Thompson River Drainage Fisheries Monitoring Report: 2021

Jason Blakney, Abigail Maddigan and Harvey Carlsmith

Montana Fish, Wildlife and Parks

Thompson Falls Field Station

Thompson Falls, MT

December 2022

Table of Contents

Introduction

This report summarizes fisheries and watershed monitoring activities conducted in the Thompson River drainage in 2021. This work includes mainstem drift boat electrofishing at two long-term monitoring sites, stream electrofishing surveys, stream temperature monitoring, Westslope Cutthroat Trout (WCT) *Oncorhynchus clarki lewisi* translocation, Bull Trout *Salvelinus confluentus* redd counts, juvenile Bull Trout capture efforts for downstream transport to below Cabinet Gorge Dam, Thompson Falls fish ladder-salmonid exploitation study (2017-2021), long-term data summary from a Bull Trout outmigration study (2014-2021) (Appendix D) as well as passive integrated transponder (PIT) array detections on tributary and mainstem arrays (2021) (Appendix E).

Data from these monitoring efforts and associated discussion are summarized by stream in this report. Two ongoing projects, Thompson River WCT translocation and the Upper Thompson Connectivity Project (UTCP) are major points of discussion for multiple streams within the watershed and specific details for these projects are outlined by stream. Background information and a general summary of these projects are described in the proceeding sub-sections.

Thompson River Westslope Cutthroat Trout translocation

In 2020, Montana Fish, Wildlife and Parks (FWP) released an Environmental Assessment for public review and subsequently signed a Decision Notice to translocate up to 1500 non-hybridized WCT over a five-year period (2020-2024) from extant populations in the Thompson River drainage to fishless reaches above natural barriers in three streams in the drainage: Bear Creek, Shroder Creek and South Fork Murr Creek (FWP 2020). Each stream is estimated to have 4.8 to 6.4 kilometers (km) of suitable habitat.

This project was initiated in an effort to preserve as many native Thompson River WCT populations as possible. The Thompson River has a high degree of connectivity between the mainstem and its tributaries. In recent years, FWP has observed non-native trout and *Oncorhynchus* hybrids (i.e., Brown Trout, Rainbow Trout, Brook Trout and Rainbow Trout-Westslope Cutthroat hybrids) in higher abundance and distributed further up tributary streams than previously detected. Much of the tributary habitat in the Thompson River is still occupied by native fish, which are often displaced by non-native trout though competition, predation and hybridization. Natural geologic barriers on tributary streams that have sufficient suitable habitat above them represent ideal places to conserve native WCT because these areas are physically not accessible to non-native and hybrid fish that occur in the mainstem Thompson River and downstream reaches of those tributaries.

Each year fish pathogen, aquatic invasive species and genetic testing were required to translocate fish within the watershed to ensure unwanted organisms and hybridized fish are not inadvertently moved. In September of 2020, 290 non-hybridized WCT were translocated into Bear Creek above the barrier falls, from river kilometer (rkm) 3.1 to 6.4. The fish were collected from neighboring populations in upper Big Rock Creek (collection location = rkm 15.1 to 15.5, n=37)

and Chippy Creek (collection location rkm 4.3 to 5.1, n= 253). In the spring and summer of 2022, efforts will be made to find evidence of natural reproduction from translocated fish and collect genetic information from their offspring. In September 2021, 346 non-hybridized WCT were translocated into Shroder Creek and South Fork Murr Creek. A total of 215 fish were moved into Shroder Creek from rkm 1.6 to 5.2. An additional 131 were moved into South Fork Murr Creek from rkm 7.9 to 8.4. The fish were collected from neighboring populations in Chippy Creek (collection location = rkm 5.3 to 6.1, n= 128), North Fork Little Thompson River (collection location = rkm 8.9 to 9.0, n= 106) and Four Lakes Creek (collection location =rkm 1.0 to 1.1 & 2.4 to 2.6, n= 112). In the spring and summer of 2023, efforts will be made to find evidence of natural reproduction from these fish translocated in 2021 and collect genetic information from their offspring.

Upper Thompson Connectivity Project

Montana Fish, Wildlife and Parks is currently working with the Trust for Public Land (TPL) to acquire a perpetual conservation easement, known as the Upper Thompson Connectivity Project (UTCP), on approximately 19,425 hectares of corporate timber land in the Thompson River drainage owned by Green Diamond Resource Company (GD). If successful, this conservation easement would complement the 2003 Thompson-Fisher conservation easement (TFCE) which permanently protected approximately 36,422 hectares of corporate timberlands in the Thompson River drainage (57,465 hectares total including the Fisher River drainage).

The proposed project borders 241 km of the Lolo National Forest (LNF) land, 58 km of state land, and 53 km of the TFCE. This conservation easement would provide perpetual protections for 8 km of Bull Trout habitat, over 32 km of WCT habitat while also protecting migratory corridors and tributary streams reaches used by Brown Trout and Rainbow Trout that live in the mainstem Thompson River, which is the most popular trout fishery in the lower Clark Fork.

Protections for the proposed UTCP are similar to the TFCE and would secure permanent public access for fishing and other types of outdoor recreational activities, grazing best management practices (BMPs), important protections for native fish streams that go above and beyond state streamside management zone (SMZ) law. It also includes forest management protections to benefit a host of fish and wildlife species and would preclude residential or mineral development. The land would remain a working forest focused on timber production and would continue to support local rural economies.

The estimated value of the UTCP is $ 17.4 million. A $13 million dollar grant request to be split between Fiscal Year (FY) 2023 and 2024 was submitted to the U.S. Forest Service Forest Legacy Program (FLP). In late March of 2022, news was received that the FY 23 request will be funded in full and ranked number one of all application in the country. In December of 2021 and 2022, the NorthWestern Energy (NWE) Thompson Falls Bull Trout Adaptive Management Fund awarded a total of $270,000 to the project, to be used as part of the 25% non-federal match funding that is needed under the FLP program. The group is hopeful the UTCP can be completed

in 2024 or 2025, although the second year of FLP funding and most of the non-federal match funding has not yet been acquired.

Methods, Results and Discussion

Thompson River

Fish in the mainstem Thompson River were sampled using an aluminum drift boat mounted with a rectifier (Smith-Root Inc., Vancouver, WA) and 5,000-watt generator. The hull of the boat served as the cathode and two fiberglass booms, each with four steel cable droppers, served as anodes. Output was standardized at one ampere of direct current. Sampling typically occurred on the descending limb of the hydrograph when stream discharge at the USGS gage site in the lower river measured 400 to 500 cubic feet per second (cfs).

Two runs were made to mark fish with each run focusing on a separate riverbank. All trout captured which were 150 mm or greater were marked with an identifiable fin clip. Fish were identified to species, measured for total length and weight, and released within the sampling section. All mortalities were weighed and measured but were excluded from population estimates. Two recapture runs were completed approximately 7-10 days after mark runs and all fish captured were visually examined for fin clips. The Chapman modification of Petersen's Mark-Recapture (MR) estimator was used to estimate population size (Pine et al. 2012). Long-term mean capture efficiency (CE) was also used to estimate population size for a given species at a specific site (Kohler and Hubert 1993; Zale et al. 2012; Kreiner and Terrazas 2018). This method can be used to estimate abundance when few marked fish are recaptured (< 5). Capture efficiency was defined as the proportion of fish captured on recapture runs that were initially tagged on mark runs. This proportion was divided from the total number of fish marked on the first two mark runs. For example, if long-term mean CE was 0.25 and 100 fish were marked in that section, a quick estimate using CE would be 400 fish. It was assumed that under normal conditions, CE and MR models should not vary greatly within the same section for a specific species.

If the MR estimate was considerably higher than the CE estimate it was presumed that the assumption(s) of the MR estimate had been violated (e.g., fish moved out of the section between the mark and recapture run). If the MR estimate was substantially lower than the CE estimate, such a finding may have been associated with a relatively large difference in numbers of fish captured on the mark run versus the recapture run. There was enough agreement between MR and CE estimates on most years that assumptions of the abundance estimator were likely met.

In 2021, the Big Hole section from river kilometer (rkm) 19.9 to 16.9 and the 19-Mile section from rkm 32.5 to 28.3 were sampled from June 1 through June 23 when Thompson River flows ranged from 948 to 420 cfs (Figure 1). Each section has been routinely sampled since 1998 (Big Hole) or 2003 (19-Mile) for similar abundance estimation. Population estimates conducted at each site were calculated and divided by total section length for a standardized estimate of linear abundance per 1.6 kilometers (1 mile).

In 2021, 267 fish were sampled in the Big Hole section. Brown Trout *Salmo trutta* (LL; n = 159) were the most abundant species captured. Other fishes sampled included Rainbow Trout *Oncorhynchus mykiss* (RB, n = 98), Bull Trout (BULL; n = 7), Westslope Cutthroat Trout (WCT; n = 1), Brook Trout *Salvelinus fontinalis* (EB; n = 1) and Sculpin *Cottus spp.* (SCU, n=1). Mountain Whitefish *Prosopium williamsoni* were likely the most abundant species in the reach but are not collected during sampling efforts, due to their numbers and limited space on the drift boat to hold fish. Juvenile trout that were visually observed to be significantly less than 150 mm were also not netted, thus their representation as proportion of the fish community is not documented.

Sampling the 19-Mile section produced 218 total fish, a majority of which were Brown Trout (n = 193). Other species captured included Rainbow Trout (n = 21), Brook Trout (n=3) and Bull Trout (n = 1). Mountain Whitefish were observed to be highly abundant, while juvenile brown trout were also observed throughout the reach.

For both sections the only species with enough captures and recaptures for reliable estimates were Brown Trout and Rainbow Trout. The Brown Trout MR estimate was 761.4 fish/1.6 km versus a CE estimate of 258.8 fish in the Big Hole section (Table 1; Figure 2). The MR estimate is likely biased high, as evidenced by the large confidence interval associated with the estimate due to a low number of recaptured fish. The CE estimate is more realistic and has considerably tighter confidence intervals. In the 19-Mile section, Brown Trout estimates were more similar, 238 fish/1.6km for MR and 136.3 fish/1.6 km for CE (Table1; Figure 4). Confidence intervals are much tighter for the estimates when compared to the Big Hole section due to higher numbers of marked fish being collected during recaptures runs.

Rainbow Trout were collected at both sections sampled in 2021, however the species was much more abundant in the Big Hole section. The MR estimate was 174.1 fish/1.6 km compared to a CE estimate of 223.8 fish/1.6 km (Table 1; Figure 3). For the 19-Mile section we were unable to acquire a MR estimate since the minimum number of recaptured three fish was not met (n=2). The CE estimate was 23.6 fish/1.6 km (Table 1; Figure 5). Rainbow Trout abundance was down at both sites in 2021 compared to the past. The species has continued to decline at the 19-Mile site since 2009 (Figure 5). The river above Fishtrap Creek (upstream of rkm 24.7) is considerably warmer, smaller, and generally lower in gradient when compared to the river downstream of Fishtrap Creek. Brown Trout were first introduced to the drainage by FWP in late 1980s and have since become the dominant species in the river above the Little Thompson River confluence (rkm 28.0), as the species generally can tolerate warmer and more marginal habitat conditions than Rainbow Trout.

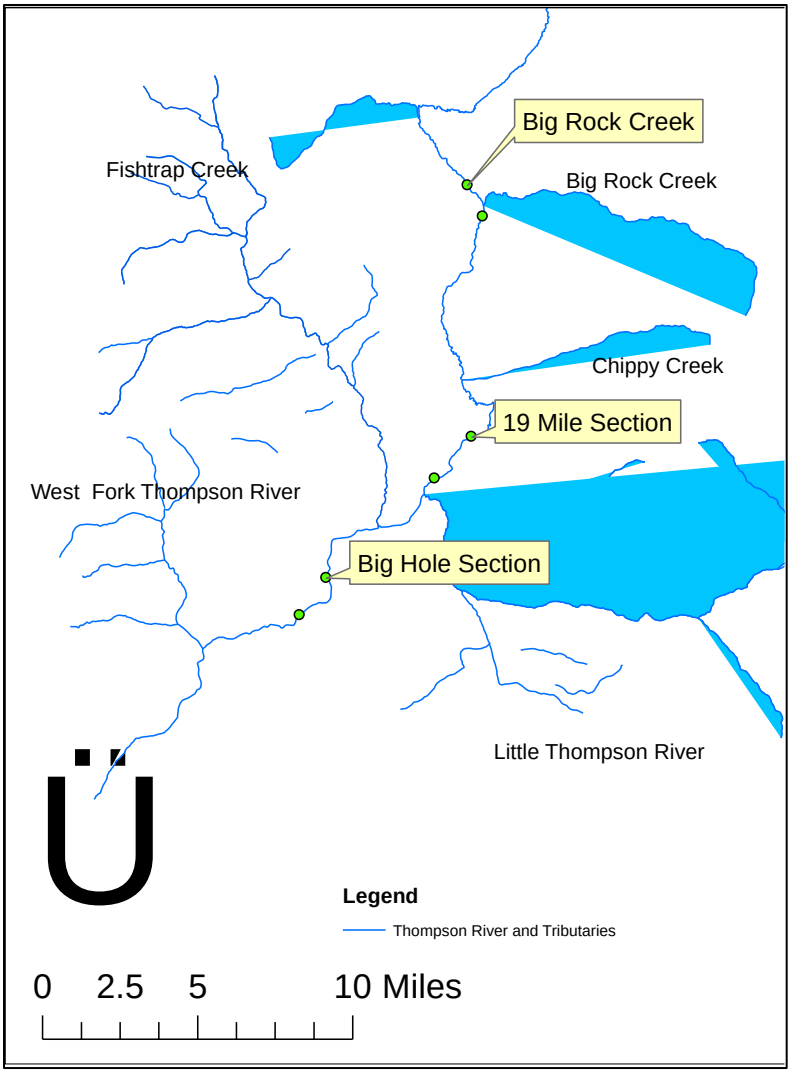


Figure 1. Map of the Thompson River with important tributaries and mainstem sampling sections identified. Big Rock Creek section was not sampled in 2021.

Table 1. Chapman mark-recapture and capture efficiency estimates for 19 Mile and Big Hole sections on Thompson River sampled in 2021.

				Mark-Recapture		**Capture Efficiency**	
Section	Date	Section length (km)	Spp.	Fish ≥ 150 mm/1.6 km	95% CI	Fish ≥ 150 mm/1.6 km	95% CI
19 Mile	6/1,2,6 &7	2.08	LL	238.0	156.3 - 385.6	136.3	120.8-156.4
			RB	-	-	23.6	18.8-31.6
			EB	2.4	-	4.1	-
Big Hole	6/15,16,22 &23	1.89	LL	761.4	311.6 - 1882.0	258.8	199.1 - 369.5
			RB	174.1	70.9 - 430.7	223.8	178.6-299.6
			BULL	9	1.6 -9.0	3.5	1.8- 72.7

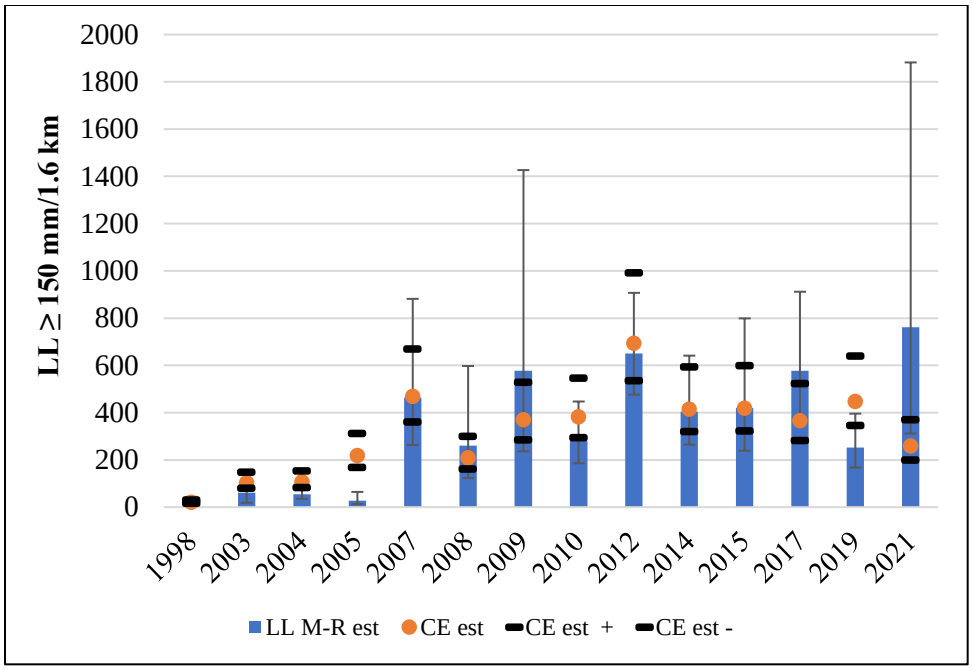


Figure 2. Chapman mark-recapture estimate (M-R est) and capture efficiency estimate (CE est, CE est +, CE est -) with 95 % confidence interval for Brown Trout (LL) per 1.6 km (per mile) in the Big Hole section of the Thompson River from 1998 to 2021.

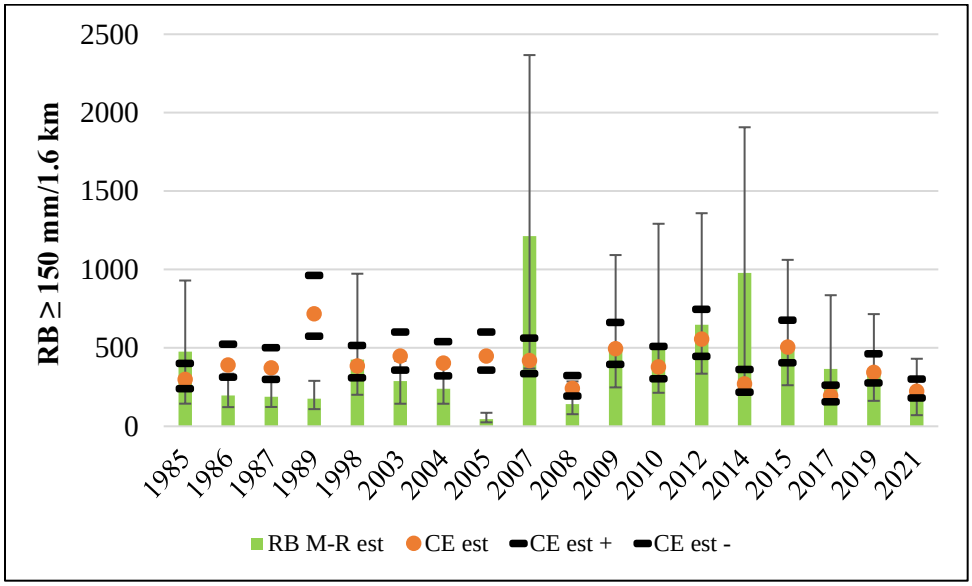


Figure 3. Chapman mark-recapture estimate (M-R est) and capture efficiency estimate (CE est, CE est +, CE est -) with 95 % confidence interval for Rainbow Trout (RB) per 1.6 km (per mile) in the Big Hole section of the Thompson River from 1998 to 2021.

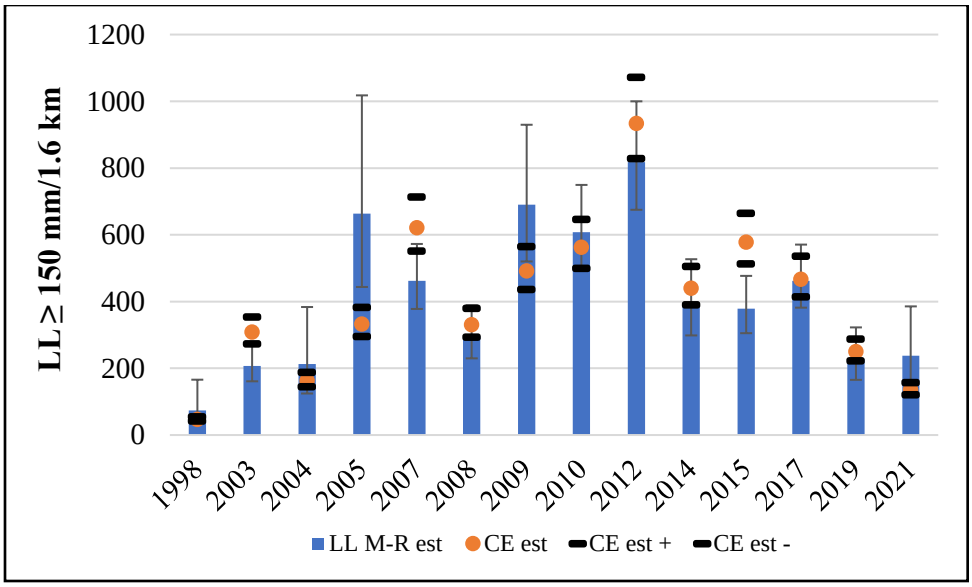


Figure 4 . Chapman mark-recapture estimate (M-R est) and capture efficiency estimate (CE est, CE est +, CE est -) with 95 % confidence interval for Brown Trout (LL) per 1.6 km (per mile) in the 19-mile section of the Thompson River from 1998 to 2021.

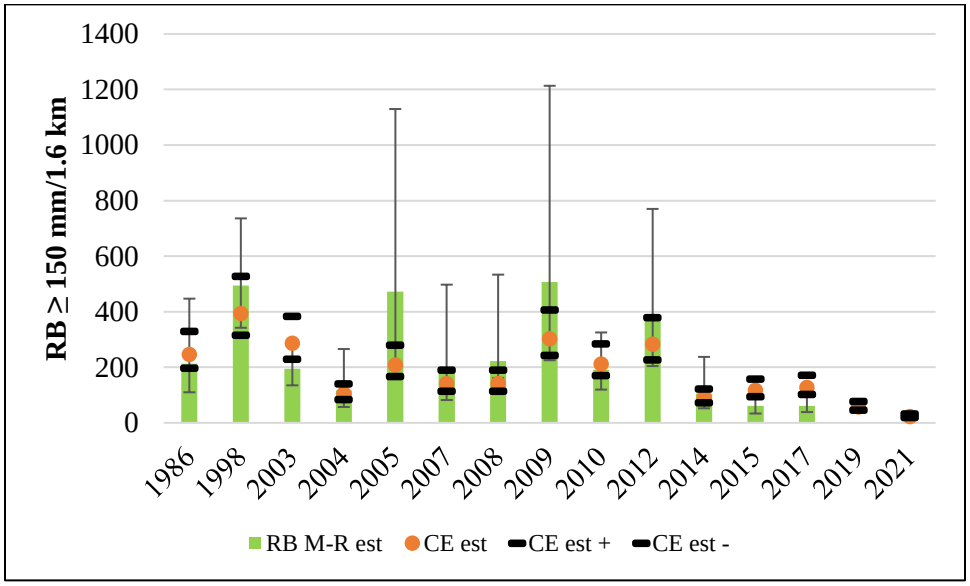


Figure 5 . Chapman mark-recapture estimate (M-R est) and capture efficiency estimate (CE est, CE est +, CE est -) with 95 % confidence interval for Rainbow Trout (RB) per 1.6 km (per mile) in the 19-mile section of the Thompson River from 1998 to 2021.

In 2021, temperature data was collected at two sites on the mainstem Thompson River. Mean monthly temperature at rkm 1.5 in July and August was 15.1℃ and 13.8℃, respectively (Figure 6). Mean monthly temperature at rkm 11.8 in July and August were 15.5℃ and 13.8℃, respectively. At rkm 1.5, temperatures exceeded 15℃ for 27 days, and at rkm 11.8 temperatures exceeded 15 ℃ for 24 days. Neither site experienced temperatures at or above 20℃ in the 2021 (Figure 7).

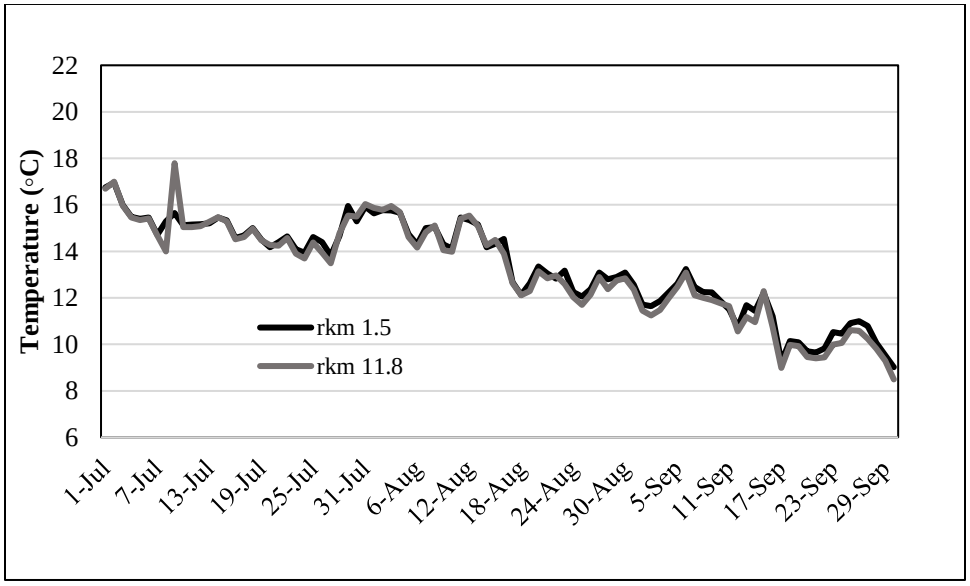


Figure 6. Daily mean temperature in the Thompson River rkm 1.5 and 11.8 in 2021.

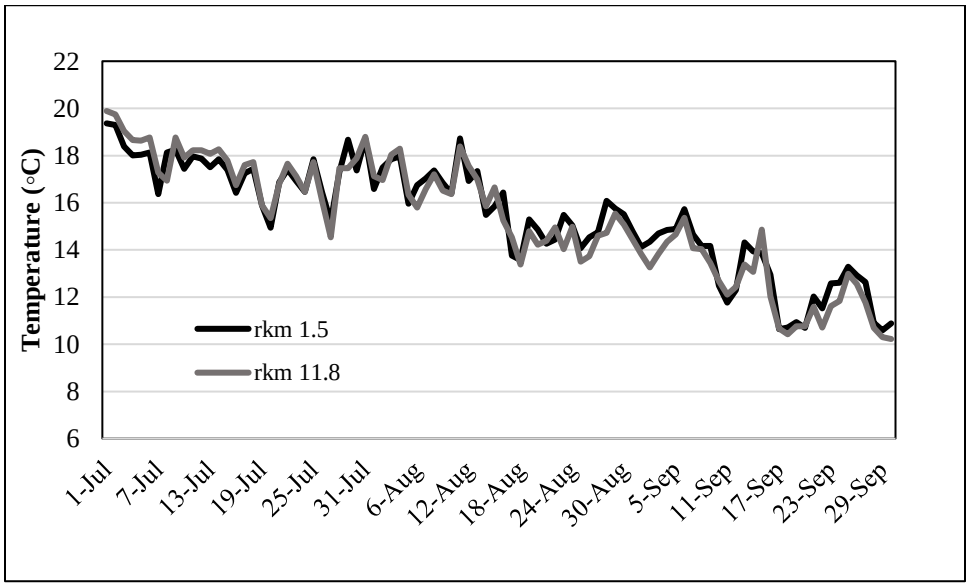


Figure 7. Daily maximum temperature in the Thompson River at rkm 1.5 and 11.8 in 2021.

Bear Creek

Bear Creek enters the Thompson River at approximately rkm 35.0. The lower 4.8 rkm of the stream are on land owned GD and the remainder of the drainage is managed by the LNF. The

lower drainage on GD land is located with the TFCE. A natural fish barrier exists in Bear Creek at 2.1 rkm and only Rocky Mountain tailed frogs *Ascaphus montanus* were present above the falls until 2020. In September of 2020, 290 non-hybridized WCT were translocated into Bear Creek above the barrier falls, between rkm 3.1 to 6.5 by FWP and LNF fisheries staff. The fish were collected from neighboring populations in upper Big Rock Creek (collection location = rkm 15.2 to 15.4 , n=37, sample #5444) and Chippy Creek (collection location = 4.9 to 5.2 rkm , n= 253, Sample # 5245)) (Kovach et al. 2021a). In the summer of 2022, efforts will be made to find evidence of natural reproduction from translocated fish.

A temperature logger was deployed above the barrier falls at rkm 2.6 in 2021 (Figure 8). Mean monthly July and August temperatures were 11.6℃ and 11.2℃, respectively. Maximum temperatures did not exceed 15°C in 2021. This stream may hold promise for resident Bull Trout population expansion and could serve as a haven for the Big Rock Creek population, which is currently being threatened by Brown Trout expansion. However, a well-established cutthroat population that occurs at relatively high abundance with consistent recruitment would need to be demonstrated before Bull Trout supplementation would be considered.

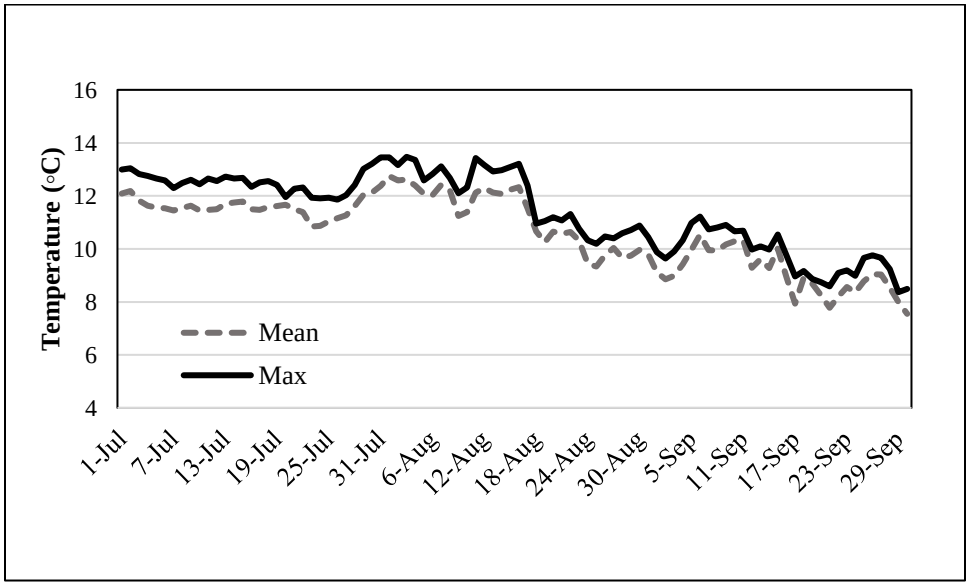


Figure 8**.** Daily mean and maximum temperatures in Bear Creek at rkm 2.6 in 2021.

Beatrice Creek

Beatrice Creek is a tributary to Fishtrap Creek at rkm 12.0. The stream is an important Bull Trout spawning and rearing tributary. Redd counts have fluctuated between low or no redds in the past few years in the lower 4.8 km, and sporadic electrofishing surveys indicated low numbers of the species over this time frame. Redd counts were initiated in the stream in 2003 . A good number of redds (i.e., more than five redds) were noted for a nine-year period from 2004 to 2012, but fewer than five redds per year have been counted since 2013, and in a few individual years no redds were found. Electrofishing surveys in 2011 noted extremely high abundance of Bull Trout in this stream, about 70 individuals/100 meters, which ranks among the highest ever observed in

the lower Clark Fork River drainage. In 2015, 12 to 25 fish/100 m were documented at three sites located at rkm 1.3, 3.4 and 4.2. These ranges of abundances are more typical of what would be considered "good" bull trout abundance in area streams. Abundance has dropped in the last few years (last sampling in 2017 and 2019), and probably coincides with lower spawning production. Westslope Cutthroat Trout and Westslope-Rainbow Trout hybrids also occur in the stream. The last genetic testing occurred at rkm 4.4 and noted 13 of 15 fish appeared to be non-hybridized, while six of the seven non-native Rainbow Trout alleles were found in one individual (sample #5048, Kovach et al. 2019a). The presence of a single Rainbow Trout allele in another individual coupled with low sample collection size, indicates updated testing, potentially at a higher resolution and certainly with a larger sample size required to determine if some or all individuals have a small amount of introgression (Kovach et al. 2019a). Fish abundance surveys will be conducted in the stream in 2023.

Although Bull Trout abundance and spawning production appears to have declined over the last 10 years, this is still an important stream for the species long-term conservation. In 2021, daily maximum temperatures did not exceed 12℃ (Figure 9). The mean monthly temperatures in July and August were 8.6℃ and 8.5℃, respectively. The lower 3.4 km of the stream occur on land owned by GD within the TFCE. Above this area, another 0.6 rkms of mainstem habitat and about 1.6 rkms of a large unnamed tributary (totaling 486 hectares) occur on GD land that would be protected through the proposed UTCP, with the rest of the drainage located on LNF land.

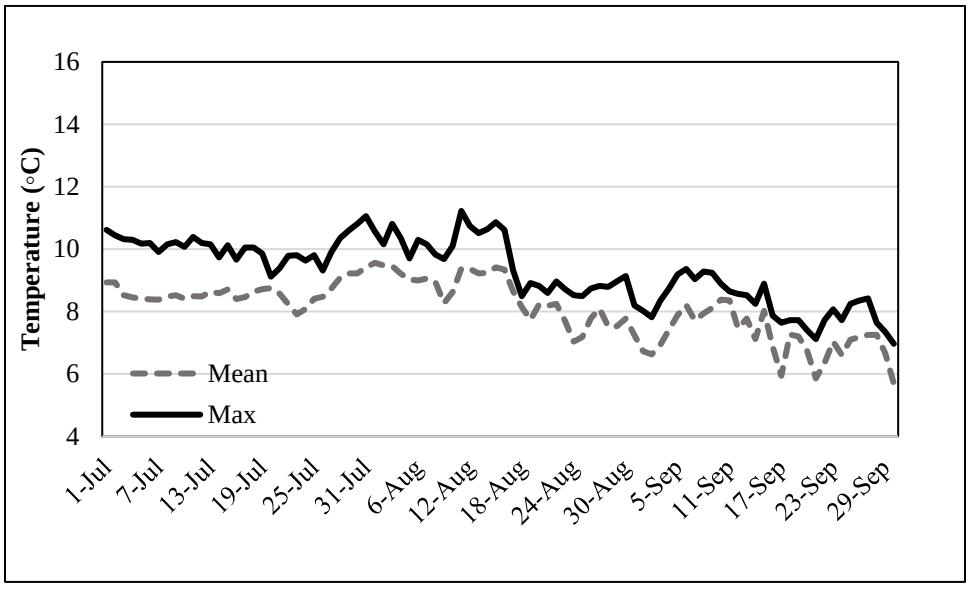


Figure 9. Daily mean and maximum temperatures in Beatrice Creek at rkm 0.2 in 2021.

Big Rock Creek

Big Rock Creek is a tributary to the Thompson River and enters the drainage approximately 52.4 rkms upstream from the Clark Fork River. Land ownership is a mixture of GD and LNF. The lower 5.2 km occur on GD land within the TFCE. The stream also passes through GD land from rkm 6.9 to 9.1, which occurs outside the TFCE. This reach of stream, which has among the highest densities of both Bull Trout and WCT in the drainage, may be one of the most important

sections of stream that will be protected through the proposed UTCP. The rest of the land is public and is administered by the LNF.

Big Rock Creek is the is one of three drainages and the upper most tributary occupied by Bull Trout in the Thompson River watershed. The stream enters the Thompson River where Brown Trout represent over 95% of the trout community in this section of the mainstem. Sampling in the lower portions of Big Rock Creek in 2021 around rkm 0.7 indicated Brown Trout comprise most of the fish community. Sampling upstream of this area at rkm 2.1 in 2010 and 2013 portrayed a fish community comprised of similar numbers of WCT and Brown Trout, with one Bull Trout encountered in 2010. At rkm 3.9 (section 2) above a series of cascades, the fish community is comprised of mainly WCT, with Bull Trout encountered in 2010 (n=3) and 2013 (n=1) but not in 2018. A 271 mm individual Brown Trout was captured at this monitoring site in 2013, although the species was not observed in 2010 or 2018 sampling. Sampling in 2010 at rkm 4.5 (section 3) and 5.5 (section 4) documented only WCT and Bull Trout. In 2018 at rkm 6.3 (section 4.5), two adult Brown Trout were captured along with 154 WCT and 29 Bull Trout. Bull Trout captured ranged from 66 to 284 mm and represent at least six age classes. No Brown Trout were captured at this site in 2013. Bull Trout were found up to at least 9.7 rkm in Big Rock Creek based on 2013 sampling efforts across the drainage.

Genetic testing in 2018 found six of 14 WCT tested at rkm 3.9 (sample # 5037) to be hybridized with Rainbow Trout, while all 15 WCT sampled at rkm 8.2 (sample # 5036) were found to be genetically pure (Kovach et al. 2019a). The WCT hybrids collected near rkm 3.9, showed substantial Rainbow Trout ancestry and analysis suggests these fish may have been recent immigrants to the stream. A physical barrier would prevent future colonization by hybrids not born in the upper drainages, which may explain how fish with substantial ancestry would be found among pure fish. Genetically pure WCT occur at rkm 8.2 and 15.8 which indicates there may be some physical barriers to movement. However, the 15 fish sample size from rkm 8.2 only had a 54% chance of documenting hybrids if they comprise 5% of the population, or a 14% chance if they only comprise 1% of the populations (Kovach et al. 2019a). In 2020, 37 WCT were collected between rkm 15.8 and 15.9. These fish were all found to be genetically pure and were subsequently translocated into Bear Creek in 2020 (sample # 5244, Kovach et al. 2021a). Future technological advances may also make hybrid removal a viable option.

Multi-pass depletion sampling downstream to a block net with two backpack electrofishing units was employed to estimate fish abundance at five sites in the drainage in 2021(Figure 10; Table 2). The site at 3.4 rkm had an estimated 15.1 WCT (95% CI 15-18) and 38.4 LL (95% CI 38-40) over 75 mm per 100 meters (m). The site at 3.9 rkm had an estimated 66.0 WCT (95% CI 59.2-76.9), and an estimated 10.7 LL (95% CI 10.7-11.3) over 75 mm per 100 m. The site at 5.5 rkm had an estimated 1.85 Bull Trout (95 % CI 1.85), 102.8 WCT (95% CI 101.9-105.5), and 13.9 Brown Trout (95% CI 13.9-14.4) over 75 mm per 100 m. The site at 6.3 rkm had an estimated 7.6 Bull Trout (95% CI 6.7-13.5), 184.8 WCT (95% CI 159-208.1), 2.9 Brown Trout (95% CI 29-4.2) over 75mm per 100m . The site at 7.9 rkm had an estimated 2 Bull Trout (95% CI 2-2) and 114.1 WCT (95% CI 102-128.8) over 75mm per 100m.

In 2021, Brown Trout comprised about 15% of fish community at rkm 3.9, whereas the species was not found at the site when it was last sampled in 2018 (Table 2; Figure 12). Just downstream below a series of cascades that likely limit fish passage most of the year, at rkm 3.4, Brown Trout comprised over 70% of the fish community. Brown Trout were also documented at rkm 5.5 and 6.3, where the species comprised 12% and 2% of the fish community (Table 2; Figure 13). Brown Trout were also sampled between rkm 6.4 and 6.8 (Table 3), marking the species known upstream distribution. Data collected from 2021 and compared to previous sampling indicate Brown Trout are increasing in abundance within core native trout habitat, however their proportion of the fish community at the most upstream depletion site has not changed between 2018 and 2021.

Spot shocking in Big Rock Creek was also conducted in 2021 to obtain Bull Trout genetic samples (Table 3). This will provide baseline information on the species for a potential fish barrier project to prevent further colonization from non-native salmonids in downstream reaches. Funding was acquired from NWE's Thompson Falls Bull Trout Adaptive Management fund for a contractor in summer/fall of 2022 to assess the potential for a fish passage barrier at three locations within the drainage. Information from a combination of local hydrologic and geological factors as well as access, cost and potential removal methods will be used when developing a long-term strategy for how to deal with non-native trout expansion and native trout conservation in the drainage.

Temperatures in Big Rock Creek at 4.8 rkm exceeded 15°C for 30 days in July and August 2021, reaching a maximum of 16.8°C (Figure 11). Daily maximum temperature exceeded 15°C for the majority of July. Mean monthly July and August temperatures were 13.5°C and 12.3°C, respectively.

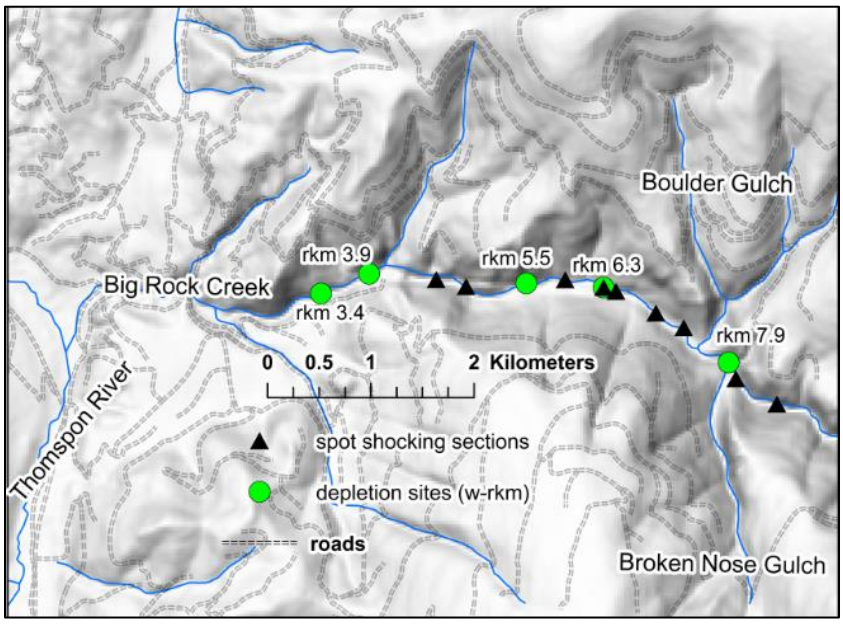


Figure 10. Big Rock Creek sampling efforts in 2021 including locations spot shocking efforts and depletion sections with river kilometers (rkm).

Table 2. Standardized linear abundance (#/100m), density (#/100m^2), and biomass (g/100m^2) estimates (fish ≥75mm) for Bull Trout (BULL), Westslope Cutthroat Trout (WCT), and Brown Trout (LL) in Big Rock Creek in 2021

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.
-	73	WCT	145-211	15.1	15.1-18.1	3.1	3.1-6.1	166.3	166.4-169.3
(3.4)		LL	112-259	38.4	38.4-40	7.8	7.8-9.5	397.7	397.7-399.3
2	103	WCT	85-254	66.0	59.2-76.9	12.5	11.2-23.3	499.6	448.2-510.5
(3.9)		LL	56-191	10.7	10.7-11.3	2.0	2.0-2.62	105.9	105.9-106.5
4	108	BULL	160-278	1.9	1.85-1.85	0.4	0.4-0.4	46.9	46.9-46.9
(5.5)		WCT	70-255	102.8	101.9-105.5	22.8	22.6-25.6	1111.3	1101.4-1114.1
		LL	65-290	13.9	13.9-14.4	3.1	3.1-3.6	220.6	200.6-201.1
4.5	105	BULL	60-315	7.6	6.7-13.5	1.5	1.3-7.4	185.5	162.3-191.3
(6.3)		WCT	78-262	184.8	159-208.1	36.2	31.2-59.6	1338.3	1152-1361.6
		LL	130-195	2.9	2.9-4.2	0.6	0.6-2.0	28.9	28.9-30.3
6	99	BULL	110-117	2.0	2-2	0.4	0.4-0.4	4.7	4.7-4.7
(7.9)		WCT	66-222	114.1	102-128.8	22.0	19.6-36.6	646.4	577.8-661.1

Table 3. Spot Shocking locations and species counts in Big Rock Creek

rkms	**Spp.**	**Count**
4.5-4.8	BULL	2
	WCT	111
	LL	21
5.9-6.3	BULL	4
	WCT	206
	LL	11
6.4-6.8	BULL	8
	WCT	179
	LL	13
6.9-7.2	BULL	6
	WCT	94
8-8.5	BULL	7
	WCT	216

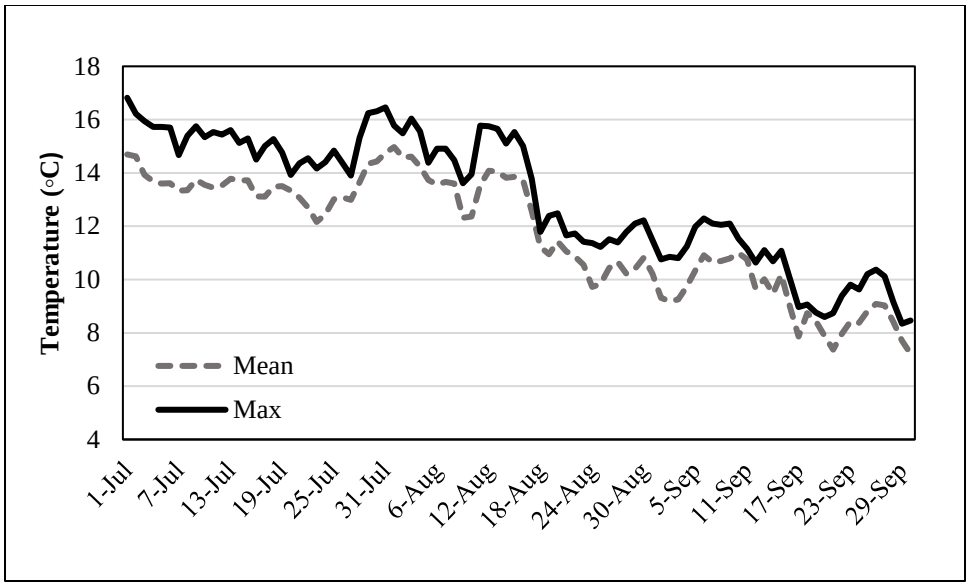


Figure 11. Daily mean and maximum temperatures in Big Rock Creek at rkm 4.8 in 2021.

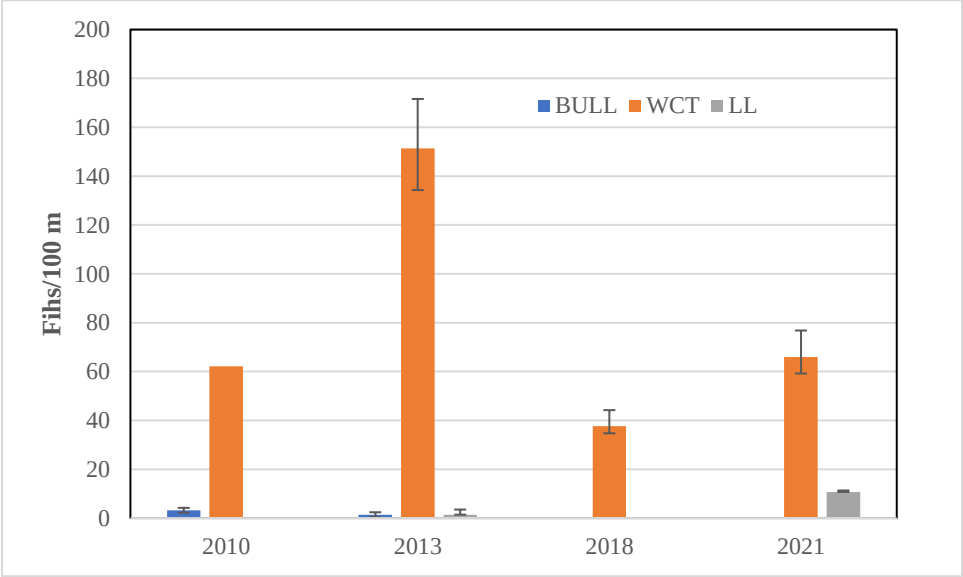


Figure 12. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL), Westslope Cutthroat Trout (WCT) and Brown Trout (LL) > 75 mm at rkm 3.9 in Big Rock Creek. The 2010 data represent single pass effort compared to two passes in 2021.

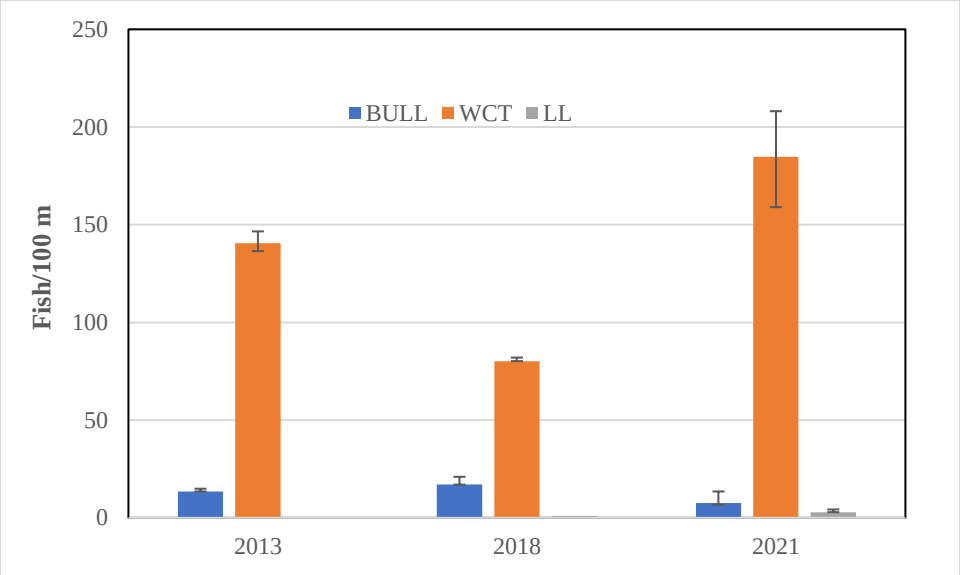


Figure 13. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL),Westslope Cutthroat Trout (WCT) and Brown Trout (LL) > 75 mm at rkm 6.3 in Big Rock Creek.

Chippy Creek

Chippy Creek is a tributary to the Thompson River at 38.4 rkm. Land ownership in the lower 4.8 rkm, which occurs within the TFCE, is a mixture of GD and state land. The section of stream from rkm 4.9 to 6.7 also occurs on land owned by GD and would be perpetually protected under the proposed UTCP. This section of stream has high densities of WCT which have recently been used to establish novel populations within the Thompson River drainage. The remainder of the land upstream of rkm 6.7 is managed by the LNF.

A series of bedrock slides at rkm 4.1 likely provide an impediment, but not a barrier, to upstream migration. Native and non-native trout exist above and below the barrier, including WCT, Brown Trout and Brook Trout. Downstream of this geologic feature, non-native trout appear to be dominant, while WCT appear to be the dominant species upstream. Non-hybridized WCT were translocated from Chippy Creek in 2020 (Bear Creek; sample #5245, Kovach et al. 2021a) and 2021(Shroder Creek and South Fork Murr Creek; sample #5314, Kovach et al. 2021b) (Figure 14). Future monitoring in the drainage will evaluate the impact of translocation on fish species abundance and community composition within the reach where fish were collected (rkm 4.8 to 6.1), as well as upstream stream reaches. Chippy Creek is an important stream for WCT conservation within the Thompson River drainage given its high genetic diversity and abundance of the species (sample #5038, Kovac et al. 2019a).

Temperatures in Chippy Creek at the trail crossing at 4.1 rkm exceeded 15°C for 34 days in July and August of 2021, reaching a maximum of 17.6°C (Figure 15). Average monthly July and August temperatures were 14.2°C and 13.3°C, respectively.

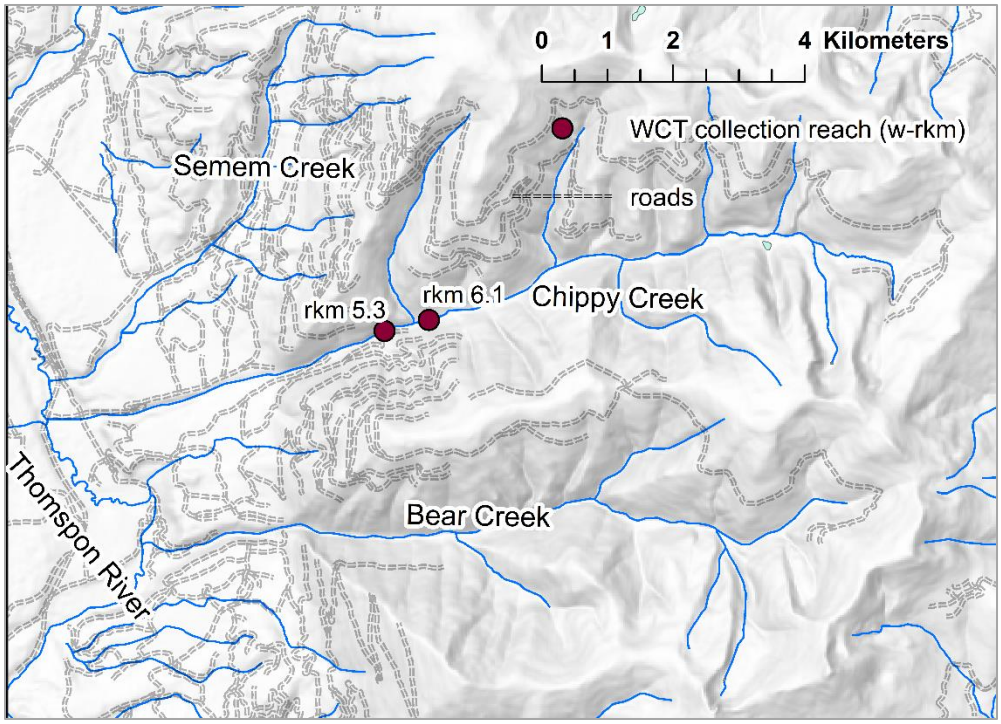


Figure 14. Collection location area in Chippy Creek for Westslope Cutthroat Trout translocated from the stream to South Fork Murr Creek and Shroder Creek in 2021.

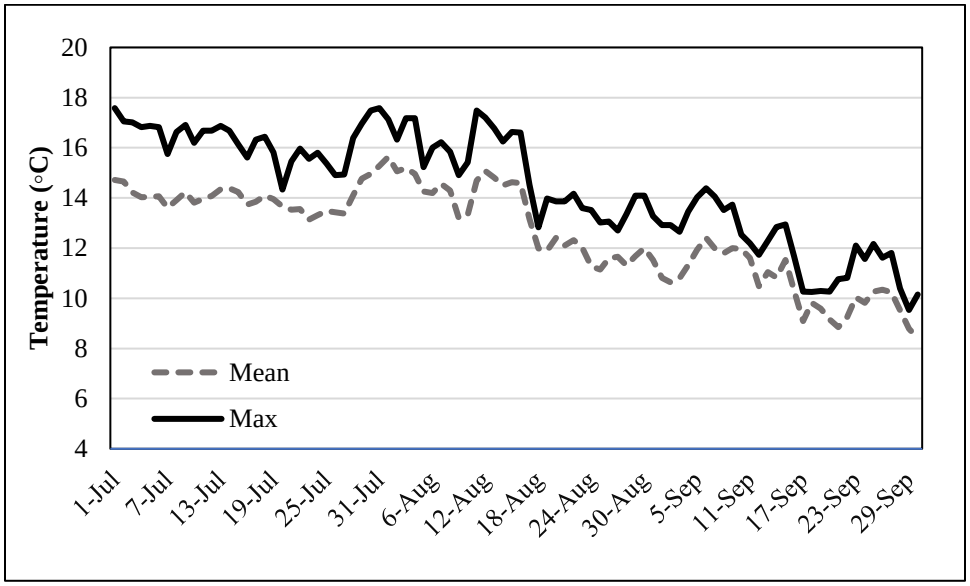


Figure 15. Daily mean and maximum temperatures in Chippy Creek at rkm 4.1 in 2021.

Deerhorn Creek

Deerhorn Creek is a tributary to the Thompson River, entering at 22.1 rkm. The ownership in the drainage is a mixture of state and GD owned land, with LNF land in the headwaters. The stream is protected up to rkm 3.5 through the TFCE. The remainder of the drainage, two sections totaling 518 hectares, would be protected under the proposed UTCP.

The stream has only been sampled on occasion and based on this limited sampling WCT appear to be the dominant fish species. Westslope Cutthroat Trout in Deerhorn Creek have been tested for hybridization at rkm 0.8 in 1990 (n=24, sample # 389), at rkm 0.5 in 2003 (n=12, sample #3137), and at rkm 2.1 (n=3) and rkm 3.7 (n=20) in 2019 (Kovach et al. 2020a). The 1990 and 2003 samples documented hybridization, while the 2019 samples, which were collected up higher in the system, were found to be comprised of non-hybridized fish. The power to detect as little as 0.3% RB a hybrid swarm based on the sample size was greater than 99%, however power is low if admixture is recent, and the population is not a hybrid swarm (Kovach et al. 2020a). No known barriers occur in Deerhorn Creek; however, the stream has been infrequently sampled and such an investigation would require walking certain stream segments, especially from rkm 2.1 to 3.7. Three juvenile Bull Trout of the same year class (age-1) were found at rkm 2.1 in 2019, which was the first documentation of Bull Trout in this stream. The presence of Bull Trout indicates some level of connectivity with the mainstem Thompson River, at least up to rkm 2.1.

Deerhorn Creek did not exceed 15°C in 2021(Figure 16). The mean monthly temperature in July and August was 8.4°C both months.

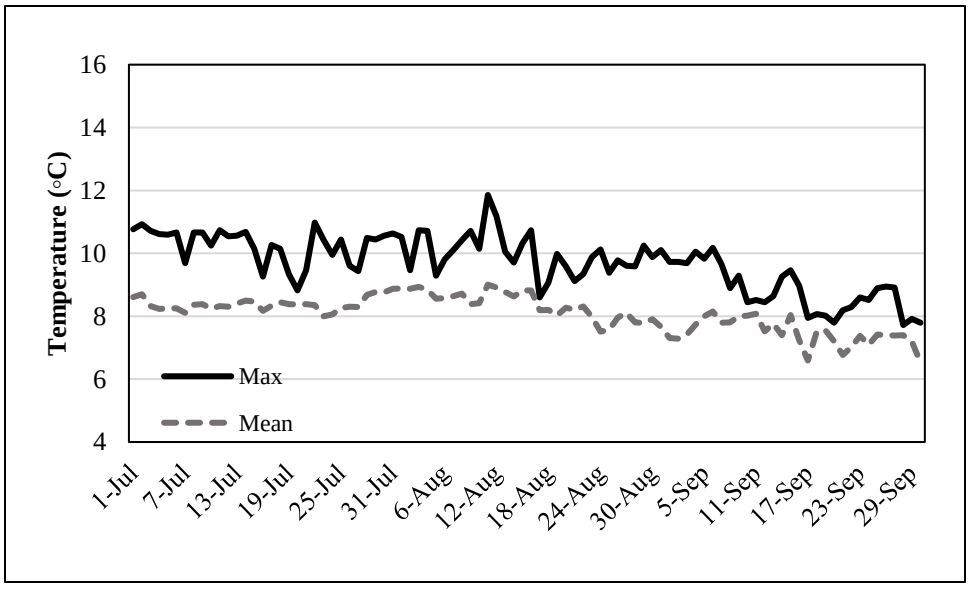


FIGURE 16. Daily mean and maximum temperatures from Deerhorn Creek just upstream of its confluence with the Thompson River in 2021.

Fishtrap Creek

Fishtrap Creek is the second largest tributary of the Thompson River in drainage area. Land ownership is a mixture of LNF, GD and state. Much of the drainage is protected through the TFCE. The UTCP would protect all remaining land in the drainage, in the range of 1048 to 1146 hectares (10-11 sections), including a small section of the mainstem and major portions of important tributary streams including Beatrice Creek and Jungle Creek.

The Fishtrap Creek drainage contains the most important significant spawning and rearing habitat for Bull Trout in the Thompson River drainage. It has been regularly sampled over the past twenty years and has been described extensively in other reports (Kreiner and Tholl 2014; Glaid 2017; Kreiner and Terrazas 2018; Kreiner and Terrazas 2020). Sampling has included electrofishing in the mainstem Fishtrap Creek and tributaries, redd counts, a 2015 graduate study, and an ongoing outmigration study (Kreiner and Terrazas 2018; Appendix D).

Monitoring activities in the drainage in 2021 included redd counts in 17 km of the mainstem with many additional kilometers surveyed in three of its major tributaries: Jungle Creek, Beatrice Creek and West Fork Fishtrap Creek. Three long-term monitoring sites were sampled on the mainstem in the summer and during the fall juvenile Bull Trout were captured during experimental efforts in the lower 4 km to actively transport fish below the three lower Clark Fork River dams to the Clark Fork River in Idaho (see Bull Trout Transport section on this report and Appendix C).

Westslope Cutthroat Trout occur over many kilometers of habitat in Fishtrap Creek and its tributaries. Hybridization is more complex in this system compared to other Thompson River tributaries, with more low-level Rainbow Trout and Yellowstone Cutthroat Trout (YCT) hybrids. The threat of hybridization to WCT in the Fishtrap Creek drainage not only comes from open connectivity within much of drainage, but also from headwater lakes historically stocked with YCT. Hybrid fish were recently documented in Beatrice Creek (n= 30, sample #5048,) West Fork Fishtrap Creek (n=30, sample #5047), Radio Creek (n=55, sample #5046) and the mainstem (n=50 , sample #5045) (Kovach et al. 2019a). For each stream, the majority of tested individuals were determined to be non-hybridized WCT. The SNP chip currently used for rapid-turn-around testing (ex., Thompson River WCT translocation project) is sufficient for identifying hybrids of moderate Rainbow/Yellowstone ancestry, but at relatively low levels of hybridization (<10%) it is a lot more likely hybrid genes could go undetected, and in the case of translocation, hybrid fish could be inadvertently moved. Additional testing will be conducted in coming years to identify non-hybridized population that may be eligible for translocation. Such locations include upper Jungle Creek and upper West Fork Fishtrap including Stony Lake Creek.

In 2021, monitoring sites were sampled on Fishtrap Creek using multiple-pass depletion methodology moving downstream into a block net at rkms 8.1, 10.9 and 15.4 (Figure 17). The site at rkm 8.1 had an estimated 5.2 Bull Trout (95% CI 5.2-6.0), 11.3 WCT (95% CI 7.8-28.8), and 3.5 Oncorhynchus species (spp.) (i.e., hybrids) (95% CI 3.5-4.5) over 75 mm per 100 m (Table 4; Figure 20). The site at rkm 10.9 had an estimated 6.7 Bull Trout (95% CI 6.7-7.5), 24

WCT (95% CI 22.1-29.6), 1 Brown Trout (95% CI 1-4.2), 10.6 Oncorhynchus spp. (95.5% CI 8.7-19.8), 1.9 Mountain Whitefish (95% CI 1.9-3.8), and 1.9 Brook Trout (95% CI 1.9-3.8) over 75 mm per 100 m in 2021 (Table 4; Figure 21). The site at 15.4 rkm had an estimated 10 Bull Trout (95 % CI 10-11.6), 18 WCT (95% CI 15-28.7), 1 Brown Trout (95% CI 1), 1 Mountain Whitefish (95% 1-4.4), and 3 Oncorhynchus spp. (95% CI 3-3) over 75 mm per 100 m (Table 4; Figure 22).

The sites sampled in mainstem had previously been sampled one to three times prior to 2021. The sites with the longest data sets in Fishtrap Creek (rkm 6.9 and 16.9) were not sampled. Limited staff and sampling time occurred in 2021 and we chose to sample sites in areas of the mainstem that had received much less prior sampling to build up more data in these areas of the drainage. In the future when sampling occurs within this drainage, these efforts should comprise multiple sites that are longitudinally spaced, to help describe how native fish abundance, especially Bull Trout, changes spatially and temporally. These surveys are also important for documenting non-native trout encroachment in native trout strongholds and for evaluating responsive management strategies.

At rkm 10.9, Bull Trout abundance in 2021 was similar to numbers documented in 2017 and 2019. At rkm 15.4, Bull Trout abundance was also similar to numbers recorded in 2015 and 2017. River kilometer 8.1 was first sampled in 2011 with a single pass and was again sampled in 2021 with two passes. Bull Trout abundance at this site was the lowest of the three mainstem Fishtrap sites sampled in 2021 (5.2 fish/100 m), with the highest estimate of abundance for the species (10 fish/100 m) being at rkm 15.4 in 2021. Westslope Cutthroat Trout abundance was higher and more variable at the two sites sampled prior to 2021 (i.e., rkm 10.9 and rkm 15.4) and ranged from 10 to 40 fish being captured. The upper bounds of some of the estimates of WCT abundance are quite large, which likely reflects the difficulties of sampling a large stream with low conductivity and relatively low densities of fish. Mountain Whitefish have been recorded at each of the three sites sampled, including at rkm 10.9 and 15.4 in 2021.

The observation of a single Brown Trout at rkm 15.4 is the most upstream detection of the species in mainstem Fishtrap Creek. Another lone Brown Trout was captured even higher up in the drainage, in the lower West Fork Fishtrap Creek in 2021, where the species has never been previously observed. The presence of Brown Trout within core Bull Trout spawning and rearing habitat is concerning, especially given Bull Trout redd counts have been below average throughout the Fishtrap Creek drainage the past few years (see Bull Trout Redd Counts section of this report). Habitat conditions in Fishtrap Creek above the West Fork confluence are likely even better suited to Brown Trout establishment (i.e., lower gradient, warmer water temperatures) than the mainstem between Beatrice and the West Fork or the three main tributaries occupied by Bull Trout. A Brook Trout was observed at rkm 10.9 in 2021, where the species was also encountered in 2015 but not in 2017 or 2019. Brook Trout also pose a significant threat to native fish in the Fishtrap Creek drainage if the species became established above the West Fork, especially given their affinity for stream habitat influence by beavers which is plentiful in the drainage above the West Fork confluence. Currently, Brook Trout

appear in low abundance in the lower portion of the Fishtrap Creek drainage and are often associated with marginal, off-channel backwaters and side channel habitat where the drainage that has the highest mean daily and maximum summer temperatures (Figure 18; Figure 19).

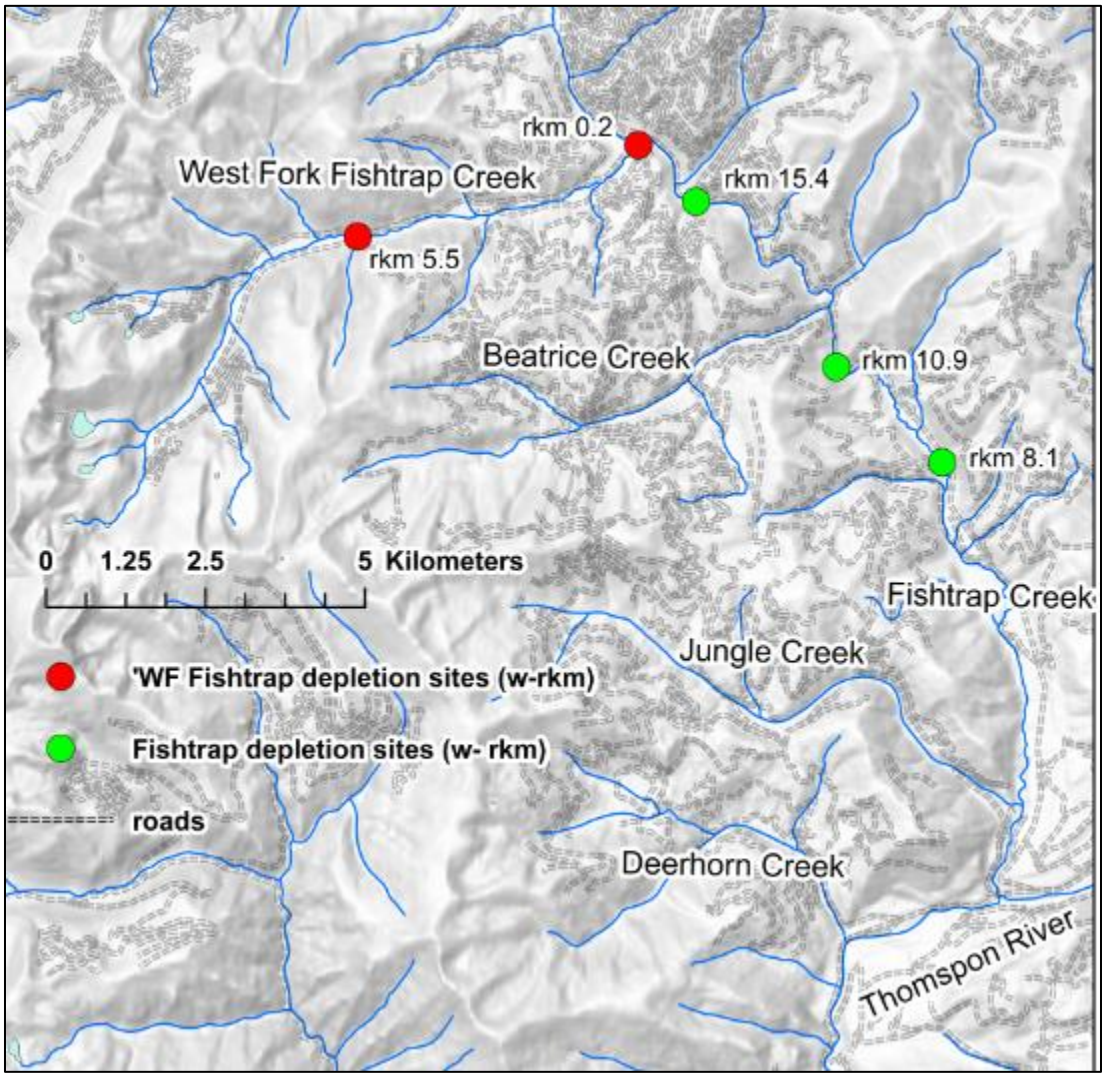


Figure 17. Electrofishing monitoring sites (multi-pass, depletion) sampled in the Fishtrap Creek drainage in August 2021.

Temperature loggers were deployed just below the Radio Creek – Fishtrap Creek confluence (rkm 21.1), below West Fork Fishtrap Creek confluence (rkm 16.8), at the bridge below the confluence with Beatrice Creek (rkm 11.4), above Jungle Creek near Rabbits Run (rkm 4.8) and near the mouth (rkm 0.0) (Figure 18; Figure 19). All thermograph locations, except rkm 11.4 and 16.8, exceeded 15°C. At the mouth of Fishtrap, temperatures exceeded 15°C for 10 days. At rkm 4.8 temperatures exceeded 15°C for 45 days, and at rkm 21.1 temperatures exceeded 15°C for 7 days. Highest maximum and average daily temperatures were recorded at rkm 4.8, which is a losing reach (i.e., reach that loses surface flows to the ground) that is further

from the cold-water inputs of West Fork Fishtrap and Beatrice Creek, and is located above Jungle Creek. The maximum temperature recorded at 4.8 rkm was 18.8°C.

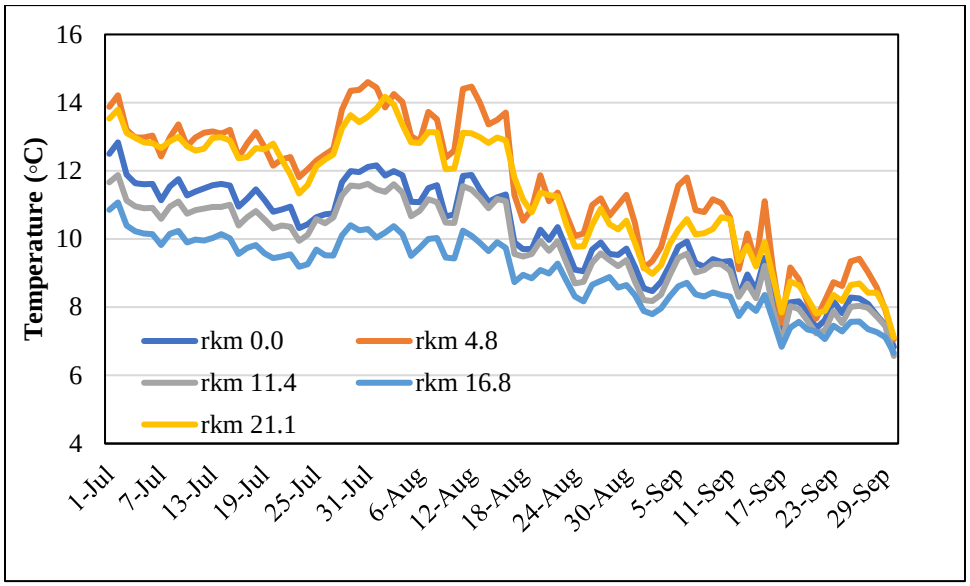


FIGURE 18**.** Daily mean temperatures in Fishtrap Creek at rkm 0.0, 4.8, 11.4,16.8, and 21.1 in 2021.

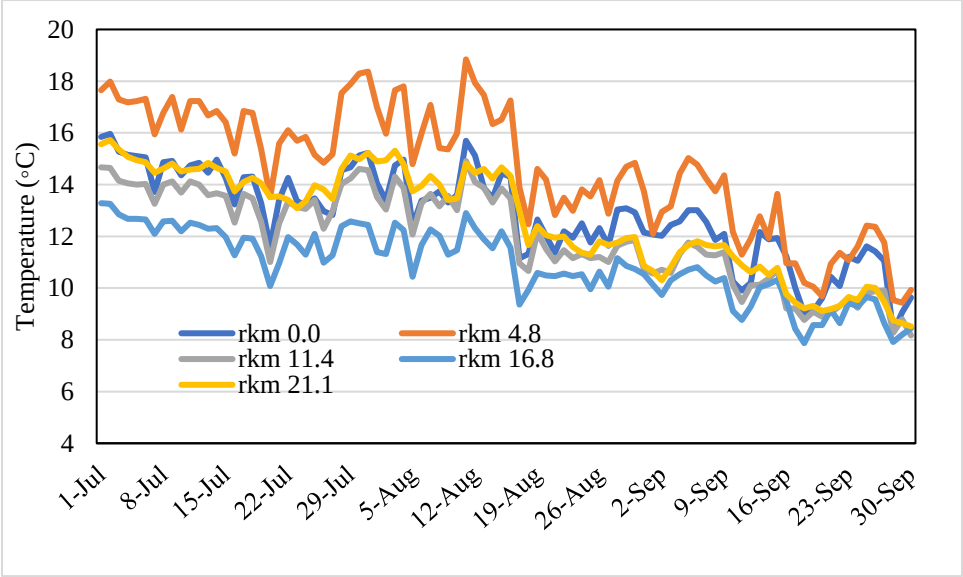


FIGURE 19. Daily maximum temperatures in Fishtrap Creek at rkm 0.0, 4.8, 11.4, 16.8 and 21.1 in 2021.

TABLE 4. Standardized linear abundance (#/100m), density (#/100m^2), and biomass (g/100m^2) estimates (fish ≥75mm) for Bull Trout (BULL), Brown Trout (LL), and Oncorhynchus (*Onc.*) and Westslope Cutthroat Trout (WCT) in Fishtrap Creek in 2021. Oncorhynchus combines Rainbow Trout (RB) and suspected RB X WCT hybrids into one category, as it is difficult to differentiate without genetic sampling.

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.
-	115	BULL		5.2	5.2-6.0	0.5	0.5-1.3	33.7	33.7-34.5
(8.1)		WCT		11.3	7.8-28.8	1.2	0.8-18.65	34.5	23.9-52
		Onc.		3.5	3.5-4.5	0.4	0.4-1.4	10.9	10.9-12
-	104	BULL		6.7	6.7-7.5	0.6	0.6-1.5	37	37-37.8
(10.9)		WCT		24	22.1-29.6	2.3	2.1-7.9	112.6	103.5-118.2
		LL		1	1-4.2	0.09	0.09-3.4	14.3	14.3-17.6
		Onc.		10.6	8.7-19.8	1	0.8-10.2	45.9	37.5-55.1
		MWF		1.9	1.9-3.8	0.2	0.2-2.1	1.1	1.1-3.0
		EB		1.9	1.9-3.8	0.2	0.2-2.1	5.9	5.9-7.8
-	100	BULL		10	10-11.6	1.2	1.2-2.7	47.3	47.3-48.7
(15.4)		WCT		18	15-28.7	4.5	3.7-15.2	149.3	124.4-160
		LL		1	1	0.1	0.1	16.5	16.5
		MWF		1	1-4.4	0.1	0.1-3.5	0.5	0.5-3.8
		Onc.		3	3	0.7	0.7	13.4	13.4

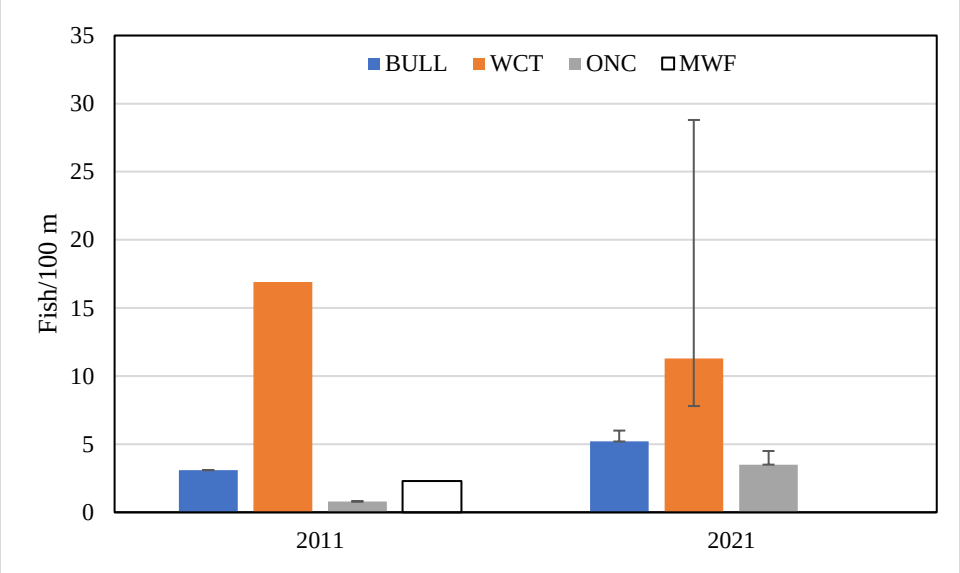


Figure 20. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL), Westslope Cutthroat Trout (WCT), Oncorhynchus hybrids (ONC) and Mountain Whitefish (MWF) > 75 mm at rkm 8.1 in Fishtrap Creek. The 2011 data represent a single pass effort compared to two passes in 2021.

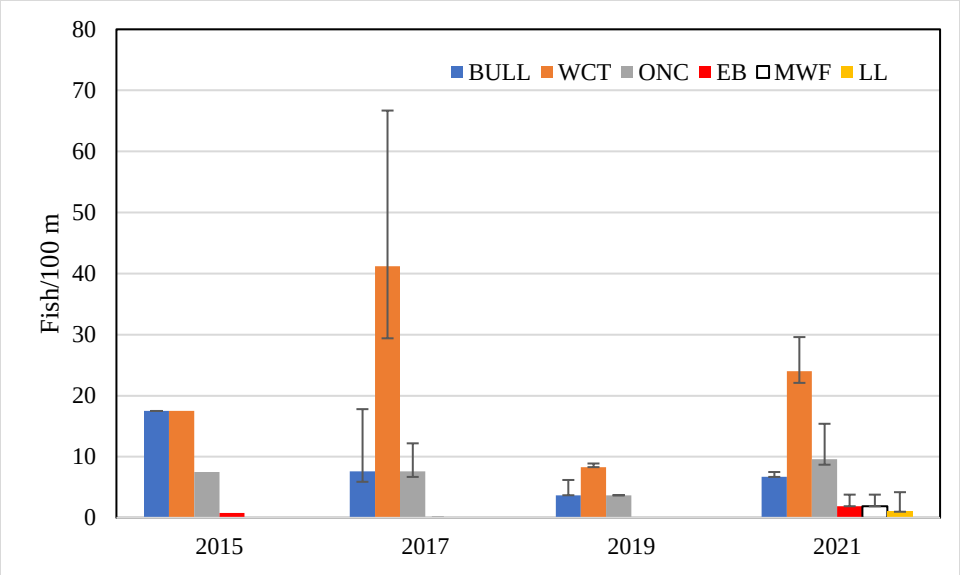


Figure 21. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL), Westslope Cutthroat Trout (WCT), Oncorhynchus hybrids (ONC), Brook Trout (EB), Mountain Whitefish (MWF) and Brown Trout (LL) > 75 mm at rkm 10.9 in Fishtrap Creek. The 2015 data represent a single pass effort.

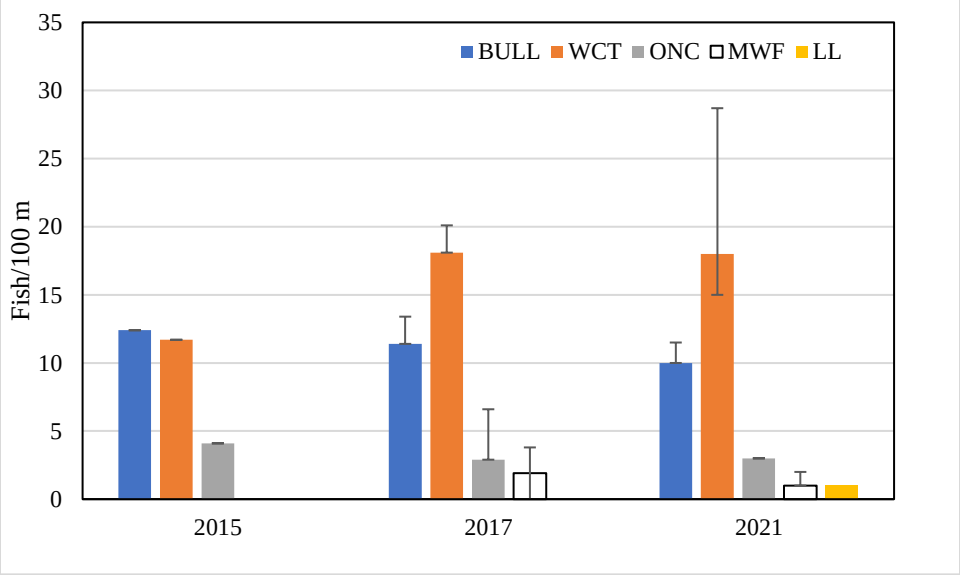


Figure 22. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL), Westslope Cutthroat Trout (WCT), Oncorhynchus hybrids (ONC), Mountain Whitefish (MWF) and Brown Trout (LL) > 75 mm at rkm 15.4 in Fishtrap Creek. The 2015 data represent a single pass effort.

Jungle Creek

Jungle Creek is a tributary to Fishtrap Creek at 1.6 rkm. Land ownership in the drainage is a checkered-boarded mixture of LNF and GD ownership. The GD land from the mouth upstream to rkm 4.0 occurs within the TFCE. Stream reaches from rkm 4.0 to 6.4, 7.4 to 7.8 and 9.5 to 9.8

would be protected by the UTCP. In total the UCTP would protect the remainder of the drainage, about 1165 hectares (4.5 sections) and about 4.0 km of perennial habitat including tributaries.

Jungle Creek contains a Bull Trout population that is believed to be comprised of mainly stream resident fish, which was found to be genetically distinct from other Bull Trout populations within the Fishtrap Creek drainage (DeHaan et al. 2016). Redd counts are conducted most years in Jungle Creek over about 6.6 km of stream. No electrofishing surveys to monitor Bull Trout were conducted in the stream in 2021 but will likely occur in 2023. Westslope Cutthroat Trout genetics were acquired from upper Jungle Creek in 2022, to evaluate the potential to translocate this population.

Temperatures in Jungle Creek did not exceed 15°C in 2021 (Figure 23; Figure 24). Mean July temperatures at rkm 1.3 and 5.8 were 9.1°C and 7.6°C, respectively, while mean August temperatures at rkm 1.3 and 5.8 were 8.9°C and 7.5°C.

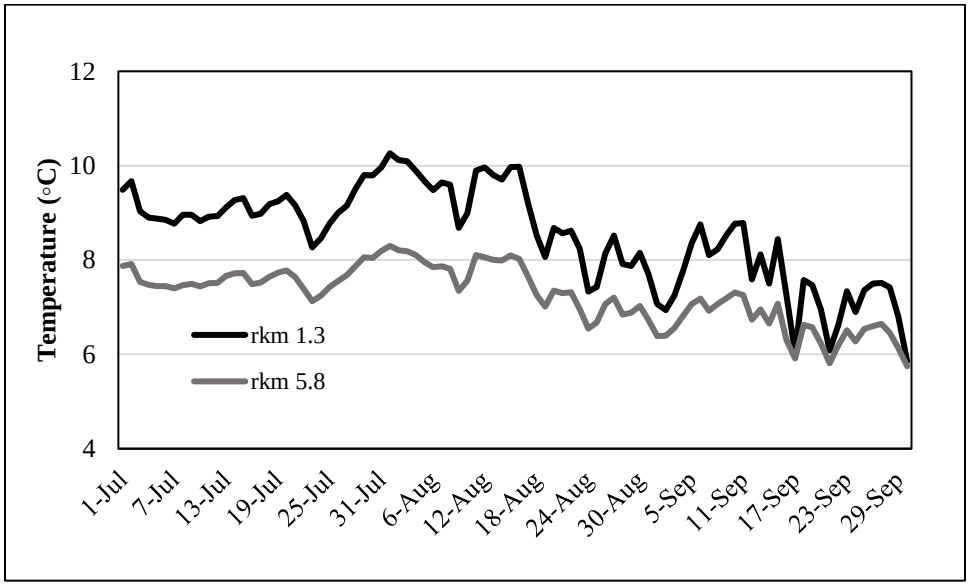


Figure 23 Daily mean temperatures in Jungle Creek at rkm 1.3 and 5.8 in 2021.

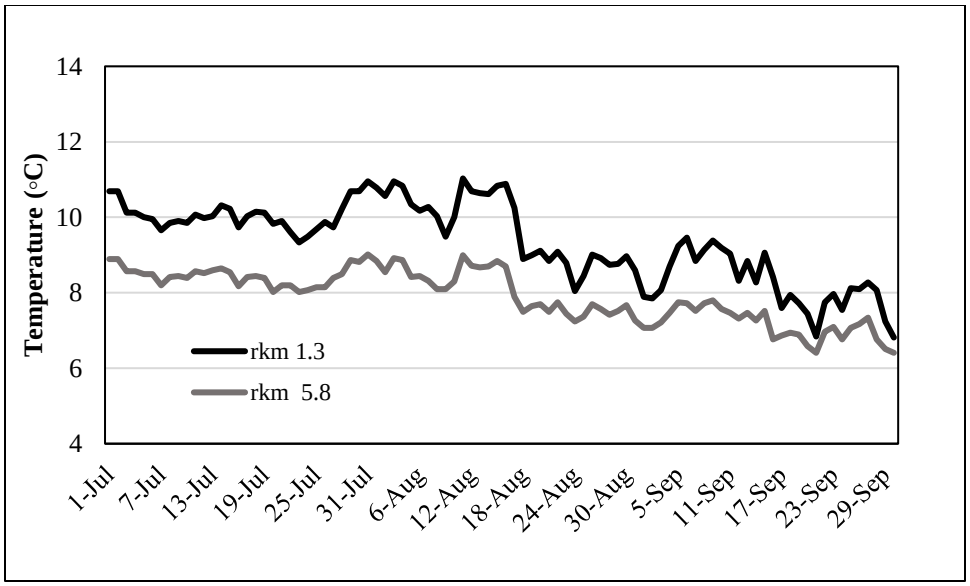


Figure 24. Daily maximum temperatures in Jungle Creek at rkm 1.3 and 5.8 in 2021.

Little Rock Creek

Little Rock Creek is a tributary to the Little Thompson River at rkm 2.3. The stream flows through a mixture of state and GD land from its lower and middle reaches to rkm 7.4. Upstream of this area the drainage occurs on federal land administered by the LNF. The section of stream from rkm 6.3 to 7.4 occurs on GD land and would be protected through the UTCP, below this area the stream is protected through the TFCE.

A few sites were sampled on the stream between 2016 and 2019. Brook Trout dominate the lower portion of the stream, while WCT are the most abundant species in upstream reaches. The transition point appears to be a permanent diversion structure around rkm 4.2. Below this diversion, the stream is heavily grazed, dewatered and temperatures are elevated. The habitat above the diversion is also impaired from grazing and stream-road interactions. Genetic samples were collected in 2020 from putative WCT above the diversion. Results indicate that 26 of 30 fish were non-hybridized WCT, while four hybrid individuals were identified each showing fairly high levels of Rainbow Trout ancestry, which implies hybridization in the drainage is recent and may have resulted from dispersal of hybrids into Little Rock Creek (sample # 5309, Kovach et al. 2021b). Given our current ability to detect hybrids with significant amounts of Rainbow Trout ancestry, efforts will be made to translocate WCT from Little Rock Creek in the coming years. Little Rock Creek was not sampled in 2021, but future efforts to better understand the community composition in the area above and below the division will be conducted to help focus future habitat restoration upstream of the diversion. The area of stream just above the diversion where the thermograph was located is heavily grazed and the stream channel resembles a flowing mud puddle. Upstream of this area, the stream crosses a logging road at rkm 5.2. This crossing has no culvert or bridge, and the stream runs down the road for some time, providing a constant elevated sediment source to the stream

Temperatures in Little Rock Creek exceeded 15°C on three days in 2021 (Figure 25). Mean July and August temperatures at rkm 4.3 were 12.8℃ and 12.2 ℃, respectively.

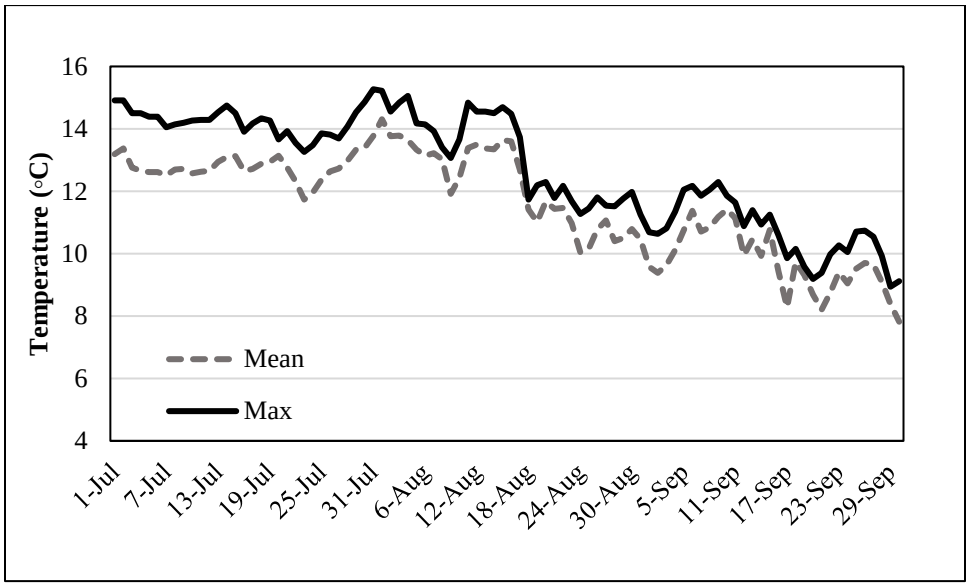


Figure 25. Daily mean and maximum temperatures in Little Rock Creek above the diversion at rkm 4.3 in 2021.

Little Thompson River

The Little Thompson River is the largest tributary, by drainage area, to the Thompson River, with the confluence 28 km upstream of the Clark Fork River. Land ownership is a mixture of GD, state, LNF, as well as some private parcels. Much of the drainage is protected through the TFCE and all remaining GD land would be protected under the UTCP. Bull Trout do not currently inhabit the Little Thompson River drainage; however, populations of aboriginal Westslope Cutthroat Trout persist in some tributaries (North Fork Little Thompson, Little Rock Creek, Mudd Creek, Alder Creek). Non-native trout (especially Brook Trout) are abundant and widely distributed through the drainage, including in tributary streams. There are two diversion canals which direct water from the headwaters of Alder Creek and McGinnis Creek through a trans-basin exchange to Confederated Salish and Kootenai Tribal land. Each ditch has a large water right which usually results in the complete capture of each creek during the period of diversion. Putative WCT from the Alder Ditch were genetically evaluated in 2022, to determine if they can be used a source for the ongoing translocation project occurring within the Thompson River drainage. In coming years, efforts will be made to collect genetic information on any additional WCT populations with the Little Thompson River drainage.

Temperatures in the Little Thompson River at the ACM bridge crossing exceeded 15°C for the entirety of July and August, a total of 62 days, and continued to exceed 15°C in and into September (Figure 26). The average monthly July and August temperatures were 16.8°C and 15.1°C respectively, with a maximum of 23.2°C. This drainage is temperature and sediment impaired through anthropogenic impacts associated with roads, livestock grazing and timber harvest, and as such aquatic habitat is likely limiting fish population across the watershed (Lower

Clark Fork Watershed Group 2018). During the summer months the stream is significantly warmer than the mainstem at their confluence, which likely reduces the capacity of this reach to hold fish during the warmer periods of the year. Reducing stream temperature and sediment delivery by improving and sustaining healthy riparian communities could improve water quality and ultimately benefit the mainstem Thompson River.

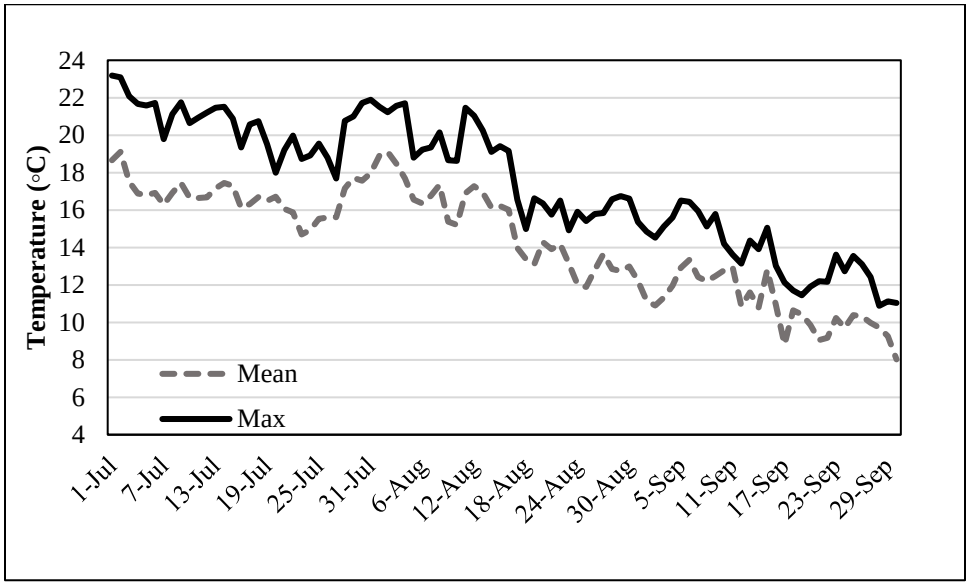


Figure 26. Daily mean and maximum temperatures in the Little Thompson River, just upstream of the mouth in 2021.

Loneman Creek

Loneman Creek is a tributary to Mudd Creek in the Little Thompson River drainage. Most of the creek flows through GD property protected under the TFCE. The stream is grazed heavily under the jointly managed Thompson River Cooperative grazing allotment (GD, Montana Department of Natural Resources Conservation, LNF). Westslope Cutthroat Trout are the primary salmonids present, although Brook Trout have recently been captured. Sculpins and tailed frogs are also present. Previous temperature monitoring revealed elevated stream temperatures compared to a similar sized stream nearby with riparian fencing (Partridge Creek; Kreiner and Terrazas 2018). This prompted FWP, Weyerhauser, and the Lower Clark Fork Watershed Group to initiate a riparian fencing project which was completed in 2018. Electrofishing and temperature data will continue to be collected in Loneman Creek to monitor the effect of the riparian fencing along the stream.

Temperatures in Loneman Creek at 0.1 rkm exceeded 15°C for 31 days in 2021 at the lower road culvert (Figure 27). In 2020, Loneman creek exceeded 15°C only 9 days in 2020. The mean July and August temperatures were 13.5°C and 12.4°C compared to 11.7°C and 11.9°C in 2020, and 11.5°C and 11.8°C in 2019. The summer of 2021 was very hot, with June and July daily air temperatures exceeding 37°C on some occasions, which may explain the elevated temperature regime observed in this and other area streams.

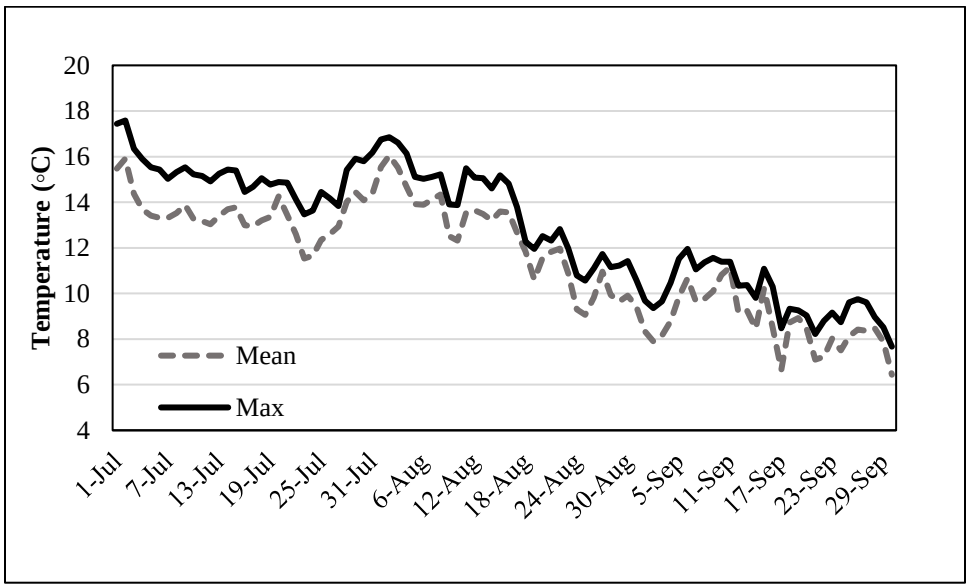


Figure 27. Daily mean and maximum temperatures in Loneman Creek at rkm 0.1 in 2021.

Murr Creek

Murr Creek is a tributary to the Thompson River at 65.8 rkm. Land ownership in the drainage is a checkered-board mix of GD and LNF, with a few sections in the headwaters recently purchased by Flathead Ridge Ranch and a private parcel near its mouth. The lower reaches of Murr Creek, from rkm 0.0 to 0.2 and 0.6 to 2.4, are protected under the TFCE. All remaining GD land in the drainage, including in the North Fork and South Fork would receive protection under the UTCP.

Surveys indicate Brook Trout may be the only species present in the mainstem above the barrier falls at rkm 2.3, as well as in the North Fork and lower South Fork. Brook Trout extend up the North Fork to at least rkm 9.7, and the South Fork to a barrier falls located at rkm 6.1. In 2021, 131 WCT were translocated above the barrier falls and were released between rkm 7.9 and 8.4 (Figure 28). Translocated fish were collected from Four Lakes Creek (sample # 5315, n=37), North Fork Little Thompson River (sample # 5312, n=35) and Chippy Creek (sample # 5314, n=59) (Kovach et al. 2021b). Approximately 5 km of secure habitat exist above the barrier where WCT were introduced.

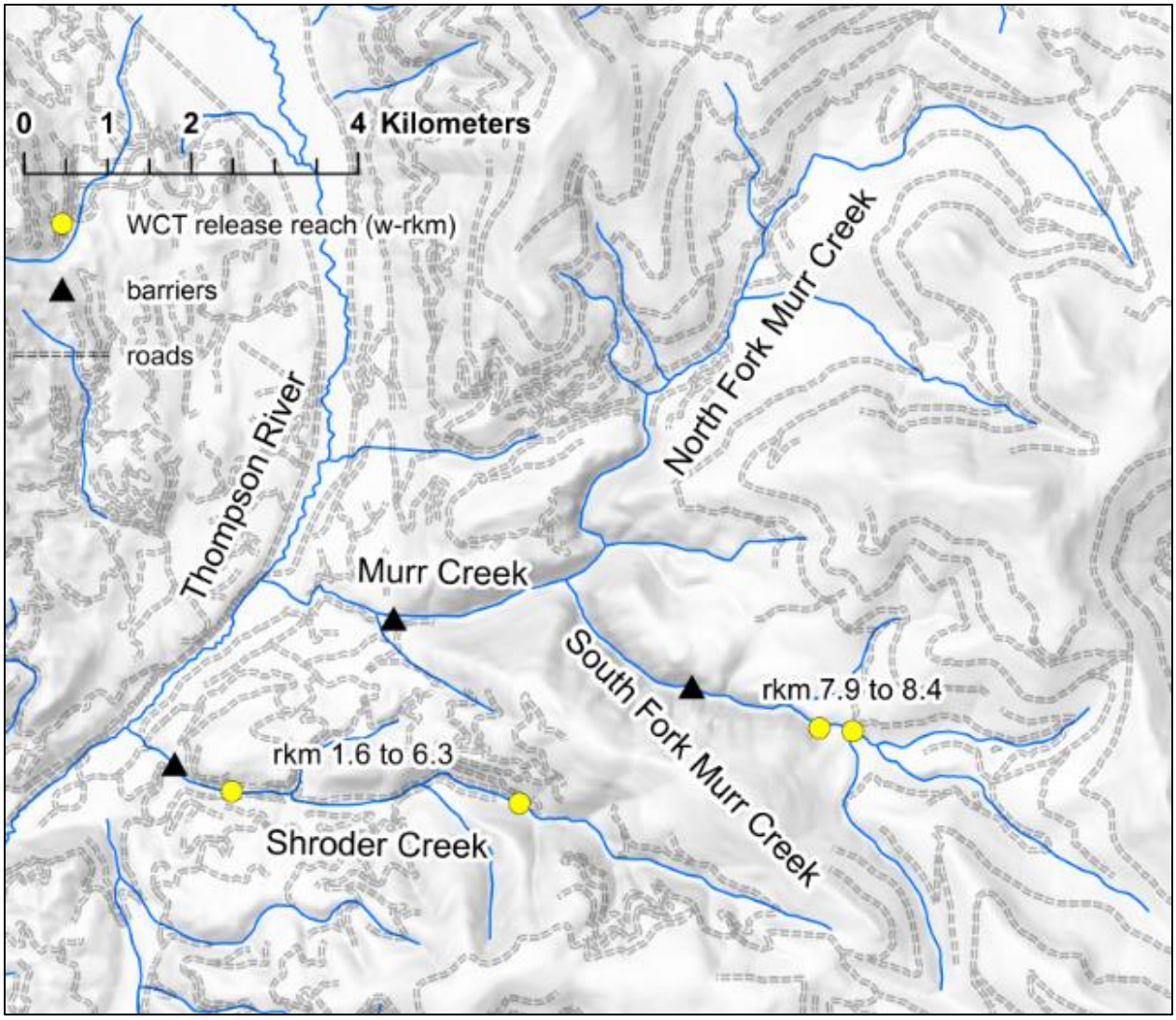


Figure 28. Westslope Cutthroat Trout release locations in 2021 in South Fork Murr Creek and Shroder Creek.

The Murr Creek drainage has the potential to be an even larger refuge for non-hybridized WCT in the Thompson River drainage. The North Fork, lower South Fork and mainstem down to the barrier falls could be treated with piscicide to remove Brook Trout. While this project would be complex, due to the rugged terrain and poor accessibility to some areas of the drainage, if completed would add an additional 14 km of secure habitat in the Murr Creek drainage.

The thermograph in Murr Creek was located just upstream of the National Forest boundary and above the apparent barrier at 2.3 rkm. Temperatures exceeded 15°C for 5 days in Murr Creek 2021 (Figure 29). Average monthly July and August temperatures were 12.7°C and 12.2°C, respectively.

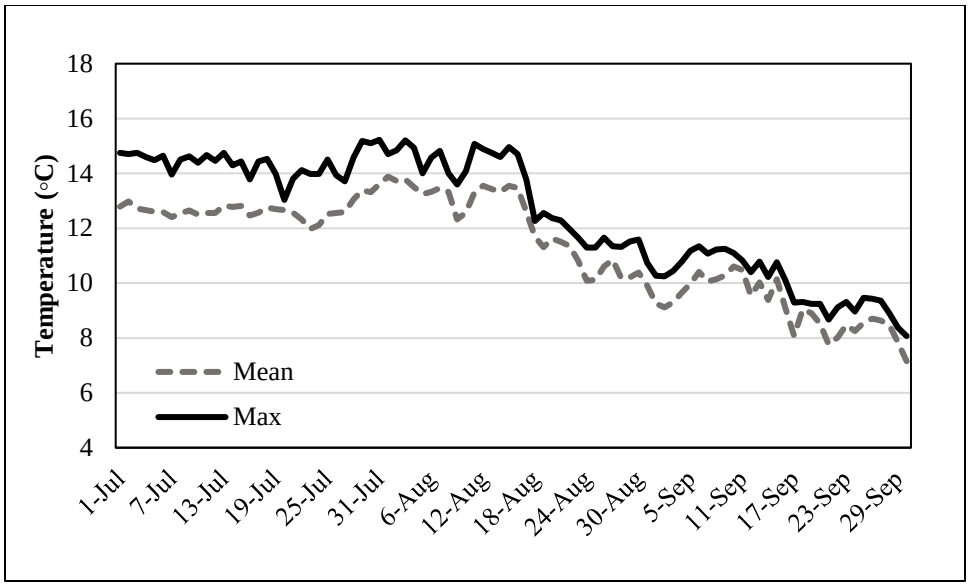


Figure 29. Daily mean and maximum temperatures in Murr Creek at rkm 2.7 in 2021.

North Fork Little Thompson River

The North Fork Little Thompson River is the largest tributary to the Little Thompson River and meets this stream about 11 rkm upstream of its confluence with the Thompson River. The lower 3.3 km of the North Fork Little Thompson River flow through a mixture of land owned by the state and GD, with all the GD land (rkm 0.0 to 0.8 and rkm 2.7 to 3.3) occurring within the 2003 TFCE. The rest of the drainage above rkm 3.3 is managed by the LNF. Previous sampling indicates this stream is comprised of non-native trout species in the lower reaches, WCT and Brook Trout in the middle reaches and only WCT in the upper reaches.

Westslope Cutthroat Trout genetics were sampled from two locations in North Fork Little Thompson River in 2017, at rkm 6.0 (lower, n=10) and at rkm 9.5 (upper, n=10). Genetic diversity appeared to be considerably less at the upper sample location, indicating little or no upstream gene flow (Kovach et al. 2020a). The stream runs through a rugged canyon with roads situated on hillslopes well above the stream, limiting previous fisheries surveys. Based on the rugged topography of the drainage it plausible that some instream feature exists that could greatly limit or entirely block upstream passage between the two sample sites which are about 3.5 rkms apart. This theory is reinforced by the observation of WCT and Brook Trout at the lower sample site, but only WCT at the upper site. In 2017 at rkm 2.4, a WCT x Rainbow Trout hybrid was identified in the field, however a tissue sample was not collected.

In July of 2021, fish were collected for fish pathogen testing associated with the WCT translocation project around rkm 0.70. No fish pathogens were documented in the stream from this sampling event. The fish community at this location was comprised nearly exclusively of non-native trout including Brook Trout, Brown Trout and a few *Oncorhynchus* hybrids. In September of 2021, 106 non-hybridized WCT were collected from the stream between rkm 8.8 and 9.0 (Figure 30). Trout were quite abundant in this reach and habitat conditions were

excellent, with only WCT observed. These individuals, following genetic testing, were released in Shroder Creek (n=71) and South Fork Murr Creek (n=35) (sample # 5312, Kovach et al. 2021b). Future efforts should seek to better understand the longitudinal dynamics between Brook Trout and WCT, within the streams reaches where they co-occur, however this will be difficult as access to the stream is very challenging above rkm 3.3. Updating the distribution of hybrids and non-hybridized WCT should also continue for this stream.

Temperatures in North Fork Little Thompson River at rkm 0.72 exceeded 15°C in 2021 for 47 consecutive days from July 1 through August 16 (Figure 31). Mean monthly July and August temperatures were 14.1°C and 13.3°C, respectively. A maximum temperature of 17.5°C was recorded on July 31.

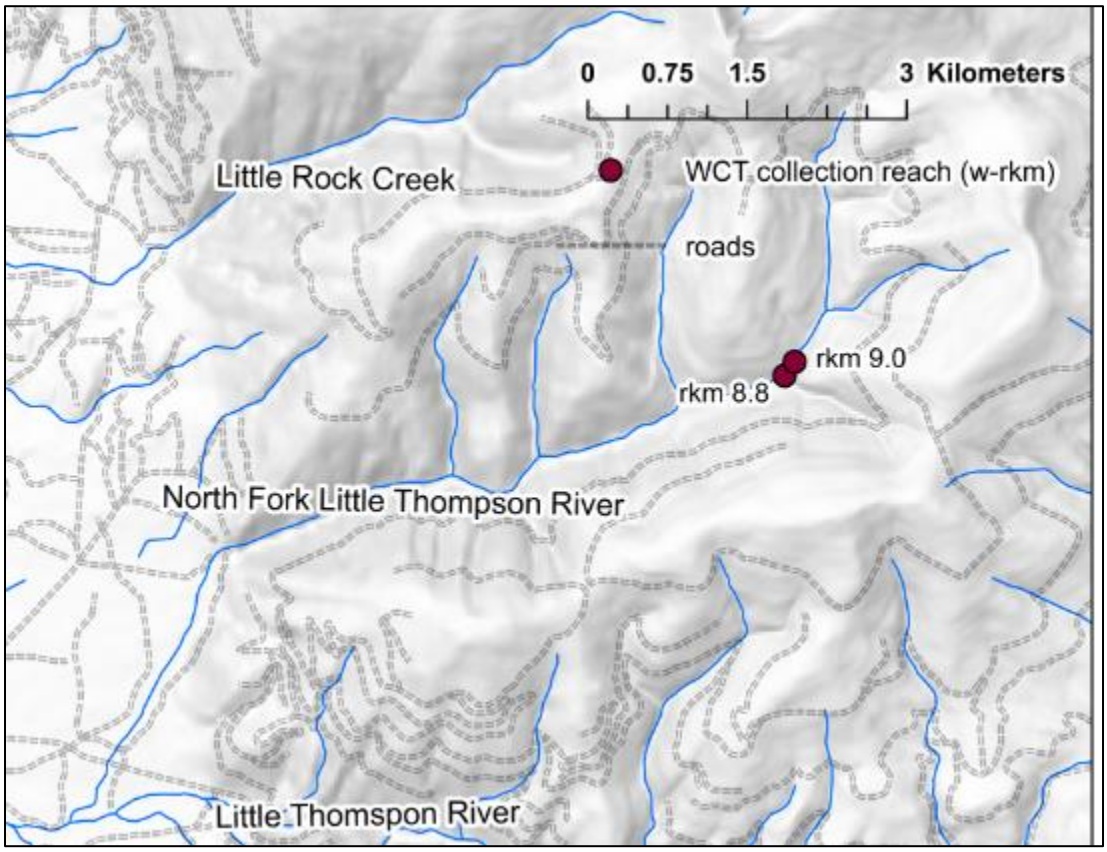


Figure 30. Westslope Cutthroat Trout collection location in North Fork Little Thompson River in 2021.

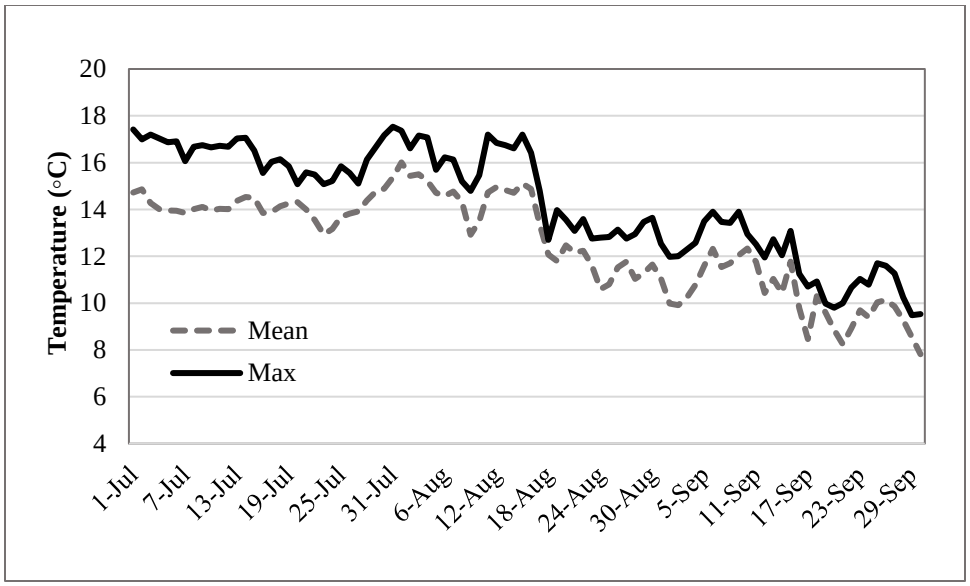


Figure 31. Daily Average and Maximum temperatures in North Fork Little Thompson at rkm 0.72.

Partridge Creek

Partridge Creek is a tributary to Mudd Creek at 2.4 rkm and is located in the Little Thompson River drainage. Ownership is a mixture of state and GD land, all of which is protected under the TFCE. Sampling in recent years has indicated that only WCT reside in Partridge Creek, or if there are any non-natives they are at very low abundance (Kreiner and Terrazas 2018; Kreiner and Terrazas 2020).

Temperatures in Partridge Creek did not exceed 15°C in 2021 at the lower road culvert (0.1 rkm) (Figure 32). Mean monthly July and August temperatures were 11.8°C and 11.2°C, respectively.

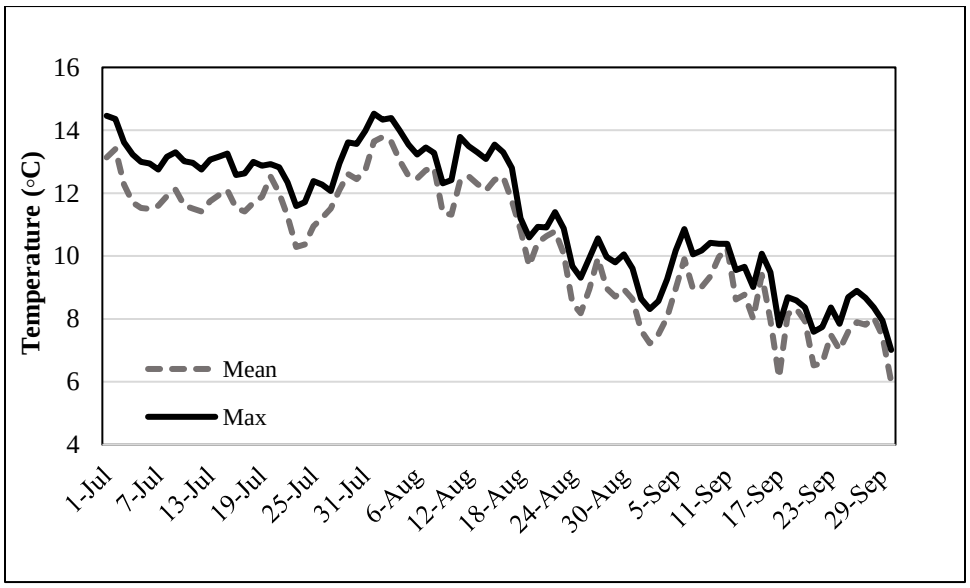


Figure 32. Daily mean and maximum temperatures in Partridge Creek at 0.1 rkm in 2021.

Shroder Creek

Shroder Creek is a tributary to the Thompson River at 63.2 rkm. Land ownership in the drainage is a checker-board mix of GD, LNF and state. The lower 2.3 km of the stream lies within the TFCE, while the remaining GD land in the drainage (section 15, rkm 4.0-5.8; section 23, rkm 6.3- 7.7) would be protected by the UTCP.

Electrofishing surveys (2008, 2019) conducted in the lower 0.5 rkms of Shroder Creek indicate the fish community is comprised entirely of non-native salmonids (i.e., Brown Trout and Brook Trout). Plum Creek Timber Company has some records of snorkel surveys suggesting there were salmonids present higher in the drainage (B. Sugden, personal communication) but this information was actually collected in neighboring Murr Creek. Multiple sampling events in 2019 and 2020 up to rkm 7.7 failed to find any fish, with reaches above rkm 7.7 dry or too small to hold fish. Surveys indicate a series of bedrock cascades at rkm 0.64 have restricted natural colonization by any fish species (Figure 33).

Figure 33. A portion of the bedrock barrier complex that left Shroder Creek naturally fishless above rkm 0.64. In 2021 Westlope Cutthroat Trout from three Thompson River drainage populations were translocated into the stream.

In 2021, a total of 216 WCT were translocated to Shroder Creek above the natural barrier. Release locations were spread out over 4.7 km of stream, from rkm 1.6 to 6.3 (Figure 28). Translocated fish were collected from Four Lakes Creek (sample #5313, n=76), North Fork Little Thompson River (sample #5312, n=71) and Chippy Creek (sample #5314, n=69) (Kovach et al. 2021b). At least 6.6 km of prime habitat exist above the barrier in Shroder Creek, with potentially another 1.5 km of small yet suitable habitat occurring above a large waterfall that may be an upstream passage barrier.

Stream temperature data in 2021 was collected just above the mouth. Temperature in Shroder Creek did not exceed 15℃ (Figure 34). Monthly mean temperatures for July and August were 12.0℃ and 11.3℃. In 2022, temperature data will be collected at one or two locations above the barrier.

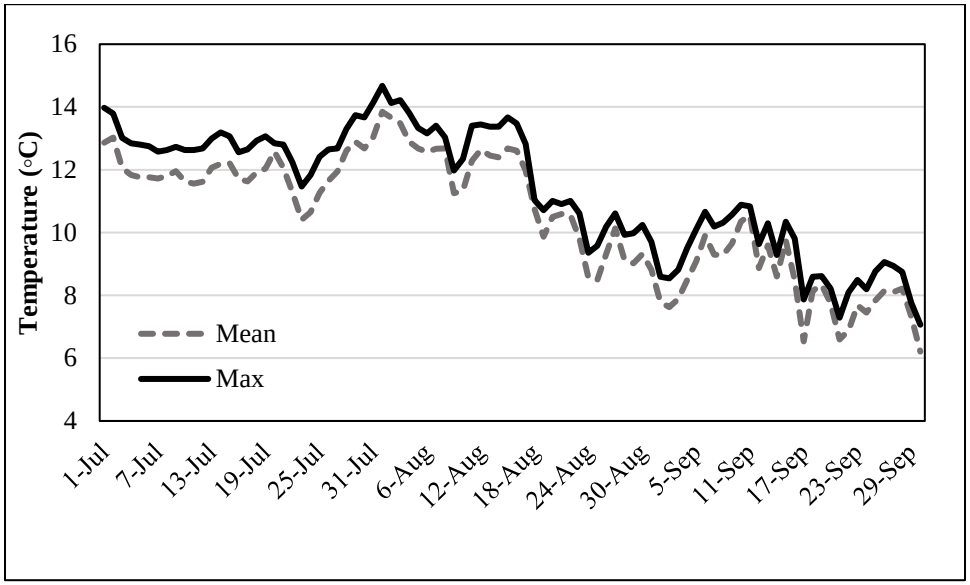


Figure 34. Daily mean and maximum temperatures just upstream of the mouth in Shroder Creek in 2021.

West Fork Fishtrap Creek

West Fork Fishtrap Creek is a tributary to Fishtrap Creek at 17.0 rkm. The entire drainage occurs on land managed by the LNF. West Fork Fishtrap Creek is a critically important spawning and rearing tributary for Bull Trout. Both migratory and resident life histories of Bull Trout occur in the drainage. Westslope Cutthroat are the most abundant fish species across the drainage.

Westslope Cutthroat Trout genetic samples were collected at rkm 0.8 (n=15) and rkm 4.3 (n=15) in 2016 (sample #5047, Kovach et. al. 2019a). With this sample size, there was a greater than99% chance of detecting 0.2% non-native admixture in a hybrid swarm. One individual with a relatively large proportion RB admixture (0.19) was noted, while the other 29 individuals tested were found to be non-hybridized WCT. High genetic variation was observed in this population compared to other pure WCT populations west of the Continental Divide. Genetic

differentiation (i.e.,FST) between West Fork Fishtrap Creek and the mainstem Fishtrap Creek was only 0.012 suggesting that gene flow is common (Kovach et al. 2019a). Twelve of the 50 trout tested from the mainstem of Fishtrap both above and below the West Fork were found to be hybrids (Kovach et al 2019a). Since no permanent barrier exists on the lower 9.5 kms of the West Fork Fishtrap Creek, the mechanism promoting the lack of hybridization in the stream relative to the mainstem Fishtrap upstream of the West Fork is currently unknown, but until we know otherwise it is best to assume it is transient (Kovach et al. 2019a). The threat of hybridization to fish in the West Fork Fishtrap Creek not only comes from open connectivity within much of the Fishtrap Creek drainage, but also from headwater lakes historically stocked with YCT. The downstream accessibly below the lakes to the West Fork Fishtrap (and Stony Lake Creek) is unknown but the outlet streams flow through steep, rocky terrain that could make downstream dispersal perilous. Additional genetic monitoring of WCT in West Fork Fishtrap Creek and Stony Lake Creek occurred in 2022, in the upper mainstem and Stony Lake Creek to investigate the distribution of hybrids and to assess if fish from the headwaters can be translocated to other suitable and protected habitat within the Thompson River drainage. A genetic swamping project was initiated in 2022 in Terrace Lake to reduce the amount of hybrid alleles in this headwater lake.

Two sites were sampled using multiple pass depletion methodology moving downstream into a block net, at rkms 0.2 and 5.1 (Figure 17; Table 5). At rkm 0.2, Bull Trout, WCT, putative *Oncorhynchus* hybrids and a lone Brown Trout were observed. This is the first detection of a Brown Trout in the West Fork and the uppermost detection to date in the Fishtrap Creek drainage. At rkm 0.2 there were an estimated 5.7 Bull Trout (95% CI 5.7-6.6), 30.5 WCT (95% CI 30.5-31.6), 0.95 Brown Trout (95% CI 0.95), and 5.7 *Onc*.(95% CI 39.6-51.2) over 75 mm per 100 m in 2021(Table 5; Figure 35). At rkm 5.1 only native species were encountered with an estimated 43.4 Bull Trout (95% CI 39.6-51.2) and 63.2 WCT (95% CI 61.3-67.4) over 75 mm per 100 m in 2021 (Table 5; Figure 36).

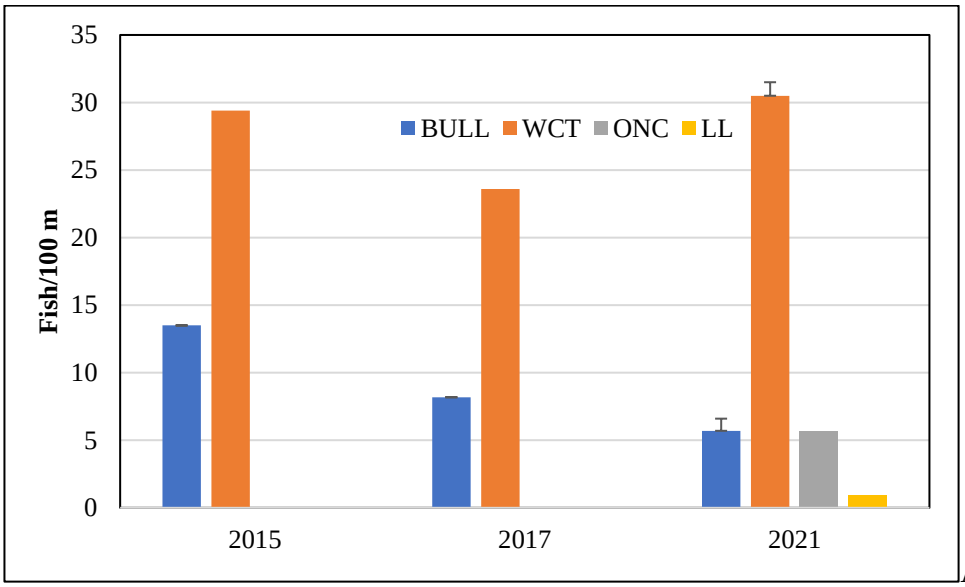
The site at rkm 0.2 was sampled twice prior to 2021 (Figure 35). The 2015 and 2017 sampling efforts consisted of a single electrofishing pass versus the two-pass sampling event that was conducted in 2021. While acknowledging the differences in sampling effort at this site, observed abundance (2015 and 2017) and the population estimate (2021) were similar for WCT, 23-30 fish/100 m. Suspected *Oncorhynchus* hybrids were observed at this site in 2021 but were not documented previously at the site. It is unclear if this finding is an artifact of differences in what sampling crews noted as hybrids or an observed increase in their upstream distribution. A slight decline in Bull Trout abundance at the site is evident as more fish were caught in 2015 and 2017 one pass compared to the catch from two passes in 2021 (Figure 35). The site at rkm 5.1 was sampled three times prior to 2021 (2011, 2015 and 2019), all with multiple electrofishing passes. The highest estimates of abundance for both native trout at this site were in 2021(Figure 36).

The observation of Brown Trout in West Fork Fishtrap Creek is extremely worrisome, given it is among the most important streams for native fish conservation in the lower Clark Fork River drainage. Monitoring will continue on a regular basis to document the presence and distribution

of both native and non-native species. In addition, Bull Trout redd counts are conducted annually over about 8 km of stream.

TABLE 5. Standardized linear abundance (#/100m), density (#/100m^2), and biomass (g/100m^2) estimates (fish ≥75mm) for Bull (BULL), Brown (LL), Oncorhynchus spp. (*Onc*.) and Westslope Cutthroat Trout (WCT) in West Fork Fishtrap Creek in 2021.

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.
-	105	BULL	130-170	5.7	5.7-6.6	0.95	0.95-1.8	25.4	25.4-26.3
(0.2)		WCT	78-222	30.5	30.5-31.6	5.1	5.1- 6.15	207	207-208.1
		LL	144	0.95	0.95-0.95	0.15	0.15-0.15	4.9	4.9-4.9
		Onc.	108-115	5.7	5.7-6.0	0.95	0.95-1.3	28.3	28.3-28.6
-	106	BULL	58-270	43.4	39.6-51.2	6.8	6.2-14.6	206.8	188.8-214.6
(5.1)		WCT	68-225	63.2	61.3-67.4	9.9	9.6-14.1	412.8	400.5-417.0



A

Figure 35. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL) and Westslope Cutthroat Trout (WCT) > 75 mm at rkm 0.2 in West Fork Fishtrap Creek. Suspected Oncorhynchus hybrids (ONC) were first noted in the data in 2021. Brown Trout (LL) were first encountered in the stream in 2021. The 2015 and 2017 data represent single pass effort compared to two passes in 2021.

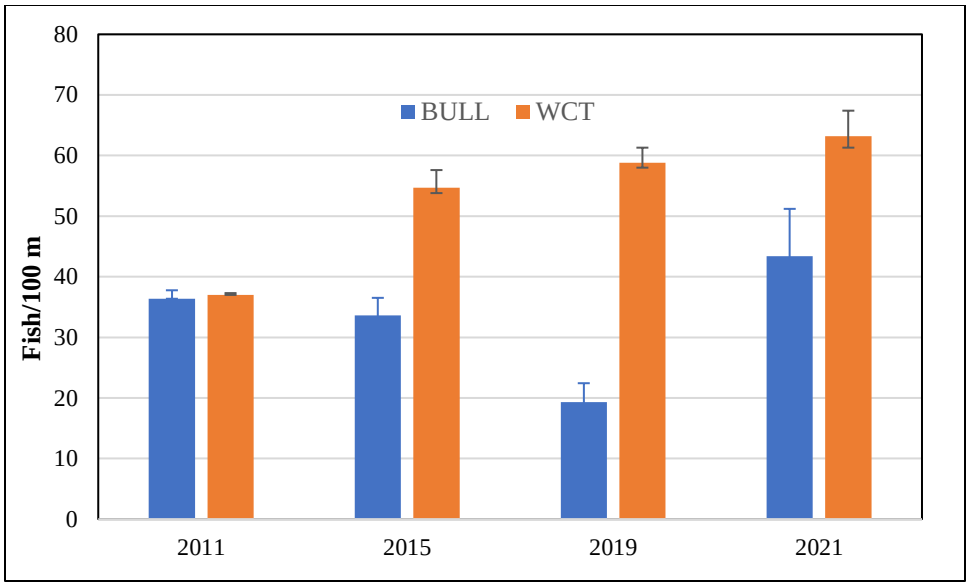


Figure 36. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Bull Trout (BULL) and Westslope Cutthroat Trout (WCT) > 75 mm at rkm 5.1 in West Fork Fishtrap Creek.

Two thermographs deployed in West Fork Fishtrap Creek, at rkm 0.4 and 8.9 (Figure 37; Figure 38). Monthly mean temperature at rkm 0.4 in July and August was 10.1℃ and 9.4℃, respectively. Monthly mean temperature at rkm 8.9 in July and August was 9.6℃ and 9.1℃, respectively. Temperatures did not exceed 15℃ in 2021.

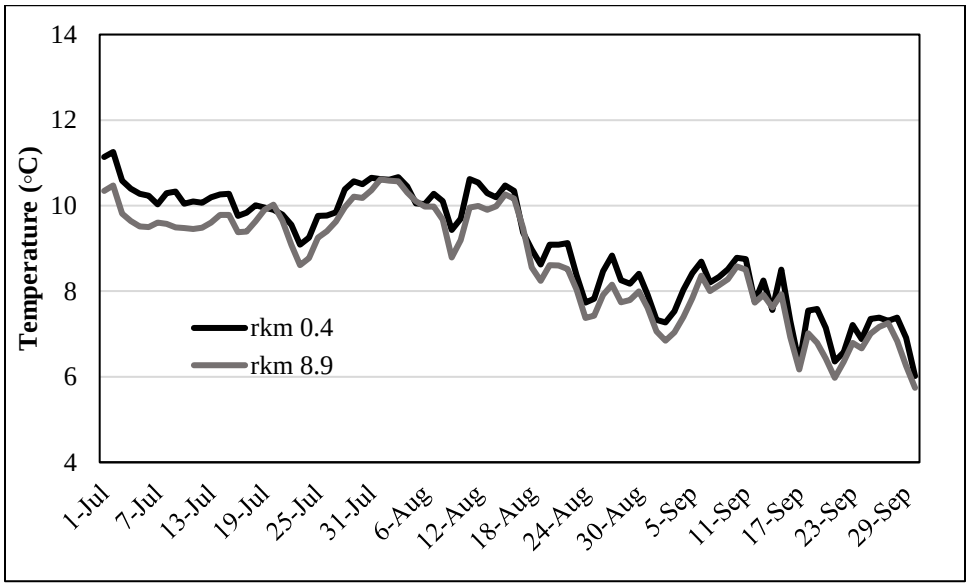


Figure 37. Daily mean temperatures in West Fork Fishtrap Creek at rkm 0.4 and 8.9 in 2021.

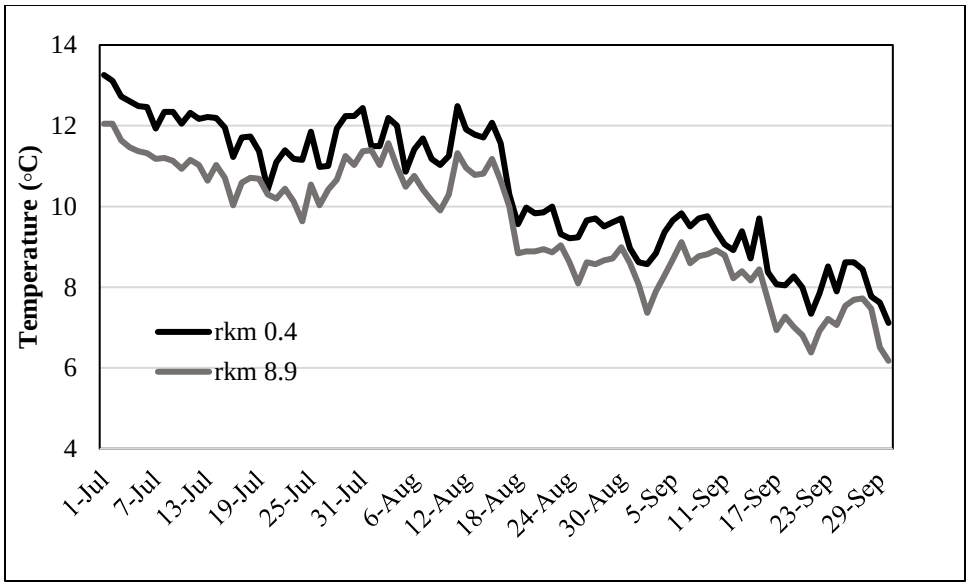


Figure 38. Daily maximum temperatures in West Fork Fishtrap Creek at rkm 0.4 and 8.9 in 2021.

West Fork Thompson River

West Fork Thompson River is a major tributary to the lower Thompson River entering at rkm 10.9. The entire drainage occurs on land managed by the LNF. This steep drainage provides significant flow and cool water inputs that rarely exceed 12°C, making the lower 10.9 km of the Thompson River the coolest portion of the river in summer.

The West Fork Thompson River is an important Bull Trout spawning and rearing stream, and like Fishtrap Creek, contains both resident and migratory life histories. The stream has been regularly sampled for the past twenty years and has been described extensively in other reports. Sampling has included mainstem electrofishing, Bull Trout redd counts, a 2014-15 graduate study (Glaid 2017), outmigration study (Kreiner and Terrazas 2018), and WCT translocation ((this report). In 2021, sampling in the mainstem was limited to pathogen sampling for WCT translocation. Brown Trout and Oncorhynchus hybrids were collected from the lower 2 km of the stream. While the stream is difficult to sample (deep, narrow and swift), fairly high densities of non-native fish were observed in the lower reaches, which is concerning given upstream reaches are a stronghold for native trout.

Westslope Cutthroat Trout were most recently tested for hybridization in West Fork Thompson River in 2018 at two locations within the drainage: just upstream of the Anne Creek confluence at rkm 8.8 (sample # 5041, n=20) and in Four Lakes Creek at rkm 1.0 (sample #5042, n=20). All fish at both locations were found to be non-hybridized (Kovach et al. 2019a). Hybrid trout have been observed both upstream and downstream of these locations. Downstream of the confluence of Four Lakes Creek and mainstem West Fork Thompson River there are bedrock chutes that may form an upstream passage barrier. No non-native salmonids have been observed above this chute; however, Bull Trout have been documented above it in both Four Lakes Creek and West

Fork-Anne Creek. In recent years, a huge cedar was dropped at this location under unknown circumstances, making the area more of an obstacle for fish passage due to aggradation of streambed material, and we were unsure if even Bull Trout could pass and thus only smaller, presumably resident sized Bull Trout redds were observed above it for several years. The stream has evolved since 2020 and the tree is causing less of an obstacle to passage, and larger redds were observed in both 2020 and 2021 upstream of this site. Given the relatively short distance from the 2018 collection site to the mainstem Thompson River and the confirmed presence of WCT x Rainbow Trout hybrids in lower portions of the West Fork in 1993 at rkm 0.5 and rkm 5.6 (sample # 856 & 862); one or more substantial barriers to upstream movement for non-native salmonids including Rainbow Trout and Oncorhynchus hybrids must exist downstream of the West Fork-Anne and Four Lakes confluence, around RM 4.7. Cabin Lake, in the headwaters of Four Lakes Creek was recently found to be comprised of WCT x YCT hybrids (Kovach et al. 2019b). The outlet stream below the lake flows through extremely steep and cliffy terrain, which may explain why no YCT genes were observed in the 2018 sample collected in lower Four Lakes Creek.

In September 2021, 112 non-hybridized WCT were collected in Four Lakes Creek from rkm 1.0-1.2 and 2.4 to 2.6 (Figure 39) (sample # 5313, Kovach et al. 2021b). Thirty-seven fish were released in the upper South Fork of Murr Creek and 75 fish were released in Shroder Creek. Three WCT were captured that were initially tagged in August 2020 (Table 6).

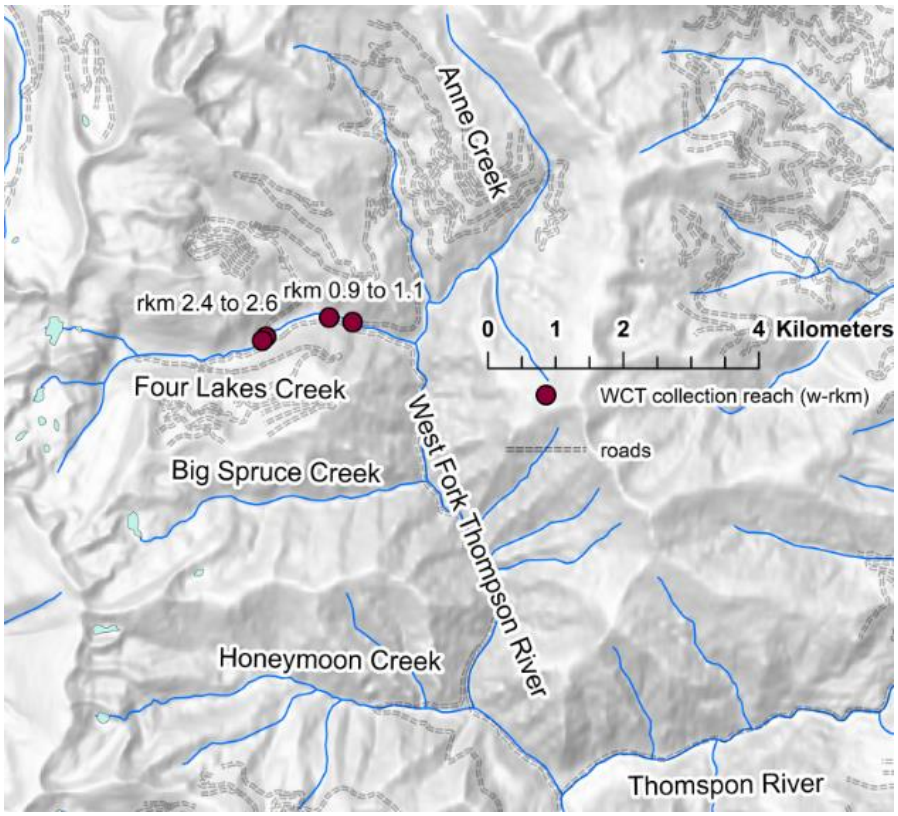


Figure 39. Westslope Cutthroat Trout collection reaches on Four Lakes Creek for translocation in 2021.

Table 6. Initial (August 2020) and recapture (September 2021) length for three Westlope Cutthroat Trout (WCT) collected in Four Lakes Creek.

2020	2021	growth (mm)
142	177	35
136	161	25
196	200	4

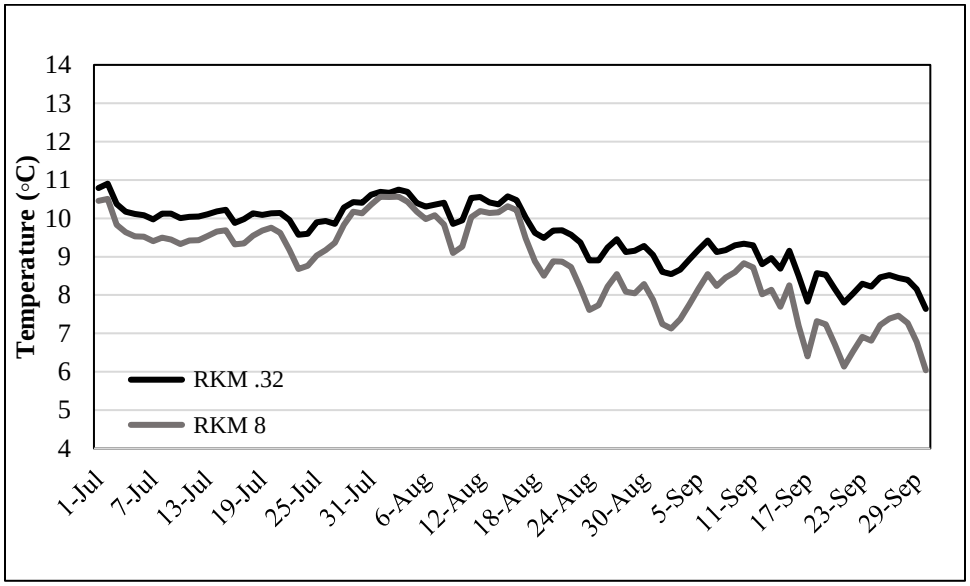


Figure 40. Mean daily temperatures from West Fork Thompson River at rkms 0.3 and 8.0.

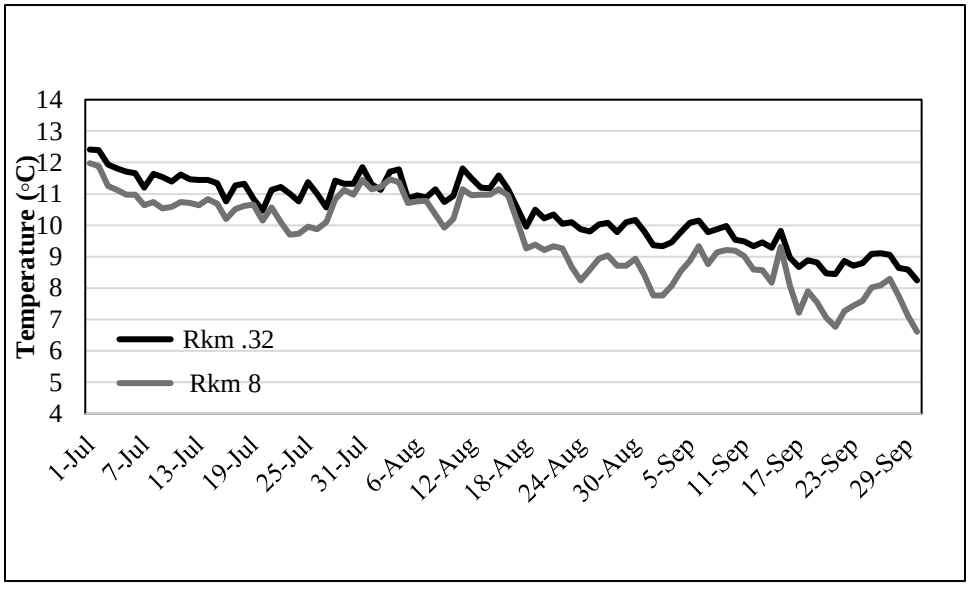


Figure 41. Daily maximum temperatures in the West Fork Thompson River at 0.3 and 8.0 rkm.

Two thermographs were deployed in West Fork Thompson River, at rkm 0.3 and 8.0 (Figure 40; Figure 41). Monthly mean temperature at rkm 0.3 in July and August was 10.1℃ and 9.9℃, respectively. Monthly mean temperature at rkm 8.0 in July and August was 9.6℃ and 9.3℃, respectively. Temperatures did not exceed 15℃ in 2021.

Bull Trout Redd Counts

Redd counts are performed annually in Bull Trout streams in the Thompson River drainage and through the lower Clark Fork River drainage. These surveys are cooperative efforts between FWP and Avista, with occasional assistance from U.S Forest Service (Kootenai NF staff). Two of the Thompson River tributary stream surveys (Jungle Creek and Beatrice Creek) were initiated and conducted by staff or contractors of Plum Creek Timber Company. These spawning site surveys help identify population trends, barriers, critical habitat, and potential threats. Redd count information from the across the lower Clark Fork River is reported each year by Avista in collaboration with FWP (Moran 2021; this report).

Sections of stream were walked at long-term monitoring reaches known as index reaches as well as at stream reaches of interest known as exploratory reaches, which are not covered during the index counts. Definitive redds are recorded if the gravel had been worked and if an obvious pit and mound are visible. Brook Trout do not occur in most reaches where redds counts are conducted in the Thompson River drainage, except in lower mainstem Fishtrap Creek, mainly downstream of Basin Draw. Bull Trout redds in this portion of the drainage are often larger, found earlier and in different locations compared to Brook Trout redds. However, some overlap between the two char species in space and time for spawning and the size of redds, in lower Fishtrap Creek and elsewhere in the lower Clark Fork is certainly possible.

Within the Thompson River Drainage, redd surveys were conducted in 2021 the last week of September and the first week of October by FWP staff (Table 7; Table 8). Redds have been observed as early as the first week of September within the Fishtrap Creek index section (i.e., 2015). These large redds were barely noticeable during the official redd count at the end of September and would have been missed by an observer that did not previously know of their existence. Future efforts should seek to count some reaches multiple times in September and October to identify the best time each reach or stream should be surveyed. Collecting this information over multiple years may help understand potential differences in spawning timing in mainstem Fishtrap versus tributaries streams and difference in spawn timing between migratory and resident fish.

Beaver activity was found in Fishtrap Creek and West Fork Fishtrap Creek, and these dams were likely partial barriers to fish passage in 2021, depending on when fish may have tried to move above them. More Bull Trout redds have been observed in lower Fishtrap Creek in recent years compared to the index reaches. This change in distribution is mainly attributed to blocked passage from fall beaver dam construction and maintenance, which seems to pick-up drastically in late August or early September. Redd counts in upstream tributaries such as West Fork Fishtrap and Beatrice Creeks have also dropped off from historic counts (Figure 42). Natural debris jams in Jungle Creek, Beatrice Creek and West Fork Fishtrap Creek almost certainly limit

upstream connectivity at base flows conditions each year, with the location and longevity of these barriers depending on the year, the intensity of the previously run-off regime as well as the size and amount of debris. A debris jam in lower Beatrice Creek was likely a barrier to passage at lower flows in 2020 and 2021, with no redds found in the stream either year.

In 2021 the total number of redd counted within index and non-index reaches in the Thompson River drained was 17 (Table 9) which is less than the 2001 to 2020 mean total count of 26 (index count in 2021 n=15, 2001-2020 mean n=23). Within the Fishtrap Creek drainage, eleven redds were found. Nine of these redds were found within the index reaches while two were found in the exploratory reaches. In the West Fork Thompson River, six redds were found in the index reach. No exploratory reaches were surveyed within the West Fork Thompson River in 2021.

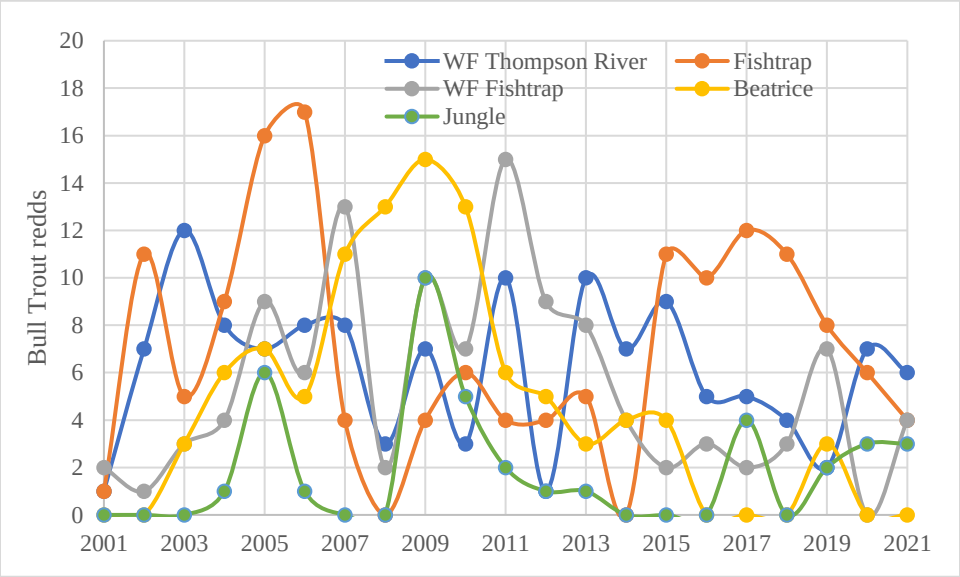


Figure 42. Annual Bull Trout redd counts from index reaches within the Thompson River drainage, from 2001 and 2021. Jungle Creek and Beatrice Creek redd counts did not begin until 2003 and were not conducted in 2018.

Table 7. Index Bull Trout redd count reaches sampled in the Thompson River Drainage.

Stream	Reach Description	Survey Date
WF Thompson R.	Spruce Creek to Anne Creek	10/8/2021
Fishtrap Cr.	Beatrice to 400m upstream of WF Fishtrap	9/28/2021
WF Fishtrap Cr.	Mouth to Road Mile 4	10/6/2021
Beatrice Cr	Mouth to Road crossing in section 2	10/1/2021
Jungle Cr.	Mouth to West Section line of T23N, R28W, S13	10/7/2021

Table 8. Exploratory (non-index) Bull Trout redd count reaches sampled in the Thompson River Drainage.

Stream	Reach Description	Survey Date
WF Thompson R.	Honeymoon Creek to Spruce Creek	Not Surveyed
Fishtrap Cr.	State property to mouth of Beatrice Creek	10/1/2021
Fishtrap Cr.	Just below Jungle to state property north sec 16	10/1/2021
WF Fishtrap Cr.	Upstream of index	10/6/2021

Table 9. Thompson River Bull Trout redd count data by individual stream for index reaches between from 2001 through 2021 including drainage total for index and combined counts (index and non-index reaches combined). NS= Not surveyed.

Stream	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
WF Thompson R.	1	4	5	8	7	8	6	3	7	3	10	1	6	7	6	3	3	4	2	7	6
Fishtrap Cr.	1	11	5	9	16	17	4	0	4	4	4	4	5	0	7	4	9	10	4	3	2
WF Fishtrap Cr.	2	1	3	4	9	6	13	2	10	7	15	9	8	4	2	3	2	3	7	0	4
Beatrice Cr.	NS	NS	3	6	7	5	11	13	15	13	6	5	3	4	4	0	0	NS	3	0	0
Jungle Cr.	NS	NS	0	1	6	1	0	0	10	5	2	1	1	0	0	0	4	NS	2	3	3
Thompson Index Total	**4**	**16**	**16**	**28**	**45**	**37**	**34**	**18**	**46**	**32**	**37**	**20**	**23**	**15**	**19**	**10**	**18**	**17**	**18**	**13**	**15**
Thompson Combined Total	**4**	**19**	**23**	**28**	**45**	**37**	**36**	**18**	**46**	**34**	**37**	**20**	**27**	**15**	**26**	**18**	**23**	**18**	**22**	**16**	**17**

Bull Trout Downstream Transport

Bull Trout are native to the Clark Fork River drainage of western Montana and are listed as a Threatened under the Endangered Species Act. Historically, migratory life history forms of Bull Trout were found throughout the Clark Fork River-Lake Pend Oreille system of western Montana and north Idaho. It was believed that many fish (adfluvial) in the basin used Lake Pend Oreille (LPO) as foraging, migration, and overwintering (FMO) habitat, while others used the mainstem Clark Fork as FMO habitat. Both fluvial and adfluvial life history forms used the Clark Fork River and many of its larger tributaries as migratory corridors to access the smaller headwater streams where they typically spawned (generally 2nd to 4th order stream). With the construction of three mainstem dams on the lower Clark Fork River (Thompson Falls -1915, Cabinet Gorge-1952, Noxon Rapids-1958), the river-lake ecosystem was fragmented for migratory Bull Trout as well as for other native fish species. Numerous Bull Trout populations across the Clark Fork Basin have been extirpated based on historical accounts of the species presence (Pratt and Huston 1993), while others have been reduced to stream residents or are being supported by fluvial fish.

For the past 20 years, Avista has annually collected adult Bull Trout below Cabinet Gorge Dam to augment the number of adult migratory Bull Trout in Montana Tributaries. Over this time, they have also conducted downstream transports of juvenile Bull trout from select lower Clark Fork River tributaries in Montana to the lower Clark Fork River in Idaho below Cabinet Gorge Dam (Bernall and Duffy 2019). At Graves Creek, the downstream transport program has resulted in an increase in upstream transported adults, and dramatic increases of Bull Trout in that stream.

Downstream transport of juvenile Bull Trout could be beneficial to increasing the number of migratory adults in the Thompson River drainage. All Bull Trout life history forms (resident, fluvial, adfluvial) still exist within the Thompson, although downstream transport efforts were focused on targeting migratory fish, hence capture efforts were only conducted in the lower reaches of Fishtrap Creek (rkm 0 -3.8).

From mid-October through mid-November of 2021, Fishtrap Creek was electrofished eight days, specifically to collect juvenile Bull Trout for downstream transport to the lower Clark Fork River in Idaho below Cabinet Gorge Dam (Table 10). Two pass depletion estimates with two electroshockers and a block net were attempted, but were not successful as, as fall vegetation in the streams caused multiple block net failures. Single pass, spot electroshocking occurred between rkm 4.3 and the mouth, and avoided complex habitats that could harbor adult fish, and any documented or suspected redds. A total of 42 Bull Trout from 120 to 225 mm were captured and transported downstream (Appendix C). Efforts were be made in 2022 to collect fish from Fishtrap Creek and the West Fork Thompson River via electrofishing and weir traps in October and November.

Table 10. Fishtrap Creek collection locations (rkm), downstream sampling coordinates and the number of juvenile Bull Trout captured and transported downstream to the lower Clark Fork River in Idaho below Cabinet Gorge Dam.

Rkms Sampled	Fish Transported
2.6-2.9	6
2.3-2.6	2
2.9-3.1	3
3.1-3.4	4
0.0-0.3	9
3.4-4.2	7
2.3-2.5	0
1.8-2.1	1
0.0-0.3	4
2.6-3.9	3
3.4-4.3	4

Thompson Falls Fish Ladder Salmonid Exploitation Study

In fall 2017, FWP and NWE started secondary tagging (additional to PIT) all salmonids passed over the fishway at Thompson Falls Dam with a T-bar tag (Floy, Seattle WA). Each tag had a unique identifier and a phone number for anglers to call and report catches and harvest. From these angler reports total catch (i.e., fish captured by anglers) and exploitation (i.e., fish harvested by anglers) can be estimated after accounting for tag loss and angler reporting bias. Tag loss was estimated over this portion of the study period (September 2017–October 2021) by

recaptured fish at the ladder. Fish with a PIT tag that were recaptured, which had also been tagged with a T-bar which had since gone missing were considered to have lost their tag loss. Angler reporting bias was assumed to be similar to Idaho anglers (Meyer et al. 2012) and was also factored into exploitation estimates. Broad scale movement in the Clark Fork basin was also documented through angler return information.

During the study period 921 fish were deployed with T-bar tags, and 1032 fish were observed in total. A total of 103 individual fish were recaptured during this time, with 110 total recapture events. We tagged 26, 188, 259, 266, and 183 fish respectively from 2017 to 2021 at the Thompson Falls Fish Ladder. Of the recaptured fish that returned to the fish ladder there were 10 recaptures within the same year, 81 recaptures within one year, and 19 recaptures within two years. Some of these recaptures are the same unique individual that returned multiple times. In the event of a lost tag, these individuals are given a new tag, and the number of years for recapture is based off the new tag. Of the 110 recaptures 41 lost their original T-bar tag, producing a tag loss estimate of 0.37. Of the tag loss fish, three were recaptured within the same year, 29 were recaptured after one year, and 10 were recaptured after two years. Tag loss for fish returning within the same year is 0.30, one year is 0.36, and over two years is 0.53. For simplicity sake, we are assuming a 0.40 overall loss rate, the mean of all three recapture types, and accounting for tag loss across time. Using 0.40 as the overall loss rate accounts for tag loss across time, while the tag loss rate of 0.37, which is how many fish of the recaptures lost their original T-bar tag does not. Therefore, for angler exploitation estimates, 0.40 was used.

From October 2017 through 2021, 57 tagged fish were reported being caught: 20 were harvested, 36 were released and one had an unknown fate (Table 11). The rate at which anglers report catching tagged fish (i.e., angler reporting bias) can vary significantly by species, waterbody, and reporting incentive (Meyer 2012). If Montana anglers are similar to Idaho anglers, then we likely only received reports of approximately 50% of the tagged fish which were caught due to angler reporting bias (Meyer et al. 2012; Meyer and Schill 2014). Correcting for tag loss and reporting bias generated an estimate of approximately 56 fish in total being harvested for an exploitation (μ) estimate of 6%, and a total angler catch of 159 fish which corresponds to 17.3% of the fish tagged in the study (Table 12). All fish with a T-bar tag had a PIT tag.

The estimates of total fish caught, and level of angler exploitation vary considerably depending on percentage of angler tag returns. In a study in Idaho, multiple species were tagged, and non-reward tag reporting averaged across species was 54.5% (Meyer and Schill 2014; Meyer et al. 2012). A study on stocked Rainbow Trout in lentic waters found first year angler return rates averaged at 23% but ranged from 0% to 76% depending on fish length, water size, and elevation (Cassinelli and Meyer 2018). Angler exploitation in one study was found to be lowest in trout species at 9.5%, and much higher with other game species (Meyer and Schill 2014). This exploitation rate is similar to estimates for this study when a 50% angler tag returned is assumed (Table 12). All these studies utilized reward tags and non-reward tags to find an angler tag return

rate, while Thompson Falls Fish Ladder does not utilize reward tags. If the Thompson Falls fish ladder wanted to find a more accurate tag return rate, it could utilize reward tags.

Table 11**.** Initial Tagging and angler recapture data for T-bar tagged fish passing the Thompson Falls Upstream Passage Facility for 2017–2021 including date recaptured, species, general location, harvest or release, and river kilometers (rkm) traveled from initial tagging location. Species abbreviations are as follows: Rainbow Trout =RB, Brown Trout =LL and Westslope Cutthroat Trout (WCT).

Date	Species	Location	Harvest	Tagging	Distance (rkm)
10/12/2017	RB	Sloan Bridge	Y	9/20/2017	132.6
6/1/2018	WCT	St. Regis River (2 rmi)	N	4/23/2018	104
10/1/2018	LL	Mouth Petty Creek	N		180
4/20/2019	LL	Vermillion Bay	Y	8/10/2018	36.7
4/16/2019	RB	Mouth Rattlesnake Creek	N	4/3/2019	241
5/22/2019	RB	Mouth Prospect Creek	Y	4/22/2018	0.6
7/27/2019	WCT	Clark Fork @ Siegel Creek	N	4/8/2019	67
8/1/2019	RB	Clark Fork @ Siegel Creek	N	7/3/2019	67
8/5/2019	RB	Mouth Prospect Creek	Y	5/10/2019	0.6
8/7/2019	RB	Mouth Thompson River	N		9.8
8/7/2019	RB	Mouth Thompson River	Y	4/22/2019	9.8
8/8/2019	RB	Mouth Thompson River	Y		9.8
8/10/2019	LL	Little Thompson River	Y	4/16/2019	37.8
9/2/2019	LL	Thompson River	Y	7/8/2019	21
9/13/2019	RB	Mouth Prospect Creek	Y	10/27/2018	0.6
10/10/2019	RB	St. Regis @ RR trestle	N	2019	101.5
4/15/2020	RB	Thompson River (7 mile)	N	9/10/2019	21
4/6/2020	LL	Vermillion Bay	Y	9/24/2019	36.7
4/27/2020	RB	Johnson Creek (Blackfoot)	N	3/25/2020	255
4/22/2020	WCT	Dixon	N	4/13/2020	62.7
5/9/2020	RB	Thompson River (6 mile)	N	3/24/2020	19
5/16/2020	RB	Thompson River (10 mile)	N		25.4
6/6/2020	RB	Thompson River (5 mile)	N	4/13/2020	17.4
6/7/2020	RB	White Pine Creek	Y	3/26/2020	45
6/19/2020	LL	Thompson River (200 bridge)	Y	7/3/2019	10.3
6/19/2020	LL	NE Blue Slide Rd	Y	9/27/2019	9.6
6/22/2020	RB	Below TF Dam	Y	6/27/2019	1
6/27/2020	RB	Eddy Islands	N	4/30/2020	12
6/27/2020	LL	Vermilion Point	N		35
7/11/2020	RB	Clark Fork @ Eddy Flats	N	4/13/2020	16
7/18/2020	RB	Below TF Dam	Y	4/27/2020	1
8/1/2020	RB	Mouth Thompson River	N	7/17/2020	9.8
8/7/2020	RB	Mouth Thompson River	Y	7/13/2020	9.8

10/3/2020	WCT	Thompson River 2 rkm	N	9/21/2020	11.8
11/18/2020	LL	Flathead River abv Dixon	N	4/10/2020	66
11/21/2020	LL	Post Creek near Dublin Rd.	N	9/21/2020	92.5
1/13/2021	RB	Mouth Thompson River		4/22/2019	9.8
2/2/2021	RB	Thompson River 14.2 rkm	N	7/20/2020	24
3/3/2021	LL	Clark Fork @ First Creek	N	9/30/2019	137
3/6/2021	RB	Thompson River 13.5 rkm	N	9/28/2020	23.3
3/17/2021	RB	Thompson River 26.4 rkm	N	9/26/2019	36.2
3/21/2021	RB	Thompson River 13.5 rkm	N	3/30/2020	24.3
4/1/2021	RB	Steamboat Island	N	5/13/2019	2.3
4/12/2021	LL	Thompson river 4.7 rkm	N	9/21/2020	
5/3/2021	RB	Thompson River	N	3/22/2021	36
5/7/2021	LL	Noxon Reservoir	N	10/1/2018	37
5/22/2021	LL	Vermillion Bay	Y	9/26/2019	34.7
5/22/2021	RB	Finnley Flats	N	5/3/2021	17.5
6/27/2021	RB	Black Foot River	N		304.8
7/10/2021	RB	Vermillion Bay	Y	3/22/2021	34.7
7/16/2021	RB	5 Miles above Donlan Flatts	N	4/13/2020	89.2
7/28/2021	RB	5 miles above Donlan Flatts	N	3/23/2020	89.2
8/1/2021	RB	Mouth of Prospect Creek	Y	4/12/2021	0.9
8/13/2021	RB	West of Thompson River	Y	7/20/2020	9.9
9/12/2021	WCT	Thompson River RKM 2.6	N	4/30/2020	11.4
9/22/2021	RB	Thompson River RKM 15.5	N	9/17/2018	25.7
10/9/2021	LL	Mouth of WFTR	N	9/7/2021	20.8

Table 12. Estimates of the total number of ladder fish caught and harvested while accounting for tag loss and angler reporting bias. Using a tag loss rate of 0.40, the number of fish tagged at the fisher ladder (n=921), the number of fish caught by anglers (n=57), and the number of fish harvested fish (n=20), this table estimates how total fish caught, and percent angler exploitation (harvested) is subject to change based on the percentage of anglers that report catching a tagged fish.

Angler Tag Returns	**10%**	**25%**	**50%**
Total Fish Caught	792	317	159
% of Tagged Fish Caught	86%	34%	17%
Total Fish Harvested	278	111	56
% Angler exploitation	30%	12%	6%

The locations of capture by anglers for trout passed above Thompson Falls Dam were widespread across the lower and middle Clark Fork River drainage as well as in the lower Flathead River drainage (Table 12). Fish were caught upstream near Missoula by the mouth of

Rattlesnake Creek (241 river kilometers upstream) and near Johnson Creek in the Blackfoot River (255 river kilometers upstream). Each of these Rainbow Trout ascended the Clark Fork River quickly, 16 days and 33 days, respectively after being passed upstream of the fish ladder. That equates to these fish on average moving upstream about nine and five miles per day. To date, a Rainbow Trout traveled the furthest upstream of the ladder; it was captured in the Blackfoot River above the Clearwater River confluence in June of 2021 and estimated to have moved 189 miles upstream. Fish caught in the lower Flathead River drainage include in Post Creek (93 river kilometers upstream) and near Sloan Bridge (133 river kilometers upstream) by Ronan. Several fish were captured between Missoula and Paradise in the Clark Fork River, and two were caught between Paradise and St. Regis. A WCT was caught in the St. Regis River (102 miles upstream).

As expected, quite a few fish were caught in the vicinity of Thompson Falls, including at the mouth of the Thompson River (10 river kilometers upstream) and Prospect Creek (0.5 river kilometers downstream), as well as in Thompson River with the most upstream fish captured in the Little Thompson River (39 river kilometers upstream). The fish caught furthest downstream was from Marten Creek Bay (50 river kilometers downstream). Vermilion Bay (37 river kilometers downstream) in Noxon Rapids Reservoir was also a popular destination for tagged fish, the location of 6 recaptures.

Acknowledgements

A special thanks to the additional personnel that help carry out samples activities described in this report including Addison Muller (FWP), Travis Rehm (FWP), Jon Hanson (Northwestern Energy), Kevin Aceituno (USFWS), Josh Schulze (LNF), Tyler Osborne (FWP), Jayden Duckworth (FWP) and other FWP AIS staff. A thoughtful review of this document was provided by Mike Hensler (FWP).

Works cited

Bernall, S. and K. Duffy. 2019. Upstream Fish Passage Program-Bull Trout, Fish Passage/Native Salmonid Restoration Program, Appendix C. Annual Project Update- 2018. Report to Avista Corporation, Noxon, Montana.

DeHaan, P., Adams, B., Von Bargen, J. and M. Brinkmeyer. 2016. Genetics analysis of native salmonids from the Lake Pend Oreille and Clark Fork River System, Idaho and Montana. U.S. Fish and Wildlife Service, Abernathy Fish Technology Center, Longview, Washington. Report to Avista Corporation, Noxon, Montana.

Cassinelli J.D. and Meyer K.A. 2018. Factors influencing return-to-creel of hatchery catchable sized Rainbow Trout stocked in Idaho lentic waters. Fisheries Research 204(2018): 316-323.

Glaid, J. 2017. Evaluation of sub-adult Bull Trout out-migration in the Thompson River drainage, Montana. Master's thesis. Montana State University, Bozeman.

Kohler, C., and W. Hubert. 1993. Inland fisheries management in North America. American Fisheries Society.

Kovach, R., S. Painter, and A. Lodmell. 2021a. March 30 Genetic Letter to Montana Fish, Wildlife and Parks. University of Montana Conservation Genetics Laboratory. Division of Biological Sciences, University of Montana, Missoula, Montana.

Kovach, R., S. Painter, and A. Lodmell. 2021b. December 6 Genetic Letter to Montana Fish, Wildlife and Parks. University of Montana Conservation Genetics Laboratory. Division of Biological Sciences, University of Montana, Missoula, Montana.

Kovach, R., S. Painter, and A. Lodmell. 2020a. March 31 Genetic Letter to Montana Fish, Wildlife and Parks. University of Montana Conservation Genetics Laboratory. Division of Biological Sciences, University of Montana, Missoula, Montana.

Kovach, R., S. Painter, and A. Lodmell. 2020b. April 16 Genetic Letter to Montana Fish, Wildlife and Parks. University of Montana Conservation Genetics Laboratory. Division of Biological Sciences, University of Montana, Missoula, Montana.

Kovach, R., Leary, R., Painter, S. and A. Lodmell. 2019a. April 10 Genetics letter to Montana Fish, Wildlife and Parks, R. Kreiner, April 10. University of Montana Conservation Genetics Laboratory, College of Forestry and Conservation, University of Montana, Missoula, Montana.

Kovach, R., Leary, R., Painter, S. and A. Lodmell. 2019b. August 6 Genetics letter to Montana Fish, Wildlife and Parks. University of Montana Conservation Genetics Laboratory, College of Forestry and Conservation, University of Montana, Missoula, Montana.

Kreiner, R., and T. Tholl. 2014. Native salmonid abundance and tributary habitat restoration monitoring. Comprehensive Report, 2011-2013. Including Summarized Data, 1999-2013. Report to Avista Corporation, Noxon, Montana and Montana Fish, Wildlife and Parks, Thompson Falls, Montana.

Kreiner, R. and M. Terrazas. 2018. Thompson River Fisheries Investigations: A Compilation Through 2017. Montana Fish, Wildlife and Parks, Thompson Falls, Montana.

Kreiner, R., and M. Terrazas. 2020. Lower Clark Fork River Tributary Sampling 2018. Montana Fish, Wildlife and Parks, Thompson Falls, Montana.

Lower Clark Fork Watershed Group. 2018. Thompson River Watershed Restoration Plan.

Meyer, K., S. Elle, Lamansky Jr., J., Mamer, E. and A. Butts. 2012. A reward-recovery study to estimate tagged-fish reporting rates by Idaho anglers. North American Journal of Fisheries Management 32:696–703.

Meyer, K. and D. Schill. 2014. Use of a Statewide angler Tag Reporting System to Estimate Rates of Exploitation and Total Mortality for Idaho Sport Fisheries. North American Journal of Fisheries Management 34:1145-1158.

Pratt K. and J. Huston. 1993. Status of bull trout (Salvelinus confluentus) in Lake Pend Oreille and the lower Clark Fork River. Draft Report prepared for the Washington Water Power Company, Spokane, Washington.

Pine, W., Hightower, J., Coggins, L. , Lauretta, M., and K. Pollock. 2012. Design and analysis of tagging studies. Pages 521-572 in A. V. Zale, D. L. Parrish, and T. M. Sutton, editors. Fisheries techniques, 3rd edition. American Fisheries Society, Bethesda, Maryland.

Zale, W., Parrish, D. and T. Sutton, editors. Fisheries Techniques, Third Edition. American Fisheries Society, Bethesda,
Maryland.

Appendix A. Temperature logger locations in Thompson River and tributaries in 2021.

Stream Name	Location
Bear Creek	2.6 rkm
Beatrice Creek	0.16 rkm
Big Rock Creek	4.8 rkm
Chippy Creek	4.1 rkm
Deerhorn	0.1 rkm
Fishtrap Creek	0.15 rkm
Fishtrap Creek	4.75 rkm
Fishtrap Creek	11.4 rkm
Fishtrap Creek	16.8 rkm
Fishtrap Creek	21.08
Jungle Creek	1.33 rkm
Jungle Creek	5.8 rkm
Little Rock Creek	4.3 rkm
Little Thompson River	0.1 rkm
Loneman Creek	0.1 rkm
Murr Creek	2.7 rkm
NF Little Thompson	0.7 rkm
Partridge Creek	0.16 rkm
Shroder Creek	0.1 rkm
Thompson River	1.5 rkm (gauge)
Thompson River	11.7 rkm (abv WF)
WF Fishtrap Creek	0.6 rkm
WF Fishtrap Creek	8.9 rkm
WF Thompson River	0.3 rkm
WF Thompson River	8.0 rkm

Appendix B. Tributary sampling/depletion locations for 2021 using the downstream block net coordinates.

Location	Rkm
Big Rock Creek	3.4
Big Rock Creek	3.9
Big Rock Creek	5.5
Big Rock Creek	6.3
Big Rock Creek	7.9
West Fork Fishtrap Creek	0.16
West Fork Fishtrap Creek	5.5
Fishtrap Creek	15.4
Fishtrap Creek	8.1
Fishtrap Creek	10.9

Appendix C. Individual information for Bull Trout collected from Fishtrap Creek and transported downstream of Cabinet Gorge Dam to the lower Clark Fork River in Idaho.

Species	Initial Tagging Date	Tagging Location (rkm)	PIT Tag	Length(mm)	Weight(g)
BULL	10/4/2021	1.6-1.8	989001033211768	229	95
BULL	10/4/2021	1.6-1.8	989001033211761	187	53
BULL	10/4/2021	1.6-1.8	989001033211763	135	20
BULL	10/4/2021	1.6-1.8	989001033211728	140	25
BULL	10/4/2021	1.6-1.8	989001033211759	139	21
BULL	10/4/2021	1.6-1.8	989001030300813	156	29
BULL	10/4/2021	1.4-1.6	989001030300749	145	28
BULL	10/4/2021	1.4-1.6	989001030300761	135	21
BULL	10/5/2021	1.8-1.9	989001030300765	145	28
BULL	10/5/2021	1.8-1.9	989001030300814	122	15
BULL	10/5/2021	1.8-1.9	989001030300733	147	28
BULL	10/5/2021	1.9-2.1	989001040185349	205	73

BULL	10/5/2021	1.9-2.1	989001030300742	172	43
BULL	10/5/2021	1.9-2.1	959001030300803	193	64
BULL	10/5/2021	1.9-2.1	989001030300808	215	84
BULL	10/15/2021	0-0.2	989001030300746	152	30
BULL	10/15/2021	0-0.2	989001030300745	134	18
BULL	10/15/2021	0-0.2	989001030300752	142	23
BULL	10/15/2021	0-0.2	989001030300724	146	24
BULL	10/15/2021	0-0.2	989001030300736	165	36
BULL	10/15/2021	0-0.2	989001030300786	205	69
BULL	10/15/2021	0-0.2	989001030300754	205	69
BULL	10/15/2021	0-0.2	989001030300788	197	58
BULL	10/20/2021	2.1-2.6	989001030300796	132	20
BULL	10/20/2021	2.1-2.6	989001030300793	162	30
BULL	10/20/2021	2.1-2.6	989001030300789	192	55
BULL	10/20/2021	2.1-2.6	989001030300766	155	28
BULL	10/20/2021	2.1-2.6	989001030300732	162	38
BULL	10/20/2021	2.1-2.6	989001030300735	200	64
BULL	10/20/2021	2.1-2.6	989001030300791	204	74
BULL	10/21/2021	1.1-1.3	989001030300778	167	39
BULL	10/22/2021	0- 0.2	989001030300782	202	65
BULL	10/22/2021	0-0.2	989001030300798	203	70
BULL	10/22/2021	0-0.2	989001030300812	189	51
BULL	10/22/2021	0-0.2	989001030300772	171	37
BULL	10/27/2021	1.6-2.4	989001030300756	135	18.3
BULL	10/27/2021	1.6-2.4	989001030300768	133	17.5

BULL	10/27/2021	1.6-2.4	989001030300715	177	40.9
BULL	10/28/2021	2.1-2.7	989001030300722	144	25
BULL	10/28/2021	2.1-2.7	989001030300771	175	36
BULL	10/28/2021	2.1-2.7	989001030300731	174	39
BULL	10/28/2021	2.1-2.7	989001030300753	170	36

Appendix D. Ongoing Bull Trout Outmigration Summary

Passive Integrated Transponder arrays were originally installed in the Thompson River drainage as part of a graduate study in 2014 and 2015 (Glaid 2017). Since the conclusion of that study, FWP and NorthWestern Energy fisheries staff have attempted to maintain the remote PIT arrays in Fishtrap Creek and West Fork Thompson River. However, because of difficult access and no permanent power source, there were some time periods in which the tributary arrays did not function. Therefore, the detection rates presented should be considered a minimum estimate.

Between 2014 and 2021, there were 183 uniquely PIT tagged bull trout detected on remote arrays in the Thompson River drainage (TABLE D-1). These fish were initially tagged in one of seven general locations: Fishtrap Creek electrofishing surveys (FTC efish), West Fork Thompson River electrofishing surveys (WFTR efish), Fishtrap Creek weir trap (FTC weir), West Fork Thompson River weir trap (WFTR weir), Mainstem Thompson River electrofishing surveys (Mainstem TR), Lake Pend Oreille adult transport fish below Cabinet Gorge Dam (LPO Transport), or other. Most tags were inserted into sub-adult fish during electrofishing surveys or weir-trapping events in Fishtrap Creek and the West Fork Thompson River. Of the 661 fish tagged in Fishtrap Creek during electrofishing surveys between 2015 and 2021, only 92 (13.9%) have been detected leaving that tributary and only 18 (2.7%) were detected leaving the mainstem Thompson River. Interestingly, four fish from the Fishtrap drainage were also detected entering the West Fork Thompson River, with one subsequently detected on the mainstem array. Similarly, in the West Fork Thompson River, of the 302 fish tagged during tributary electrofishing surveys between 2014 and 2019, 43 (13.9%) were detected leaving that tributary and only 11 (3.6%) were detected at the mainstem array.

Fish actively captured out-migrating in weir traps from both streams were detected at higher rates leaving the Thompson River. In Fishtrap Creek in 2015, 91 fish were captured moving downstream in a weir trap near the mouth of the stream and 12 (13%) were eventually detected leaving the mainstem Thompson River. In West Fork Thompson River, that number was higher as 47 fish were captured leaving that tributary and 19 (40%) were eventually detected at the mainstem array. Over that same time period, 18 Bull Trout were tagged in the mainstem Thompson River and two have been detected on an array. One was a large adult Bull Trout which was detected shortly after capture on the mainstem Thompson River array and presumedly left the system, the other was a sub-adult tagged in the Big Hole section and detected on the

West Fork Thompson River array shortly after. Other detections include Bull Trout either passed at the Thompson Falls fish ladder, transported above Cabinet Gorge Dam with a genetic assignment to the Thompson River, or sampled outside of the drainage.

Westslope Cutthroat Trout detections have been considerably lower than Bull Trout with only 10 of the 572 fish tagged in tributaries detected on tributary array systems through 2021 (1.7%; Table D-2). Most Westslope Cutthroat Trout array detections were from adult fish tagged as they are passed over the ladder at Thompson Falls Dam.

To date we have only determined the fate of two fish that were tagged in the tributaries and out-migrated. One fish (989001004067528) which was originally tagged in Jungle Creek in 2015 was detected on the FTCR array in fall of 2019. Another (989001004500631) was originally tagged in the FTC weir in 2015 and was detected in Prospect Creek in the fall of 2018. Other interesting highlights from these data include four separate fish, all Bull Trout that out-migrated from Fishtrap Creek drainage, and then entered West Fork Thompson River. Three fish were (989001030300967, 989001004067491, 989001004067541) which out-migrated from FTC in 2020, 2017, 2016 respectively and were detected in the West Fork Thompson River the same year. One individual(989001004449734) was tagged in 2015 but not detected in the West Fork until 2016. In 2021, multiple adult Bull Trout were transported from below Cabinet Gorge Dam and detected on arrays within the Thompson River (Table D-1). In 2021, eight fish were transported to the Thompson River, and seven were detected within the tributaries. In 2021, one BULL (982126050371207) was captured at the Thompson Falls Fish Ladder. It was initially tagged below Cabinet Gorge Dam in 2020, and transported to the Thompson River, with a genetic assignment to Fishtrap Creek. It later traveled downstream and was detected on the mainstem array. On May 26, 2021, it was recaptured at the Thompson Falls fish Ladder, released above Thompson Falls Dam and detected entering the mainstem Thompson River on 05/30/2021. It was detected entering Fishtrap Creek 6/18/2021 and exiting the creek 9/13/2021. It was then detected on the mainstem array on 9/20/2021.

TABLE D-1 Bull Trout detected on remote PIT arrays in the Thompson River with original tagging years and locations of PIT tagged fish within the drainage. See above for location descriptions

	Number of individuals tagged per location									Detected on Arrays					
Location	2014	2015	2016	2017	2018	2019	2020	2021	Total	FTC	FTC	WFTR	WFTR	MSTR	MSTR
FTC Efish	0	420	17	56	12	59	31	66	661	85(7)	13.9%	4	0.6%	18	2.7%
WFTR Efish	53	146	0	36	0	29	38	0	302	0	0.0%	35(7)	13.9%	11	3.6%
FTC Weir	0	91	0	0	0	0	0	0	91	4	4.4%	0	0.0%	12	13.2%
WFTR Weir	0	47	0	0	0	0	0	0	47	0	0.0%	2	4.3%	19	40.4%
Mainstem TR	5	10	0	3	0	2	0	3	23	4	17.4%	1	4.3%	2	8.7%
TF Ladder	1	2	3	1	0	1	1	0	9	2	22.2%	1	11.1%	3	33.3%
LPO Transport	11	7	1	4	5	3	4	8	43	16	37.2%	11	25.6%	23	53.5%
Other	∞	∞	∞	∞	∞	∞	∞	∞	1	1	100.0%	0	0.0%	0	0.0%

(Arrays: FTC- Fishtrap Creek, WFTR- West Thompson River, MSTR- Mainstem Thompson River.) (Because several individual fish were detected on multiple arrays, individual array detections do not always add up to the total. Numbers in parentheses indicate fish which were not detected on that specific array but were known to outmigrate based on other detections.)

TABLE D-2 Westslope Cutthroat Trout detected on PIT arrays in the Thompson River with original tagging years and locations.

	Number Tagged Per Location									Detected on Arrays					
Location	2014	2015	2016	2017	2018	2019	2020	2021	Total	FTC	FTC	WFTR	WFTR	MSTR	MSTR
FTC Efish	0	0	196	174	3	6	23	0	402	10	2.49%	0	0%	3	0.75%
FTC Weir	0	2	0	0	0	0	0	0	2	2	100%	0	0%	0	0%
WFTR Efish	0	0	0	65	0	4	101	0	170	0	0%	1	0%	0	0%
TF Ladder	36	37	36	14	14	21	23	7	181	5	2.76%	0	0%	50	28%

TABLE D-3. Ladder fish detected on PIT arrays in the Thompson River with original tagging years.

	Number Tagged Per Year									Detected on Arrays					
Species	2014	2015	2016	2017	2018	2019	2020	2021	Total	FTC	FTC	WFTR	WFTR	MSTR	MSTR
LL	67	153	169	86	56	183	78	74	866	8	0.92%	8	0.92%	481	55.54%
MWF	0	54	6	0	3	4	9	3	79	0	0%	0	0%	14	17.72%
RB	144	238	310	171	103	133	167	118	1,384	7	0.51%	3	0.22%	544	39.31%

Appendix E. Passive Integrated Transponder (PIT array) detections in the Thompson River drainage in 2021.

TABLE E-1 Individuals detected on the PIT array in Fishtrap Creek in 2021. Species abbreviations are as follows:, Bull Trout=BULL, Brown Trout=LL, Mountain Whitefish=MWF, Rainbow Trout=RB and Westslope Cutthroat Trout (WCT).

Species	PIT	Date Detected	Number of Daily Detections	Initial Tagging	Tagging Location	Length (mm)	Weight (mm)
RB	982000362691270	4/14/2021-4/17/2021	4	6/26/2020	Thompson River 16.8-19.9 rkm	386	
BULL	982126050371179	6/12/2021, 6/29/2021	2	4/18/2021	Below Cabinet Gorge Dam, Clark Fork River~24.1 rkm	618	2772
BULL	982126050371191	9/9/2021	1	9/3/2021	Below Cabinet Gorge Dam, Clark Fork River ~24.1 rkm	591	1666
BULL	982126050371207	6/18/2021-6/28/2021, 7/19/2021, 8/16/2021, 9/13/2021	6	4/14/2020	Below Cabinet Gorge Dam, Clark Fork River ~24.1 rkm	504	1126
WCT	989001006029224	4/3/2021, 8/13/2021	1	4/23/2021	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	300	280
BULL	989001007069695	8/11/2021	1	6/15/2021	Thompson River 16.8-19.9 rkm	658	
BULL	989001007069710	6/27/2021	1	6/15/2021	Thompson River 16.8-19.9 rkm	230	97
BULL	989001007069723	6/27/2021	1	6/15/2021	Thompson River 16.8-19.9 rkm	230	102
Unknown	989001007208213	4/7/2021	1				
BULL	989001026318232	9/18/2021	1	8/12/2020	Fishtrap Creek 16.6 rkm	123	17
RB	989001030300686	4/24/2021,4/29/2021	2	3/23/2020	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	549	1822
RB	989001030300870	4/8/2021	1	7/14/2020	Thompson Falls Fish Ladder, Clark fork River ~116.9 rkm	469	924
BULL	989001033211395	9/24/2021	1	8/19/2021	West Fork Fishtrap Creek 0.1rkm	148	28

BULL	989001033211404	11/30/2021	1	8/19/2021	West Fork Fishtrap Creek 0.1 rkm	147	27
BULL	989001033211452	9/22/2021	1	8/19/2021	West Fork Fishtrap Creek 5.1 rkm	170	42
BULL	989001033211467	12/3/2021	1	8/19/2021	West Fork Fishtrap Creek 5.1 rkm	170	41
BULL	989001033211522	11/7/2021	1	8/23/2021	Fishtrap Creek 8.1 rkm	200	69
BULL	989001033211532	10/13/2021	1	8/20/2021	Fishtrap Creek 16.5 rkm	129	20
BULL	989001033211537	8/27/2021	1	8/23/2021	Fishtrap Creek 8.1 rkm	211	84
BULL	989001033211566	10/10/2021	1	8/20/2021	Fishtrap Creek 16.5 rkm	206	83
WCT	989001033212895	4/18/2021	1	9/12/2020	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	395	576
RB	989001033212964	4/4/2021, 5/3/2021	2	10/12/2021	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	467	1030
BULL	989001033211534	11/14/2021	1	8/20/2021	Fishtrap Creek 16.6 rkm	161	37

TABLE E-2 Individuals detected on the West Fork Thompson River PIT array in 2021. Species abbreviations are as follows:, Bull Trout=BULL, Brown Trout=LL and Westslope Cutthroat Trout (WCT).

Species	PIT	Date Detected	Number of daily detections	Initial Tagging	Tagging Location	Length (mm)	Weight (g)
BULL	982126050371100	6/3/2021	1	5/20/2021	Below Cabinet Gorge Dam, Clark Fork River ~24.1 rkm	545	1800
BULL	982126050371110	8/4/2021-9/25/2021	4	4/20/2021	Below Cabinet Gorge Dam, Clark Fork River ~ 24.1 rkm	474	882
BULL	982126050371114	9/3/2021	1	8/31/2021	Below Cabinet Gorge Dam, Clark Fork River ~24.1 rkm	606	1664
BULL	982126050371147	9/3/2021	1	8/31/2021	Below Cabinet Gorge Dam, Clark Fork River ~24.1 rkm	616	2034
BULL	982126050371156	9/2/2021	1	5/6/2021	Below Cabinet Gorge Dam, Clark Fork River ~24.1 rkm	448	876
BULL	989001007069529	10/23/2021	1	8/26/2020	4.1 rkm West Fork Thompson River	215	85

BULL	989001007069548	10/2/2021	1	8/26/2020	4.1 rkm West Fork Thompson River	180	50
BULL	989001030300996	3/25/2021	1	7/31/2019	7.4 rkm West Fork Thompson River	127	17
WCT	989001007069578	10/24/2021	1	8/13/2020	1.93 rkm West Fork Thompson River	140	24
LL	989001033212699	10/29/2021	1	10/19/2021	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	546	1470
LL	989001033212754	10/30/2021-10/31/2021	2	10/12/2021	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	445	768

TABLE E-3. Native Fish individuals detected on the Main Stem Thompson River PIT array in 2021. Species abbreviations are as follows:, Bull Trout=BULL, Mountain Whitefish=MWF and Westslope Cutthroat Trout (WCT).

Species	Tag number	Date Detected	Initial Tagging	Tagging Location	Length (mm)	Weight (g)
WCT	982000365415136	7/24/2021	9/20/2020	Chippy Creek 4.9 rkm*	219	
WCT	982000365415156	6/27/2021	9/20/2021	Chippy Creek rkm 4.9 rkm*	161	
BULL	982126050371100	6/17/2021-6/19/2021, 9/23/2021	5/20/2021	Below Cabinet Gorge Dam, Clark Fork River ~24.1 rkm	545	1800
BULL	982126050371114	10/2/2021-11/2/2021	8/31/2021	Below Cabinet Gorge Dam, Clark Fork River ~24.1 rkm	606	1664
BULL	982126050371156	5/12/2021, 9/3/2021	5/6/2021	Below Cabinet Gorge Dam, Clark Fork River ~24.1 rkm	448	876
BULL	982126050371157	6/10/2021	5/30/2021	Below Cabinet Gorge Dam, Clark Fork River ~24.1 rkm	707	3988
BULL	982126050371207	5/30/2021, 9/20/2021	4/14/2021	Below Cabinet Gorge Dam, Clark Fork River ~24.1 rkm	504	1126
MWF	989001005372413	5/2/2021, 10/4/2021	4/25/2016	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	247	114
BULL	989001007069548	10/4/2021	8/26/2021	West Fork Thompson River 4.1 rkm	180	50
BULL	989001007069584	1/13/2021	8/27/2020	Fishtrap Creek 2.7 rkm	158	32
WCT	989001030300706	9/1/2021	4/20/2021	Thompson Falls Fish Ladder. Clark Fork River ~116.9 rkm	349	476

BULL	989001030300790	7/1/2021	6/22/2021	Thompson River 16.8-19.9 rkm	175	44
WCT	989001030300873	6/14/2021	4/30/2020	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	352	514
BULL	989001033211522	12/19/2021	8/23/2021	Fishtrap Creek 8.1 rkm	200	69
BULL	989001033211566	10/11/2021	8/20/2021	Fishtrap Creek 16.5 rkm	206	83
WCT	989001033211920	4/6/2021	4/5/2021	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	400	672
WCT	989001033212895	3/19/2021, 6/6/2021-6/11/2021	9/21/2020	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	395	576
WCT	989001033212906	7/2/2021	9/21/2020	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	391	520
MWF	989001033212916	4/26/2021, 5/28/2021-9/21/2021	10/13/2020	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	359	414
MWF	989001033212918	7/1/2021, 8/28/2021	10/5/2020	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	410	702
WCT	989001033212967	8/7/2021-8/14/2021	9/21/2020	Thompson Falls Fish Ladder, Clark Fork River ~116.9 rkm	406	616

*Fish were tagged in Chippy Creek and translocated to Bear Creek as part of the Westslope Cutthroat Transfer. These fish out migrated from Bear Creek, then were detected on the Mainstem Thompson Array.