

2005 Bull Trout Spawning Surveys Report For selected Grande Ronde and Imnaha River Streams

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

The 2005 Bull Trout Spawning Surveys Report for selected Grande Ronde and Imnaha River Streams summarizes 2005 bull trout redd count data and compares this with past years data. Bull trout redd counts have been conducted annually on the Wallowa-Whitman National Forest (Forest) and along some sections of private property of the Lostine River by the Fish and Wildlife Service (Service), Oregon Department of Fish and Wildlife (ODFW), the Forest, Nez Perce Tribe (NPT), contractors, and volunteers for the past six to seven years. Objectives of the survey included; locate bull trout spawning areas, determine redd characteristics, determine bull trout timing of spawning, collect spawning density data, and over time, use this data to assess local bull trout population trends and the long-term recovery of bull trout. Objectives of the 2005 survey included the above objectives, and in addition, identification of the locations of the 2005 bull trout spawning reaches on maps, and the collection of UTM coordinate data on the spatial distribution of the 2005 bull trout redds observed along the Lostine River. Spawning surveys for bull trout required as many as 10-12 people in one day. Surveyors walked the rivers through the selected "index areas" to locate the bull trout redds. The survey protocol (in addition to repeat surveys, or one-time late surveys where feasible) included; visit to known bull trout redd and review of survey form prior to redd count survey, experienced bull trout redd count surveyor(s) paired with an inexperienced surveyor, bull trout redds measured, data recorded, redds flagged during survey, and all stream flagging removed post-surveys. Bull trout timing of spawning for surveyed streams in general was approximately September 15 through October 15, and as early as August 15 in the Imnaha River system. Thirty-two total bull trout redds for 10.5 miles of survey (including Pole Bridge to Six Mile Bridge) were documented in 2005 on the Lostine River. Sixteen total bull trout redds for 2.8 miles of survey were documented in 2005 on Bear Creek (including Goat Creek). Two hundred and seventy six total bull trout redds for 19.4 miles of survey were documented in 2005 on the Imnaha River. Sixteen total bull trout redds for 8.6 miles of survey were documented in 2005 on Big Sheep Creek and Lick Creek. Future needs include continued funding and support from all involved parties for conducting and reporting bull trout redd counts.

ACKNOWLEDGMENTS

The Service has, for the past two 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 for this project.

This project would not have been possible without the dedication, hard work, funding, and assistance provided by all the partners. The WMO provided an invaluable service in 2005, providing a horse/mule packer to pack surveyors in and out of the Upper Imnaha to conduct the annual spawning survey in that drainage. We had contracted this service in the past, and this year, with limited funding, the WMO provided this important service.

I would like to thank the partners in 2005 which included; the WMO, ODFW, NPT, and Anderson Perry and Associates (Anderson Perry). Special thanks to the people who walked the streams, helped with scheduling surveys and surveyors, provided access to private property, assisted in Arc-mapping, or summarized the data. These included: Gary Miller, Paul Sankovich, Brad Smith, Ken Bronec, Peter Cleary, Gretchen Sausen, Marisa Meyer, Keith Paul, Everett Leach, Jeff Nehls, Max Hoffman, Maria Shepherd, Cindy Sloan, Rick Christian, Andrew McClay, Jeff Yanke, Ian Wilson, Jake Kimbro, and Shivonne Nesbit.

INTRODUCTION

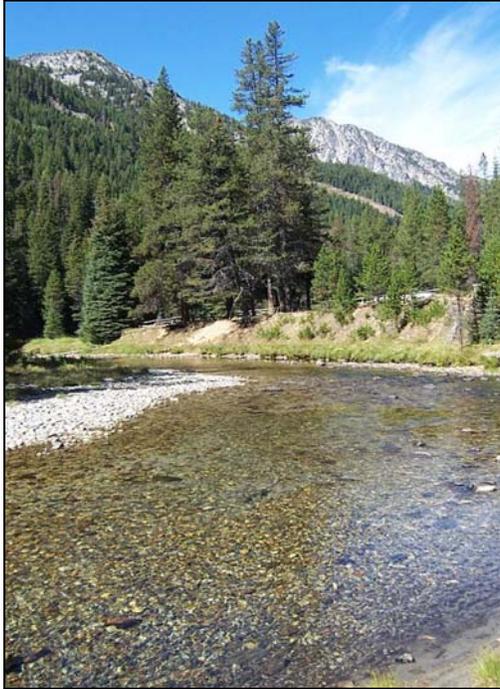
Bull Trout redd counts (spawning surveys) have been conducted annually on the Wallowa Valley, Hells Canyon National Recreation Areas (HCNRA), and Eagle Cap districts of the Forest and along some sections of private property of the Lostine River by the Service, ODFW, the Forest, NPT, contractors, and volunteers for the past six to seven years.

Objectives of the survey include; 1) to locate bull trout spawning areas, 2) to determine redd characteristics, 3) determine bull trout timing of spawning, 3) collect spawning density data, 4) overtime (≥ 15 years) use this data to access population trends for local bull trout, and 5) use this information for the long-term recovery of bull trout.

Objectives of the 2005 survey included the above objectives and 6) identify on maps the location of the 2005 bull trout spawning reaches, and 7) collect UTM coordinate data on the spatial distribution of the 2005 bull trout redds observed along the Lostine River.

LOCATION

The Service and several partners conducted bull trout spawning surveys in 2005 on selected streams in the Grande Ronde and Imnaha Sub-Basins. Stream systems surveyed in 2005 for bull trout redds included; the Lostine River, Bear and Goat Creeks, the Imnaha River, Big Sheep Creek and Lick Creek. Refer to the attached maps for reaches of these streams surveyed. (Appendix A).



Downstream view of the Lostine River near Turkey Flat. Bull trout spawning area.



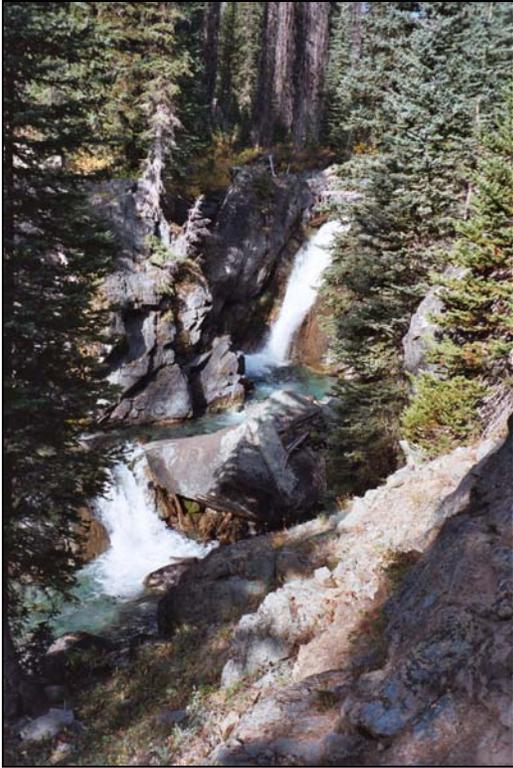
Upstream view of Bull Trout Spawning Survey on the Lostine near Turkey Flat, 2005.



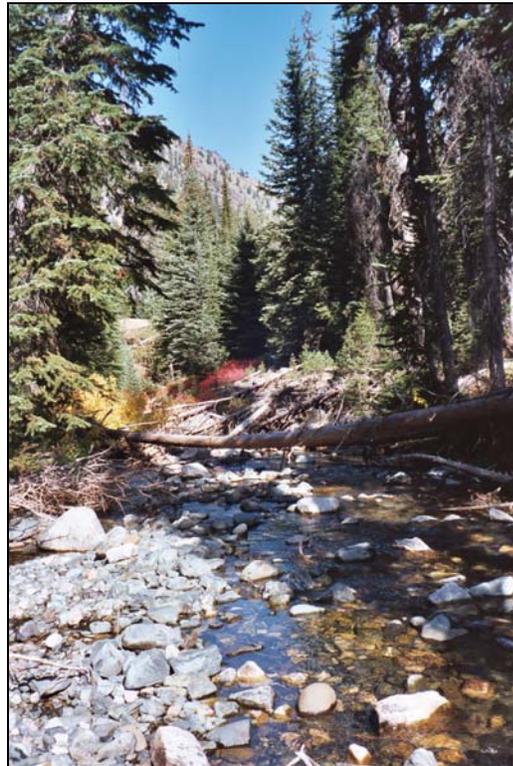
North Fork Imnaha River, 2005 Bull Trout Spawning Survey Area.



North Fork Imnaha River, 2005 Bull Trout Spawning Survey, showing steep cutbank.



Cliff Creek waterfalls, resident bull trout population above falls



Cliff Creek bull trout spawning habitat

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 at the same time each year (September – October). Due to the lack of available experienced surveyors to conduct these river surveys, each year, 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), rather than one day. Surveys were conducted twice (mid and late bull trout spawning season) on the Lostine River, Big Sheep Creek, and Lick Creek. One-time surveys were conducted late in the spawning season in 2005 on the Middle Imnaha (Blue Hole to Indian Crossing), Upper Imnaha River and tributaries, and Bear and Goat Creeks, due to access and funding limitations. Refer to Appendix B, Table 1 comparing survey data and survey frequency for 1999-2005 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 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.

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 2005, in addition to the above, bull trout redd UTM locations on the Lostine River within the “index areas” also were documented.



Bull Trout Spawning Survey on the Lostine River
Downstream of Shady Campground in 2005.

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

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 2005. From 1999 to 2005, bull trout spawning areas were established (in particular, the Lostine and Imnaha Rivers) for these streams. Redd characteristics also were measured on these streams. The Middle Imnaha (Imnaha River from the fish weir below Gumboot confluence to Indian Crossing) was not surveyed in 2005, (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 in 2005 because of limited funding, a lack of experienced surveyors and a minimal number of redds documented in this area in past years.



1999-2005 Cooperative multi-agency effort surveying and measuring bull trout redds on the Lostine River.



Bull Trout Spawning Trio on redd, Lostine River

Timing of Bull Trout Spawning

Bull trout timing of spawning for our surveyed streams in general was approximately September 15 through October 15, and as early as August 15 in the Imnaha River system. Lostine has been very consistent or predictable (with commencement of spawning typically September 15), and Imnaha (being a much larger system) has been less predictable. This is based on information documented during bull trout spawning surveys and Chinook surveys where bull trout were documented 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]). We have questions as to what time of the year, dependent on annual flows,

bull trout pass over the falls. In some years fluvial size bull trout spawning has been documented in the South Fork Imnaha in mid-late Sept/early October but in recent years it has not. ODFW observed large fluvial bull trout spawning in South Fork Imnaha in mid August 2005 (B.Knox, ODFW, pers.comm, 2005). ODFW 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 collection are necessary 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 2005. Thirty-two total bull trout redds for 10.5 miles of survey (including Pole Bridge to Six Mile Bridge) were documented in 2005 on the Lostine River. Pole Bridge to Six Mile Bridge section has not been surveyed every year. Figure 1 compares 8.5 miles of consistently surveyed index areas on the Lostine from 1999 to 2005, excluding Pole Bridge to Six Mile Section. The Lostine River had a low of 22 redds in 2002 to a high of 70 redds in 2003, and back to a low of 24 redds in 2005. The seven year average from 1999 to 2005 for the Lostine River is 37 redds. Redds in 2003 for the Lostine River totaled 70, which is almost double the 7-year average. Total redd numbers (in the 8.5 miles of comparable index areas) on the Lostine ranged from 22-70 redds within the 7- year period (not consecutively). 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].

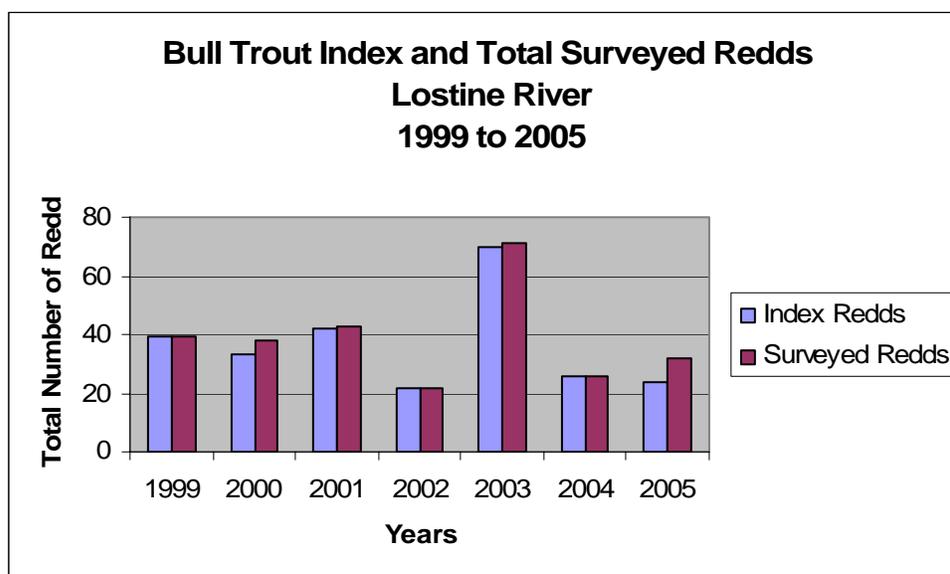


Figure 1. Comparison of bull trout surveyed redds and index redds (comparable miles) documented from 1999 to 2005 on the Lostine River.

Innaha River

Two hundred and seventy six total bull trout redds for 19.4 miles of survey were documented in 2005 on the Innaha River (from Indian Crossing to Blue Hole and upstream). These areas were only surveyed once in 2005, mid to late spawning season. Figure 2 compares 17.5 miles of consistently surveyed index areas on the Innaha from 2001 to 2005. The Innaha River surveys included from the bridge at Indian Crossing Campground (RM 67 to approximately 11 miles upstream to Cliff Creek confluence on the S.F. Innaha at RM 78 and included significant bull trout tributary streams (Refer to Appendix A). Redd counts on the Innaha River system had increased from 101 redds in 2002 to 261 redds in 2005. The five-year average from 2001 to 2005 was 213 redds for the Innaha River system. Total redd numbers on the Innaha ranged from 101-261 within the 5-year period. The highest bull trout redd counts for the Innaha River from 2001 to 2005 was recorded in the Upper Innaha from Blue Hole to Cliff Creek, including Upper Innaha tributaries.

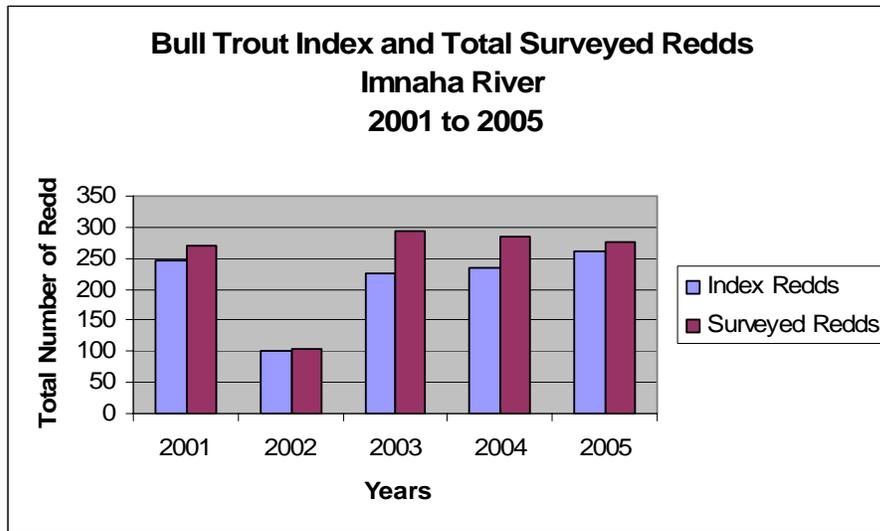


Figure 2. Comparison of bull trout surveyed redds and index redds (comparable miles) documented from 2001 to 2005 on the Innaha River.

Big Sheep Creek

Sixteen total bull trout redds for 8.6 miles of survey were documented in 2005 on Big Sheep Creek and Lick Creek. These areas were surveyed twice in 2005, mid to late spawning season. Figure 3 compares 7.6 miles of consistently surveyed index areas on Big Sheep and Lick Creeks from 2000 to 2005. Redd counts on the Big Sheep system had decreased from 34 redds in 2002 to 9 total redds in 2005. The six-year average from 2000 to 2005 was 15 for the Big Sheep system. Total redd numbers within the Big Sheep system ranged from 8-34 within the 6-year 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 2005) and in frequency, (the 2000-2001 survey was conducted once late season, and in 2002-2003, 2005 survey was 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.

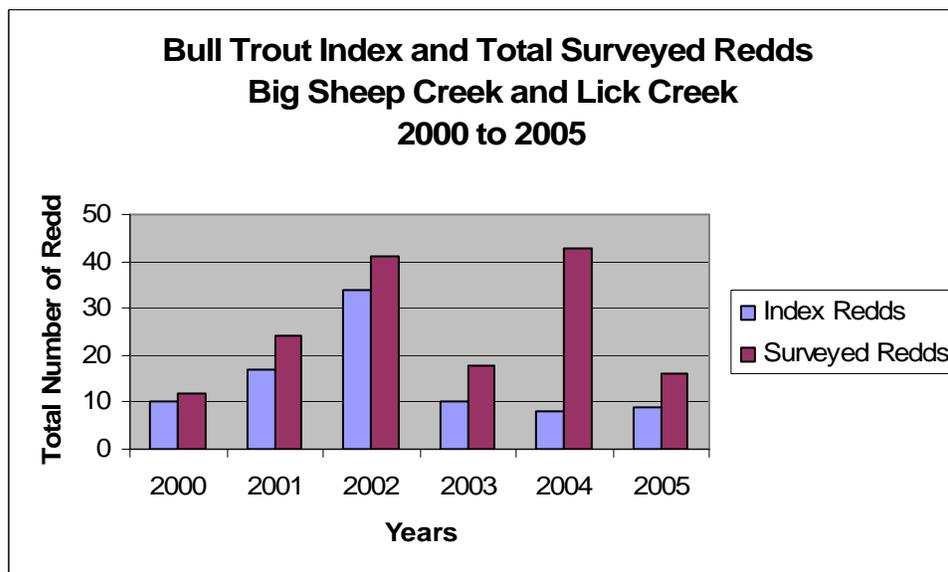


Figure 3. Comparison of bull trout surveyed redds and index redds (comparable miles) documented from 2000 to 2005 on Big Sheep and Lick Creeks.

Bear Creek

Sixteen total bull trout redds for 2.8 miles of survey were documented in 2005 on Bear Creek (including Goat Creek). These areas were surveyed once in 2005, late spawning season. Figure 2 compares 1.9 miles of consistently surveyed index areas on Bear and Goat Creeks from 1999 to 2005. Redd counts on the Bear Creek and Goat Creeks had a low of 5 redds in 2000 to a high of 11-12 total redds in 2001, 2003, 2004, and 2005. The seven-year average from 1999 to 2005 is 9 for the Bear and Goat Creeks. Total redd numbers within Bear system ranged from 5-12 within the seven-year period. Bear Creek/Goat Creek spawning data collected from 1999 to 2005 is restricted in scope due to access and funding limitations. 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).

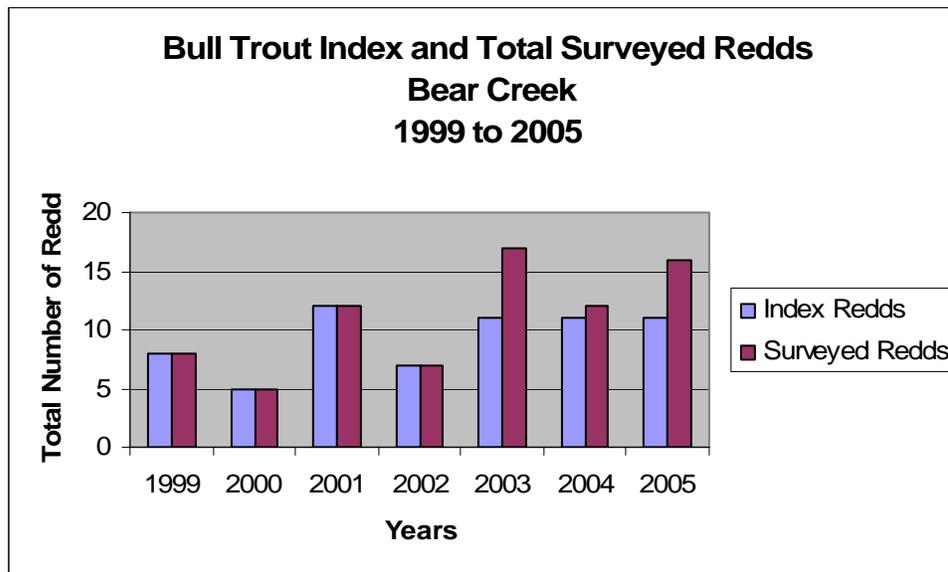


Figure 4. Comparison of bull trout surveyed redds and index redds (comparable miles) documented from 1999 to 2005 on Bear Creek (including Goat Creek).

Sizes of Bull Trout Redds

Bull trout redds were measured using the same methodology in 2004 and 2005 and comparison of bull trout redd sizes, mean redd area (m^2) for these years is illustrated in Figures 5 and 6 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). A redd made by a female fluvial bull trout (fluvial redd) will be much larger than a redd made by a female resident bull trout (resident redd). 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).

Figure 5 compares bull trout redd sizes for the Lostine River, Bear Creek, and Goat Creek in 2004 and 2005. Mean redd area (m^2) in 2004 and 2005 ranged from 1-1.3 for the Lostine, 0.5-0.6 for Goat Creek, and 0.2-0.2 for Bear Creek. The Bear Creek sample area may not represent the entire Bear Creek spawning habitat (limited miles of Bear Creek were surveyed in a location near Goat Creek). Brook trout are thought to be abundant in Bear Creek (due to historical stocking in the headwater lakes). From analysis of the data illustrated in Figure 5, Bear Creek bull trout redds appeared to be resident redds and there could be overlap with brook trout, although this has not been verified. The Lostine River contains brook trout, but for most survey years, we have not observed brook trout spawning with bull trout, nor have we observed brook trout spawning. In the future, we will have genetics data for the Lostine, which will help determine to what magnitude that hybridization of brook trout and bull trout has occurred to date in this system. Currently, genetic sampling of bull trout/brook trout to help determine degree of hybridization has not occurred on Bear Creek. Goat Creek was limited in available spawning habitat. It appears from the data in 2004 and 2005, that the redds 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). Few bull trout were observed during the Bear and Goat Creek surveys due to being a one time late survey in October. 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 these fish were determined to be resident. 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.

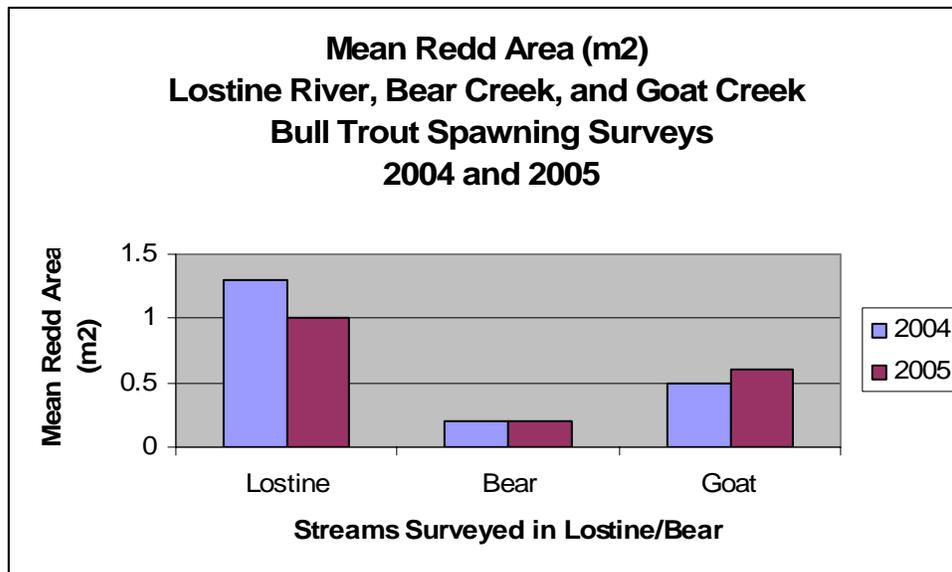


Figure 5. Comparison of bull trout redd sizes [mean redd area (m^2)] for Lostine River, Bear, and Goat Creeks sampled during bull trout spawning surveys, 2004 and 2005.

Imnaha and Big Sheep

Figure 6 compares bull trout redd sizes for the sampled streams in the Imnaha system in 2004 and 2005. Mean redd area (m^2) in 2004 and 2005 ranged from 0.3-0.8 for Lick Creek, 0.1-0.1 for Big Sheep, 1.6-1.8 for Upper Imnaha, 0.3-1.2 for N.F. Imnaha, 0.9-1.1 for S.F. Imnaha, and 0.1-0.3 for Cliff Creek. Middle Imnaha was not compared due to limited sample size in 2005. Cliff Creek is a known resident system due to an impassable 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 redd size was higher than in 2005 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. Several redds observed in 2005 were identified by the bull trout surveyors as extremely large redds and noted as Chinook redds, but later, were not included in the Chinook count due to ODFW's lack of confidence that these redds were actually Chinook redds (F.Monzyk, ODFW, pers. comm., 2005; and B.Knox, pers. comm.). Lick Creek data in 2004 appeared to be a combination of resident and fluvial redds and Big Sheep was resident redds for both years, Upper Imnaha and S.F. Imnaha contained a majority of fluvial redds, N.F. Imnaha appears to have had more resident redds in 2004 and more fluvial size redds in 2005, and Cliff Creek is a known resident system with an average redd size of $0.1 m^2$ in 2005. Mean redd size was greater, a size of $0.3 m^2$ in 2004 as a result of a fluvial redd near the mouth and potential superimposition of redds above the barrier. Refer to Tables 4a and 4b for additional information on 2005 bull trout redd characteristics.

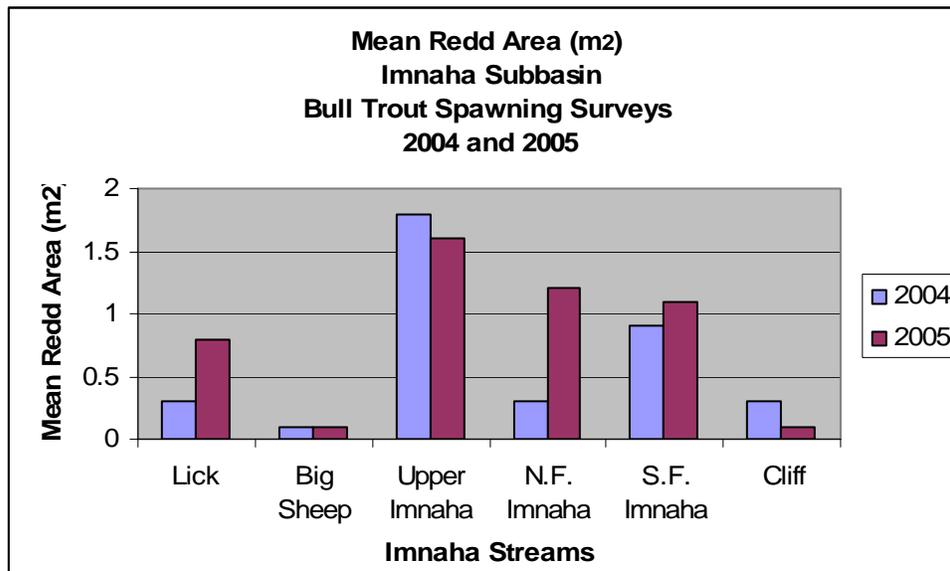


Figure 6. Comparison of bull trout redd sizes [mean redd area (m^2)] for sampled streams in the Imnaha Subbasin, 2004 and 2005.

DISCUSSION

Continued funding and cooperative support is necessary for conducting bull trout redd counts in the future. At least 15 years (consecutive years) of bull trout redd data are necessary for adequate 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 we have a complete 15 years of data.

Dunham et al. 2001 mention several causes for error when conducting redd counts including; 1) observer variability in counting total redds, 2) variation in redd and habitat characteristics, and 3) incomplete sampling of spawning areas in time and space. They suggest that final redd counts be conducted in the later half of October to include most of the spawning activity, but not too late due to higher stream flows and snow accumulation. They also recommend multiple (or repeat) surveys be conducted throughout the spawning season, and state that the practice of counting redds once at the end of the spawning season may lead to errors, due to difficulty in recognition of the redds due to age. The report states that experienced surveyors also are important. Their results indicated a need to improve the reliability of redd counts. They do admit that redd counts have been the least invasive and least expensive technique for monitoring bull trout populations, but that redd counts need to be further evaluated.

Our sampling protocol, as mentioned earlier, included pairing experienced with inexperienced bull trout redd count surveyors. The experienced surveyors were typically familiar with the areas surveyed and therefore, were familiar with variation in redds due to habitat differences in each system. Most of the systems, especially Lostine and Imnaha, have been sampled at least twice (where feasible). The Big Sheep system was sampled twice in 2002-2005 (except for Big Sheep which was sampled once late season in 2004) and Bear/Goat was sampled only once at the end of spawning season (late October) due to access, funding, and therefore, lesser priority placed upon this watershed. Bear Creek bull trout spawning data is limited in its application due to potential errors from a one-count survey and there are many miles that are not being surveyed on Bear Creek (as mentioned previously). The one time survey on Goat is still better than none, as it should give some density data that should be comparable over time, but probably slightly underestimating the true adult escapement in that system. More time should be spent in this system (dependent on funding) to help determine timing of spawning, location of spawning, and a larger survey effort to determine numbers of redds. Additional genetic data also is necessary to assess the bull trout/brook trout degree of hybridization in the system.

Surveys in the Lostine should be adequate related to the time and space issue [Lostine bull trout appear to prefer the headwaters to spawn, and for the past seven years have spawned in the same general areas on a predictable fashion (especially in their timing and selection of areas to spawn within, dependent on stream flows and gravel availability)]. Experienced surveyors were paired with inexperienced surveyors for the Lostine. Inexperienced surveyors have been shown both redds in progress and post-completion. To improve actual surveying during spawning we may want to survey 1-3 times, and if only 2 times, include an early one (week of Sept 15) to take advantage of adult spawning bull trout presence in the spawning area, helping train surveyors in understanding redd progress and follow-up with a late survey to get the complete redd number. In 2005 we surveyed an extra day, early in the season, in short sections of the upper reaches of the Lostine and were able to see redds being formed and bull trout occupying redds. This should occur for future years.

The Upper Imnaha appears to be where the large fluvial size fish hold and spawn during spawning season (Sept 15-October 15 and as early as August 15, in some years). We have conducted our surveys in this area (upstream of the Blue Hole) in early October, conducting a one-time survey. We have conducted a one-time survey in Upper Imnaha due to remote access and limited funding. The timing of survey (prior to end of October) is due to weather (surveyors are camping in late fall), availability of experienced surveyors, ease of identification of redds, and estimated timing of spawning. This may mean that some late spawners are missed. In the future, if it is possible to survey twice in this Upper Imnaha section (both feasible to find experienced surveyors and funding for 2 pack trips) I would recommend it to get a more accurate redd count and understand the timing of spawning in Upper Imnaha. At a minimum, it would be worthwhile to have someone check for timing of fish movement over the falls, and timing of spawning in the Upper Imnaha system. ODFW has agreed in the future to flag Chinook redds in the Upper Imnaha and note any spawning bull trout fish and or redds, to accurately identify between Chinook and bull trout redds and further document timing of bull trout spawning (B.Knox, and B.Smith, ODFW, pers. comm., 2005).



Imnaha bull trout observed during spawning survey

We have surveyed Big Sheep and Bear Creek systems from 1999 to 2005, on a limited scale (both time and space) to have some data for this area. In the future, partners need to discuss if it is desirable to continue to conduct these surveys (dependent on funding) or if instead we put our efforts to additional surveys for the Imnaha and Lostine systems.

In 2006, dependent on funding, we would like to conduct a study on the Lostine River, Big Sheep, and Lick Creeks to determine experienced surveyor error in redd counts and determine a sampling error to derive more accurate estimates of, and confidence intervals for, redd counts. An experienced bull trout surveyor would conduct bull trout redd counts on these streams several times during the spawning season and this data would be compared with other experienced surveyors data (from two sample times). UTM data was collected on the Lostine in 2005, which is in our database and could be compared to 2006 data. In addition, a proposed spring/summer Chinook salmon hatchery may be built and operated on the Lostine River near the 6-mile bridge. Future bull trout surveys on this system may answer the question as to what effects the hatchery and associated

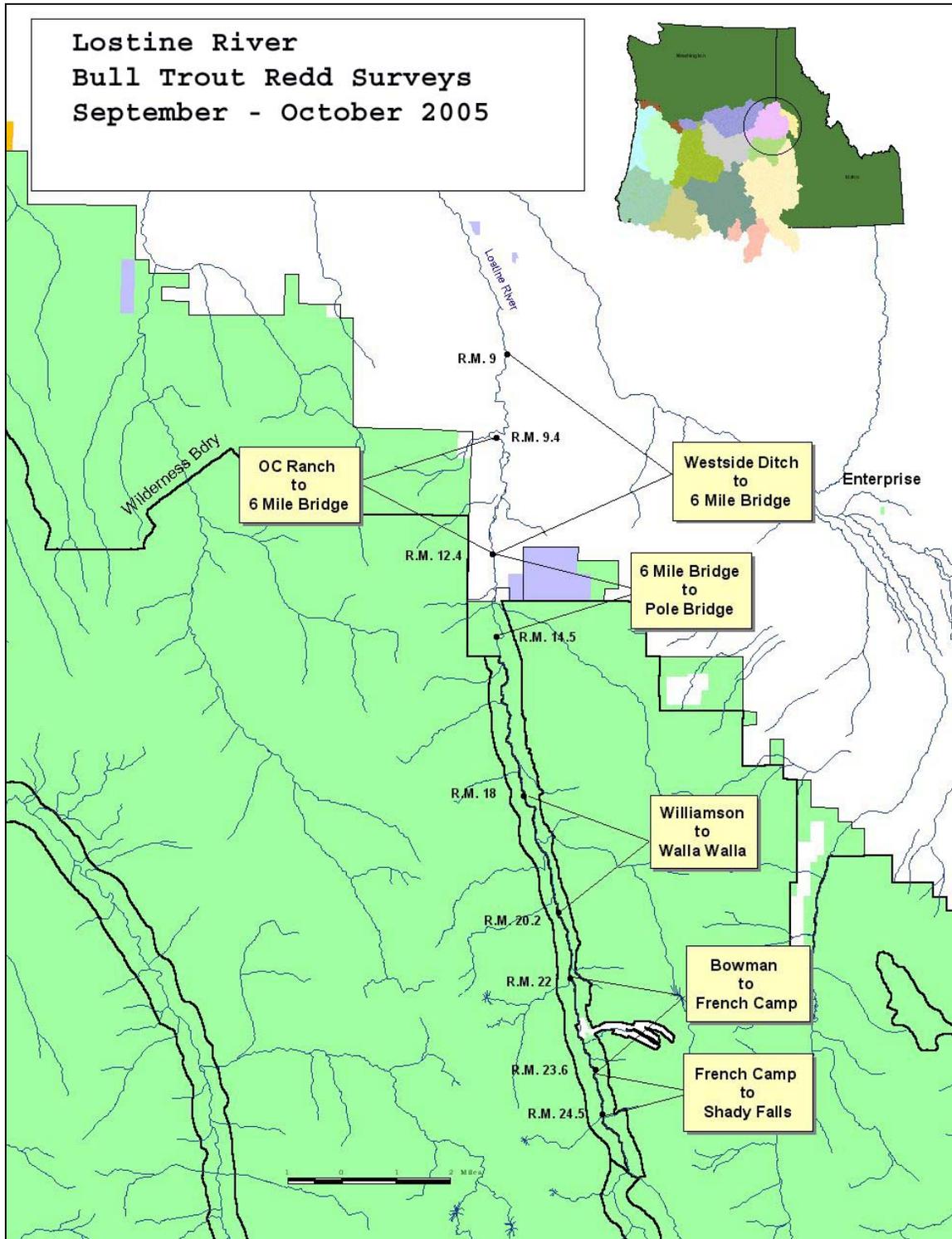
activities (such as weirs and water removal) have on bull trout fish passage, timing of spawning, location of spawning, and density of spawning pre and post-operations.

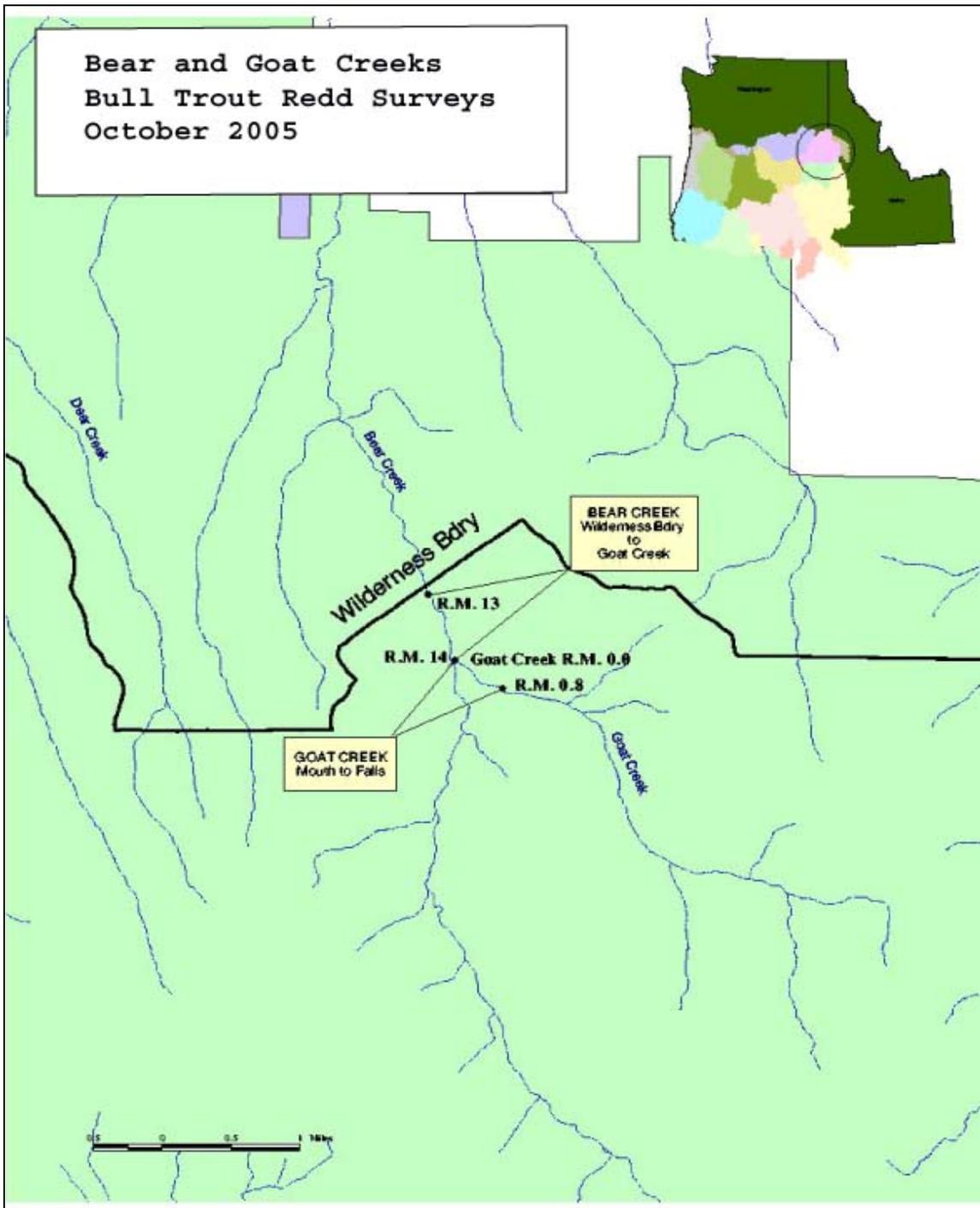
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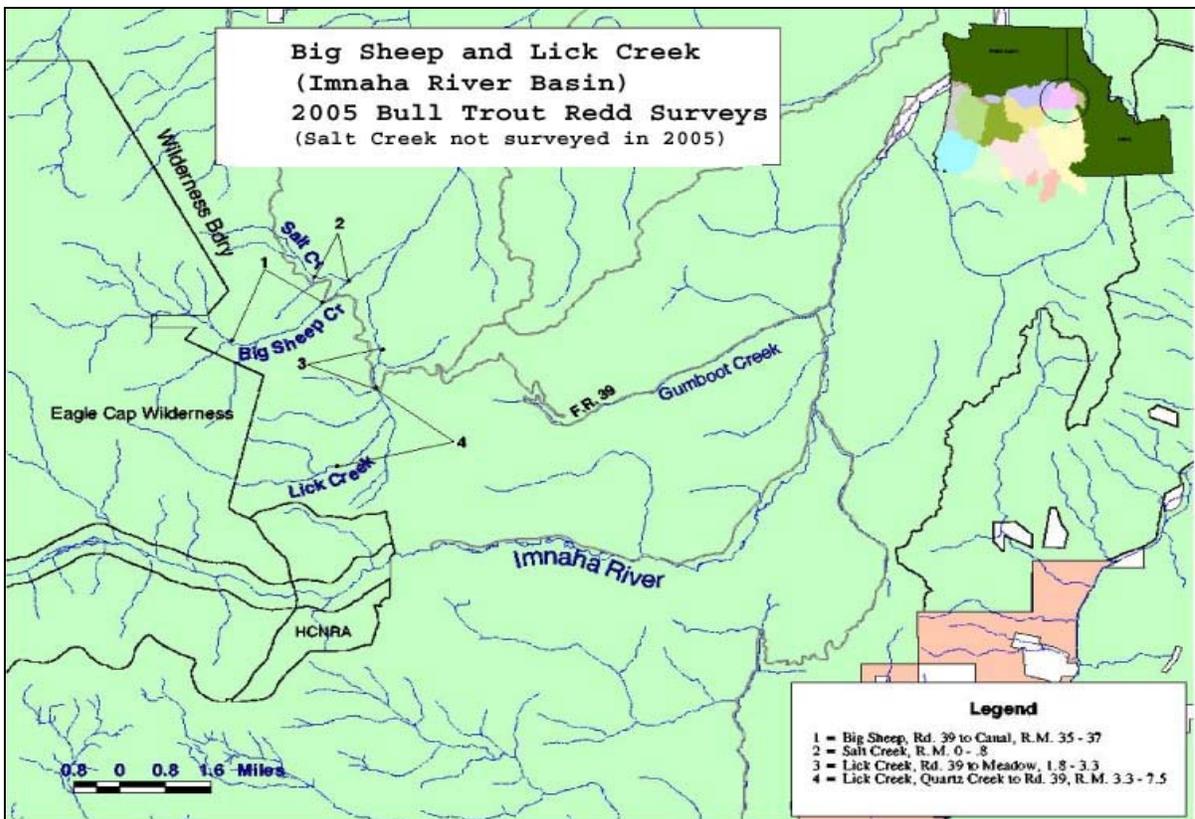
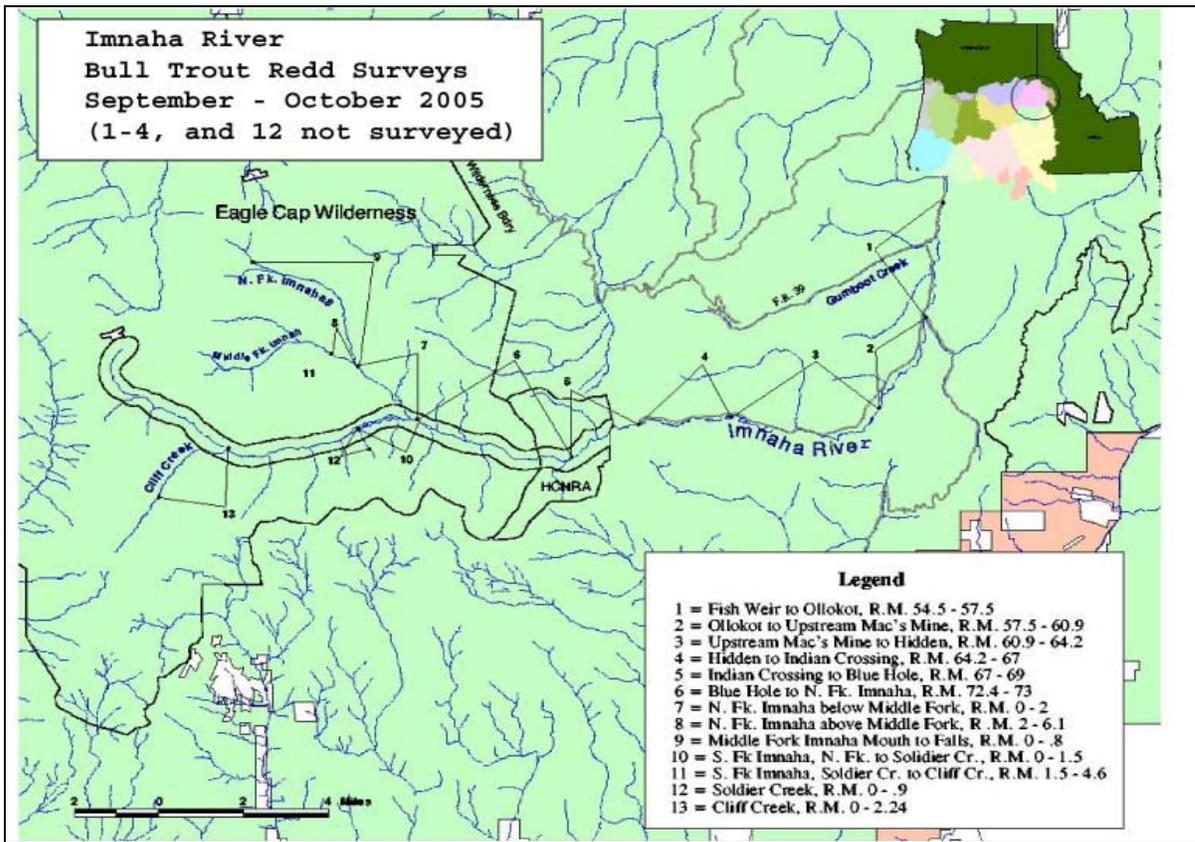
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APPENDIX A – MAPS







APPENDIX B – TABLES

Table 1 – Bull Trout Spawning Surveys and Survey Frequencies for selected Grande Ronde River and Imnaha River Streams, 1999-2005

Stream	Year	Dates	Survey	Total	Total	Total
			Frequency	Redds	Miles	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
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
	2004	10/1	Once	11	2.3	4.8
2005	10/11	Once	16	2.8	5.7	

Table 1 (Continued)– Bull Trout Spawning Surveys and Survey Frequencies for selected Grande Ronde River and Imnaha River Streams, 1999-2005

Stream	Year	Dates	Survey Frequency	Total Redds	Total Miles	Total Redds/Mile
Lostine/Bear	1999			45	11.55	3.9
	2000			43	15.54	2.8
	2001			55	16.7	3.3
	2002			29	13	2.2
	2003			88	14.3	6.2
	2004			37	10.8	3.4
	2005			48	13.3	3.6
Imnaha River (excluding Big Sheep)	1999	9/20,28,10/11	Middle = Thrice	14	15.2	0.9
	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
	2005	9/26-28, 10/7	Once Upper and Middle	276	19.4	14.2
Middle=Blue Hole to Indian this year						

Table 1 (Continued)– Bull Trout Spawning Surveys and Survey Frequencies for selected Grande Ronde River and Imnaha River Streams, 1999-2005

Stream	Year	Dates	Survey Frequency	Total Redds	Total Miles	Total Redds/Mile
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

Table 2a – Bull Trout Spawning Surveys for the Lostine River Comparing 1999 – 2005 Surveys

Stream	Years						
	1999	2000	2001	2002	2003	2004	2005
Lostine River			Redds	Surveyed			
Reaches (miles surveyed)							
OC Ranch to Westside Ditch (0.4 miles)	0	0	0	0	0	0	0
Lundquist Bridge to OC Ranch (2.8)	1	0	2	3	3	5	0
Williamson to Walla Walla (2.2 miles)	0	2	1	0	6	1	3
Bowman to French Camp (1.6 miles)	18	19	16	11	18	3	9
French Camp to Shady Falls (1.5)	20	12.0	23	8	43	17	12
Lostine Total Redds (Comparable Reaches)	39	33	42	22	70	26	24
Lostine Total Miles of Comparable Stream	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Lostine Redds/Mile Comparable Stream	4.6	3.9	4.9	2.6	8.2	3.1	2.8
Total Redds For Year	39	38.0	43.0	22.0	71.0	26.0	32.0
Total Miles Surveyed For Year	9.8	13.7	14.4	10.7	10.5	8.5	10.5
Total Redds/Mile For Year	4.0	2.8	3.0	2.1	6.8	3.1	3.0

Notes: The Lostine was surveyed thrice in 1999 and 2000. Survey years 2001-2005, the Lostine was surveyed twice, (except Shady Campground and Turkey Flat areas were surveyed thrice in 2005). 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 – 2005 Surveys

Stream	Years						
	1999	2000	2001	2002	2003	2004	2005
Bear Creek							
			Redds	Surveyed			
Reaches (miles surveyed)							
Bear: Goat Confluence to Wilderness Boundary (1mile)	0	2	3	1	2	3	5
Goat Creek: Mouth to Falls (0.9)	8	3	9	6	9	8	6
Bear (and Goat) Total Redds (Comparable Reaches)	8	5	12	7	11	11	11
Bear Creek Total Miles of Comparable Stream	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
Total Redds For Year	8	5	12	7	17	12	16
Total Miles Surveyed For Year	1.9	1.9	2.3	2.3	3.8	2.3	2.8
Total Redds/Mile For Year	4.2	2.6	5.2	3.0	4.5	5.2	5.7

Notes: These surveys were conducted once, 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)].

**Table 2c – Bull Trout Spawning Surveys for the Imnaha River
Comparing 2001 – 2005 Surveys**

Stream	Years				
	2001	2002	2003	2004	2005
Imnaha River	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
South Fork Imnaha, NF to Soldier (1.5 miles)	6	7	14	12	44
South Fork Imnaha, Soldier to Cliff (3.1 miles)	33	18	37	29	55
North Fork Imnaha:					
North Fork, above Middle Fork (4.1 miles)	49	18	40	68	39
North Fork, below Middle Fork to mouth (2.1 miles)	2	8	15	9	21
Middle Fork, mouth to falls (0.8 miles)	12	0	12	6	24
Imnaha River:					
Imnaha River, NF to Falls (0.6 miles)	0	3	5	1	2
Imnaha River, Falls to lower falls (0.8 miles)	41	18	35	40	13
Imnaha River, Blue Hole to Indian Crossing (2.0 miles)	8	7	9	3	2
Imnaha Total Redds (Comparable Reaches)	247	101	224	233	261
Imnaha Total Miles of Comparable Stream	17.5	17.5	17.5	17.5	17.5
Imnaha Redds/Mile Comparable Stream	14.1	5.8	12.8	13.3	14.9
Total Redds For Year	269	103	293	286	276
Total Miles Surveyed For Year	19.4	18.3	42.8	41.2	19.4
Total Redds/Mile For Year	13.9	5.6	6.8	6.9	14.2

Notes: All the reaches on the Imnaha were surveyed once in 2005.

All reaches except Blue Hole to Indian were surveyed once in 2001 to 2004.

The Blue Hole to Indian Crossing reach was surveyed twice, in mid September and October from 2001 to 2004.

**Table 2d – Bull Trout Spawning Surveys for Big Sheep and Lick Creek
Comparing 2000 – 2005 Surveys**

Stream	Years					
Big Sheep Creek (including Lick Creek)	2000	2001	2002	2003	2004	2005
		Redds	Surveyed			
Reaches (miles surveyed)						
Big Sheep, canal to 39 rd. (1.9 miles)	2	6	17	2	3	5
Lick Creek, Meadow to 39 rd. (1.5 miles)	0	6	3	0	1	3
Lick Creek, 39 rd. to Quartz Creek (4.2 miles)	8	5	14	8	4	1
Big Sheep Total Redds (Comparable Reaches)	10	17	34	10	8	9
Big Sheep Creek Total Miles of Comparable Stream	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
Total Redds For Year	12	24	41	18	43	16
Total Miles Surveyed For Year	8.4	8.4	9.3	9.3	14.1	8.6
Total Redds/Mile For Year	1.4	2.9	4.4	1.9	3.0	1.9

Table 3a – Bull Trout Spawning Surveys for the Imnaha River, 2005

Imnaha Basin	Dates	Kilometers Surveyed	Miles Surveyed	Redds Occupied	Redds Unoccupied	Redds Total	Redds Per km	Redds Per Mile	Total Bull Trout (But)Observed	But <6 “	But <12” (~300mm)	But <18” (450 mm)	But >18 (450 mm)
Stream Reach, Section													
Upper Imnaha System													
South Fork Tributaries													
Cliff Cr., mouth to 2.5 miles	Sep 27	4.0	2.5	11.0	50.0	61.0	15.3	24.4	57.0	13.0	44.0	0.0	0.0
South Fork Tributaries Total		4.0	2.5	11.0	50.0	61.0	15.3	24.4	57.0	13.0	44.0	0.0	0.0
North Fork													
Middle Fork, mouth to falls	Sep 28	1.3	0.8	3.0	21.0	24.0	18.5	29.7	8.0	0.0	5.0	3.0	0.0
N.F. above M.F. (reach 3-7)	Sep 26	6.6	4.1	4.0	35.0	39.0	5.9	9.5	15.0	7.0	4.0	2.0	2.0
N.F. below M.F. (reach 1-2)	Sep 26-28	3.4	2.1	1.0	20.0	21.0	6.2	9.9	3.0	0.0	1.0	0.0	2.0
North Fork Total		11.3	7.0	8.0	76.0	84.0	7.4	12.0	26.0	7.0	10.0	5.0	4.0
South Fork													
S.F., N.F. to Soldier	Sep 26	2.4	1.5	2.0	42.0	44.0	18.3	29.5	4.0	0.0	3.0	1.0	0.0

Table 3a (Continued) – Bull Trout Spawning Surveys for the Imnaha River, 2005

Imnaha Basin	Dates	Kilometers Surveyed	Miles Surveyed	Redds Occupied	Redds Unoccupied	Redds Total	Redds Per km	Redds Per Mile	Total Bull Trout (But)Observed	But <6 “	But <12” (~300mm)	But <18” (450 mm)	But >18 (450 mm)
S.F., Soldier to Cliff	Sep 27	5.0	3.1	1.0	54.0	55.0	11.0	17.7	6.0	2.0	1.0	2.0	1.0
South Fork Total		7.4	4.6	3.0	96.0	99.0	13.4	21.5	10.0	2.0	4.0	3.0	1.0
Upper Imnaha													
Upper Imnaha (Falls to North Fork)	Sep 28	1.0	0.6	0.0	2.0	2.0	2.0	3.2	0.0	0.0	0.0	0.0	0.0
Upper Imnaha Falls to lower falls	Sep 28	1.3	0.8	3.0	10.0	13.0	10.0	16.1	10.0	0.0	0.0	7.0	3.0
Falls downstream .67 mi. to beg. of gorge	Sep 28	1.1	0.7	0.0	5.0	5.0	4.5	7.3	1.0	0.0	0.0	1.0	0.0
Lower end of gorge to next gorge (.25 miles)	Sep 28	0.4	0.2	0.0	8.0	8.0	20.0	32.2	1.0	0.0	0.0	1.0	0.0
Canyon above slide to canyon just above slide	Sep 28	1.5	0.9	2.0	0.0	2.0	1.3	2.1	2.0	0.0	1.0	1.0	0.0
Upper (U.) Imnaha Total		5.3	3.3	5.0	25.0	30.0	5.7	9.1	14.0	0.0	1.0	10.0	3.0
U. Imnaha System Total		28.0	17.4	27.0	247.0	274.0	9.8	15.7	107.0	22.0	59.0	18.0	8.0

Table 3a (Continued) – Bull Trout Spawning Surveys for the Imnaha River, 2005

Imnaha Basin	Dates	Kilometers Surveyed	Miles Surveyed	Redds Occupied	Redds Unoccupied	Redds Total	Redds Per km	Redds Per Mile	Total Bull Trout (But)Observed	But <6 “	But <12” (~300mm)	But <18” (450 mm)	But >18 (450 mm)
Middle Imnaha													
Blue Hole to Indian Crossing	Oct 7	3.2	2.0	0.0	2.0	2.0	0.6	1.0	5.0	0.0	0.0	5.0	0.0
Middle Imnaha Total		3.2	2.0	0.0	2.0	2.0	0.6	1.0	5.0	0.0	0.0	5.0	0.0
Big Sheep System													
Big Sheep, Canal to Rd. 39	Sep 20	3.1	1.9	0.0	1.0	1.0	0.3	0.5	15.0	8.0	7.0	0.0	0.0
Big Sheep, Canal to Rd. 39	Oct 6	3.1	1.9	0.0	4.0	4.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0
Big Sheep, Trailhead to Canal	Sep 20	1.6	1.0	1.0	1.0	2.0	1.3	2.0	1.0	0.0	1.0	0.0	0.0
Big Sheep, Trailhead to Canal	Oct 6	1.6	1.0	0.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lick Cr. Meadow to 39 rd.	Sep 19	2.4	1.5	0.0	0.0	0.0	0.0	0.0	3.0	0.0	3.0	0.0	0.0
Lick Cr. Meadow to 39 rd.	Oct 6	2.4	1.5	0.0	3.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lick Cr. 39 Rd. to Quartz Cr.	Sep 20	6.8	4.2	0.0	1.0	1.0	0.1	0.2	1.0	1.0	0.0	0.0	0.0

Table 3a (Continued)– Bull Trout Spawning Surveys for the Imnaha River, 2005

Imnaha Basin	Dates	Kilometers Surveyed	Miles Surveyed	Redds Occupied	Redds Unoccupied	Redds Total	Redds Per km	Redds Per Mile	Total Bull Trout (But)Observed	But <6 “	But <12” (~300mm)	But <18” (450 mm)	But >18 (450 mm)
Lick Cr. 39 Rd. to Quartz Cr.	Oct 6	6.8	4.2	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0
Big Sheep System Total		13.9	8.6	1.0	15.0	16.0	1.2	1.9	23.0	11.0	12.0	0.0	0.0
Imnaha Basin Total		45.1	28.0	28.0	264.0	292.0	6.5	10.4	135.0	33.0	71.0	23.0	8.0

**Table 3b – Bull Trout Spawning Surveys for some tributary streams within the Grande Ronde Basin
Lostine River and Bear Creek, 2005**

Grande Ronde Basin	Dates	Kilometers Surveyed	Miles Surveyed	Redds Occupied	Redds Unoccupied	Redds Total	Redds Per km	Redds Per Mile	Total Bull Trout (But)Observed	But <6 “	But <12” (~300mm)	But <18” (450 mm)	But >18 (450 mm)
Stream Reach, Section													
Bear Creek													
Goat Cr (Mouth to Falls)	Oct 11	1.4	0.9	0.0	6.0	6.0	6.4	10.0	2.0	0.0	2.0	0.0	0.0
Bear Creek (wilderness boundary to upstream Goat .5 miles)	Oct 11	2.3	1.4	0.0	7.0	7.0	3.1	5.0	0.0	0.0	0.0	0.0	0.0
Bear Creek (wilderness boundary downstream .5 miles)	Oct 11	0.8	0.5	0.0	3.0	3.0	3.7	6.0	10.0	4.0	4.0	2.0	0.0
Bear Creek Totals		4.5	2.8	0.0	16.0	16.0	3.6	5.7	12.0	4.0	6.0	2.0	0.0

**Table 3b (Continued) – Bull Trout Spawning Surveys for some tributary streams within the Grande Ronde Basin
Lostine River and Bear Creek, 2005**

Grande Ronde Basin	Dates	Kilometers Surveyed	Miles Surveyed	Redds Occupied	Redds Unoccupied	Redds Total	Redds Per km	Redds Per Mile	Total Bull Trout (But)Observed	But <6 “	But <12” (~300mm)	But <18” (450 mm)	But >18 (450 mm)
Stream Reach, Section													
Lostine River													
OC Ranch to Westside Ditch	Sept 22	0.6	0.4	0.0	0.0	0.0	0.0	0.0	13.0	0.0	0.0	13.0	0.0
OC Ranch to Westside Ditch	Oct 3	0.6	0.4	0.0	0.0	0.0	0.0	0.0	7.0	0.0	2.0	5.0	0.0
Lundquist Bridge to OC Ranch	Sep 21-22	4.4	2.8	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	10.0
Lundquist Bridge to OC Ranch	Oct 3	4.4	2.8	0.0	0.0	0.0	0.0	0.0	7.0	0.0	5.0	2.0	0.0
Pole Bridge to 6 Mile Bridge	Sep 21	3.2	2.0	0.0	2.0	2.0	0.6	1.0	1.0	0.0	0.0	0.0	1.0
Pole Bridge to 6 Mile Bridge	Oct 3	3.2	2.0	0.0	6.0	6.0	1.9	3.0	0.0	0.0	0.0	0.0	0.0
Williamson to Walla Walla	Sep 22	3.5	2.2	0.0	3.0	3.0	0.8	1.4	1.0	0.0	0.0	0.0	1.0
Williamson to Walla Walla	Oct 4	3.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turkey Flat	Sep 15			3.0	3.0	6.0			11.0	2.0	3.0	6.0	0.0
Bowman to French Camp	Sep 21	2.6	1.6	0.0	2.0	2.0	0.8	1.3	1.0	0.0	0.0	1.0	0.0
Bowman to French Camp	Oct 3	2.6	1.6	0.0	1.0	1.0	0.4	0.6	0.0	0.0	0.0	0.0	0.0
Shady Campground	Sep 15			0.0	0.0	0.0			7.0	3.0	2.0	2.0	0.0
French Camp to Shady Falls	Sep 21	2.4	1.5	2.0	7.0	9.0	3.7	6.0	4.0	2.0	2.0	0.0	0.0

**Table 3b (Continued) – Bull Trout Spawning Surveys for some tributary streams within the Grande Ronde Basin
Lostine River and Bear Creek, 2005**

Grande Ronde Basin	Dates	Kilometers Surveyed	Miles Surveyed	Redds Occupied	Redds Unoccupied	Redds Total	Redds Per km	Redds Per Mile	Total Bull Trout (But)Observed	But <6 “	But <12” (~300mm)	But <18” (450 mm)	But >18 (450 mm)
French Camp to Shady Falls	Oct 4	2.4	1.5	0.0	3.0	3.0	1.2	2.0	0.0	0.0	0.0	0.0	0.0
Lostine River Totals		16.8	10.5	5.0	27.0	32.0	1.9	3.1	62.0	7.0	14.0	39.0	2.0

Table 4a – Summary Bull Trout Redd Survey, Grande Ronde River Basin, Lostine River, Bear Creek, and Goat Creek, 2005

Stream	n*1		Length (M)	Width (M)	Area (m ²)	Length/Width ratio
Lostine	32	mean	1.3	0.7	1.0	1.8
		sd	0.6	0.3	0.9	0.7
		max	2.8	1.8	3.6	4.0
		min	0.4	0.3	0.2	0.8
Bear Creek	10	mean	0.5	0.3	0.2	1.7
		sd	0.2	0.1	0.1	0.4
		max	0.9	0.5	0.5	2.5
		min	0.4	0.2	0.1	1.0
Goat Creek	6	mean	0.9	0.7	0.6	1.5
		sd	0.2	0.2	0.3	0.4
		max	1.3	0.9	1.2	2.3
		min	0.7	0.3	0.2	1.1

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

Table 4b – Summary Bull Trout Redd Survey, Imnaha River Basin, 2005

Stream	n*1		Length (M)	Width (M)	Area (m ²)	Length/Width ratio
Lick Creek	4	mean	1.1	0.8	0.8	1.4
		sd	0.2	0.2	0.3	0.1
		max	1.2	1.0	1.2	1.5
		min	0.8	0.6	0.5	1.2
Big Sheep Creek	12	mean	0.4	0.2	0.1	2.1
		sd	0.1	0.1	0.0	0.8
		max	0.7	0.4	0.1	3.5
		min	0.2	0.1	0.0	0.7
Middle Imnaha	2	mean	0.9	0.5	0.4	1.9
		sd	0.5	0.1	0.3	0.7
		max	1.2	0.5	0.6	2.4
		min	0.6	0.4	0.2	1.4
Upper Imnaha	30	mean	1.8	0.8	1.6	2.2
		sd	0.7	0.3	1.1	0.5
		max	3.5	1.5	4.1	3.4
		min	0.8	0.5	0.5	1.3
N.F. Imnaha	84	mean	1.4	0.7	1.2	2.0
		sd	0.7	0.3	0.9	0.6
		max	3.0	1.4	3.5	4.0
		min	0.5	0.2	0.1	0.9

Table 4b (Continued) – Summary Bull Trout Redd Survey, Innaha River Basin, 2005

Stream	n*1		Length (M)	Width (M)	Area (m2)	Length/Width ratio
S.F. Innaha	99	mean	1.4	0.7	1.1	2.0
		sd	0.6	0.3	0.8	0.5
		max	3.1	2.0	4.0	4.0
		min	0.5	0.3	0.2	1.0
Cliff Creek	61	mean	0.5	0.3	0.1	1.9
		sd	0.1	0.1	0.1	0.4
		max	0.8	0.5	0.4	3.0
		min	0.3	0.2	0.0	1.0

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