have not observed brook trout spawning with bull trout. This observation changed in 2008 where they appeared to be spawning together and hybrid fish were observed. Genetic sampling of bull trout/brook trout in the Lostine has occurred but the results have not been reported to date. Currently, genetic sampling of bull trout/brook trout has not occurred on Bear Creek to assess the magnitude of hybridization. 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 2004-2008 that the redds in Goat Creek were a combination of resident and fluvial fish, as the redd sizes were midway between the Bear Creek (resident size) and the Lostine (fluvial size) (except for the fluvial-size redds in Bear Creek in 2007 and 2008. Two bull trout that were observed occupying a redd on Goat Creek in 2004 were <12 inches (<300 ml) and were on a redd that had an area of  $0.3 m^2$ ; therefore, this size of redd is resident (related to the fish size). 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 (m<sup>2</sup>)] for Lostine River, Bear, and Goat Creeks sampled during bull trout spawning surveys, 2004-2008.**



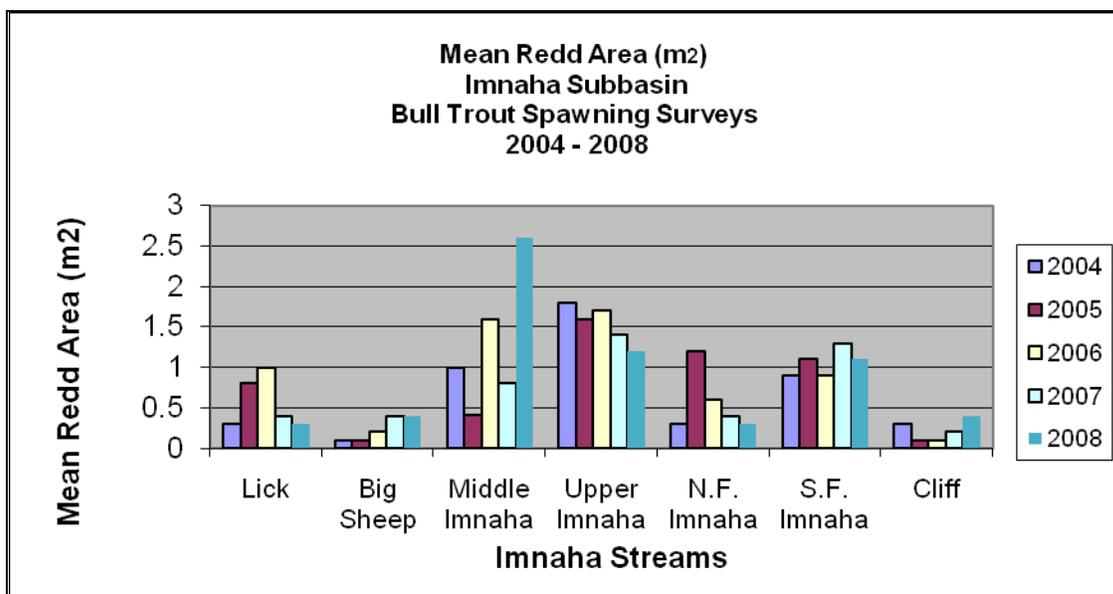
Footnote: Bull trout redds were not observed in the index area of Bear Creek in 2006.

### *Imnaha and Big Sheep*

Figure 7 compares bull trout redd sizes for the sampled streams in the Imnaha system in years 2004-2008. Mean redd area (m<sup>2</sup>) ranged from 0.3-1.0 for Lick Creek, 0.1-0.4 for Big Sheep, 1.2-1.8 for Upper Imnaha, 0.3-1.2 for N.F. Imnaha, 0.9-1.3 for S.F. Imnaha, and 0.1-0.4 for Cliff Creek. Middle Imnaha had only two redds observed in 2005 and three redds in 2004. In 2006-2008, Middle Imnaha had a large distribution of redds in this survey area (sample size = 18 for 2006 and 2007 and 28 for 2008) compared to past years. Middle Imnaha in 2004 and 2006 had primarily fluvial size redds with resident redds documented in 2005 and a mix of fluvial and resident redds in 2007 and 2008. As shown in Figure 7 below, very large redds (produced by large fluvial bull trout) were documented on the Middle Imnaha in 2008. Cliff Creek is a known resident system with a waterfall near the mouth. The survey on Cliff Creek in 2004 included a large fluvial size redd near the confluence with the S.F. 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. Lick Creek and Imnaha had an overlap of bull trout and chinook redds, which may make differentiation between the two sometimes difficult. Lick Creek data in 2004-2008 appeared to be a combination of resident and fluvial redds (with more resident redds documented in 2004, 2007, and 2008). Big Sheep contained resident redds all years, and Upper Imnaha and S.F. Imnaha contained a majority of fluvial redds. North Fork Imnaha appears to have had more resident redds in 2004, 2007, and 2008, more fluvial size redds in 2005, and a mix of fluvial and resident in 2006. Cliff Creek is a known resident system with a mean redd size of 0.2 m<sup>2</sup> in 2007. Mean redd size was greater, a size of 0.3 m<sup>2</sup> in 2004 as a result of a fluvial redd near the mouth and potential superimposition of redds above the barrier. 2007 mean redd size included a few larger redds below the falls (near the mouth) which are presumed to be fluvial redds. 2008 mean redd size was greatest above the falls, likely superimpositions of redds above the

barrier. In 2008 not all 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). Refer to Tables 4a and 4b in Appendix B for additional information on 2008 bull trout redd characteristics.

**Figure 7. Comparison of bull trout redd sizes [mean redd area (m<sup>2</sup>)] for sampled streams in the Imnaha Subbasin, 2004-2008.**



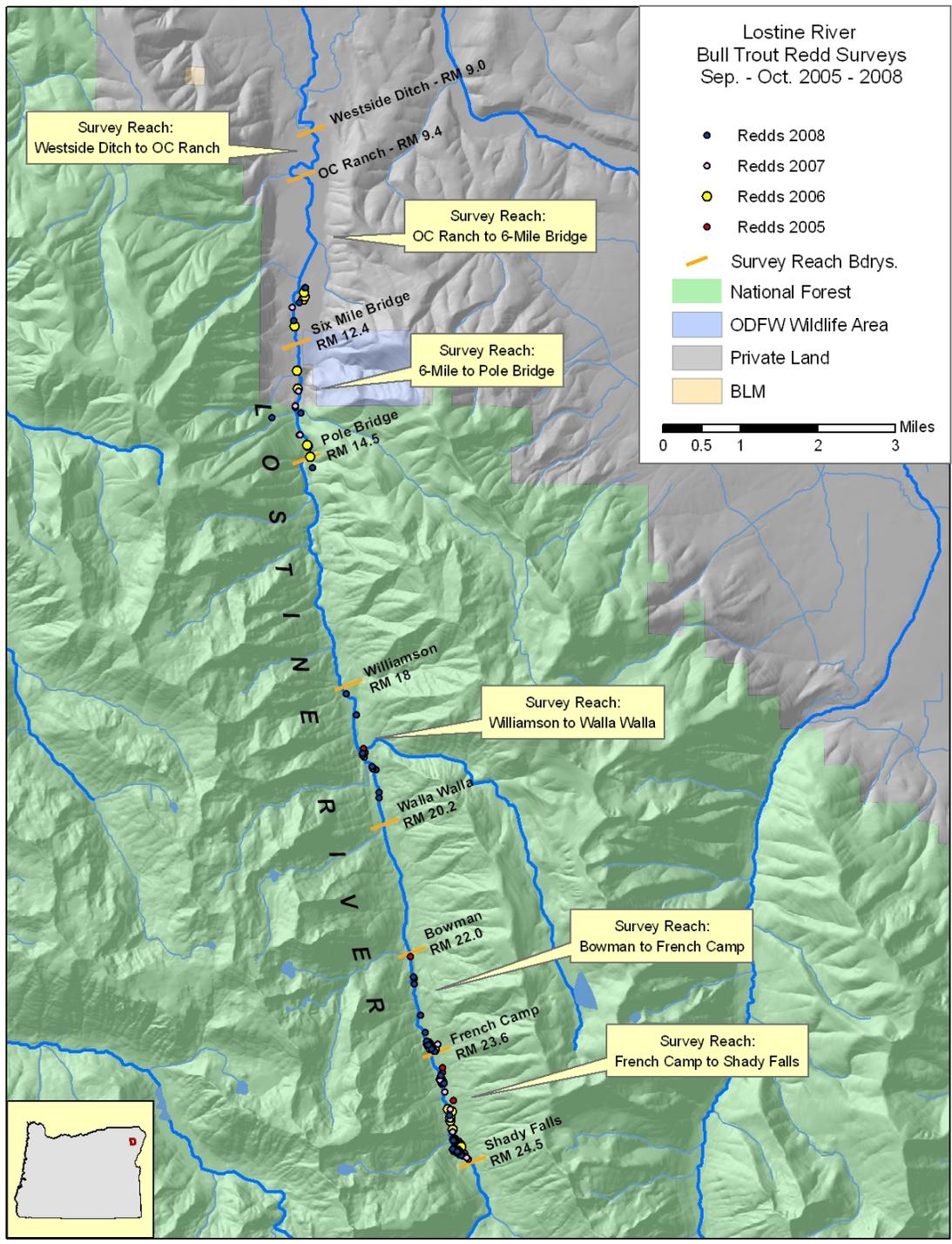
### Bull Trout Redd Distribution on the Lostine River

The bull trout spawning survey on the Lostine River in years 2005 through 2008 included collection of UTM coordinate data on the spatial distribution of the bull trout redds observed along the Lostine River (Figure 8). Bull trout redds on the Lostine River (as well as in other surveyed streams) were often arranged in complexes (several redds in close proximity to each other) as shown in Figure 8. Redds were primarily located in the French Camp to Shady Falls and Bowman to French Camp reaches along the Lostine River in both 2005 and 2006; and mainly in the French Camp to Shady Falls reach in 2007 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 2005-2008, especially in the upper reaches of the Lostine River (Figure 8). Location and densities of bull trout redds in 2008 were similar to past years except for the Williamson to Walla Walla Reach, which had several more redds documented in 2008 than in previous years.

Sections of the Lostine River not surveyed due to insufficient spawning gravels (boulder and cobble dominated substrate) and difficult access include; Bowman to Walla Walla (approximately 2.2 miles) and Williamson to Pole Bridge (approximately 3.5 miles). Downstream of Westside Ditch on the Lostine River (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.



Upstream view of the Lostine River near Turkey Flat, within the French Camp to Bowman bull trout spawning area. Surveyors in photo are left to right; Shelly Schmidt (Anderson Perry), Christian Jilek (NMFS), and Sue Brady (Anderson Perry).



**Figure 8. Map of the Lostine River showing bull trout redd survey reaches and bull trout redd locations in years 2005 through 2008.**

## DISCUSSION

A combination of low flows (due to drought conditions) and severe streambed scour activity in the spring season of 2006-2008 created limited available habitat for spawning bull trout in the fall season of 2006-2008. This is noted by the author as most evident in the Lostine/Bear and Imnaha systems. During drought conditions, as in 2006-2008, Bear Creek had limited spawning habitat for fluvial bull trout due to subbing out of flows. It is assumed that there is habitat upstream of the index area above subbing flows for resident bull trout. In 2007, surveyors noted a chinook redd (obvious because of the huge size and large substrate) in lower Goat Creek which was probably a result of extremely low flows and warm temperatures in Bear Creek in 2007. Several side channels on the Imnaha were no longer flowing in 2006-2008, and this was evident as well during the chinook surveys on these streams. This likely had an effect on densities and distribution of redds for both bull trout and chinook species in these systems.



Upper Imnaha Falls with author and Peter Cleary (Nez Perce Tribe) in photo

The Imnaha in 2006-2008 had a large distribution of bull trout redds that extended further downstream than in past years (Blue Hole to Indian Crossing, a two mile section); which may be due to limited passage of fluvial bull trout at the falls and potential bull trout/chinook interactions that are not well understood. In 2008, the redd size was larger; therefore, larger fluvial fish were building redds in this area. As mentioned in the previous reports, additional research on timing in the Imnaha and especially passage above and below the falls would be beneficial in our understanding of bull trout in this system.

The Middle Fork of Big Sheep (a one mile section of stream in the headwaters) was surveyed in 2008 per recommendation by Service researchers. They have documented several bull trout in that area post their survey of the area utilizing electrofishing techniques. It appears to be excellent rearing habitat, but in 2008 there were very limited spawning gravels and/or use of existing gravels by spawning resident bull trout.



Middle Fork Big Sheep Bull Trout Redd Survey in 2008

Quartz Creek, a tributary to Lick Creek, had an experimental survey also per Service researcher recommendations. There appears to be bull trout spawning and rearing habitat in this stream, as six redds were reported in a one mile survey reach of stream. The stream is very healthy, i.e. excellent canopy cover/streamside vegetation; therefore, the stream is not recommended to survey on an annual basis due to difficult access and a problem in detecting redds due to the amount of cover.

Overall, future needs for this project include continued funding and support from all involved parties for conducting and reporting bull trout redd counts in the Wallowa Mountains. 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.

## CONCLUSION

The local bull trout populations surveyed appear to be relatively stable for the survey period (1999-2008); although, a minimum of 15 years is needed to determine population trends.

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, has 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 Lostine River is considered a moderately-strong population within the Grande Ronde Subbasin. Our results are consistent with Buchanan et al. (1997). Lostine River and Bear Creek contain brook trout and the degree of hybridization is unknown. The Nez Perce Tribal Fisheries office has expressed a concern on the amount of bull trout hybrid fish they are catching at their weir near the mouth (Personal communications, Mary Edwards and Jeff Nehls, Nez Perce Tribe, 2008). 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 recommended to help determine the significance of this threat.



Bull Trout and potential brook trout hybrid spawning pair building redd, Lostine River, 2008



Upper Imnaha River, 2008. (Photo courtesy of Jake Kimbro, ODFW).



## REFERENCES

- Al-Chokhachy, R., P. Budy, and H. Schaller. 2005. Understanding the significance of redd Counts: a comparison between two methods for estimating the abundance of and monitoring bull trout populations. *North American Journal of Fisheries Management* 25:1505-1512.
- Bellerud, B.L., S. Gunkel, A.R. Hemmingsen, D.V. Buchanan, and P.J. Howell. 1997. Bull Trout Life History, Genetics, Habitat Needs, and Limiting Factors in Central and Northeast Oregon. 1996 Annual Report. Project Number 95-54. Bonneville Power Administration, Portland, OR.
- Bjornn, T.C., and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. *American Fisheries Society Special Publications* 19:139-179.
- Bonar, S.A., M. Divens, and B. Bolding. 1997. Methods for sampling the distribution and abundance of bull trout/Dolly Varden. Washington Department of Fish and Wildlife Research Report No. RAD97-05. Olympia, WA. 48 p.
- Buchanan, D.V., M.L. Hanson, and R.M. Hooton. 1997. Status of Oregon's Bull Trout. Oregon Department of Fish and Wildlife, Portland, Oregon.
- Dunham, J., B. Rieman, and K. Davis. 2001. Sources and Magnitude of Sampling Error in Redd Counts for Bull Trout. *North American Journal of Fisheries Management* 21:343-352.
- Ecovista. 2004. Salmon Subbasin Management Plan. For the Nez Perce Tribe Watershed Division and Shoshone Bannock Tribe as part of Northwest Power and Conservation Council's Fish and Wildlife Program.
- Ecovista. 2004a. Imnaha Subbasin Plan. Plan includes Assessment, Inventory, and Management Plan. For Nez Perce Tribe as part of Northwest Power and Conservation Council's Fish and Wildlife Program.
- Krueger, C. C., and D. J. Decker. 1993. The process of fisheries management. Pages 33-54 in C. C. Kohler and W. A. Hubert, editors. *Inland fisheries management in North America*. American Fisheries Society, Bethesda, Maryland.
- Maxwell, B.A. 1999. A power analysis on the monitoring of bull trout stocks using redd counts. *North American Journal of Fisheries Management*. 19: 860-866.
- Mendel, G., M. Gembala, J. Trump, and C. Fulton. 2006. Baseline Assessment of Salmonids in Tributaries of the Snake and Grande Ronde Rivers in Southeast Washington. 2005 Annual Report. Washington Department of Fish and Wildlife, Dayton, WA.
- Nowak, C. M. and 25 co-authoring agencies. 2004. Grande Ronde Subbasin Plan. Prepared for the Northwest Power and Conservation Council.

- Ratliff, D.E. and P.J. Howell. 1992. The status of bull trout populations in Oregon. Pages 10 to 17 In: P.J. Howell and D.V. Buchanan, eds. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.
- Rieman, B.E. and D.L. Myers 1997. Use of redd counts to detect trends in bull trout (*Salvelinus confluentus*) populations. *Conservation Biology* 11:1015-1018.
- Sankovich, P. m., S.L. Gunkel, A.R. Hemmingsen, I.A. Tattam, and P.J. Howell. 2003. Migratory patterns, structure, abundance, and status of bull trout populations from subbasins in the Columbia Plateau. 2002 Annual Report. Project 199405400. Bonneville Power Administration, Portland, OR.
- Starcevich, S.J., S. Jacobs, and P.J. Howell. 2005. Migratory Patterns, Structure, Abundance, and Status of Bull Trout Populations from Subbasins in the Columbia Plateau and Blue Mountain Provinces. 2004 Annual Report. Project 199405400. Bonneville Power Administration, Portland, OR.
- Taper, M.L., D.F. Staples, and B.B. Shepard. 2005. Observer Error Structure in Bull Trout Redd Counts in Montana Stream: Implications for Inference on True Redd Numbers. *North American Journal of Fisheries Management*, in-review. Presented as a Power Point Presentation at ScCS meeting in Glacier Park Montana, September 7-9, 2005.
- U.S. Department of the Interior, Fish and Wildlife Service. 2002. Chapter 11, Grande Ronde River Recovery Unit, Oregon and Washington and Chapter 12, Imnaha-Snake Rivers Recovery Unit. In: U.S. Fish and Wildlife Service. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.
- U.S. Fish and Wildlife Service. 1999 – 2006. Unpublished bull trout spawning survey data on file at La Grande Field Office, U.S. Fish and Wildlife Service, La Grande, Oregon.

## APPENDIX A – PHOTOS TAKEN AT SURVEY LOCATIONS



Lostine River Surveyors, from Left to right, Shelly Schmidt (Anderson Perry), Christian Jilek (NMFS), Jake Kimbro (ODFW), Dave Bright (NPT), Mac Huff (private consultant), Gretchen Sausen (Service), Sue Brady (Anderson Perry), and Jeff Nehls (NPT).



Upper Innaha River, View of Log Jam from the trail, 2008. (Photo courtesy of Jake Kimbro).



Bear Creek near confluence with Goat Creek, 2008.



Lostine River, Pole Bridge to Green Bridge Reach. View looking downstream at Green bridge. Photo taken during chinook survey, 2008.



Lostine River within Lostine River Ranch Reach, View Upstream, 2008.



Jake Kimbro (ODFW) in route to beginning of Middle Fork Big Sheep bull trout survey, downstream of falls, 2008.



Upper Innaha River, Beginning of 1<sup>st</sup> to 2<sup>nd</sup> Gorge Section, Upstream View. 2008. (Photo courtesy of Jake Kimbro, ODFW).



Upper Innaha River, Beginning of 1<sup>st</sup> to 2<sup>nd</sup> Gorge Section, Downstream View. 2008. (Photo courtesy of Jake Kimbro, ODFW).



Upper Imnaha River, Beginning of Reach Gorge above Slide to Gorge below slide Section 2008. (Photo courtesy of Jake Kimbro, ODFW).



Upper Imnaha River, Beginning of Reach: Bottom of First Gorge, Upstream View, 2008. (Photo courtesy of Jake Kimbro, ODFW).



Upper Imnaha River, Lower End of First Gorge, 2008 (Photo courtesy of Jake Kimbro, ODFW)



Upper Imnaha River at Rock Creek , approx 200 meters above 1<sup>st</sup> Gorge to 2<sup>nd</sup> Gorge Reach, 2008 (Photo courtesy of Jake Kimbro, ODFW)



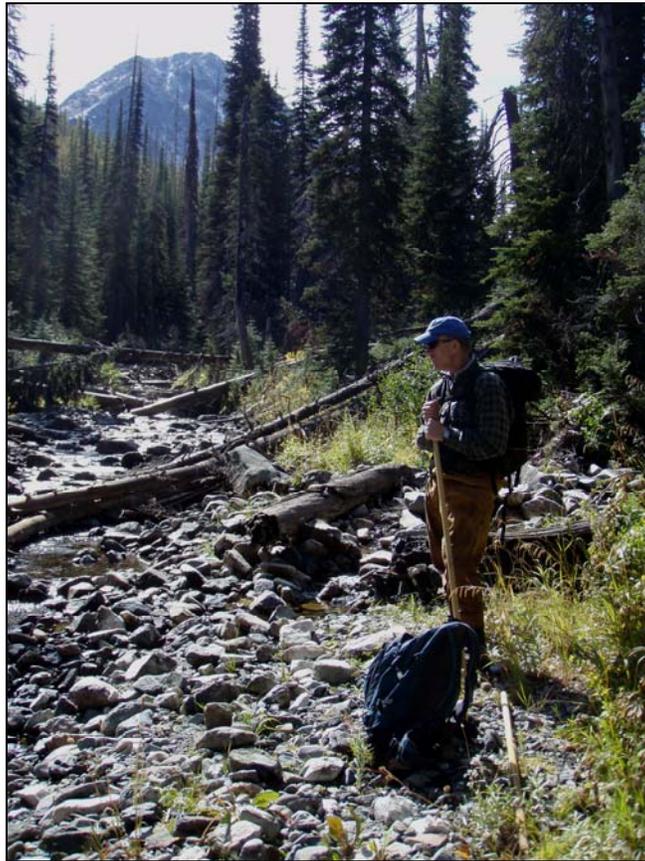
Upper Innaha River, End of Reach: Gorge above Slide to Gorge below Slide, 2008.  
Downstream View. (Photo courtesy of Jake Kimbro, ODFW).



Upper Innaha River, End of Reach: Lower Falls to First Gorge Section, 2008.  
Downstream View. (Photo courtesy of Jake Kimbro, ODFW).



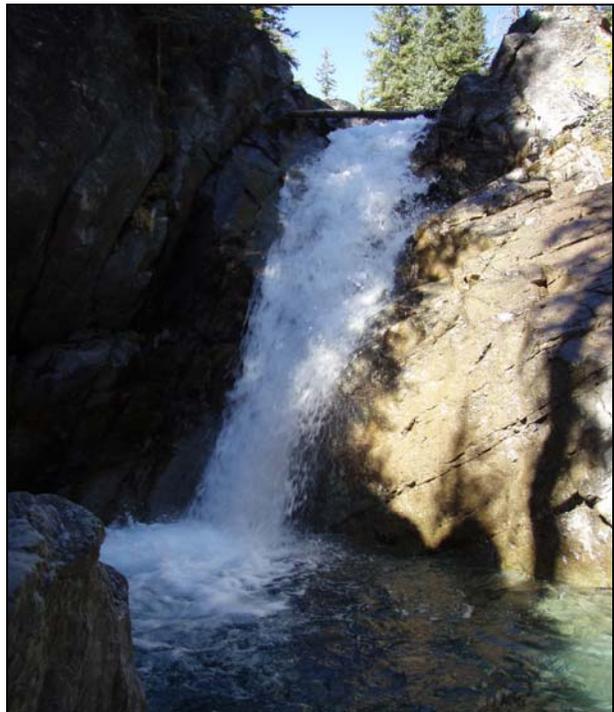
Upper Imnaha River, Reach: Gorge above Slide to Gorge just below Slide, 2008. Mac Huff in photo. (Photo courtesy of Jake Kimbro, ODFW).



Cliff Creek, Start of Survey at tributary junction at 2.5 miles Upstream from the mouth, 2008. Mac Huff in photo.



Cliff Creek waterfall, 0.5 miles from mouth, resident bull trout population above falls, 2008.



Middle Imnaha Falls, survey begins here and Surveyors work downstream to the N.F. Imnaha confluence.



Suzanne Anderson (USFWS) surveying at S.F. Imnaha River downstream of Soldier Creek, 2008



**APPENDIX B – TABLES**

**Table 1 – Bull Trout Spawning Surveys and Survey Frequencies for selected Grande Ronde River and Imnaha River Streams, 1999-2008**

<b>Stream</b>	<b>Year</b>	<b>Dates</b>	<b>Survey Frequency</b>	<b>Total Redds</b>	<b>Total Miles</b>	<b>Total Redds/Mile</b>
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	
Bear Creek	1999	9/7,9/22	Once Bear, Twice Goat	6	1.8	3.3
(including Goat Cr)	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
	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)	11.0	7.2	1.5
	2008	9/30, 10/7	Twice	20	3.2	6.3

**Table 1 (Continued)– Bull Trout Spawning Surveys and Survey Frequencies for Selected Grande Ronde River and Imnaha River Streams, 1999-2008**

<b>Stream</b>	<b>Year</b>	<b>Dates</b>	<b>Survey Frequency</b>	<b>Total Redds</b>	<b>Total Miles</b>	<b>Total Redds/Mile</b>
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	3.2
	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
	2003	9/25-26,9/29-30,10/1,10/8-9	Upper = Once, Middle = Twice	266	31.6	8.4
	2004	9/15-9/16,9-27,28,29,10/7-8	Upper = Once, Middle = Twice	293	31.5	9.3
Middle=Blue Hole to Indian	2005	9/26-28, 10/7	Once Upper and Middle	276	19.4	14.2
2005-2006	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

**Table 1 (Continued)– Bull Trout Spawning Surveys and Survey Frequencies for Selected Grande Ronde River and Imnaha River Streams, 1999-2007**

<b>Stream</b>	<b>Year</b>	<b>Dates</b>	<b>Survey Frequency</b>	<b>Total Redds</b>	<b>Total Miles</b>	<b>Total Redds/Mile</b>
Big Sheep	1999	9/21,29,30,10/18,19	Once	20	14.2	1.4
[(including Lick, and Salt).	2000	10/13-10/16	Once	12	8.4	1.4
	2001	10/14,10/17	Once	24	8.4	2.9
Salt Cr. not surveyed post 2003,	2002	9/30,10/1,10/14-15	Twice	41	9.3	4.4
and Upper Big	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
Sheep exploratory in 2004].	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

**Table 2a–Bull Trout Spawning Surveys for the Lostine River Comparing 1999 to 2008 Surveys**

Stream	Survey Years									
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
<b>Lostine</b>										
	<b>Redds Surveyed</b>									
<b>Reaches (miles surveyed)</b>										
Lundquist Bridge to OC Ranch (2.8)	1	0	2	3	3	5	0	5	4	5
Williamson to Walla Walla (2.2 miles)	0	2	1	0	6	1	3	0	2	13
Bowman to French Camp (1.6 miles)	18	19	16	11	18	3	9	9	5	12
French Camp to Shady Falls (1.5)	20	12.0	23	8	43	17	12	22	31	20
<b>Lostine Total Redds (Comparable Reaches)</b>	<b>39</b>	<b>33</b>	<b>42</b>	<b>22</b>	<b>70</b>	<b>26</b>	<b>24</b>	<b>36</b>	<b>42</b>	<b>50</b>
<b>Lostine Total Miles of Comparable Stream</b>	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
<b>Lostine Redds/Mile Comparable Stream</b>	<b>4.6</b>	<b>3.9</b>	<b>4.9</b>	<b>2.6</b>	<b>8.2</b>	<b>3.1</b>	<b>2.8</b>	<b>4.2</b>	<b>5.2</b>	<b>6.2</b>
<b>Total Redds For Year</b>	39	38.0	43.0	22.0	71.0	26.0	32.0	45	47	53
<b>Total Miles Surveyed For Year</b>	9.8	13.7	14.4	10.7	10.5	8.5	10.5	10.5	10.1	10.1
<b>Total Redds/Mile For Year</b>	4.0	2.8	3.0	2.1	6.8	3.1	3.0	4.3	4.6	5.2

Notes: The Lostine was surveyed three times in 1999 and 2000. During survey years 2001-2008, the Lostine was surveyed twice (except Shady Campground and Turkey Flat areas were surveyed three times in 2005, 2006, and 2008). 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 – 2008 Surveys**

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

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, 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 – 2008 Surveys**

Stream	Survey Years							
	2001	2002	2003	2004	2005	2006	2007	2008
<b>Imnaha River</b>	<b>Redds Surveyed</b>							
<b>Reaches (miles surveyed)</b>								
<b>South Fork Imnaha and tributaries:</b>								
Cliff Creek, mouth to 2.5 miles (2.5 miles)	96	22	57	65	61	17	93	52
South Fork Imnaha, NF to Soldier (1.5 miles)	6	7	14	12	44	9	30	6
South Fork Imnaha, Soldier to Cliff (3.1 miles)	33	18	37	29	55	26	37	15
<b>North Fork Imnaha:</b>								
North Fork, above Middle Fork (4.1 miles)	49	18	40	68	39	18	30	17
North Fork, below Middle Fork to mouth (2.1 miles)	2	8	15	9	21	6	7	5
Middle Fork, mouth to falls (0.8 miles)	12	0	12	6	24	7	17	8
<b>Imnaha River:</b>								
Imnaha River, NF to Falls (0.6 miles)	0	3	5	1	2	3	2	1
Imnaha River, Falls to lower falls (0.8 miles)	41	18	35	40	13	37	28	12
Imnaha River, Blue Hole to Indian Crossing (2.0 miles)	8	7	9	3	2	18	18	28
<b>Imnaha Total Redds (Comparable Reaches)</b>	<b>247</b>	<b>101</b>	<b>224</b>	<b>233</b>	<b>261</b>	<b>141</b>	<b>262</b>	<b>144</b>
<b>Imnaha Total Miles of Comparable Stream</b>	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
<b>Imnaha Redds/Mile Comparable Stream</b>	<b>14.1</b>	<b>5.8</b>	<b>12.8</b>	<b>13.3</b>	<b>14.9</b>	<b>8.1</b>	<b>15.0</b>	<b>8.23</b>
<b>Total Redds For Year</b>	269	103	293	286	276	186	284	184
<b>Total Miles Surveyed For Year</b>	19.4	18.3	42.8	41.2	19.4	19.4	19.4	19.4
<b>Total Redds/Mile For Year</b>	13.9	5.6	6.8	6.9	14.2	9.6	14.6	9.5

Notes:

All reaches except Blue Hole to Indian Crossing were surveyed once in 2001 to 2008.

The Blue Hole to Indian Crossing reach was surveyed twice, in mid September and October from 2001-2008, except in 2005 it was surveyed once.

**Table 2d – Bull Trout Spawning Surveys for Big Sheep Creek and Lick Creek, Comparing 2001 – 2008 Surveys**

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

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 2002-2008, except for Big Sheep which was surveyed once in 2004.



**Bull Trout Spawning Surveys  
For the Imnaha River, 2008  
USFWS, La Grande Field Office**

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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)
<b>Upper Imnaha System</b>														
<b>South Fork Tributaries</b>														
Cliff Cr., mouth to 3.6 km	23-Sep	4.0	2.5	2.0	50.0	52.0	13.0	20.8	7.0	0.0	7.0	0.0	0.0	
<b>South Fork Tributaries Total</b>		<b>4.0</b>	<b>2.5</b>	<b>2.0</b>	<b>50.0</b>	<b>52.0</b>	<b>13.0</b>	<b>20.8</b>	<b>7.0</b>	<b>0.0</b>	<b>7.0</b>	<b>0.0</b>	<b>0.0</b>	
<b>North Fork</b>														
Middle Fork., mouth to falls	23-Sep	1.3	0.8	0.0	8.0	8.0	6.2	9.9	0.0	0.0	0.0	0.0	0.0	
N. Fk., above M. Fk. (reach 3-7) 8.0	22-Sep	6.6	4.1	0.0	17.0	17.0	2.6	4.1	1.0	0.0	1.0	0.0	0.0	
N. Fk., below M. Fk. (reach 1-2)	23-Sep	3.4	2.1	0.0	5.0	5.0	1.5	2.4	1.0	0.0	1.0	0.0	0.0	
<b>North Fork Total</b>		<b>11.3</b>	<b>7.0</b>	<b>0.0</b>	<b>30.0</b>	<b>30.0</b>	<b>2.7</b>	<b>4.3</b>	<b>2.0</b>	<b>0.0</b>	<b>2.0</b>	<b>0.0</b>	<b>0.0</b>	
<b>South Fork</b>														
S. Fk., North Fork to Soldier Cr.	22-Sep	2.4	1.5	0.0	6.0	6.0	2.5	4.0	1.0	0.0	1.0	0.0	0.0	
S. Fk., Soldier to Cliff Cr.	23-Sep	5.0	3.1	2.0	13.0	15.0	3.0	4.8	2.0	2.0	0.0	0.0	0.0	
<b>South Fork Total</b>		<b>7.4</b>	<b>4.6</b>	<b>2.0</b>	<b>19.0</b>	<b>21.0</b>	<b>2.8</b>	<b>4.6</b>	<b>3.0</b>	<b>2.0</b>	<b>1.0</b>	<b>0.0</b>	<b>0.0</b>	
<b>Upper Imnaha</b>														
Upper Imnaha (Falls to North Fork)	24-Sep	1.0	0.6	0.0	1.0	1.0	1.0	1.6	0.0	0.0	0.0	0.0	0.0	
Upper Imnaha Falls to lower falls	24-Sep	1.3	0.8	0.0	12.0	12.0	9.2	14.9	2.0	0.0	0.0	1.0	1.0	
Falls downstream .67 mi. to beg. of gorge	24-Sep	1.1	0.7	0.0	36.0	36.0	32.7	52.7	0.0	0.0	0.0	0.0	0.0	
Lower end of gorge to next gorge (.25 mi)	24-Sep	0.4	0.2	1.0	7.0	8.0	20.0	32.2	1.0	0.0	1.0	0.0	0.0	
Canyon above slide to canyon just above slide	24-Sep	1.5	0.9	0.0	2.0	2.0	1.3	2.1	0.0	0.0	0.0	0.0	0.0	
<b>Upper Imnaha Total</b>		<b>5.3</b>	<b>3.3</b>	<b>1.0</b>	<b>58.0</b>	<b>59.0</b>	<b>11.1</b>	<b>17.9</b>	<b>3.0</b>	<b>0.0</b>	<b>1.0</b>	<b>1.0</b>	<b>1.0</b>	
<b>Upper Imnaha System Total</b>		<b>28.0</b>	<b>17.4</b>	<b>5.0</b>	<b>157.0</b>	<b>162.0</b>	<b>5.8</b>	<b>9.3</b>	<b>15.0</b>	<b>2.0</b>	<b>11.0</b>	<b>1.0</b>	<b>1.0</b>	
<b>Imnaha Basin Total (Page 2)</b>		<b>18.7</b>	<b>11.1</b>	<b>8.0</b>	<b>50.0</b>	<b>58.0</b>	<b>3.1</b>	<b>5.2</b>	<b>114.0</b>	<b>80.0</b>	<b>24.0</b>	<b>0.0</b>	<b>10.0</b>	
<b>Imnaha Basin Total Pages 1 &amp; 2)</b>		<b>46.7</b>	<b>28.5</b>	<b>13.0</b>	<b>207.0</b>	<b>220.0</b>	<b>4.7</b>	<b>7.7</b>	<b>129.0</b>	<b>82.0</b>	<b>35.0</b>	<b>1.0</b>	<b>11.0</b>	

Bull Trout Spawning Surveys  
For the Imnaha River, 2008  
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Imnaha Basin Stream Reach, Section	Date(s)	Kilometers Surveyed	Miles Surveyed	Redds					Total But obs	Bull Trout Observed (mm)			
				Occ	Unocc	Total	Per km	Per Mile		<6"(150mm)	<12" (~300mm)	<18"(450mm)	>18"(450mm)
<b>Middle Imnaha</b>													
Blue Hole to Indian Crossing	25-Sep	3.2	2.0	6.0	20.0	26.0	8.1	13.1	11.0	0.0	1.0	0.0	10.0
Blue Hole to Indian Crossing	6-Oct			0.0	2.0	2.0	0.6	1.0	0.0	0.0	0.0	0.0	0.0
<b>Middle Imnaha Total</b>		<b>3.2</b>	<b>2.0</b>	<b>6.0</b>	<b>22.0</b>	<b>28.0</b>	<b>8.8</b>	<b>14.1</b>	<b>11.0</b>	<b>0.0</b>	<b>1.0</b>	<b>0.0</b>	<b>10.0</b>
<b>Big Sheep System</b>													
M.F. Big Sheep, 1.0 mile Upstream Upper Stream Crossin	29-Sep	1.6	1.0	0.0	2.0	2.0	1.3	2.0	1.0	0.0	1.0	0.0	0.0
M.F. Big Sheep, 1.0 mile Upstream Upper Stream Crossin	10-Oct			0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0
Big Sheep, Canal to Rd. 39	29-Sep	3.1	1.9	1.0	2.0	3.0	1.0	1.6	9.0	3.0	6.0	0.0	0.0
Big Sheep, Canal to Rd. 39	10-Oct			0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0
Quartz Cr. Trib to Lick	1-Oct	1.6	1.0	0.0	6.0	6.0	3.8	6.0	0.0	0.0	0.0	0.0	0.0
Lick Cr. Meadow to 39 rd.	1-Oct	2.4	1.0	0.0	4.0	4.0	2.5	4.0	0.0	0.0	0.0	0.0	0.0
Lick Cr. 39 Rd. to Quartz Cr.	29-Sep	6.8	4.2	1.0	9.0	10.0	1.5	2.4	86.0	72.0	14.0	0.0	0.0
Lick Cr. 39 Rd. to Quartz Cr.	10-Oct			0.0	5.0	5.0	0.7	1.2	5.0	3.0	2.0	0.0	0.0
<b>Big Sheep System Total</b>		<b>15.5</b>	<b>9.6</b>	<b>2.0</b>	<b>28.0</b>	<b>30.0</b>	<b>1.9</b>	<b>3.1</b>	<b>103.0</b>	<b>80.0</b>	<b>23.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Imnaha Basin Total (Page 1)</b>													
		<b>28.0</b>	<b>17.4</b>	<b>5.0</b>	<b>157.0</b>	<b>162.0</b>	<b>5.8</b>	<b>9.3</b>	<b>15.0</b>	<b>2.0</b>	<b>11.0</b>	<b>1.0</b>	<b>1.0</b>
<b>Imnaha Basin Total (Page 2)</b>													
		<b>18.7</b>	<b>11.1</b>	<b>8.0</b>	<b>50.0</b>	<b>58.0</b>	<b>3.1</b>	<b>5.2</b>	<b>114.0</b>	<b>80.0</b>	<b>24.0</b>	<b>0.0</b>	<b>10.0</b>
<b>Imnaha Basin Total Pages 1 &amp; 2)</b>													
		<b>46.7</b>	<b>28.5</b>	<b>13.0</b>	<b>207.0</b>	<b>220.0</b>	<b>4.7</b>	<b>7.7</b>	<b>129.0</b>	<b>82.0</b>	<b>35.0</b>	<b>1.0</b>	<b>11.0</b>

**Bull Trout Spawning Surveys  
For Some Grande Ronde Tributaries, 2008  
USFWS, La Grande Field Office**

Grande Ronde 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)
<b>Bear Creek</b>														
Goat Cr (Mouth to Falls)	30-Sep	1.4	0.9	0.0	4.0	4.0	2.8	4.4	8.0	5.0	3.0	0.0	0.0	
Goat Cr (Mouth to Falls)	7-Oct			0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	
Bear Creek (Standley Trail to USFS Cabin)	30-Sep	1.4	0.9	0.0	7.0	7.0	4.8	7.8	14.0	0.0	12.0	2.0	0.0	
Bear Creek (Standley Trail to USFS Cabin)	7-Oct			0.0	3.0	3.0	2.1	2.3	3.0	0.0	3.0	0.0	0.0	
Bear Creek (USFS Cabin to Goat Creek)	30-Sep	0.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Bear Creek (USFS Cabin to Goat Creek)	7-Oct			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Bear Creek (Goat Creek to Wilderness Boundary)	30-Sep	1.4	0.9	0.0	1.0	1.0	0.7	1.1	2.0	1.0	0.0	1.0	0.0	
Bear Creek (Goat Creek to Wilderness Boundary)	7-Oct			0.0	5.0	5.0	3.5	3.8	0.0	0.0	0.0	0.0	0.0	
<b>Bear Creek Totals</b>		<b>5.1</b>	<b>3.2</b>	<b>0.0</b>	<b>20.0</b>	<b>20.0</b>	<b>3.9</b>	<b>6.3</b>	<b>29.0</b>	<b>6.0</b>	<b>20.0</b>	<b>3.0</b>	<b>0.0</b>	
<b>Lostine River</b>														
Lundquist Bridge to OC Ranch	10/1,10/2	4.4	2.8	0.0	5.0	5.0	1.1	1.8	3.0	0.0	0.0	1.0	2.0	
Lundquist Bridge to OC Ranch	10-Oct			0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	6.0	
Pole Bridge to 6 Mile Bridge	1-Oct	3.2	2.0	0.0	3.0	3.0	0.9	1.5	2.0	1.0	1.0	0.0	0.0	
Pole Bridge to 6 Mile Bridge	10-Oct			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Williamson to Walla Walla	2-Oct	3.5	2.2	0.0	3.0	3.0	0.8	1.4	0.0	0.0	0.0	0.0	0.0	
Williamson to Walla Walla	10-Oct			0.0	10.0	10.0	2.8	4.5	0.0	0.0	0.0	0.0	0.0	
Mini Turkey Flat	17-Sep			0.0	2.0	2.0			0.0	0.0	0.0	0.0	0.0	
Bowman to French Camp	1-Oct	2.6	1.6	0.0	6.0	6.0	2.3	3.8	11.0	6.0	3.0	1.0	1.0	
Bowman to French Camp	9-Oct			0.0	4.0	4.0	1.6	1.0	0.0	0.0	0.0	0.0	0.0	
Mini Shady Campground	17-Sep			0.0	4.0	4.0			8.0	3.0	4.0	1.0	0.0	
French Camp to Shady Falls	1-Oct	2.4	1.5	0.0	9.0	9.0	3.7	6.0	12.0	3.0	5.0	3.0	1.0	
French Camp to Shady Falls	9-Oct			0.0	7.0	7.0	2.9	1.9	3.0	0.0	1.0	2.0	0.0	
<b>Lostine River Total</b>		<b>16.2</b>	<b>10.1</b>	<b>0.0</b>	<b>53.0</b>	<b>53.0</b>	<b>3.3</b>	<b>5.3</b>	<b>45.0</b>	<b>13.0</b>	<b>14.0</b>	<b>8.0</b>	<b>10.0</b>	
<b>Grande Ronde Basin Total</b>														



**Table 4a –  
Summary of Measured Bull Trout Redds, Grande Ronde River Basin  
Lostine River, Bear Creek, and Goat Creek 2008**

Stream	n*		Length (M)	Width (M)	Area (m2)	Length/Width ratio
Lostine	53	mean	1.2	0.8	1.0	1.6
		sd	0.5	0.3	0.8	0.5
		max	2.6	1.7	3.6	3.6
		min	0.3	0.3	0.1	0.7
Bear	16	mean	1.0	0.7	0.7	1.6
		sd	0.4	0.2	0.4	0.6
		max	1.8	1	1.4	3
		min	0.5	0.3	0.2	0.8

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

**Table 4b – Summary of Measured Bull Trout Redds, Imnaha River Basin 2008**

Stream	n*		Length (M)	Width (M)	Area (m2)	Length/Width ratio
Lick Creek	25	mean	0.6	0.4	0.3	1.8
		sd	0.4	0.3	0.5	0.7
		max	2.1	1.3	2.7	3.7
		min	0.2	0.1	0.0	0.7
Big Sheep Creek	5	mean	0.8	0.4	0.4	1.8
		sd	0.3	0.2	0.3	0.6
		max	1.2	0.8	0.9	2.7
		min	0.3	0.3	0.1	1.1
Middle Imnaha	28	mean	2.0	1.3	2.6	1.6
		sd	0.3	0.3	0.8	0.4
		max	2.3	2.0	4.0	2.3
		min	1.0	0.7	0.6	1
Upper Imnaha	59	mean	1.4	0.7	1.2	1.9
		sd	0.7	0.3	1.1	0.5
		max	3.7	1.8	6.5	3.2
		min	0.3	0.2	0.0	0.8
N.F. Imnaha	30	sd	0.6	0.3	0.3	2.1
		max	0.4	0.1	0.3	0.5
		min	2.0	0.7	1.2	3.2
		min	0.2	0.1	0.0	1.2
S.F. Imnaha	21	mean	1.4	0.7	1.1	2.0
		sd	0.6	0.3	1.2	0.6
		max	3.2	1.9	6.0	3.2
		min	0.6	0.3	0.2	1.2
Cliff Creek	32**	mean	0.7	0.5	0.4	1.6
		sd	0.2	0.2	0.2	0.5
		max	1.2	0.9	0.8	2.8
		min	0.3	0.3	0.1	0.8

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

\*\* Cliff Creek had 32 redds measured out of 52 total redds documented. 31 redds were resident (above the falls) and 1 was measured below the falls.