Native Salmonid Abundance and Tributary Habitat Restoration Monitoring

Annual Project Update – 2022

Montana Tributary Habitat Acquisition and

Recreational Fishery Enhancement Program

Appendix B

November 2023

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Annual Project Update – 2022

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Introduction

This is an annual update of work completed as part of the Montana Tributary Habitat Acquisition and Recreational Fishery Enhancement Program, Appendix B of the Clark Fork Settlement Agreement. This update focuses on native salmonid population monitoring conducted in 2022 in tributaries to the lower Clark Fork River in Montana. Fish population estimates were conducted at long-term monitoring sites in the following streams: Graves Creek, East Fork Bull River, North Fork East Fork Bull River, and South Fork Bull River. Westslope Cutthroat Trout *Oncorhynchus clarki lewisi* genetic monitoring was conducted in Graves Creek, East Fork Bull River, North Fork East Fork Bull River, South Fork Bull River, Chippewa Creek, and Little Fatman Creek. Additional sampling in intermittent portions of Prospect Creek to salvage native salmonids stranded in ephemeral pools was performed. Trend information by species for long-term electrofishing monitoring sites, yearly thermograph data, mean yearly Bull Trout *Salvelinus confluentus* growth by drainage, and summaries of fish detections on the Prospect Creek, Graves Creek, Vermilion River, Bull River, and East Fork Bull River Passive Integrated Transponder (PIT) tag arrays can be found in appendices A through D respectively.

Methods

In 2022, backpack electrofishing units were used at depletion sections of stream that were 85–115 m in length. All depletion sections were sampled from the upstream-most point in the section to a block net at the bottom of the site. Bull Trout were scanned for a PIT tag and a 12 mm long full duplex PIT tag was implanted in the dorsal sinus of all unmarked fish ≥100 mm. If a PIT tag was present the identification number was recorded.

Multi-pass population estimates for fish greater than or equal to 75 mm were conducted in Montana Fish, Wildlife and Parks (FWP) internal Fisheries Information System (FIS) using K-pass removal equations (Ogle 2010) derived for Zippin (1958) and modified by Carle and Strub (1978). Prior to 2017, these population estimates were conducted by hand (in Excel) and it appears there are slight differences, in most instances, for both the estimates and their associated confidence intervals. Historical data for all the sites sampled in 2021 were recalculated using FIS and are now up to date (Appendix A). Efforts are being made to redo all population estimates using FWP's FIS.

Linear abundance for this report is defined as the population estimate (based on multiple passes, typically 2 or 3) standardized to a 100 m section of stream. Salmonid biomass ($g/100m^2$) was estimated using the population estimate, mean fish weight at each sampling location and the area of stream that was sampled based on the section length and six wetted widths [(population estimate * mean weight) / (reach length * mean reach width) * 100)]. Density ($fish/100m^2$) was estimated using the population estimate and the area of stream that was sampled [(population estimate * 100) / (reach length * mean reach width)].

Fish tissue samples were collected from Westslope Cutthroat Trout in select streams for genetic analysis. Genetic samples were analyzed for purposes of describing the presence and extent of

non-native genetic admixture from Rainbow Trout *Oncorhynchus mykiss* and/or Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri*. A targeted genomic approach was used to genotype all fish with >2,300 species diagnostic markers (combination of Westslope, Rainbow and Yellowstone diagnostic markers). In each stream, tissue samples were collected across the spatial extent of the population. Continued regular genetic analysis is crucial to inform conservation and management of Westslope Cutthroat Trout populations into the future.

Thermographs were deployed in most important native salmonid tributaries with data collected from July 1 through September 30. Stream temperature was recorded every 30 minutes over the entirety of the study period. Mean and maximum daily temperatures are displayed for each stream in Appendix B. For more detailed information on stream temperature sampling locations, methodologies, and analysis refer to: Horn and Tholl 2011; Kreiner and Tholl 2014; or Blakney and Tholl 2019.

An overview of the long-term trends in stream salmonid abundance and biomass for monitoring sites sampled in 2022 is provided in Appendix A. Table A-1 provides the slope of the line (and direction of the trend), coefficient of determination, and *p*-value from linear regression of time (year) versus linear abundance and biomass for long-term sample sites, and is organized by stream, site, and species. In most instances, time was a poor covariate with abundance and biomass, as these metrics are likely influenced by environmental variables that were not quantified. Given the available data, a significant trend was noted when the *p*-value from the linear regression was less than or equal to 0.05. If the significance level is less than or equal to 0.05, it can be said that the relationship between time and the dependent variable (abundance or biomass) is different from zero. The direction and magnitude of this trend is expressed as the slope. A positive value would suggest the species to be increasing, while a negative value would imply a declining trend. If the *p*-value is greater than 0.05, that relationship is not different from zero (there is no relationship), regardless of the coefficient of determination (r^2) value.

Significance levels at or below 0.05 coupled with moderate or higher coefficient of determination values ($r^2 > 0.30$ in ecological studies) would suggest that the described relationship has a high probability of not occurring by chance alone and that some portion of the variation within the data (r^2 value) can be attributed to changes in fish species' abundance or biomass over time. A specific site was included in this analysis if it had been sampled three or more times. The majority of species-specific metrics at a given site (abundance and biomass) did not change over time and thus species at those sites can be considered stable (Table A-1). For these streams and sites with fewer sampling events it is likely that more regular sampling would be needed to detect changes to the fish community, therefore it is not surprising that many of these sites did not show statistically significant trends. Trends that appear at sites with a relatively low number of sampling events should also be interpreted with caution.

Results and Discussion

Graves Creek

Graves Creek is a tributary to Noxon Reservoir, draining ~74 km^2 of the western edge of the Cabinet Mountains. The watershed is functionally separated by a large waterfall at approximate river kilometer (Rkm) 5.6. Migratory Bull Trout have access to lower Graves Creek below the falls, while only Westslope Cutthroat Trout and low abundances of Brook Trout *Salvelinus fontinalis* exist above the falls. Other salmonids species that occur at low densities in lower Graves Creek include Brown Trout *Salmo trutta*, Rainbow Trout, *Oncorhynchus* hybrids, and Mountain Whitefish *Prosopium williamsoni*. Human impacts in the watershed consist of timber harvest, roads, and development, with many of the impairments occurring below the falls. About half of the land bordering stream in the lower drainage is privately owned. A stream restoration project on lower Graves Creek occurred in the summer of 2009 which included the addition of large

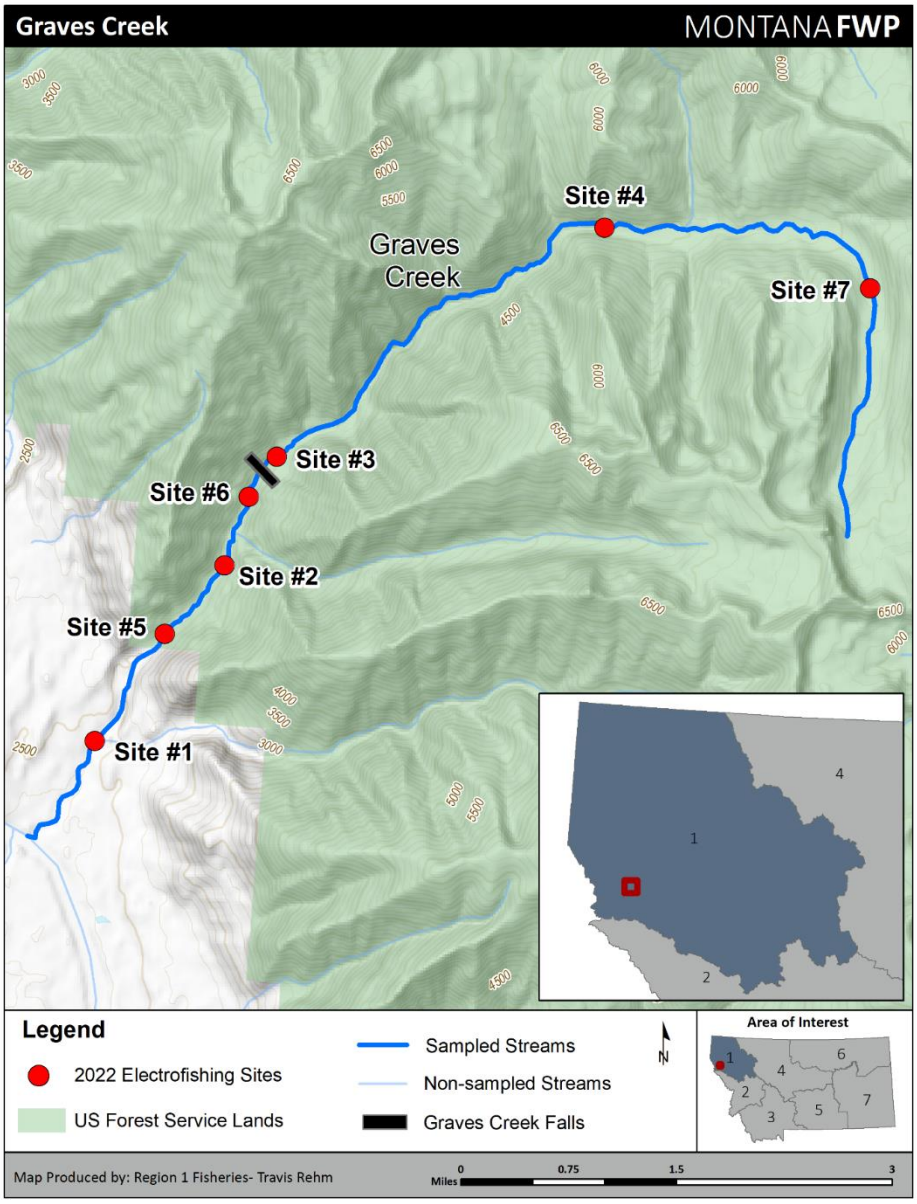

Figure 1. Graves Creek electrofishing sites sampled in 2022.

woody debris jams and stabilization of an eroding bank near Rkm 1.0 (Horn 2011). A second small-scale habitat project was completed in 2019 where four large woody debris structures were completed to facilitate spawning gravel deposition in lower Graves Creek (Trout Unlimited et al. 2022). In 2021, a large wildfire burned at high severity across most of the upper Graves Creek watershed. This wildfire may increase productivity and stream tempeture within Graves Creek.

Two monitoring sites have been surveyed in lower Graves Creek since 2003 (Figure 1). Site 1 is located a few hundred meters upstream of the 2009 restoration area on private land at Rkm 1.5. Site 2 is located just above Winniemuck Creek downstream of the falls at Rkm 4.3. Two monitoring sites were sampled for the first time in lower Graves Creek in 2022. Site 5 is located a couple hundred meters on to Forest Service ownership at Rkm 3. Site 6 is ~400 meters downstream of Graves Creek fall at Rkm 5. Two monitoring sites in upper Graves Creek above Graves Creek Falls have been surveyed since 2002. Site 3 is located just ~100 meters above Grave Creek Falls at Rkm 5.6. Site 4 is located where Graves Creek Road (FS 367) crosses Graves Creek at Rkm 10. Site 7 located ~ 0.75 km above the Lawn Lake trailhead at Rkm 14.1 was sampled for the second time in 2022. A permanent weir is located in the lower portion of Graves Creek just downstream of the Blueslide Road bridge. The weir is operated to capture out-migrating juvenile Bull Trout that are subsequently driven to and released in the Clark Fork River below Cabinet Gorge Dam (Oldenburg 2018). PIT tag arrays are located above and below the weir to monitor movements of both juvenile and adult fish.

Bull Trout were captured at all four sites sampled in lower Graves Creek in 2022. Sites 1 and 2 have been sampled eleven times since 2003. Mean Bull Trout abundance at Site 1 was 7.3 fish/100 meters from 2003–2018 (n = 11), compared to 4 fish/100 m in 2022 (Table 1; Figure 2). However, Bull Trout abundances have greatly fluctuated at Site 1 over the years. At Site 2 mean abundance from 2003–2018 (n = 11) was 30.4 fish/100 m, compared to 46.5 fish/100 m in 2022 (Table 1; Figure 3). Site 5 and 6, both sampled for the first time in 2022, had Bull Trout abundances of 17.8 and 29 fish/100 m, respectively (Table 1; Figure 4; Figure 5). Bull Trout abundance continues to be relatively high throughout the drainage compared to the species abundance encountered in other lower Clark Fork River tributaries. These stable to increasing abundances are likely due to Bull Trout passage efforts by both the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Upstream Fish Passage Program and Tributary Trapping and Downstream Juvenile Bull Trout Transport Program.* This stable Bull Trout abundance within Graves Creek has also been observed during annual redd surveys. Eleven redds where observed in 2022 which is near the long-term 2001-2021 average of 10.3 (Moran and Kusnierz 2023).

Abundances of Westslope Cutthroat Trout also appear stable to increasing in Graves Creek both below and above the falls. All long-term monitoring sites observed abundances greater than the long-term averages. Below the falls, mean Westslope Cutthroat Trout abundance was 29.9 and 27.1 fish/100 meters from 2003–2018 (n = 10), compared to 48 and 30.3 fish/100 m in 2022, for Sites 1 and 2, respectively (Table 1; Figure 2; Figure 3). Above the falls, mean Westslope

Cutthroat Trout abundance was 42 and 88 fish/100 meters from 2002–2017 (n = 3), compared to 66.3 and 101.8 fish/100 m in 2022, for Site 3 and 4, respectively (Table 1; Figure 4; Figure 5).

Recent increases in non-native fish have been observed in lower Graves Creek. Brown Trout and *Oncorhynchus* hybrids were all at record highs for Site 1 in 2022 (Table 1; Figure 2). This marks a significant increase in *Oncorhynchus* hybrid abundance over time (linear regression, $r^2 = 0.38$, $p = 0.04$; Appendix A). These non-native fish have been present in lower Graves Creek over the last 20+ years, however their abundance and distribution should continue to be carefully monitored. Contemporaneously, in upper Graves Creek significant declines in Brook Trout abundance and biomass have been observed in Site 4 (linear regression, $r^2 = 0.9$, $p = 0.05$; Appendix A). In 2022, no Brook Trout were observed in Graves Creek Site 4 (Table 1; Figure 5).

Table 1. Standardized linear abundance (#/100m), density (#/100m^2) and biomass (g/100m^2) estimates (fish≥75mm) for Bull (BULL), Brook (EB), Brown (LL), Westslope Cutthroat (WCT) and *Oncorhynchus* hybrids (RBxWCT) in Graves Creek in 2022.

Site # (Rkm)	Section Length (m)	Spp.	Length Range (mm)	Estimate per 100 m	95% C.I.	Estimate per 100 m^2	95% C.I.	g/100 m^2	95% C.I.
1	100	BULL	71-223	4.0	1.3-6.7	0.5	0.5-3.3	31.2	28.5-34.0
(1.5)		EB	176-176	1.0	1.0-1.0	0.1	0.1-0.1	8.6	8.6-8.6
		LL	59-280	14.0	14.0-14.0	1.9	1.9-1.9	92.1	92.1-92.1
		WCT	91-289	48.0	41.7-54.3	6.6	0.3-12.8	341.9	335.5-348.2
		RBxWCT	113-157	11.0	10.4-11.6	1.5	0.9-2.1	40.7	40.1-41.3
2	99	BULL	59-196	46.5	38.1-54.8	5.7	5.2-14.0	130.3	122.0-138.6
(4.3)		EB	130-150	2.0	2.0-2.0	0.2	0.2-0.2	7.4	7.4-7.4
		WCT	36-278	30.3	28.7-31.9	3.7	2.1-5.3	210.6	209.1-212.2
3	104	EB	95-214	4.8	2.5-7.1	0.7	0.7-3.0	21.4	19.2-23.7
(5.6)		WCT	71-268	66.3	60.7-72.0	10.2	4.6-15.9	438.9	433.3-444.6
4	109	WCT	65-263	101.8	95.2-108.5	17.6	10.9-24.2	895.4	888.8-902.1
(10.5)									
5	107	BULL	64-225	17.8	15.7-19.8	2.5	0.5-4.5	95.0	93.0-97.1
(3.0)		EB	137-137	0.9	0.9-0.9	0.1	0.1-0.1	3.6	3.6-3.6
		LL	130-130	0.9	0.9-0.9	0.1	0.1-0.1	4.2	4.2-4.2
		WCT	92-296	44.9	37.3-52.4	6.3	5.8-13.8	278.0	270.5-285.5
6	100	BULL	62-264	29.0	28.2-29.8	4.5	3.7-5.2	102.6	101.8-103.4
(5.0)		EB	67-67	N/A					
		WCT	68-287	29.0	27.8-30.2	4.5	3.3-5.7	298.9	297.7-300.1
7	104	WCT	48-166	1.0	1.0-1.0	0.1	0.1-0.1	6.8	6.8-6.8
(14.1)									

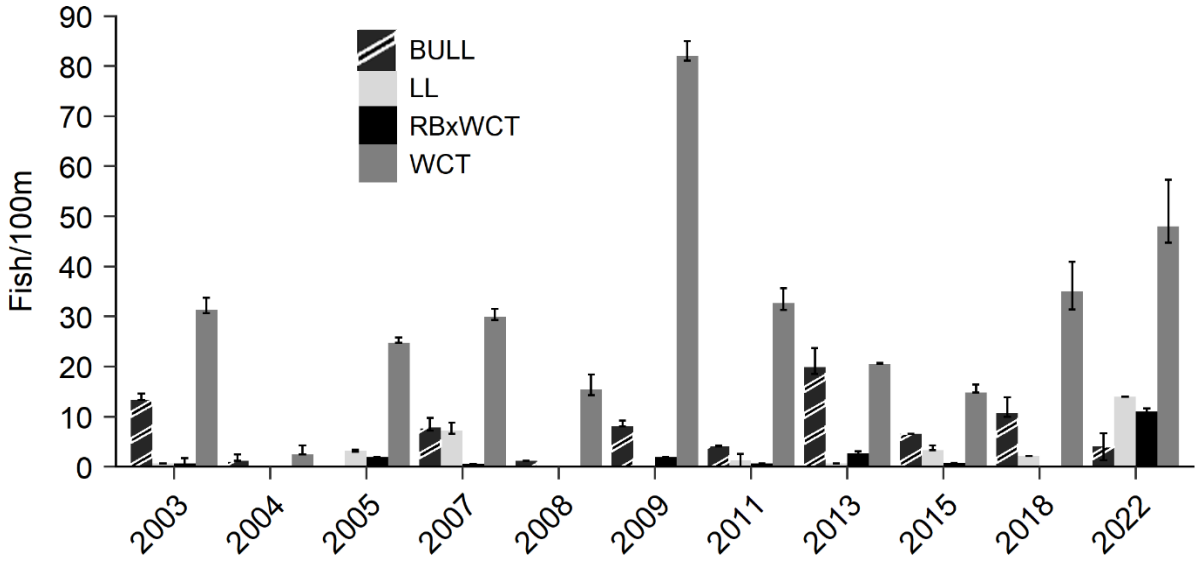

Figure 2. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL), Westslope Cutthroat Trout (WCT), Brown Trout (LL), and *Oncorhynchus* hybrids (RBxWCT) at Site 1 in Graves Creek.

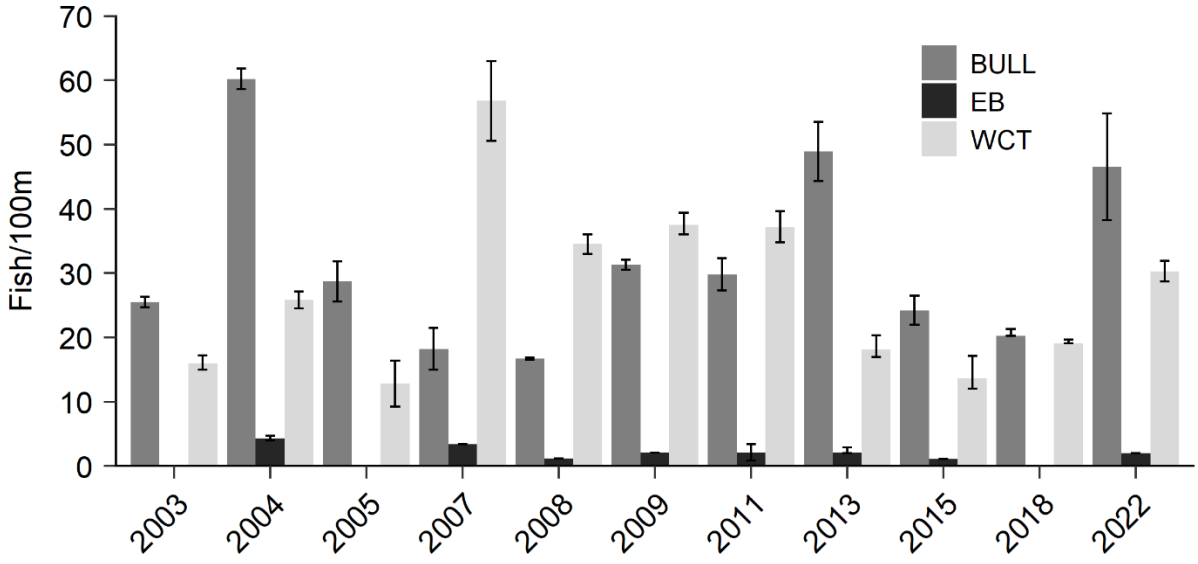

Figure 3. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL), Westslope Cutthroat Trout (WCT), and Brook Trout (EB) at Site 2 in Graves Creek.

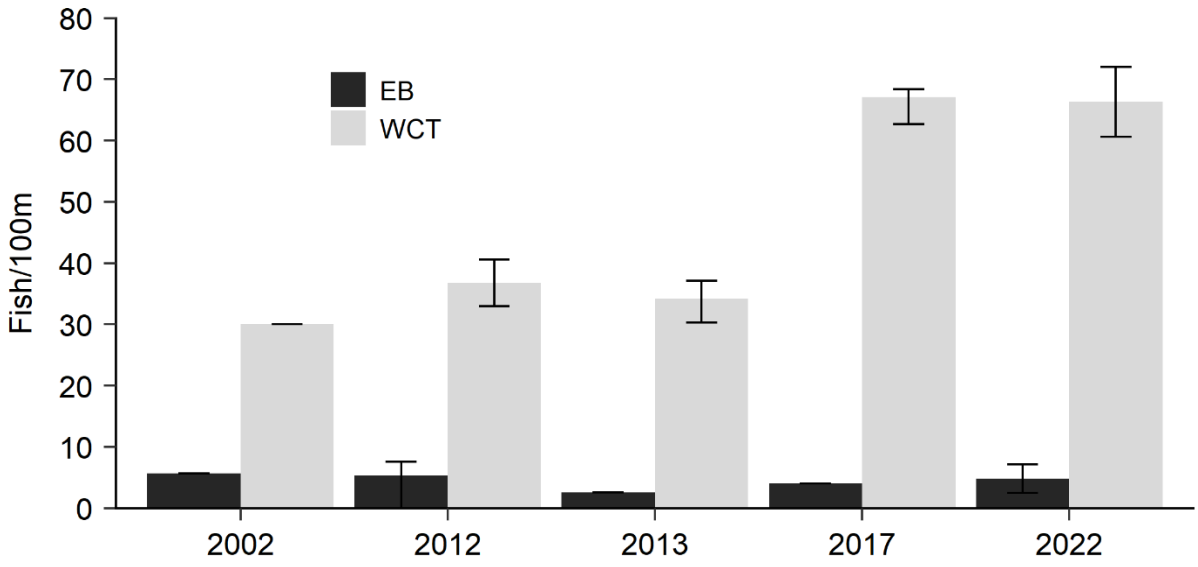

Figure 4. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Westslope Cutthroat Trout (WCT) and Brook Trout (EB) at Site 3 in Graves Creek.

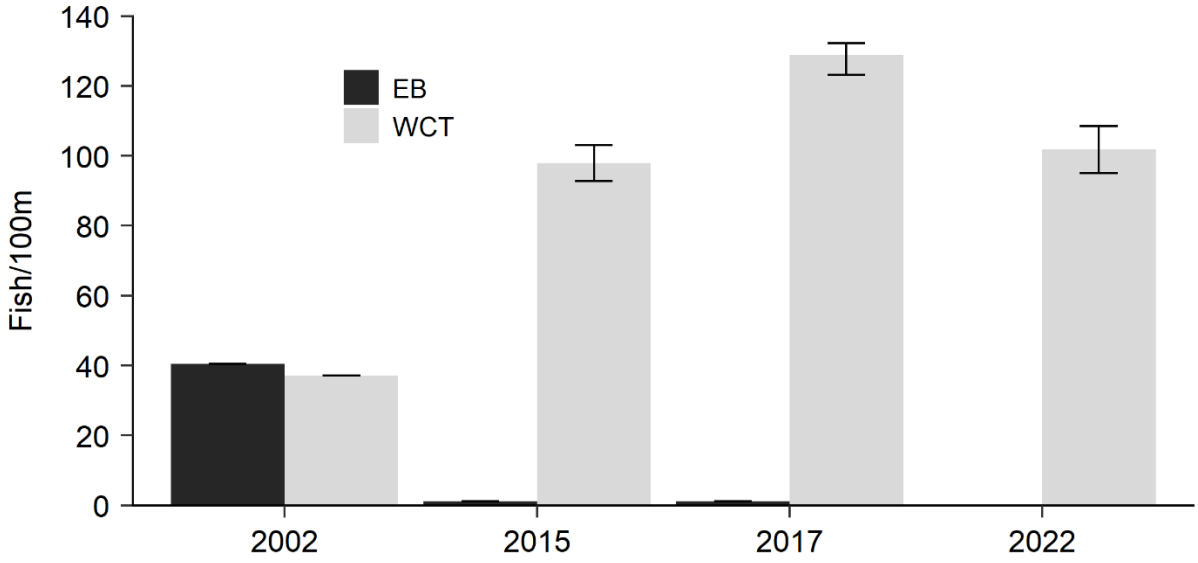

Figure 5. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Westslope Cutthroat Trout (WCT) and Brook Trout (EB) at Site 4 in Graves Creek.

East Fork Bull River

The East Fork Bull River (EFBR) drains ~71 km^2 from the Cabinet Mountain Wilderness to the mainstem Bull River. It supports the only remaining Bull Trout population in the Bull River drainage. Increased sedimentation and decreased channel stability within the drainage have been caused by roads, timber harvest, flooding, and other natural events. In 2001 a ~366 m reach on lower EFBR was modified via rechannelization, revegetation, and large woody debris installation. Periodic vegetation enhancement has occurred along this reach and others downstream since 2002 to maintain and restore riparian condition. During high water in 2008, an avulsion caused flows to return to a historic channel on the opposite side of the valley from the restored reach. Additionally, a major rechanneling project occurred several hundred meters upstream of Site 1 in 2008; known as the East Fork Slide Project.

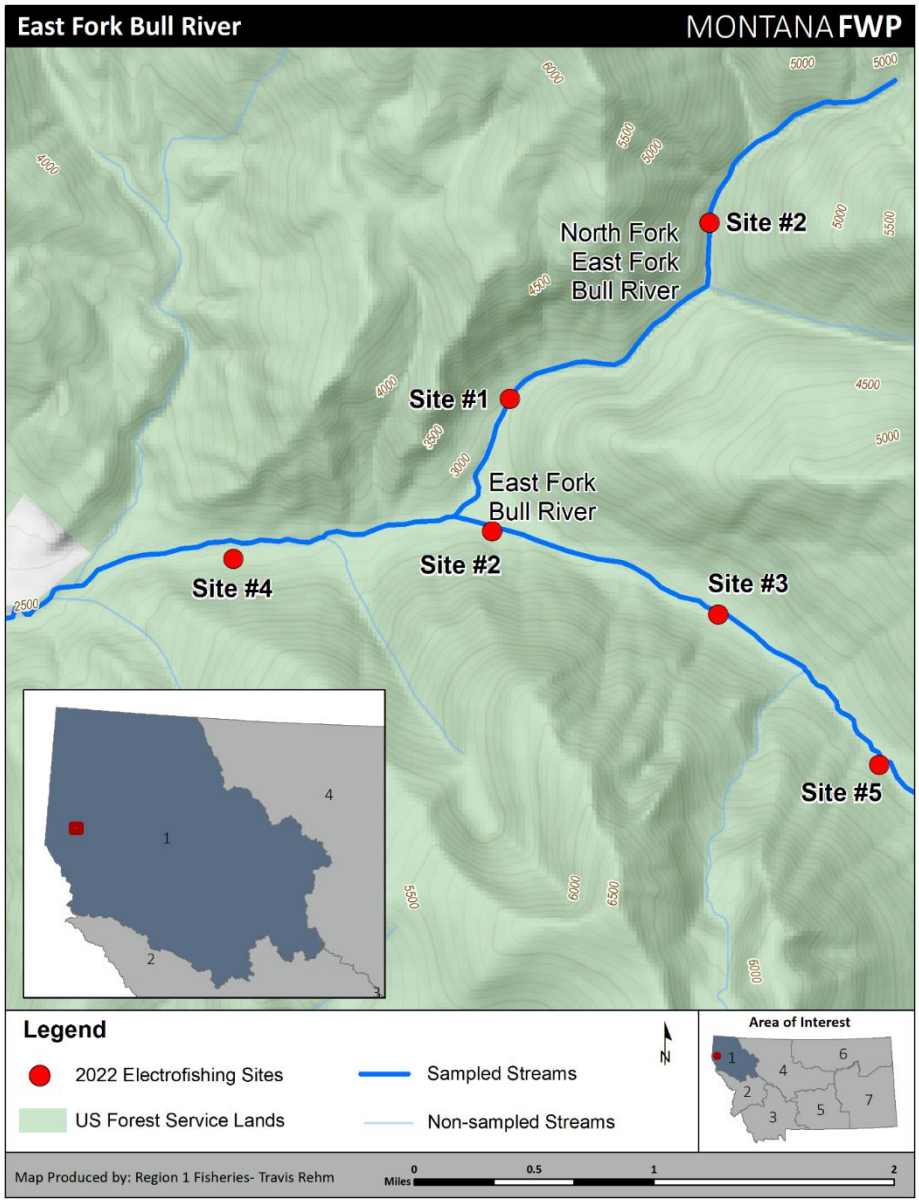

Figure 6. East Fork Bull River and North Fork East Fork Bull River electrofishing sites sampled in 2022.

Active suppression of non-native salmonids occurred in the EFBR from 2007-2009. Over that period >5,400 fish were removed from the system (Moran et al. 2022). These sites have been intensively monitored by Appendix C staff as part of the non-

native suppression project (Moran et al. 2022). In order to look at long-term trends, data collected at monitoring sites by the suppression crews is also included in this report. Excavation of Brown Trout redds during annual redd surveys has also occurred in EFBR since 2007. Additionally, non-native salmonids captured in weir traps, associated with conservation efforts preformed under *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Tributary Trapping and Downstream Juvenile Bull Trout Transport Program,* have been excluded from accessing upper reaches of EFBR since 2007. These activities have kept non-native salmonids abundances below pre-suppression levels. However, Bull Trout recruitment does not appear to be strong enough to sufficiently respond to the reduction in competition (Moran et al. 2022). Starting in 2018, additional protocols associated with the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Upstream Fish Passage Program* were developed for adult Bull Trout that genetically assigned to Lightning Creek tributaries that are captured downstream of Cabinet Gorge Dam. After the mouth of Lightning Creek becomes dewatered, fish captured downstream of Cabinet Gorge Dam that assign genetically to Lightning Creek are transported upstream to the EFBR to provide additional potential spawners (Bernall and Duffy 2019). Since that time, 24 Bull Trout that genetically assigned to Lightning Creek have been transported to the EFBR (15 in 2018 and 9 in 2019; Bernall, *In Prep*).

Four monitoring sites were surveyed in the EFBR in 2022 (Figure 6). Site #2 is located just above North Fork East Fork Bull River at Rkm 5.5. Site #3 is located near the St. Paul Lake Trailhead at Rkm 7.1. Site #4 is located approximately 550 m upstream of where South Fork Bull River Road (FS 410) meets East Fork Bull River Road (FS 407) at Rkm 3.6. Site #5 is located approximately 1.6 km up the St. Paul Lake trail (FS #646) at Rkm 8.6.

Bull Trout were captured at all four sites sampled in EFBR in 2022. Mean Bull Trout abundance at Site 2 was 18.1 fish/100 meters from 2001–2018 (n = 14), compared to 24.7 fish/100 m in 2022 (Table 2; Figure 7). At Site 3 mean Bull Trout abundance from 2000–2018 (n = 15) was 24.8 fish/100 m, compared to 13.4 fish/100 m in 2022 (Table 2; Figure 8). Mean Bull Trout abundance at Site 4 was 10.6 fish/100 meters from 2007–2018 (n = 3), compared to 0.9 fish/100 m in 2022 (Table 2; Figure 9). Site 5 was sampled for the first time in 2022 and Bull Trout abundance was 21.9 fish/100 m (Table 2). While Bull Trout abundances have declined recently in Sites 3 and 4, the population currently appears to be relatively stable in the upper reaches of EFBR. These observations coupled with the declining numbers of redds observed during annual surveys (Moran and Kusnierz 2023), suggest that a higher proportion of EFBR Bull Trout may be adopting a resident life history.

Abundances of Westslope Cutthroat Trout appear to be stable in EFBR. Mean Westslope Cutthroat Trout abundance at Site 2 was 39.3 fish/100 meters from 2001–2018 (n = 14), compared to 35.3 fish/100 m in 2022 (Table 2; Figure 7). At Site 3 mean Westslope Cutthroat Trout abundance from 2000–2018 (n = 15) was 33.4 fish/100 m, compared to 51.5 fish/100 m in 2022 (Table 2; Figure 8). Mean Westslope Cutthroat Trout abundance at Site 4 was 36.2 fish/100 meters from 2007–2018 (n = 3), compared to 30.4 fish/100 m in 2022 (Table 2; Figure 9). Site 5

was sampled for the first time in 2022 and Westslope Cutthroat Trout abundance was 60 fish/100 m (Table 2).

Recent increases in non-native fish have been observed in EFBR Site 4 (Figure 9), with Brown Trout achieving levels not recorded since prior to 2007, the first year in which they were removed under the non-native fish suppression effort (Moran et al. 2022). These non-native fish have been present in EFBR over the last +20 years, however their abundance and distribution should continue to be carefully monitored.

Table 2. Standardized linear abundance (#/100m), density (#/100m^2) and biomass (g/100m^2) estimates (fish≥75mm) for Bull (BULL), Brook (EB), Brown (LL) and Westslope Cutthroat (WCT) in East Fork Bull River in 2022.

Site # (Rkm)	Section Length (m)	Spp.	Length Range (mm)	Estimate per 100 m	95% C.I.	Estimate per 100 m^2	95% C.I.	g/100 m^2	95% C.I.
2	85	BULL	80-144	24.7	16.9-32.5	3.0	2.7-10.9	45.2	37.4-53.0
(5.5)		WCT	81-228	35.3	25.8-44.7	4.3	3.9-13.8	206.6	197.1-216.1
3	97	BULL	106-257	13.4	8.1-18.7	1.5	1.3-6.7	52.4	47.2-57.7
(7.1)		WCT	58-226	51.5	46.3-56.8	5.6	0.3-10.9	196.1	190.8-201.4
4	115	BULL	50-167	0.9	0.9-0.9	0.1	0.1-0.1	4.1	4.1-4.1
(3.6)		EB	45-150	0.9	0.9-3.8	0.1	0.1-3.0	2.7	0-5.6
		LL	60-280	21.7	18.7-24.8	2.6	2.5-5.7	104.8	101.7-107.8
		WCT	69-275	30.4	25.7-35.2	3.7	3.5-8.4	165.0	160.2-169.8
5	105	BULL	73-241	21.9	10.5-33.3	3.5	2.9-14.9	118.2	106.8-129.6
(8.6)		WCT	55-220	60.0	47.3-72.7	9.5	8.3-22.2	371.4	358.7-384.1

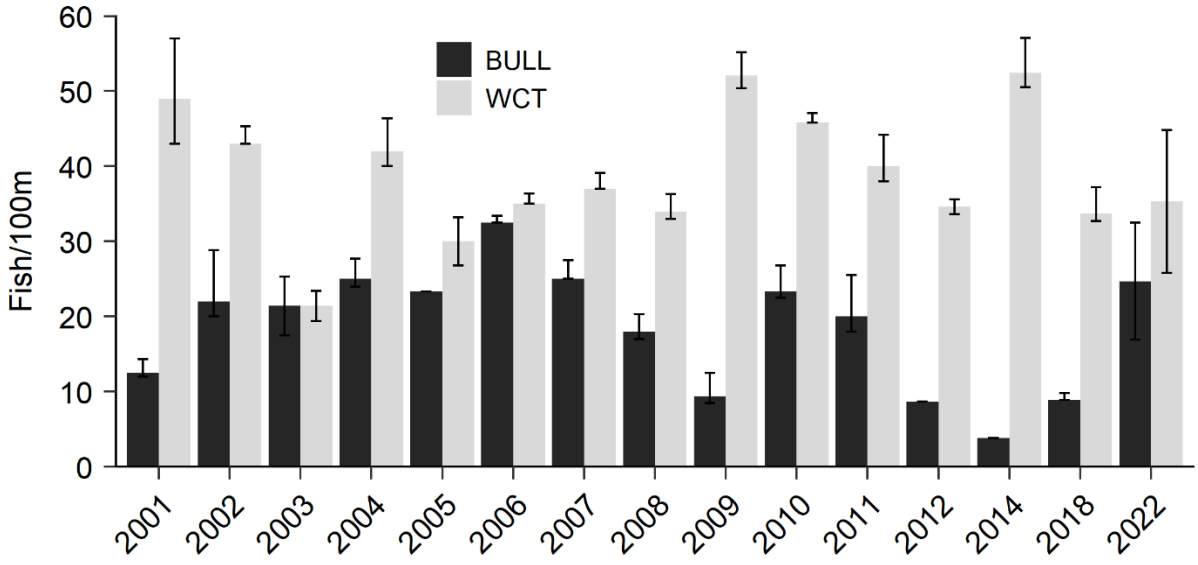

Figure 7. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL) and Westslope Cutthroat Trout (WCT) at Site 2 in East Fork Bull River.

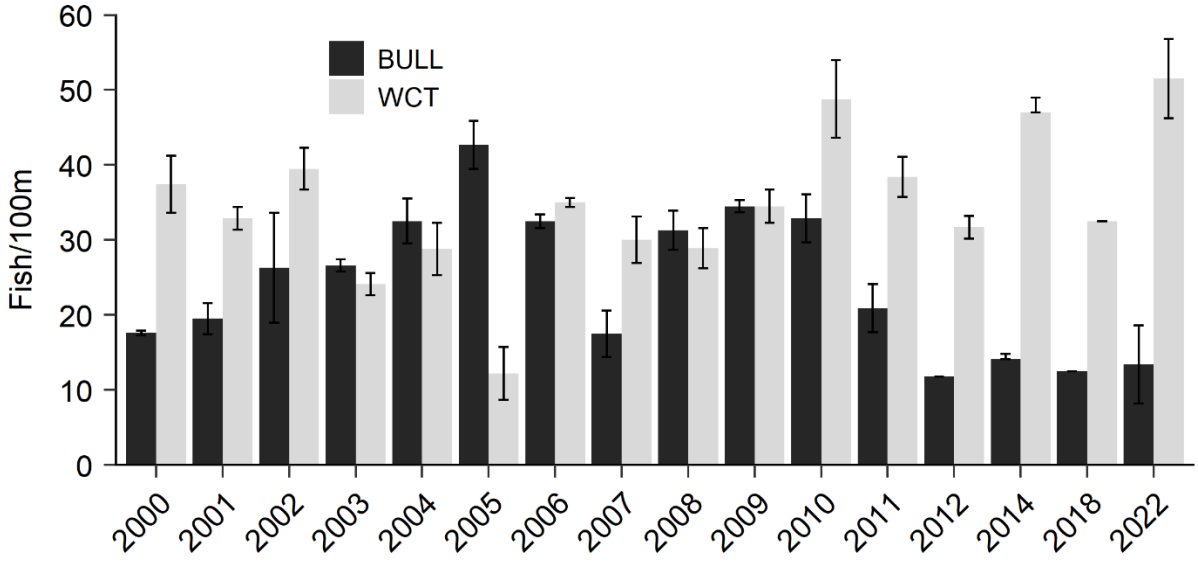

Figure 8. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL) and Westslope Cutthroat Trout (WCT) at Site 3 in East Fork Bull River.

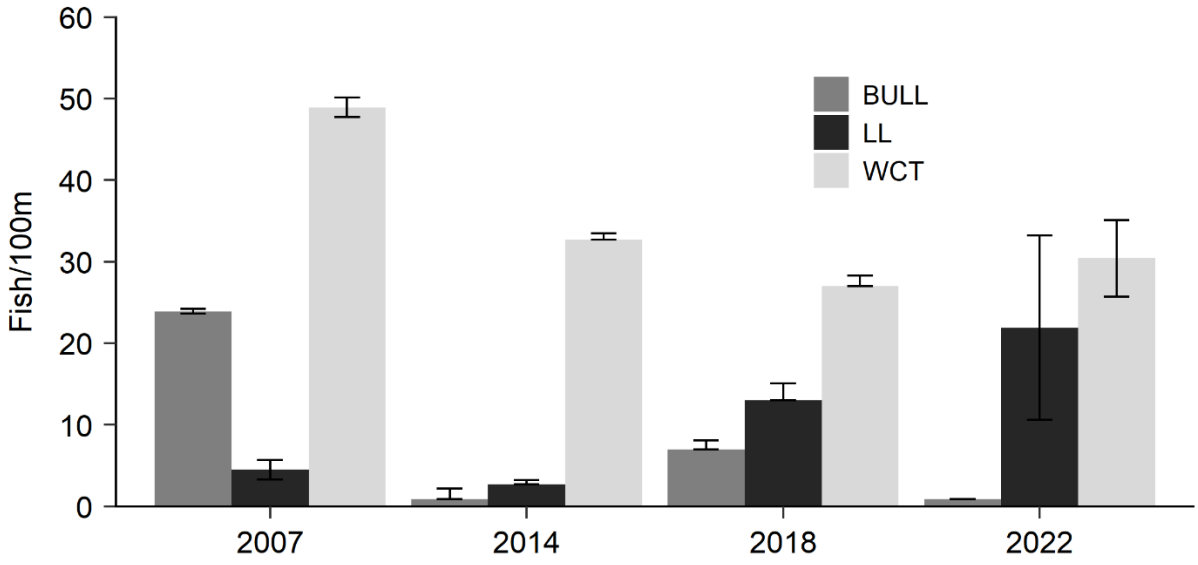

Figure 9. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL), Brown Trout (LL), and Westslope Cutthroat Trout (WCT) at Site 4 in East Fork Bull River.

North Fork East Fork Bull River

North Fork East Fork Bull River (NFEFBR) is a tributary to the East Fork Bull River which enters the drainage approximately 5 km^2 upstream from mainstem Bull River. It lies entirely on Kootenai National Forest with its headwaters in the Cabinet Mountains Wilderness. A forest road provides limited access to the lower end, and a trail provides access to the upper end. The stream has a boulder dominated channel with an excellent riparian canopy comprised mainly of western red cedar. Sites 1 and 2 were first sampled during 2013 (Figure 6). In 2022, these sites were sampled for the second time. The lowest site was approximately 550 m upstream of the East Fork Bull River Road (FS 410) at Rkm 1.0. The second site was located at Rkm 2.9, approximately 500 m upstream of Devil's Club Creek.

Abundances of Westslope Cutthroat Trout appear stable to in NFEFBR. Both long-term monitoring sites observed abundances greater than those in 2013. Westslope Cutthroat Trout abundance was 42.7 and 47.4 fish/100 meters in 2013, compared to 48.9 and 65.6 fish/100 m in 2022, for Sites 1 and 2, respectively (Table 3; Figure 10; Figure 11).

Table 3. Standardized linear abundance (#/100m), density (#/100m^2) and biomass (g/100m^2) estimates (fish≥75mm) for Westslope Cutthroat Trout (WCT) in North Fork East Fork Bull River in 2022.

Site # (Rkm)	Section Length (m)	Spp.	Length Range (mm)	Estimate per 100 m	95% C.I.	Estimate per 100 m^2	95% C.I.	g/100 m^2	95% C.I.
1 (1.0)	88	WCT	60-196	48.9	46.6-51.1	8.3	6.1-10.5	173.9	171.7-176.1
2 (2.9)	96	WCT	52-211	65.6	62.0-69.3	14.3	10.6-17.9	370.9	367.2-374.6

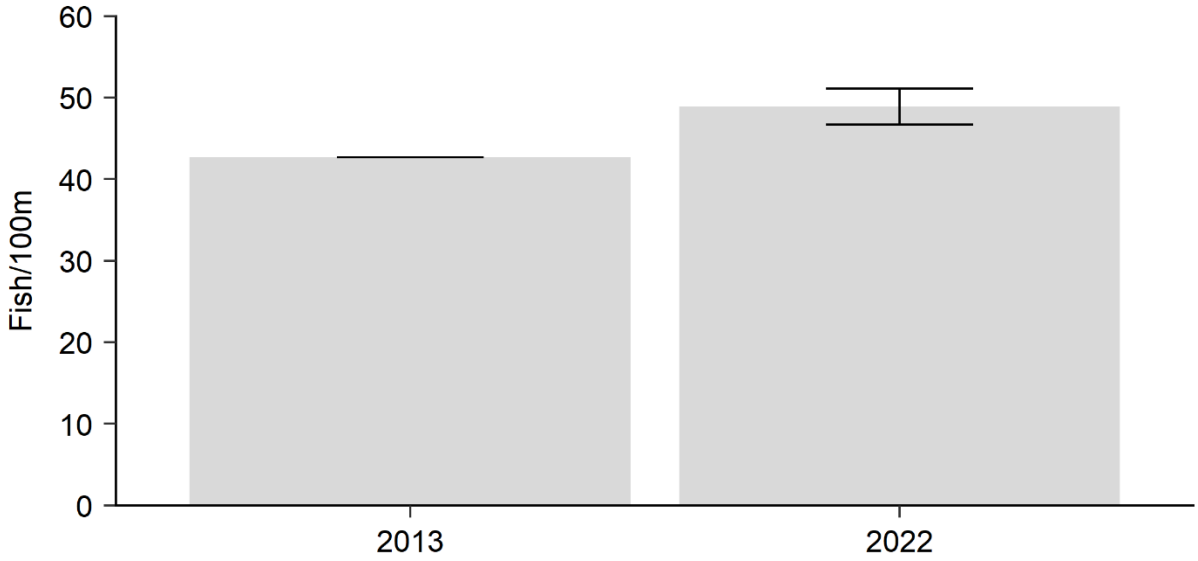

Figure 10. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Westslope Cutthroat Trout (WCT) at Site 1 in North Fork East Fork Bull River.

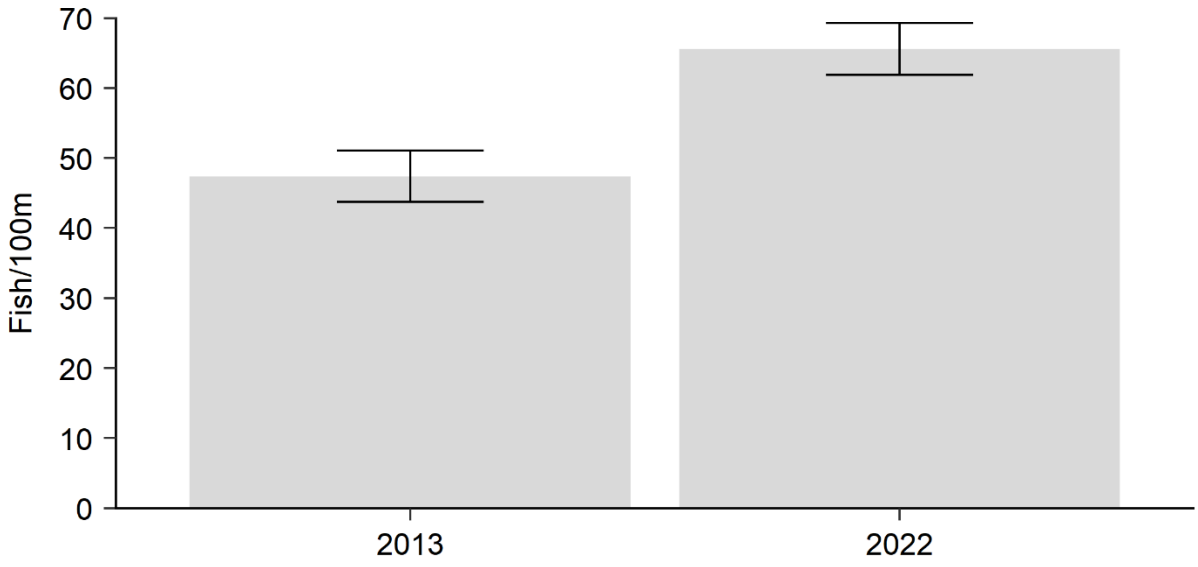

Figure 11. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Westslope Cutthroat Trout (WCT) at Site 2 in North Fork East Fork Bull River.

South Fork Bull River

The South Fork Bull River (SFBR) enters the mainstem Bull River immediately below the confluence of the North and Middle Forks which is approximately 42 kilometers upstream of Cabinet Gorge Reservoir. The SFBR drains ~37 km^2 from the Cabinet Mountains into the mainstem Bull River (GEI 2005). Timber harvest and road development are the main anthropogenic impacts in the area. The SFBR was identified as an important Bull Trout stream in the Bull River drainage (WWP 1996), but the species has not been observed in the drainage since 2006 (Horn and Tholl 2008). The SFBR contains a noteworthy population of Westslope Cutthroat Trout. However, genetic analysis from samples collected in 2007 and 2014 found some hybridization with Rainbow Trout in the lower reaches (Ardren et al. 2008; Dehann et al. 2016). Brook trout are also common in the SFBR and hybridization with Bull Trout has been documented in the past (DeHaan and Ardren 2007). A landslide in 1992, near the confluence with Chippewa Creek led to increased sedimentation and channel braiding. In 2003, a restoration project at this slide restructured the creek back to a single channel with enhanced fish habitat (Horn 2011). The new channel has remained intact since construction.

Four sites have been sampled in the SFBR since 2001 (Figure 12). Site 1 is located on the lower end at approximately Rkm 0.25 just upstream from the confluence of the North and Middle Forks. Site 2 is located just above Chippewa Creek at approximately Rkm 3.7 at the site of the landslide restoration project. Site 3 is located at Rkm 0.75 on Chippewa Creek and site 4 is

located on the SFBR just upstream of site 2 at Rkm 5.0. Sites 3 and 4 are considered the control reaches for restoration monitoring at site 2.

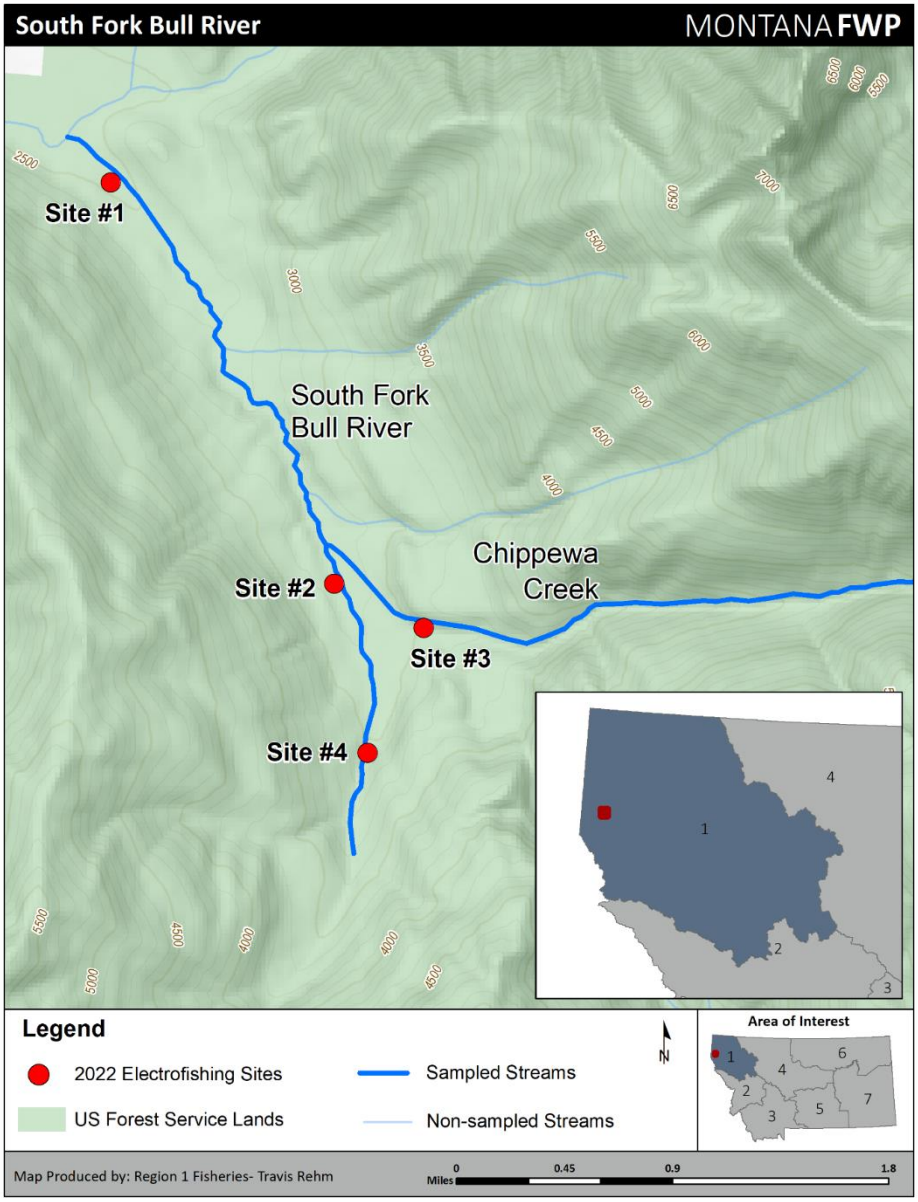

Figure 12. South Fork Bull River electrofishing sites sampled in 2022.

No Bull Trout were observed in SFBR during 2022 sampling. Abundances of Westslope Cutthroat Trout observed in 2022 were lower than historic means but appear stable in most sites. In SFBR, mean Westslope Cutthroat Trout abundance was 34.7, 52.5 and 59.7 fish/100 meters from 2001–2016 (n = 11), compared to 17.9, 46.5 and 26.4 fish/100 m in 2022, for Sites 1, 2 and 4, respectively (Table 4; Figure 13, 14 and 16). Site 4 has shown significant declines in Westslope Cutthroat abundance over the sampling period (linear regression, $r^2 = 0.6$, $p = 0.01$; Appendix A). In Chippewa Creek, mean Westslope Cutthroat Trout abundance was 40.3 fish/100 meters from 2001–2016 (n =11), compared to 41.3 fish/100 m in 2022 (Table 4; Figure 15).

Brook Trout have been common in the drainage throughout the sampling period and appear to be stable to increasing in all sites. In Chippewa Creek (Site 3) a significant increase in Brook Trout abundance over time has been observed (linear regression, $r^2 = 0.44$, $p = 0.05$; Appendix A).

Table 4. Standardized linear abundance (#/100m), density (#/100m^2) and biomass (g/100m^2) estimates (fish≥75mm) for Westslope Cutthroat (WCT) and Brook Trout (EB) in South Fork Bull River in 2022.

Site # (Rkm)	Section Length (m)	Spp.	Length Range (mm)	Estimate per 100 m	95% C.I.	Estimate per 100 m^2	95% C.I.	g/100 m^2	95% C.I.
1	106	EB	38-203	30.2	26.9-33.5	5.9	2.6-9.2	148.0	144.7-151.3
(0.4)		WCT	61-185	17.9	13.7-22.2	3.5	3.3-7.8	63.3	59.0-67.5
2	101	EB	50-231	70.3	65.6-75.0	18.5	13.8-23.2	388.5	383.8-393.1
(3.8)		WCT	60-203	46.5	43.4-49.6	12.2	9.1-15.4	293.9	290.8-297.0
3	104	EB	126-215	9.6	8.3-10.9	2.0	0.7-3.4	106.4	105.1-107.7
(1.0)		WCT	64-189	41.3	39.8-42.9	8.8	7.3-10.3	202.3	200.8-203.8
4	106	EB	40-155	7.5	6.8-8.3	2.2	1.4-2.9	64.7	64.0-65.4
(5.0)		WCT	61-168	26.4	24.8-28.1	7.5	5.9-9.2	128.3	126.6-130.0

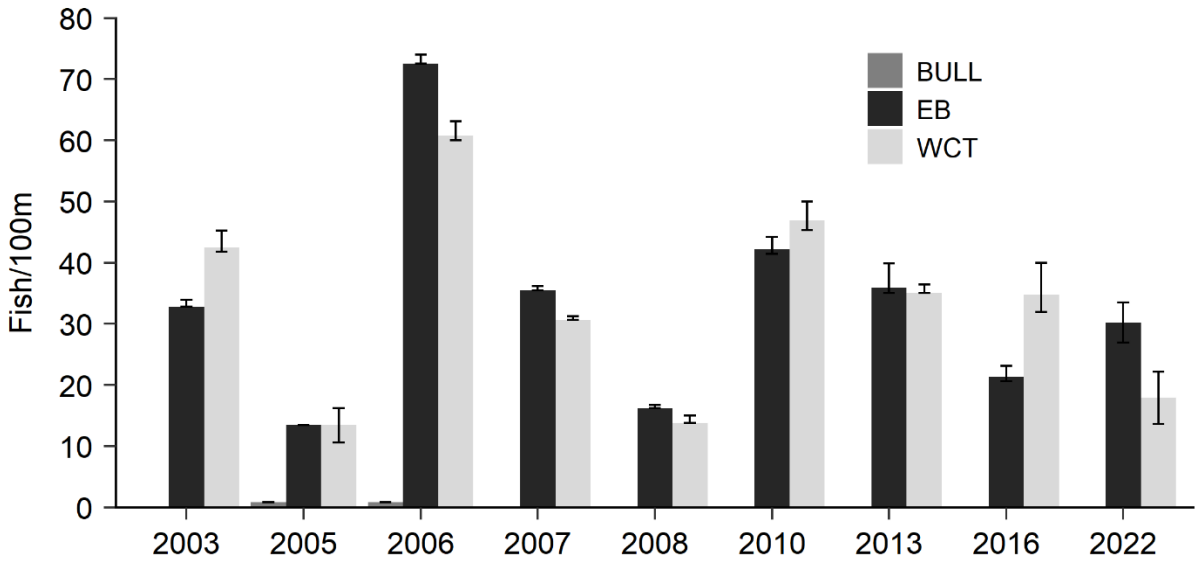

Figure 13. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL), Westslope Cutthroat Trout (WCT), and Brook Trout (EB) at Site 1 in South Fork Bull River.

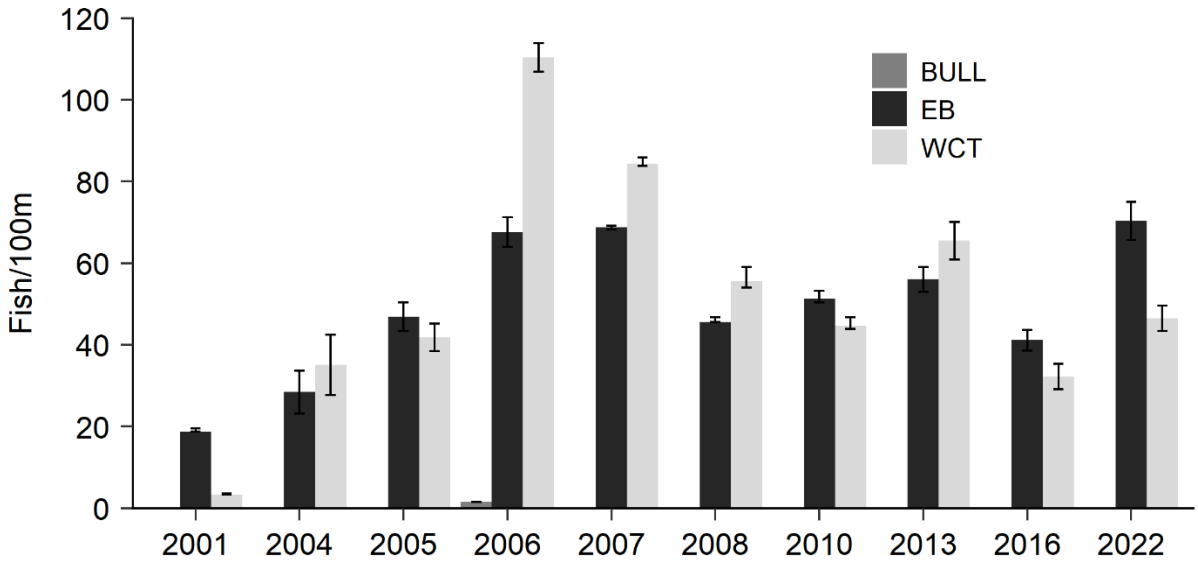

Figure 14. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL), Westslope Cutthroat Trout (WCT), and Brook Trout (EB) at Site 2 in South Fork Bull River.

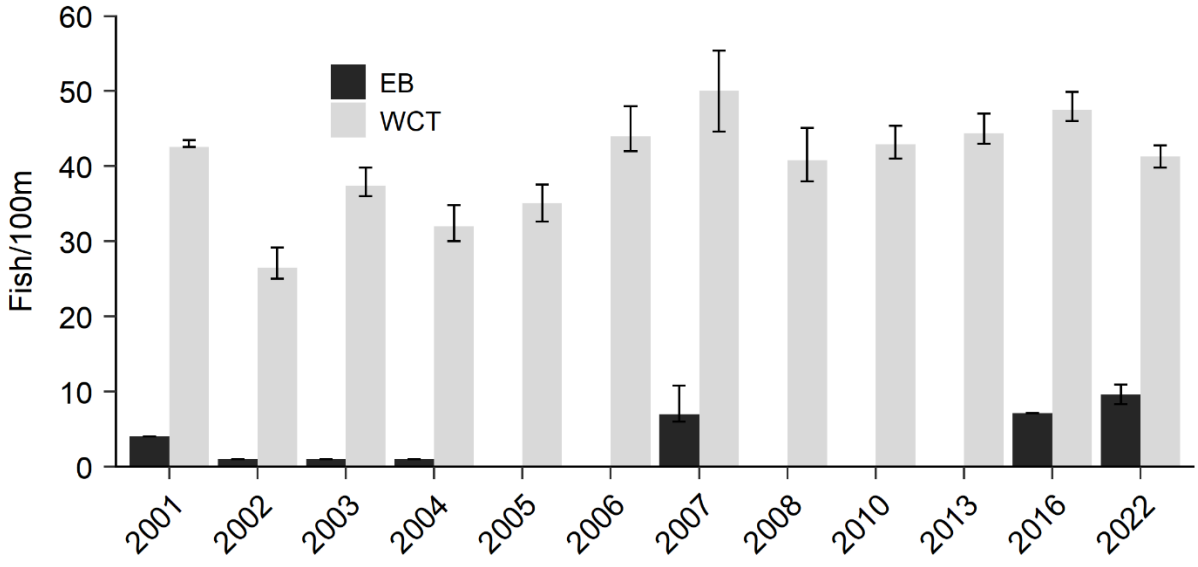

Figure 15. Linear abundance estimates (fish/100 m) with 95% confidence intervals Westslope Cutthroat Trout (WCT) and Brook Trout (EB) at Site 3 in Chippewa Creek.

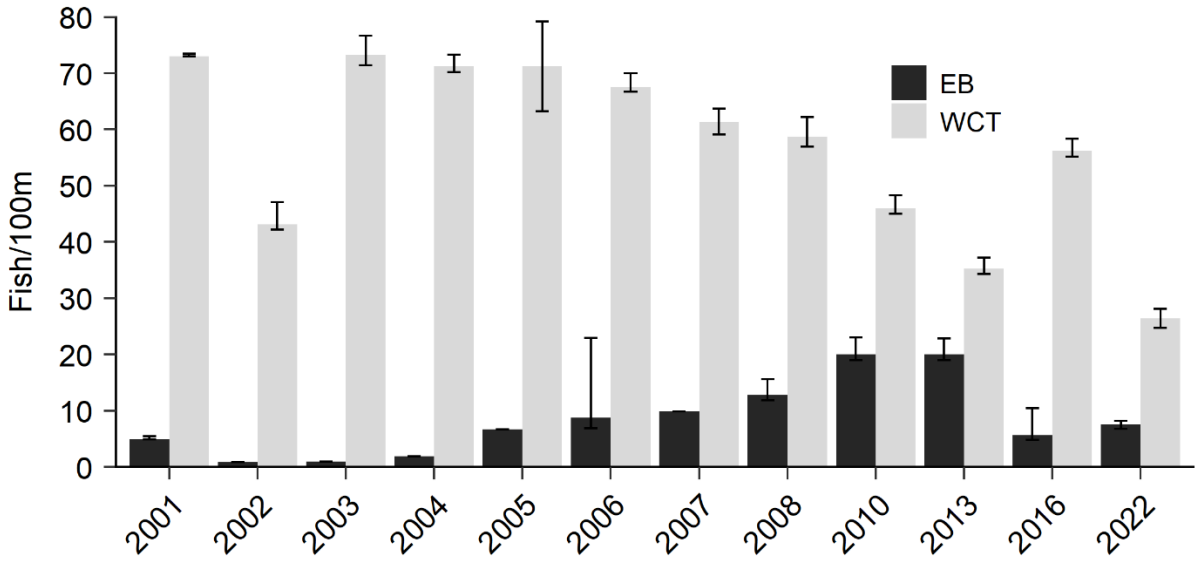

Figure 16. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Westslope Cutthroat Trout (WCT) and Brook Trout (EB) at Site 4 in South Fork Bull River.

Prospect Creek Bull Trout Rescue

In 2012, the U.S. Geological Survey and FWP while working on a stream intermittency study, encountered Bull Trout in stranded pools in an ephemeral section of Prospect Creek just upstream of its confluence with Crow Creek (R. Kreiner, FWP, personal observation). Twenty Bull Trout and 17 putative Westslope Cutthroat Trout were salvaged from these pools and moved downstream to the lower perennial portion of Prospect Creek. The next year, fish were left in these pools based on discussions with the U.S Fish and Wildlife Service. Fish rescue efforts resumed in 2014 and through 2016, 37 of the 41 Bull Trout captured were transported to the lower Clark Fork River in Idaho, below Cabinet Gorge Dam. The four other fish that were too small to be PIT tagged or transported, were released near Brush Gulch (Eric Oldenburg, Avista, personal communication; Oldenburg et al. 2015). Bull Trout captured in ephemeral portions of Prospect Creek in 2017–2021 were moved into Crow Creek (n = 117) (Rehm et al. 2022).

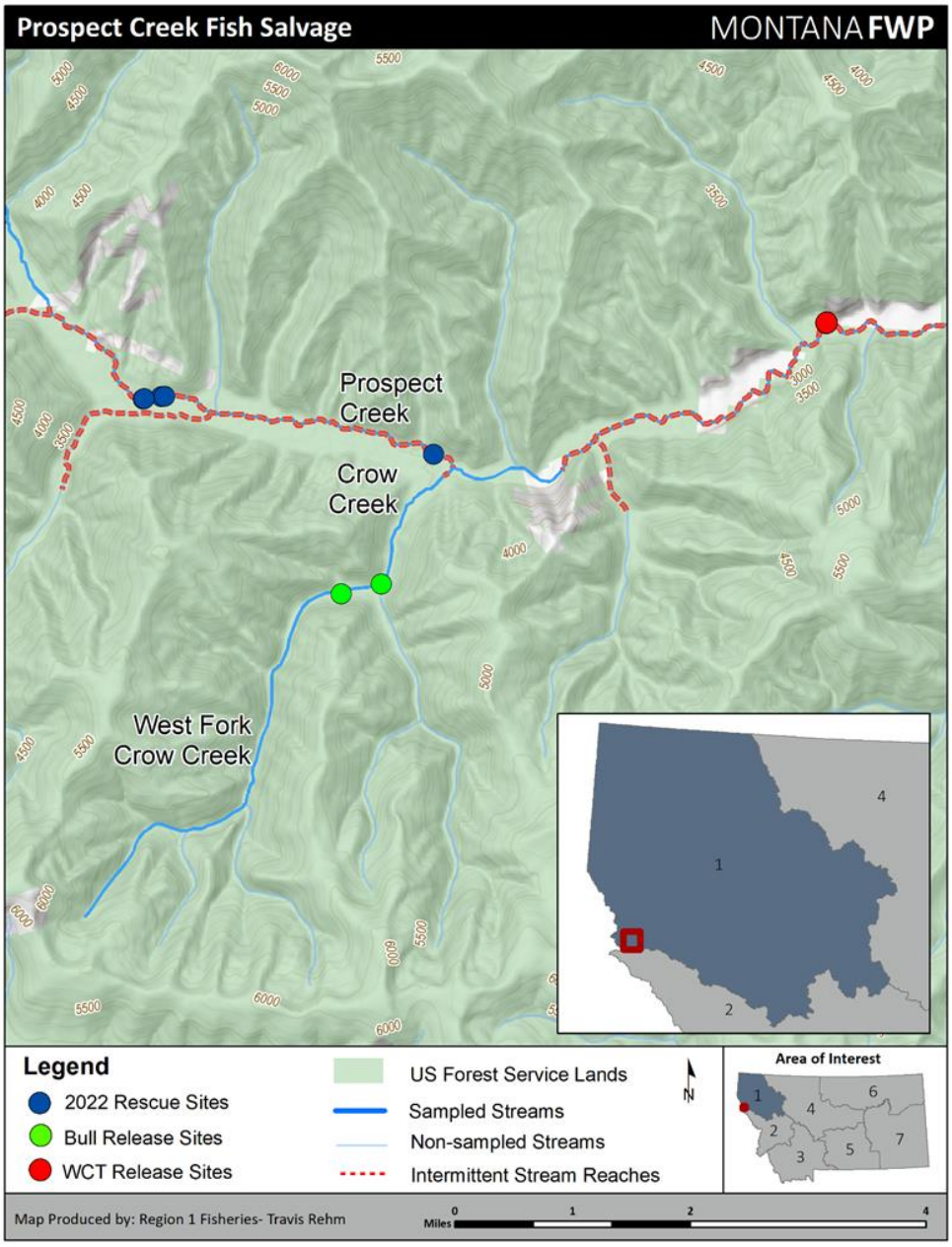

Figure 17. Prospect Creek fish rescue and release sites 2022.

In 2022, efforts to capture Bull Trout in stranded pools in the mainstem of Prospect Creek occurred over eight days in July (7/29) and August (8/1, 8/3, 8/5, 8/9, 8/10, 8/22 and 8/23). Observations indicate timing and extent of intermittency is quite variable where some stream reaches dry up in a matter of hours, while in other areas the stream and associated ephemeral pools may take days or weeks to go completely dry. A total of 87 Bull Trout were rescued from isolated pools ranging 53–271 mm in length and were relocated to Crow Creek and West Fork Crow Creek (Figure 17). Seventy-five Bull Trout were PIT tagged (≥100 mm), eleven other Bull Trout were released untagged (<100 mm), and one mortality occurred. The mean length of Bull Trout captured in ephemeral pools was 159 mm with 16 fish ≥ 200 mm. There were eleven Bull Trout ranging 53–70 mm in length and 60 Bull Trout 105–198 mm. Based on length at time of capture fish ranged from an estimated age-0 to age-4+ (Zymonas 2006). Genetics were collected from all Bull Trout rescued from Prospect Creek and released into Crow Creek.

Fifty-seven Bull Trout ≥ 200 mm in length have been rescued from the intermittent sections of Prospect Creek since 2012. Of these 57 fish, 45 Bull Trout have been released into Crow Creek 2017–2022. Resident Bull Trout ≥200 mm in length are likely age-4 or older and should be at or near sexual maturity (Rieman and McIntyre 1993; Zymonas 2006). Annual supplementation with fish from stranded pools could increase Bull Trout production in Crow Creek. Because of the low densities of Bull Trout in the drainage, even a few more large fish in Crow Creek could benefit the population. One redd in 2018, two redds in 2019 and one redd in 2022 were observed in Crow Creek, while only two redds were found in the drainage 2003–2017. However, no redds were observed in 2020 and 2021 (Moran and Kusnierz 2023).

Starting in 2023, efforts will be made to determine if Bull Trout rescued from pools in ephemeral sections of Prospect Creek are producing offspring and what percentage of Bull Trout are emigrating out of the creek after salvaging efforts. This work is being completed under the new project *Montana Tributary Habitat Acquisition and Recreational Fishery Enhancement Program (Appendix B), Prospect Creek Bull Trout Salvage Evaluation*.

Westslope Cutthroat Trout were also salvaged from ephemeral pools in portions of Prospect Creek. A total of 128 Westslope Cutthroat Trout were rescued and released in the lower perennial reach of Prospect Creek just downstream of Brush Gulch (Rkm 13.0) in 2022. Fish ranged from 89–279 mm in length with an average length of 180 mm. All Westslope Cutthroat Trout were PIT tagged and 23 fish rescued in 2022 were later detected on the Prospect Creek PIT tag array located downstream at Rkm 0.7. Five Westslope Cutthroat Trout rescued in 2021 and one Westslope Cutthroat Trout rescued in 2019 were also detected on the Prospect Creek PIT array in 2022 (Appendix D-1).

Westslope Cutthroat Trout Genetic Monitoring

Graves Creek

Genetic samples (n = 43) from putative WCT were collected from three reaches of Graves Creek in 2022 at Rkm 5.6, 10.5, and 14.1 (Figure 1). All samples were collected above Graves Creek Falls which is a fish passage barrier. Definitive evidence of Rainbow Trout ancestry in 2 fish (<1%) and Yellowstone Cutthroat Trout ancestry in 29 fish was detected (Table 5; Kovach 2023). At least 67% of the fish in the sample were hybrids with non-native ancestry anywhere from 0.3% (relatively low) to ~17.7% (fairly high). Hybrids were detected at each sampling location but, Yellowstone Cutthroat Trout ancestry is more prevalent in the portion of the Creek directly above the Graves Creek Falls (Kovach 2023).

Given these results it is safe to conclude that Graves Creek harbors a hybrid swarm between Yellowstone Cutthroat Trout and Westslope Cutthroat Trout, with a few individuals also possessing some rainbow trout ancestry (Kovach 2023).

East Fork Bull River

Genetic samples (n = 135) of putative WCT were collected from four reaches of East Fork Bull River in 2022 at Rkm 3.6, 5.5, 7.1, and 8.6 (Figure 6). Definitive evidence of Rainbow Trout ancestry in 5 fish was detected, with ancestry in the hybrids ranging from 0.3% to 25.7% (Table 5; Kovach 2023). The remaining fish in the sample appeared to be non-hybridized Westslope Cutthroat Trout. Previous samples (#58, 119, 3074) have failed to detect any rainbow trout hybrids. This may suggest that hybridization is increasing in the East Fork Bull River, or previous samples failed to detect Rainbow Trout hybrids (Kovach 2023).

The current data clearly demonstrate that hybridization is occurring in the East Fork Bull River, as all hybrids were multi-generation backcrosses, with a single fish that appeared to be an F2 backcross to a Westslope Cutthroat Trout. That does provide some evidence that recent Rainbow Trout invasion and hybridization is still occurring (i.e., a Rainbow Trout or an F1 hybrid must have spawned in the East Fork Bull River in the last two generations; Kovach 2023). East Fork Bull River is still considered to be a Westslope Cutthroat Trout stronghold and could serve as a potential donor for fish conservation efforts. However, the data potentially suggest that hybridization is ongoing and increasing in the system, and thus, hybridization may become progressively problematic in this watershed (Kovach 2023).

North Fork East Fork Bull River

Genetic samples (n = 100) from putative WCT were collected from two reaches of North Fork East Fork Bull River in 2022 at Rkm 1 and 2.9 (Figure 6). No definitive Rainbow Trout or Yellowstone Cutthroat Trout ancestry was detected in any individuals in the sample (Table 5). Given the very large sample size and high-resolution genomic information, the data strongly suggest that North Fork East Fork Bull River harbors a non-hybridized population of Westslope Cutthroat Trout (Kovach 2023).

South Fork Bull River

Genetic samples (n = 100) were collected from three reaches of South Fork Bull River in 2022 at Rkm 0.4, 3.8, and 5 (FIGURE 12). Definitive evidence of Rainbow Trout ancestry in 2 fish were detected, with ancestry in the hybrids ranging from 1% to 9.3%. The remaining fish in the sample appeared to be non-hybridized Westslope Cutthroat Trout (Table 5; Kovach 2023). These results are consistent with a past sample in the South Fork Bull River that also detected a single hybrid (sample #3075; Kovach 2023).

The current data clearly demonstrate that hybridization is occurring in (or near) the South Fork Bull River. Both fish are multi-generation backcrosses from “historical” hybridization events

between Westslope Cutthroat Trout and Rainbow Trout. However, hybrids were still quite rare in the South Fork Bull River. This suggests there may be some biological mechanism preventing widespread hybridization (e.g., natural selection or assortative mating), and/or propagule pressure has been insufficient to overwhelm natural selection that should, and often does (Muhlfeld et al. 2009 and Kovach et al. 2015), favor native Westslope Cutthroat Trout. South Fork Bull River is still a Westslope Cutthroat Trout stronghold and could serve as a potential donor for fish conservation efforts.

Chippewa Creek

Genetic samples (n = 44) were collected from one reach of Chippewa Creek in 2022 at Rkm 1 (Figure 12). No definitive Rainbow Trout or Yellowstone Cutthroat Trout ancestry was detected in any individuals in the sample (Table 5). The data strongly suggest that Chippewa Creek harbors a non-hybridized population of Westslope Cutthroat Trout (Kovach 2023).

Litte Fatman Creek

Genetic samples (n = 27) were collected from one reach of Little Fatman Creek in 2021 and 2022 at Rkm 0.1. No definitive Rainbow Trout or Yellowstone Cutthroat Trout ancestry was detected in any individuals in the sample (Table 5). The data strongly suggest that Little Fatman Creek harbors a non-hybridized population of Westslope Cutthroat Trout (Kovach 2023).

Table 5. Summary of hybridization results. The Max RBT and YCT columns denote the maximum individual Rainbow Trout and Yellowstone Cutthroat Trout ancestry observed.

Sample	Year	N	#Hybrids	#WCT	Max RBT	Max YCT
EF Bull River	2022	135	5	130	25.7	0
NF EF Bull River	2022	100	0	100	0	0
SF Bull River	2022	100	2	98	9.3	0
Chippewa Creek	2022	44	0	44	0	0
Graves Creek	2022	43	29	13?	0.6	17.7
Little Fatman Creek	2021-22	27	0	27	0	0

PIT Tag Array Detection Summary

Prospect Creek Array

A PIT tag array was installed in lower Prospect Creek (Rkm 0.7) in August of 2018 and was a cost-share between the Avista and Northwestern Energy mitigation programs (Biomark 2018c). In 2022, 44 fish were detected on the array including Bull Trout, Brown Trout, Rainbow Trout, and Westslope Cutthroat Trout (Appendix D-1). Of the 2 Bull Trout that were detected, neither were initially tagged in Prospect Creek. Both were fish transported upstream from below Cabinet Gorge Dam under the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Upstream*

Fish Passage Program. The first was a Graves Creek upstream transport in 2018 and 2019. This fish was also transported downstream below Cabinet Gorge Dam as a juvenile under the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Tributary Trapping and Downstream Juvenile Bull Trout Transport Program,* in 2015. During 2021 and 2022 this fish has made apparent spawning movements up Prospect Creek. The second Bull Trout was transported to the South Fork Jocko River in 2021. This fish likely overwintered in Noxon Reservoir and failed to ascend the Thompson Falls Fish Ladder. This fish also made apparent spawning movements up Prospect Creek in 2022. It is possible that these and other adult Bull Trout spawned in Dry Creek, a tributary to Prospect Creek just upstream of the Prospect Creek PIT tag array. In 2022, 7 larger-size Bull Trout redds were observed in the tributary (Moran and Kusnierz 2023).

Thirty Westslope Cutthroat Trout were detected on the Prospect Creek array in 2022. Twenty-nine of those fish came from salvaging efforts in the ephemeral reaches of Prospect Creek (2019–2022). A single Westslope Cutthroat Trout tagged at the Thompson Falls Fish Ladder in 2021 was detected making an apparent spawning movement up Prospect Creek in 2022. The remaining fish detected on the array included 2 Brown Trout and 10 Rainbow Trout. All of these fish were initially tagged at the Thompson Falls Fish Ladder, with the exception of one Rainbow Trout that was tagged in the Clark Fork River (mouth of the Thompson River) in 2021 as part of a Thompson Falls Fish Ladder efficiency study.

Graves Creek Array

The current Graves Creek PIT array was installed in 2015 at Rkm 0.6. In 2022, 46 fish were detected on the array including Bull Trout, Brown Trout, *Oncorhynchus* hybrid, and Westslope Cutthroat Trout (Appendix D-1). Forty Bull Trout were detected on the array in 2022. Eight of these fish were tagged in Graves Creek as part of the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Bull Trout Emigration Study* as juveniles in 2019 and 2020. Ten additional Bull Trout were tagged during electrofishing efforts in Graves Creek described earlier in this report. Nineteen Bull Trout detected were fish transported upstream from below Cabinet Gorge Dam to the Graves Creek under the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Upstream Fish Passage Program* from 2019-2022. Fourteen of these fish were also transported downstream from Graves Creek to below Cabinet Gorge Dam as juveniles under the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Tributary Trapping and Downstream Juvenile Bull Trout Transport Program*. The remaining 4 Bull Trout were tagged at the permanent weir site in Graves Creek in 2022.

Three Westslope Cutthroat Trout were detected on the Graves Creek array in 2022. All of those fish were tagged at the permanent weir site in Graves Creek in 2022. The remaining fish detected on the array included 2 Brown Trout and a *Oncorhynchus* hybrid. One Brown Trout and the *Oncorhynchus* hybrid were initially tagged at the Thompson Falls Fish Ladder in 2022 and 2020,

respectively. The remaining Brown Trout was tagged in the Clark Fork River in 2022 as part of a Thompson Falls Fish Ladder efficiency study.

Vermilion River Array

In the summer of 2019, a PIT tag array was installed on the lower Vermilion River at Rkm 2.8. (Biomark 2019). In 2022, 10 fish were detected on the array including Bull Trout, Brown Trout, and Westslope Cutthroat Trout (Appendix D-1). Forty-one and forty-two fish were PIT tagged during sampling of the Vermilion River in 2019 and 2020, respectively. Species PIT tagged included Bull Trout (n = 55), Westslope Cutthroat Trout (n = 27), and an *Oncorhynchus* hybrid. Seven Bull Trout were detected on the array in 2022 (Appendix D-1). Two of these Bull Trout were tagged as juveniles during Vermilion River sampling in 2020. An additional juvenile Bull Trout tagged in the Vermilion River in 2020 during electrofishing under the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Tributary Trapping and Downstream Juvenile Bull Trout Transport Program* was detected on the array. The remaining Bull Trout detected were fish transported upstream from below Cabinet Gorge Dam to the Vermilion River under the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Upstream Fish Passage Program*. Three of those Bull Trout were transported to the Vermilion River in 2022 and the remaining Bull Trout was transported in 2020. This fish has likely overwintered in Noxon Reservoir and has made apparent spawning movements in the Vermilion River in 2020, 2021 and 2022.

One Westslope Cutthroat Trout initially tagged in 2019 was detected on the array in both 2021 and 2022. The remaining Westslope Cutthroat Trout was tagged at the Thompson Falls Fish Ladder in 2021. This is the same fish that was detected making an apparent spawning movement up Prospect Creek in 2022. One Brown Trout was detected on the array in 2022 that was initially tagged at the Thompson Falls Fish Ladder.

Bull River Array

In August of 2018, a PIT tag array was installed on the lower Bull River at Rkm 4.5 (Biomark 2018a). In 2022, 135 fish were detected on the array including Bull Trout, Brook Trout, Brown Trout, Mountain Whitefish, Rainbow Trout, *Oncorhynchus* hybrids and Westslope Cutthroat Trout (Appendix D-1). Six Bull Trout were detected on the array in 2022. Two of these Bull Trout were tagged in the East Fork Bull River as part of the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Bull Trout Emigration Study* as juveniles in 2019 and 2020. Another in the East Fork Bull River weir in 2022 under the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Tributary Trapping and Downstream Juvenile Bull Trout Transport Program.* One more Bull Trout was tagged in the Bull River as part of sampling efforts for the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Westslope Cutthroat Trout Transport Evaluation.* The remaining two Bull Trout detected were fish transported upstream from below Cabinet Gorge Dam to the East Fork Bull River under the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Upstream Fish Passage Program* in 2021 and 2022.

Twenty-five Westslope Cutthroat Trout were detected on the Bull River array in 2022. Twenty-one of those fish came from tags associated with the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Westslope Cutthroat Trout Transport Evaluation* all tagged in 2022. The remaining four Westslope Cutthroat Trout were transported upstream from below Cabinet Gorge Dam to Cabinet Gorge Reservoir under the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Upstream Fish Passage Program* in 2022. One of those fish was transported in both 2021 and 2022.

Seventy-nine Brown Trout, eighteen Brook Trout, three Rainbow Trout, and three *Oncorhynchus* hybrids were detected on the Bull River array in 2022. Forty-three Brown Trout, two Brook Trout, two Rainbow Trout, and three *Oncorhynchus* hybrids came from tags associated with the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Westslope Cutthroat Trout Transport Evaluation* all tagged in 2022. The remaining thirty-six Brown Trout and sixteen Brook Trout were fish tagged during East Fork Bull River weir exclusion efforts as part of the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Tributary Trapping and Downstream Juvenile Bull Trout Transport Program.* The Last Rainbow Trout was initially tagged at the Thompson Falls Fish Ladder in 2022. A single Mountain Whitefish was also detected on the Bull River Array that was tagging in 2019 at the East Fork Bull River screw trap associated with *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Tributary Trapping and Downstream Juvenile Bull Trout Transport Program.*

East Fork Bull River Array

In September of 2018, a PIT tag array was installed on East Fork Bull River at Rkm 0.2 (Biomark 2018b). In 2022, 31 fish were detected on the array including Bull Trout, Brook Trout, Brown Trout, Mountain Whitefish, *Oncorhynchus* hybrids and Westslope Cutthroat Trout (Appendix D-1). Four Bull Trout were detected on the array in 2022. One Bull Trout was tagged in the Bull River as part of sampling efforts for the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Westslope Cutthroat Trout Transport Evaluation*. The remaining three Bull Trout detected were fish transported upstream from below Cabinet Gorge Dam to the East Fork Bull River under the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Upstream Fish Passage Program* in 2021 and 2022. All Bull Trout were also detected on the Bull River Array excluding one of the transported Bull Trout.

Five Westslope Cutthroat Trout were detected on the Bull River array in 2022. Two were tagged in the East Fork Bull River as part of the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Tributary Trapping and Downstream Juvenile Bull Trout Transport Program* in 2018 and 2021. Another was tagged in the Bull River as part of sampling efforts for the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Westslope Cutthroat Trout Transport Evaluation.* The remaining two Westslope Cutthroat Trout detected were transported upstream from below Cabinet Gorge Dam to Cabinet Gorge Reservoir under the *Fish Passage/Native*

Salmonid Restoration Plan (Appendix C), Upstream Fish Passage Program in 2022. These two fish were also detected on the Bull River Array.

Nineteen Brown Trout, a Brook Trout, and an *Oncorhynchus* hybrid were detected on the East Fork Bull River array in 2022. Eleven Brown Trout, and the Oncorhynchus hybrid came from tags associated with the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Westslope Cutthroat Trout Transport Evaluation* all tagged in 2022. The remaining eight Brown Trout and Brook Trout were tagged during East Fork Bull River weir exclusion efforts as part of the *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Tributary Trapping and Downstream Juvenile Bull Trout Transport Program.* A single Mountain Whitefish was also detected on the Bull River Array that was tagged in 2019 at the East Fork Bull River screw trap associated with *Fish Passage/Native Salmonid Restoration Plan (Appendix C), Tributary Trapping and Downstream Juvenile Bull Trout Transport Program*. This fish was also detected on the Bull River Array.

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Appendix A. Long-term abundance (fish/100 m) and biomass (grams/100 m^2) trends for stream reaches sampled in 2022.

Table A-1. Coefficient of determination (r^2), slope and *P*-value from linear regression analyses of abundance (fish/100m) and biomass (g/100m2) over time organized by sites and species for long-term monitoring sites in lower Clark Fork tributaries sampled in 2022. Bold text signifies significant relationships. Sampling Period (Period) and sample size (n) indicate how many times a site was sampled within year period. Species abbreviations include Bull Trout (BULL), Brook Trout (EB), *Oncorhynchus* hybrids (RBxWCT), and Westslope Cutthroat Trout (WCT).

				Abundance			Biomass		
Stream	**Site (Rkm)**	**Period (n)**	**Species**	**r^2**	**Slope**	***P*-value**	**r^2**	**Slope**	***P*-value**
Graves	1 (1.5)	2003-22 (11)	BULL	0.03	0.17	0.62	0.21	1.8	0.15
Graves	1 (1.5)	2003-22 (11)	WCT	0.06	0.85	0.47	0.21	6.53	0.16
Graves	1 (1.5)	2003-22 (11)	LL	0.33	0.4	0.06	0.06	1.87	0.47
Graves	1 (1.5)	2003-22 (11)	RBxWCT	0.38	0.32	**0.04**	0.01	0.19	0.79
Graves	2 (4.3)	2003-22 (11)	BULL	0.00	0.15	0.85	0.09	-1.4	0.38
Graves	2 (4.3)	2003-22 (11)	WCT	0.01	-0.19	0.81	0.00	0.9	0.88
Graves	2 (4.3)	2003-22 (11)	EB	0.02	-0.03	0.71	0.01	-0.1	0.77
Graves	3 (5.6)	2002-22 (5)	WCT	0.7	2.06	0.08	0.77	11.23	**0.05**
Graves	3 (5.6)	2002-22 (5)	EB	0.13	-0.06	0.55	0.06	-0.59	0.68
Graves	4 (10.5)	2002-22 (4)	WCT	0.74	3.91	0.14	0.61	21.24	0.27
Graves	4 (10.5)	2002-22 (4)	EB	0.9	-2.2	**0.05**	0.9	-16.5	**0.05**
EFBR	2 (5.5)	2001-22 (15)	BULL	0.09	-0.41	0.28	0.39	-1.86	**0.01**
EFBR	2 (5.5)	2001-22 (15)	WCT	0.00	0.01	0.97	0.16	3.77	0.14
EFBR	3 (7.1)	2000-22 (16)	BULL	0.21	-0.7	0.08	0.05	-1.06	0.43
EFBR	3 (7.1)	2000-22 (16)	WCT	0.23	0.75	0.06	0.03	1.48	0.52
EFBR	4 (3.6)	2007-22 (4)	BULL	0.69	-1.4	0.17	0.81	-6.62	0.1
EFBR	4 (3.6)	2007-22 (4)	WCT	0.78	-1.34	0.12	0.36	-6.48	0.4
EFBR	4 (3.6)	2007-22 (4)	LL	0.72	1.17	0.15	0.99	6.32	**0.01**
EFBR	4 (3.6)	2007-22 (4)	EB	0.73	0.06	0.14	0.78	0.22	0.12
SFBR	1 (0.4)	2003-22 (9)	WCT	0.07	-0.68	0.51	0.07	-2.63	0.48
SFBR	1 (0.4)	2003-22 (9)	EB	0.28	1.45	0.12	0.00	-0.13	0.98
SFBR	2 (3.8)	2001-22 (10)	WCT	0.00	0.31	0.86	0.17	-11.82	0.28
SFBR	2 (3.8)	2001-22 (10)	EB	0.28	1.45	0.12	0.00	0.18	0.97
SFBR	3 (1)	2001-22 (12)	WCT	0.21	0.49	0.13	0.3	3.33	0.07
SFBR	3 (1)	2001-22 (12)	EB	0.34	0.32	**0.05**	0.44	3.93	**0.02**
SFBR	4 (5)	2001-22 (12)	WCT	0.54	-1.88	**0.01**	0.6	-11.71	**0.00**
SFBR	4 (5)	2001-22 (12)	EB	0.17	0.43	0.19	0.14	2.52	0.24

Appendix B. Stream Temperature Monitoring Data 2022

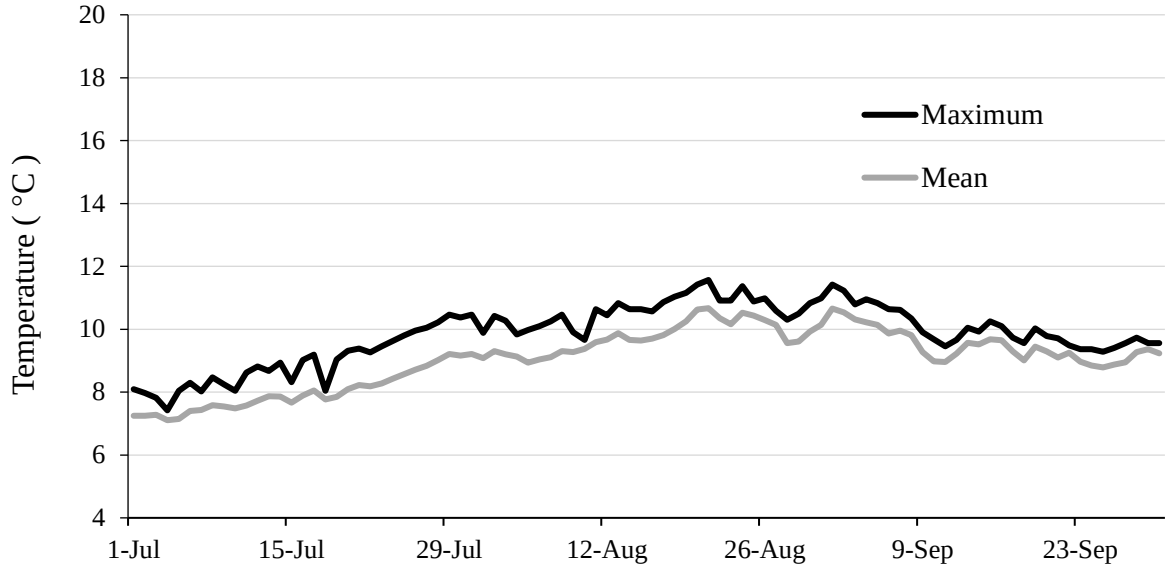

Figure B-1. Maximum and mean daily water temperatures in East Fork Blue Creek (Rkm 0.3), 2022.

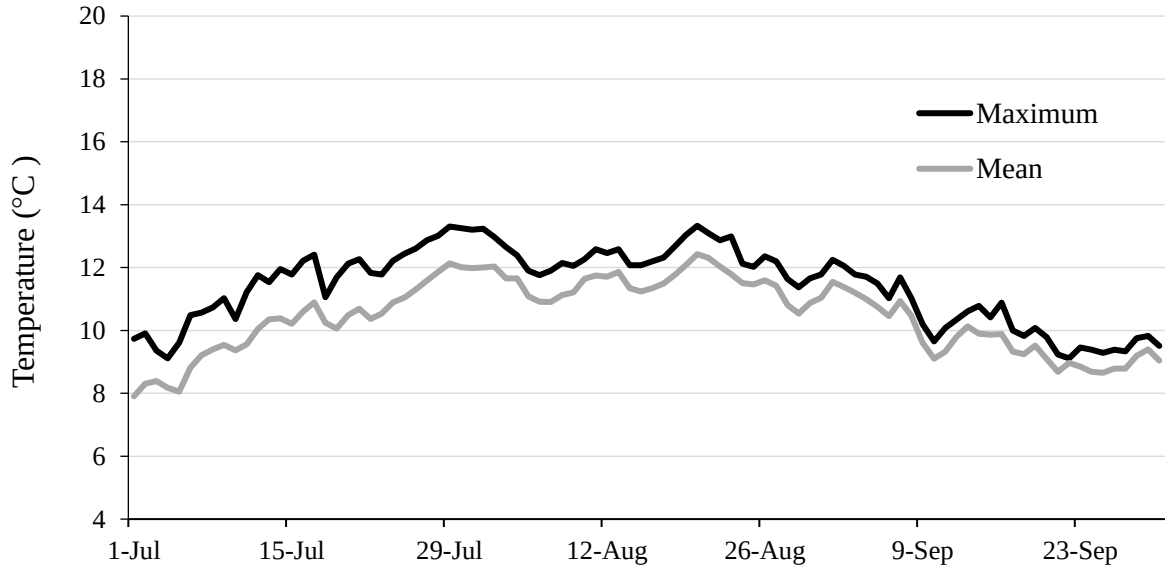

Figure B-2. Maximum daily water temperatures in upper Prospect Creek (Rkm 29.3), 2022.

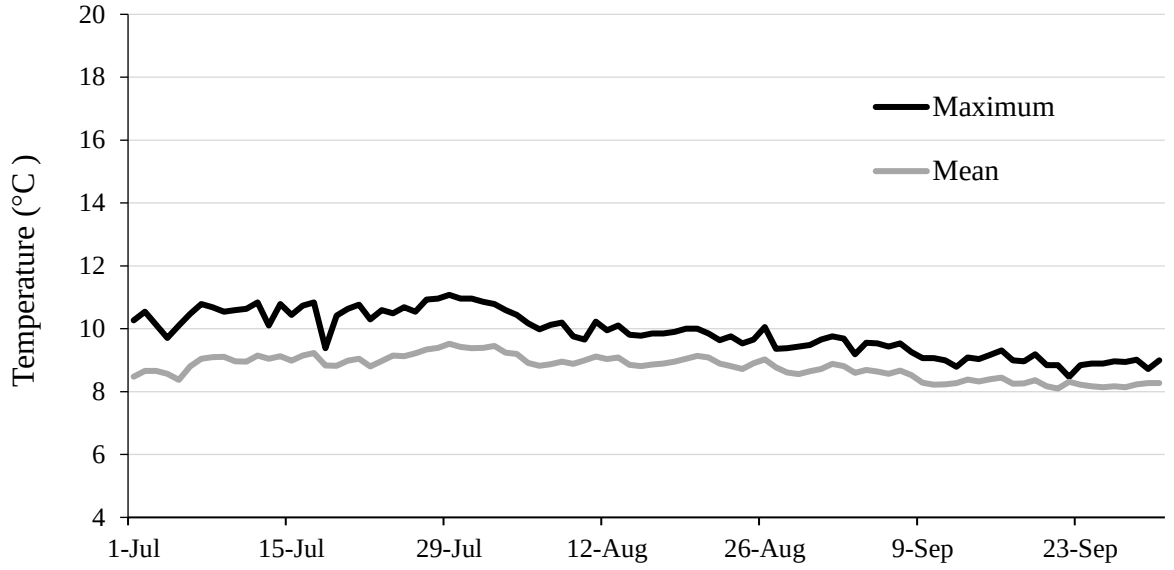

Figure B-3. Maximum and mean daily water temperatures in Prospect Creek below Crow Creek (Rkm 19.5), 2022.

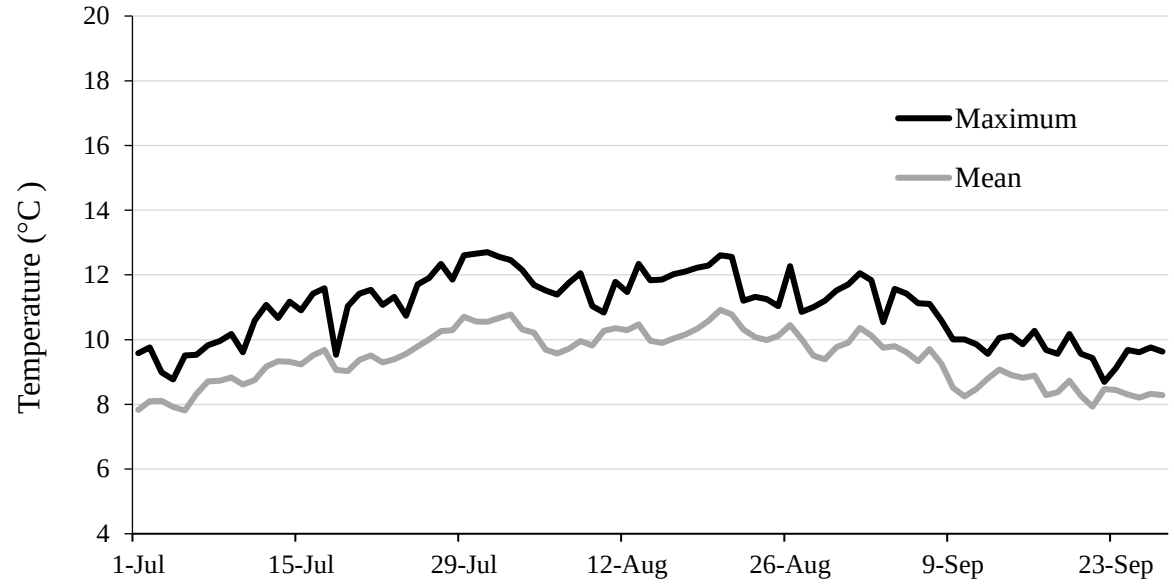

Figure B-4. Maximum and mean daily water temperatures in Cooper Gulch above long-term monitoring Site 1 (Rkm 3.7), 2022.

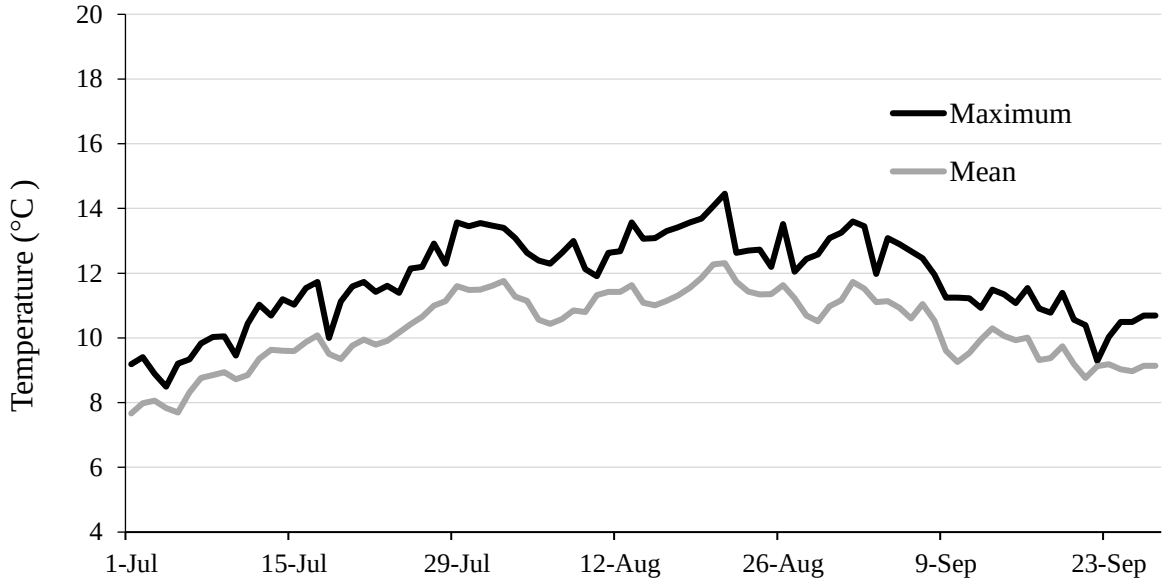

Figure B-5. Maximum and mean daily water temperatures in Cooper Gulch below Chipmunk Creek (Rkm 5.5), 2022.

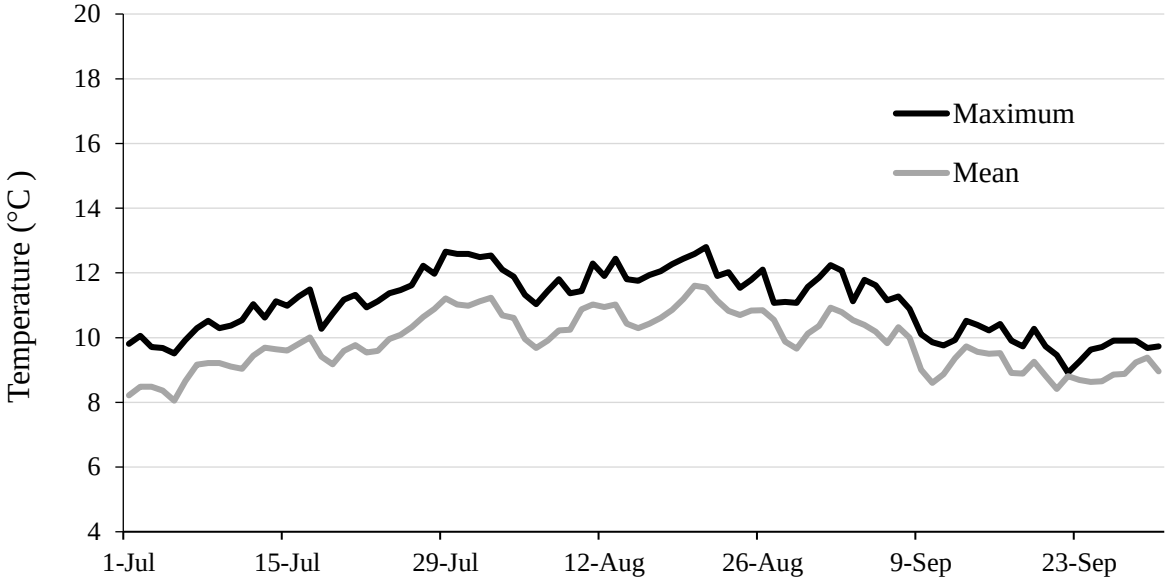

Figure B-6. Maximum and mean daily water temperatures in Crow Creek restoration reach (Rkm 1.8), 2022.

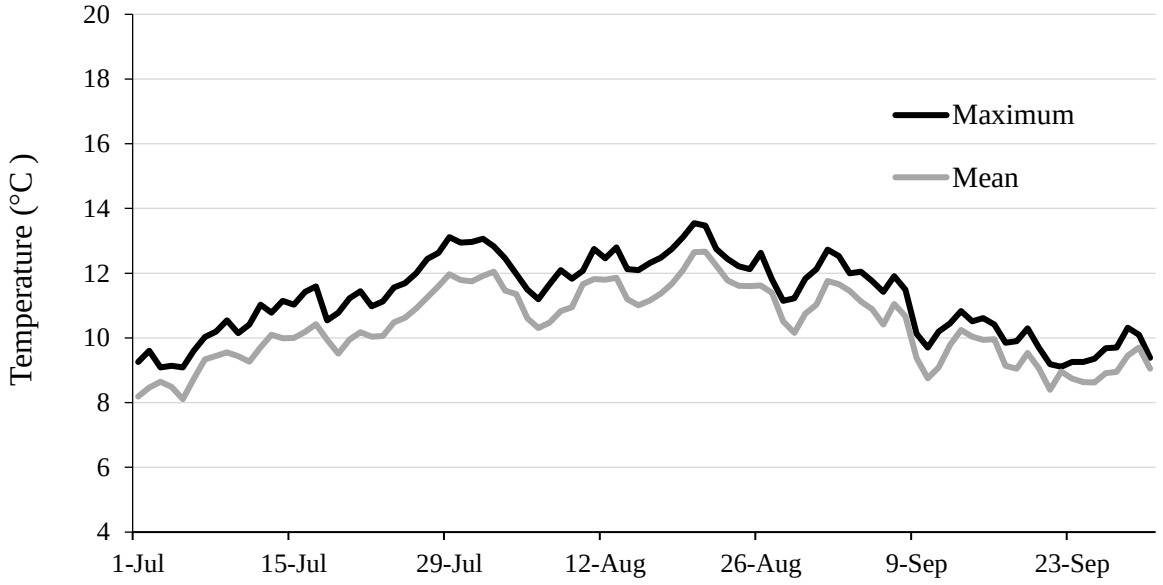

Figure B-7. Maximum and mean daily water temperatures in West Fork Crow Creek (Rkm 0.6), 2022.

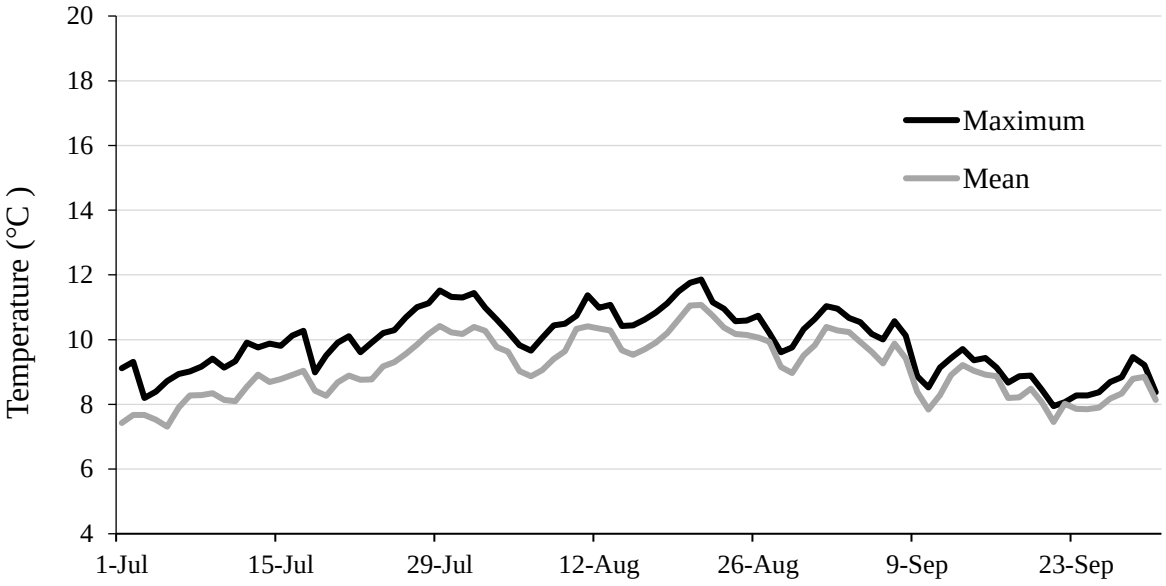

Figure B-8. Maximum and mean daily water temperatures in East Fork Crow Creek (Rkm 2), 2022.

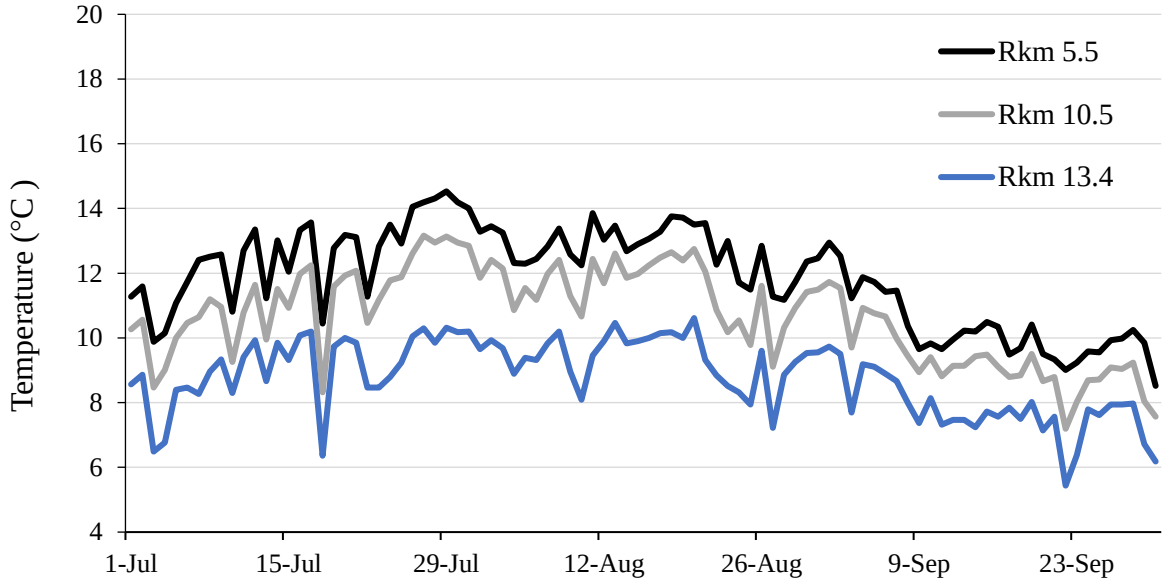

Figure B-11. Maximum daily water temperatures in Lower West Fork Trout Creek (Rkm 1.4), above Robins Run (Rkm 4.9), and below the South Branch (Rkm 7.0), 2022.

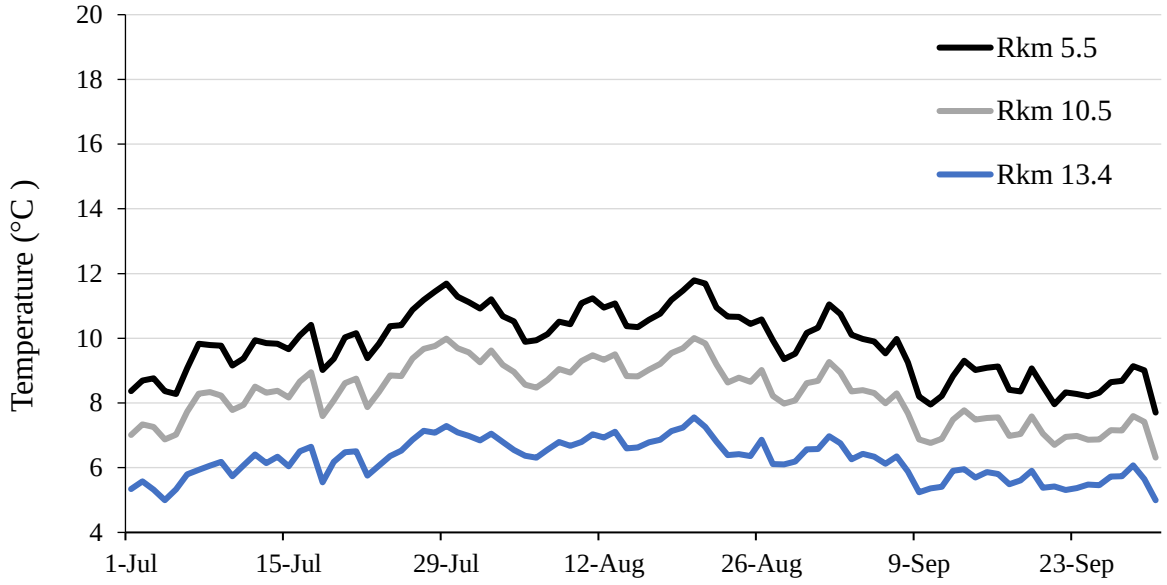

Figure B-10. Mean daily water temperatures in Graves Creek above the falls (Rkm 5.5), upstream of second bridge (Rkm 10.5), and at Lawn Lake Trailhead (Rkm 13.4), 2022.

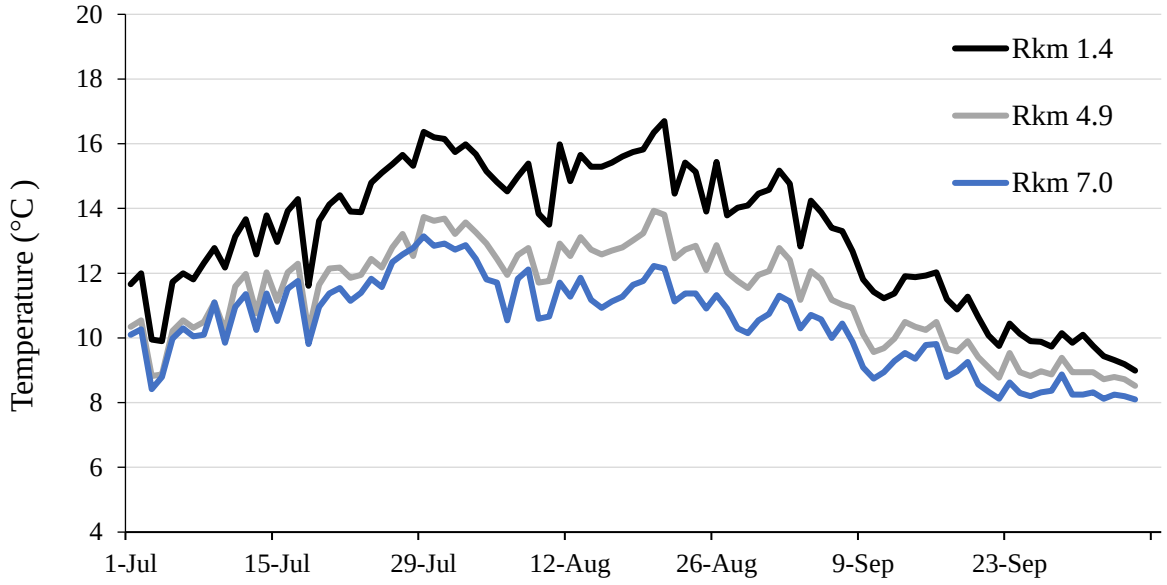

Figure B-11. Maximum daily water temperatures in Lower West Fork Trout Creek (Rkm 1.4), above Robins Run (Rkm 4.9), and below the South Branch (Rkm 7.0), 2022.

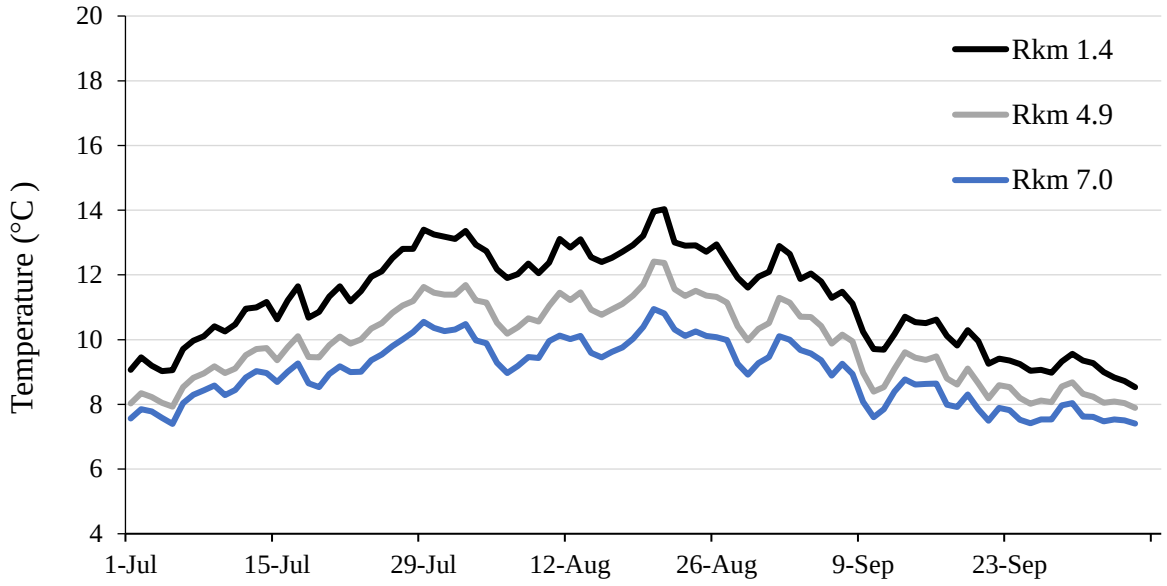

Figure B-12. Mean daily water temperatures in Lower West Fork Trout Creek (Rkm 1.4), above Robins Run (Rkm 4.9), and below the South Branch (Rkm 7.0), 2022.

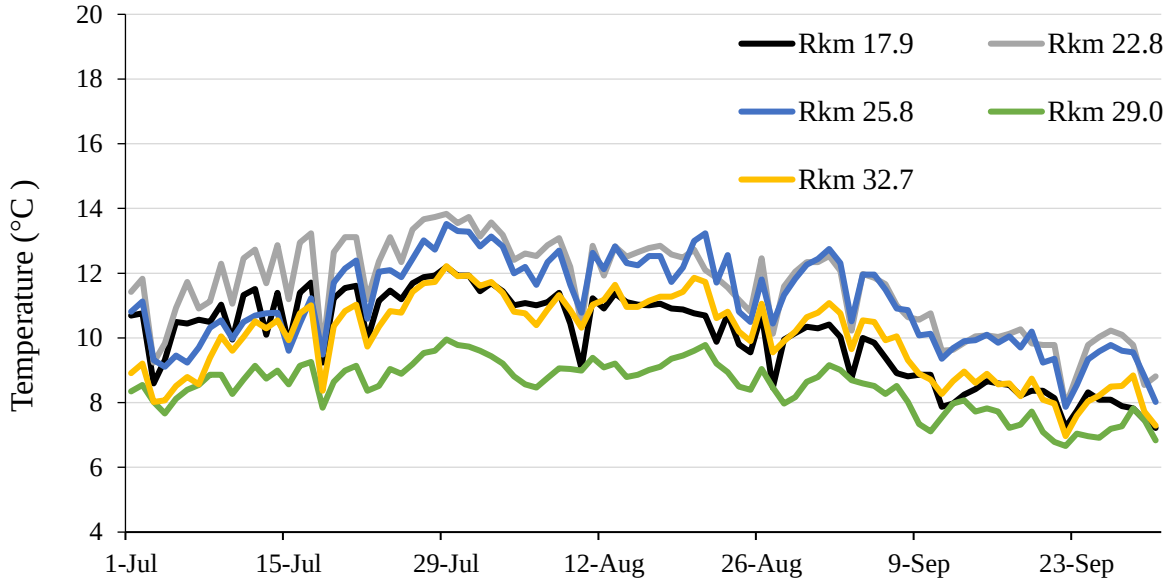

Figure B-13. Maximum daily water temperatures in Vermilion River above Chapel Slide (Rkm 17.9), below Willow Creek (Rkm 22.8), Below Charred Creek (Rkm 25.8), below Miller Creek (Rkm 29), and at Control Creek (Rkm 32.7), 2022.

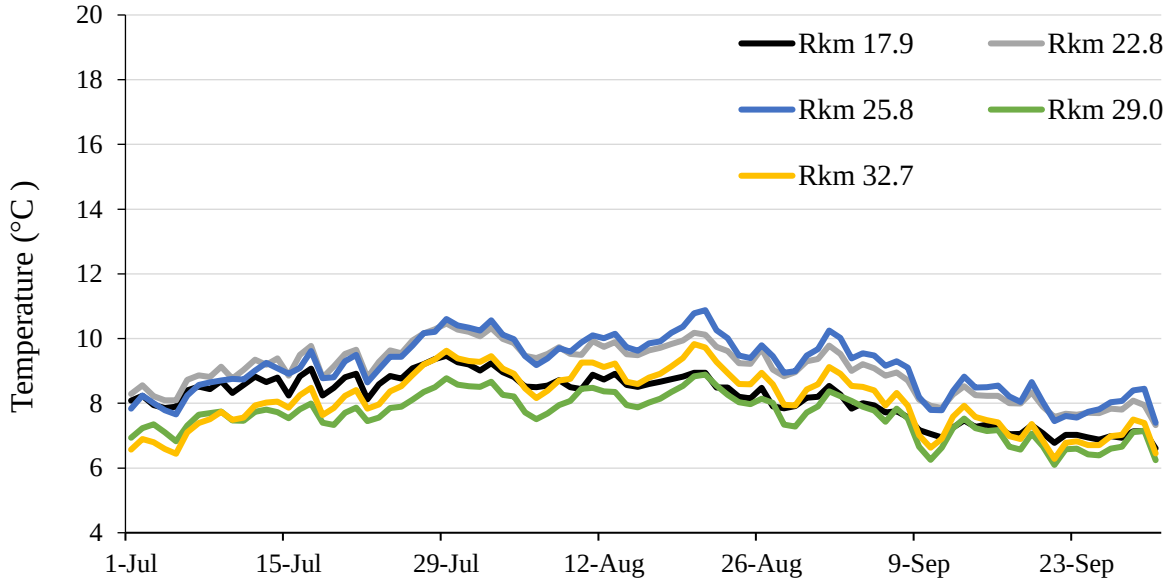

Figure B-14. Mean daily water temperatures in Vermilion River above Chapel Slide (Rkm 17.9), below Willow Creek (Rkm 22.8), Below Charred Creek (Rkm 25.8), below Miller Creek (Rkm 29), and at Control Creek (Rkm 32.7), 2022.

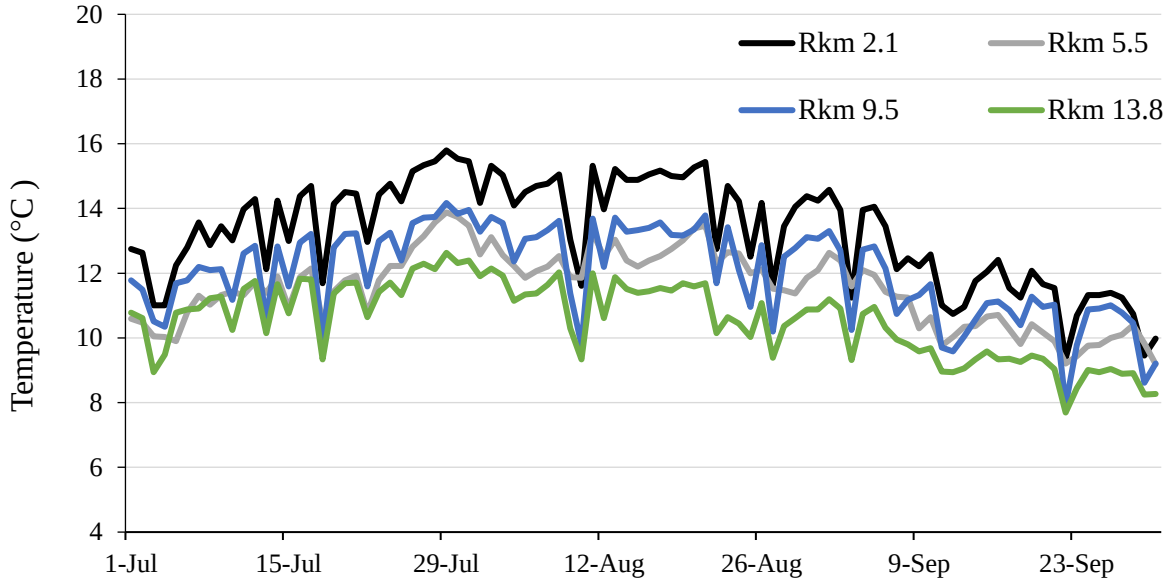

Figure B-15. Maximum daily water temperatures in the Vermilion River below Grouse Creek (Rkm 13.8), below Cataract Creek (Rkm 9.5), Below Canyon Creek and Roe Gulch (Rkm 5.5), and near mouth (Rkm 2.1), 2022.

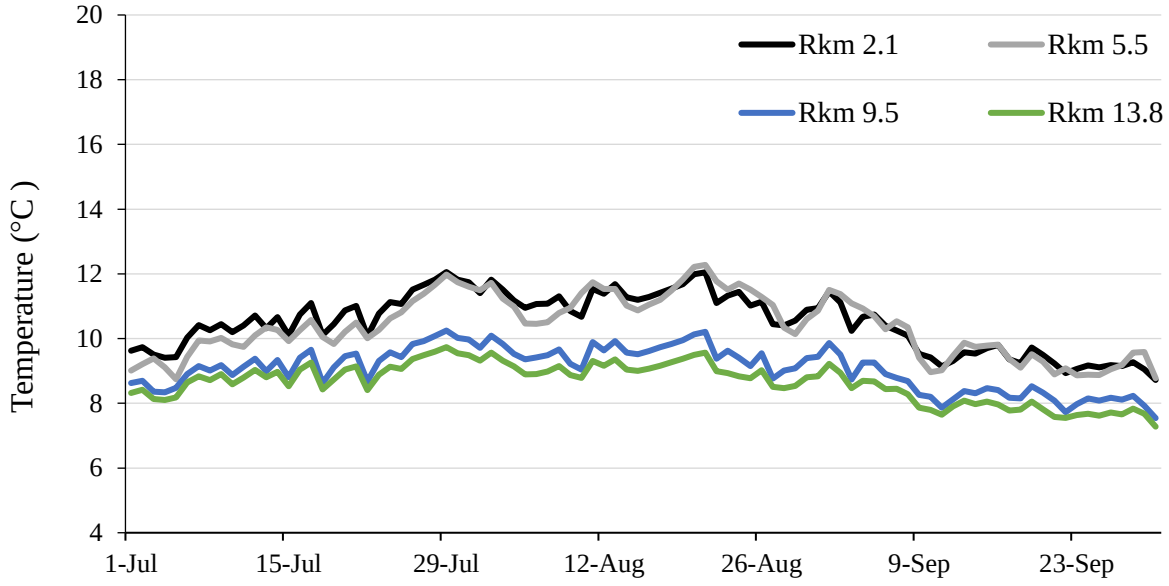

Figure B-16. Mean daily water temperatures in the Vermilion River below Grouse Creek (Rkm 13.8), below Cataract Creek (Rkm 9.5), Below Canyon Creek and Roe Gulch (Rkm 5.5), and near mouth (Rkm 2.1), 2022.

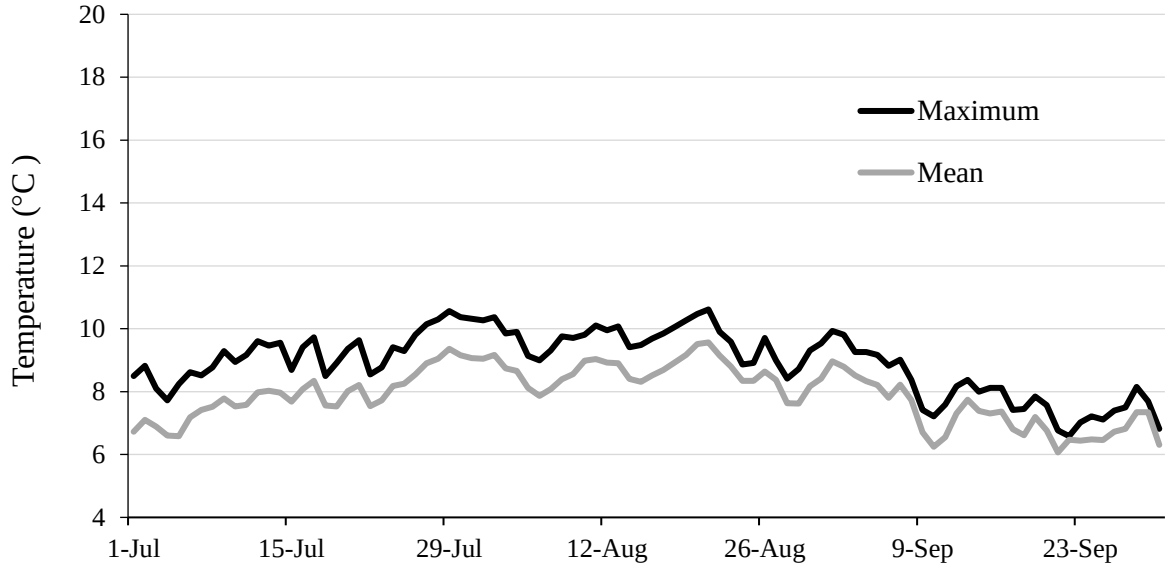

Figure B-17. Maximum and mean daily water temperatures in Happy Gulch (Rkm 0), 2022.

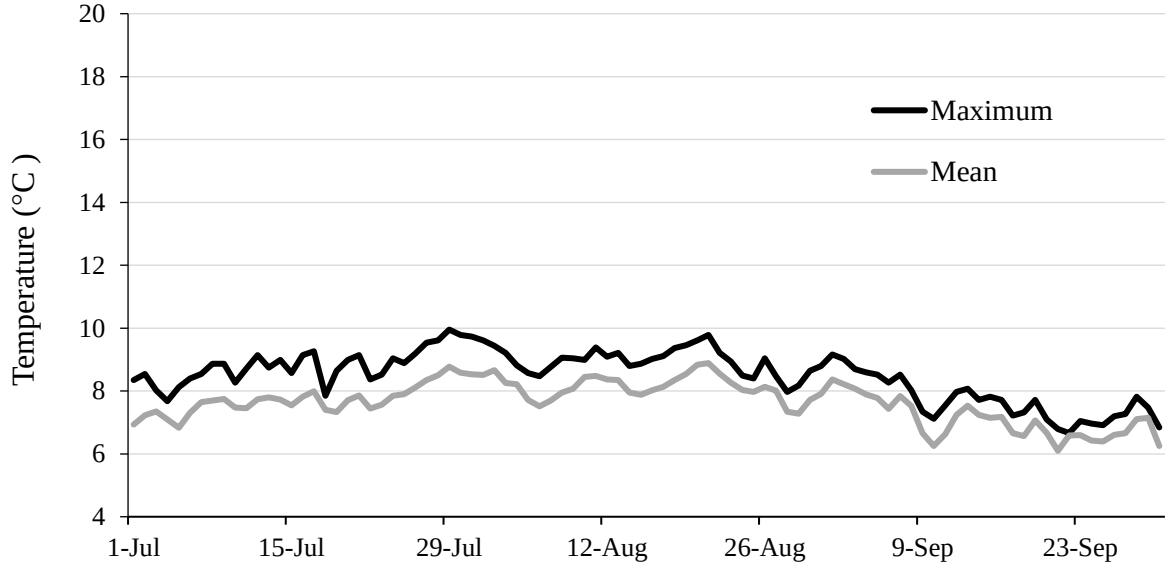

Figure B-18. Maximum and mean daily water temperatures in Miller Creek (Rkm 0.3), 2022.

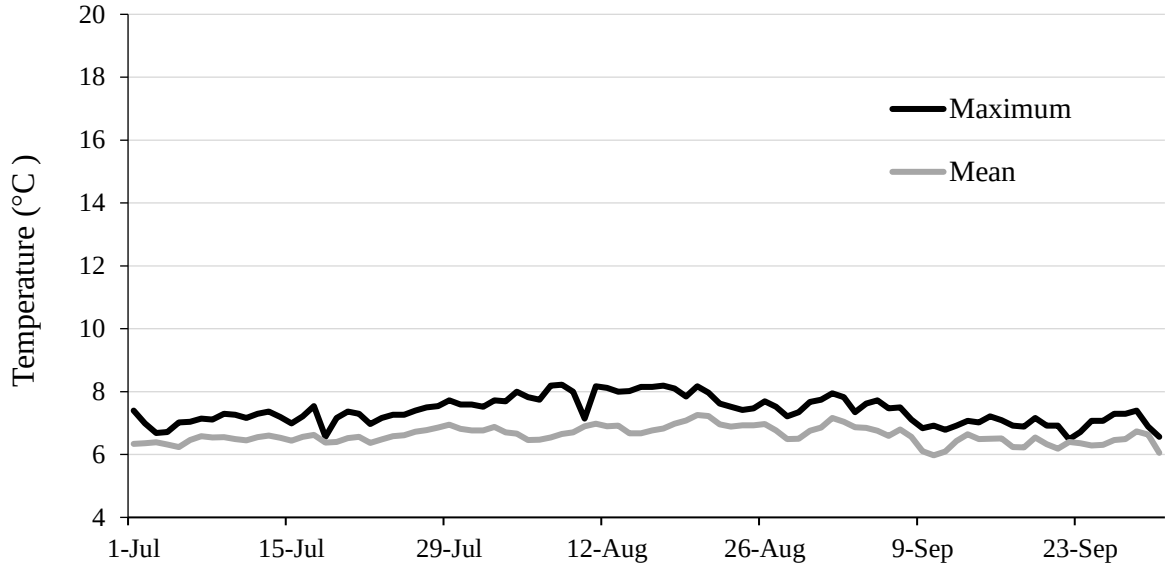

Figure B-19. Maximum and mean daily water temperatures in Sims Creek (Rkm 0), 2022.

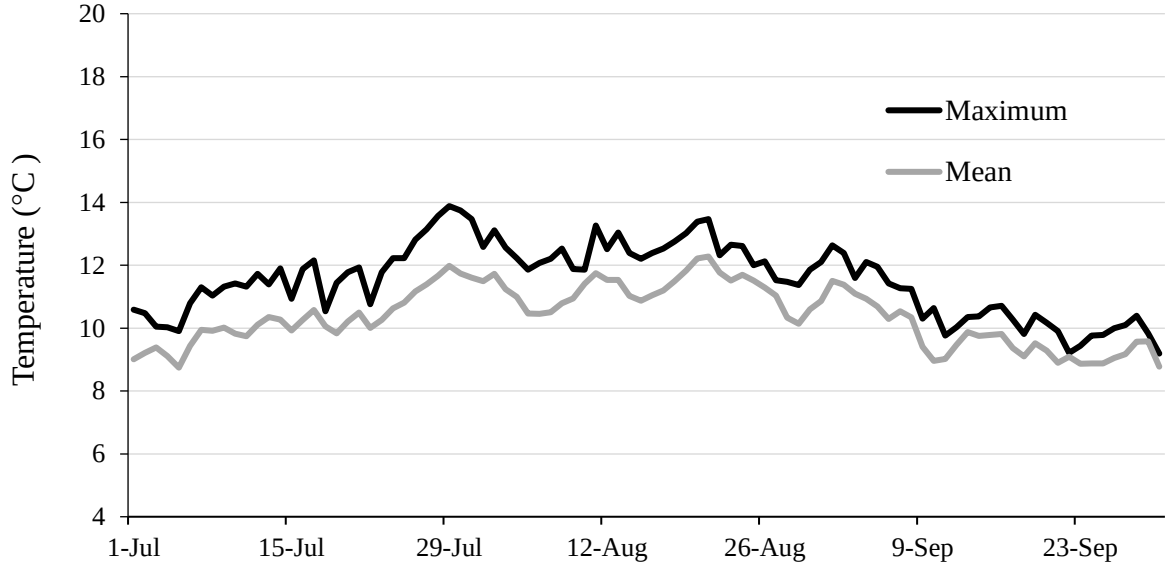

Figure B-20. Maximum and mean daily water temperatures in Canyon Creek (Rkm 0.8), 2022.

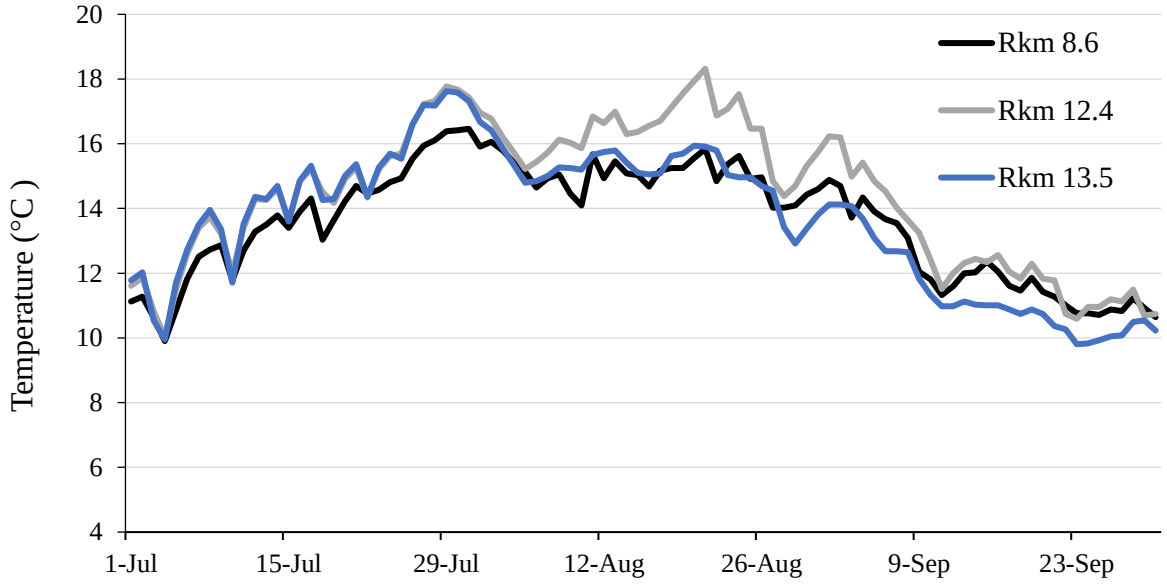

Figure B-21. Maximum daily water temperatures in Rock Creek above the West Fork of Rock Creek (Rkm 8.6), above trailhead (Rkm 12.4), and below upper cascade (13.5) 2022.

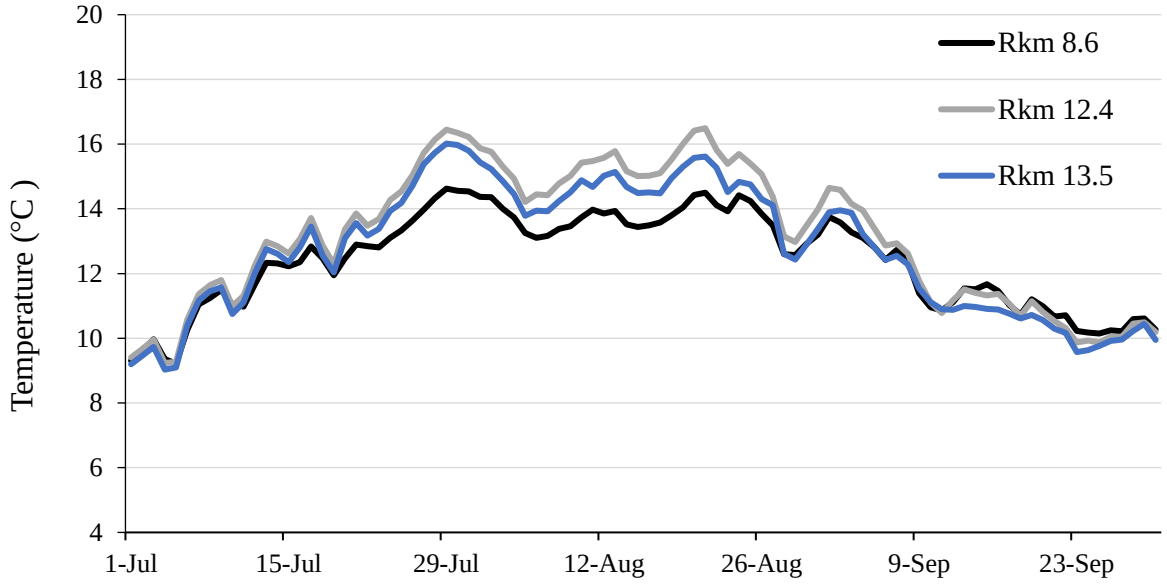

Figure B-22. Mean daily water temperatures in Rock Creek above the West Fork of Rock Creek (Rkm 8.6), above trailhead (Rkm 12.4), and below upper cascade (13.5) 2022.

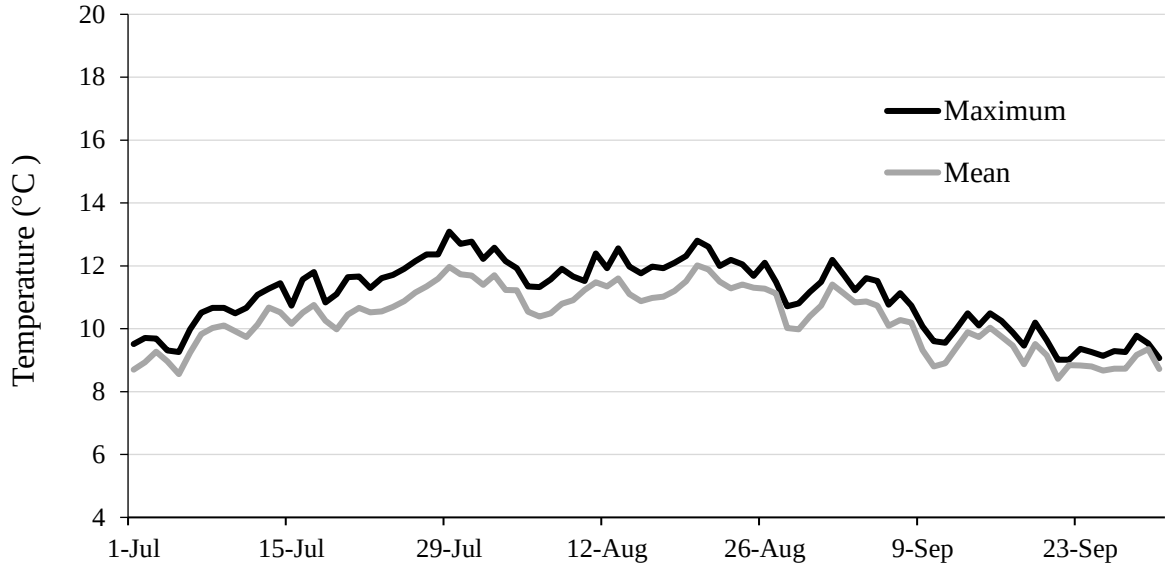

Figure B-23. Maximum and mean daily water temperatures in South Fork Bull River (Rkm 0.03), 2022.

Appendix C. Mean Yearly Growth Rates for Recaptured Bull Trout

Table C-1. Data summary of calculated mean yearly growth rates for recaptured Bull Trout in streams and tributaries in the Lower Clark Fork drainage. Initial and recapture data ranges 2001–2022.

Stream	Mean Yearly Growth (mm)	Number of Recaps
Cooper Gulch	39.9	17
Crow Creek	45	3
East Fork Bull River	50.8	78
Fishtrap Creek	55.5	2
Graves Creek	48.4	90
Jungle	34	2
Lower Prospect	74.6	3
Rock Creek	34.3	18
South Fork Bull River	56.5	1
Upper Prospect	35.1	70
Vermilion River	63.5	30
West Fork Thompson	29.5	26
West Fork Trout Creek	40.8	3

Appendix D. Fish Detected on Lower Clark Fork River PIT tag arrays

Table D-1. PIT tag number, species, length and weight at initial tagging; initial tagging location, project associated with initial tagging, river kilometer (Rkm) and date; and range of date detections on PIT tag arrays in lower Prospect Creek, Graves Creek, Vermilion River, Bull River, and East Fork Bull River in 2022. Species abbreviations include Bull Trout (BULL), Brook Trout (EB), Brown Trout (LL), Mountain Whitefish (MWF), *Oncorhynchus* hybrids (RBxWCT), Rainbow Trout (RB), and Westslope Cutthroat Trout (WCT).

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Prospect	982126050371177	BULL	655	2446	Below Cabinet	Upstream transport	-	9/13/2021	7/24-10/5
Prospect	982000411793253	BULL	211	75	Graves	Primary weir	0.5	5/11/2015	8/14-9/29
Prospect	989001033212881	LL	489	1096	Thompson Falls Dam	Ladder	105.5	10/14/2020	10/26-11/5
Prospect	989001033212708	LL	413	700	Thompson Falls Dam	Ladder	105.5	7/17/2021	5/13-10/1
Prospect	989001033211802	RB	456	848	Thompson Falls Dam	Ladder	105.5	5/3/2021	2/25
Prospect	989001033211949	RB	390	550	Thompson Falls Dam	Ladder	105.5	4/29/2021	3/1
Prospect	989001030300688	RB	537	1578	Thompson Falls Dam	Ladder	105.5	3/30/2020	3/18-7/18
Prospect	989001033211805	RB	502	1328	Clark Fork	Ladder Efficiency Study	100.2	6/8/2021	3/23-7/12
Prospect	989001033212696	RB	522	1344	Thompson Falls Dam	Ladder	105.5	3/17/2022	3/24
Prospect	989001030300630	RB	312	298	Thompson Falls Dam	Ladder	105.5	4/20/2020	4/25-6/7
Prospect	989001033212713	RB	414	650	Thompson Falls Dam	Ladder	105.5	3/21/2022	4/2-6/11
Prospect	989001033212744	RB	493	1212	Thompson Falls Dam	Ladder	105.5	3/29/2022	4/3-5/29
Prospect	989001033211847	RB	470	1094	Thompson Falls Dam	Ladder	105.5	3/28/2022	5/4-5/19
Prospect	989001030300675	RB	325	296	Thompson Falls Dam	Ladder	105.5	9/30/2019	7/17

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Prospect	989001006029434	WCT	214	100	Prospect Creek	Salvage	17.7 -24.6	7/26/2021	1/3
Prospect	989001006029481	WCT	210	116	Prospect Creek	Salvage	17.7 -24.6	7/26/2021	1/7
Prospect	989001040870226	WCT	174	52	Prospect Creek	Salvage	17.7 -24.6	8/22/2022	10/22
Prospect	989001040870172	WCT	150	33	Prospect Creek	Salvage	17.7 -24.6	8/23/2022	11/19
Prospect	989001040870222	WCT	200	73	Prospect Creek	Salvage	17.7 -24.6	8/23/2022	11/29
Prospect	989001040632169	WCT	175	53	Prospect Creek	Salvage	17.7 -24.6	8/9/2022	12/11
Prospect	989001033211821	WCT	352	409	Thompson Falls Dam	Ladder	105.5	8/23/2021	2/10-4/22
Prospect	989001026318555	WCT	179	51	Prospect Creek	Salvage	24.6	8/5/2019	2/22
Prospect	989001006029395	WCT	156	33	Prospect Creek	Salvage	17.7 -24.6	7/30/2021	3/7-5/4
Prospect	989001006029453	WCT	209	98	Prospect Creek	Salvage	17.7 -24.6	7/26/2021	5/4
Prospect	989001006029433	WCT	169	46	Prospect Creek	Salvage	24.7	7/26/2021	5/6
Prospect	989001040632162	WCT	213	89	Prospect Creek	Salvage	17.7 -24.6	8/9/2022	8/10
Prospect	989001040632235	WCT	221	110	Prospect Creek	Salvage	17.7 -24.6	8/9/2022	8/11
Prospect	989001040632226	WCT	235	133	Prospect Creek	Salvage	17.7 -24.6	8/10/2022	8/12
Prospect	989001030300740	WCT	192	74	Prospect Creek	Salvage	17.7 -24.6	8/3/2022	8/13
Prospect	989001033210399	WCT	89	7	Prospect Creek	Salvage	17.7 -24.6	8/5/2022	8/15-8/17
Prospect	989001033210469	WCT	237	133	Prospect Creek	Salvage	17.7 -24.6	8/5/2022	8/17
Prospect	989001040632151	WCT	237	130	Prospect Creek	Salvage	17.7 -24.6	8/9/2022	8/17
Prospect	989001033210471	WCT	220	113	Prospect Creek	Salvage	17.7 -24.6	7/9/2022	8/20

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Prospect	989001030300797	WCT	200	77	Prospect Creek	Salvage	17.7 -24.6	8/3/2022	8/21
Prospect	989001040632193	WCT	239	151	Prospect Creek	Salvage	17.7 -24.6	8/9/2022	8/21
Prospect	989001040632239	WCT	215	105	Prospect Creek	Salvage	17.7 -24.6	8/10/2022	8/23
Prospect	989001040870157	WCT	186	60	Prospect Creek	Salvage	17.7 -24.6	8/22/2022	8/23
Prospect	989001040870168	WCT	173	44	Prospect Creek	Salvage	17.7 -24.6	8/22/2022	8/23
Prospect	989001040870133	WCT	221	103	Prospect Creek	Salvage	17.7 -24.6	8/23/2022	8/24
Prospect	989001040870151	WCT	187	72	Prospect Creek	Salvage	17.7 -24.6	8/23/2022	8/24
Prospect	989001040870197	WCT	158	32	Prospect Creek	Salvage	17.7 -24.6	8/23/2022	8/24
Prospect	989001040632185	WCT	251	156	Prospect Creek	Salvage	17.7 -24.6	8/9/2022	8/25
Prospect	989001030300748	WCT	244	150	Prospect Creek	Salvage	17.7 -24.6	8/3/2022	8/26
Prospect	989001040632183	WCT	165	36	Prospect Creek	Salvage	17.7 -24.6	8/9/2022	9/23-9/25
Graves	989001040632262	BULL	118	14	Graves Creek	Site #2	4.1	8/9/2022	8/24
Graves	989001040632281	BULL	169	43	Graves Creek	Site #2	4.1	8/9/2022	9/22-9/23
Graves	989001040632287	BULL	144	26	Graves Creek	Site #2	4.1	8/9/2022	10/5
Graves	989001040632324	BULL	136	22	Graves Creek	Site #2	4.1	8/9/2022	11/1
Graves	989001040632292	BULL	192	59	Graves Creek	Site #5	3	8/12/2022	10/1
Graves	989001040632319	BULL	184	29	Graves Creek	Site #5	3	8/12/2022	10/21
Graves	989001040632330	BULL	178	45	Graves Creek	Site #5	3	8/18/2022	9/24
Graves	989001040632342	BULL	185	82	Graves Creek	Site #5	4	8/18/2022	9/17
Graves	989001040632270	BULL	159	35	Graves Creek	Site #6	5	8/19/2022	10/6

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Graves	989001030299763	BULL	163	35	Graves Creek	Emigration study	4.2	7/25/2019	9/16
Graves	989001030299800	BULL	172	40	Graves Creek	Emigration study	3.3	7/24/2019	6/20-9/30
Graves	989001033211145	BULL	110	12	Graves Creek	Emigration study	3.3	7/22/2020	5/12
Graves	989001033408905	BULL	112	11	Graves Creek	Emigration study	3.3	8/4/2020	5/11
Graves	989001033408926	BULL	105	9	Graves Creek	Emigration study	3.3	8/4/2020	1/5-8/23
Graves	989001033409098	BULL	105	9	Graves Creek	Emigration study	2.7	8/5/2020	5/24
Graves	989001033409109	BULL	112	12	Graves Creek	Emigration study	2.7	8/5/2020	6/1-6/13
Graves	989001033409135	BULL	114	12	Graves Creek	Emigration study	2.7	8/5/2020	5/31
Graves	982126050371161	BULL	536	-	LPO	Gill netting	-	3/2/2021	9/27-9/28
Graves	982126050371172	BULL	575	-	LPO	Gill netting	-	9/10/2021	4/10-9/24
Graves	989001040632214	BULL	189	55	Graves Creek	Site #1	1.5	8/18/2022	9/24
Graves	982000411793253	BULL	211	74.7	Graves Creek	Permanent Weir	0.7	5/11/2015	9/30-10/9
Graves	982126050371128	BULL	131	16.8	Graves Creek	Permanent Weir	0.7	10/10/2016	10/1
Graves	982126050371153	BULL	140	21.2	Graves Creek	Permanent Weir	0.7	10/18/2017	6/21-9/30
Graves	982126050371192	BULL	155	32.3	Graves Creek	Permanent Weir	0.7	10/23/2017	10/10-10/11
Graves	982126050371253	BULL	189	52	Graves Creek	Permanent Weir	0.7	9/10/2014	5/16-9/24
Graves	989001026316426	BULL	144	23.3	Graves Creek	Permanent Weir	0.7	10/22/2018	9/22-9/24
Graves	989001026316727	BULL	228	90	Graves Creek	Permanent Weir	0.7	10/11/2019	9/1-9/30
Graves	989001026316834	BULL	190	57	Graves Creek	Permanent Weir	0.7	10/19/2019	10/9
Graves	989001026316906	BULL	179	39.6	Graves Creek	Permanent Weir	0.7	10/23/2019	9/23
Graves	989001026316956	BULL	197	56.5	Graves Creek	Permanent Weir	0.7	10/24/2019	10/2-10/3
Graves	989001026316963	BULL	174	40	Graves Creek	Permanent Weir	0.7	10/29/2019	8/31-9/27

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Graves	989001026317127	BULL	140	20.3	Graves Creek	Permanent Weir	0.7	11/9/2019	8/25-10/1
Graves	989001030151069	BULL	175	45.3	Graves Creek	Permanent Weir	0.7	4/21/2020	8/19-9/24
Graves	989001030151098	BULL	158	30	Graves Creek	Permanent Weir	0.7	4/29/2019	10/7-10/8
Graves	989001030299544	BULL	235	94	Graves Creek	Permanent Weir	0.7	9/20/2019	10/20-10/21
Graves	989001030299573	BULL	185	44.3	Graves Creek	Permanent Weir	0.7	9/19/2019	9/24-9/25
Graves	989001033210721	BULL	230	84.6	Graves Creek	Permanent Weir	0.7	3/25/2022	3/25-3/27
Graves	989001033210753	BULL	196	57.8	Graves Creek	Permanent Weir	0.7	9/8/2022	9/8-12/27
Graves	989001033210766	BULL	270	150.5	Graves Creek	Permanent Weir	0.7	9/21/2022	9/21
Graves	989001042385963	BULL	269	147.8	Graves Creek	Permanent Weir	0.7	9/23/2022	9/23
Graves	989001033212608	LL	444	824	Thompson Falls Dam	Ladder	106	9/26/2022	12/28
Graves	989001033212809	LL	430	736	Clark Fork River	Ladder Efficiency Study	100.2	3/24/2022	10/31-11/3
Graves	989001030300636	RBxWCT	459	914	Thompson Falls Dam	Ladder	106	4/13/2020	6/7-6/21
Graves	989001030299517	WCT	325	336.9	Graves Creek	Permanent Weir	0.7	10/20/2022	10/20-10/28
Graves	989001042386017	WCT	233	133.2	Graves Creek	Permanent Weir	0.7	10/2/2022	10/2
Graves	989001042386048	WCT	106	10	Graves Creek	Permanent Weir	0.7	10/17/2022	12/26-12/27
Vermilion	989001026318447	BULL	166	41	Vermilion River	Site #5	18	9/1/2020	3/3
Vermilion	989001033211333	BULL	161	36	Vermilion River	Site #5	18	9/1/2020	9/16
Vermilion	982126050371121	BULL	638	2420	Below Cabinet Gorge	Upstream transport	-	9/21/2020	9/28
Vermilion	989001033409533	BULL	101	8	Vermilion River	Site #2	6.3	11/5/2020	3/2
Vermilion	982126050371123	BULL	636	2414	Below Cabinet Gorge	Upstream transport	-	6/16/2022	10/14
Vermilion	982126050371132	BULL	630	2436	Below Cabinet Gorge	Upstream transport	-	9/23/2022	10/10

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Vermilion	982126050371106	BULL	588	1754	Below Cabinet Gorge	Upstream transport	-	9/29/2022	10/17
Vermilion	989001033212400	LL	558	1856	Thompson Fall Dam	Ladder	106	10/13/2022	10/30-11/26
Vermilion	989001026316025	WCT	350	518	Vermilion River	Site #1	3.2	8/28/2019	3/22
Vermilion	989001033211821	WCT	352	409	Thompson Fall Dam	Ladder	106	8/23/2021	4/30
Bull River	989001033409159	BULL	152	28	East Fork Bull River	Emigration Study	7.7	8/12/2020	1/19
Bull River	982126050371126	BULL	445	708	Below Cabinet Gorge	Upstream Transport	-	9/19/2021	6/19
Bull River	982126050371158	BULL	507	1178	Below Cabinet Gorge	Upstream Transport	-	4/19/2022	5/28
Bull River	989001033210463	BULL	267	152	Bull River	WCT Evaluation	9.6	7/13/2022	11/7-11/8
Bull River	989001030300046	BULL	277	172	East Fork Bull River	Bull River Weir	0.7	10/29/2022	9/27-11/1
Bull River	989001030299466	BULL	112	11	East Fork Bull River	Emigration Study	8.6	8/12/2019	1/1
Bull River	989001040185392	EB	147	29	East Fork Bull River	Bull River Exclusion	0.7	9/12/2021	1/22
Bull River	989001040185368	EB	112	9	East Fork Bull River	Bull River Exclusion	0.7	10/9/2021	1/1-4/27
Bull River	989001040185505	EB	179	64	East Fork Bull River	Bull River Exclusion	0.7	11/4/2021	1/12
Bull River	989001033409678	EB	126	21	East Fork Bull River	Bull River Exclusion	0.7	6/26/2022	6/26-8/17
Bull River	989001033409652	EB	151	20	East Fork Bull River	Bull River Exclusion	0.7	8/31/2022	8/31
Bull River	989001033409650	EB	215	94	East Fork Bull River	Bull River Exclusion	0.7	9/26/2022	9/27
Bull River	989001042385897	EB	116	14	East Fork Bull River	Bull River Exclusion	0.7	10/2/2022	10/2
Bull River	989001042385928	EB	149	31	East Fork Bull River	Bull River Exclusion	0.7	10/3/2022	10/3
Bull River	989001042385341	EB	192	61	East Fork Bull River	Bull River Exclusion	0.7	10/20/2022	10/20-11/3

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Bull River	989001042385877	EB	161	22	East Fork Bull River	Bull River Exclusion	0.7	10/22/2022	10/22, 10/24
Bull River	989001042385879	EB	148	18	East Fork Bull River	Bull River Exclusion	0.7	10/22/2022	10/22
Bull River	989001042385867	EB	143	26	East Fork Bull River	Bull River Exclusion	0.7	10/23/2022	10/23
Bull River	989001042385911	EB	158	33	East Fork Bull River	Bull River Exclusion	0.7	10/31/2022	10/31, 11/1
Bull River	989001042385942	EB	128	17	East Fork Bull River	Bull River Exclusion	0.7	10/31/2022	10/31
Bull River	989001042385944	EB	121	16	East Fork Bull River	Bull River Exclusion	0.7	10/31/2022	10/31-11/2
Bull River	989001033210840	EB	209	90	East Fork Bull River	Bull River Exclusion	0.7	11/3/2022	11/3
Bull River	989001033210333	EB	220	-	Bull River	WCT Transport Evaluation	2.5	7/8/2022	8/8
Bull River	989001033210372	EB	195	89	Bull River	WCT Transport Evaluation	9.6	7/5/2022	8/11-8/15
Bull River	989001026316479	LL	199	72	East Fork Bull River	Bull River Exclusion	0.7	11/3/2018	11/1, 12/12
Bull River	989001030151083	LL	107	11	East Fork Bull River	Bull River Exclusion	0.6	4/15/2019	11/5
Bull River	989001033409633	LL	255	150	East Fork Bull River	Bull River Exclusion	0.7	11/7/2020	10/31-11/15
Bull River	989001033409611	LL	410	631	East Fork Bull River	Bull River Exclusion	0.7	11/9/2020	1/1-3/1, 10/31-11/1
Bull River	989001033409744	LL	128	20	East Fork Bull River	Bull River Exclusion	0.7	5/4/2021	3/23
Bull River	989001033409746	LL	128	18	East Fork Bull River	Bull River Exclusion	0.7	6/3/2021	6/11, 6/13
Bull River	989001040185364	LL	225	103	East Fork Bull River	Bull River Exclusion	0.7	9/17/2021	2/19, 6/17
Bull River	989001040185374	LL	206	78	East Fork Bull River	Bull River Exclusion	0.7	9/19/2021	6/28
Bull River	989001040185495	LL	422	723	East Fork Bull River	Bull River Exclusion	0.7	10/27/2021	10/31-12/30
Bull River	989001040185502	LL	465	1074	East Fork Bull River	Bull River Exclusion	0.7	10/27/2021	7/18-8/27

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Bull River	989001033409171	LL	184	52	East Fork Bull River	Bull River Exclusion	0.7	11/11/2021	7/27
Bull River	989001033409172	LL	163	33	East Fork Bull River	Bull River Exclusion	0.7	11/11/2021	7/12
Bull River	989001033409184	LL	353	365	East Fork Bull River	Bull River Exclusion	0.7	11/11/2021	2/20-11/26
Bull River	989001033409222	LL	327	319	East Fork Bull River	Bull River Exclusion	0.7	11/11/2021	10/22-10/31
Bull River	989001033409725	LL	449	719	East Fork Bull River	Bull River Exclusion	0.7	11/12/2021	9/22
Bull River	989001033409644	LL	238	117	East Fork Bull River	Bull River Exclusion	0.7	5/5/2022	5/5/2022
Bull River	989001033409728	LL	106	11	East Fork Bull River	Bull River Exclusion	0.7	5/9/2022	5/10-5/11
Bull River	989001033409649	LL	193		East Fork Bull River	Bull River Exclusion	0.7	8/31/2022	8/31, 10/21
Bull River	989001033409696	LL	128	19	East Fork Bull River	Bull River Exclusion	0.7	9/2/2022	9/2-9/3
Bull River	989001033409643	LL	117	15	East Fork Bull River	Bull River Exclusion	0.7	9/11/2022	9/12-9/14
Bull River	989001042385859	LL	122	14	East Fork Bull River	Bull River Exclusion	0.7	10/29/2022	10/29-11/3
Bull River	989001042385863	LL	120	15	East Fork Bull River	Bull River Exclusion	0.7	10/29/2022	10/29
Bull River	989001042385873	LL	163	38	East Fork Bull River	Bull River Exclusion	0.7	10/29/2022	10/29
Bull River	989001042385861	LL	244	111	East Fork Bull River	Bull River Exclusion	0.7	10/30/2022	10/30
Bull River	989001042385865	LL	110	12	East Fork Bull River	Bull River Exclusion	0.7	10/31/2022	11/2
Bull River	989001042385869	LL	246	132	East Fork Bull River	Bull River Exclusion	0.7	10/31/2022	11/2
Bull River	989001042385345	LL	145	25	East Fork Bull River	Bull River Exclusion	0.7	11/1/2022	11/2
Bull River	989001042385887	LL	455	858	East Fork Bull River	Bull River Exclusion	0.7	11/1/2022	11/2, 11/26
Bull River	989001042385895	LL	217	100	East Fork Bull River	Bull River Exclusion	0.7	11/1/2022	11/2-11/26

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Bull River	989001042385910	LL	258	175	East Fork Bull River	Bull River Exclusion	0.7	11/1/2022	11/2-11/16
Bull River	989001042385926	LL	405	611	East Fork Bull River	Bull River Exclusion	0.7	11/1/2022	10/2-11/27
Bull River	989001042385930	LL	555	1578	East Fork Bull River	Bull River Exclusion	0.7	11/1/2022	11/2-11/9
Bull River	989001042385951	LL	156	34	East Fork Bull River	Bull River Exclusion	0.7	11/1/2022	11/2-11/4
Bull River	989001042385292	LL	420	692	East Fork Bull River	Bull River Exclusion	0.7	11/2/2022	11/2
Bull River	989001042385320	LL	472	1198	East Fork Bull River	Bull River Exclusion	0.7	11/2/2022	11,2, 12/1
Bull River	989001042385347	LL	131	20	East Fork Bull River	Bull River Exclusion	0.7	11/2/2022	11/2, 11/3
Bull River	989001033210293	LL	208	-	Bull River	WCT Transport Evaluation	2.5	7/8/2022	8/2, 8/3
Bull River	989001033210301	LL	238	-	Bull River	WCT Transport Evaluation	2.5	7/8/2022	7/14
Bull River	989001033210303	LL	212	-	Bull River	WCT Transport Evaluation	2.5	7/8/2022	7/29
Bull River	989001033210336	LL	321	-	Bull River	WCT Transport Evaluation	2.5	7/8/2022	7/31, 12/30
Bull River	989001033210357	LL	218	-	Bull River	WCT Transport Evaluation	2.5	7/8/2022	7/27, 7/29
Bull River	989001040632174	LL	271	-	Bull River	WCT Transport Evaluation	1.8	8/8/2022	8/30
Bull River	989001040870369	LL	410	-	Bull River	WCT Transport Evaluation	28.6	9/13/2022	11/6, 11/16
Bull River	989001040870394	LL	400	-	Bull River	WCT Transport Evaluation	2.5	9/26/2022	10/25-11/5
Bull River	989001033210473	LL	180	51	Bull River	WCT Transport Evaluation	2.5	5/4/2022	5/5-6/30
Bull River	989001033210481	LL	426	799	Bull River	WCT Transport Evaluation	2.5	5/4/2022	5/5-7/13, 12/13-12/14
Bull River	989001033210498	LL	250	161	Bull River	WCT Transport Evaluation	2.5	5/4/2022	8/24
Bull River	989001033210513	LL	259	177	Bull River	WCT Transport Evaluation	2.5	5/4/2022	6/28-7/14

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Bull River	989001033210521	LL	330	360	Bull River	WCT Transport Evaluation	1.8	5/4/2022	5/4-5/15
Bull River	989001033210529	LL	406	582	Bull River	WCT Transport Evaluation	28.6	5/4/2022	5/4-12/31
Bull River	989001033210551	LL	340	347	Bull River	WCT Transport Evaluation	15.3	5/4/2022	6/25, 9/25
Bull River	989001033210558	LL	177	54	Bull River	WCT Transport Evaluation	9.6	5/4/2022	6/22-7/3
Bull River	989001033210571	LL	159	46	Bull River	WCT Transport Evaluation	9.6	5/4/2022	9/4-9/5
Bull River	989001033210289	LL	489	1285	Bull River	WCT Transport Evaluation	9.6	7/5/2022	7/5, 12/9, 12/30
Bull River	989001033210290	LL	352	495	Bull River	WCT Transport Evaluation	9.6	7/5/2022	7/17, 10/30
Bull River	989001033210329	LL	474	1085	Bull River	WCT Transport Evaluation	9.6	7/5/2022	7/5
Bull River	989001033210348	LL	437	992	Bull River	WCT Transport Evaluation	9.6	7/5/2022	11/29
Bull River	989001033210349	LL	418	861	Bull River	WCT Transport Evaluation	9.6	7/5/2022	7/5-12/28
Bull River	989001033210351	LL	571	1766	Bull River	WCT Transport Evaluation	9.6	7/5/2022	7/5
Bull River	989001033210478	LL	231	138	Bull River	WCT Transport Evaluation	9.6	7/5/2022	7/16
Bull River	989001033210486	LL	180	76	Bull River	WCT Transport Evaluation	9.6	7/5/2022	7/12-7/27
Bull River	989001033210503	LL	505	1380	Bull River	WCT Transport Evaluation	9.6	7/5/2022	11/29
Bull River	989001033210565	LL	545	1798	Bull River	WCT Transport Evaluation	9.6	7/5/2022	7/18
Bull River	989001033210279	LL	231	-	Bull River	WCT Transport Evaluation	9.6	7/8/2022	8/31-12/30
Bull River	989001033210308	LL	166	44	Bull River	WCT Transport Evaluation	9.6	7/13/2022	11/11
Bull River	989001033210322	LL	160	38	Bull River	WCT Transport Evaluation	9.6	7/13/2022	7/16-7/27
Bull River	989001033210345	LL	386	660	Bull River	WCT Transport Evaluation	9.6	7/13/2022	11/14-11/23

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Bull River	989001033210358	LL	147	89	Bull River	WCT Transport Evaluation	9.6	7/13/2022	7/16
Bull River	989001033210365	LL	356	444	Bull River	WCT Transport Evaluation	9.6	7/13/2022	7/16
Bull River	989001033210377	LL	447	1075	Bull River	WCT Transport Evaluation	9.6	7/13/2022	12/12, 12/13
Bull River	989001033210378	LL	308	580	Bull River	WCT Transport Evaluation	2.5	7/13/2022	11/24
Bull River	989001033210400	LL	539	1617	Bull River	WCT Transport Evaluation	9.6	7/13/2022	7/13-7/22, 11/15-12/9
Bull River	989001033210410	LL	397	710	Bull River	WCT Transport Evaluation	9.6	7/13/2022	7/29
Bull River	989001033210411	LL	305	363	Bull River	WCT Transport Evaluation	9.6	7/13/2022	7/14-8/22
Bull River	989001033210415	LL	450	1118	Bull River	WCT Transport Evaluation	9.6	7/13/2022	7/16, 10/30, 12/8
Bull River	989001033210438	LL	300	342	Bull River	WCT Transport Evaluation	9.6	7/13/2022	7/13-7/15, 9/7-12/31
Bull River	989001033210440	LL	555	1766	Bull River	WCT Transport Evaluation	9.6	7/13/2022	10/23-11/13
Bull River	989001033210466	LL	198	81	Bull River	WCT Transport Evaluation	9.6	7/13/2022	7/13-8/9
Bull River	989001040870369	LL	410	-	Bull River	WCT Transport Evaluation	9.6	9/13/2022	11/6, 11/16
Bull River	989001026316569	MWF	395	542	East Fork Bull River	Screw Trap	0.7	6/23/2019	3/29, 12/27
Bull River	989001033211847	RB	470	1094	Thompson Fall Dam	Ladder	106	3/28/2022	9/2
Bull River	989001040870266	RB	250	-	Bull River	WCT Transport Evaluation	1.8	8/29/2022	10/21
Bull River	989001040870317	RB	254	-	Bull River	WCT Transport Evaluation	1.8	8/29/2022	9/6
Bull River	989001033210309	RBxWCT	461	916	Bull River	WCT Transport Evaluation	9.6	7/5/2022	10/15
Bull River	989001040632349	RBxWCT	205	-	Bull River	WCT Transport Evaluation	33.3	7/18/2022	11/15

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Bull River	989001040632181	RBxWCT	310	-	Bull River	WCT Transport Evaluation	2.1	8/8/2022	10/23
Bull River	982126050371136	WCT	385	556	Below Cabinet Gorge	Upstream Transport	-	4/13/2021	5/5
Bull River	982126050371139	WCT	361	552	Below Cabinet Gorge	Upstream Transport	-	5/3/2022	6/16
Bull River	982126050371154	WCT	412	-	Below Cabinet Gorge	Upstream Transport	-	5/3/2022	6/23-10/6
Bull River	982126050371131	WCT	432	746	Below Cabinet Gorge	Upstream Transport	-	6/9/2022	6/15, 7/1-7/9
Bull River	989001033210483	WCT	340	-	Bull River	WCT Transport Evaluation	22	5/27/2022	7/6, 10/23
Bull River	989001033210368	WCT	175	-	Bull River	WCT Transport Evaluation	27.2	7/11/2022	8/6
Bull River	989001033210434	WCT	196	-	Bull River	WCT Transport Evaluation	27.4	7/18/2022	11/4
Bull River	989001040870331	WCT	228	-	Bull River	WCT Transport Evaluation	21.6	7/29/2022	11/22
Bull River	989001040632201	WCT	232	-	Bull River	WCT Transport Evaluation	1.8	8/8/2022	11/9-12/30
Bull River	989001040870438	WCT	228	-	Bull River	WCT Transport Evaluation	17.3	9/6/2022	11/14
Bull River	989001040870467	WCT	208	-	Bull River	WCT Transport Evaluation	17	9/6/2022	11/10
Bull River	989001040870503	WCT	230	-	Bull River	WCT Transport Evaluation	17.3	9/6/2022	11/10
Bull River	989001040870527	WCT	217	-	Bull River	WCT Transport Evaluation	17.3	9/6/2022	9/8
Bull River	989001040870512	WCT	308	-	Bull River	WCT Transport Evaluation	19.6	9/12/2022	12/31
Bull River	989001040870374	WCT	215	-	Bull River	WCT Transport Evaluation	21.5	9/14/2022	12/17
Bull River	989001040870337	WCT	281	-	Bull River	WCT Transport Evaluation	16.4	9/19/2022	12/29
Bull River	989001040870338	WCT	230	-	Bull River	WCT Transport Evaluation	16.8	9/19/2022	11/11
Bull River	989001040870380	WCT	236	-	Bull River	WCT Transport Evaluation	17.2	9/19/2022	12/17

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
Bull River	989001040870420	WCT	206	-	Bull River	WCT Transport Evaluation	17.2	9/19/2022	11/11
Bull River	989001040870407	WCT	230	-	Bull River	WCT Transport Evaluation	16.8	9/21/2022	11/10
Bull River	989001040870363	WCT	230	-	Bull River	WCT Transport Evaluation	21.6	9/27/2022	12/2
Bull River	989001040870378	WCT	228	-	Bull River	WCT Transport Evaluation	21.6	9/27/2022	11/8
Bull River	989001040870459	WCT	230	-	Bull River	WCT Transport Evaluation	38.4	9/7/2022	11/10
Bull River	989001033210566	WCT	171	43	Bull River	WCT Transport Evaluation	33.2	4/29/2022	5/8-8/17
Bull River	989001040870312	WCT	216	107	Bull River	WCT Transport Evaluation	36.7	8/31/2022	12/16
EF Bull River	982126050371112	BULL	400	-	LPO	Gill Net Boat	-	1/21/2021	8/10
EF Bull River	982126050371126	BULL	445	708	Below Cabinet Gorge	Upstream Transport	-	8/19/2021	7/21
EF Bull River	982126050371158	BULL	507	1178	Below Cabinet Gorge	Upstream Transport	-	4/19/2022	6/20
EF Bull River	989001033210463	BULL	267	152	Bull River	WCT Transport Evaluation	9.6	7/13/2022	10/29
EF Bull River	989001040185392	EB	147	29	East Fork Bull River	Weir	0.7	9/13/2021	1/23
EF Bull River	989001026316384	LL	363	500	East Fork Bull River	Bull River Exclusion	0.2	10/27/2018	10/31, 12/29
EF Bull River	989001026317058	LL	480	1112	East Fork Bull River	Bull River Exclusion	0.7	11/20/2019	10/31
EF Bull River	989001026317138	LL	490	1231	East Fork Bull River	Bull River Exclusion	0.7	11/17/2019	11/5, 11/7
EF Bull River	989001030151083	LL	107	11	East Fork Bull River	Bull River Exclusion	0.6	4/15/2019	11/27-12/30
EF Bull River	989001030151200	LL	176	46	East Fork Bull River	Bull River Exclusion	0.7	9/15/2020	4/26-10/31
EF Bull River	989001042385320	LL	472	1198	East Fork Bull River	Bull River Exclusion	0.7	11/2/2022	11/5-11/7
EF Bull River	989001042385926	LL	405	611	East Fork Bull River	Bull River Exclusion	0.7	11/1/2022	11/5, 11/6

Array	PIT Tag No.	Species	Length (mm)	Weight (g)	Tagging location	Initial tagging	Rkm	Date tagged	Date Detected
EF Bull River	989001040185502	LL	465	1074	East Fork Bull River	Bull River Exclusion	0.7	10/27/2021	10/31
EF Bull River	989001040870381	LL	410	-	East Fork Bull River	WCT Transport Evaluation	16.9	9/26/2022	11/5, 11/7
EF Bull River	989001040870391	LL	456	-	East Fork Bull River	WCT Transport Evaluation	16.9	9/21/2022	11/5
EF Bull River	989001033210287	LL	255	177	Bull River	WCT Transport Evaluation	9.6	7/13/2022	7/22
EF Bull River	989001033210322	LL	160	38	Bull River	WCT Transport Evaluation	9.6	7/13/2022	7/22
EF Bull River	989001033210338	LL	473	1336	Bull River	WCT Transport Evaluation	9.6	7/13/2022	12/29
EF Bull River	989001033210486	LL	180	76	Bull River	WCT Transport Evaluation	9.6	7/5/2022	7/22
EF Bull River	989001033210516	LL	346	367	Bull River	WCT Transport Evaluation	9.6	5/4/2022	10/31, 11/17
EF Bull River	989001033210522	LL	158	35	Bull River	WCT Transport Evaluation	9.6	5/4/2022	5/7
EF Bull River	989001033210532	LL	190	70	Bull River	WCT Transport Evaluation	9.6	5/4/2022	7/6
EF Bull River	989001033210551	LL	340	347	Bull River	WCT Transport Evaluation	9.6	5/4/2022	11/1, 12/28
EF Bull River	989001033210556	LL	360	-	Bull River	WCT Transport Evaluation	33.5	4/29/2022	12/12, 12/14
EF Bull River	989001026316569	MWF	395	542	East Fork Bull River	Screw Trap	0.7	6/23/2019	6/5, 7/1
EF Bull River	989001033210457	RBxWCT	180	151	Bull River	WCT Transport Evaluation	0.2	7/19/2022	7/20-7/22
EF Bull River	989001026317543	WCT	155	39	East Fork Bull River	Site #3	5.5	8/8/2018	5/23
EF Bull River	982126050371136	WCT	385	556	Below Cabinet Gorge	Upstream Transport	-	4/13/2021	5/13-6/27
EF Bull River	982126050371154	WCT	412	758	Below Cabinet Gorge	Upstream Transport	-	5/3/2022	6/27, 7/1
EF Bull River	989001040870437	WCT	101	9	Bull River	WCT Transport Evaluation	37.8	9/1/2022	9/24
EF Bull River	989001040185356	WCT	302	243	East Fork Bull River	Weir	0.7	9/19/2021	5/4, 9/3