Thompson River Fisheries Investigations:

A Compilation Through 2017

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Contents

INTRODUCTION

This report represents a summary of work conducted in the Thompson River watershed until 2017. The document also consolidates other valuable information on the Thompson River watershed that influences the current state of the drainage. Included are fisheries monitoring, special projects, land ownership, history of roads, fish stocking records, angler pressure, thermographs, fire history, and fish genetics sampling among other topics.

The Thompson River is a sixth order tributary (1631 km^2; Strahler 1952), to the Clark Fork River in western Montana. The Thompson River is a north/south oriented watershed which originates from multiple headwater lakes (Thompson Chain of Lakes). The river travels approximately 85 river kilometers (rkm) south to southwest where it meets the Clark Fork River. The river is generally categorized into two distinct stream segments. The upper river extends from the Thompson Chain of Lakes in the headwaters downstream to the Little Thompson River (about 28 rkm upstream from the mouth). This stretch of river consists of a low gradient, meandering channel, which alternates between primarily an E-channel type and a C-channel type (Rosgen 1994). The lower Thompson River is defined as extending from the Little Thompson River confluence at rkm 28 downstream to the mouth. Here, the river flows through a confined canyon and is characterized by higher gradient and larger substrate, with primarily a B, and less frequently a C channel types (Rosgen 1994).

In general, the upper Thompson River is warmer than the lower river. Several factors contribute to this thermal regime including its origin as the outflow from the Thompson Chain of Lakes (rkm 85-88), lower stream velocities, and a lack of riparian canopy cover. The Thompson River flows for nearly 20 rkm before it begins to cool with the addition of several tributaries such as Murr Creek (rkm 68), Big Rock Creek (rkm 52), and Chippy Creek (rkm 40). The three largest tributaries to the Thompson River by volume and drainage area all enter the lower river and are Fishtrap Creek (rkm 25), the Little Thompson River (rkm 29), and West Fork Thompson River (rkm 11). However, recent temperature monitoring has revealed that the addition of the Little Thompson River increases water temperatures in the Thompson River. Temperatures become considerably cooler with the addition of Fishtrap Creek, and the lowest 11 rkm are the coolest of the entire mainstem due to the addition of West Fork Thompson River.

Since 1957, the United States Geological Survey has maintained a streamflow gauge on the lower Thompson River. Over that time, annual maximum discharge averages approximately 2,500 cubic feet per second (cfs) which typically occurs on or near May 8 but has ranged from January through June. Maximum measured peak flow was 6,080 cfs on June 9, 1964, and minimum measured peak flow was about 500 cfs on May 3, 1977. Maximum mean monthly discharge is typically about 1,280 cfs which occurs during the month of May, while baseflow is usually in September when flows average less than 200 cfs.

The Thompson River and its tributaries contain native Westslope Cutthroat Trout *Oncorhynchus clarki lewisi*, Bull Trout *Salvelinus confluentus,* and Mountain Whitefish *Prosopium williamsoni* as well as native suckers *Catostomus* spp. and sculpins *Cottus* spp. Other common fish species in the Thompson River include: Rainbow Trout *Oncorhynchus mykiss*, Brown Trout *Salmo trutta*, and Brook Trout *Salvelinus fontinalis*. Western Pearlshell Mussels *Margaritifera falcata*, a species of special concern in Montana, also inhabit the drainage, primarily in the upper mainstem and the Little Thompson River (Stagliano 2015).

According to reports from original residents of the Thompson River Valley, angler catch in the Thompson River at the beginning of the 20th century consisted of large cutthroat trout, Bull Trout, and whitefish (Hagerman-Benton 2003). However, Montana Fish & Game (F&G) began stocking the Thompson River and tributaries with Rainbow Trout as early as 1933. "Cutthroat Trout" were also stocked in the drainage around this time and based on old hatchery records were likely to be primarily Yellowstone Cutthroat Trout. Historic creel data from the Thompson River revealed that by the 1950s and 1960s, angler catch varied but was dominated either by cutthroat trout, Rainbow Trout, Brook Trout, or Mountain Whitefish. Electrofishing surveys in 1974 revealed Mountain Whitefish, Rainbow Trout, and Brook Trout to be the dominant species at two monitoring sections (rkm 30 and rkm 49). Other species such as cutthroat trout, Bull Trout, Largescale Sucker, sculpins, Longnose Dace *Rhinichthys cataractae*, Yellow Perch *Perca flavescens*, and Redside Shiner *Richardsonius balteatus* were captured in numbers too low for an estimate to be obtained. A single Brown Trout was first collected in the lower Thompson River in 1979. In 1988, Brown Trout were stocked in the Thompson River and are currently the dominant game species in the upper section of river and comprise about half of the game fish in the lower river.

Although Westslope Cutthroat Trout and Bull Trout are not the most abundant trout species in the mainstem Thompson River, they do exist in several tributaries. Westslope Cutthroat Trout are present in nearly every tributary drainage to the Thompson River, while Bull Trout are currently known to be present in West Fork Thompson River, Fishtrap Creek (and tributaries), and Big Rock Creek. Due to a lack of captures in the Thompson River near Big Rock Creek, low genetic diversity (DeHaan et al. 2015), and a variable size structure, it is believed that the population in Big Rock Creek is almost entirely resident. The populations in Fishtrap Creek and West Fork Thompson River contain a mix of migratory and resident fish (Huston 1994, Glaid 2017).

In the 1970s and 1980s, much of the Thompson River was managed under the general fishing regulations (5 trout/day, 1 greater than 356 mm (14 inches)). However, in 1984 Montana Fish, Wildlife and Parks (MFWP) attempted to improve trout abundance, species composition, and fish quality by creating a 10.9 km catch and release section in the Thompson River. This section extended from the mouth of the West Fork Thompson River to the mouth of Deerhorn Creek. By

1990, no significant increase in size of fish was detected and the regulation was dropped. It was determined that game fish (primarily Rainbow Trout) traveled great distances and were being harvested outside of the protected zone.

General western district regulations guided management on the Thompson River through 2000, when they were again changed. At that time, catch and release regulations were placed on Westslope Cutthroat Trout, and only artificial lures could be used for anglers over 14 years old. For other trout, the limit remained three daily, but with a slot limit of 10-18” with only one fish over 18 inches in length. At that time, the winter catch and release section on the upper river was removed and this section was closed to fishing outside of the general season. This was done to protect spawning fish, primarily Rainbow Trout. Finally, to protect native species in West Fork Thompson River and Fishtrap Creek, all anglers were required to use artificial lures only.

In 2009, in response to increasing abundances of Brown Trout throughout the drainage, all length limits were removed from Brown Trout in the Thompson River (three fish daily, no length limit). At the same time, catch and release restrictions were placed on all Rainbow Trout in the Thompson River.

Based on results of MFWPs biannual mail-in angler surveys, total angling pressure on the Thompson River has fluctuated widely since 1982 but recently hit an all-time high (TABLE 2). Separate estimates were obtained for both sections of the Thompson River (Section 1- lower river; Section 2- upper river) but have been combined for the purposes of this report. The upper river has been closed to fishing outside of the general season since 2000, so regulations and therefore fishing pressure should not be assumed equal for the entire river. Much of the fishing pressure is from the mouth of the Little Thompson River downsteam to the confluence with the Clark Fork River, as this part of the river is open for year-round angling.

Landownership

There are three major landowners in the Thompson River basin. The United States Forest Service (USFS; 47%), the State of Montana (DNRC) (7%), and private timber companies (currently Weyerhauser; 43%) have historically and currently own a large majority of the property within the Thompson River basin. The other 3% is non-commercial private land. Although mostly undeveloped, there are cabins and permanent residences scattered throughout the basin (some on DNRC land).

Most of the Thompson River drainage is accessible to the public. The Forest Service administers a substantial portion of land in the drainage and MFWP owns a conservation easement (86,000 acres; FIGURE 1) that maintains public access to much of the private timber land bordering the river and prominent tributaries of Fishtrap Creek and the Little Thompson River. Additionally, after acquiring all Plum Creek lands in 2015, Weyerhauser agreed to keep all land holdings in Montana open to public use. There are some private non-timber lands within the drainage, but it does not significantly decrease public access to the river. An angler can access the river nearly anywhere simply by parking off the side of a road and walking to the river.

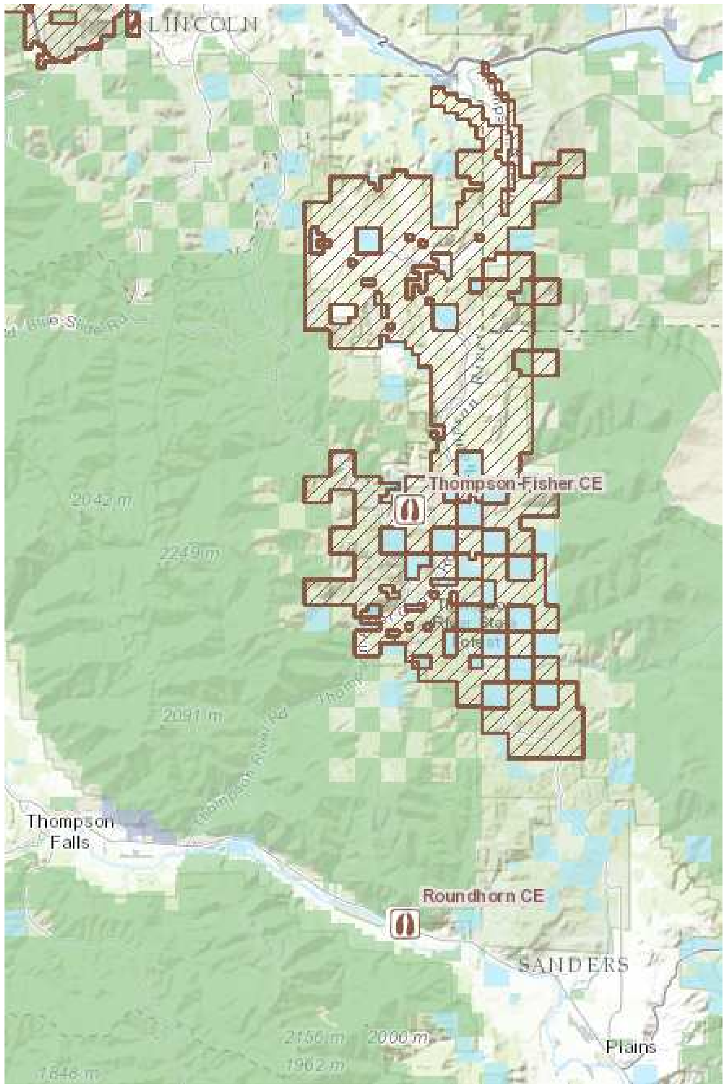

FIGURE 1. Thompson River portion of the Thompson-Fisher conservation easement (brown outline and stripe) covering 86,000 acres of private timber company property.

Roads

Currently, Forest Roads (FR) 56 and 9991 span the entire length of the river corridor from Montana Highway 200 to U.S. Highway 2. The lower 29 km of the Thompson River is closely paralleled on each side by the two roads. As the valley widens in the upper basin, there is less encroachment on the river, however, redundant road systems and excessive crossings are still common. The tributary road network is also extensive, resulting in numerous road crossings in most drainages.

Forest Road 56 follows the west side of the river and was initially constructed during the years of the Great Depression (1930s) by the Civilian Conservation Corps (CCC) (Sanders County Ledger, Sherry Hagerman-Benton, April 10, 2003). It was eventually extended to run all the way to Highway 2 near the Thompson Chain of Lakes. FR 9991 currently follows the east side of the Thompson River. It was originally constructed in the early 1950s by the Anaconda Copper Company. At that time, the company had a log-loading facility near the mouth of the Thompson River and did not want to be held to the 80,000-pound load limit in place on USFS roads (J. Vashro, personal communication). The presence of two roads in a single riparian corridor did not go unnoticed by state fisheries biologists. Prior to the completion of this new road, Montana Fish and Game identified direct damage to the fishery and recognized the senselessness of the construction (Beal and Stefanich 1953). During their survey of the road construction, F&G employees noted at least 12 instances where the new road had 1) straightened the channel, 2) placed fill in the stream, and 3) destroyed fish habitat, or in most cases all three. They stated that "it was not conceivable why a new road would be built when a good road already existed on the west side of the river", and that it "could not be comprehended why the road was not located farther back from the stream".

In 2000, over 74 miles of roads and 55 drainage crossings were evaluated for numerous characteristics influencing the hydrology of the Thompson River (Beussink et al. 2008). This assessment was conducted to provide information on potential alternatives to the proposed Thompson River Forest Highway.

Stream channel morphology— The parallel roads in the lower river have the largest influence on morphology by decreasing floodplain capacity, increasing channel entrenchment, and causing wider and shallower reaches in the presence of roads. The changes in morphology cause myriad effects which will be discussed.

The width-to-depth ratios of the Thompson River are generally among the higher values normal for this stream class. Channel straightening has resulted in incision and bank erosion for portions of the river. It has also cut off meanders, resulting in greater stream power, and down cutting. However, channel incision is generally localized, not a systemic problem. The river is generally more entrenched with less floodplain than would be expected for a river of this type and size. The river also has little woody debris, resulting in few pools and shallow pool depth.

Fluvial geomorphic trends— Sinuosity and pools have changed in the lower river because of the roads and meander cutoffs. The roads and meander cutoffs have resulted in lower channel length than historically observed. The loss of sinuosity is directly associated with reduced pool habitat.

Historically, the river likely moved smaller grain sizes because it had less stream power. Increases in stream power have resulted in a greater ability to scour the channel bed and banks. Meander belt width and channel width have decreased along the river because the river is confined by roads.

Road 56 and the Preferred Alternative encroach on less river within 125 feet of the road and have the lowest percent of flood prone area occupied. But overall, the two roads encroach on much of the lower river and flood prone area.

Bank condition— Most of the surveyed banks had low erosion potential. Most bank hardening occurs where there is little vegetation and steep slopes.

Riparian vegetation— Roads are the biggest influence on riparian vegetation in the Thompson River. They have allowed riparian changes including: vegetation removal, import of fill material, direct segmentation, altered hydrologic connection, confinement, elimination, and isolation of historic riparian areas.

Large woody debris recruitment— Large wood recruitment comes from the area proximal to the river, where a mature tree could fall, and potentially be picked up during high water. In the Thompson River, it is a 120-foot extension of the flood prone area. Much of the recruitment area is occupied by roads, and this is especially high in the lower watershed. Road construction, logging, and land clearing have decreased the tree communities in the recruitment area.

Road sediment delivery/Shade/Cores/Crossings— Over 74 miles of roads, and 55 drainage crossings, were evaluated for road surface erosion and terrestrial sediment delivery. This evaluation found road segments within 300 feet of the river contributed more sediment than stream crossings.

Most of the 41 contributing sources of road sediment were in the lower watershed. The areas with the largest amount of sediment delivery were also the areas with the lowest riparian shade, with the lower watershed having lower riparian shade than the rest of the watershed. The lower watershed also has the longest length of roads basically serving as the stream bank. The town sites of Copper King and Snider also have petroleum hydrocarbons in their sub-grade material. The hydrocarbons are the legacy of petroleum-based dust abatement practices. The McNeil cores found sites >300 ft. from a road or sites with road encroachment but also with a functioning floodplain had the lowest percent fines. Sites with road encroachment without a functioning floodplain had the highest percent fines. Of the 32 total stream crossings evaluated, results from 14 suggested a risk of failure. The most fill from at risk crossings include: Goat Creek (933 tons), Big Hole (252 tons; failed and replaced in 2017), Deerhorn (419 tons; bridge erected in 2010), and tributary 8 (419 tons).

Discussion

The lower section of the Thompson River is highly influenced by the existing road network. The highest streambank erodibility, proportion of occupied riparian area, sediment contribution from road surface erosion, road contamination, and channel substrate fines occur in the lower watershed (32.5 km). The lower watershed also suffers from the lowest riparian shade. The data for this report was collected in 2000, and the highway department applied a sealant cover to County Road 56 in 2001. The sealed section is from Highway 200 to just above Copper King campground (~4.5 km). We believe this sealant cover would have substantially reduced the road sediment delivery from levels calculated in 2000, but likely not eliminate them. A single road system would substantially decrease the negative effects of the two-road system currently in place. Along with increasing LWD recruitment, a one road system would substantially increase the quality of aquatic habitat in the watershed, and especially increase habitat quality in the lower river. Having a single road, either the preferred alternative or County Road 56 and removing at least portions of road 9991, would provide the most benefit to the Thompson River. The lower river is of primary importance because this section of river is the primary location of native salmonids (Glaid 2017). Bull Trout primarily occupy the Thompson River from Fishtrap Creek to the confluence with the Clark Fork River. Enhancing habitat within the lower watershed would provide direct benefits to federally threatened Bull Trout, and benefit other native and recreationally important fishes. Having a single road (either option) or removal of substantial portions of road 9991 would increase sinuosity, riparian shade, and streambank stability more than any other option. It would also decrease sediment contribution, channel substrate fines, proportion of occupied riparian area, and channel substrate fines. A change in the road system in the Thompson River would allow the stream to interact with the watershed in a more natural and healthy way. The river would have increased LWD, sinuosity, pool depth, and riparian shade, and lower sediment inputs, which results in better aquatic habitat.

Fish Stocking Summary

The Thompson River drainage was extensively stocked from 1930-1990 including lakes and streams. More recent stocking events occur less frequently and are primarily focused on mountain lakes (1990-present). The purpose of all stocking events in this drainage has been to enhance angler opportunity. Two streams and seven lakes in the Thompson River drainage have been stocked (TABLE 1). Stocking began in 1930 with 20,000 cutthroat trout in the Thompson River, and continues to this day with stocking of high mountain lakes.

Historical stocking did not evaluate many conservation concerns which are now considered when stocking waterbodies. Hybridization and competition are common concerns with the introduction of non-native fishes, and the Thompson River drainage has been stocked with Arctic Grayling, Brook Trout, Brown Trout, Rainbow Trout, and Yellowstone Cutthroat Trout. Stocking in mountain lakes (since 1971) has consisted exclusively of native species on a set schedule. Since the 1970s, the State of Montana no longer stocks fish in streams with wild trout (Vincent 1987), however the Thompson River was stocked in 1988 and 1989 to establish Brown Trout.

TABLE 1. Stocking history of streams and lakes in the Thompson River drainage through 2015.

Location	# Stockings	Years	# Fish	Species
Thompson River	213	1930-1989	1,850,715	EB, LL, CT, RB
Fishtrap Creek	10	1936-1952	159,240	CT, RB
Arrowhead Lake	16	1941-2014	50,742	CT, WCT
Cabin Lake	13	1934-2010	76,201	CT, WCT
Deer Lake	13	1971-2014	18,621	WCT
Duckhead Lake	13	1941-2014	29,151	EB, CT, WCT
Fishtrap Lake	6	1941-1966	122,860	GR, WCT, RB
Stony Lake	16	1980-2014	32,773	WCT
Terrace Lake	14	1957-2015	54,707	CT, WCT

Angler pressure

The statewide angler use surveys are conducted by mailing a questionnaire to a random sample of resident and nonresident licensed anglers for each month of the year. The surveys estimate total “angler days” which is defined as one angler fishing one body of water for any amount of time on a given day. The Thompson River is divided into two sections for angler pressure surveys. However, due to uncertainty of the boundary of the lower (Section 1) and upper (Section 2) river, we combined results for only a total pressure estimate.

Surveys were conducted on the Thompson River annually from 1982-1985, and then every other year from 1989 to 2015. Angler estimates varied from a low of 4,045 days in 1991, to 13,093 days in 2015 (TABLE 2). Angler estimates for residents have varied from a low of 2,750 days in 2007 to 10,476 days in 2015 (TABLE 2). Non-resident angling has also been highly variable with as many as 4,203 angler days in 2009, but as few as 577 days in 1985. The Thompson River has exceeded 10,000 angler days on four occasions (1997, 1999, 2009, and 2015), and has averaged 8,229 angler days per year. Residents have accounted for approximately 72% of the pressure and have averaged 5,951 days per year compared to non-resident average of 2,263 days.

Estimates of pressure have increased over the past ten years, but many recent estimates were similar to the early 1980s (TABLE 2). Based on observation and early reports (Thomas 1997), the river has likely transformed from a stream in which locals harvested large numbers of trout, to a destination fishing stream. Local anglers, as well as anglers from Missoula, Kalispell, Sandpoint, ID, and Spokane, WA, are commonly observed fishing the Thompson River. Preserving and enhancing a quality sport fishery will continue to be a priority in the Thompson River moving forward.

TABLE 2. Angler pressure estimates for the Thompson River from angler survey results.

Year	Total		Resident		Non-Resident		Ranking	
	Days (SD)	Trips	Days (SD)	Trips	Days (SD)	Trips	State	Region
2015	13,093 (3,391)	126	10,476 (3,278)	97	2,617 (869)	29	84	15
2013	8,879 (1,512	105	6,794 (1,425	82	1,832 (504)	23	113	17
2011	8,722 (1,309)	163	6,103 (1,146)	112	2,618 (634)	51	78	12
2009	11,133 (1,484)	189	6,930 (1,108)	129	4,203 (989)	60	79	17
2007	6,026 (1,288)	177	2,750 (975)	38	3,276 (842)	52	91	18
2005	7,625 (1,349)	149	3,652 (810)	82	3,973 (1,077)	67	86	17
2003	7,814 (1,221)	171	4,578 (949)	100	3,236 (767)	71	87	16
2001	6,076 (924)	156	4,172 (682)	114	1,904 (624)	42	112	26
1999	11,189 (1,881)	282	8,746 (1,709)	220	2,443 (783)	62	72	11
1997	10,081 (1,859)	257	7,893 (1,763)	194	2,188 (592)	63	79	14
1995	9,629 (2,709)	221	7,460 (2,643)	160	2,169 (596)	61	77	12
1993	6,888 (1,026)	205	5,507 (970)	163	1,381 (336)	42	86	18
1991	4,045 (814)	116	3,163 (856)	87	882 (247)	29	114	21
1989	6,569 (1,013)	142	4,849 (904)	97	1,720 (457)	45	70	11
1985	5,416 (1,574)	26	4,839 (1,542)	20	577 (317)	6	96	18
1984	6,554 (2,227)	28	5,447 (2,149)	15	1,107 (583)	13	81	13
1983	9,586 (3,687)	68	7,592 (3,619)	36	1,994 (699)	32	93	16
1982	8,790 (2,340)	63	6,174 (1,637)	51	2,616 (1,672)	12	72	14

MAINSTEM FISHERIES MONITORING

The earliest attempts at monitoring the recreational fishery on the Thompson River were creel interviews conducted on the upper river in the 1940s and extending through the 1960s. Electrofishing by fisheries biologists began in the 1970s at sites located near rkm 30 (Little Thompson Section) and rkm 49 (Meadow Creek Section). In 1984, after MFWP designated a 10.9 km catch and release section on the Thompson River, a new electrofishing site was established at rkm 16 (Big Hole Section) to document a fisheries response to the new regulation. Despite the catch and release regulation being dropped in 1990, regular monitoring of the Big Hole Section has occurred over the past thirty years. The 19-mile section which is nearly identical to the Little Thompson section has also been routinely monitored since the 1980s. In 1990 a onetime sampling event occurred near the mouth of Schroder Creek. In 2007, a site near the Meadow Creek section was replicated. Finally, in 2013 a new section was created at rkm 50 and has been sampled twice (Big Rock Creek Section). Currently, MFWP attempts to sample each site every other year, to evaluate data on the fish community over time. These data are used to look at species composition, species distribution, size structure, and abundance. The information gathered during routine sampling events helps inform management decisions, like regulations, for the Thompson River.

Methods

Fish in the mainstem Thompson River were sampled using an aluminum drift boat mounted with a rectifier (GPP; 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 smooth direct current.

Typically, two runs were made to mark fish with each run focusing on a separate river bank and all trout captured which were 150 mm or greater marked with an identifiable fin clip. Fish were identified to species, measured for total length and weight and released back within the sampling section. All mortalities were weighed and measured but were excluded from population estimation. Two recapture runs were usually 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 estimator was used to estimate population size (Equation 1) (Pine et al. 2012).

Equation 1. Chapman modification of the Petersen Mark-Recapture method (Pine et al. 2012).

$$\mathrm{N} = \frac{(M+1)*(C+1)}{(r+1)} - 1$$

where:
N= Population Estimate
M= Number of fish marked on "Mark" runs
C= Total number of marked and unmarked fish captured on "Recapture" runs
r= Total number of marked fish captured on "Recapture" runs

and:

$$Standard\ Deviation\ (SD) = \sqrt{\frac{(M+1)(C+1)(1-r)(C-r)}{(r+1)^2(r+2)}}$$

The 95% Confidence intervals (CI) were calculated using the equation:

$$95\%CI = 1.96 \times (SD)$$

Ogle (2010) recommended a minimum of seven recaptures to calculate mark-recapture (MR) estimates. However, due to low capture efficiencies during certain years, we calculated population estimates with a minimum of five recaptures. In cases where less than five marked fish were re-captured, an estimate of abundance was calculated using the long-term mean capture efficiency for the specific species and section. Capture efficiency (CE) 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, capture efficiency should not vary greatly within the same section for a specific species. Sampling typically occurred on the descending limb of the hydrograph when stream discharge at the USGS gage site in the lower river measured 400–500 cfs. If more than two mark runs were performed, only the first two were used in the CE population estimates. This technique was also calculated in years with adequate recaptures to verify accuracy and assumptions. If the MR estimate was higher than the CE estimate it was assumed 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 lower than the CE estimate, it 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.

Beginning in the mid-1980s, two sites on the Thompson River were monitored using these methods. The Big Hole Section is a 3.0 km section from rkm 14.1–17.1. This section was established in 1985 to monitor the effects of a recently established catch and release section on the Thompson River (FIGURE 2). Although the catch and release regulation on this section was discontinued in 1989, the section was continually monitored. The 19-Mile section was also established in the 1980s and is located between rkm 27.8–31.1.

In 2013, the “Big Rock Creek Section” was established from rkm 52.8–54.9 (FIGURE 2). This section was sampled for the second time again in 2016. Population estimates collected at each site were calculated and divided by total section length for a standardized estimate of linear abundance per 1.6 kilometers (hereafter: mile).

For less frequently sampled fish such as native Westslope Cutthroat Trout and Bull Trout, catch per unit effort (C/*f*) was calculated using the total number of fish captured on the first mark run only. The total number of Bull Trout and Westslope Cutthroat Trout captured was almost always higher because sampling usually consisted of two marking and two recapture runs. However, sampling was not entirely consistent between years, so using C/*f* from the first pass only enabled us to evaluate trends from all years. In these cases, trends rather than absolute values were examined.

Additionally, species composition was analyzed using total catch on the first run only. Species composition was calculated separately from population estimates because adequate recaptures could not be obtained from most trout species including Bull Trout and Westslope Cutthroat

Trout. Non-salmonids and Mountain Whitefish were not consistently netted and were not included in composition calculations.

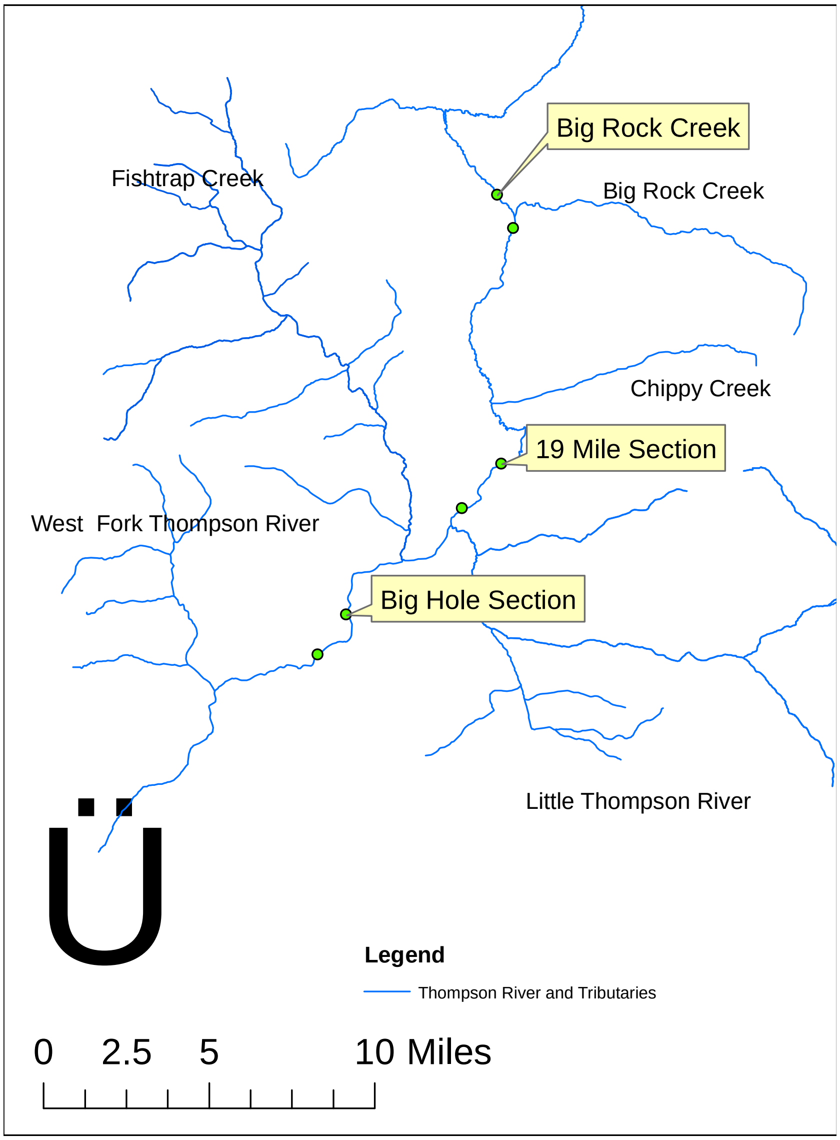

FIGURE 2. Map of the Thompson River with important tributaries and mainstem sampling sections identified.

Size structure of trout populations was evaluated using several metrics. Length frequency histograms were constructed using 10 mm groupings. Additionally, proportional stock densities (PSD) were calculated for Rainbow Trout (Simpkins and Hubert 1996) and Brown Trout (Milewski and Brown 1994) populations over time. PSD categories for Rainbow Trout (Simpkins & Hubert 1996) are: stock, 250–400 mm (10–16 in.); quality, 400–500 mm (16–20 in.); preferred, 500–650 mm (20–26 in.); memorable, 650–800 mm (26–31 in.); and trophy, >800 mm. PSD categories for lotic Brown Trout (Milewski and Brown 1994) are: stock, 150–229 mm (6–9”); quality, 230-299 mm (9–12”); preferred, 300–379 mm (12-15”); memorable, 380-460 mm (15-18”); and trophy, >460 mm (18+”). Because of the inconsistencies between length categories of Brown and Rainbow Trout (e.g., a “quality” Brown Trout = 230 mm versus a “quality” Rainbow Trout = 400 mm), we also compared proportions of Brown and Rainbow Trout greater than 356 mm (14”).

Results

Rainbow Trout— Since 1985, capture efficiency of Rainbow Trout in the Big Hole Section has ranged from 0.07 to 0.20 (mean: 0.12). Mark Recapture estimates for fish greater than 150 mm have varied from 200–600 fish/mile (FIGURE 3). However, in years when MR estimates produced a number greater than 500 fish per mile, confidence intervals were wide and CE estimates indicated the population was likely closer to 300–400 fish per mile. Confidence intervals were relatively wide in years when population estimates were high. Between 1999 and 2002, no MR estimates were attempted, and sampling consisted of a two pass C/f event, with both passes occurring on the same day.

Capture efficiencies for Rainbow Trout in the 19-Mile section have ranged from 0.10–0.26 (mean: 0.18). Population estimates indicate the Rainbow Trout populations were highest in the late-90s, and currently have been reduced to less than 50 fish/mile (≥150mm) (FIGURE 4).

Between 1985 and 2005, Rainbow Trout were the most commonly sampled trout species in the Big Hole Section. During that time, Rainbow Trout comprised 55–95% of the trout sampled. Since then, Brown Trout have been sampled more frequently. Based on sampling frequency, mark-recapture estimates, and estimates using long-term mean capture efficiency, it appears that Brown Trout are now slightly more abundant than Rainbow Trout in the Big Hole section and are dominant in the upper two sections.

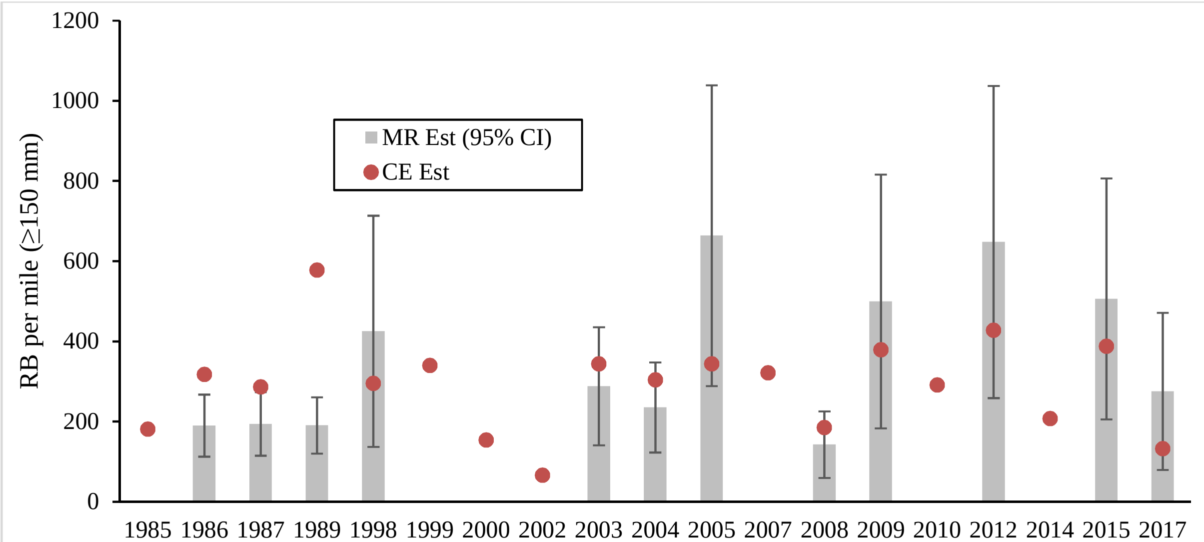

FIGURE 3. Standardized (per mile) population estimates of Rainbow Trout (≥150mm) in the Big Hole section of the Thompson River.

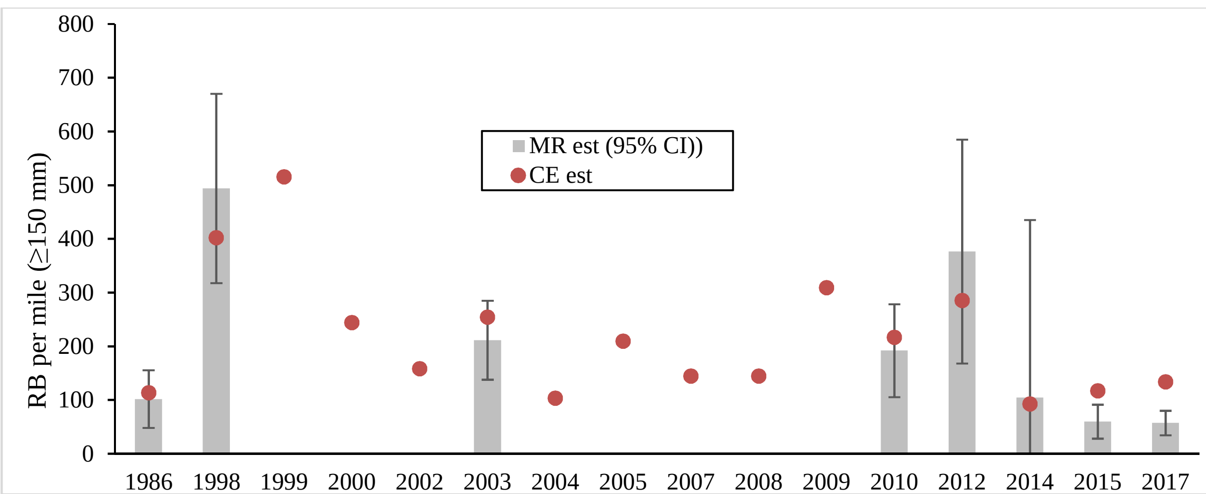

FIGURE 4. Standardized (per mile) population estimates of Rainbow Trout (≥150mm) in the 19 Mile section of the Thompson River.

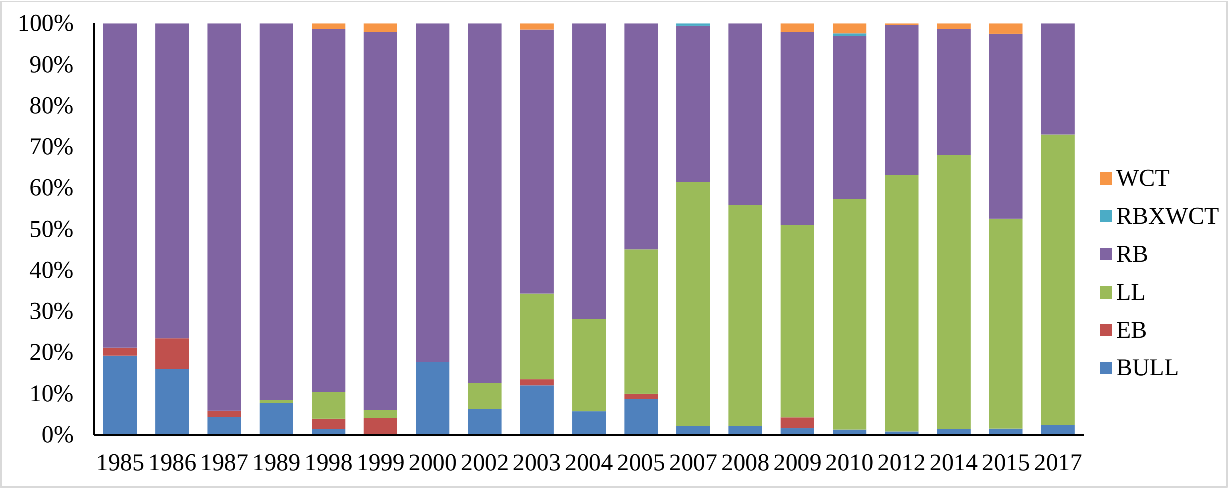

FIGURE 5. Trout species composition in the Big Hole Section of the Thompson River based on total numbers of fish netted on the first two mark runs.

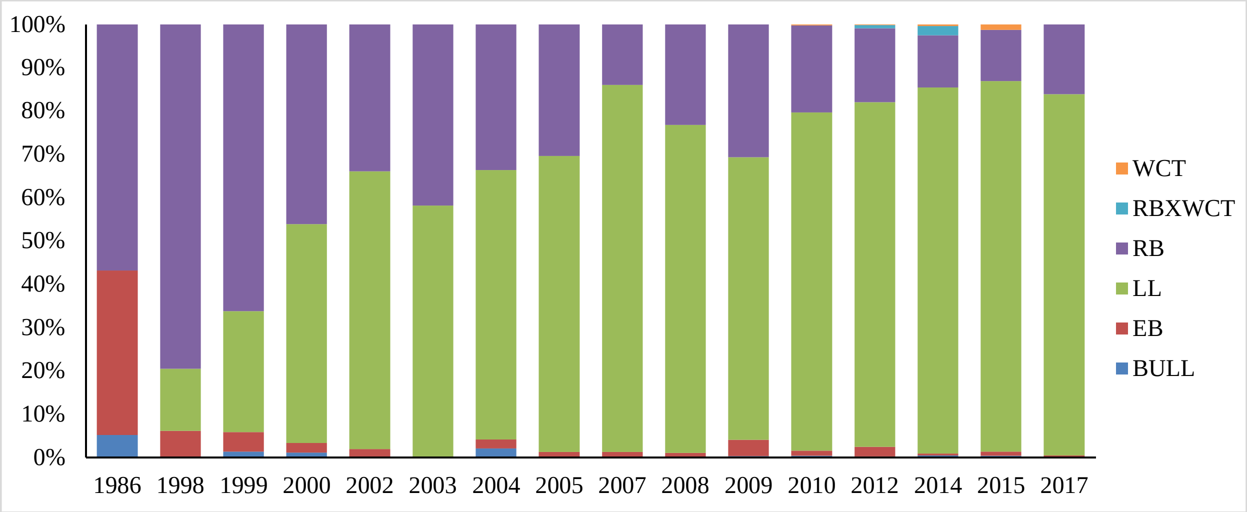

FIGURE 6. Trout species composition in the 19 Mile Section of the Thompson River based on total numbers of fish netted on the first two mark runs.

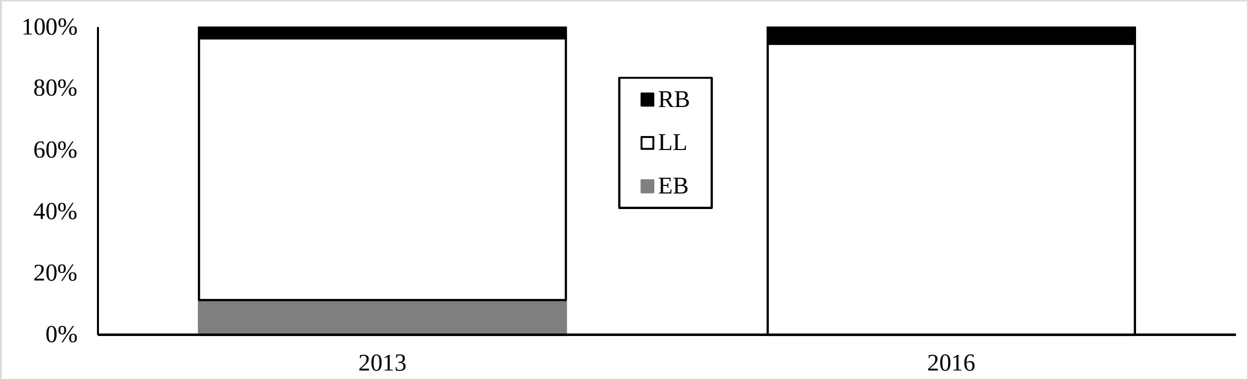

FIGURE 7. Trout species composition in the Big Rock Creek Section of the Thompson River based on total numbers of fish netted on the first two mark runs.

Since 1985, the number of quality Rainbow Trout sampled in the Thompson River has been low in both sections (FIGURES 8 & 9; range:0–20), although the number of stock fish has increased in the Big Hole section. The proportion of Rainbow Trout ≥356 mm has increased in recent years. Currently, the percentage of Rainbow Trout greater than 356 mm is at 31% in the Big Hole section, down from 38% in 2015. In the 19 Mile section, proportions of Rainbow Trout ≥356 mm have increased from a low of zero in 2008, to 11% (FIGURE 10). However, as mentioned previously, abundance of Rainbow Trout in this section is currently low (FIGURE 6).

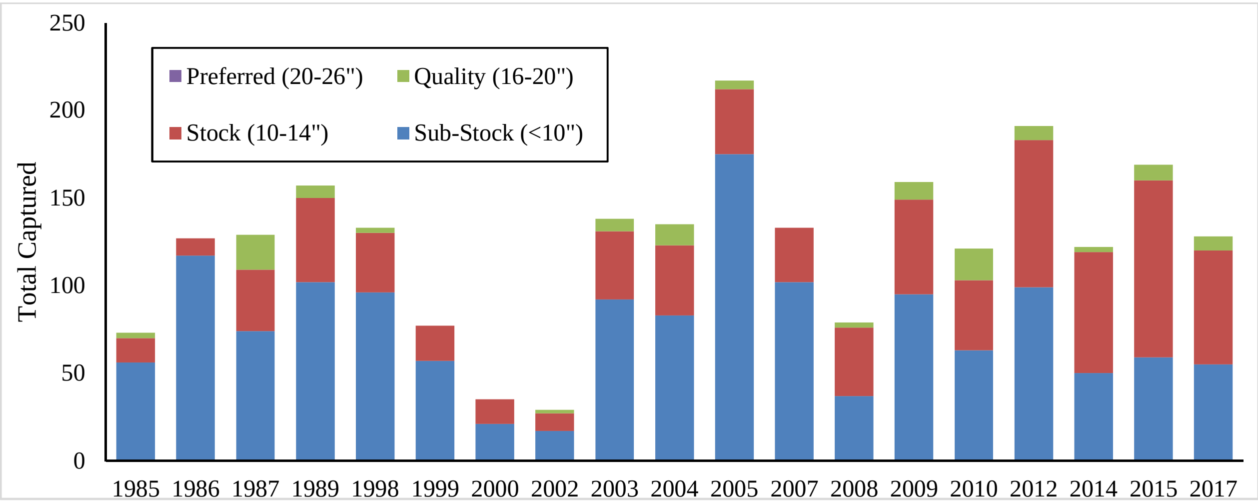

FIGURE 8. Proportional stock densities of Rainbow Trout captured in the Big Hole Section of the Thompson River.

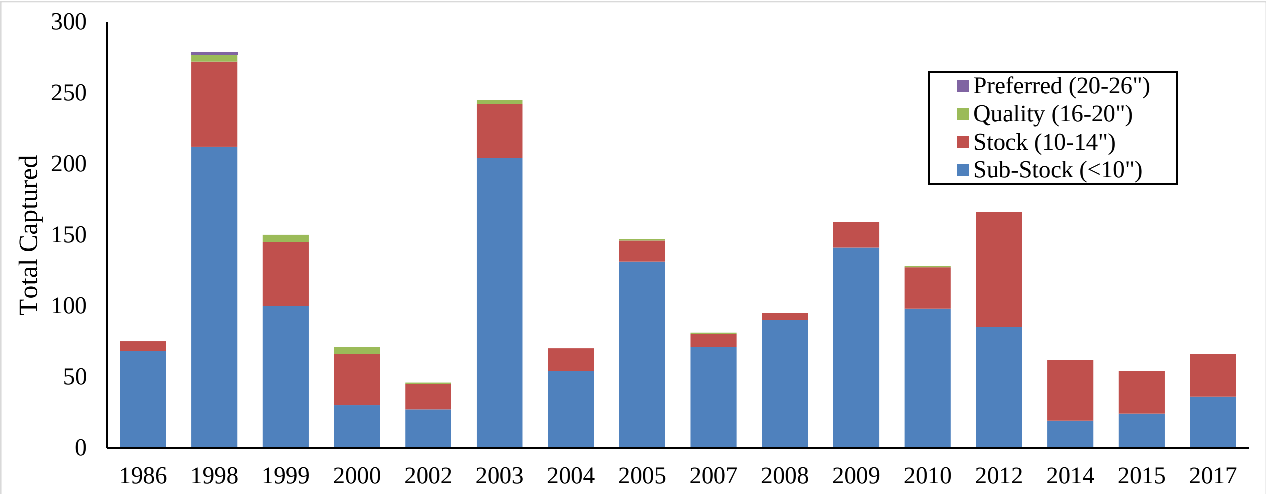

FIGURE 9. Proportional stock densities of Rainbow Trout captured in the 19-Mile Section of the Thompson River.

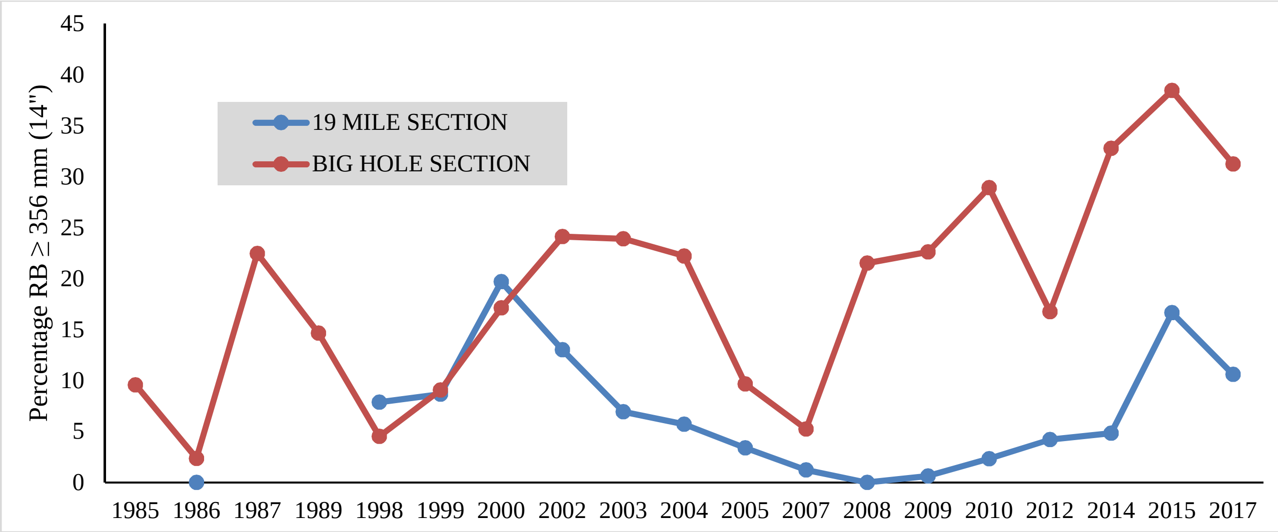

FIGURE 10. Percentage of Rainbow Trout greater than 356 mm (14”) in two sections of the Thompson River.

Median relative weight (W_r) of Thompson River Rainbow Trout has fluctuated slightly over time with no distinct trend. Overall, W_r is currently in the mid to upper-nineties which is similar to the 1980s. However, Rainbow Trout W_r decreases with increasing length which may indicate that food is limited for larger Rainbow Trout in the Thompson River (FIGURE 11). For example, in both sampling sections, sub-stock Rainbow Trout had greater relative weight than stock fish, which had greater W_r than quality fish (FIGURE 11; FIGURE 12). This may be related to the apparent rarity of quality Rainbow Trout in the Thompson River, and could indicate the necessity of migratory fish to fill in size structure of Rainbow Trout in the Thompson River.

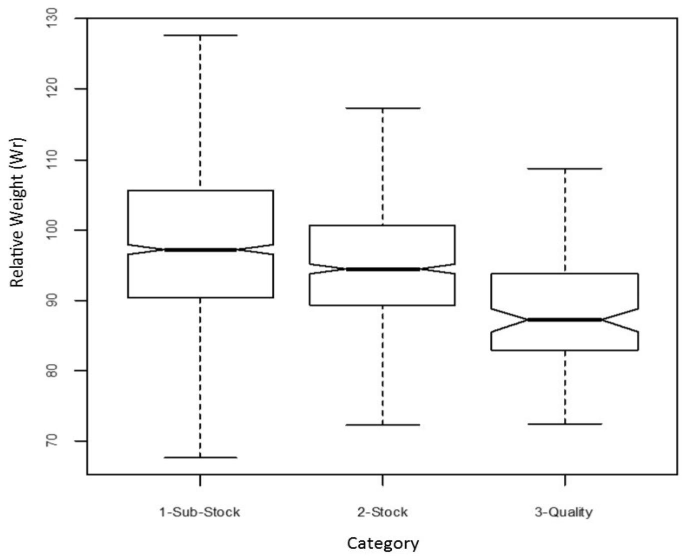

FIGURE 11. Relative weight of Rainbow Trout by sizeclass in the Big Hole section of the Thompson River. Values displayed are maximum, minimum, median, 25% and 75% quartiles. Notches indicate a 95% confidence interval of the median value.

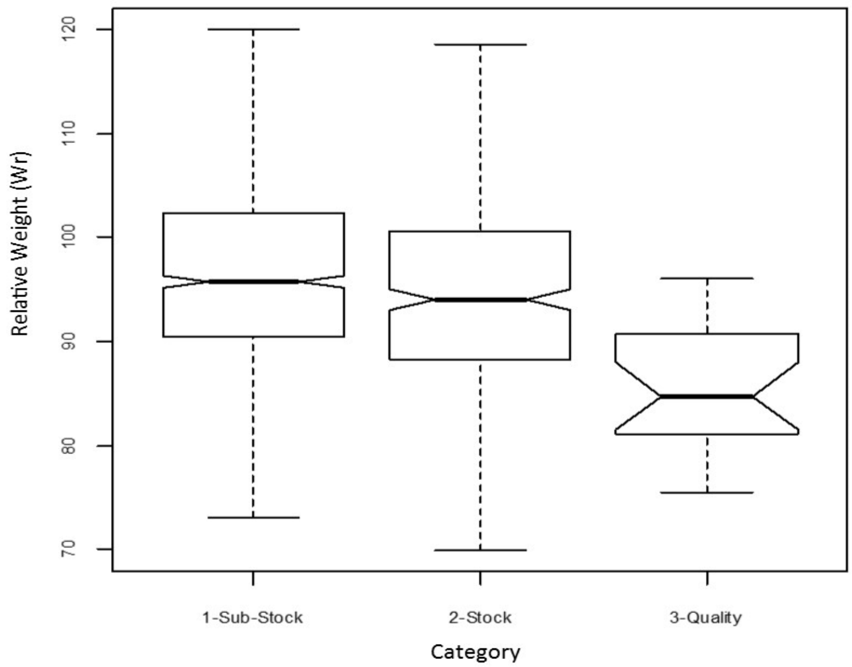

FIGURE 12. Relative weight of Rainbow Trout by sizeclass in the 19 Mile section of the Thompson River. Values displayed are maximum, minimum, median , 25% and 75% quartile. Notches indicate a 95% confidence interval of the median value.

Brown Trout— Since 2005, capture efficiency of Brown Trout in the Big Hole Section has ranged from 0.09–0.31 (mean: 0.15). Mark-recapture estimates for fish greater than 150 mm have ranged from 0–600 fish/mile from 2000–2012. In the most recent sampling events (2014 and 2015), MR estimates and CE estimates indicate the current population is between 250–450 fish/mile, although confidence intervals are wide.

Capture efficiencies for Brown Trout in the 19-Mile section have ranged from 0.12–0.32 (mean: 0.22). Mark-recapture estimates indicate that between 2003 and 2015, Brown Trout greater than 150 mm ranged from 200–800 fish/mile. Most recently, both methods indicate that there are approximately 400 stock or better Brown Trout per mile in the 19 Mile section.

Capture efficiency of Brown Trout in the Big Rock Creek section was 0.28–0.29 in both years sampled (2013 and 2016). Mark-recapture estimates were similar between years (430–480 fish/mile). However, the number of fish captured in 2013 was nearly twice that of 2016. This was likely due to the reduced effectiveness of electrofishing caused by two recently-built beaver dams which inundated approximately 1/3 of the section in 2016.

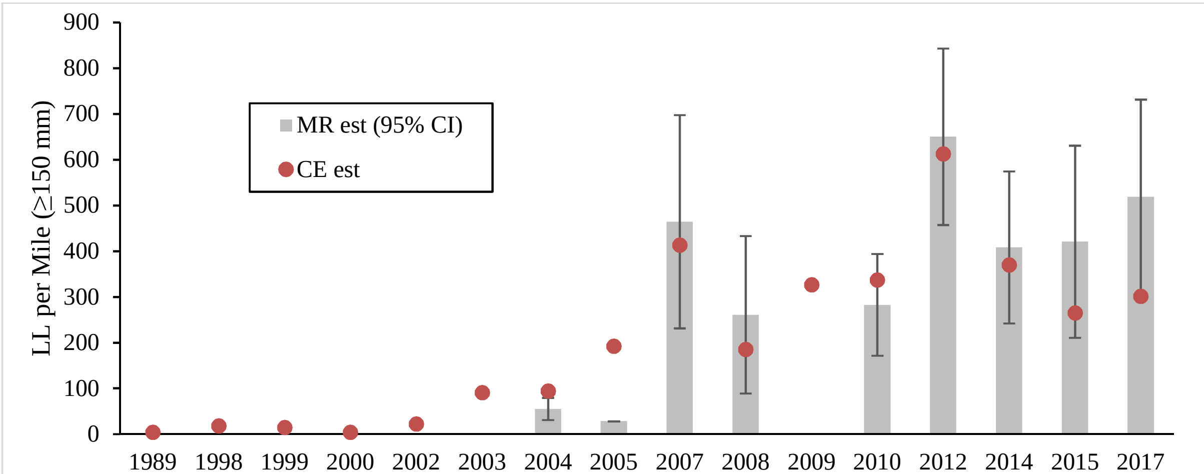

FIGURE 13. Standardized (per mile) population estimates of Brown Trout (≥150mm) in the Big Hole section of the Thompson River.

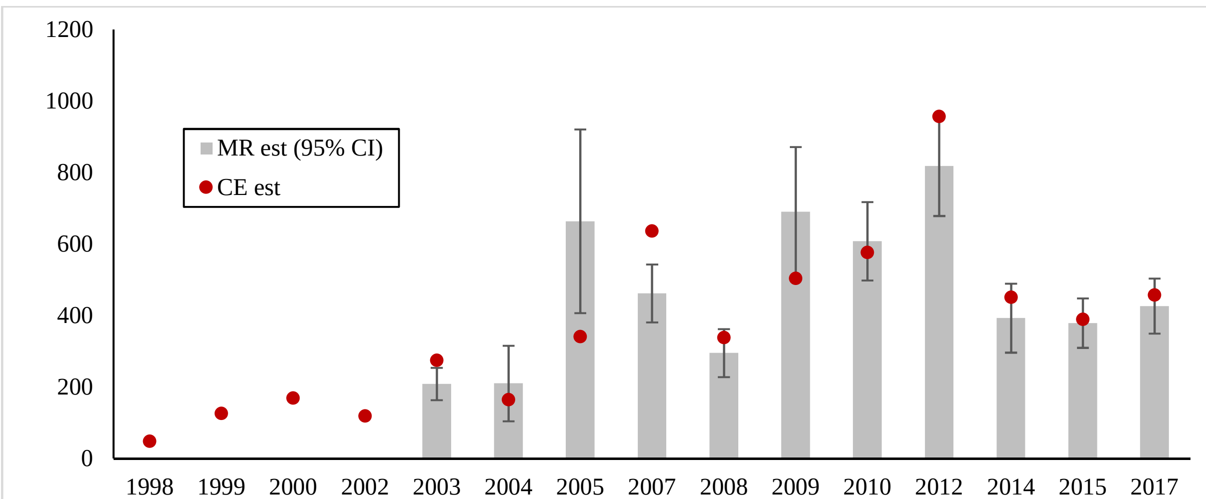

FIGURE 14. Standardized (per mile) population estimates of Brown Trout (≥150mm) in the 19 Mile section of the Thompson River.

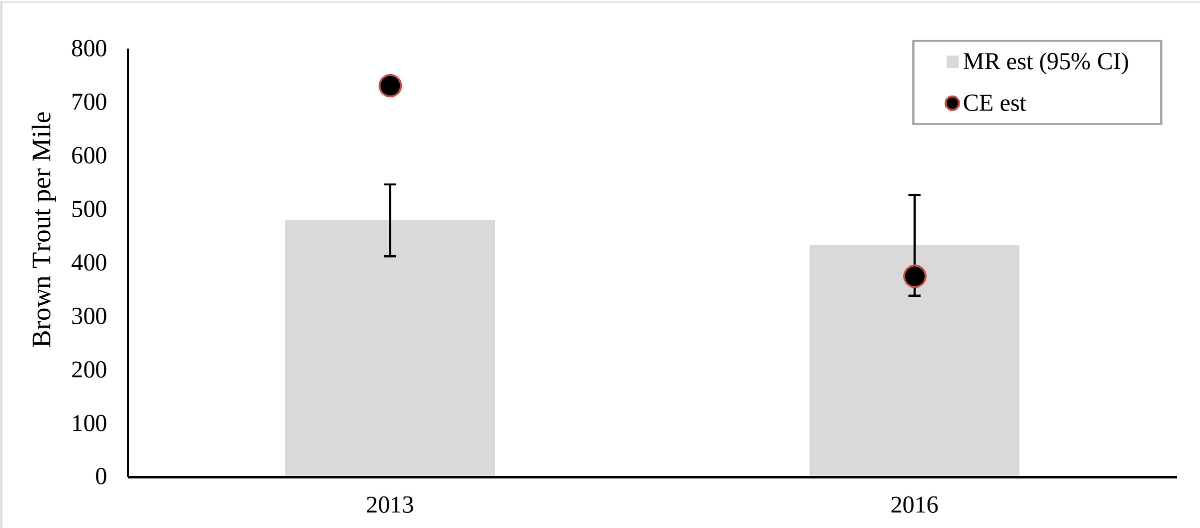

FIGURE 15. Standardized (per mile) population estimates of Brown Trout (≥150mm) in the Big Rock Creek section of the Thompson River.

Based on capture abundance in all sections, Brown Trout are currently the most common trout species in the three Thompson River monitoring sections (FIGURES 5-7). While species composition is more evenly split between Rainbow and Brown Trout in the Big Hole section (our trend section for the lower river), Brown Trout currently comprise 84–95% of trout in both upper sections, which is representative of the uppermost 50 rkm.

Numbers of preferred Brown Trout were greatest in 2012 and 2014 (FIGURE 16). Our most recent sampling results were comparable to numbers sampled in 2007–2009. Brown Trout which exceed 400 mm in length were rare during all sampling events in the Thompson River, similar to Rainbow Trout.

In the 19 Mile section, abundance of Brown Trout increased until 2012, and the proportion of quality fish was highest in that year (FIGURE 17). However, the proportion of fish greater than 356 mm decreased from a high near 50% in 2002. Between 2005–2015, proportion of Brown Trout greater than 356 mm ranged from 4–13% (FIGURE 18). In 2015, the number of preferred Brown Trout sampled in the 19 Mile section was lower (38–45% of the 2012 and 2014 total.) The proportion of stock or better Brown Trout (12”+) was at 53% in the Big Rock Creek section in 2013, but only 38% by 2016.

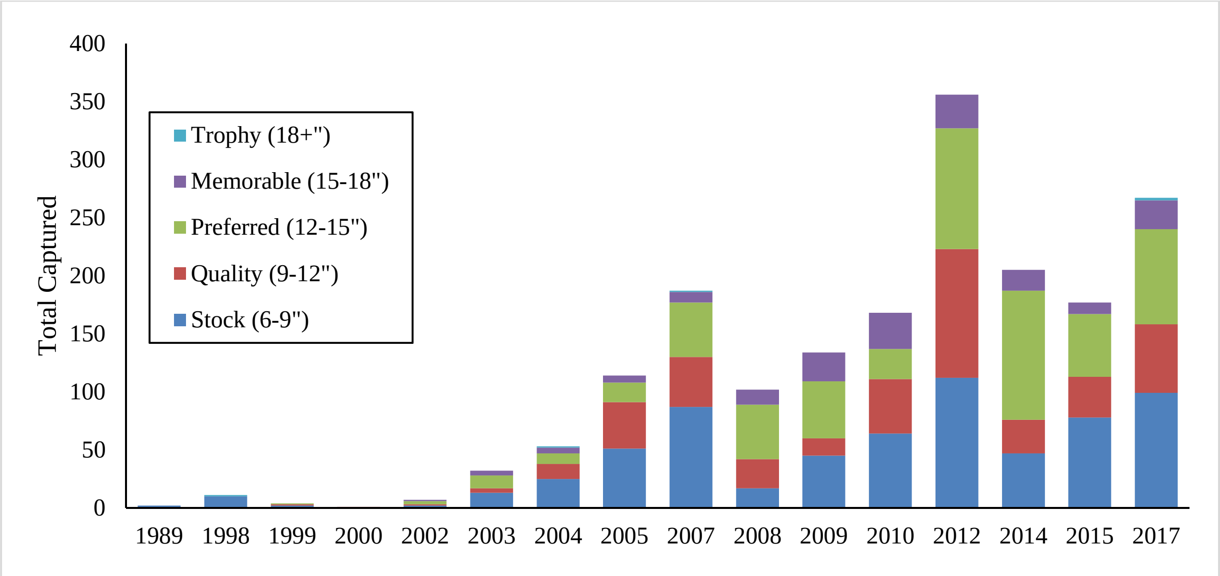

FIGURE 16. Proportional Stock Densities (PSD) of Brown Trout in the Big Hole Section of the Thompson River.

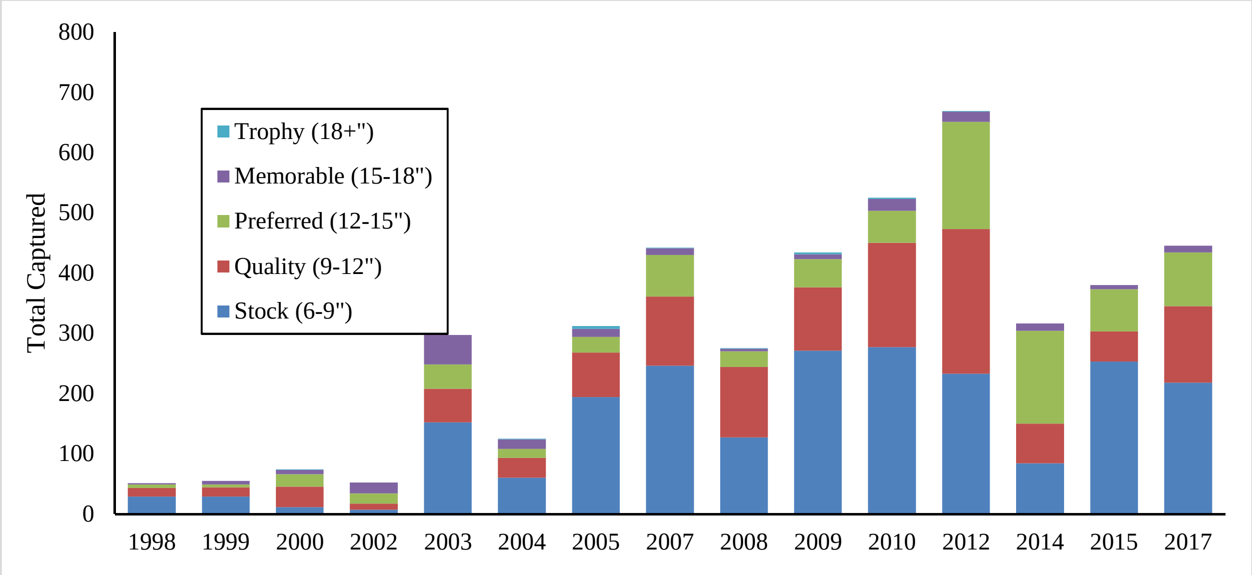

FIGURE 17. Proportion Stock Densities (PSD) of Brown Trout in the 19 Mile Section of the Thompson River.

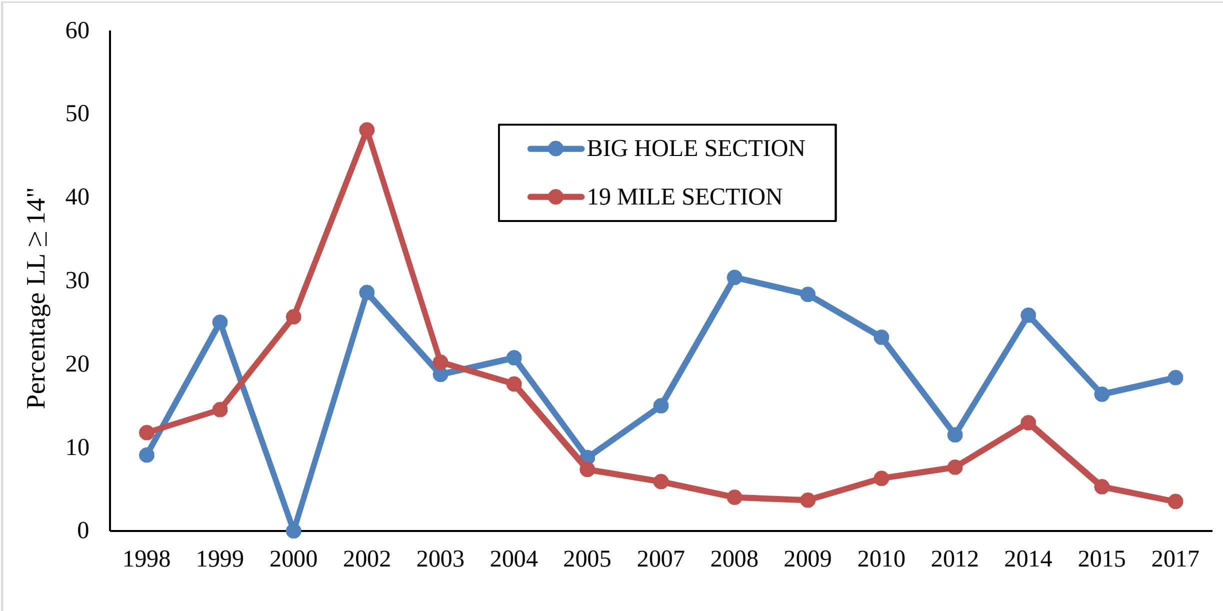

FIGURE 18. Percentage of Brown Trout greater than 356 mm (14") in two sections of the Thompson River.

Overall, median relative weight of Thompson River Brown Trout has increased since 2005 and is currently in the mid-90s in the Big Hole and 19 Mile sections (FIGURES 19 & 20). In the Big Rock Creek section, median relative weight of Brown Trout was similar between years and was in the low-nineties. There was less of a decrease in W_r associated with increased length in Brown Trout than in Rainbow Trout, however Brown Trout in the preferred and quality categories tended to have slightly higher median Wr than stock or memorable fish.

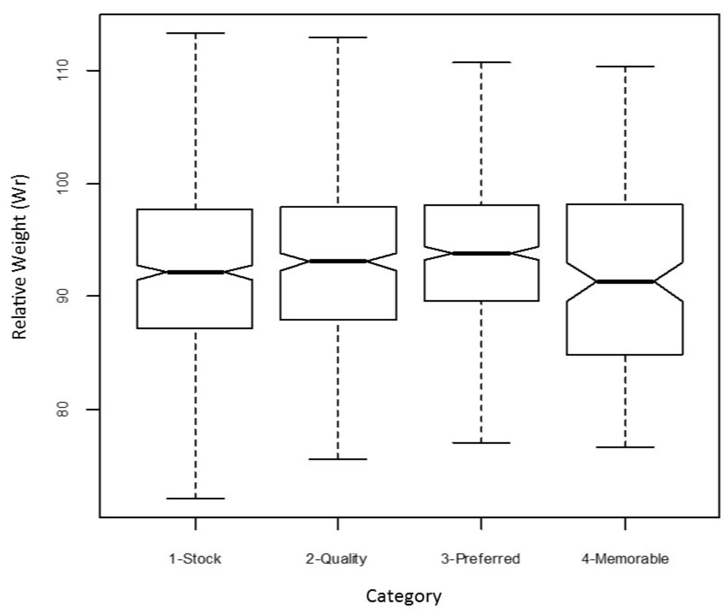

FIGURE 19. Relative weight of Brown Trout by sizeclass in the Big Hole section of the Thompson River. Values displayed are median value, 25% quartile, and 75% quartile. Notches indicate a 95% confidence interval of the median value.

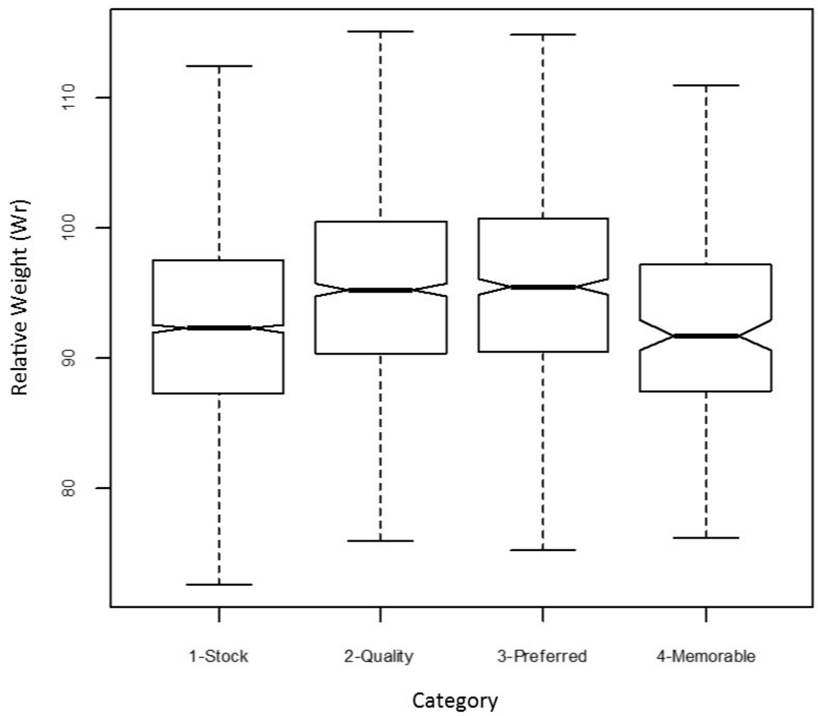

FIGURE 20. Relative weight of Brown Trout by sizeclass in the 19 Mile section of the Thompson River. Values displayed are median value, 25% quartile, and 75% quartile. Notches indicate a 95% confidence interval of the median value.

Bull Trout— Bull Trout have been less frequently sampled than Rainbow or Brown Trout in the Thompson River since the 1980s. Because of low numbers of marked fish, recaptures were rare and estimates could not be generated in nearly all years of sampling. In general, Bull Trout were more commonly sampled in the Big Hole section than in the 19 Mile section (FIGURE 21).

Since 1985, approximately 185 Bull Trout have been sampled during mainstem electrofishing efforts in the Big Hole Section. Mean length of these fish was 228 mm and varied from 97–775 mm. This number does not include the recapture of seven previously marked Bull Trout from subsequent runs. The most Bull Trout captured in one year occurred in 1986 when 36 were captured. In the 19 Mile section, less Bull Trout have been encountered. Since 1986, 25 Bull Trout have been sampled during mainstem electrofishing surveys with a mean length of 219 mm. Again, the most Bull Trout sampled in one year occurred in 1986 when seven were captured.

Overall, C/*f* of Bull Trout captured on the first pass has decreased since the 1980s (FIGURE 22), although higher catches were recorded in 2003 and 2005 in the Big Hole section (FIGURE 22).

Total catch of Bull Trout on the first pass has been low since 2007 (range: 2-4). However, nine individual Bull Trout were captured on four sampling runs in the Big Hole section in 2015.

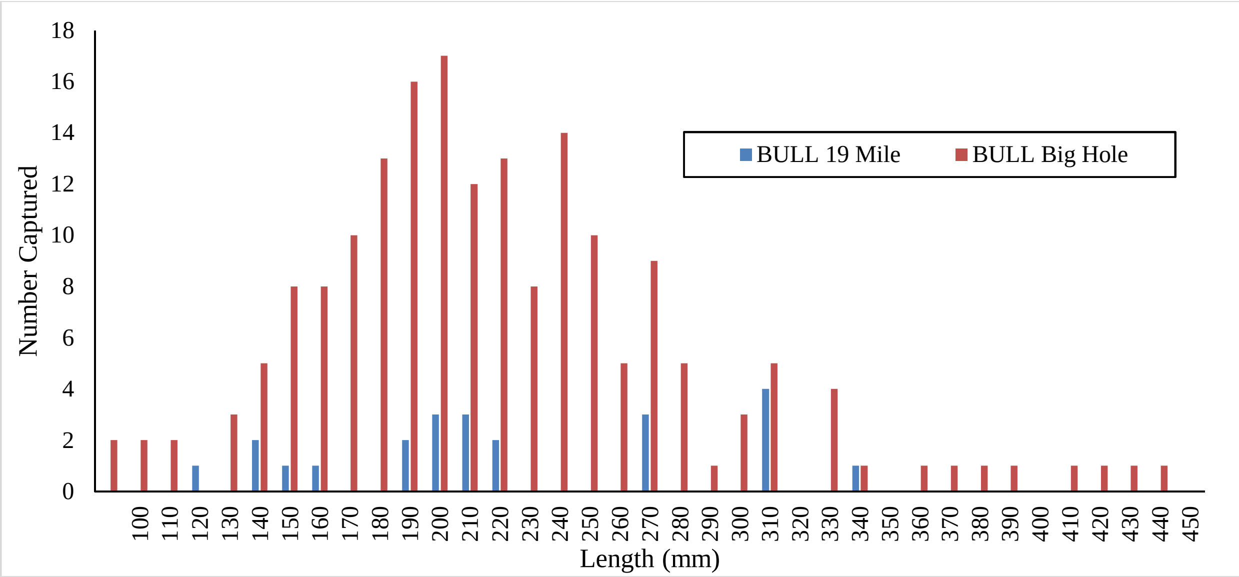

FIGURE 21. Length frequency distribution of Bull Trout captured since 1985 in two mainstem Thompson River electrofishing sections (excludes five fish captured which were greater than 450 mm).

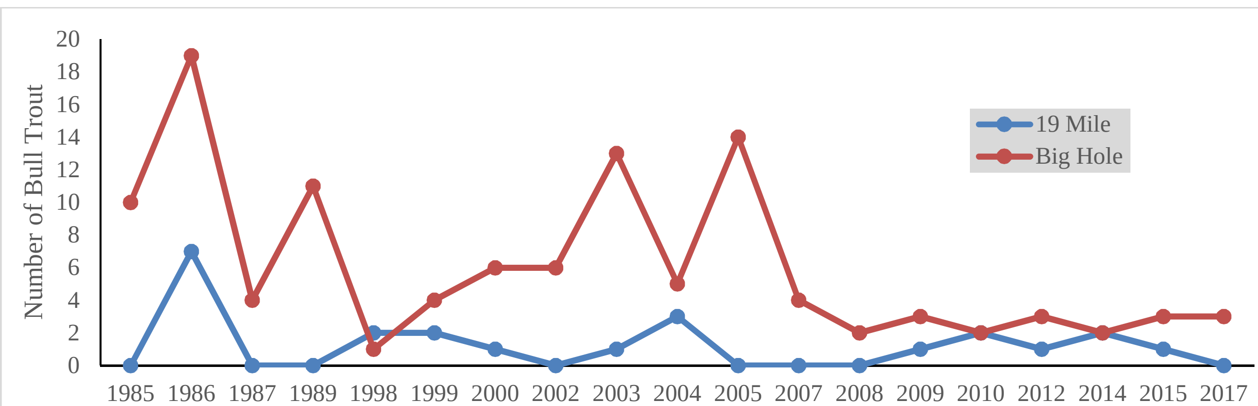

FIGURE 22. Catch per unit effort of Bull Trout captured on first pass in the Thompson River.

Westslope Cutthroat Trout— Westslope Cutthroat Trout have not been captured in high abundance during mainstem sampling since the 1980s. In fact, only 54 phenotypically identified Westslope Cutthroat Trout have been sampled in the two long-term sections since 1985. Mean length of these fish was 237 mm with a range of 108-384 mm (FIGURE 23). Approximately 2/3 of these fish have come from the Big Hole Section.

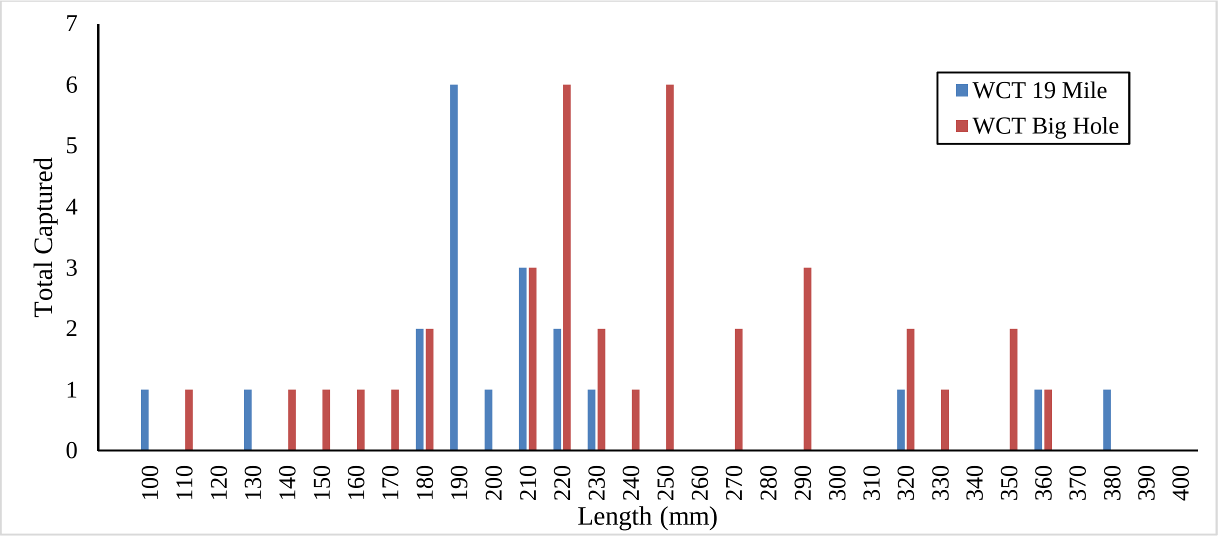

FIGURE 23. Length frequency distribution of Westslope Cutthroat Trout captured since 1985 in two mainstem Thompson River electrofishing sections.

Catch per unit effort of WCT in the mainstem Thompson River has increased recently but was low in 2017 (FIGURE 24). Only one WCT was captured on a recapture run in the 19-Mile section.

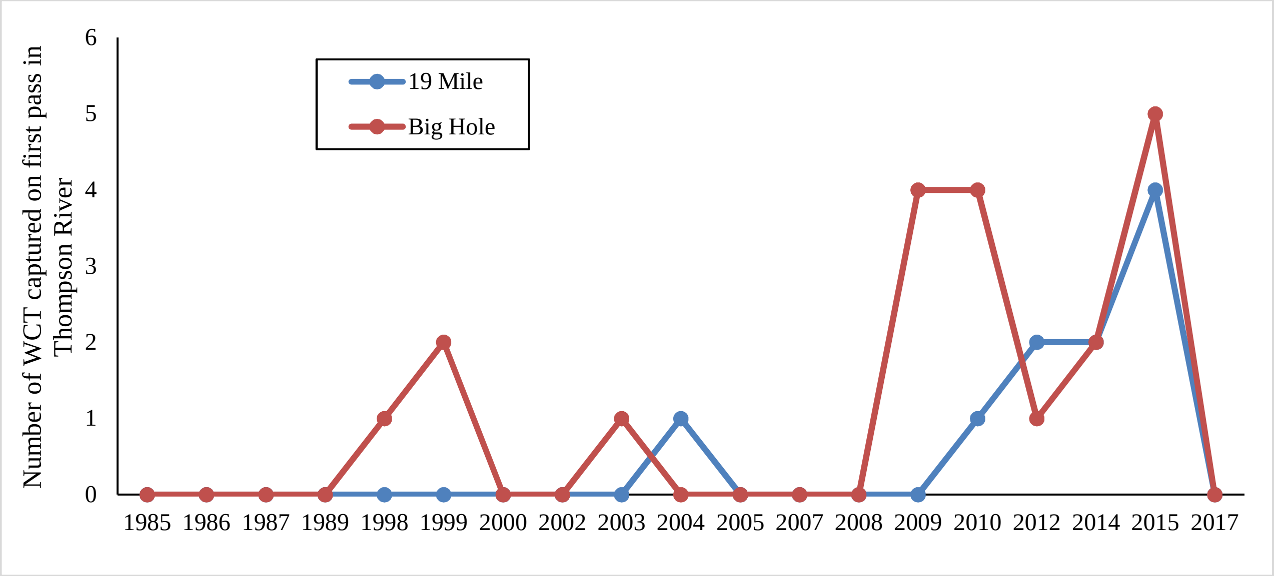

FIGURE 24. Catch per unit effort of Westslope Cutthroat Trout captured on first pass in the Thompson River.

Brook Trout— Based on sampling data since the 1980s, Brook Trout have not been a dominant species in the mainstem Thompson River. However, they were more common in the 1980s, prior to the establishment of Brown Trout. They have also been more common in the upper river. In the 1980s, Brook Trout comprised approximately 38% of the trout in the 19-Mile section, and only about 7% of the trout in the Big Hole section. Currently they make up less than 1% of the trout species composition in both the 19-Mile and Big Hole sections.

In the Big Rock Creek section, Brook Trout were more common in 2013 than in 2016. An MR estimate of approximately 150 brook trout per mile was calculated in 2013 (n=66), but in 2016 only two Brook Trout were sampled. Overall, Brook Trout have been a small component of the trout sampled in the mainstem Thompson River.

Mountain Whitefish— Mountain Whitefish have not been consistently netted during all sampling events in the Thompson River, but are abundant throughout the mainstem. A MR estimate on the Big Hole section in 1985 estimated 306 MWF per mile (95% CI: 140-472, ≥150 mm). The following year in the 19 Mile section, an estimate of 137 MWF per mile was calculated (95% CI: 92-182, ≥150 mm). On both sampling events, the number of MWF marked was greater than the number of Rainbow Trout. In recent years, a sub-set of MWF has been netted infrequently, but trends in abundance cannot be inferred from this data.

Length data collected in the 1980s and again in 2010, revealed that size structure of Mountain Whitefish is different between the two sections, but has remained similar over the past thirty years. In the Big Hole section, mean length of sampled Mountain Whitefish in 1985 was 293 mm, while in 2010 it was 272 mm (FIGURE 25). In both years there was a considerable portion of the catch which exceeded 300 mm (>40%). In the 19-Mile section, mean length in 1986 was 240 mm compared with 242 mm in 2010 (FIGURE 26). In both years, fish exceeding 300 mm were rare (<10%). In 2013, 90 MWF were netted in the Big Rock Creek section with a mean length of 284 mm (range: 115-412mm). Based on mean length and proportions of fish greater than 300 mm, it appears that MWF are larger in the Big Rock Creek section than in the 19 Mile section.

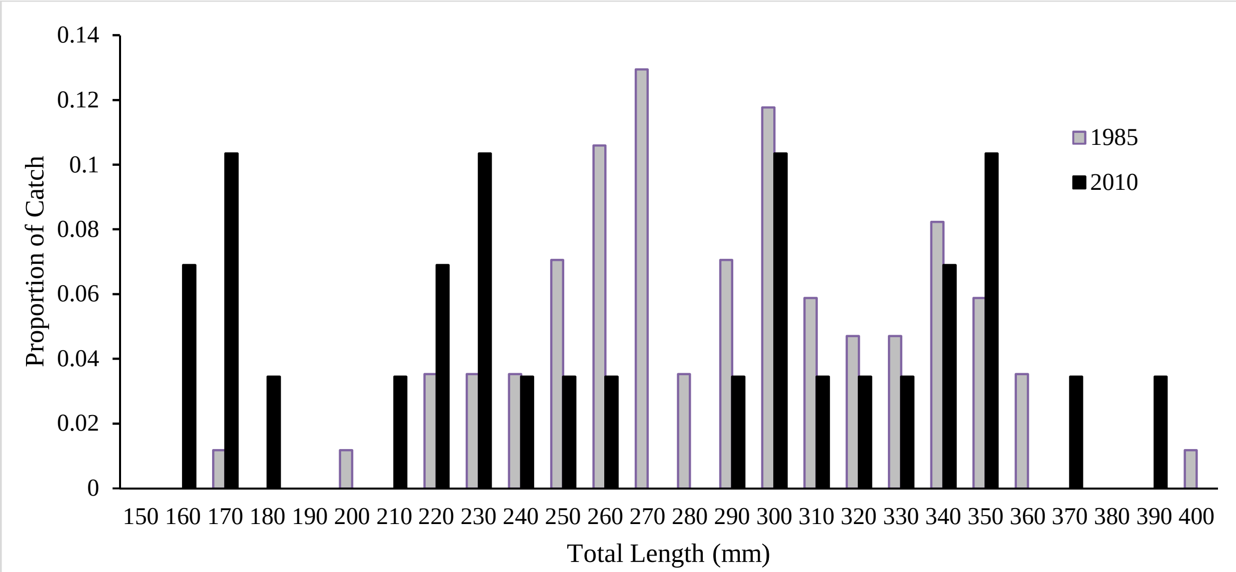

FIGURE 25. Length Frequency proportions of Mountain Whitefish in the Big Hole section of the Thompson River in 1985 and 2010.

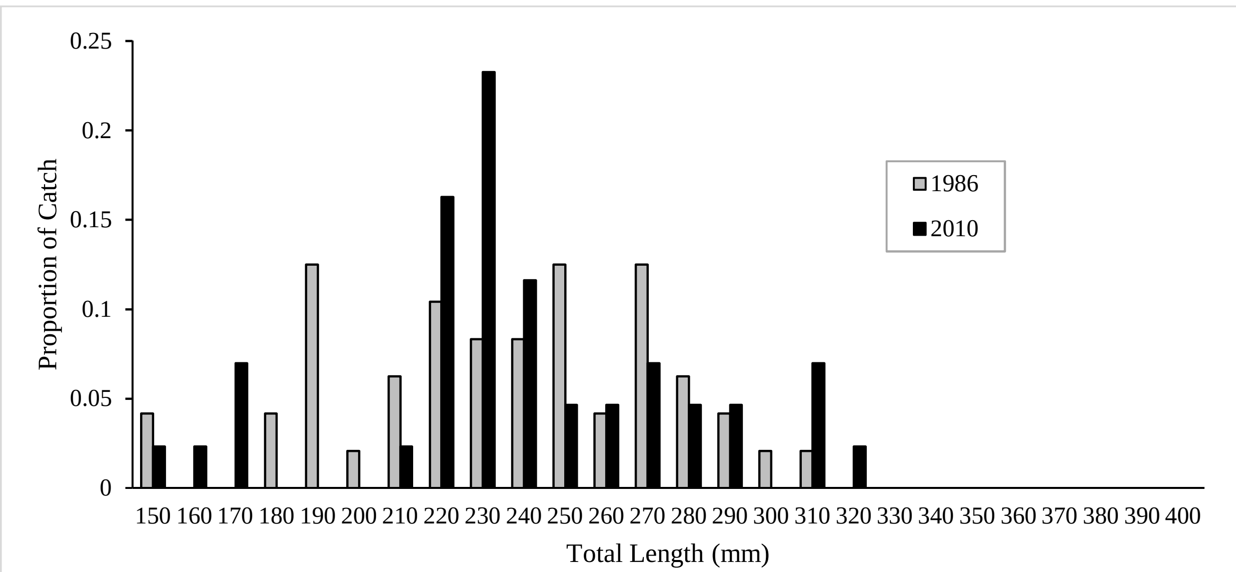

FIGURE 26. Length Frequency proportions of Mountain Whitefish in the 19 Mile section of the Thompson River in 1985 and 2010.

Discussion

Between 1933 and 1982, over 75,000 Rainbow Trout were stocked into the Thompson River. Likely due to these stocking events, Rainbow Trout were the dominant trout species in the Thompson River in the 1980's and 1990's and were frequently captured by anglers dating back to the 1940's. At some point near 2000, their numbers appear to have declined in both long-term sections. The extremely low catches of Rainbow Trout during *C/f* sampling events in 2000 and 2002 were likely an indication of the lowest populations in recent history. In the Big Hole section, they have rebounded to similar numbers, while in the 19 Mile section, their numbers remained low. The winter closure placed on the upper river in 2000 was intended to protect spawning Rainbow Trout, but at this point is currently preventing anglers from catching Brown Trout. Because this regulation is not serving its intended purpose of protecting and strengthening Rainbow Trout populations, it is recommended that it be removed. Because of the time of year when sampling is conducted on the Thompson River (late-spring/early-summer), it is possible that Rainbow Trout which are marked on the initial runs may leave the section prior to the recapture run in certain years.

Despite their apparent decrease in abundance throughout much of the upper river, size structure of Rainbow Trout in the Big Hole section has improved. Size of fish as well as proportions greater than 356 mm have increased. However, conditions in the river may prevent Rainbow Trout from reaching truly large sizes if they remain in the Thompson River. Migratory fish captured in the Thompson Falls fish ladder and subsequently detected at the mouth of the Thompson River, indicate that Clark Fork River fish are substantially larger (FIGURE 27). Decreased relative weight of larger Rainbow Trout in the Thompson River may indicate that food is limiting for larger fish. This could be due to competition caused by abundant smaller size-classes of Rainbow and Brown Trout.

Introduced Rainbow Trout may compete and hybridize with native Westslope Cutthroat Trout. Rainbow Trout have been present in the drainage for over 80 years, but anthropogenic factors such as habitat degradation and climate change may contribute to recent non-native species advancement into the tributaries (Muhlfeld et al. 2017). In the Thompson River drainage, hybrids have been observed in several key tributaries, and have recently been identified in previously unoccupied areas of the Fishtrap Creek drainage (Painter 2017). Additionally, tributary PIT arrays installed in 2015 on the West Fork Thompson River and Fishtrap Creek have documented Rainbow Trout from the Thompson Falls fish ladder.

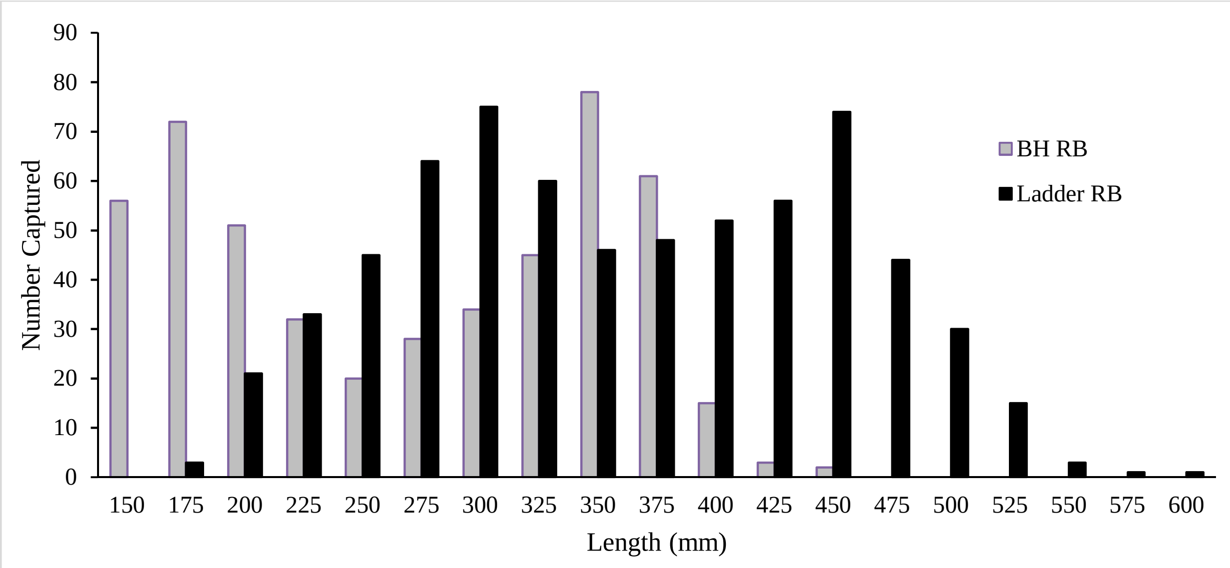

FIGURE 27. Length frequency distributions of Rainbow Trout sampled during the years 2012, 2013, and 2015 from the Big Hole section of the Thompson River and at the Thompson Falls fish ladder. It is estimated that 40% of trout which use the fishway eventually enter the Thompson River.

A single Brown Trout was detected in the lower Thompson River in 1979. However, it was not until 80,000 Brown Trout were stocked into the Thompson River in 1988-89 that their populations began to increase dramatically. Based on sampling data, they appeared to colonize more quickly in the upper river and are now the dominant trout species in that section of river.

Size structure of Brown Trout differs between sections and from that of Rainbow Trout. In the Big Hole section, the proportion of fish greater than 356 mm has ranged from 0–30% and is currently at 18%. In the 19 Mile section, proportions of Brown Trout greater than 356 mm has been low since 2005 and is currently at 3.5%. The proportion greater than 356 mm was 14% in the Big Rock Creek section for both years sampled. Despite a much lower volume of water in the upper river (above Little Thompson River), densities of Brown Trout are high (approximately 400 fish per mile in both sections.) It is likely that increased harvest (and winter fishing pressure) would benefit the size structure and allow the river to produce larger fish.

Similar to Rainbow Trout, mean length of Brown Trout captured at the Thompson Falls fish ladder is larger than mean length observed in the Thompson River (FIGURE 28). Since a PIT array was installed in 2015, approximately 40% of ladder-tagged trout have been documented to enter the Thompson River. This supports the assumption that larger trout in the Thompson River are primarily migratory.

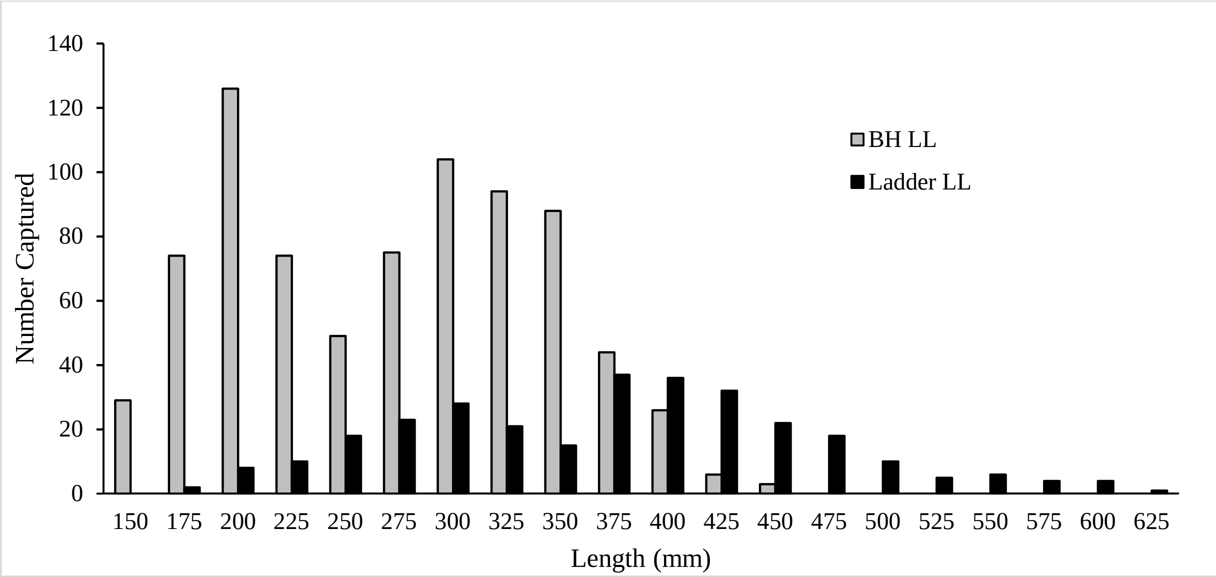

FIGURE 28. Length frequency distributions of Brown Trout sampled during the years 2012, 2013, and 2015 from the Big Hole section of the Thompson River (BH LL) and at the Thompson Falls fish ladder (Ladder LL). It is estimated that 30-40% of trout which use the fishway eventually enter the Thompson River.

Currently, the upper river is closed to fishing from December 1 through the third Saturday in May. This regulation has effectively protected Brown Trout from angling for six months out of the year. Removing this regulation would simplify the regulations and allow anglers a chance to fish the upper river in the winter and spring. In some years, the salmonfly *Pteronarcys californica* hatch has run its course prior to the third Saturday in May and opening the river year-round would allow anglers access to this hatch. It may also disperse early-season angling pressure from the lower river.

Bull Trout exist in the mainstem Thompson River as well as three tributary systems in the drainage. The life history expression varies from resident to migratory (fluvial/adfluvial) (Huston 1994). Based on research conducted on the outmigration of Bull Trout in the West Fork Thompson and Fishtrap Creek, downstream moving juvenile Bull Trout are not immediately destined to exit the mainstem Thompson River. Currently, only about 20% of the Bull Trout documented to leave those tributaries have also left the mainstem. The other 80% are believed to reside in the Thompson River or are mortalities. Length distributions of all Bull Trout sampled in the mainstem since the 1980s indicates a larger size than those documented leaving the tributaries in 2000-2002 and 2014-2015. This supports the finding that fish spend at least one or two years in the Thompson River before either leaving the system or returning to a tributary. Several more years of PIT tag array maintenance in the tributaries may provide insight into the survival rates and life histories of Bull Trout which have emigrated from Thompson River tributaries.

In 2015, weir traps were operated in the lower kilometer of West Fork Thompson River and Fishtrap Creek to capture and tag outmigrating Bull Trout. In Fishtrap Creek, 95 juvenile Bull Trout were captured moving downstream with an average length of 165 mm, while 47 were captured exiting West Fork Thompson River with an average length of 171 mm. The larger mean length of Bull Trout captured during mainstem electrofishing corroborates findings from the outmigration study (Glaid 2017) which showed either delayed emigration from the mainstem Thompson River or no emigration at all.

Based on limited data collected through radio telemetry on outmigrating Bull Trout in 2015, several observations warrant further discussion (Glaid 2017). First, likely based on a lack of complex habitat, several areas of the Thompson River were observed to have been avoided by outmigrating Bull Trout. This includes the lowest mainstem sampling site (i.e., the Big Hole Section). Bull Trout appeared to select for areas up- and downstream of this site, but densities or relative abundances elsewhere are unknown due to a lack of sampling. Because of the deep pools which exist in the lower river, electrofishing would be inefficient. Other techniques such as snorkeling could be employed to verify presence/absence of native Bull Trout. In the future, quantitative habitat surveys may be conducted to determine any potential correlations to specific habitat types based on the movement of radio-tagged Bull Trout from 2015.

Another result showed disproportionally higher numbers of Bull Trout in mink *Neovision vision* dens than other trout species which are more common in the Thompson River. Glaid (2017) found that mink killed 29% of his radio-tagged fish, and subsequent searches of mink dens found that non-radio-tagged Bull Trout were the most abundant species present (72%) despite only comprising approximately 1-5% of the total trout population in the Thompson River. Brown Trout were entirely absent, and Rainbow Trout comprised 18% of trout observed in mink dens. Although Bull Trout and mink have evolved together, anthropogenic reductions in habitat complexity may reduce a Bull Trout's ability to escape predation. For example, if Bull Trout evolved to escape predation by hiding in logjams, the lack of large wood in the Thompson River may lead to higher exploitation by predators. Lindstrom and Hubert (2004) documented higher mink predation on Brook Trout than Cutthroat Trout in a stream which lacked large woody debris in the winter, even though both species evolved with mink.

Although Bull Trout likely exist at higher densities in other areas of the Thompson River, C/*f* within the Big Hole section may be a useful index of relative abundance since they have been captured nearly every year this site has been sampled. Relative abundance at this site was highest in 1986, but larger catches were also recorded in 2003 and 2005. The most notable change which has occurred since the 1980s was the introduction and subsequent increase of Brown Trout. Brown and Bull Trout interactions in the Thompson River are unknown, but these species overlap, and competition is likely high.

The construction of two roads directly within the riparian corridor has dramatically impacted habitat complexity and quality through the elimination of a floodplain, loss of riparian vegetation, and reduced large woody debris recruitment. These factors have negatively impacted the potential of the Thompson River. The impacts are more severe on the lower river, where the two roads are rarely more than 100 meters from the stream at any given location. Because recent research has shown that Bull Trout do use the lower mainstem Thompson River for extended periods of time, extensive mainstem restoration should be considered. Complete removal of an existing road and subsequent rehabilitation of flood plain and vegetation would be costly and socially controversial but must be considered for Bull Trout recovery goals and to benefit the sport fishery.

Despite being present, and often common, in nearly every tributary to the Thompson River, Westslope Cutthroat Trout are rare in the mainstem. Similar to Bull Trout, Cutthroat Trout abundance is believed to be higher in the lower 11 rkm of the Thompson River where electrofishing does not occur (below West Fork Thompson River.) In this section of river, the water is colder, and anglers report catching more Westslope Cutthroat Trout.

The introduction and subsequent increase of Rainbow Trout in the mainstem Thompson River for the past 80 years has certainly affected the Westslope Cutthroat Trout fishery. Genetic samples collected by Joe Huston in 1993 documented some hybridization between Rainbow Trout and Westslope Cutthroat Trout in the lower portions of West Fork Thompson River and Fishtrap Creek (Leary 1993). Samples collected in 2016 detected low levels of hybridization at locations further upstream than the 1993 study (Painter 2017; Appendix C).

Barrier construction is a common conservation action which can protect resident WCT populations from non-native fish which may compete or hybridize with them (Novinger and Rahell 2003). However, barriers are not a viable option if a migratory life history of a desirable species is present. Because Bull Trout are present in West Fork Thompson River and lower Fishtrap Creek, barrier construction is precluded. In mainstem Fishtrap creek, a potential natural barrier near rkm 23 may protect Westslope Cutthroat Trout upstream (genetic analysis is pending). If so, there are approximately 11 rkm of protected stream occupied by pure WCT in upper Fishtrap Creek and the Mantrap Fork of Fishtrap Creek. In some streams, barrier construction could be considered to protect existing Westslope Cutthroat Trout populations or could be combined with non-native species removals. A stream such as Big Rock Creek which is believed to contain resident Bull Trout could be considered for barrier construction, however Brown Trout and Rainbow Trout × Cutthroat Trout hybrids already exist above a series of bedrock slides near the lower end of the creek. Further research into the life histories of Bull and Westslope Cutthroat Trout there would be required prior to any action, but it is likely the waterfall could be modified to become a barrier.

In the Thompson River drainage, past stocking of Yellowstone Cutthroat Trout also threatened Westslope Cutthroat Trout. For example, Cabin Lake, Fishtrap Lakes, and Terrace Lake were all previously stocked with Yellowstone Cutthroat Trout. However, analysis conducted in 2016 revealed that hybridization levels (YCTxWCT) in Fishtrap Lakes and Radio Creek were 1% or less (range: 0.42-1.00%; Painter 2017; Appendix C). Historic analysis in upper West Fork Thompson River and Four Lakes Creek revealed no hybridization with Yellowstone Cutthroat Trout.

Non-native Brook Trout are a documented threat to Bull Trout and Westslope Cutthroat Trout in many western streams where the species currently overlap (Leary et al. 1993, Petersen et al. 2004). Brook Trout may out-compete both species for food and habitat and can hybridize with Bull Trout. As mentioned previously, Brook Trout are not common in the mainstem Thompson River, but are abundant in certain tributaries. Brook Trout appear to be more common in degraded tributaries such as the Little Thompson River and McGregor Creek. In colder tributaries such as West Fork Thompson River and Fishtrap Creek, low densities of Brook Trout are present in the lower sections of stream. However, no physical barrier prevents Brook Trout from ascending to upper Fishtrap Creek. Upper Fishtrap Creek is warmer, lower in velocity, and has abundant beaver dams, all of which may be favorable for Brook Trout. Although only anecdotal evidence exists, the introduction of Brown Trout into the mainstem Thompson River may have reduced Brook Trout densities. Replacement of Brook Trout by Brown Trout is common in the eastern United States (Fausch and White 1981).

Mountain Whitefish are an abundant native salmonid which exists throughout the mainstem Thompson River and in low densities within Fishtrap Creek. Whitefish provide some value as a sportfish, and provide an important food source to piscivorous trout, birds, and mammals. Based on length analysis between Mountain Whitefish captured in the 19-Mile and Big Hole section in the 1980s and 2010, size structure has remained similar for thirty years, with bigger fish occurring in the lower river.

Migratory patterns and life history characteristics of Thompson River Mountain Whitefish are unknown. Mountain Whitefish have been captured in the Thompson Falls fish ladder sporadically since it began operation in 2011. Of these fish, a small sample size (n = 54) has been PIT tagged in concert with the operation of the PIT tag array at the mouth of the Thompson River. Since 2014, only one (1.9%) tagged whitefish has been documented to move between the Clark Fork River and the Thompson River. Whitefish are abundant in the Clark Fork and Thompson Rivers, so it is likely that migration between the two rivers is common. Because of the availability of three PIT tag arrays in the Thompson River, tagging a number of whitefish during routine sampling could answer some basic questions about movement and tributary use.

MAINSTEM TEMPERATURE MONITORING

Temperature Loggers (thermographs) have been deployed at specific locations in the Thompson River with varying frequency from 1997–2016. We have compiled all collected data from select locations from the Thompson River USGS gauge site at river mile 1, to a location above Big Rock Creek near river mile 33. The selected locations provide a longitudinal cross-section of temperatures within the river over that period. Additional temperature monitoring has been conducted by private timber companies in the Thompson River (currently Weyerhauser) and will be discussed later.

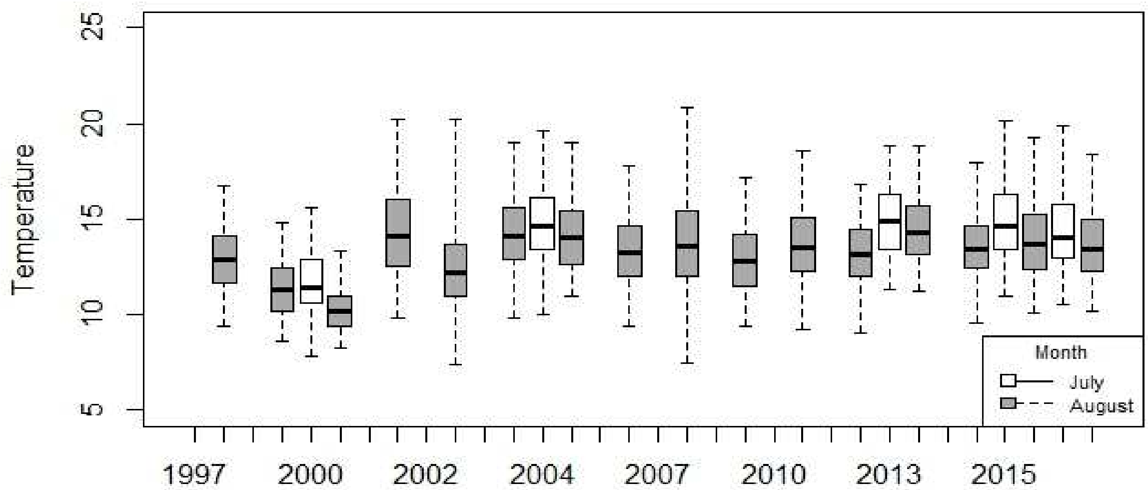

FIGURE 29. Mid-summer temperatures (degrees Celsius) at the Thompson River USGS gauge site (River Mile 1) intermittently from 1997–2016.

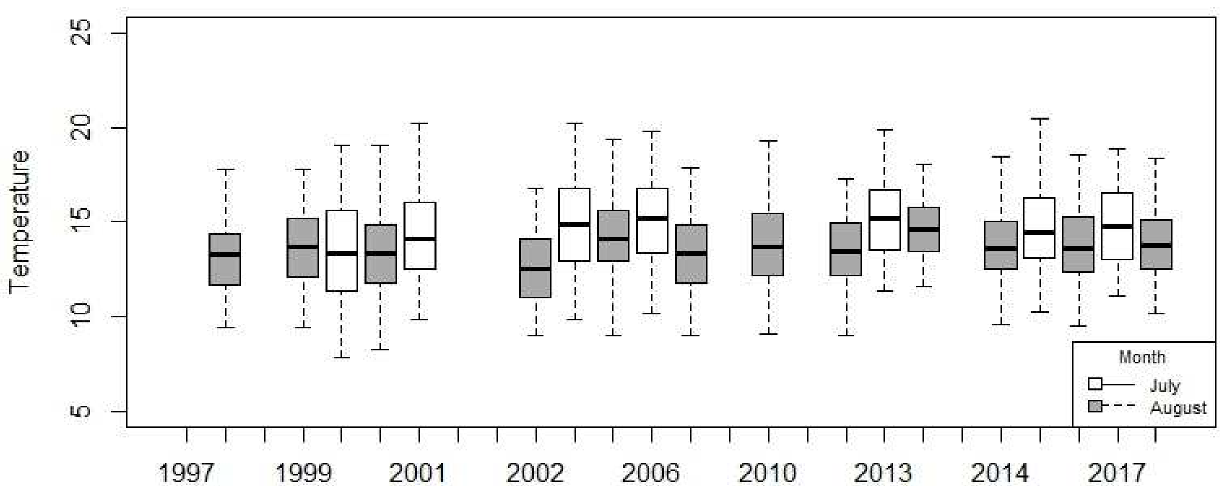

FIGURE 30. Mid-summer temperatures (degrees Celsius) in the Thompson River above the West Fork Thompson River intermittently from (River Mile 8) 1997–2017.

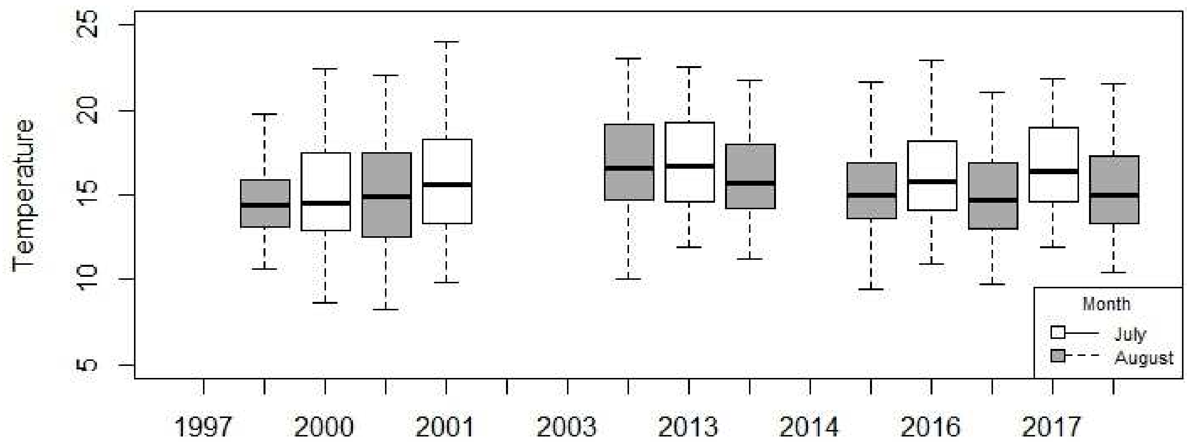

FIGURE 31. Mid-summer temperatures (degrees Celsius) in the Thompson River above Fishtrap Creek (River Mile 17) intermittently from 1997–2017.

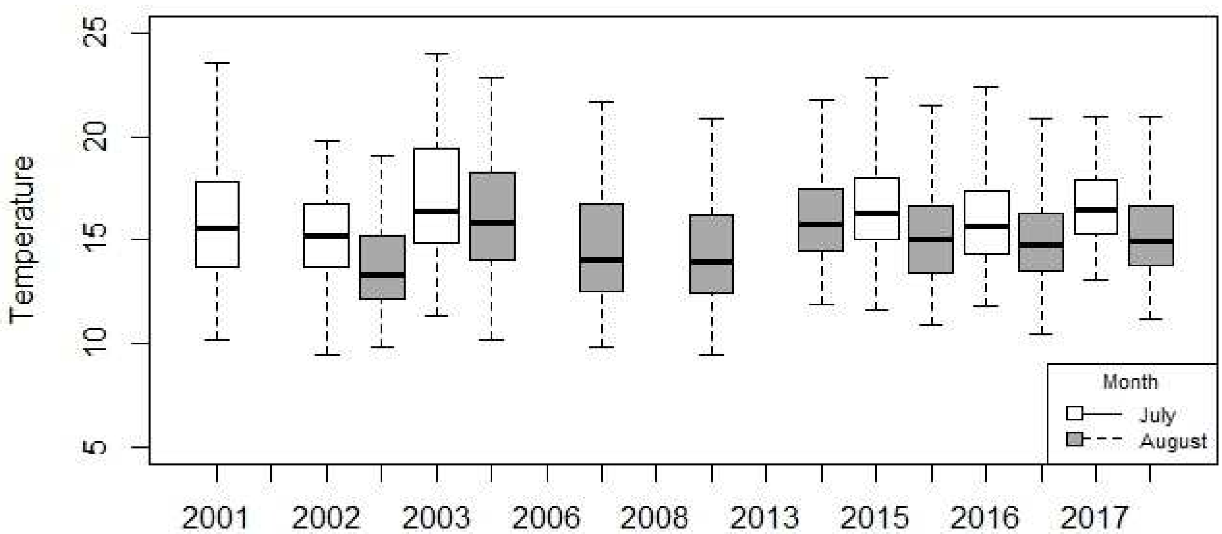

FIGURE 32. Mid-summer temperatures (degrees Celsius) in the Thompson River combined from above the Little Thompson River to the 19-mile (River Mile 19) shocking section intermittently from 2001–2017.

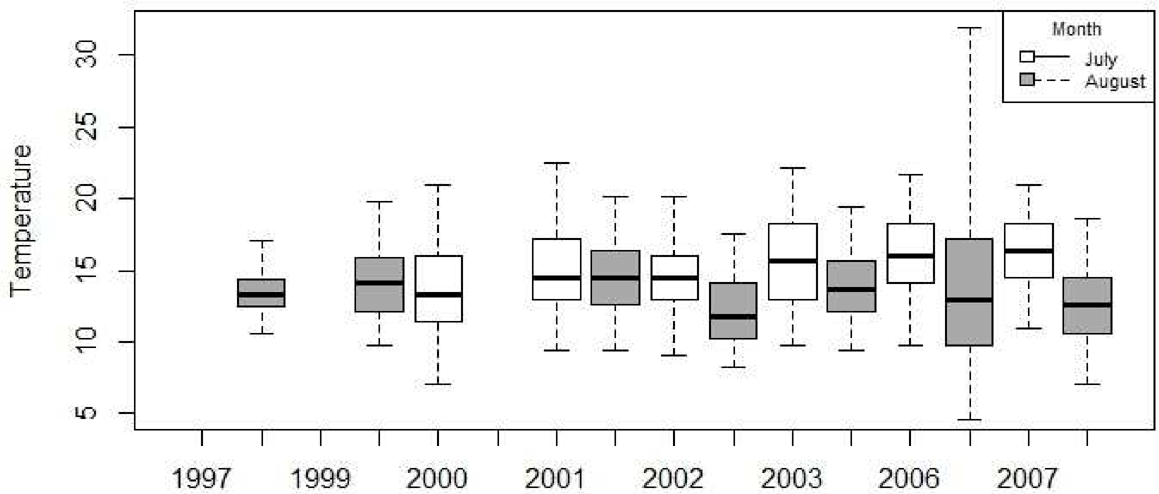

FIGURE 33. Mid-summer temperatures (degrees Celsius) in the Thompson River above Big Rock Creek intermittently from 1997–2007. It appears that August 2006 was out of water for at least a portion of the month.

Discussion

Temperature profiling by river mile conducted by Weyerhauser Corporation, shows a gradual decrease in water temperatures on the mainstem Thompson River from a high point near the confluence with McGregor Creek, down to the Little Thompson River (Weyerhauser Corporation, unpublished data). In this upper section of river, the coolest point is near the confluence with Big Rock Creek. However, as the Little Thompson River enters near the midway point, the mainstem is warmed for approximately two river miles until the cooler water of Fishtrap Creek is mixed in. Fishtrap Creek and the West Fork Thompson River provide a large quantity of cooler water to the mainstem.

Some of the reasons for warmer temperatures in the Thompson River are the lack of riparian vegetation and incorporated large woody debris, much of which can be attributed to road encroachment on the river (Beussink et al. 2008). The entire river would benefit from more riparian shade and large woody debris. Riparian shade and large woody debris would decrease solar radiation and increase pool formation and depth, providing cover for fish and lowering water temperatures.

The warming of the mainstem near the confluence with the Little Thompson River indicates elevated temperatures in that tributary. Although no habitat evaluation of the Little Thompson River exists, some obvious factors which may contribute to increased temperatures include over-grazing, road abundance, diversions, and timber harvest. It is not common in western Montana for tributary networks to have higher water temperatures than the mainstem systems they flow into. Stream remediation strategies should be considered to mitigate the long-term effects of habitat degradation in the Thompson River and the Little Thompson River. In many instances, simple riparian fencing would allow more riparian vegetation to establish in heavily grazed systems which would increase habitat complexity and shade and would likely decrease stream temperature.

For Bull Trout, mean summer temperatures of less than 12°C in spawning and rearing streams are considered necessary (Al-Chokachy et al. 2015). However, the temperature threshold in maturation habitat for sub-adult and adult fish is likely higher. Temperatures in the mainstem Thompson River below Fishtrap Creek and West Fork Thompson River are cooler than other nearby Bull Trout streams such as Blackfoot River and Rock Creek (Pierce et al. 2008, USGS), and are certainly lower than nearby reservoirs (Kreiner and Tholl 2016). Future restoration work aimed at improving road/stream interactions could further reduce stream temperature and therefore improve Bull Trout maturation habitat in the lower Thompson River.

TRIBUTARY MONITORING

FISHTRAP CREEK

Drainage overview— Fishtrap Creek has a basin size of 242 km2 and elevations vary from 867–2249 meters. The drainage is comprised of 73.8% USFS land, 23.4% Weyerhauser timber land, 2.3% Montana State Trust Lands, and 0.5% private land. The drainage had a road density of 3.9 km/km2, 1.05 crossings/stream km, and 85.3% of the stream has roads in the riparian area. Sixteen percent of the drainage burned in 1910, and since then another 15.5% has been used for timber harvest.

Routine monitoring— Routine monitoring of specific locations within the Fishtrap Creek drainage has occurred since 1999. Generally, backpack electrofishing has been used for population estimates of juvenile Bull Trout Salvelinus confluentus and Westslope Cutthroat Trout Oncorhynchus clarki lewisi by depletion. These data are used to look at species composition, species distribution, size structure, and abundance. The information gathered during routine sampling events helps inform biologists of the apparent status of fishes in the tributaries and can lead to other specific inquiries.

Two evaluation sites were established in Fishtrap Creek for long term monitoring and location information is available in Appendix B.

Results— Abundance estimates varied for WCT from 0–42 fish per 100 m (mean: 12) for the lower site (FIGURE 34) and from 4–84 fish per 100 m (mean: 22) for the upper site (FIGURE 35). Bull Trout abundance varied from 1–28 fish per 100 m (mean: 9) for the lower site and from 9–43 fish per 100 m (mean: 17) for the lower site.

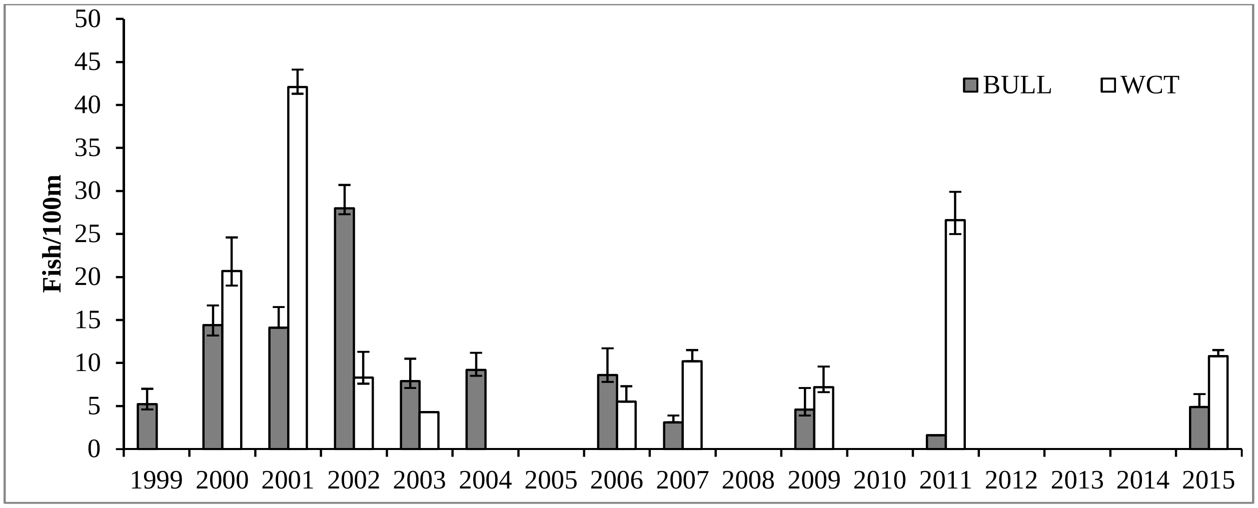

FIGURE 34. Fishtrap Creek abundance estimates (± 95% CI) for the lower trend monitoring section from 1999–2015.

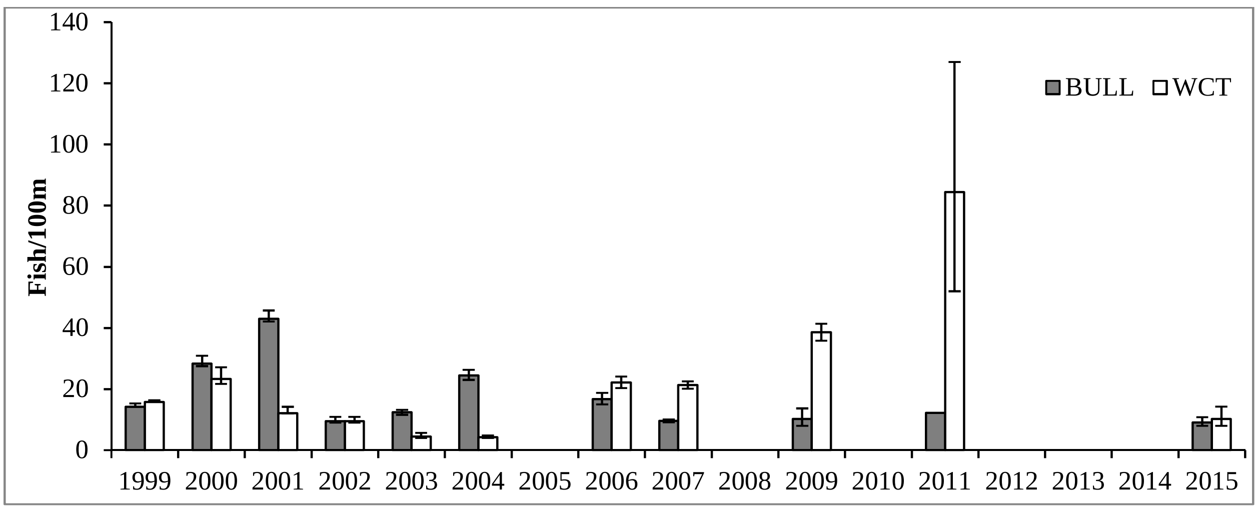

FIGURE 35. Fishtrap Creek abundance estimates (± 95% CI) for the upper trend monitoring section from 1999–2015.

Discussion— Abundance of both species is greatest at the upper site where the water is colder and the habitat is complex. At both sites, annual fluctuations in WCT abundance are extreme. Bull Trout estimates were highest in both sections from the years, 2000-2002. This may coincide with higher densities encountered during mainstem sampling in 2003-2005 (FIGURE 22).

Overall, abundances of Bull Trout at both sites in 2015 were lower than abundances observed in the early 2000s. However, additional sampling from Fishtrap Creek in 2015 revealed higher abundances at eight other sites, including some which had catch rates of 4-5 times the upper site (Glaid 2017).

Fishtrap Creek Temperature Monitoring— Thermographs have been deployed in different locations in Fishtrap Creek from 1999–2016. We have reported data collected from Fishtrap Creek below Jungle Creek for this period. The longitudinal temperature profile of Fishtrap Creek is complex, with cold water inputs from West Fork Fishtrap Creek, Beatrice Creek, and Jungle Creek. There is also a relatively large spring complex just upstream of West Fork Fishtrap Creek that provides enough cold water to cool the stream temperatures considerably from further upstream.

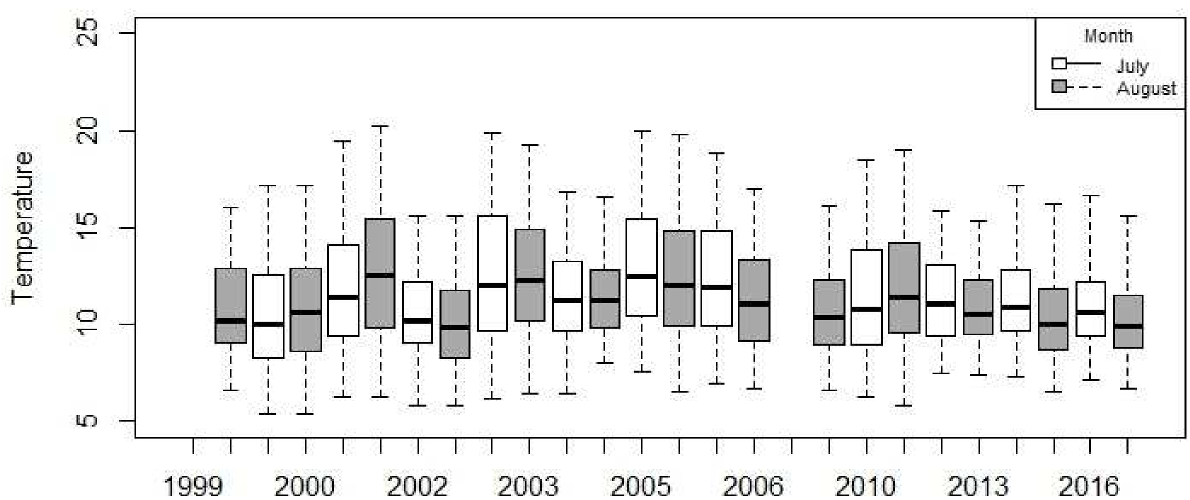

FIGURE 36. Mid-summer temperatures in Fishtrap Creek below the confluence with Jungle Creek intermittently from 1999–2016.

Discussion— Mid-summer water temperatures in lower Fishtrap Creek are considerably lower than the Thompson River upstream of Fishtrap Creek (FIGURE 31). While daily maximum temperatures approached 20°C in some years, monthly median temperatures from 1999–2016 varied from about 10–12°C. Additionally, important sections of Fishtrap Creek upstream are considerably colder due to groundwater and tributary inflows.

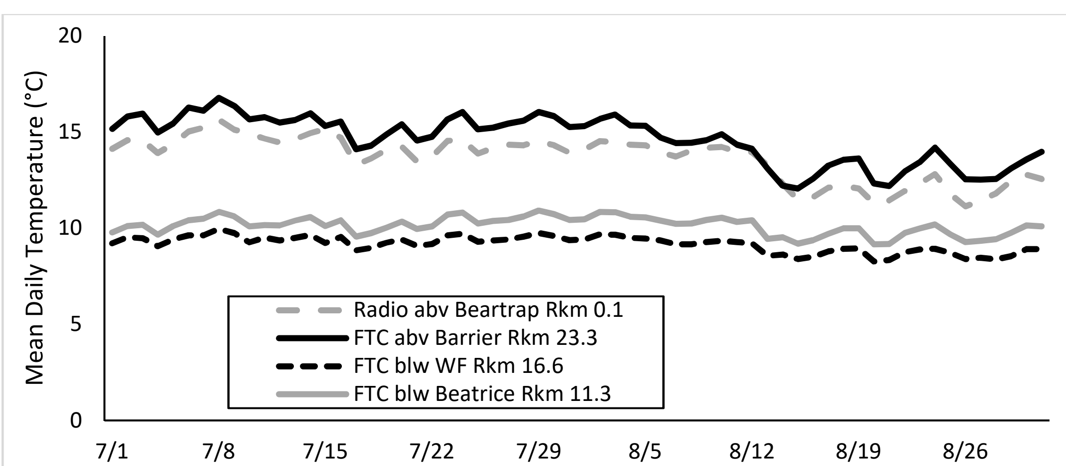

FIGURE 37. Mean daily water temperatures in the Fishtrap Creek drainage during summer, 2017.

Fishtrap Creek Genetics and Movement— Sampling in 2016-2017 was conducted in the Fishtrap Creek watershed to assess species composition and genetic purity (FIGURE 36) in addition to deploying PIT tags in both Bull Trout and Westslope Cutthroat Trout to evaluate movement and differential life history strategies within Fishtrap Creek. Sampling sites were either randomly re-sampled from Glaid (2017) or chosen at intervals assumed to provide an adequate snapshot of species composition and Westslope Cutthroat Trout genetics. The main objective of the genetics sampling was to identify any legacy effects of stocking non-native fishes within the drainage, or colonization and hybridization by non-native fishes. The tagging analysis will be compiled over the next few years in conjunction with remote PIT array operation in lower Fishtrap Creek. This data will identify movement patterns and life history strategies of both native trout species and may reveal survival rates of fish which have left the drainage.

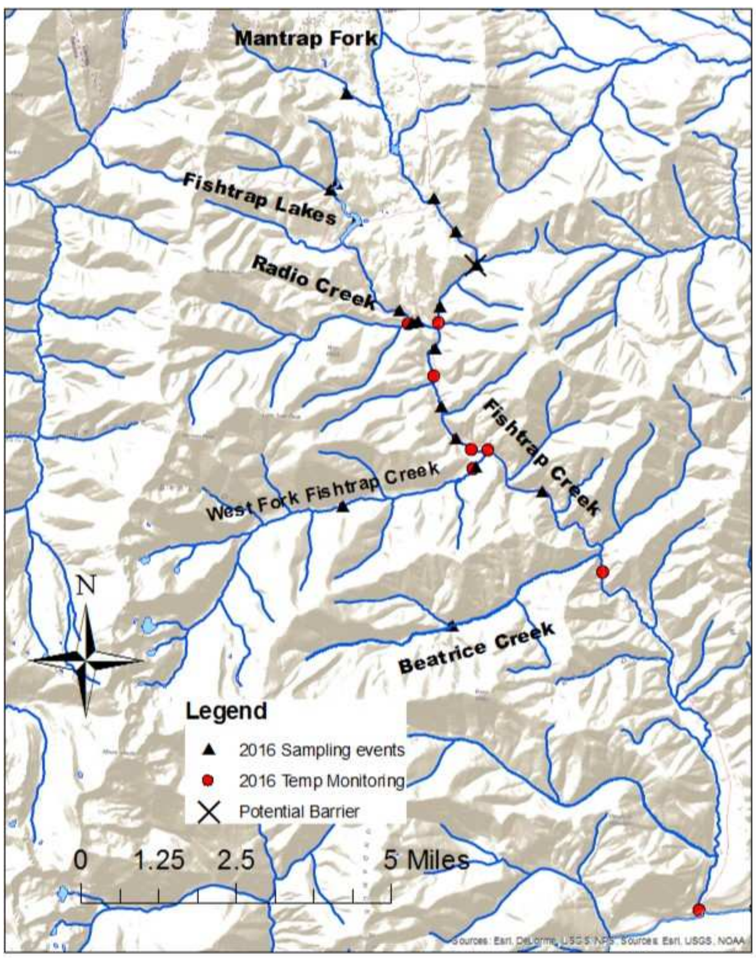

FIGURE 38. Sampling and temperature monitoring sites in 2016.

Fishtrap Creek (mainstem)— Genetic samples were collected from Fishtrap Creek cutthroat trout in 1991 and 2016. The 1991 samples (n = 26) were taken from rkm 21 (above WF Fishtrap) and analyzed by allozymes. The samples were reported as pure Westslope Cutthroat Trout. The 2016/17 samples (n = 30) were taken from multiple locations and indicate low levels of hybridization with Rainbow Trout in the drainage. A hybrid index score was given to indicate the number of Rainbow Trout alleles detected during analysis (e.g., 0 was a pure WCT, 1 was hybridized with a single RB allele). The hybridization with YCT is given as a percentage of YCT introgression because it is a hybrid swarm, not hybridized individuals.

TABLE 3. Sampling locations and species composition in 2016-2017 for genetics and movement investigations in Fishtrap Creek. Genetics analysis includes number of samples analyzed and number of hybrids (hybrid index for RB introgression; percentage hybridization for Yellowstone Cutthroat Trout (YCT) hybridization). PIT indicates the number of fish implanted with a Passive Integrated Transponder for movement investigation.

Stream	Location	Year	WCT	Genetics	PIT	Hybrids	BULL	PIT
Fishtrap Creek	11.5 rkm	2017	35		34		7	7
	14.8 rkm	2016	10		8		2	2
	15.7 rkm	2017	16		15		3	2
	16.5 rkm	2017	19		19		13	12
	17.9 rkm	2016	10	10	10	0	2	2
	18.8 rkm	2016	23	10	22	4 (2)	1	1
	20.5 rkm	2016	20	10	15	2 (2)		
	21.9 rkm	2016	29		21		1	1
	24.5 rkm	2016	13		10			
	25.4 rkm	2016	14					
Beatrice Creek	4.4 rkm	2016	15	15	10	2 (3.5)		
	4.2 rkm	2017	30		30		1	1
WF Fishtrap Creek	0.2 rkm	2017	26		22		9	9
	0.6 rkm	2016	15	15	13	1 (14)	1	1
	2.7 rkm	2016	16	15	15	0	9	9
	6.9 rkm	2017	60		36		9	9
	9.0 rkm	2017	43		25		18	17
Beartrap Creek	0.1 rkm	2016	42		29			
Radio Creek	0.6 rkm	2016	35		13		1	1
	1.2 rkm	2016	45		18			
	5.8 rkm	2016	47	10	12	YCT (1.0)		
Fishtrap Lake		2016	21	15		YCT (0.4)		
Upper Fishtrap Lake		2016	11	10		YCT (0.6)		
Mantrap Fork	1.0 rkm	2016	29					

Fishtrap Lake— Samples were obtained for genetic analysis from Fishtrap Lake in 1988, 1989, and 2016. The 1988 samples (n = 360) were analyzed using allozymes and indicated pure Westslope Cutthroat Trout, while the 1989 samples (n = 29) were considered partially hybridized using the same technique. The 2016 samples (n = 15) were analyzed using single nucleotide polymorphisms (SNP's) and indicated low levels (<1%) of Yellowstone Cutthroat Trout hybridization.

West Fork Fishtrap Creek— Samples were obtained for genetic analysis in 1993 and 2016. The 1993 samples were from rkm 0.2 (n = 31) and rkm 3.1 (n = 16) and indicated pure Bull Trout. In 2016, WCT samples from rkm 0.6 (n=15) and rkm 2.7 (n=15) were submitted for analysis. One fish at the lower site was identified as a hybrid with an index score of 14. This fish was visually identified as a hybrid prior to analysis and was removed from the population.

Beatrice Creek— In 1991, WCT samples from rkm 0.2 (n = 5) indicated hybridized Westslope Cutthroat Trout and Rainbow Trout but samples from rkm 3.4 (n = 5) were pure Westslope Cutthroat Trout. In 2016, 15 WCT samples were analyzed from Rkm 4.4. Two fish were identified as RBxWCT hybrids with a mean hybrid index of 3.5.

Jungle Creek— In 2003, 30 WCT samples from rkm 6.9 in Jungle Creek were submitted for analysis. No hybridization was detected.

JUNGLE CREEK

Jungle Creek was routinely sampled at two locations between 2003 and 2015. Population estimates of juvenile Bull Trout *Salvelinus confluentus* and Westslope Cutthroat Trout *Oncorhynchus clarki lewisi* were obtained by depletion.

Routine monitoring

Two electrofishing sites were established in Jungle Creek for long term monitoring in 2003. Both sites are 100m in length. Location information is available in Appendix B.

Results

Abundance estimates for WCT ranged from 25 to 49 per 100 m (mean: 35) at the lower site (FIGURE 38) and from 26–75 per 100 m (mean: 46) at the upper site (FIGURE 39). Bull Trout abundance ranged from 0–5 per 100 m (mean: 1.8) at the lower site and from 1–18 per 100 m (mean: 6) at the lower site.

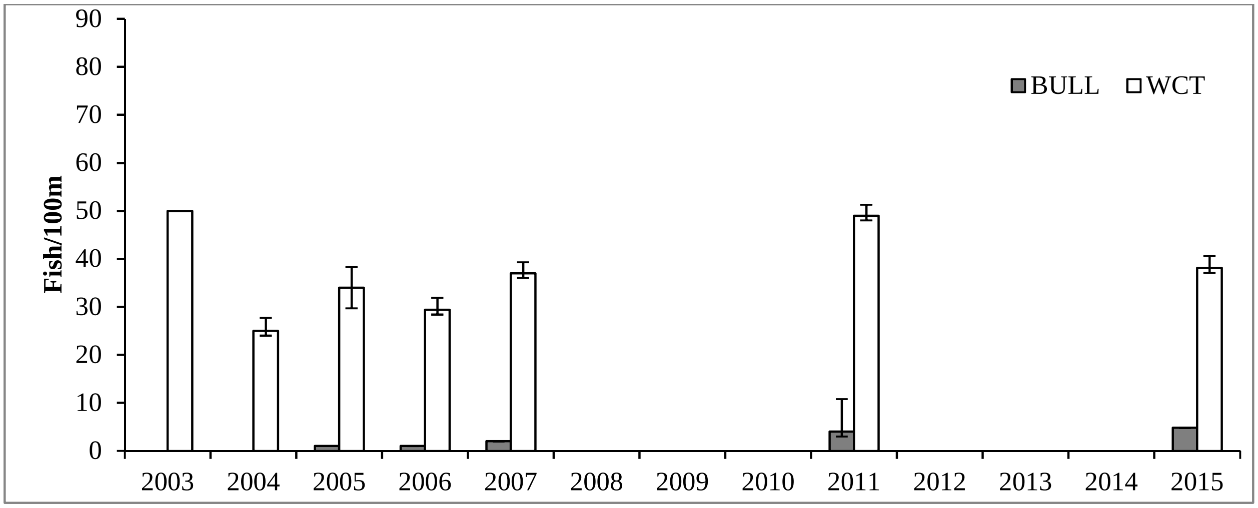

FIGURE 38. Jungle Creek abundance estimates (± 95% CI) for the lower trend monitoring section from 2003–2015.

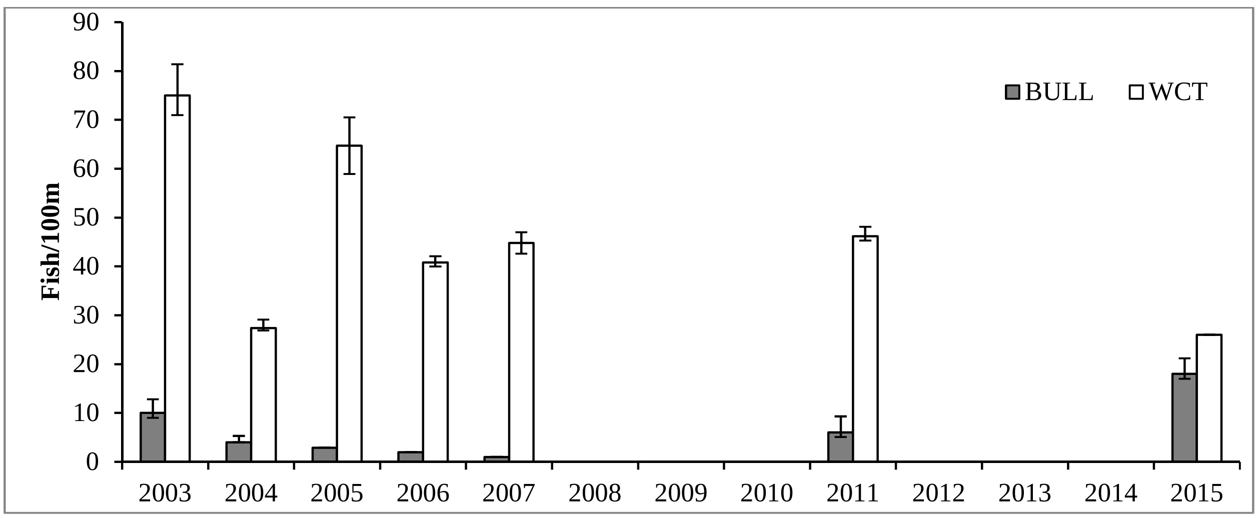

FIGURE 39. Jungle Creek abundance estimates (± 95% CI) for the upper trend monitoring section from 2003–2015.

Discussion

Abundance estimates fluctuate annually in Jungle Creek. Westslope Cutthroat Trout are more abundant than Bull Trout in all years, especially at the lower site. Current estimates of Bull Trout were 18 per 100 m at the upper site, and less than five per 100 m at the lower site. Additionally, genetic results of Bull Trout from Jungle Creek indicate that they cluster separately from other Fishtrap Creek locations (DeHaan et al. 2015). This may be a result of a primarily resident Bull Trout population in Jungle Creek.

WEST FORK THOMPSON RIVER

Drainage overview from MFWP GIS database— West Fork Thompson River (WFTR) has a basin size of 92.2 km^2 and elevations varying from 790–2256 meters. The drainage area is owned entirely by the USFS. The drainage had a road density of 1.1 km/km2, 0.24 crossings/stream km, and 37.5% of the stream has roads in the riparian area. Between 1910 and 2010, only six percent of the drainage had been burned by wildfire. In 2014, as part of the Thompson River fire complex which burned approximately 1,700 acres in the drainage (inciweb.nwcg.gov), the Spruce fire burned several hundred acres in the West Fork Thompson River. Another 11.3% has been used for timber harvest.

Habitat surveys were conducted by Land and Water Consulting in 2001 for West Fork Thompson River. The river is primarily a “B” channel type (Rosgen 1996) with gradients ranging from 0–8%. The stream averages 23.5% pools and had a LWD rating of 1 (Land and Water Consulting 2001).

Long-term monitoring

The West Fork Thompson River has been routinely sampled since 1999. Backpack electrofishing has been used at two locations to obtain population estimates of juvenile Bull Trout *Salvelinus confluentus* and Westslope Cutthroat Trout *Oncorhynchus clarki lewisi* by depletion.

Results

In the WFTR, abundance estimates varied for Westslope Cutthroat Trout from 21–71 (mean: 49) for the lower site (FIGURE 40; rkm 1.8) and from 10–40 (mean: 16) for the upper site (FIGURE 41; rkm 6.4). Bull Trout abundance varied from 4–12 (mean: 8) for the lower site and from 11–61 (mean: 38) for the lower site.

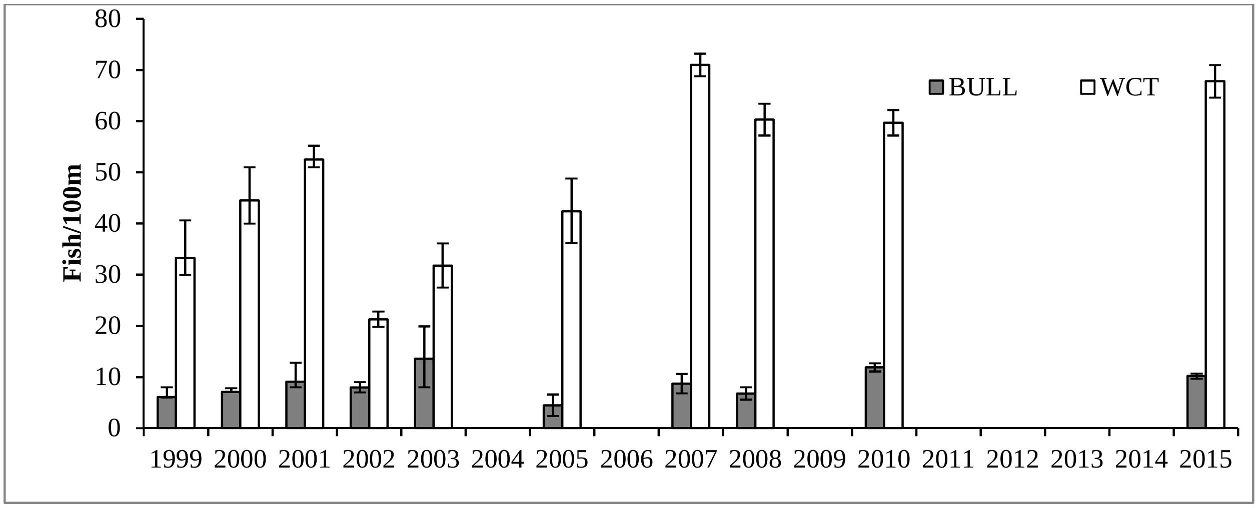

FIGURE 40. West Fork Thompson River abundance estimates (± 95% CI) for the lower trend (rkm 1.8) monitoring section from 1999–2015.

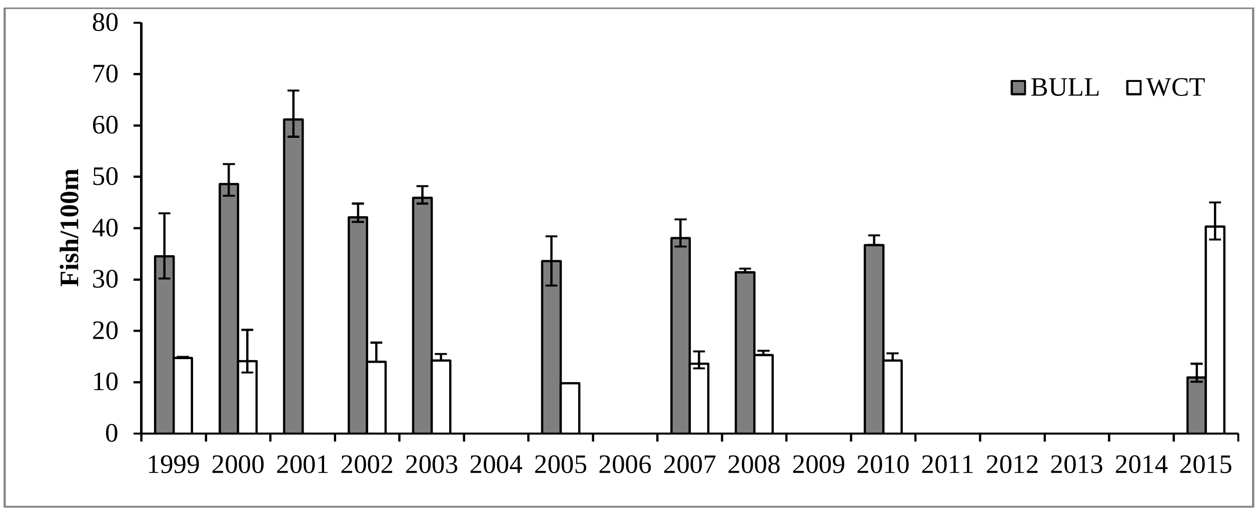

FIGURE 41. West Fork Thompson River abundance estimates (± 95% CI) for the upper trend (rkm 6.4) monitoring section from 1999–2015.

Discussion

In contrast to many long-term monitoring sites in lower Clark Fork River tributaries, the upper site in the WFTR historically contained more Bull Trout than Westslope Cutthroat Trout. Like the other sites, there is considerable variability between sampling events. The contrast between high Bull Trout numbers during electrofishing surveys and small numbers of weir captures indicates that residency may be a common life history in the WFTR. Liermann (2003) also expressed this opinion but thought there were relatively similar numbers of migrants as Fishtrap Creek when considering drainage size. This is entirely possible, and the upper section of WFTR may contain some the best juvenile rearing habitat in the drainage, producing high abundance estimates. Comparisons of abundance and outmigration of Bull Trout from WFTR and Fishtrap Creek should continue to be evaluated.

The apparent decline in Bull Trout at the upper site (rkm 7.2) is considerable. However, additional sampling in 2015 revealed abundances that were 2-3 times greater at six other sites between rkm 2.8 and rkm 6.5 (Glaid 2017). These sites are not regularly sampled. The upper long-term site is located just below a large bedrock slide which has recently accumulated abundant woody debris and may be serving as a temporary barrier (see *Redd Survey* section). Large migratory redds have not been observed above this slide since at least 2011. In 2015 and 2016, smaller resident-sized Bull Trout were observed spawning upstream of the slide. The increase in WCT at this section is likely attributable to the decline in Bull Trout there.

WFTR Temperature Monitoring— Thermographs have been deployed in the lower West Fork Thompson River, near the mouth from 1999–2016. We have compiled all collected data from this location in WFTR which provide an idea of thermal regime over more than 15 years.

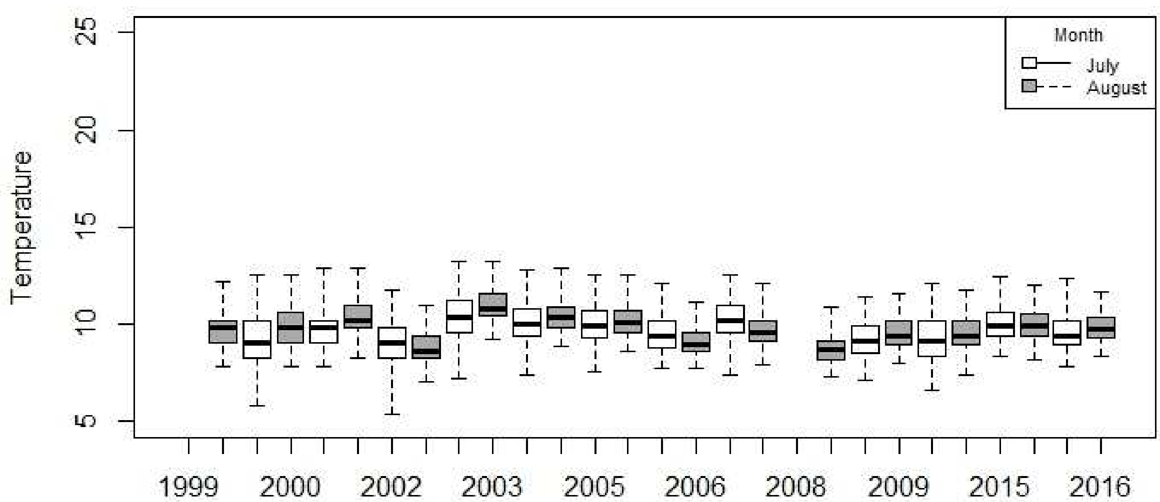

FIGURE 42. Mid-summer temperatures near the mouth of the West Fork Thompson River intermittently from 1999–2016.

Discussion— West Fork Thompson River is a cold stream with relatively low interannual variability. Median daily temperatures during the summer remain very close to 10°C during all years. Consistently high summer flows resulting from groundwater influence, high gradient, and a dark canyon through which it flows likely contribute to sustained cold-water temperatures.

Genetics Sampling

West Fork Thompson River— Samples were obtained for genetic sampling in 1994. The samples from rkm 0.3 (n = 6) indicated a hybrid swarm and rkm 3.5 (n = 6) indicated four pure Westlope Cutthroat Trout, one hybrid, and one Rainbow Trout.

Four Lakes Creek— Genetics samples were obtained in 1984. The samples (n =16) were taken for allozyme analysis and indicated pure Westslope Cutthroat Trout.

BIG ROCK CREEK

Big Rock Creek is a tributary stream to the Thompson River which enters the drainage approximately 52.4 rkm upstream from the Clark Fork River. The stream is home to both Bull Trout and Westslope Cutthroat Trout, although Brown Trout and Rainbow Trout hybrids have recently been discovered in lower sampling locations. Most of the drainage burned during the "Chippy Creek Fire", which was the state of Montana's largest wildfire in 2007. As a result, the upper portions of the drainage lack large conifers in many locations, but are being re-colonized by alders which are dense in areas. The topography in the upper drainage is mellow, and the stream winds through the gentle valley for several kilometers before gaining velocity and volume with the additions of Mandy Gulch (rkm 11.6), Broken Nose Gulch (rkm 7.6), and Boulder Gulch (rkm 7.4). In this reach, the stream flows through several canyons, deep pools are common, and water temperatures are coldest.

Methods

In 2010, eleven sites were sampled in Big Rock Creek ranging from rkm 2.1-15.4 (FIGURE 43). Sampling consisted of presence/absence surveys to determine species composition. In 2013, five sites were sampled. Three of these sites were identical to 2010 (site 1,2, and 8), and two were slightly different (site 4.5 and 7.5) (FIGURE 41). In 2016, water temperatures were monitored near the mouth of Big Rock Creek and upstream below Boulder Gulch (FIGURE 44).

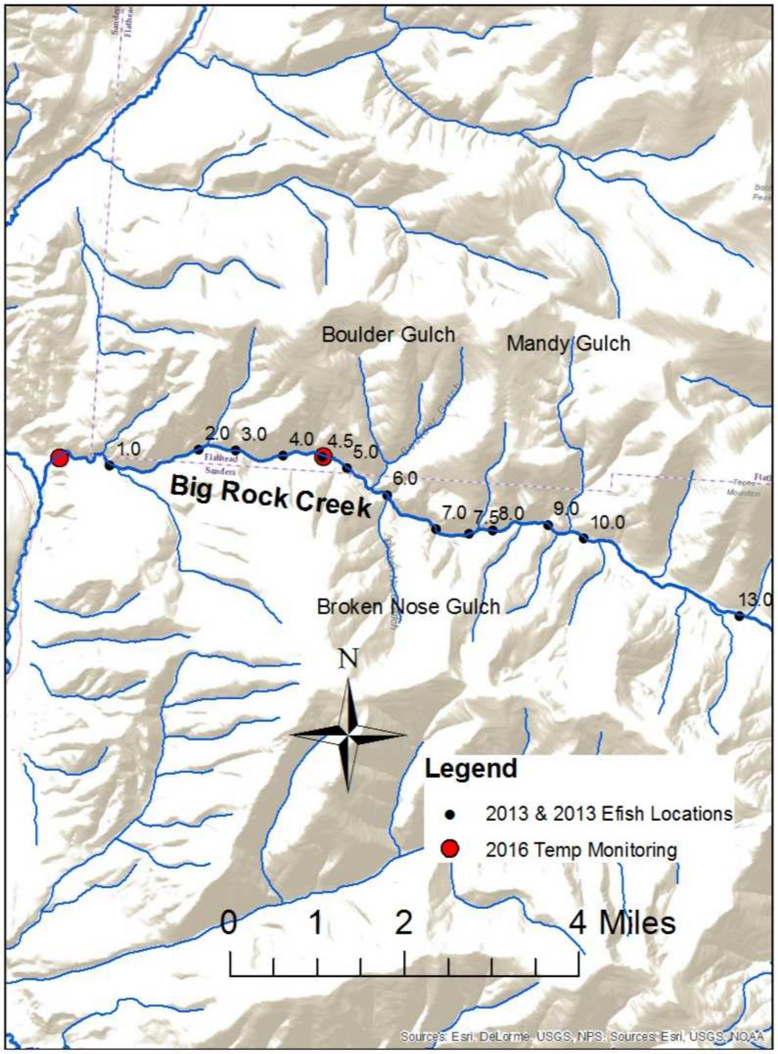

FIGURE 43. Sampling locations as temperature monitoring in Big Rock Creek in 2013 & 2016.

Results

Using data from 2010 and 2013 combined, Bull Trout occupied at least 7.5 km of stream at low densities (TABLE 4). Their abundance (based on *C/f*) was highest in the middle (rkm 6.3) and tapered off on the upper and lower edges. Westslope Cutthroat Trout were present at all locations from rkm 2.1 to rkm 15.4. However, based on phenotypic characteristics, hybridization with Rainbow Trout was noted through at least rkm 4.9. Brown Trout were present in high densities at rkm 2.1, and a lone individual was captured at rkm 3.9 in 2013.

TABLE 4. Results from electrofishing surveys in 2010 and 2013 in Big Rock Creek. All fish greater than or equal to 75 mm in length were counted and estimates are based on 100m sections with 95% confidence intervals. Sampling at site 4.5 also captured 7 age-0 Bull Trout which were not counted in estimates or first pass captures. Phenotypically identified Rainbow/Cutthroat hybrids were combined with cutthroat trout estimates in the lower 5.4 river kilometers.

Site	rkm	Length	Year	Pass	WCT	Estimate	Bull	Estimate	LL	Estimate
1	2.1	89.0	2013	1	40	59 (55-63)	0		12	19 (17-21)
			2010	1	9		1		11	
2	3.8	95.0	2013	1	55	106 (92-120)	1		1	
			2010	1	59		3		0	
3	4.6	100.0	2010	1	13		1		0	
4	5.4	100.0	2010	1	20		3		0	
4.5	6.2	94.0	2013	1	94	135 (129-141)	9	13 (12-14)	0	
5	6.7	90.0	2010	1	69		4		0	
6	7.7	75.0	2010	1	39		2		0	
7	9.0	76.0	2010	1	41		1		0	
7.5	9.6	50.0	2013	1	35		1		0	
8	10.1	75.0	2013	1	126	166 (156-176)	0		0	
			2010	1	21		0		0	
9	11.2	75.0	2010	1	96		0		0	
10	12.0	75.0	2010	1	45		0		0	
13	15.3	100.0	2010	1	33		0		0	

Mean daily water temperatures only exceeded 12°C on three occasions during July and August at the upper site (FIGURE 44). During that same time at the lower site, temperatures exceeded 12°C for 49 days with some mean daily values exceeding 15°C.

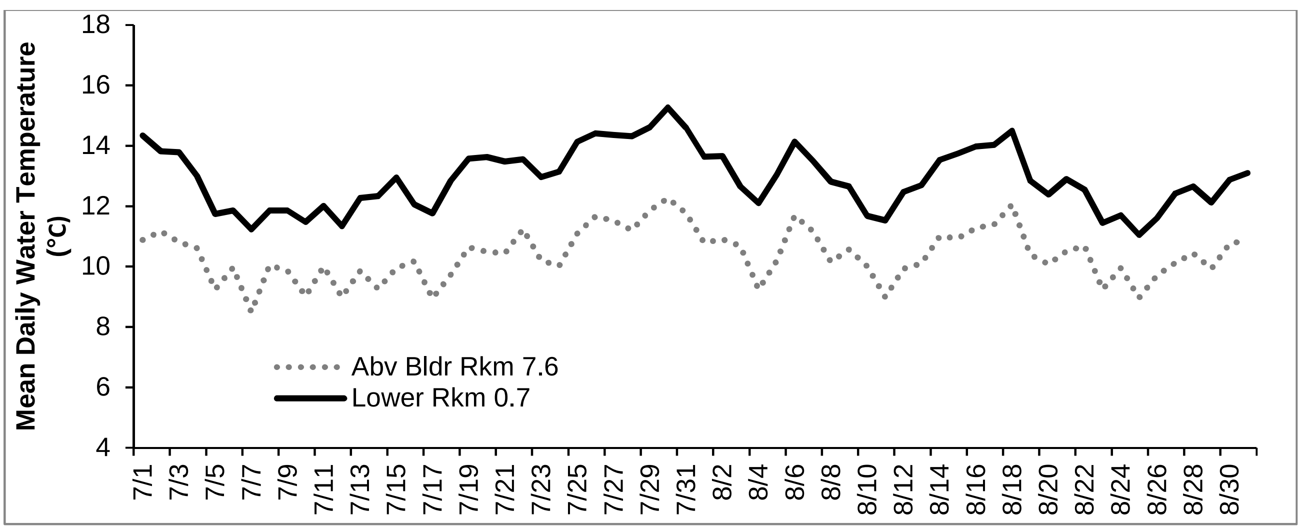

FIGURE 44. Temperatures at two monitoring locations in Big Rock Creek 2016.

Discussion

Efforts should be made to protect the native fish assemblage in Big Rock Creek. Although temperatures in the upper end of the basin are likely elevated due to the natural topography and aspect of the drainage as well the loss of canopy cover from the 2007 fire, the river gains enough water volume and gradient with the addition of several tributaries to support a small Bull Trout population for at least seven stream kilometers. The Bull Trout in Big Rock Creek are thought to be a resident population based on 1) a lack of captures in the mainstem Thompson River near the creek; 2) the observation of resident adult-sized fish at several sections; and 3) lower genetic variation than other nearby populations (DeHaan et al. 2015). Currently Brown Trout are limited to the lowest sections of stream, however this should be monitored and options to halt upstream progression should be considered. If a barrier is pursued, a thorough investigation of genetic integrity should be conducted to ensure that only pure Westslope Cutthroat Trout are present above. A series of waterfalls on the lower end of the stream could potentially be modified into a permanent barrier if desired.

LITTLE THOMPSON RIVER

The Little Thompson River is a tributary stream to the Thompson River with a confluence 28 km upstream from the Clark Fork River. It has a drainage area of approximately 310 km^2. Bull Trout are currently absent from the Little Thompson River, but populations of apparently aboriginal Westslope Cutthroat Trout persist in several of the tributaries. The drainage has many non-native trout (primarily Brook Trout) which are distributed throughout the mainstem and many of the tributaries. There are two diversion canals which direct water from the headwaters of Alder Creek and McGinnis Creek through a trans basin exchange to the Confederated Salish and Kootenai Tribal land. Each ditch has a large water right (~60 cfs) which is unlikely to be fully utilized in most years. This usually results in the complete capture of each creek during the period of diversion.

In 2014, the Little Thompson River was classified as impaired due to altered stream side vegetation, excessive nutrients (total nitrogen and phosphorus), and sedimentation (Montana DEQ 2014). The probable causes were excessive forest roads, agricultural grazing, and timber harvest.

Fisheries Monitoring— In 2016, FWP initiated presence/absence electrofishing surveys in the Little Thompson River watershed to assess species composition throughout the drainage. Sampling sites of 100m were chosen at intervals assumed to provide an adequate snapshot of species composition. Sampling was concentrated on smaller tributaries and the upper portions of the larger tributaries to better locate populations of Westslope Cutthroat Trout. Fin clips were collected from cutthroat trout to identify any hybridization. In 2017, sampling was expanded to include additional tributaries and investigate Brook Trout distribution and origin within Little Rock Creek (TABLE 5). To test the species' invasion potential, we moved 82 adipose fin-clipped Brook Trout from upstream locations to a pool downstream of two perched culverts near rkm 1.6. The upstream extent of Brook Trout was also investigated in the North Fork Little Thompson River. Additional sampling was planned for Nancy Creek, but was not conducted due to an absence of water.

TABLE 5. Sampling locations and species composition in 2016-2017 for the Little Thompson River.

Stream	Location	Year	WCT	EB	RBxWCT
Little Rock Creek	1.9 rkm	2017	0	21	
	2.3 rkm	2016	0	15	
	4.2 rkm	2017	40	19 (10 mort; 9 moved)	
	5.6 rkm	2016	71	2	
	5.8-4.2; 1.6 rkm	2017	unk	255 (182 mort; 73 moved)	1
Mudd Creek	4.0 rkm	2016	5	16	
	7.4 rkm	2016	5	0	
NF Little Thompson	2.4 rkm	2017	5	20	1
	5.95 rkm	2017	35	4	
	9.5 rkm	2017	41	0	
Nancy Creek	0.8 rkm	2016	No Water		
	3.5 rkm	2016	No Water		
Partridge Creek	0.6 rkm	2016	2	0	
	0.96 rkm	2017	4	0	
	1.9 rkm	2017	9	0	
Todd Creek	0.6 rkm	2016	2	7	
Loneman Creek	0.6 rkm	2016	16	0	
	1.2 rkm	2017	6	2	
	2.4 rkm	2017	0	(no fish)	

Discussion— Westslope Cutthroat Trout were documented in all sampled tributaries to the Little Thompson River in 2016-2017. Westslope Cutthroat Trout were also observed in the Alder Creek Ditch which diverts water from Alder Creek to the Confederated Salish and Kootenai Tribes reservation for irrigation. A low-maintenance fish screen could help prevent entrainment of these native salmonids. In Loneman Creek, two Brook Trout were sampled during 2017, but WCT were still the more abundant species there. Grazing improvements such as fencing would greatly improve habitat by increasing vegetation, shade, and bank stability while decreasing sediment and temperature. In Partridge Creek, Westslope Cutthroat Trout may be isolated above a culvert because no Brook Trout were sampled in three separate events in 2016 and 2017. Partridge Creek is grazed by cattle, but riparian vegetation is much fuller than in nearby Loneman Creek. Because of this, water temperatures in Partridge Creek were much lower than in Loneman Creek.

In lower Todd Creek, Brook Trout outnumbered Westslope Cutthroat Trout. However, planned sampling of upper Todd Creek in 2016 did not occur to due to a wildfire and a resultant area closure. The uppermost distribution of Westslope Cutthroat Trout and Brook Trout in Todd Creek may be investigated further in 2018. The effects of the 2016 wildfire on the drainage are unknown, but they may affect riparian habitat quality which could alter species composition. In upper Mudd Creek, Westslope Cutthroat Trout and Brook Trout were present. Riparian vegetation is largely intact there, but sediment impacts from the dual road system are obvious. A portion of this dual road system was removed in 2016 by Weyerhauser, and future consolidations could further improve stream conditions there.

Our sampling in Little Rock Creek revealed that two perched culverts at rkm 1.6 were not barriers to Brook Trout, even at baseflow. We moved 82 adipose fin-clipped Brook Trout from upstream locations to a pool downstream of the culverts, and two of these fish were subsequently sampled upstream less than a week later. Sampling in upper Little Rock Creek also revealed a permanent diversion of water from Little Rock Creek into neighboring Marten Creek. The water right allows for the diversion of 0.07 cubic meters per second (2.3 cfs) from June 1 to October 19 each year. However, there is currently no structure in place to measure flow or to cease diversion (head-gate) and the entire creek is diverted year-round into Marten Creek. Downstream of the diversion, Little Rock Creek only re-emerges due to seepage and escaped water from the dilapidated diversion ditch. Lower Little Rock Creek flows at a much-reduced rate. During spring run-off, the entire creek is still funneled into the ditch, but much of the flow spills out of the ditch at various locations and flows unconsolidated through the forest. Eventually, a majority of the water funnels back to the perched culverts, but a significant portion of Little Rock Creek probably has not received maximum flushing flows for a century (water right priority date October 1895). This diversion likely contributes to increased water temperatures observed downstream (FIGURE 47). A proper diversion structure has been identified as a future fisheries restoration project and could be coupled with a reduction or elimination of Brook Trout in the drainage.

Temperature Monitoring— Thermographs have been deployed in the lower Little Thompson River at varying intervals from 2001–2017 (FIGURE 45). We have compiled all collected data from the mouth of the Little Thompson River regarding temperatures within the river over that period. Median summer temperature is commonly at 15°C, but maximum temperatures exceed 20°C in all years (FIGURE 45). In 2015, a complete July dataset was not obtained, but water temperatures from July 1 through July 4 were believed to have exceeded 23°C. Additionally, many other Little Thompson River tributaries were monitored in 2016 and 2017 (FIGURES 46, 47, 48).

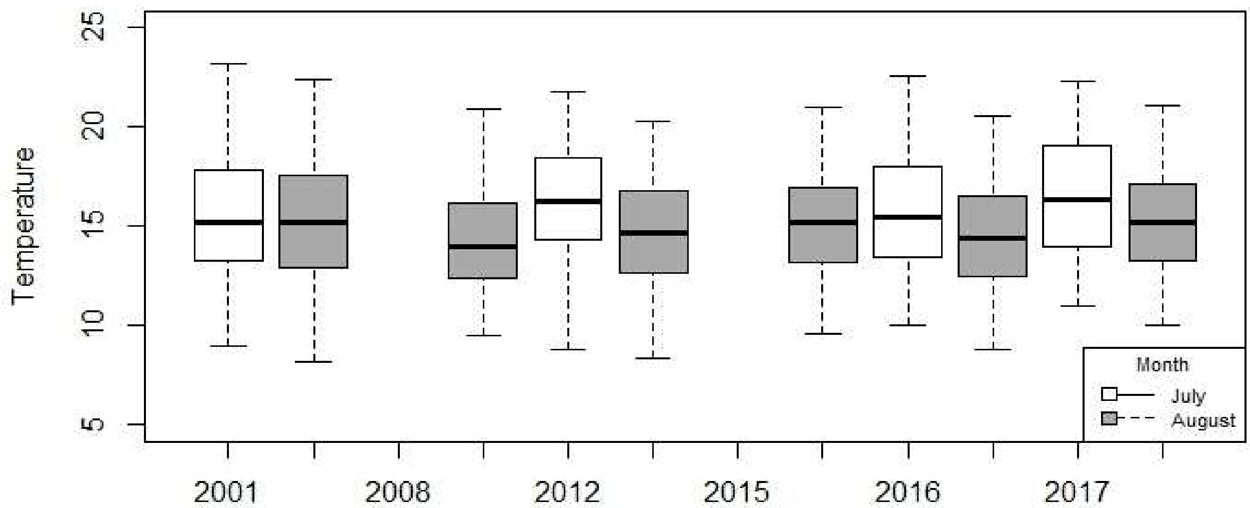

FIGURE 45. Mid-summer temperatures in the lower Little Thompson River intermittently from 2001–2017.

FIGURE 46. Mean summer water temperatures from four locations within the Little Thompson River, 2017.

In Little Rock Creek, thermographs deployed at three locations in 2016 revealed a dramatically different temperature profile. Due to the diversion at rkm 4.8, the two lower sites had much warmer water temperatures than the upper site (FIGURE 47).

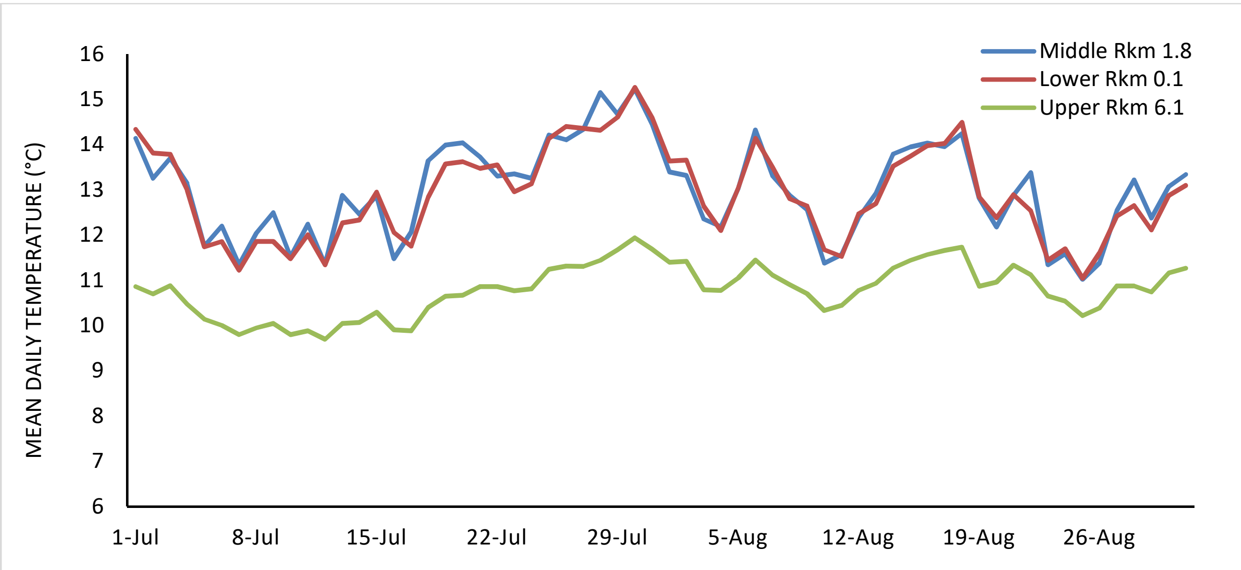

FIGURE 47. Mean daily temperatures for Little Rock Creek in summer, 2016.

Thermographs were also deployed in the Mudd Creek drainage. In 2017, a temperature logger was placed in lower Loneman Creek (rkm 0.1), lower Partridge Creek (rkm 0.1), lower Mudd Creek (rkm 0.1), and Upper Mudd Creek (rkm 6.6). Temperatures were coldest in upper Mudd Creek and Partridge Creek. Elevated temperatures in Loneman Creek were likely the result of cattle grazing activities in the drainage. Grazing improvements have been identified as a future fisheries restoration project there.

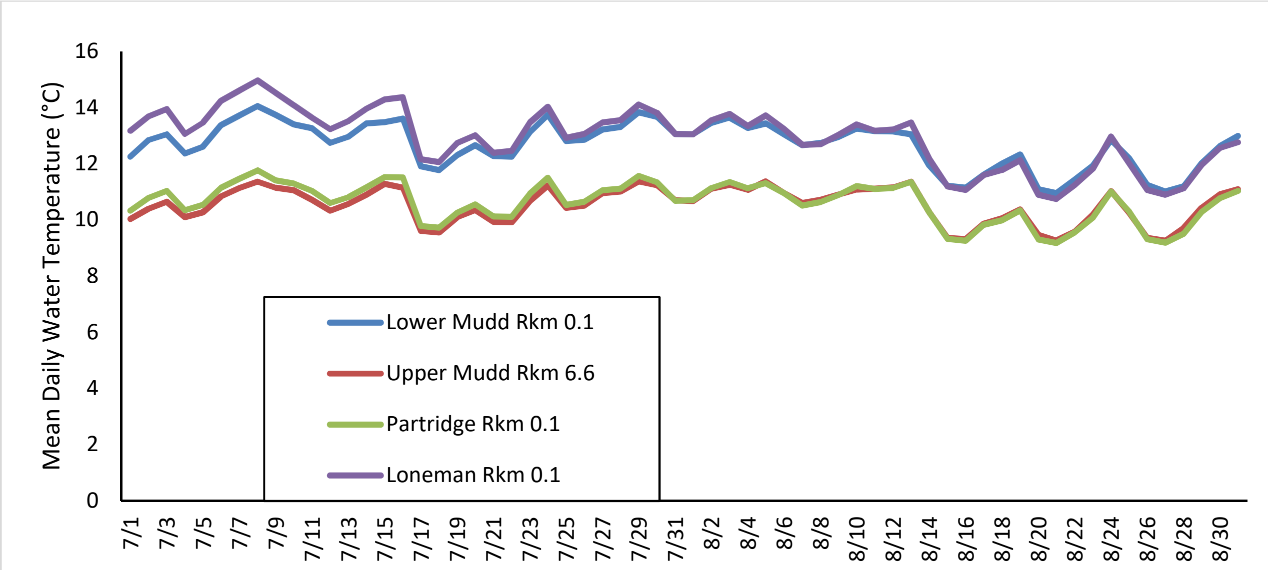

FIGURE 48. Mean daily water temperatures in the Mudd Creek drainage in summer, 2016.

Genetics Sampling

Little Rock Creek— Genetic samples were obtained in 2007 by Plum Creek (now Weyerhauser Corporation). The samples were taken from rkm 0.5 (n = 20) and analyzed using Indel. All results indicated pure Westslope Cutthroat Trout.

McGinnis Creek— Genetic samples were obtained in 2008. One Brook Trout was analyzed using PINES and confirmed to be a Brook Trout. Samples of Oncorhynchus were collected from 0.6 to 2.44 rkm (n =34) and Indel analysis indicated pure Westslope Cutthroat Trout.

Alder Creek— Genetic samples were obtained in 2008 from 2.5 rkm (n = 4). PINES analysis indicated that all Brook Trout samples were in fact Brook Trout. In 2016, WCT were visually identified in Alder Creek ditch near the CSKT boundary. Flow measurements were also taken from the ditch and creek below the diversion with less than 0.3 cfs in Alder Creek and 1.4 cfs in Alder Creek ditch. Spring flow measurements in 2017 showed 9.6 cfs in Alder Creek ditch and 5 cfs in McGinnis Creek ditch. The CSKT has water rights to 64.6 cfs in the Alder Creek ditch and 58.7 cfs in the McGinnis Creek ditch.

OUTMIGRATION STUDIES

Introduction and Methods

Since 2000, several attempts have been made to describe the outmigration behavior of Bull Trout in the Thompson River drainage. Between 2000 and 2002, an investigation was conducted to assess the abundance of fishes moving to and from the West Fork Thompson River and Fishtrap Creek (Liermann 2003). Additional habitat and electrofishing surveys from that study were discussed in other sections of this report. In 2014 and 2015, Northwestern Energy funded a graduate study which attempted to look at juvenile Bull Trout behavior and habitat use in the lower Clark Fork River reservoirs (Glaid 2017). The study used a combination of electrofishing and weir trapping to capture fish and track their movements with PIT, acoustic, and/or radio-tags. Additionally, this study also employed the use of remote PIT tag arrays at the mouths of the mainstem Thompson River (MSTR), West Fork Thompson River (WFTR), and Fishtrap Creek (FTC). Since the completion of the graduate study, the tributary arrays have been maintained sporadically (WFTR and FTC), with primary down-time occurring in the spring, while the mainstem array has been more consistently operated during all months (MSTR).

2000-2002

A “picket weir” style trap was installed in lower West Fork Thompson River (rkm 0.1) and middle FTC (rkm 7.8) and operated continuously from July through November of each year (2000-2002). Fish were anaesthetized prior to taking length (mm) and weight (g). Fish larger than 74 mm were injected with a passive integrated transponder (PIT) tag. Fin clips of Bull Trout and Westslope Cutthroat Trout greater than 50 mm were taken for genetic analysis in 2000 and 2001.

2014-2017

During October 2014, the lower 1.6 kilometers of WFTR was electrofished to deploy tags into sub-adult Bull Trout. Fish which exceeded 44 g received an acoustic tag and a PIT tag, while all other fish >99 mm received only a PIT tag. A remote PIT tag array was installed at the mouth of the MSTR as well as the mouth of the WFTR.

In 2015, an additional PIT tag array was installed at the mouth of FTC (Rkm 0.1). During July and August, 35 sites in WFTR, FTC, Jungle Creek, Beatrice Creek, and West Fork Fishtrap Creek (WF FTC) were electrofished to deploy PIT tags into sub-adult Bull Trout. Additionally, picket weirs identical to those from Liermann (2003) were used to capture fish at the mouth of WFTR and FTC during September and October. During weir-trapping events, fish greater than 44 g received either an acoustic or a radio-tag, while all other fish (>99 mm) received only a PIT tag. No tracking of acoustically-tagged fish was conducted because fish did not enter reservoir habitat prior to battery expiration. Fourteen Bull Trout were radio-tagged and tracked within the MSTR, and those results were thoroughly evaluated by Glaid (2017).

The remote PIT tag arrays were operated continuously throughout the fall and winter of 2015 and the duration of the graduate study (Glaid 2017). Since then, Montana Fish, Wildlife and Parks has maintained them. However, due to their remoteness and the lack of a consistent power source, the tributary arrays have been inconsistently maintained through some winter and spring seasons. However, the MSTR array has been more consistently maintained since fall 2014.

In 2016 and 2017, additional PIT tags were deployed into Westslope Cutthroat Trout and Bull Trout in other locations of FTC and WFTR.

Results

Weir Traps (Fishtrap Creek)

Although weir traps were operated over different durations between the two-time periods, peak catch of downstream moving Bull Trout (≤300 mm) occurred during October in most years (FIGURE 49). In 2002, catch was low during all months of trap operation (FIGURE 49). October was the only month which had continuous weir operation during all four years of study, and total October catch was highest in 2000 (n=113), followed by 2001 (n=66), 2015 (n=41), and 2002 (n=1). However, weir traps were operated in very different locations between the two-time periods, and the trap location from 2000-2002 (rkm 7.8) likely targeted fish which may not have been actively outmigrating. While mean length of captured fish was similar (158 mm, 165 mm), length distribution was different, with more small and large fish captured at the upper location (FIGURE 50). The trap location in 2015 (rkm 0.1) likely targeted outmigrating fish and did not catch younger fish, or older residents.

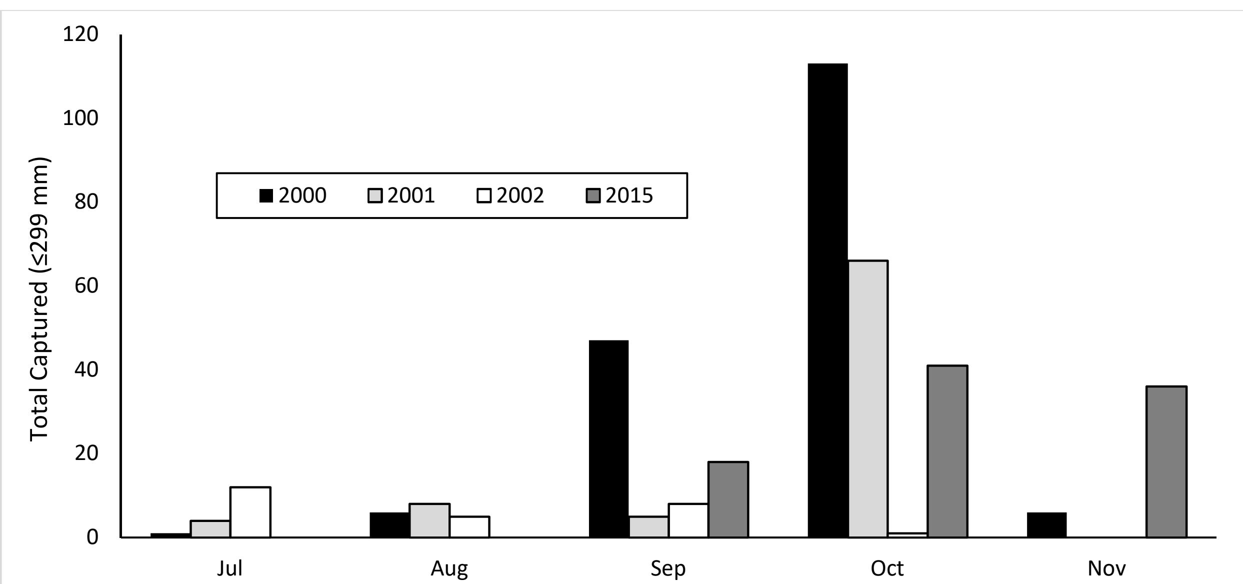

FIGURE 49. Total downstream moving Bull Trout captured in weir traps in Fishtrap Creek during four fall seasons. Weir traps operated from 2000-2002 were located at rkm 7.8, while the weir trap in 2015 was located at rkm 0.1.

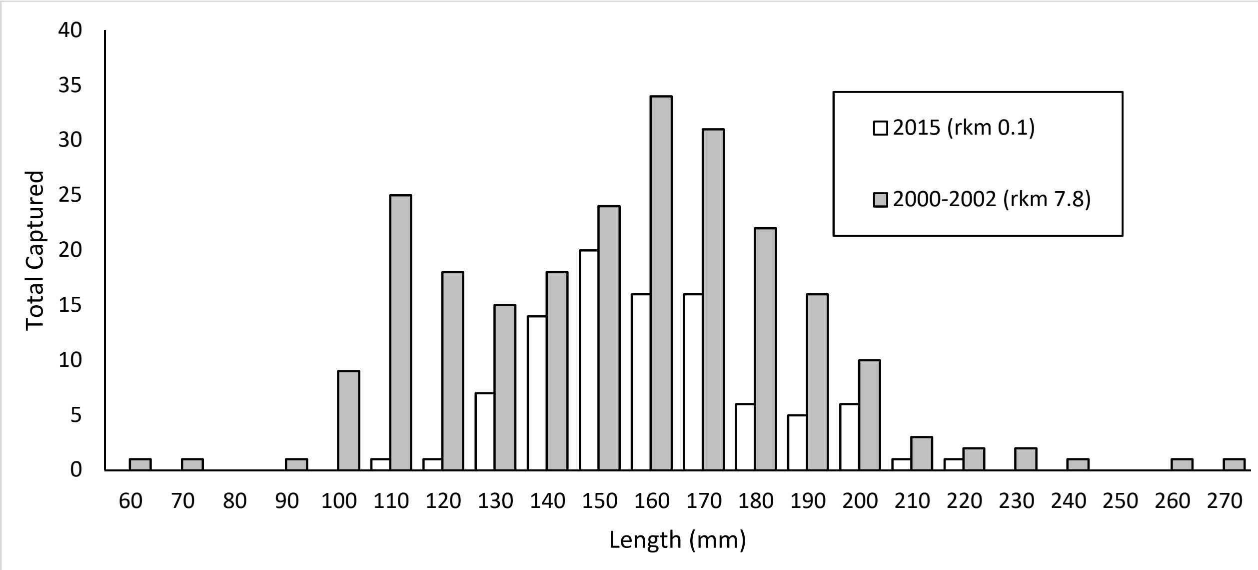

FIGURE 50. Length distribution of downstream moving Bull Trout captured in weir traps in Fishtrap Creek during four fall seasons. Weir traps operated from 2000-2002 were located at rkm 7.8, while the weir trap in 2015 was located at rkm 0.1.

Weir Traps (West Fork Thompson River)

In WFTR, weir traps were operated in similar locations near the mouth of the creek during both time periods (rkm 0.1), and peak catch of downstream moving Bull Trout (≤300 mm) again occurred primarily during October. October was the only month during all four years in which the WFTR weir was operated continuously and total October catch was highest in 2015 (n=39), followed by 2001 (n=32), 2002 (n=26), and 2000 (n=6). Mean length of captured fish was greater in 2000–2002 (204 mm vs. 172 mm), as more large fish were captured (FIGURE 52). Interestingly, juvenile abundances in the upper monitoring site on WFTR were 3-5 times higher in 2000-2002 than they were in 2015, yet October weir captures were greater in 2015.

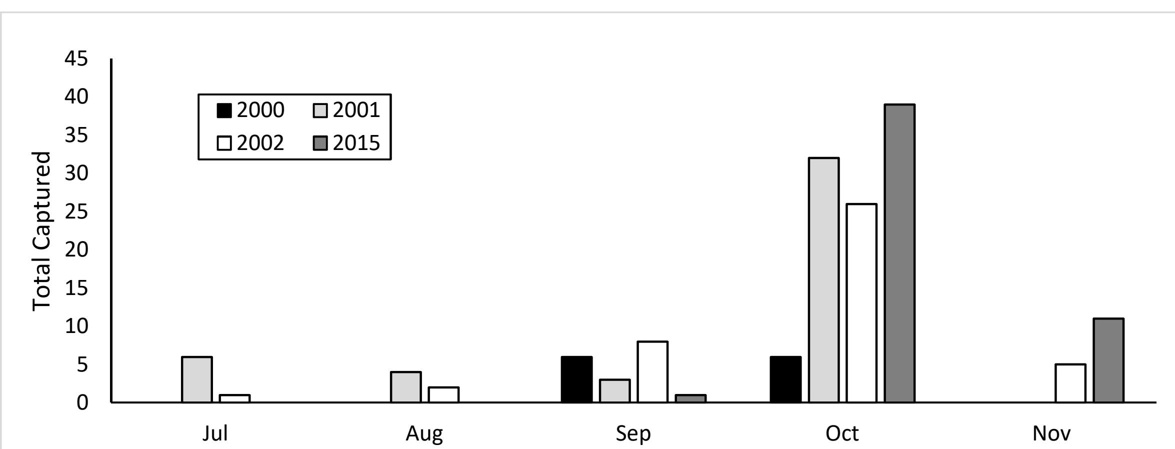

FIGURE 51. Total downstream moving Bull Trout captured in weir traps in WFTR Creek during four fall seasons.

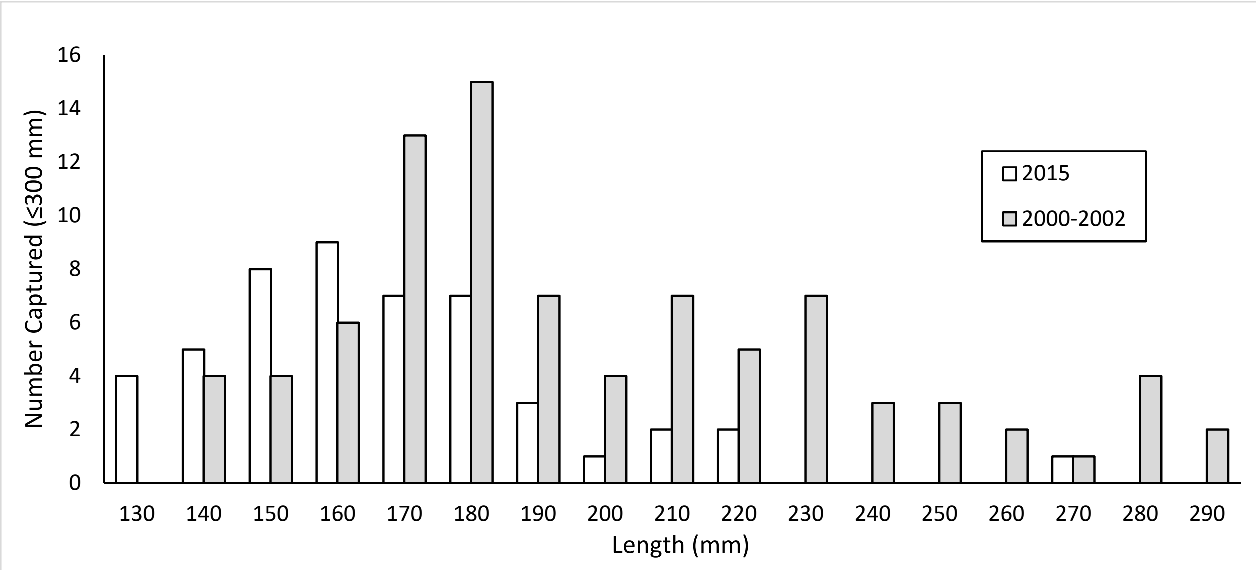

FIGURE 52. Length distribution of downstream moving Bull Trout captured in weir traps in WFTR during four fall seasons.

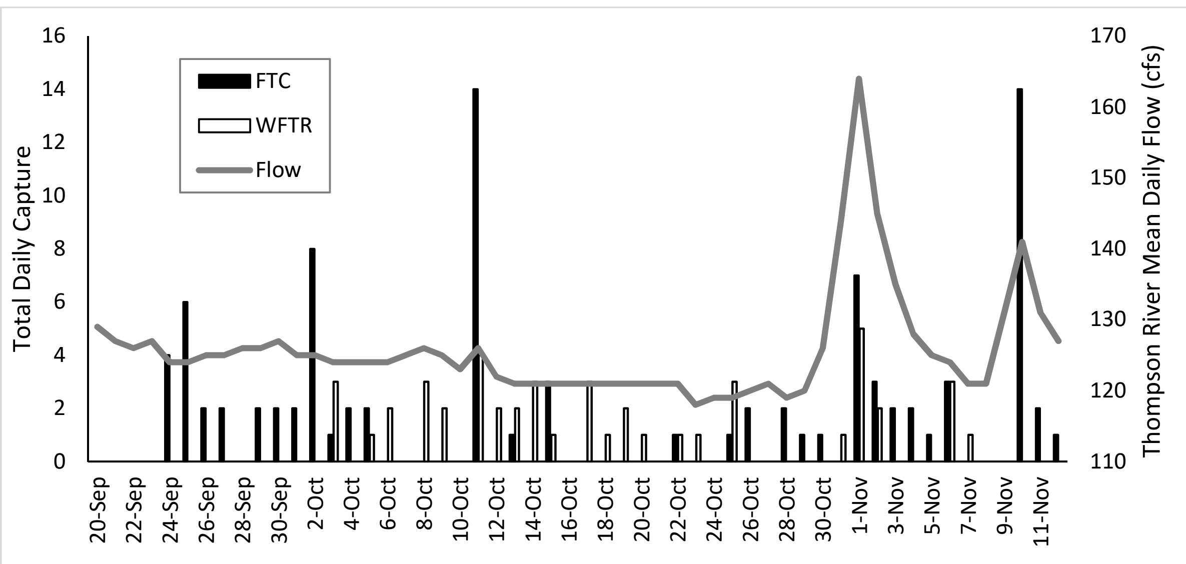

FIGURE 53. Total daily catch of downstream moving Bull Trout from weir traps in WFTR and FTC during 2015 with daily discharge (cubic feet per second) in the mainstem Thompson River at the USGS gauge.

Electrofishing and PIT tag arrays

In 2014, 53 Bull Trout were captured and tagged in the lower 1.6 rkm of WFTR during October (TABLE 6; Glaid 2017). Seven of those 53 (13%) were detected leaving the WFTR during 2014

(TABLE 7). Of these fish, only one was detected leaving the MSTR that same year, and one was detected at the MSTR array in March 2016.

TABLE 6. Bull Trout tagged during tributary electrofishing in the Thompson River drainage from 2014-2017.

Location	2014	2015	2016	2017
WF Fishtrap Ck		137	10	34
Beatrice Ck		107		1
Jungle Ck		39		
Fishtrap Ck		140	6	21
WF Thompson R	53	149		36
Radio Ck			1	
TOTAL	53	572	17	92

In 2015, an additional 572 Bull Trout were tagged in five separate tributaries in the Fishtrap and West Fork Thompson River draianges (TABLE 6; Glaid 2017). Through the end of 2017, 58 of these fish have been detected at the FTC array (two additional fish tagged in 2016 and 2017 have also been detected) (TABLE 7). At the WFTR array, 29 fish have been detected leaving that stream, all tagged in 2014 or 2015 (TABLE 7). In both 2016 and 2017, a fish originally tagged in the FTC drainage was among the detections in the WFTR (Jungle Creek- 2016, Fishtrap Creek- 2017).

TABLE 7. Known Bull Trout outmigrants from FTC and WFTR from 2014-2017. (Numbers exclude duplicates (e.g., fish detected on array and in weir trap, fish detected in FTC array prior to detection in WFTR)). 2015 array numbers may include 27 fish blocked at the weir in FTC, and two fish blocked at the weir in WFTR.

Sample Type	Fishtrap Creek	WF Thompson R
2014 Array		7
2015 Array	53	16
2015 Weir	89	46
2016 Array	3	4
2017 Array	2	2
TOTAL	147	75

The FTC weir trap captured 94 total downstream moving sub-adult Bull Trout in 2015. Eighty-nine of these fish were unmarked, while five were recaptures from the summer's sampling upstream (5%) (TABLE 7). Using combined data from the weir traps and arrays, a total of 147 sub-adult Bull Trout have been known to leave FTC since fall, 2015, with 145 of these fish being tagged in 2015. Based on the proportion of recaptures in the 2015 weir data (5%), this total of known outmigrants is likely a small percentage of the actual outmigrants. Additionally, of the 423 fished tagged by electrofishing in FTC and its tributaries in 2015, only 56 have been detected leaving (13%).

The 2015 WFTR weir trap captured 48 out-migrating Bull Trout in 2015. Forty-six of these fish were unmarked and two were re-captures from the summer's sampling (1.3%). Using combined data from the weir traps and arrays, a total of 75 tagged Bull Trout have been known to leave WFTR since 2014, all were tagged in 2014 or 2015. Based on the proportion of recaptures in the 2015 weir data (1.3%), this total of known outmigrants is likely a small percentage of the actual outmigrants. Additionally, of the 202 fished tagged in WFTR by electrofishing in 2014 and 2015, only 29 have been detected leaving (14%).

In 2016, while collecting Westslope Cutthroat Trout genetic samples in upper FTC, 17 additional Bull Trout were tagged. None of these fish have since been detected. Finally, in 2017, 56 additional Bull Trout were tagged in the FTC drainage. One of these fish was detected at the FTC array in October 2017 (1.8%). Thirty-six additional Bull Trout were tagged in the WFTR and none have been detected by the array as of the end of 2017.

In conjunction with the collection of WCT genetic samples and the continued operation of the PIT tag arrays on FTC and WFTR, 435 WCT were tagged in 2016 and 2017 (TABLE 8). Only three of these tagged WCT have been detected at remote arrays. In 2016, one WCT from the 2016 sampling was detected at the FTC array. In 2017, two WCT from that year's sampling were detected at the FTC array. No WCT have been detected at the WFTR array through 2017.

TABLE 8. Westslope Cutthroat Trout tagged during tributary electrofishing in the Thompson River drainage from 2016-2017.

Location	2016	2017
WF Fishtrap Ck	28	83
Beatrice Ck	10	23
Fishtrap Ck	86	68
WF Thompson R		65
Beartrap Fork	29	
Radio Ck	43	
TOTAL	196	239

At the MSTR array, 28 juvenile Bull Trout were detected from 2014–2015. Of these, 16 were originally tagged in the WFTR weir, 7 were tagged in FTC weir, and five each were tagged electrofishing in FTC and WFTR. In 2016, 16 tagged juvenile Bull Trout were detected at the MSTR PIT array. The fish were originally tagged either electrofishing in WFTR (n=4) or FTC (n=5), or from the WFTR-weir (n=4) and the FTC weir (n=3). In 2017, three additional juvenile Bull Trout were detected at the MSTR array. One was originally electrofished in WF Fishtrap Creek in 2015, and the other two were originally tagged in the FTC weir in 2015.

Of the 47 sub-adult Bull Trout detected at the MSTR arrays from 2014-2017, 25 were originally tagged in the WFTR. Twenty of these 25 fish (80%) were from the WFTR weir in 2015. The other five were tagged while electrofishing upstream. However, because the WFTR array was inconsistently run during many winter, spring, and early summer months, only one of these five fish (20%) was detected at the WFTR array prior to being detected at the mainstem. This fish was originally tagged in the lower WFTR on 8/6/2015, was detected leaving the WFTR on 2/25/16, and was detected at the MSTR array on 5/4/16.

Of the 22-fish detected at the MSTR array which were originally tagged in the FTC drainage, 12 of 22 (55%) were tagged at the FTC weir in 2015. The other ten were tagged at upstream locations and were primarily from mainstem FTC (n=6), with lesser numbers from WF FTC (n=2), Jungle Creek (n=1) and Beatrice Creek (n=1). Seven of the ten were detected leaving FTC at the array prior to detection at the MSTR array. Travel time from the FTC array to the MSTR array varied from two days to 584 days, with four fish making it in less than 10 days.

Discussion

Consistent with the results of other studies (Huston 1994, Liermann 2003, Zymonas 2006), Bull Trout which originate in Thompson River tributaries exhibit a variety of life histories. Based on the preliminary results of this study, an adfluvial form appears to be the least common Bull Trout life history currently present in the Thompson River. Only 56 of 423 (13%) Bull Trout tagged in FTC in 2015 have been detected leaving that tributary, and only 29 of 202 (14%) Bull Trout originally tagged in WFTR in 2014-15 have been detected leaving that tributary. Attempts were made to quantify post-PIT tag survival in the tributaries using a mobile PIT-tag wand, but detection efficiency was too low to obtain an estimate. And of the fish which were known to leave the tributaries and enter the mainstem Thompson River, only 20% were documented at the MSTR array.

Tributary PIT arrays were not continuously operational, and it is known that the WFTR array only detected 1/5 (20%) of Bull Trout known to migrate through to the MSTR array, while the FTC array detected 7/10 (70%) of fish which did the same. Due to the inconsistency of operation for the arrays in FTC and WFTR, other fish may have left the tributaries undetected as the arrays did not operate in 2016 or 2017 from late-winter until July or August. However, the PIT arrays were operational during both fall seasons which is when significant Bull Trout outmigration is believed to occur (Downs et al. 2006). Additionally, in 2017, the arrays were anchored in a more permanent way and are expected to operate continuously in the future. This may enable detection of previously undetected Bull Trout as they make their way back to spawning tributaries as adults, or allow us to detect fish at times when the arrays would previously be inoperable.

The MSTR array has been more consistently operated since 2014. There has been at least one detection of a sub-adult Bull Trout at the MSTR array during each calendar month. Typically, a detection at the MSTR array indicated an out-migrating Bull Trout, however several fish were detected for multiple months at the array and appeared to be inhabiting the lower MSTR. For example, a fish originally tagged in WF FTC in July 2015, was subsequently detected leaving FTC in September 2015. This fish was then detected 584 days later at the MSTR array in April 2017. It was detected multiple times throughout the spring and fall of 2017, with the last detection occurring on December 6, 2017. This fish has likely spent the past 2.5 years primarily in the mainstem Thompson River with a possible foray into the Clark Fork River.

In 2017, one of the MSTR array's seven nodes malfunctioned for several months. This likely reduced its efficiency of detection, but many fish were still detected on other nodes during that time and most Bull Trout detections at the array have come from nodes occurring on the river edges, rather than mid-channel. Because of this reliability, numbers of Bull Trout detected at the MSTR array are likely more accurate than from the tributary arrays which is why several fish detected at the MSTR, were not detected leaving the tributaries.

Finally, the observation that an additional 28 previously tagged Bull Trout were detected at the FTC array during weir operation but were not captured in the weir may indicate a level of trap avoidance. This will be investigated thoroughly and may be reported in a separate document.

The proportions of Bull Trout detected leaving the tributaries and the mainstem indicates that conservation actions intended to benefit reservoir-utilizing Bull Trout (e.g., Northern Pike suppression, trap and transport) would only benefit a small percentage of Bull Trout in the Thompson River. Instead, conservation actions intended to benefit Thompson River Bull Trout should focus first on perceived problems within the Thompson River basin, before actions downstream are considered. An adfluvial form of Bull Trout was perhaps more common prior to dam construction, as migratory life histories can be suppressed due to man-made barrier construction (Nelson et al. 2002; Schmetterling 2003). However, given the current physical habitat limitations in the Clark Fork River, focus should be placed on conserving populations and improving conditions within vital tributary networks such as the Thompson River.

REDD SURVEYS

Introduction

Fishtrap Creek and its tributaries, along with the West Fork Thompson River, provide the primary spawning and rearing habitats for Bull Trout in the Thompson River, and represent the only significant Bull Trout populations for 60 miles in the area upstream of Thompson Falls Dam. Bull Trout redd counts have been consistently conducted since the early 2000s in portions of five streams within these two drainages. These survey reaches were not intended to serve as a complete census of Bull Trout spawning in the drainage but do serve as an index of spawning abundance which can be compared year-to-year. In some years, surveys may occur outside of index reaches to identify additional spawning areas, especially if access to index reaches appears to be restricted due to obstructions such as beaver dams. Redd counts are conducted in late-September or early-October after most of the spawning is believed to have occurred. Redd counts in Jungle and Beatrice Creeks are believed to occur for primarily resident Bull Trout and will not be discussed in this report.

Fishtrap Creek and West Fork Fishtrap Creek

Background

The index reaches in Fishtrap Creek and West Fork Fishtrap Creek (WF FTC) represent a continuous segment of water (approximately eight miles combined) and are used interchangeably by migratory adult Bull Trout. However, resident Bull Trout also exist in each stream and this overlap in life history is not clearly understood. The index section in Fishtrap Creek extends from the confluence with Beatrice Creek upstream to an area approximately 0.5 miles above WF FTC where a series of springs enters the creek. The springs are the result of water lost in the headwater meadows being forced to the surface at a valley knickpoint. The confluence of these springs offers consistent summer discharge, the coldest summer water temperatures in the drainage, and likely provides excellent over-winter habitat. The index section in WF FTC is the lowest four miles of stream.

In 2015, due to low numbers of redds observed in 2014 and increasing observations of beaver and man-made recreational dams in both streams, an additional 6-mile section of Fishtrap Creek was surveyed for redds (Jungle Creek confluence to Beatrice Creek confluence). This additional survey was also conducted in 2016 and 2017. The objectives of this additional survey were to 1) locate other areas used by spawning Bull Trout in Fishtrap Creek, and 2) determine if flow and/or the presence of beaver or recreational dams may influence redd locations. Both 2015 and 2016 experienced significantly lower spring run-off in the Thompson River than 2017 (based on mean spring flows measured on the lower Thompson River) (FIGURE 54). This allowed large beaver dam complexes to persist and increase over multiple years (FIGURE 56). Sustained higher flows in spring 2017 fully or partially removed many of these multi-year dams. This likely allowed unimpeded access into Fishtrap Creek during early summer, but some dams were rebuilt beginning in July (FIGURE 55). It was predicted that more redds would be in upstream reaches of Fishtrap Creek and in WF FTC during higher flow years and that multi-year beaver dam complexes would persist in years with low flows.

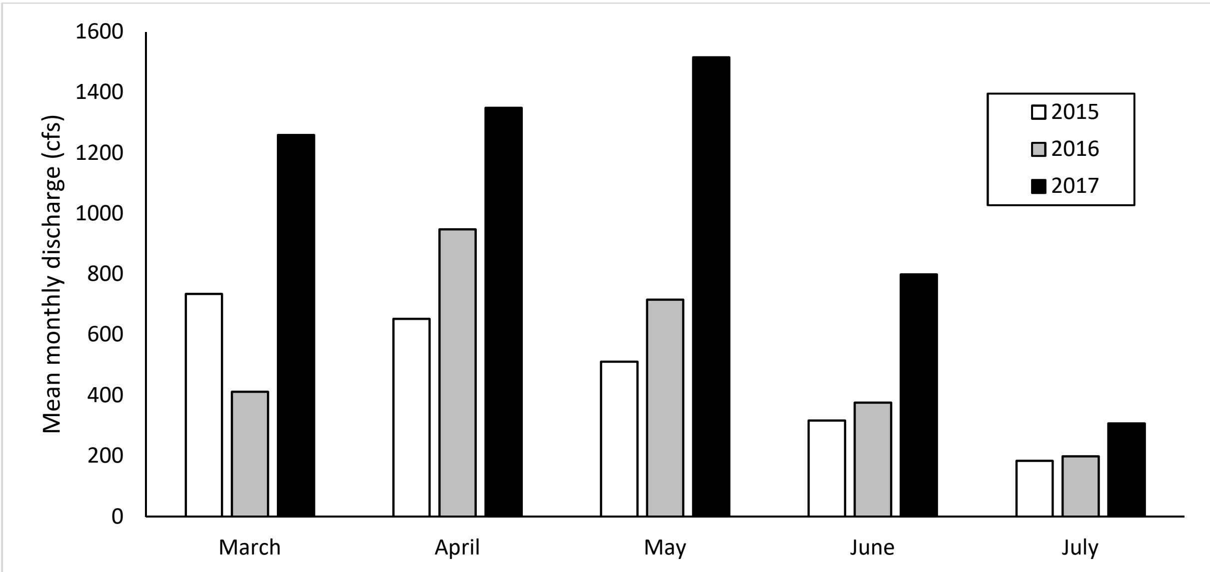

FIGURE 54. Mean monthly discharge during spring in the lower Thompson River, 2015-2017.

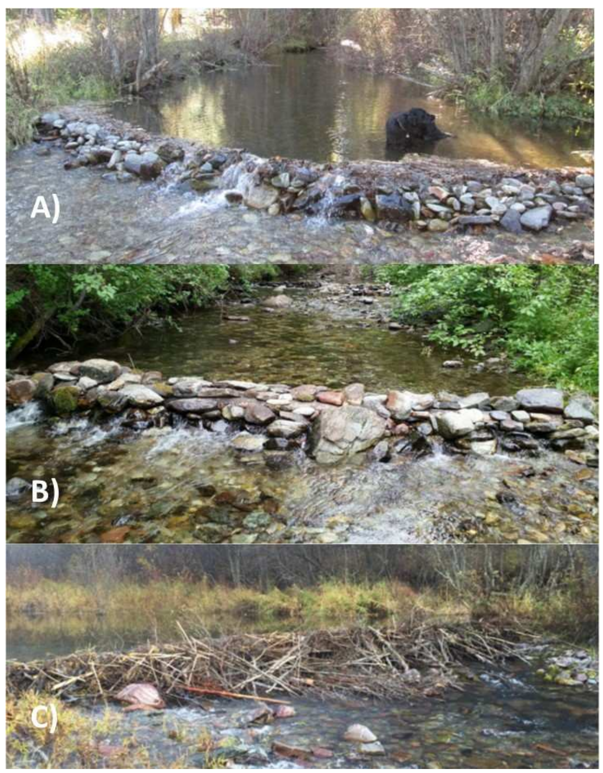

FIGURE 55. Recreational dams in lower WFFTC in 2014 and 2015 (A, B), and beaver dams in lower Fishtrap Creek approximately one mile up from the Thompson River (C). Approximately five large beaver dams were observed near the Jungle Creek confluence in 2015 and 2016 and Bull Trout redds were located nearby. Since this was outside of the documented index reach, the beaver dams were thought to have restricted access upstream to the index reach.

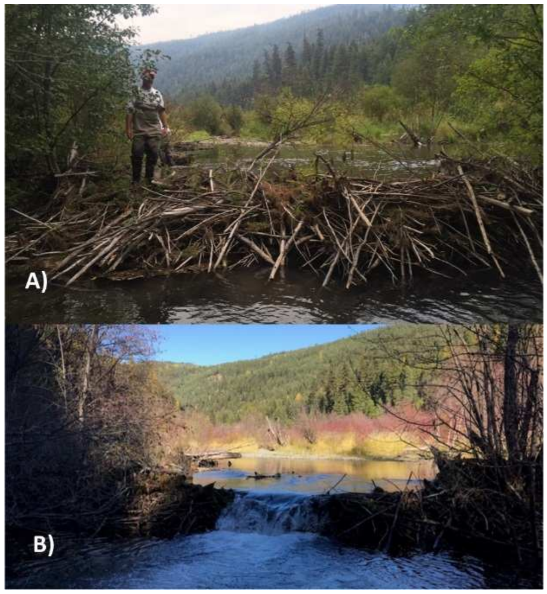

FIGURE 56. Multi-year beaver dam which was built up during several low-water years (A), and in September 2017 (B) after high-water partially dislodged it. Access through this dam was unrestricted during the entire summer of 2017. This dam was within the index reach and multiple redds were located below it in 2015 and 2016.

Results

Primary observations from this survey were that Bull Trout spawned in downstream reaches of Fishtrap Creek outside the index reach during all three years. However, the proportion of redds found there varied slightly (TABLE 9). The lowest number of redds observed in lower Fishtrap Creek over the study period, as well as the lowest proportion of redds in lower Fishtrap Creek occurred in 2017 when there was better access to upper Fishtrap Creek (TABLE 9). Redd numbers in the Fishtrap/WF FTC index sections combined have ranged from 2-25 since 2001, with a mean value of 12 (Appendix A). The count in 2016 and 2017 was 11 and 12 respectively. In 2014, for only the second time since 2001, zero Bull Trout redds were documented in mainstem Fishtrap Creek. Four redds were counted in WF FTC.

Since 2015, redd numbers in mainstem FTC downstream of the index reach have been monitored (Jungle to Beatrice). Results were 4 redds in 2015, 6 in 2016, and 3 in 2017. The three redds identified in 2017 indicate that although access to the upper river was unrestricted, some fish still spawned low in the system. In 2017, all lower beaver dams had washed out and a “losing reach” near river kilometer 4.5 contained adequate water for passage. The lower spawning reach likely receives a groundwater recharge as water reemerges below the losing reach (FIGURE 58).

TABLE 9. Redd numbers in lower Fishtrap Creek, upper Fishtrap Creek, WF FTC, and the overall proportion of redds in Lower FTC during 2015, 2016, and 2017.

Year	Lower FTC	Upper FTC	WFFTC	Proportion
2015	4	7	2	0.31
2016	6	7	5	0.33
2017	3	9	2	0.21

Discussion

Bull Trout generally begin upstream migrations in spring as river flows descend and water temperatures begin to warm (Swanberg 1999). However, in the lower Clark Fork River where dams have negatively altered the physical habitat, migrations may extend all the way through September (Bernall and Duffy 2017). In Fishtrap Creek, Bull Trout which migrate early can likely access areas further upstream in a drainage than later migrating fish. Access over waterfalls, beaver dams, and other obstacles is enhanced during spring months, even on low-flow years. However, the time available to access upstream locations is greater in high run-off years due to higher sustained flows and partial or permanent removal of beaver dams.

It is likely beneficial for migratory fish to spawn in the upper reaches of Fishtrap Creek or WFTR for several reasons. Stream temperatures near the index reaches average about 10°C during summer months with a maximum barely exceeding 12°C (FIGURE 57). In lower Fishtrap Creek (downstream of the index reach), maximum temperatures exceeded 16°C on several occasions in 2017, and means were higher than upper areas. Additionally, non-native Brook and Brown Trout exist in low to moderate densities in lower Fishtrap Creek but are functionally absent from the index reach. In some years, higher sediment loads are also observed in lower Fishtrap Creek.

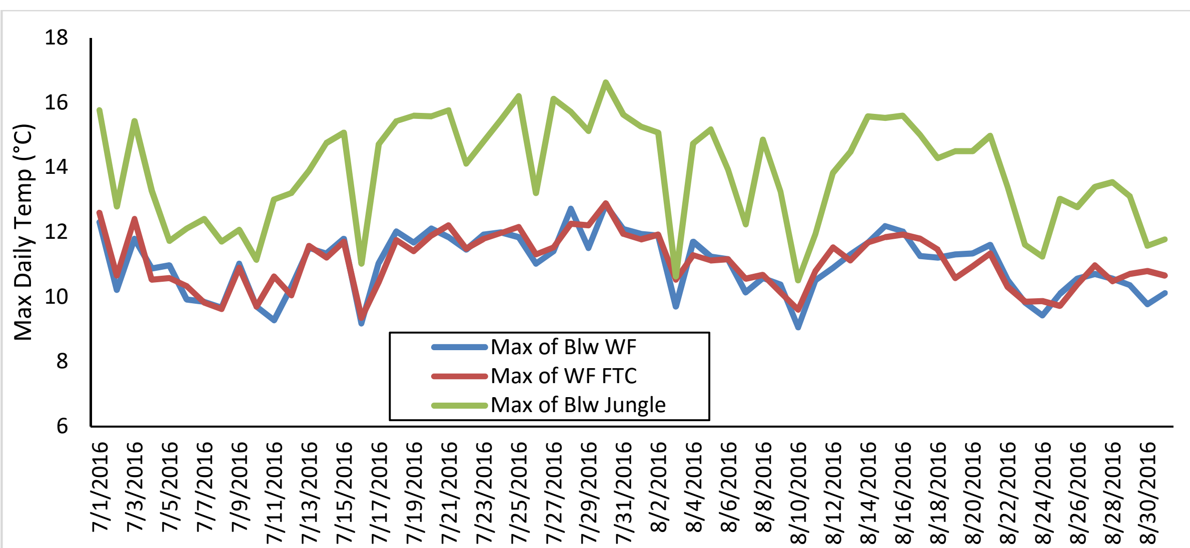

FIGURE 57. Maximum daily water temperatures in sections of Fishtrap Creek and lower WFFTC in 2016.

This study revealed that fish spawned in lower Fishtrap Creek despite unlimited access to the upper river at all points during the summer, 2017. Ground-water influence and adequate spawning gravels in the lower creek may provide appealing conditions for redd construction despite access to areas further upstream. Finally, unlike 2015 and 2016, four Bull Trout which genetically assigned to the Thompson River were captured below Cabinet Gorge Dam, ID in August and September 2017 and transported to the Thompson River. One or more of these redds in the downstream portion of Fishtrap Creek may be attributable to those fish (three of the four were detected on the Fishtrap Creek array in September or October).

Fishtrap Creek has not been routinely electrofished downstream of river kilometer 6.1. Surveys conducted upstream of that reveal that densities of Bull Trout are generally low in the middle sections of Fishtrap Creek (Rkm 6-Rkm 9) and high in upper Fishtrap Creek (Rkm 11-16). However, based on the results of these redd surveys, Bull Trout spawning activity may be higher in lower Fishtrap Creek (Rkm 1-6) than middle Fishtrap Creek (Rkm 6-9). It is recommended that exploratory electrofishing surveys be conducted in lower Fishtrap Creek (Rkm 1.5- Rkm 4.5). Information collected may reveal success of lower Bull Trout spawning activity and potential threat of non-native fish in lower Fishtrap Creek. In 2017, a Brown Trout redd survey was conducted during early December in this reach and no redds were observed. Non-native spawning surveys may continue in the future.

FIGURE 58. The downstream end of the “Losing Reach” on Fishtrap Creek in a low-flow year (2015) which limits migratory access to the upper river in summer.

WEST FORK THOMPSON RIVER

Background

In the West Fork Thompson River, the 2.7 km index reach between Big Spruce Creek and Anne Creek has been monitored for Bull Trout redds since the 1990s. Radio telemetry conducted by Liermann in 2003 verified that a five-foot waterfall approximately 0.8 km downstream of Four Lakes Creek was not a barrier (see Telemetry section). Additional surveys in Four Lakes Creek and downstream of Big Spruce Creek have occurred sporadically in the past. In 2003, seven additional redds were observed in Four Lakes Creek, yet the survey was discontinued a year later.

Results

Since 2001, numbers of redds counted within the index reach have ranged from 1-10 with an annual average of 5.9. Surveys of adjacent areas have contributed 2-7 additional redds annually. Since at least 2012, no migratory Bull Trout redds have been observed above the 5-foot waterfall which dissects the index reach below the confluence with Four Lakes Creek (FIGURE 60). A large woody debris jam has accumulated there and may be inhibiting migration, although resident fish have been observed spawning above (FIGURE 61).

FIGURE 60. Waterfall located mid-index reach of West Fork Thompson River. Accumulated woody debris at the falls has likely prevented upstream migrations in recent years as migratory fish or their redds have not been observed above the falls in at least six spawning seasons. High quality spawning gravel exists above this jam. (Angler in photo for scale).

FIGURE 61. Resident bull trout (<250 mm) observed spawning above falls in WFTR.

Discussion

Despite a modest number of redds observed annually (Index Mean: 5.9), the West Fork Thompson River historically contained some of the highest densities of Bull Trout in the lower Clark Fork drainage. Conditions in this stream are optimal for rearing and recruitment. Flows are consistently high throughout the summer, pools are abundant, and temperatures are cold. However, the West Fork Thompson River is a high-gradient stream which has a dominant boulder/cobble substrate with limited amounts of spawning gravels. The reach from the waterfall up to Anne Creek appears to contain the highest abundance of quality spawning material in the stream, the river is further from the road, and is located farthest from non-native source populations. Yet, in recent years, migratory fish have not spawned above the waterfall. A recent decline in abundance observed at the uppermost long-term monitoring site (FIGURE 41) may be the result of impeded migration at the falls. The monitoring site is located just downstream of the falls. Additionally, surveys in Four Lakes Creek should be re-initiated occasionally to document spawning in this once important tributary.

2006 CREEL SURVEY

There have been periodic efforts to collect creel data in the Thompson River as far back as the 1940's. These data were largely collected ad-hoc as part of fieldwork being conducted in the drainage and were not formalized. The most rigorous creel data for the Thompson River was collected by MFWP and summarized by Katzman (2006). The following summary is condensed from the findings of Katzman (2006).

Introduction

In addition to the statewide angler use surveys, a separate angler study was conducted on the Thompson River for the 2005 license year. The project was intended to determine the nature and extent a proposed change in the road system in the Thompson River would have on recreational fishing effort, distribution, and access. The two-part survey (creel and mail) was done to collect baseline data on existing fishing effort, harvest, and distribution.

Methods

A two-stage roving creel survey was used to count vehicles and anglers (first stage) and conduct verbal interviews (second stage). The survey area was stratified into two sections which accounted for survey technicians to cover the area efficiently, differences in fish habitat, and differences in seasonal fishing regulations. The lower section was from the mouth of the Thompson River to the 17-mile (27.4 km) bridge. The upper section was from the 17-mile bridge to mile 39 (63 km) of road 9991.

The survey was also stratified by season and weekends/holidays and weekdays to reduce variability of fishing effort. The seasonal stratification also corresponded to changes in fishing regulations. A time of day stratification was also employed because of the difference in photoperiod between summer and winter.

An additional mail survey was conducted to supplement the information gathered by the creel survey. The mail survey helped identify angler concerns regarding access if a single road system was implemented or potentially paved. Surveys were mailed ($n = 750$) to anglers interviewed during the creel survey who were willing to complete a mail survey, to people responding to the statewide fishing survey who were not interviewed during the creel survey, and to local residents with fishing licenses.

Results

A total of 958 angler interviews were conducted. An estimated total of 7,075 (SD = 581.4) angler hours occurred on the lower river and 1450 (SD = 184) angler hours occurred on the upper river. Anglers primarily caught and targeted trout, with a few targeting whitefish (7%). Trout made up 80% of the catch in the lower section and 96% in the upper section. Most fishing occurred during summer, but spring was similar for the lower section with April, May, and June being the busiest months. Most fish were released, with small percentages of trout (2.7%) and whitefish (7.4%) harvested. Most anglers were from Montana (70.6%) and Flathead (45%) and Sanders (38%) counties.

The mail survey had 381 responses (51%) including 307 anglers and 74 blank surveys returned as requested. Most respondents were from Montana (78%) and of those most were from Sanders County (72%). In addition to providing angler information, most participants indicated maintaining angler access is important or very important at locations frequently used by anglers (80%). Other important or very important concerns were that parking be allowed on the road shoulder (87%), highway pullouts provide parking along the road (76%), undeveloped access maintained (73%), overnight camping use (66%), and day use and picnicking use (61%). Other responses included overnight recreational vehicle access (39%), boating access (57%), and swimming access (49%). Participants generally wanted access maintained in the event of a single road, with opportunity provided by adequate pull-outs or parking areas, walking bridges, and trails to maintain current access should a road be removed. The primary concern over road removal was that access would be adequately maintained by a single road, followed by safety concerns of traffic and speeding, but also the primitive aspects of the Thompson River be maintained. There were concerns over crowding, pollution, fishing pressure, congestion, and access to both sides of the river.

Discussion

Many anglers were apprehensive about the concept of a single road system in the Thompson River, primarily due to a perceived reduction in access to the river. However, based on the details from the USFS's original plan (Beussink et al. 2008) and the physical characteristics of the Thompson River, any reductions in road densities on the lower 26 km of the Thompson River could not possibly increase the distance from road to stream greater than 0.4 km. All major trails and campgrounds would continue to have road access. Reductions in roads would also result in more opportunities for anglers who seek solitude. Rock Creek near Missoula (FWP Region 2), receives roughly ten times the angling pressure of the Thompson River, but anglers have the option of fishing remotely in some locations, or next to the road in others. The benefits of even a slight reduction in road/stream interactions to the aquatic resource would be positive.

TELEMETRY

Fish were captured below the Thompson Falls Dam in 2000–2002, implanted with radio tags, and moved above the dam. The fish were moved above the dam to investigate whether a passage structure at Thompson Falls Dam was warranted.

Methods

Fish were captured below the Thompson Falls Dam by boat-mounted electrofishing, hook-and-line sampling, or in a Denil chute with trap box. Three sizes of radio tag were used depending on fish size keeping the tag to <2% of the fish's body weight.

Results

In 2000, five fish (3Westslope Cutthroat Trout, 2 Rainbow Trout) were moved above Thompson Falls Dam to the mouth of the Thompson River. Relocations of these fish extended from 0.08–48.28 km above the dam. None of the fish went back below the dam once released upstream. No fish were detected in the Thompson River in 2000.

In 2002, seven fish (1 Bull Trout, 6 Westslope Cutthroat Trout) were tracked above Thompson Falls Dam. The Bull Trout moved into the Thompson River and on to the West Fork Thompson River in May where it remained into the fall. The Bull Trout remained nearly 7.7 rkm up the West Fork Thompson River, just below the confluence with Four Lakes Creek for most of the summer. One of the tagged Westslope Cutthroat Trout moved into the Thompson River and was documented in the Little Thompson River during the spring. The other Westslope Cutthroat Trout were documented all over the Clark Fork drainage, including Cedar Creek, the Saint Regis River, and Noxon Rapids Reservoir.

Discussion

The telemetry results documented a range of movements, including apparent spawning runs and dam fallback. Since this study, passage has been implemented at Thompson Falls Dam to benefit native and recreational species.

UPSTREAM TRANSPORT

As part of the Clark Fork Settlement Agreement for mitigation of two mainstem Clark Fork River dams, Avista Utilities biologists capture and transport adult Bull Trout from the Clark Fork River below Cabinet Gorge Dam, to genetically assigned tributaries in Montana. Four methods were employed to capture Bull Trout for upstream transport including two active capture methods, night electrofishing and hook-and-line sampling, and two passive capture methods, the fish ladder trap at the Cabinet Gorge Fish Hatchery and a weir trap in lower Twin Creek.

TABLE 10. Details of all adult Bull Trout captured as part of Avista's upstream transport program which genetically assigned to tributaries upstream of Thompson Falls Dam since 2007.

Capture	Method	Length	Weight	Release	Release Site	Origin
9/21/2017	Ladder	732	3941	9/26/2017	Cherry Creek ramp	Other
9/13/2017	Ladder	708	3345	9/15/2017	ACM Bridge	TR
9/6/2017	Ladder	745	3799	9/11/2017	ACM Bridge	TR
8/27/2017	E-fish	624	2779	8/30/2017	ACM Bridge	TR
7/13/2017	E-fish	615	1985	7/14/2017	St. Regis boat ramp	Other
5/26/2016	E-fish	650	3629	6/2/2016	Thompson Falls Res.	TR
4/21/2016	E-fish	592	2466	4/27/2016	Thompson Falls Res.	Other
8/27/2015	E-fish	735	4082	8/31/2015	Thompson River	TR
8/11/2015	E-fish	637	2551	8/16/2015	St. Regis River	Other
8/11/2015	E-fish	616	2275	8/16/2015	St. Regis River	Other
8/6/2015	E-fish	531	1446	8/10/2015	Thompson River	TR
8/3/2015	E-fish	557	1585	8/10/2015	Thompson River	TR
6/11/2015	E-fish	631	2863	6/17/2015	Thompson River	TR
5/31/2015	E-fish	604	2608	6/4/2015	Thompson River	TR
4/14/2015	E-fish	558	2041	4/17/2015	Thompson Falls Res.	TR
4/14/2015	E-fish	653	3062	4/17/2015	Thompson Falls Res.	TR
10/3/2014	Weir	570	1531	10/6/2014	WF Thompson River	TR
9/24/2014	Ladder	614	2324	9/26/2014	Fishtrap Creek	TR
9/6/2014	Ladder	684	2721	9/10/2014	Fishtrap Creek	TR
7/24/2014	E-fish	566	1644	7/30/2014	Fishtrap Creek	TR
7/17/2014	E-fish	532	1304	7/23/2014	WF Thompson River	TR
7/13/2014	E-fish	614	2211	7/16/2014	WF Thompson River	TR
7/2/2014	E-fish	648	2523	7/3/2014	WF Thompson River	TR
6/15/2014	E-fish	540	1360	6/18/2014	WF Thompson River	TR
5/11/2014	E-fish	718	3629	5/14/2014	Clark Fork R. (Paradise)	Other
4/29/2014	E-fish	525	1247	5/2/2014	WF Thompson River	TR
4/22/2014	E-fish	572	2126	4/25/2014	St. Regis	Other
4/20/2014	E-fish	528	1304	4/23/2014	WF Thompson River	TR
9/27/2013	Ladder	744	4082	9/28/2013	Fishtrap Creek	TR
9/26/2013	Ladder	475	851	9/30/2013	WF Thompson River	TR
9/14/2013	Weir	616	2466	9/18/2013	WF Thompson River	TR
9/4/2013	Ladder	554	1361	9/9/2013	WF Thompson River	TR
6/23/2013	E-Fish	651	2806	6/26/2013	WF Thompson River	TR
6/19/2013	Angling	606	2155	6/26/2013	Fishtrap Creek	TR
6/13/2013	E-fish	607	2324	6/19/2013	Fishtrap Creek	TR
6/9/2013	E-fish	567	2211	6/12/2013	Thompson R. @ Fishtrap	TR
6/28/2012	E-fish	575	1870	7/5/2012	Thompson River	TR
6/26/2012	E-fish	815	6010	7/2/2012	Fishtrap Creek	TR
5/17/2012	E-fish	620	2580	5/18/2012	Fishtrap Creek	TR
5/13/2012	E-fish	575	2211	5/17/2013	Fishtrap Creek	TR
5/13/2012	E-fish	520	1190	5/17/2012	Fishtrap Creek	TR

Capture	Method	Length	Weight	Release	Site	Origin
5/13/2012	E-fish	637	2154	5/14/2012	Fishtrap Creek	TR
5/1/2012	E-fish	616	2324	5/4/2012	St. Regis	Other
4/26/2012	E-fish	585	1928	5/2/2012	Fishtrap Lake	TR
9/22/2011	Ladder	606	1871	9/26/2011	SF Jocko River	Other
9/22/2011	Weir	592	1701	9/26/2011	Thompson River	TR
9/21/2011	Weir	613	2268	9/22/2011	Thompson River	TR
8/30/2011	E-fish	650	2892	9/2/2011	Fishtrap Creek	TR
7/28/2011	E-fish	516	1021	8/3/2011	Thompson River	TR
7/24/2011	E-fish	496	1190	7/25/2011	Graves Creek	Other
7/5/2011	E-fish	669	1948	7/8/2011	Noxon Reservoir	TR
7/3/2011	E-fish	513	1191	7/5/2011	Cabinet Gorge Reservoir	Other
6/26/2011	E-fish	470	907	6/29/2011	Noxon Reservoir	TR
6/21/2011	E-fish	462	907	6/24/2011	Noxon Reservoir	TR
6/21/2011	E-fish	701	3685	6/24/2011	Noxon Reservoir	TR
6/19/2011	E-fish	570	1729	6/23/2011	Noxon Reservoir	TR
6/5/2011	E-fish	585	1814	6/8/2011	Noxon Reservoir	TR
6/2/2011	E-fish	500	1049	6/8/2011	Noxon Reservoir	TR
5/22/2011	E-fish	710	3856	5/20/2011	Noxon Reservoir	TR
5/17/2011	E-fish	530	1360	5/25/2011	Noxon Reservoir	TR
4/24/2011	E-fish	627	2835	4/27/2011	Noxon Reservoir	Other
4/19/2011	E-fish	586	2126	4/22/2011	Noxon Reservoir	Other
8/31/2010	E-fish	614	1842	9/3/2010	Thompson River	TR
8/18/2010	E-fish	535	1190	8/20/2010	Thompson River	TR
7/25/2010	E-fish	598	2212		WF Thompson River	TR
7/6/2010	E-fish	724	4366	7/13/2010	WF Thompson River	TR
6/25/2010	E-fish	535	1587	6/30/2010	Thompson River	TR
5/16/2010	E-fish	634	2665	5/19/2010	Thompson River	TR
5/13/2010	E-fish	621	2778	5/19/2010	Thompson River	Other
5/5/2010	Angling	534	1247	5/12/2010	Thompson River	TR
4/29/2010	E-fish	547	1389	5/5/2010	Thompson River	TR
9/28/2009	Ladder	700	3289	9/30/2009	Clark Fork R. (St. Regis)	Other
9/23/2009	Ladder	592	2100	9/25/2009	Fishtrap Creek	TR
9/22/2009	Angling	490	964	9/25/2009	Fishtrap Creek	TR
9/22/2009	Ladder	646	2382	9/25/2009	Fishtrap Creek	TR
9/21/2009	Angling	585	1701	9/23/2009	St. Regis	Other
9/21/2009	Ladder	610	2041	9/23/2009	St. Regis	Other
9/21/2009	Ladder	600	1845	9/23/2009	St. Regis	Other
9/15/2009	Ladder	563	1815	9/18/2009	St. Regis	Other
6/11/2009	E-fish	660	2722	6/15/2009	Thompson River	TR
6/11/2009	Angling	710	3686	6/15/2009	Thompson River	TR
6/7/2009	E-fish	580	1616	6/10/2009	Clark Fork R. (Paradise)	Other
5/26/2009	E-fish	516	1361	5/29/2009	Thompson River	TR
9/3/2008		519			Clark Fork River	Other

Capture	Method	Length	Weight	Release	Site	Origin
8/24/2008		545			Clark Fork River	Other
8/24/2008		515			Clark Fork River	Other
6/1/2008		630			Thompson River	TR
5/25/2008		546			Thompson River	TR
5/20/2008		595			Thompson River	TR
4/22/2008		595			Clark Fork River	TR
4/9/2008		554			Jocko River	Other
				10/8/2007	Thompson Falls Res.	TR
				9/10/2007	Thompson Falls Res.	TR
				8/31/2007	Thompson Falls Res.	TR
				8/24/2007	Thompson Falls Res.	Other
				7/6/2007	Thompson Falls Res.	TR

Summary

The Thompson River and its tributaries are a top priority for fisheries management in the lower Clark Fork River, as both a recreational sport fishery and as a native species stronghold. In the mainstem river, species composition has shifted dramatically since the 1990s, and Brown Trout are now the most abundant trout species in the river. Native trout are not common in the mainstem, but recent tagging studies have shown that Bull Trout use the river during all seasons and for extended periods of time. Mountain Whitefish are common, and size structure of this species has remained similar over the past thirty years.

In the tributaries, Westslope Cutthroat Trout are present in most tributary systems. Efforts to preserve this species and protect its habitat will be a priority. Restoration projects should be considered, even in previously overlooked drainages such as the Little Thompson River. Bull Trout are present in three tributary drainages. Population indices fluctuate, but observational data indicates that primary areas of use may vary annually and may be driven by temporary barriers such as beaver dams or debris jams. Efforts to keep non-native species out of key spawning and rearing areas should be considered.

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Appendix A. Redd surveys

Redd surveys have been conducted in the Thompson River drainage annually since 2000. Prior to that, Huston conducted isolated redd surveys in certain tributaries (Huston 1994). Index reaches have been established in Fishtrap Creek, West Fork Fishtrap Creek, Beatrice Creek, Jungle Creek, and West Fork Thompson River. Additionally, exploratory redd surveys have been conducted in some years to document other spawning areas, or changes in primary spawning reaches.

Redd surveys from Fishtrap Creek and West Fork Thompson River basins from 2001–2016. Numbers in parentheses indicate total redds counted including exploratory surveys.

Stream	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Avg.
WFTR	1	7	5(12)	8	7	8	6 (8)	3	7	3	10	1	6(10)	7	6 (9)	3(5)	3(5)	5.4(6.5)
FTC	1	11	5	9	16	17	4	0	4	6	4	4	5	0	7(11)	7(13)	9(12)	6.4(7.2)
WFFTC	2	1	3	4	9	6	13	2	10	7	15	9	8	4	2	5	2	6.0

Appendix B. Electrofishing survey locations and results of sampling in the Thompson River.

Stream	Location	Latitude	Longitude	Length	Date	Pass	BULL	WCT	RB	LL	MWF	RBxWCT	EB	LNSU	Notes
Alder Creek		47.7135	-114.7719		7/9/2009								43		
		47.7154	-114.7705		9/1/1991			1					6		
		47.74285	-114.7976		8/4/2008			6					36		
	Above Culvert	47.74289	-114.7963	100	8/13/2008			37					22		Pure
		47.7569	-114.8176		8/4/2008										None
Alder Ditch		47.75874	-114.7527	100	8/14/2008			22				9			
Anne Creek		47.7086	-115.2084	88	8/2/2015		4	45							
		47.714	-115.2069		8/17/1994		2	2	11		1		5		
		47.714	-115.2069	104	8/17/1999	1	19	16							
		47.714	-115.2069	104		2	10								
		47.714	-115.2069	104		3	6	1							
		47.714	-115.2069	104	7/19/2000	1	56	11			1				
		47.714	-115.2069	104		2	18	6			1				
		47.714	-115.2069	104		3	8	5				1			
		47.714	-115.2069	104	7/29/2010	1	14	27							
		47.714	-115.2069	104		2	8	4							
		47.714	-115.2069	104		3	3	1							
Bear Creek		47.7786	-114.8951		8/6/2008										None
Beartrap Creek	Radio confluence	47.8451	-115.1741	97	7/14/2011	1	40	68							
		47.8451	-115.1741	97		2	4	7							
		47.8451	-115.1741	97	8/19/2015			103							
	0.08 RKM	47.8451	-115.1743	100	7/26/2016			42							
	Section 2	47.8445	-115.192	100	7/28/2011										None
		47.8453	-115.1986		9/24/1992			15							
		47.8453	-115.1986		8/15/2010		40	68							
	1.8 mi abv Radio	47.8392	-115.2115	113	8/19/2015			41							
Beatrice Creek	160 m abv lwr bridge	47.7937	-115.1055	123	7/21/2015		11	25							
		47.7932	-115.1071		9/21/1993							5			Hy.
	lower mgmt	47.7896	-115.1174	112	7/26/2011	1	51	34							
	lower mgmt	47.7896	-115.1174	112		2	19	7							
	lower mgmt	47.7896	-115.1174	112		3	9	2							
	lower mgmt	47.7896	-115.1174	112	7/16/2015	1	12	33							

Stream	Location	Latitude	Longitude	Length	Date	Pass	BULL	WCT	RB	LL	MWF	RBxWCT	EB	LNSU	Notes
Beatrice Creek	lower mgmt	47.7896	-115.1174	112		2	2	8							
	Plum Cr bridge	47.7842	-115.1304	114	7/21/2015		26	34							
	between bridges	47.7783	-115.1395	116	7/21/2015		30	26							
	4.2 rkm	47.7766	-115.148	120	8/31/2017			31							
	upper mgmt	47.7763	-115.149	100	7/25/2011	1	14	31							
	upper mgmt	47.7763	-115.149	100		2	2	1							
	upper mgmt	47.7763	-115.149	100	7/17/2015	1	24	39							
	upper mgmt	47.7763	-115.149	100		2	2	3							
	4.43 rkm	47.7754	-115.152	100	8/4/2016			15							
		47.7729	-115.1651		9/21/1993			5							Pure
Big Spruce Creek		47.689	-115.2071		7/12/2007							33			Hy.
		47.6872	-115.2206		7/11/2007			28							
Big Hole Creek	1.5 up trail	47.6574	-115.1046		8/1/2002										None
Big Rock Creek	Section 1	47.8713	-114.9848	89	8/27/2010		1	9		11					
	Section 1	47.8713	-114.9848	89	8/7/2013	1		40		23					
	Section 1	47.8713	-114.9848	89		2		10		9					
	Section 1	47.8713	-114.9848	89		3		7		5					
	Section 2	47.8749	-114.9633	95	8/27/2010		3	59							
	Section 2	47.8749	-114.9633	95	8/21/2013	1	1	58							
	Section 2	47.8749	-114.9633	95		2		23		1					
	Section 2	47.8749	-114.9633	95		3		16							
	Section 3	47.8752	-114.9542	100	8/26/2010		1	13							
	Section 3	47.8752	-114.9542		8/21/2009		2	37							
	Section 4	47.8749	-114.9424	100	8/26/2010		3	20							
	Section 4.5	47.8751	-114.9328	94	8/5/2013	1	15	95							
	Section 4.5	47.8751	-114.9328	94		2	4	24							
	Section 4.5	47.8751	-114.9328	94		3	1	13							
	Section 5	47.8736	-114.9264	90	8/26/2010		4	69							
	Section 6	47.8696	-114.9161	75	8/26/2010		2	39							
	Section 7	47.8645	-114.9035	76	8/26/2010		1	41							
	Section 7.5	47.8641	-114.8953	50	8/22/2013		1	35							
	Section 8	47.865	-114.8895	75	8/25/2010			21							
	Section 8	47.865	-114.8895	75	8/6/2013	1		136							
	Section 8	47.865	-114.8895	75		2		33							
	Section 9	47.8664	-114.8761	75	8/25/2010			97							

Stream	Location	Latitude	Longitude	Length	Date	Pass	BULL	WCT	RB	LL	MWF	RBxWCT	EB	LNSU	Notes
Big Rock Creek	Section 10	47.8646	-114.8671	75	8/25/2010			47							
	Section 13	47.8536	-114.8273	100	8/25/2010			34							
Boiling Springs Cr.		48.0166	-115.0412		7/23/2004			5	164			15	7		
		47.9957	-115.0769		7/11/2003				9				86		
Chippy Creek		47.7874	-114.9841		8/1/2005				20						
Cool Creek		47.8615	-115.216		7/1/2007										None
Deerhorn Creek					1988			22				1			
	0.5-1 rkm				1990			24							1%
	0.5-1 rkm				2003			25							11%
Fishtrap Creek	Weir trap	47.714	-115.0592	2	2015		94	6	33	8	11			1	
	6.1 rd km	47.7588	-115.0646	149	8/3/2015		3	12				14	5		
	lower mgmt	47.7638	-115.075	152	8/25/1999	1	7		16	2	1				
	lower mgmt	47.7638	-115.075	152		2	1		7		1				
	lower mgmt	47.7638	-115.075	152	7/27/2000	1	59	33	10		9				
	lower mgmt	47.7638	-115.075	152		2	22	11	1		2				
	lower mgmt	47.7638	-115.075	152		3	10	6	1		1				
	lower mgmt	47.7638	-115.075	152		4	6	1							
	lower mgmt	47.7638	-115.075	152	7/18/2001	1	21	41	7				1		
	lower mgmt	47.7638	-115.075	152		2	14	8							
	lower mgmt	47.7638	-115.075	152		3	5	5	2						1 unk
	lower mgmt	47.7638	-115.075	152	8/6/2002	1	24	4	5						
	lower mgmt	47.7638	-115.075	152		2	6	5	3				1		
	lower mgmt	47.7638	-115.075	152		3	5	1	1				1		
	lower mgmt	47.7638	-115.075	152	7/24/2003	1	8	6				1	1		
	lower mgmt	47.7638	-115.075	152		2	2								
	lower mgmt	47.7638	-115.075	152	7/22/2004	1	10		1		1	1	1		
	lower mgmt	47.7638	-115.075	152		2	1		1		1				
	lower mgmt	47.7638	-115.075	152	7/21/2006	1	3		6		1	1	2		
	lower mgmt	47.7638	-115.075	152		2	7	3	3			2			
	lower mgmt	47.7638	-115.075	152		3		1				1			
	lower mgmt	47.7638	-115.075	152	7/30/2007	1	2	9	4				1		
	lower mgmt	47.7638	-115.075	152		2	2	2							
	lower mgmt	47.7638	-115.075	152		3		2	1			1			
	lower mgmt	47.7638	-115.075	152	7/22/2009	1	5	9	3	2			1		
	lower mgmt	47.7638	-115.075	152		2	1	3							

Stream	Location	Latitude	Longitude	Length	Date	Pass	BULL	WCT	RB	LL	MWF	RBxWCT	EB	LNSU	Notes
Fishtrap Creek	lower mgmt	47.7638	-115.075	152	8/10/2011	1	2	28			6	2			
	lower mgmt	47.7638	-115.075	152		2		5							
	lower mgmt	47.7638	-115.075	152	7/21/2015	1	2	9	1	1		1			
	lower mgmt	47.7638	-115.075	152		2	1	1		1					
	lower mgmt	47.7638	-115.075	152		3	1	1	1						
	Section 1.1	47.7736	-115.0768		9/13/2006		8	88	1			1			
	Section 1.1	47.7736	-115.0768		7/30/2007		8	48	3		4	4	1		
	Section 1.1	47.7736	-115.0768		7/30/2009		3	68			10				
	Section 1.1	47.7736	-115.0768	130	8/9/2011		4	12	1		1				
	Section 5	47.7742	-115.0778	86	7/30/2013		3	26				3			
	weir (6.7 km)				2000		173	81	23		50		1		
	weir (6.7 km)				2001		83	54	11		23		4		
	weir (6.7 km)				2002		26	23	6		60		2		
	8.75 rd km	47.7749	-115.0792	121	8/3/2015		10	13		1		6	2		
	9.7 rd km	47.7809	-115.0877	140	8/3/2015		2	5	1		2	1	2		
	11.3 rk km	47.7861	-115.1004	120	8/3/2015		21	21	1			8	1		
	Section 1.2	47.7896	-115.1014	100	8/28/2011	1	11	45			4	2			
		47.7896	-115.1014	100		2	2	8							
	11.5 rkm	47.7911	-115.1017	119	8/22/2017		7	35	5		1	2			
	blw Beatrice	47.7911	-115.1018	112	7/27/2015		20	13	3	1		3			
	12.3 rd km	47.7943	-115.1028	147	8/4/2015		33	51	5		1	14			
	13.05 rd km	47.7962	-115.107	146	8/5/2015		9	22	1			10	1		
	Daisy Shale	47.8033	-115.1198	135	7/27/2015		9	13				3			
	14.8 rkm	47.8079	-115.1244	100	8/4/2016		1	7							
	14.8 rkm	47.8079	-115.1244	100	8/10/2016		1	3							
	15.7 rkm	47.8081	-115.1254	130	8/5/2015		7	14				1			
	15.7 rkm	47.8081	-115.1254	131	8/21/2017		3	16							
	16.3 rkm	47.8078	-115.1323	145	8/6/2015		18	17				6			
	16.5 rkm	47.8078	-115.1323	105	8/21/2017		13	19	1		2	2			
	upper mgmt	47.8164	-115.1395	90	8/16/1999	1	12	6							
	upper mgmt	47.8164	-115.1395	90		2	6	11							
	upper mgmt	47.8164	-115.1395	90		3	2	1							
	upper mgmt	47.8164	-115.1395	90		4		1							
	upper mgmt	47.8164	-115.1395	90	7/26/2000	1	44	14	7		2				
	upper mgmt	47.8164	-115.1395	90		2	19	7							

Stream	Location	Latitude	Longitude	Length	Date	Pass	BULL	WCT	RB	LL	MWF	RBxWCT	EB	LNSU	Notes
Fishtrap Creek	upper mgmt	47.8164	-115.1395	90		3	8	6	1		1				
	upper mgmt	47.8164	-115.1395	90		4	6	2							
	upper mgmt	47.8164	-115.1395	90	7/14/2001	1	44	7			1				
	upper mgmt	47.8164	-115.1395	90		2	13	5							
	upper mgmt	47.8164	-115.1395	90		3	2	1							
	upper mgmt	47.8164	-115.1395	90	7/22/2002	1	2	4			2				
	upper mgmt	47.8164	-115.1395	90		2	4								
	upper mgmt	47.8164	-115.1395	90		3	1								
	upper mgmt	47.8164	-115.1395	90		4	2	1							
	upper mgmt	47.8164	-115.1395	90		5	1								
	upper mgmt	47.8164	-115.1395	90	8/5/2002	1	6	8			1				
	upper mgmt	47.8164	-115.1395	90		2	3	1							
	upper mgmt	47.8164	-115.1395	90		3	1								
	upper mgmt	47.8164	-115.1395	90	7/25/2003	1	14	2							
	upper mgmt	47.8164	-115.1395	90		2	5	2							
	upper mgmt	47.8164	-115.1395	90		3									
	upper mgmt	47.8164	-115.1395	90	7/24/2006	1	9	13				1			
	upper mgmt	47.8164	-115.1395	90		2	3	4							
	upper mgmt	47.8164	-115.1395	90		3	2	2			1				
	upper mgmt	47.8164	-115.1395	90	7/27/2007	1	8	16							
	upper mgmt	47.8164	-115.1395	90		2	4	2				1			
	upper mgmt	47.8164	-115.1395	90		3	1	2							
	upper mgmt	47.8164	-115.1395	90	7/21/2009	1	8	31			1				
	upper mgmt	47.8164	-115.1395	90		2	1	3							
	upper mgmt	47.8164	-115.1395	90	8/26/2011	1	2	18	1		1				
	upper mgmt	47.8164	-115.1395	90	8/26/2011	2	3	17			1				
	upper mgmt	47.8164	-115.1395	90	8/26/2011	3	6	6			1				
	upper mgmt	47.8164	-115.1395	90	8/26/2011	4	3	11							
	upper mgmt	47.8164	-115.1395	90	7/20/2015	1	4	3							
	upper mgmt	47.8164	-115.1395	90		2	4	4							
	upper mgmt	47.8164	-115.1395	90		3		1							
	17.9 rkm	47.8189	-115.1559	100	7/26/2016		2	10							
	abv Shale Creek	47.8245	-115.1606	107	7/15/2011	1	5	14							
	abv Shale Creek	47.8245	-115.1606	107		2		5							
	abv Shale Creek	47.8245	-115.1606	107		3									

Stream	Location		Latitude	Longitude	Length	Date	Pass	BULL	WCT	RB	LL	MWF	RBxWCT	EB	LNSU	Notes
Fishtrap Creek	18.8 rkm		47.8255	-115.1614	107	7/19/2016		1	23							
	20.5 rkm		47.839	-115.1664	110	7/19/2016			20							
		2.2	47.8453	-115.164		9/23/1992			10							
		2.2	47.8453	-115.164	103	7/13/2011	1	8	31							
		2.2	47.8453	-115.164	103		2	3	9							
		2.2	47.8453	-115.164	103		3	1	8							
	21.9 rkm		47.8492	-115.1647	100	7/23/2016		1	29							
		2.3	47.8523	-115.1533	100	7/26/2011	1	4	46							
		2.3	47.8523	-115.1533	100		2	5	17							
		2.3	47.8523	-115.1533	100		3	1	8							
	24.5 rkm		47.8669	-115.1611	100	7/27/2016			13							
			47.8413	-115.1651		9/4/1991			26							Pure
	25.35 rkm		47.8729	-115.1683	100	8/10/2016			14							
		2.4	47.878	-115.1826	110	7/29/2011	1		45							
		2.4	47.878	-115.1826	110		2		10							
Fishtrap Lake			47.8644	-115.1985		8/30/1988			360							Pure
			47.8644	-115.1985		5/18/1989			29							Pure
			47.8644	-115.1985			Net 1		21						28	
			47.8644	-115.1985			Net 2								1	
Four Lakes Creek			47.7094	-115.2146		9/20/1984			8							
			47.7108	-115.2307		8/1/1984			8							
			47.7104	-115.2219		8/16/1994		5	10							
			47.7104	-115.2219	118	7/28/2010	1	24	32							
			47.7104	-115.2219	118		2	3	1							
Goat Creek			47.6048	-115.2235		9/2/2003			25							Pure
Honeymoon Creek			47.6605	-115.1928		7/11/2007			6							
			47.6687	-115.1911	132	7/30/2015		20	63							
	below culvert		47.6601	-115.2093		7/11/2007			3							
	abv trlhd culvert		47.6597	-115.2111		7/11/2007										None
Jungle Creek	Jeff's lower		47.7309	-115.0702	151	8/18/2015		6	37	1				2		
	lower mgmt		47.7343	-115.0782	100	7/19/2006	1	1	35							
	lower mgmt		47.7343	-115.0782	100		2		4							
	lower mgmt		47.7343	-115.0782	100	7/23/2007	1	2	48							

Stream	Location	Latitude	Longitude	Length	Date	Pass	BULL	WCT	RB	LL	MWF	RBxWCT	EB	LNSU	Notes
Jungle Creek	lower mgmt	47.7343	-115.0782	100		2		3							
	lower mgmt	47.7343	-115.0782	100	7/28/2011	1	2	49							
	lower mgmt	47.7343	-115.0782	100		2	1	5							
	lower mgmt	47.7343	-115.0782	100	7/16/2015	1	5	35							
	lower mgmt	47.7343	-115.0782	100		2		5							
	Jeff's upper	47.7371	-115.103	150	8/17/2015		16	22							
	upper mgmt	47.7404	-115.1237	96	7/18/2006	1	2	39							
	upper mgmt	47.7404	-115.1237	96		2		11							
	upper mgmt	47.7404	-115.1237	96		3		3							
	upper mgmt	47.7404	-115.1237	96	7/20/2007	1	1	51							
	upper mgmt	47.7404	-115.1237	96		2		3							
	upper mgmt	47.7404	-115.1237	96	7/27/2011	1	5	55							
	upper mgmt	47.7404	-115.1237	96		2	1	3							
	upper mgmt	47.7404	-115.1237	96	7/17/2015	1	14	26							
	upper mgmt	47.7404	-115.1237	96		2	3								
		47.7431	-115.1294		7/17/2003			30							Pure
Indian Creek		47.9136	-115.0505		7/31/2002					2			1		
		47.9136	-115.0505		8/24/2010								6		
	0.6 mi abv Twin Lk	47.9172	-115.0569		7/31/2002								1		
		47.9187	-115.0617		9/9/2013				1	13			97		
		47.9475	-115.1005		9/16/2013			43							
Lazier Creek	0.5 river mi	47.9107	-115.0661		8/1/2002										None
	middle	47.9012	-115.1139	93	9/16/2013			1	31				2		
		47.8948	-115.1166		9/17/2009				44			6	1		
Little Rock Creek					1988			11				1			
		47.7209	-115.0007		6/27/2007			20							Pure
	1.9 rkm	47.7226	-114.9873	100	7/26/2017								21		
	2.3 rkm	47.7239	-114.9831	100	7/18/2016								15		
	4.2 rkm	47.7293	-114.9596	100	7/26/2017			40					19		
	5.6 rkm	47.728	-114.9409	100	7/18/2016			71					2		
	5.8-4.2 rkm	47.729	-114.9561		2017								255		
Little Thompson R.		47.6805	-114.8344		9/10/1991			7	1				4		
		47.6805	-114.8344		9/1/1992			6					14		
		47.6934	-114.8144		7/9/2009			8					18		

Stream	Location	Latitude	Longitude	Length	Date	Pass	BULL	WCT	RB	LL	MWF	RBxWCT	EB	LNSU	Notes
Loneman Creek	0.6 rkm	47.643	-114.9383	116	7/20/2016			16							
	1.2 rkm	47.6429	-114.9283	100	7/17/2017			6					2		
	2.4 rkm	47.6425	-114.9081	100	7/17/2017										None
Mantrap Fork	1 rkm	47.8969	-115.2013	100	7/28/2016			29							
Marten Creek		47.7422	-114.963		6/26/2007			9							Pure
McGinnis Creek	1025 bridge	47.6751	-114.8241	100	8/14/2008			34					22		Pure
		47.6668	-114.811		7/10/2009			4					41		
	1 mi abv 1025 br	47.6572	-114.7982	100	9/16/2008			2					33		
		47.6518	-114.7915		7/10/2009			5					25		
	Placer Spur Rd	47.6431	-114.7788	50	9/16/2008			8					7		
		47.6358	-114.7702		7/9/2009			37					17		
McGinnis Ditch		47.6439	-114.7551	100	8/14/2008										
Mudd Creek	4 rkm	47.6552	-114.973	92	7/21/2016			5					16		
	7.4 rkm	47.6412	-114.9441	90	7/21/2016			5							
Murr Creek		47.9419	-114.929		8/12/2014								118		
NF Little Thompson	2.4 rkm	47.699	-114.9307	79	7/17/2017			5				1	20		
		47.7064	-114.9219		9/23/2008			52		1			3		
		47.7073	-114.9202		9/3/1992			9					3		
	6 rkm	47.7115	-114.8925	91	8/30/2017			35					4		
	9.5 rkm	47.7278	-114.8553	100	7/18/2017			41							
NF Murr Creek		47.9665	-114.9104		7/29/2002								169		
Partridge Creek	0.6 rkm	47.9683	-114.9649	91	7/21/2016			2							
	0.9 rkm	47.659	-114.9599	88	7/19/2017			4							
	1.9 rkm	47.6608	114.9456	102	7/19/2017			9							
Radio Creek	0.6 rkm	47.8452	-115.1712	100	7/19/2016		1	35							
	1.2 rkm	47.8475	-115.1785	100	7/28/2016			45							None
	5.75 rkm	47.8744	-115.2054	100	7/25/2016			47							
Schroder Creek		47.9216	-114.9913		8/17/2008					2			30		
Tepee Creek		47.6962	-114.8038		8/5/2008								10		
		47.7054	-114.811		8/5/2008								37		
Todd Creek	0.6 rkm	47.6593	-114.9827	100	7/21/2016			2					7		
Twin Lakes Creek	1 mile abv mouth	47.9304	-115.0543		7/31/2002			6							
	Section 2	47.9434	-115.0542	62	9/10/2013			46							
U. Fishtrap Lake		47.8451	-115.2045		5/12/2016			18							

Stream	Location	Latitude	Longitude	Length	Date	Pass	BULL	WCT	RB	LL	MWF	RBxWCT	EB	LNSU	Notes
WF Fishtrap Creek		47.8141	-115.1456		10/1/1993		31						116		Pure
	0.2 rkm (bridge)	47.8151	-115.1452	126	7/22/2015		18	49							
	0.2 rkm	47.8151	-115.1452	110	8/31/2017		9	26							
	0.6 rkm	47.8121	-115.1485	100	8/3/2016		1	15							
	big pondo	47.8088	-115.1556	148	7/23/2015		55	73							
	old bridge	47.8045	-115.1732	85	8/2/2011	1	14	28							
	old bridge	47.8045	-115.1732	85		2		4							
		47.8037	-115.1776				7	20							
		47.8024	-115.1896		9/1/1992		7	6							
	2.7 rkm	47.8011	-115.1933	98	8/3/2016		8	17							
		47.7998	-115.2016		10/1/1993		16								Pure
	new bridge	47.7995	-115.2022	100	8/3/2011	1	32	56							
	new bridge	47.7995	-115.2022	100		2	4	8							
	new bridge	47.7995	-115.2022	100	7/20/2015	1	31	62							
	new bridge	47.7995	-115.2022	100		2	8	13							
	upr beaver dam	47.7938	-115.2232	112	7/23/2015		10	99							
	6.9 rkm	47.7938	-115.2233	106	8/9/2017		9	60							
		47.787	-115.2282		7/9/2009		1	35							
	Site 3	47.7848	-115.2289	99	8/5/2011		8	39							
	9 rkm	47.7783	-115.2321	103	8/22/2017		18	43							
		47.7664	-115.2434		7/9/2009			35							
WF Thompson R.	lower mile	47.6502	-115.174	1600	10/3/2014		53								
		47.6529	-115.1762		9/21/1993							6			Hy.
	weir trap	47.6505	-115.1748	2	2000		12	5	27						
		47.6505	-115.1748	2	2001		45	21	23		12		1		
		47.6505	-115.1748	2	2002		42	2	67		58		1		
		47.6505	-115.1748	2	2015		50	1	24		7				
	0.3 miles	47.6541	-115.1795	100	7/21/2010	1	2	8	10	15		1			
		47.6541	-115.1795	100		2		1							
	culverts	47.6559	-115.183	135	8/6/2015		19	33	9						
	lower mgmt	47.661	-115.1925	67	8/21/1999	1	2	14		2		15			
	lower mgmt	47.661	-115.1925	67		2	2	5	1			2			
	lower mgmt	47.661	-115.1925	67		3	2	8	2			3			
	lower mgmt	47.661	-115.1925	67		4		2	2						
	lower mgmt	47.661	-115.1925	67	7/20/2000	1	8	55			5				

Stream	Location	Latitude	Longitude	Length	Date	Pass	BULL	WCT	RB	LL	MWF	RBxWCT	EB	LNSU	Notes
WF Thompson R.	lower mgmt	47.661	-115.1925	67		2	2	29			2				
	lower mgmt	47.661	-115.1925	67		3	1	19							
	lower mgmt	47.661	-115.1925	67	7/19/2001	1	3	41							
	lower mgmt	47.661	-115.1925	67		2	4	13							
	lower mgmt	47.661	-115.1925	67		3	1	9							
	lower mgmt	47.661	-115.1925	67	8/8/2002	1	4	13	5			1			
	lower mgmt	47.661	-115.1925	67		2	2	4	2						
	lower mgmt	47.661	-115.1925	67		3		2							
	lower mgmt	47.661	-115.1925	67	7/18/2003	1	6	29	3			1			
	lower mgmt	47.661	-115.1925	67		2	2	7	1						
	lower mgmt	47.661	-115.1925	67	7/18/2005	1	1	16				4			
	lower mgmt	47.661	-115.1925	67		2	2	8							
	lower mgmt	47.661	-115.1925	67		3		3							
	lower mgmt	47.661	-115.1925	67	7/26/2007	1	4	40							
	lower mgmt	47.661	-115.1925	67		2	1	8							
	lower mgmt	47.661	-115.1925	67		3	1	3							
	lower mgmt	47.661	-115.1925	67	8/18/2008	1	4	30				2			
	lower mgmt	47.661	-115.1925	67		2		14							
	lower mgmt	47.661	-115.1925	67		3	1	1							
	lower mgmt	47.661	-115.1925	67	7/26/2010	1	6	33	1			3			
	lower mgmt	47.661	-115.1925	67		2	2	9							
	lower mgmt	47.661	-115.1925	67		3		4							
	lower mgmt	47.661	-115.1925	67	7/14/2015	1	5	31							
	lower mgmt	47.661	-115.1925	67		2	1	12							
	lower mgmt	47.661	-115.1925	67		3	0	4				2			
	Site 1A- 1.9	47.6713	-115.1896	122	7/27/2010	1	8	44							
	Site 1A- 1.9	47.6713	-115.1896	122		2	3	11							
	Site 1A- 1.9	47.6713	-115.1896	122		3		3							
	3.5 rkm	47.6748	-115.1879	116	7/30/2015		30	43				4			
	4.1 rkm	47.6788	-115.1908	144	7/29/2015		35	40	1			4			
		47.6788	-115.1908	97.5	8/24/2017		17	19							
	4.6 rkm	47.6809	-115.1938	135	7/29/2015		29	36				6			
		47.6809	-115.1938	115	8/24/2017		12	27							
	Site 1B, 3 miles	47.6842	-115.1972	100	7/28/2010	1	16	11							
	Site 1B, 3 miles	47.6842	-115.1972	100		2	6	15							

Stream	Location	Latitude	Longitude	Length	Date	Pass	BULL	WCT	RB	LL	MWF	RBxWCT	EB	LNSU	Notes
WF Thompson R.	Site 1B, 3 miles	47.6842	-115.1972	100		3		5							
	blw Spruce Creek	47.6897	-115.2029		9/17/1993							6			Hy.
		47.6883	-115.2017	131	7/28/2015		30	61							
	abv Spruce Creek	47.6932	-115.206	129	7/28/2015		26	59							
	6.5 rkm	47.6947	-115.2062	109	8/23/2017		23	41							
	upper mgmt	47.7029	-115.2065	120	7/20/2001	1	45	7							
		47.7029	-115.2065	120		2	15								
		47.7029	-115.2065	120		3	9	5							
		47.7029	-115.2065	120	8/7/2002	1	33	15	2		3				
		47.7029	-115.2065	120		2	8								
		47.7029	-115.2065	120		3	6	3							
		47.7029	-115.2065	120	7/22/2003	1	57	20							
		47.7029	-115.2065	120		2	18	9							
		47.7029	-115.2065	120		3	6	2							
		47.7029	-115.2065	120	7/19/2005	1	23	7							
		47.7029	-115.2065	120		2	12	5							
		47.7029	-115.2065	120		3	5								
	upper mgmt	47.7029	-115.2065	120	7/24/2007	1	36	14				1			
		47.7029	-115.2065	120		2	7	3							
		47.7029	-115.2065	120	9/3/2008	1	28	15	1						
		47.7029	-115.2065	120		2	7	1							
		47.7029	-115.2065	120		3	2	2				1			
		47.7029	-115.2065	120	7/27/2010	1	33	11				2			
		47.7029	-115.2065	120		2	7	5							
		47.7029	-115.2065	120		3	4	1							
		47.7029	-115.2065	120	7/15/2015	1	11	39							
		47.7029	-115.2065	120		2	2	9							