

2021 Bull Trout Monitoring in the Wallowa Mountains



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Cover photo: Jon Rombach - Bear Creek, 2021

ABSTRACT

This report summarizes Bull Trout monitoring coordinated by the Nez Perce Tribe in the Wallowa Mountains of Northeast Oregon in 2021. We conducted Bull Trout redd counts in the Grande Ronde River and Imnaha River subbasins in 2021 and compared those with prior years. Streams surveyed in 2021 included: Lostine River, Little Minam River, Dobbin Creek, Big Sheep Creek, and Lick Creek. Redd counts were below average in Big Sheep Creek, Lick Creek, and the Lostine River compared to previous years. Redds counts in the Little Minam River and Dobbin Creek were greater than the 2020 counts and similar to surveys conducted in the early 2000s. We plan to continue long-term population monitoring via redd counts in priority streams in the future, though some surveys will not be conducted on an annual basis but rather on an interval schedule (e.g., 5-10 year intervals). In 2021, we collected eDNA samples in Trout Creek (a tributary to the Minam River) and Boulder Creek (a tributary to the Little Minam River). Little or no prior information was available on Bull Trout distribution in these tributaries. Bull Trout eDNA was detected in all four samples from Boulder Creek and none of the seven samples from Trout Creek. In addition to eDNA samples, we conducted electrofishing surveys in the Bear Creek watershed to investigate the distribution of Bull Trout and Brook Trout and the extent of hybridization between the two species. The Bear Creek electrofishing data and subsequent genetic analyses are part of an on-going collaboration with ODFW; results will be reported at a later date when the genetic analyses are complete. We plan to continue using eDNA sampling, electrofishing, and/or snorkeling to monitor Bull Trout populations and the threat of hybridization with Brook Trout.

ACKNOWLEDGMENTS

We acknowledge the 20 plus-year effort put forth by the U.S. Fish and Wildlife Service (USFWS) and its many partners to conduct Bull Trout spawning ground surveys in the Wallowa Mountains of Northeast Oregon. In 2019, the Nez Perce Tribe took on the role of coordinating some of these surveys and building on that long-term data set. This project would not have been possible without the dedication, hard work, funding, and assistance provided by all partners. We would like to thank the following partners who assisted in 2021: the USFWS, Oregon Department of Fish and Wildlife (ODFW), and United States Forest Service (USFS). Special thanks to staff who walked the streams, helped schedule surveys and surveyors, provided access to private property, helped with planning, assisted with grants, produced maps, or summarized data. These included: Gretchen Sausen, Paul Sankovich, Sam Owens (USFWS); Sam Williams, Brian Simmons, Lynne Price, Jon Rombach (NPT); Sarah Brandy, Alan Miller (USFS); Mike Meeuwig, Jake Roth, Reagan Hasselbring (ODFW); Phil Howell (volunteer); and private property landowners on the Lostine River.

INTRODUCTION

Bull Trout were listed as threatened under the Endangered Species Act in 1998 following declines throughout their historic range. This listing prompted the creation of a recovery plan (USFSW 2015) that broadly defined goals, objectives, and management actions for Bull Trout

recovery throughout the coterminous United States. Collaboration among local agencies and organizations has resulted in the development of a monitoring strategy (Howell et al. 2018) specific to Bull Trout core areas located in northeast Oregon and southeast Washington (i.e., the Grande Ronde River and Imnaha River subbasins). This monitoring strategy identifies past monitoring efforts and makes suggestions on how to continue monitoring core areas into the future. Additionally, the Nez Perce Tribe has recently lead an effort among local agencies and organizations to develop and regularly update a monitoring implementation plan for Bull Trout core areas so we can be more strategic and collaborative in our monitoring efforts.

Extensive Bull Trout monitoring has been conducted in northeast Oregon and southeast Washington to inform post-listing recovery efforts (Howell et al. 2018 and references therein; Sausen 2019). Bull Trout spawning ground surveys (i.e., redd counts) have been a principal part of that monitoring, and have been conducted annually in selected streams within the Grande Ronde River and Imnaha River subbasins from 1999 to 2021. More recently, we have also employed eDNA sampling to better understand the coarse scale distribution of Bull Trout and Brook Trout within the subbasins. Results from eDNA sampling have allowed us to identify streams and stream segments where the two species potentially overlap, and subsequently use electrofishing to capture and collect tissue samples for genetic analysis from Bull Trout, Brook Trout, and suspected hybrids. Recent surveys to collect genetic samples (both eDNA and tissue) complements our existing long-term redd count dataset and allows us to better understand and identify potential threats to local Bull Trout populations. Additionally, these data will help inform future monitoring needs, management actions, and the recovery status of Bull Trout.

Objectives of the monitoring include:

- Continue long-term monitoring and trend analysis of redd counts, spawning distribution, and spawn timing for local Bull Trout populations.
- Investigate the distribution and relative abundance of Bull Trout and Brook Trout and the extent of hybridization between the two species.
- Use these monitoring data and other information to help assess actions in support of the long-term recovery of Bull Trout.

METHODS

In 2021, the Nez Perce Tribe and multiple partners conducted Bull Trout spawning ground surveys within the Wallowa River/Minam River, Little Minam River, and Imnaha River core areas. Streams surveyed for Bull Trout redds included: Lostine River, Little Minam River, Dobbin Creek, Big Sheep Creek, and Lick Creek (Figure 1). We also collected water samples for eDNA analysis from Trout Creek and Boulder Creek in the Minam River and Little Minam River watersheds, respectively (Figure 1). The results from eDNA samples collected in 2020 from the Bear Creek watershed that were analyzed for the presence/absence of Bull Trout and Brook Trout (Rumelhart et al. 2021) were used to determine the spatial extent of electrofishing surveys conducted in the Bear Creek watershed in 2021. During these surveys, tissue samples were collected from all Bull Trout, Brook Trout, and suspected hybrids that were captured.

Results from the electrofishing surveys and genetic analysis of the tissue samples will be presented in the 2022 Bull Trout Monitoring in the Wallowa Mountains report.

Spawning Ground Surveys

The Nez Perce Tribe spawning ground surveys are part of a larger effort in northeast Oregon and southeast Washington that occurs in September and October during the Bull Trout spawning period. Surveyors walk rivers and streams through selected index areas and other suspected Bull Trout habitat to survey for redds. Index areas in this report refer to known Bull Trout spawning reaches that have been surveyed on an annual basis for about 20 years.

Bull Trout spawning in the core areas typically occurs from about September 1 through October 15, and can occur as early as August 15 in the Imnaha River subbasin, based on past spawning data (Sausen 2019). In 2021, surveys were conducted twice between September 20 and October 7 (i.e., mid and late spawning season) in the Lostine River, Little Minam River, Dobbin Creek, Big Sheep Creek, and Lick Creek.

The survey protocol in 2021 was consistent with past monitoring efforts (Sausen 2019) and included: 1) visits to known Bull Trout redds and review of the survey form prior to the initial survey (for inexperienced surveyors, when needed); 2) experienced Bull Trout redd count surveyors were paired with less experienced surveyors (on-the-job training); 3) new Bull Trout redds were identified and measured, data were recorded, and redds were flagged; and 4) all flagging was removed during the last survey of the year. Data recorded during redd counts included: date of survey, stream location, GPS location of each redd, size of each redd (m), visibility of each redd, number of redds, and number and sizes of Bull Trout observed during surveys.

Bull Trout redds were measured using the same methodology from 2004 through 2021 (Sausen 2019). Redd size is related to the size of the fish that created it and can be used to estimate the proportion of smaller resident Bull Trout to larger fluvial (migratory) Bull Trout (Howell & Sankovich 2012; Sausen 2019). We categorized redds < 1 m in length as constructed by resident Bull Trout and redds ≥ 1 m in length or a total area ≥ 0.4 m² as redds constructed by fluvial Bull Trout. Size criteria were selected based on personal communications with Gretchen Sausen (USFWS) and data presented in Howell et al. 2018.

eDNA Sampling

We followed eDNA sampling protocols outlined by the National Genomics Center for Wildlife and Fish Conservation (Carim et al. 2016). Bull Trout and Brook Trout distribution data (e.g., StreamNet) and advice from project partners was considered when selecting eDNA sample sites. Specifically, we selected sites in designated critical Bull Trout habitat with moderate to high probability of detection (Young et al. 2017) but limited or no information on the current presence/absence of both species. eDNA results will contribute to The Aquatic eDNA Atlas (<https://www.fs.fed.us/rm/boise/AWAE/projects/the-aquatic-eDNAAtlas-project.html>), a crowd-sourced open-access database of eDNA data for aquatic species. Additionally, eDNA data from

this project will fill in gaps for areas not assessed during The Range-Wide Bull Trout eDNA Project (https://www.fs.fed.us/rm/boise/AWAE/projects/BullTrout_eDNA.html).

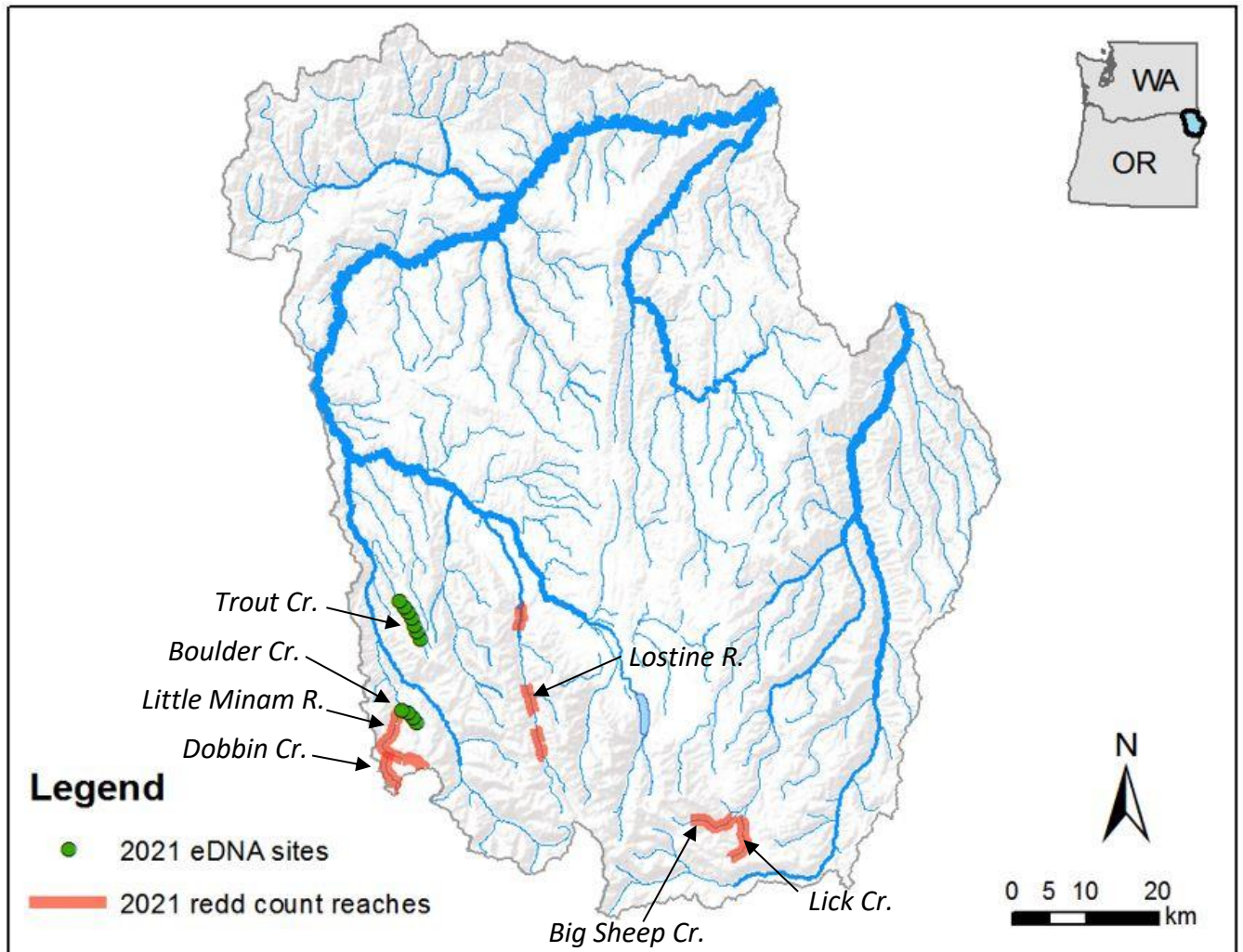


Figure 1. Location of Bull Trout spawning ground and eDNA surveys in 2021. See results section for detailed maps of each survey area.

RESULTS & DISCUSSION

Lostine River Spawning Ground Surveys

The Lostine River has been considered a moderately-strong population within the Grande Ronde River subbasin (Buchanan et al. 1997). The index reaches (8.1 miles) on the Lostine River have been surveyed annually from 1999-2021, with index reach counts ranging from 19 to 70 redds per year (Figure 2). In 2021, surveys were conducted twice, mid and late spawning season. In 2021, 36 redds or 4.4 redds/mile were documented during index reach surveys in the Lostine River. These counts were slightly below the annual average of 39 redds per year in index reaches (1999-2020). The Lostine River has both resident and fluvial Bull Trout. In 2021, we estimated

82% of the redds were made by fluvial fish and 18% by resident fish (Figure 3). See Appendix Table 1a for annual summary data from 1999-2021 of redds per reach and miles surveyed.

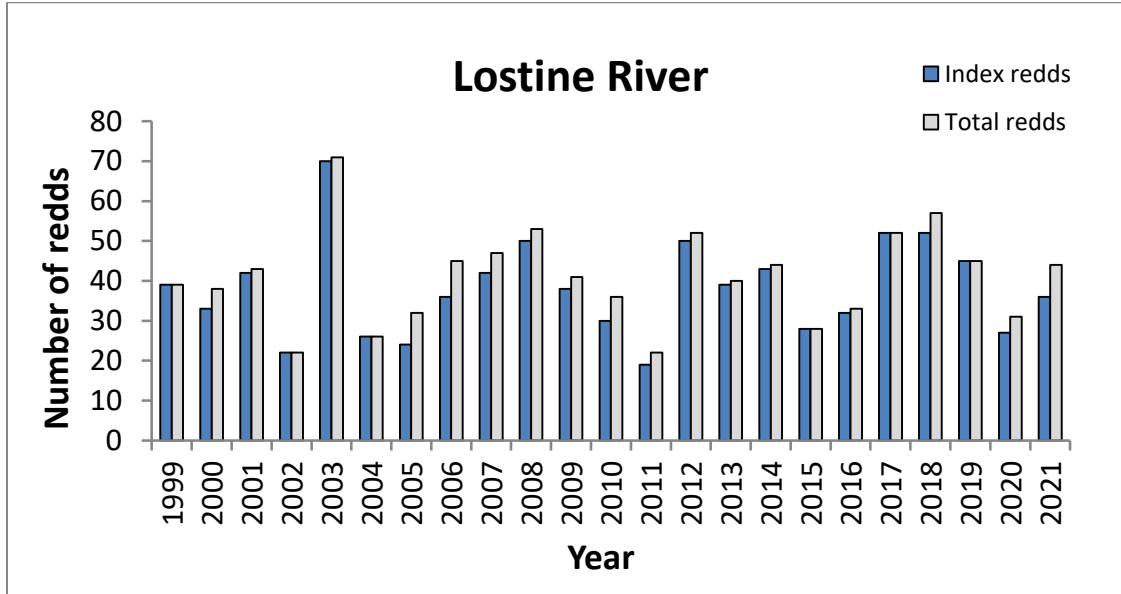


Figure 2. Bull Trout total redds (grey bars) and index redds (blue bars) observed during spawning ground surveys from 1999 through 2021 in the Lostine River.

2021 Lostine River Bull Trout Redds

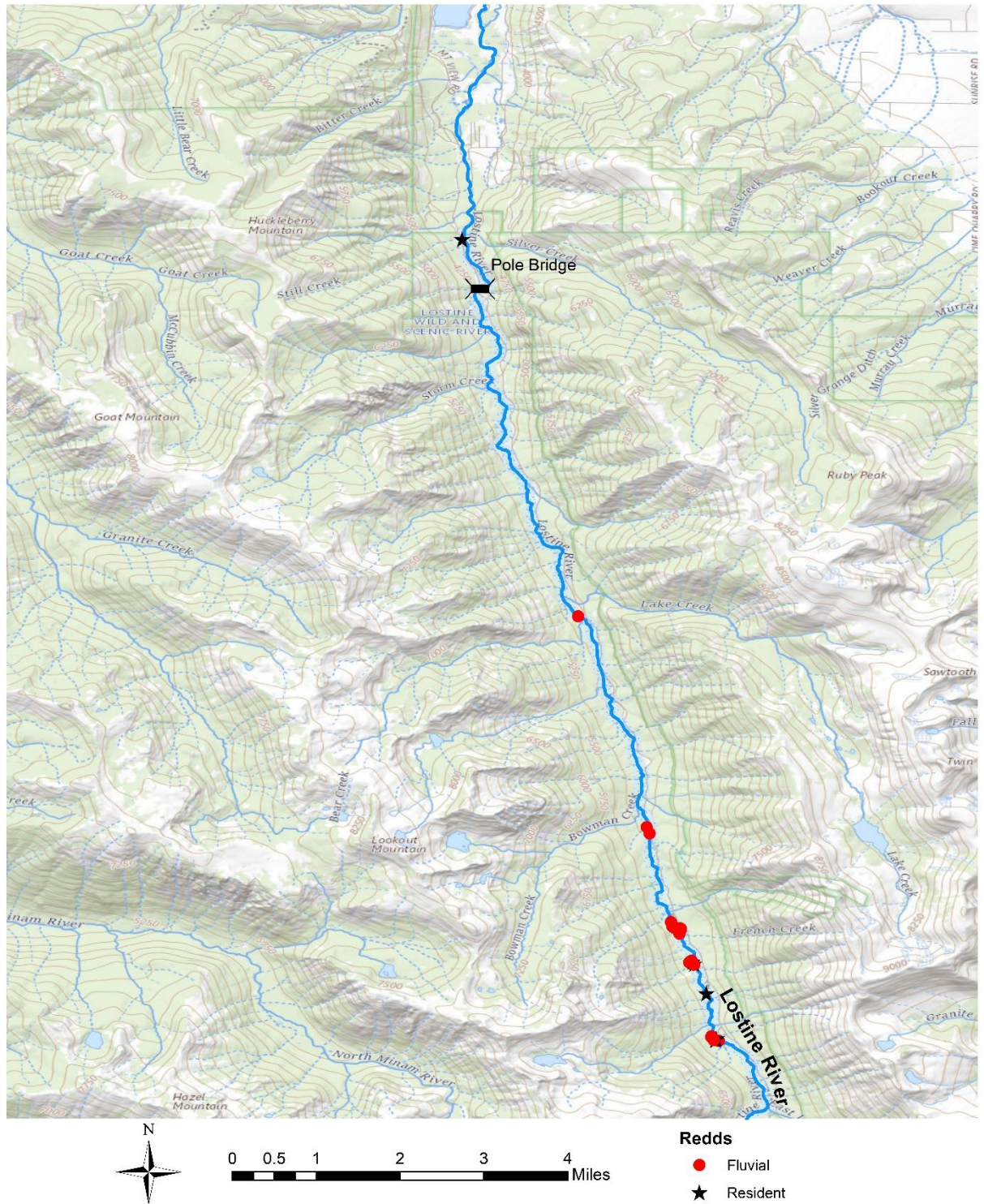


Figure 3. Location of Bull Trout reds observed on the Lostine River in 2021. Redds were located in close proximity to each other; one waypoint can represent numerous reds.

Big Sheep Creek Spawning Ground Surveys

The index reach (1.9 miles) on Big Sheep Creek has been surveyed annually from 2000-2021, though the within-year frequency of surveys has varied somewhat (see details in Appendix Table 1b). Surveys were conducted twice in 2021, mid and late spawning season. In 2021, 5 redds or 2.6 redds/mile were documented during the index surveys (Figure 4). From 2000-2020 the average redd count for the index reaches was 7.8 redds or 4.1 redds/mile. Big Sheep has both resident and fluvial Bull Trout. In 2021, we estimated 82% of redds were made by resident fish and 18% by fluvial fish (Figure 5). See Appendix Table 1b for annual summary data from 2000-2020 of redds per reach and miles surveyed.

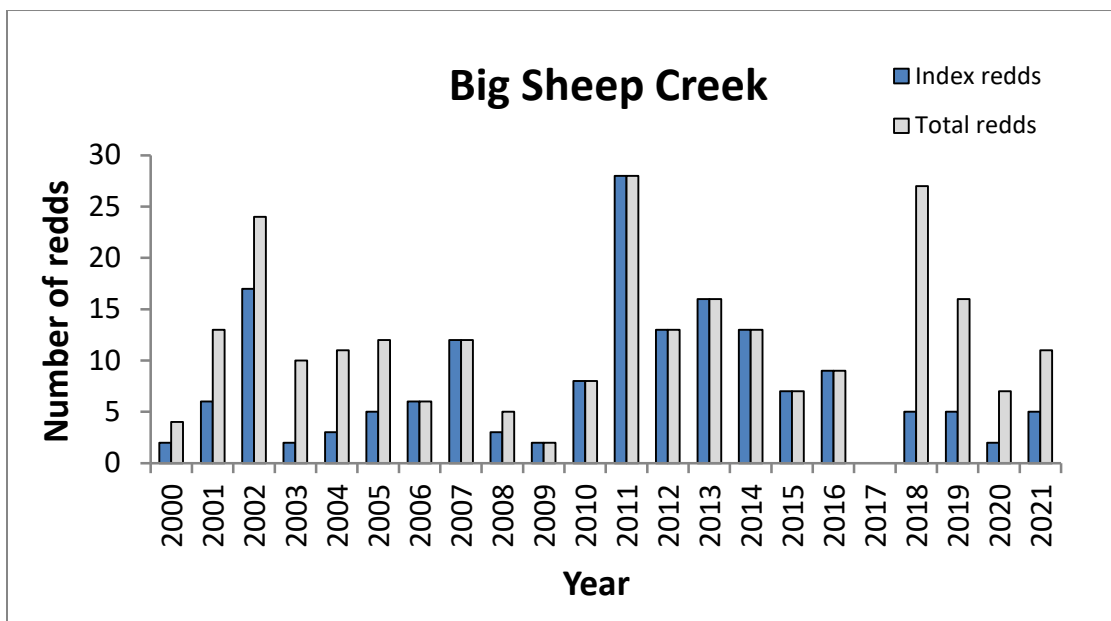


Figure 4. Bull Trout total redds (grey bars) and index redds (blue bars) observed during spawning ground surveys from 1999 through 2021 in Big Sheep Creek. The Big Sheep Creek index reach was surveyed in 2017, but no redds were found.

2021 Big Sheep Creek Bull Trout Redds



Figure 5. Location of Bull Trout redds observed in Big Sheep Creek in 2021.

Lick Creek Spawning Ground Surveys

Index reaches (3.7 miles) were surveyed on Lick Creek from 2000-2017 and 2019-2021. A limited survey was conducted on Lick Creek in 2018; therefore, the 2018 survey data were not directly comparable to other years. Only index reaches have been surveyed in Lick Creek over this time period (2000-2021) with the exception of 2008, when additional reaches were surveyed. In 2021, Bull Trout spawning ground surveys were conducted twice, mid and late spawning season, and 3 redds were documented or 0.81 redds/mile (Figure 6). In comparison, the average redd count for the index reaches from 2000-2017 and 2019-2020 was 9.7 redds or 2.6 redds/mile. In 2021, we estimated 100% of the redds were made by resident fish (Figure 7). See Appendix Table 1c for annual summary data from 2000-2021 of redds per reach and miles surveyed.

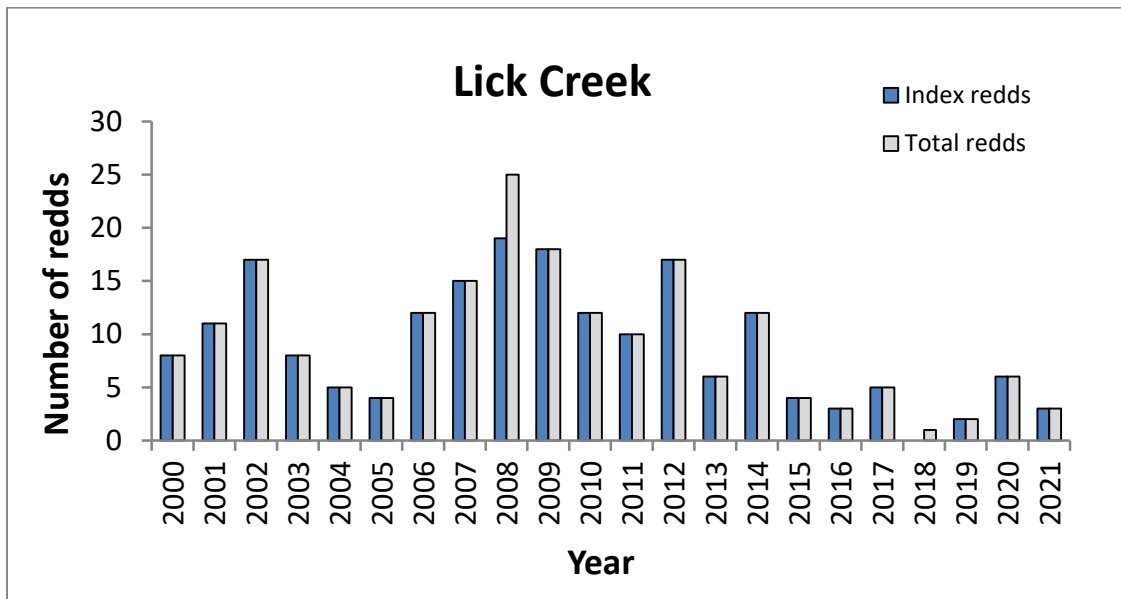


Figure 6. Bull Trout total redds (grey bars) and index redds (blue bars) observed during spawning ground surveys from 2000 through 2021 in Lick Creek. Survey efforts were limited to a single survey in one reach in 2018, so no index data were available for that year.

2021 Lick Creek Bull Trout Redds



Figure 7. Location of Bull Trout redds observed Lick Creek in 2021.

Little Minam River and Dobbin Creek Spawning Ground Surveys

The Little Minam River, including Dobbin Creek (a main tributary), were surveyed for Bull Trout redds from 1997-2003, 2005 and 2020. Surveys conducted in 1997 were primarily for training purposes, so we elected not to use those data for analysis. To facilitate comparison of redd counts across time, we identified index reaches based on the distribution of redds from the surveys conducted in the late 1990s and early 2000s. From 1998-2001 surveys were conducted four times in each index reach. In 2002, 2003, 2005 and 2020 surveys were conducted twice in each index reach. In 2020, redd counts were notably lower than in previous survey years so we elected to repeat the surveys in 2021 to gain a better understanding of the recent trend in redd counts in this drainage.

In 2021, index reach surveys were conducted twice, mid and late spawning season. We elected to compare 2021 redd counts to 2002, 2003, 2005 and 2020 redd counts because the same number of surveys were conducted each year. In 2021, 111 redds or 10.4 redds/mile were documented during index reach surveys. These results were very similar to survey years 2002, 2003 and 2005 (figure 8) and suggest that the Bull Trout population is stable. One hypothesis for the low redd count in 2020, was that the fish were spawning later than normal because we observed numerous fresh redds and fish on redds during the 2nd survey in 2020.

The monitoring strategy (Howell et al. 2018) suggests conducting redd counts twice per survey season at 8-10 year intervals in the Little Minam River, barring a dramatic change in the watershed (e.g., forest fire and debris flow). Based on the observed redds in 2021, we plan to follow the management strategy and return in 8-10 years.

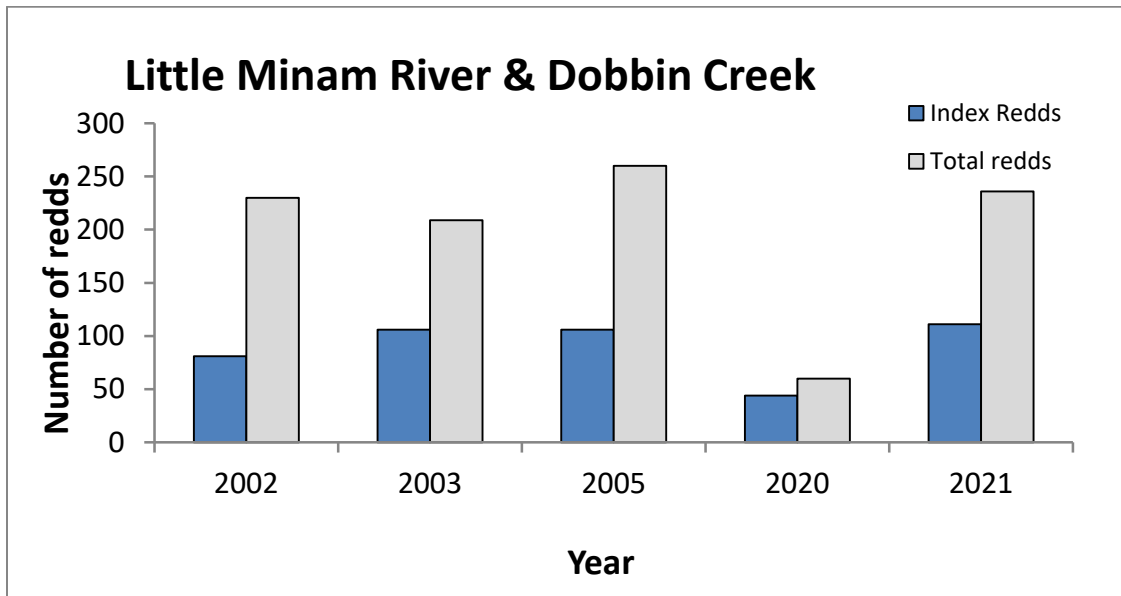


Figure 8. Bull Trout total redds (grey bars) and index redds (blue bars) observed during spawning ground surveys from 2002-2003, 2005 and 2020-2021 on the Little Minam River and Dobbin Creek. In 2021, the index reaches were surveyed twice, but a few of the non-index reaches were only surveyed once.

2021 Little Minam River and Dobbin Cr Bull Trout Redds

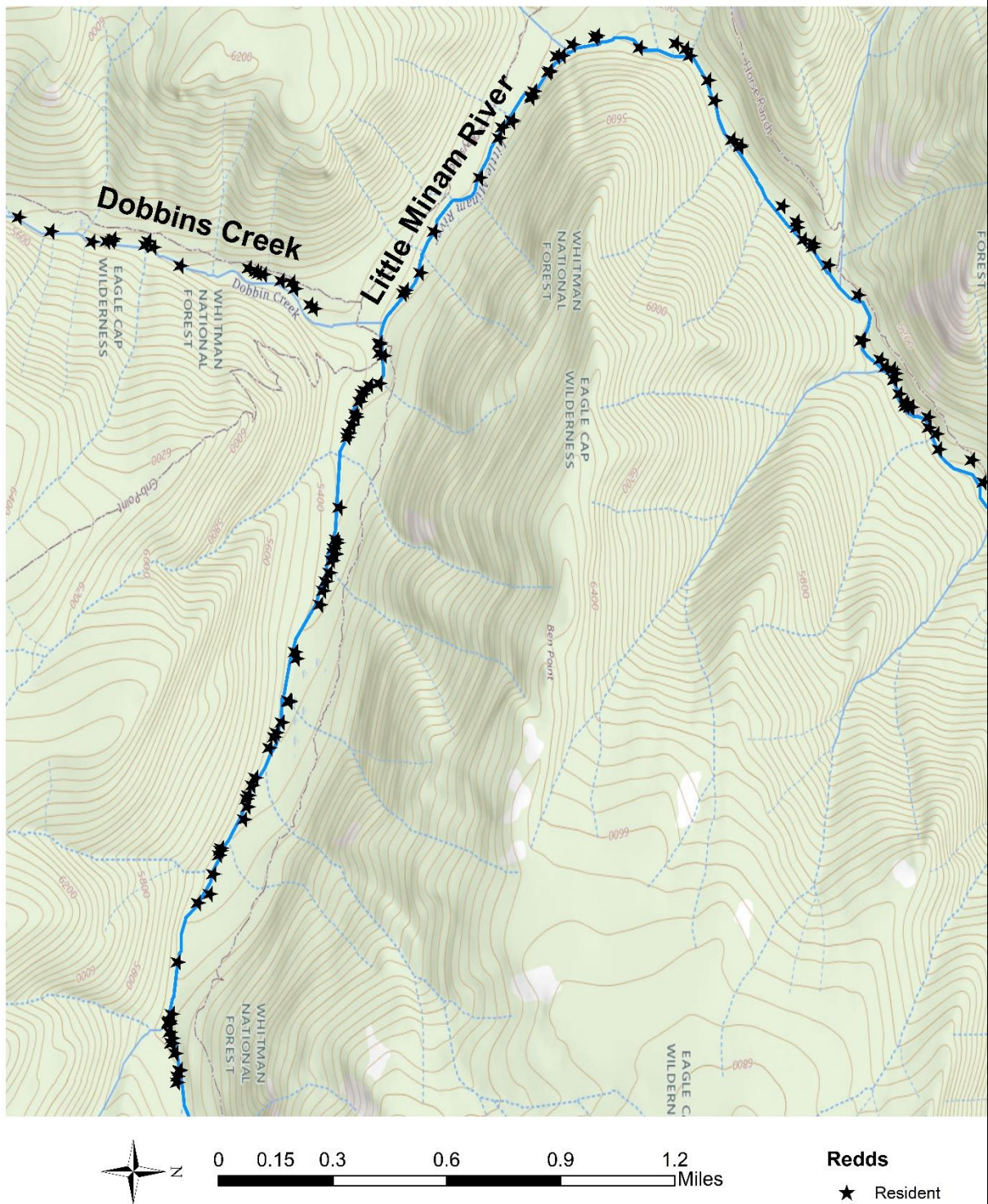


Figure 9. Location of Bull Trout reds observed in the Little Minam River and Dobbin Creek in 2021.

Little Minam River and Minam River Watershed eDNA Sampling

Information about Bull Trout in the Little Minam River and Minam River watersheds is limited to relatively few surveys (i.e., snorkel and spawning ground) conducted mostly in the late 1990s and early 2000s. Brook Trout have been documented in areas of the upper Minam River watershed, but overlap in the distribution of the two species is unknown. Recent and proposed monitoring efforts have been focused on learning more about the extent of Bull Trout and Brook Trout distribution and hybridization in these watersheds. Spawning ground surveys were conducted in the Little Minam River and Dobbin Creek in 2020 and 2021 and in the Minam River around the confluence of Elk Creek in 2017 and 2018. These surveys documented a resident population of Bull Trout in the Little Minam River and Dobbin Creek and fluvial Bull Trout in the Minam River. However, there is little to no information on the presence or distribution of Bull Trout in other areas of the watersheds. As an initial attempt to better understand the distribution of Bull Trout, we collected water samples for eDNA analysis from Boulder Creek and Trout Creek, tributaries to the Little Minam River and Minam River, respectively (Figures 11 & 12). Lab analyses detected Bull Trout eDNA in all four samples from Boulder Creek and did not detect Bull Trout DNA in any of the seven samples from Trout Creek (Table 1e).



Figure 10. Collecting an eDNA sample.

2021 Boulder Creek eDNA Sites



Detection
★ Bull Trout

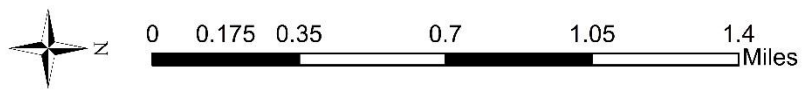
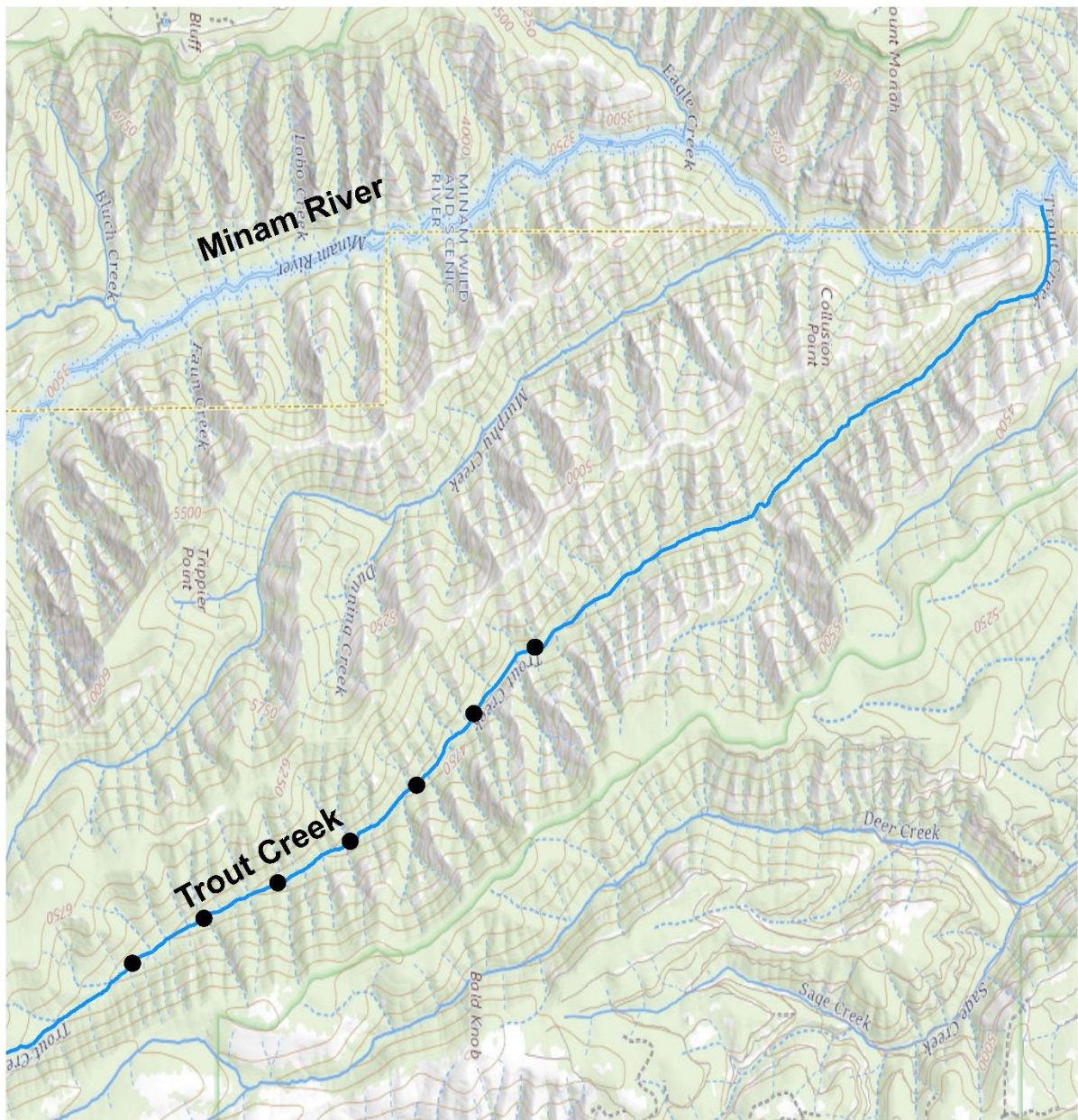


Figure 11. Boulder Creek eDNA sample sites and results.

2021 Trout Creek eDNA Sites



Detection

● No Bull Trout



Figure 12. Trout Creek eDNA sample sites and results.

CONCLUSIONS & FUTURE WORK

A unique and valuable long-term Bull Trout redd count dataset has been collected in northeast Oregon; 23 years of data from the Lostine River; 21 years of data from Big Sheep Creek and Bear Creek; and 18 years of data from the Imnaha River. As a whole, 23 years of redd surveys within the Imnaha River and Wallowa/Minam River core areas has documented persistent and relatively stable Bull Trout populations. Long-term datasets are scarce in Bull Trout recovery units, including the Mid-Columbia Recovery Unit, and we support continuing to build on this long-term dataset. Consistently collected redd count data are useful for determining relative abundance and distribution of Bull Trout populations, especially those populations with fish expressing fluvial life history strategies. These spawning ground survey data are also useful for monitoring the effects of and informing actions to address potential threats such as climate change, hybridization, and catastrophic disturbance. We plan to continue long-term monitoring with spawning ground surveys in priority streams, as outlined in the Northeastern Oregon/Southeastern Washington Monitoring Strategy (Howell et al. 2018). Some spawning ground surveys will be conducted annually, while others will be conducted on an interval of 5-10 years, barring dramatic changes in survey site habitat (e.g., forest fire or debris flow).

In 2022, the Nez Perce Tribe and partners will use eDNA sampling, electrofishing, and snorkeling to continue to collect information on the distribution, relative abundance, and extent of hybridization of Bull Trout and Brook Trout, targeting areas where the two species distributions likely overlap. Data collected using these sampling techniques, in conjunction with long-term redd count data, will increase our knowledge and understanding of Bull Trout within the Imnaha River and Grande Ronde River core areas. The Nez Perce Tribe will coordinate with partners (e.g., USFWS, Oregon Department of Fish and Wildlife, US Forest Service, and others) prior to field work to coordinate Bull Trout monitoring efforts in northeast Oregon and southeast Washington. Project results will continue to be disseminated annually in a written report to the USFWS Project Officer and the Grande Ronde-Imnaha Bull Trout Recovery Workgroup.

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APPENDIX

Table 1a. Bull Trout spawning survey results for the Lostine River from 1999 through 2021.

Lostine River	<i>Index reach name (length)</i>				<i>Redd totals</i>		<i>Survey reach length</i>		<i>Redd density</i>	
	6 Mile Bridge to Lostine River Ranch (2.8 miles)	Williamson to Walla Walla (2.2 miles)	Bowman to French Camp (1.6 miles)	French Camp to Shady Falls (1.5 miles)	Index redds	Total redds	Index reach survey miles	Total survey miles	Index redds/mile	Total redds/mile
1999	1	0	18	20	39	39	8.1	9.8	4.8	4.0
2000	0	2	19	12	33	38	8.1	13.7	4.1	2.8
2001	2	1	16	23	42	43	8.1	14.4	5.2	3.0
2002	3	0	11	8	22	22	8.1	10.7	2.7	2.1
2003	3	6	18	43	70	71	8.1	10.5	8.6	6.8
2004	5	1	3	17	26	26	8.1	8.5	3.2	3.1
2005	0	3	9	12	24	32	8.1	10.5	3.0	3.0
2006	5	0	9	22	36	45	8.1	10.5	4.4	4.3
2007	4	2	5	31	42	47	8.1	10.1	5.2	4.7
2008	5	13	12	20	50	53	8.1	10.1	6.2	5.2
2009	0	8	7	23	38	41	8.1	10.1	4.7	4.1
2010	1	2	6	21	30	36	8.1	10.1	3.7	3.6
2011	1	0	3	15	19	22	8.1	10.1	2.3	2.2
2012	1	3	18	28	50	52	8.1	10.1	6.2	5.1
2013	1	1	10	27	39	40	8.1	10.1	4.8	4.0
2014	1	7	14	21	43	44	8.1	10.1	5.3	4.4
2015	0	2	11	15	28	28	8.1	10.1	3.5	2.8
2016	0	0	17	15	32	33	8.1	10.1	4.0	3.3
2017	0	0	25	27	52	52	8.1	10.1	6.4	5.1
2018	2	2	23	25	52	57	8.1	10.1	6.4	5.6
2019	0	0	20	25	45	45	8.1	8.1	5.6	5.6
2020	4	2	15	6	27	31	8.1	10.1	3.3	3.1
2021	0	1	18	17	36	44	8.1	10.1	4.4	4.4

Notes: The Lostine was surveyed three times per year in 1999 and 2000. The Lostine was surveyed twice per year from 2001-2021 (except Shady Campground and Turkey Flat areas were surveyed three times in 2005, 2006, and 2008, and Turkey Flat was surveyed three times in 2009). The Lostine River Ranch (OC Ranch) has been surveyed once (October) in recent years due to lack of access to this private land during hunting season. Pole Bridge to 6 Mile Bridge (included in the total redd numbers and total miles) was surveyed once in 2018. 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 1b. Bull Trout spawning survey results for Big Sheep Creek from 1999 through 2021.

Big Sheep Creek	<i>Index reach name (length)</i>	<i>Redd totals</i>		<i>Survey reach length</i>		<i>Redd density</i>	
	Canal to 39 rd. (1.9 miles)	Index redds	Total redds	Index reach survey miles	Total survey miles	Index redds/mile	Total redds/mile
2000	2	2	4	1.9	2.5	1.1	1.6
2001	6	6	13	1.9	2.5	3.2	5.2
2002	17	17	24	1.9	3.6	8.9	6.7
2003	2	2	10	1.9	3.6	1.1	2.8
2004	3	3	11	1.9	1.9	1.6	5.8
2005	5	5	12	1.9	2.9	2.6	4.1
2006	6	6	6	1.9	1.9	3.2	3.2
2007	12	12	12	1.9	2.9	6.3	4.1
2008	3	3	5	1.9	3.6	1.6	1.4
2009	2	2	2	1.9	1.9	1.1	1.1
2010	8	8	8	1.9	1.9	4.2	4.2
2011	28	28	28	1.9	1.9	14.7	14.7
2012	13	13	13	1.9	1.9	6.8	6.8
2013	16	16	16	1.9	1.9	8.4	8.4
2014	13	13	13	1.9	1.9	6.8	6.8
2015	7	7	7	1.9	1.9	3.7	3.7
2016	9	9	9	1.9	1.9	4.7	4.7
2017	0	0	0	1.9	1.9	0.0	0.0
2018	5	5	27	1.9	6.5	2.6	4.2
2019	5	5	16	1.9	4.3	2.6	3.7
2020	2	2	7	1.9	4.3	1.1	1.6
2021	5	5	11	1.9	4.3	2.6	2.6

Notes: Survey frequency varied by year, surveys were conducted once in mid to late October in years 2000 and 2001, surveys were conducted twice, once in September and once in October in years 2002-2016 and years 2018-2021 with the exception of 2004 and 2017 it was only surveyed once.

Table 1c. Bull Trout spawning survey results for Lick Creek from 1999 through 2021.

Lick Creek	<i>Index reach name (length)</i>		<i>Redd totals</i>		<i>Survey reach length</i>		<i>Redd density</i>	
	Meadow to 39 rd. (1.5 miles)	39 rd. to Quartz Creek (2.2 miles)	Index redds	Total redds	Index reach survey miles	Total survey miles	Index redds/mile	Total redds/mile
2000	0	8	8	8	3.7	3.7	2.2	2.2
2001	6	5	11	11	3.7	3.7	3.0	3.0
2002	3	14	17	17	3.7	3.7	4.6	4.6
2003	0	8	8	8	3.7	3.7	2.2	2.2
2004	1	4	5	5	3.7	3.7	1.4	1.4
2005	3	1	4	4	3.7	3.7	1.1	1.1
2006	5	7	12	12	3.7	3.7	3.2	3.2
2007	3	12	15	15	3.7	3.7	4.1	4.1
2008	4	15	19	25	3.7	3.7	5.1	6.8
2009	5	13	18	18	3.7	3.7	4.9	4.9
2010	7	5	12	12	3.7	3.7	3.2	3.2
2011	4	6	10	10	3.7	3.7	2.7	2.7
2012	4	13	17	17	3.7	3.7	4.6	4.6
2013	3	3	6	6	3.7	3.7	1.6	1.6
2014	5	7	12	12	3.7	3.7	3.2	3.2
2015	0	4	4	4	3.7	3.7	1.1	1.1
2016	0	3	3	3	3.7	3.7	0.8	0.8
2017	0	5	5	5	3.7	3.7	1.4	1.4
2018	1	N/A	1	1	1.5	1.5	0.7	0.7
2019	0	2	2	2	3.7	3.7	0.5	0.5
2020	4	2	6	6	3.7	3.7	1.6	1.6
2021	0	3	3	3	3.7	3.7	0.8	0.8

Notes: Survey frequency varied by year, surveys were conducted once in mid to late October in years 2000 and 2001, and surveys were conducted twice, once in September and once in October in years 2002-2016, 2020-2021. In 2017 and 2019, surveys were conducted once in October. In 2018 Lick Cr was only surveyed once in September and was limited to the lower reach.

Table 1d. Bull Trout spawning survey results for Little Minam River and Dobbin Cr from 1998 – 2003, 2005, 2020 – 2021.

Little Minam River & Dobbin Creek	<i>Index reach name (length)</i>			<i>Redd totals</i>		<i>Survey reach length</i>		<i>Redd density</i>	
	Little Minam: LM7 to LM6 (1.5 miles)	Little Minam: LM6 to Dobbin Mouth (1.4 miles)	Dobbin Cr: Dobb 1 to Dobb Mouth (1.2 miles)	Index redds	Total redds	Index reach survey miles	Total survey miles	Index redds/mile	Total redds/mile
1998	98	65	15	178	381	4.1	10.4	43.4	36.6
1999	62	30	10	102	300	4.1	10.4	24.9	28.8
2000	77	60	24	161	270	4.1	10.4	39.3	26.0
2001	96	90	43	229	434	4.1	10.4	55.9	41.7
2002	40	35	6	81	230	4.1	10.4	19.8	22.1
2003	57	34	15	106	209	4.1	10.4	25.9	20.1
2005	24	63	19	106	260	4.1	10.4	25.9	25.0
2020	14	20	10	44	60	4.1	10.4	10.7	5.8
2021	33	59	19	111	236	4.1	10.4	27.1	22.7

Notes: From 1998-2001 surveys were conducted four times in each reach. In 2002, 2003, 2005, 2020 - 2021 surveys were conducted twice in each reach.

Table 1e. eDNA results for Trout and Boulder creeks.

Site #	Stream Name	Zone	Easting	Northing	Date Collected	Bull Trout DNA Detected?	Comments
TC-01	Trout Creek	11	450208	5032636	9/30/2021	N	
TC-02	Trout Creek	11	450808	5031836	9/30/2021	N	
TC-03	Trout Creek	11	451444	5031090	9/30/2021	N	
TC-04	Trout Creek	11	451938	5030207	9/30/2021	N	
TC-05	Trout Creek	11	452265	5029295	9/29/2021	N	
TC-06	Trout Creek	11	452543	5028552	9/29/2021	N	
TC-07	Trout Creek	11	452953	5027518	9/29/2021	N	
BC-01	Boulder Creek	11	450514	5017751	10/6/2021	Y	
BC-02	Boulder Creek	11	451339	5017387	10/6/2021	Y	
BC-03	Boulder Creek	11	452068	5016697	10/6/2021	Y	
BC-04	Boulder Creek	11	452564	5015981	10/6/2021	Y	

Notes: Trout and Boulder creeks were only analyzed for Bull Trout DNA.