Technical Memorandum

Thompson River – Fish Monitoring, 2014-2015 Summary
NorthWestern Energy
FERC Project No. 1869

Introduction

NorthWestern Energy (Licensee or NorthWestern) owns and operates the 92.6-megawatt Thompson Falls Hydroelectric Project (Project) built in 1917 on the Clark Fork River near Thompson Falls, Montana (Figure 1). The Federal Energy Regulatory Commission (Commission or FERC) relicensed the Project (FERC Project No. 1869) in 1979 and amended the License to include a new powerhouse in 1990. The current FERC License is scheduled to expire on December 31, 2025.

Figure 1: Thompson Falls Hydroelectric Project looking upstream.

In 1998, the bull trout (*Salvelinus confluentus*) was federally-listed under the Endangered Species Act as a threatened species (Federal Register, 1998). Critical habitat was designated in 2005 and revised in 2010 (Federal Register, 2005, 2010).

The Licensee filed a Biological Evaluation with FERC, discussing the effects of the Project on bull trout and proposed conservation measures with the Commission on April 7, 2008. The Biological Evaluation identified several factors directly related to Project operation that negatively impact bull trout in the Clark Fork River.

In 2008, the Commission concluded that the Project is adversely affecting bull trout and proposed conservation measures to reduce the Project's adverse effects on bull trout.

On November 4, 2008 the U.S. Fish and Wildlife Service (FWS) filed with the Commission a Biological Opinion (BO) and associated Incidental Take Statement, which includes reasonable and prudent measures and Terms and Conditions (TCs) to minimize incidental take of bull trout. The FWS concluded in its BO that the Project is currently adversely affecting bull trout and the Licensee's proposed conservation measures will reduce, but not totally eliminate, adverse impacts of the Project (FWS, 2008).

On February 12, 2009 the Commission issued an Order Approving Construction and Operation of Fish Passage Facilities for the Thompson Falls Project (FERC, 2009). This Order included the reasonable and prudent measures, TCs, and conservation recommendations from the FWS's BO. TC 5a of the BO states that:

> During the first 5 years of the Phase 2 evaluation (2010 through 2015) PPL Montana, with Technical Advisory Committee (TAC) involvement and Service approval, will conduct a prioritized 5-year evaluation of factors contributing to the potential loss or enhancement of migratory bull trout passage through Thompson Falls Reservoir. Goals and objectives for this assessment and scientifically-based methodology will be developed through the TAC and approved by the Service no later than the end of 2010 and will focus at a minimum on better understanding temperature and water current gradients through the reservoir; travel time, residence time, and pathways that juvenile and subadult bull trout select in moving through the reservoir; and an assessment of impacts of predatory nonnative fish species on juvenile and subadult bull trout residing in or passing through the reservoir. The initial findings will be summarized and supported with scientifically based conclusions, no later than the end of 2015, with a goal of adaptively improving survival of juvenile bull trout in Thompson Falls Reservoir as they pass downstream or reside in the system. A second, more comprehensive summary of conclusions and recommendations regarding reservoir impacts will be submitted as part of the scientific review package by the end of 2020 (*see* TC1h).

In compliance with TC 5a, the Licensee collaborated with TAC members and prepared a 5-Year Reservoir Monitoring Plan, which was approved by the FWS and submitted to the FERC on June 17, 2010. FERC issued an Order approving the 5-Year Reservoir Plan on February 9, 2011.

Due to the geographic proximity of the Thompson Falls Dam to the Thompson River and the duration that the Thompson Falls Dam has served as a fish barrier, the Thompson Falls Dam has likely had the greatest impact on bull trout in the Thompson River drainage. Therefore, the Thompson Falls Fisheries TAC has identified the Thompson River as a critical drainage to concentrate bull trout protection and enhancement measures and allocation of funding. The objectives identified in the 5-Year Reservoir Monitoring Plan include:

1. Characterization of bull trout in the Thompson River drainage
2. Characterization of the affect that Thompson Falls Reservoir has on bull trout emigrating from the Thompson River drainage (or elsewhere upstream, as these are not necessarily separable) and migrating downstream in the Clark Fork River

Studies to implement the objectives of the 5-Year Reservoir Monitoring Plan have been ongoing since 2011. In 2014, the Licensee funded a multi-year (2014-2016) study to evaluate the impact of Thompson Falls Reservoir on the out-migration habits of juvenile bull trout. This research is being conducted by a graduate student from Montana State University (MSU). The Fish Passage Project Annual Reports prepared by the Licensee for FERC describe the results of Licensee-funded bull trout passage studies and habitat improvement efforts.

The purpose of this Technical Memo is to summarize the results of data collected during salmonid tagging studies in the Thompson River drainage since 2014. Much of this information has been gathered by MSU, Montana Fish, Wildlife and Parks (FWP), and Northwestern incidental to studies related to bull trout passage. This Technical Memo includes a status report on the bull trout study completed by MSU in 2014 and 2015, additional fisheries data (on species other than bull trout) collected in conjunction with the MSU study, and passive integrated transponder (PIT) tag antenna array detections of fish in the mainstem Thompson River, Fishtrap Creek, and West Fork Thompson River.

NorthWestern proposes to continue to prepare an annual synopsis to briefly summarize activities occurring in the Thompson River that are outside the scope and reporting requirements of the FWS BO (2008) and the 2009 FERC Order.

Thompson River Drainage

The Project is located 6.3 miles downstream of the confluence of the Thompson River with the Clark Fork River. Thompson River drainage is approximately 630 square miles with a stream

network of 1,326 linear miles (Plum Creek, 1997) (Figure 2). Elevations in the drainage vary from 2,457 feet at the confluence with the Clark Fork River to 7,464 feet on Baldy Mountain in the southeast corner of the drainage. Annual precipitation in the watershed varies from less than 20 inches in the lowest bottom-lands to greater than 60 inches along the highest ridges (Plum Creek, 1997).

The Thompson River has several major tributaries including the West Fork Thompson River, Fishtrap Creek, Little Thompson River, Chippy Creek, and Big Rock Creek. The confluence of the Little Thompson River is near the 17-mile bridge, and both Fishtrap Creek and the West Fork Thompson River join the Thompson River downstream of the mouth of the Little Thompson River. A series of lakes in the headwaters of the Thompson River release relatively warm water into the river. The warmest water temperatures in the Thompson River occur just downstream from the confluence of the Little Thompson River and above the confluence of Fishtrap Creek. Water temperatures are cooler near the mouth of the Thompson River.

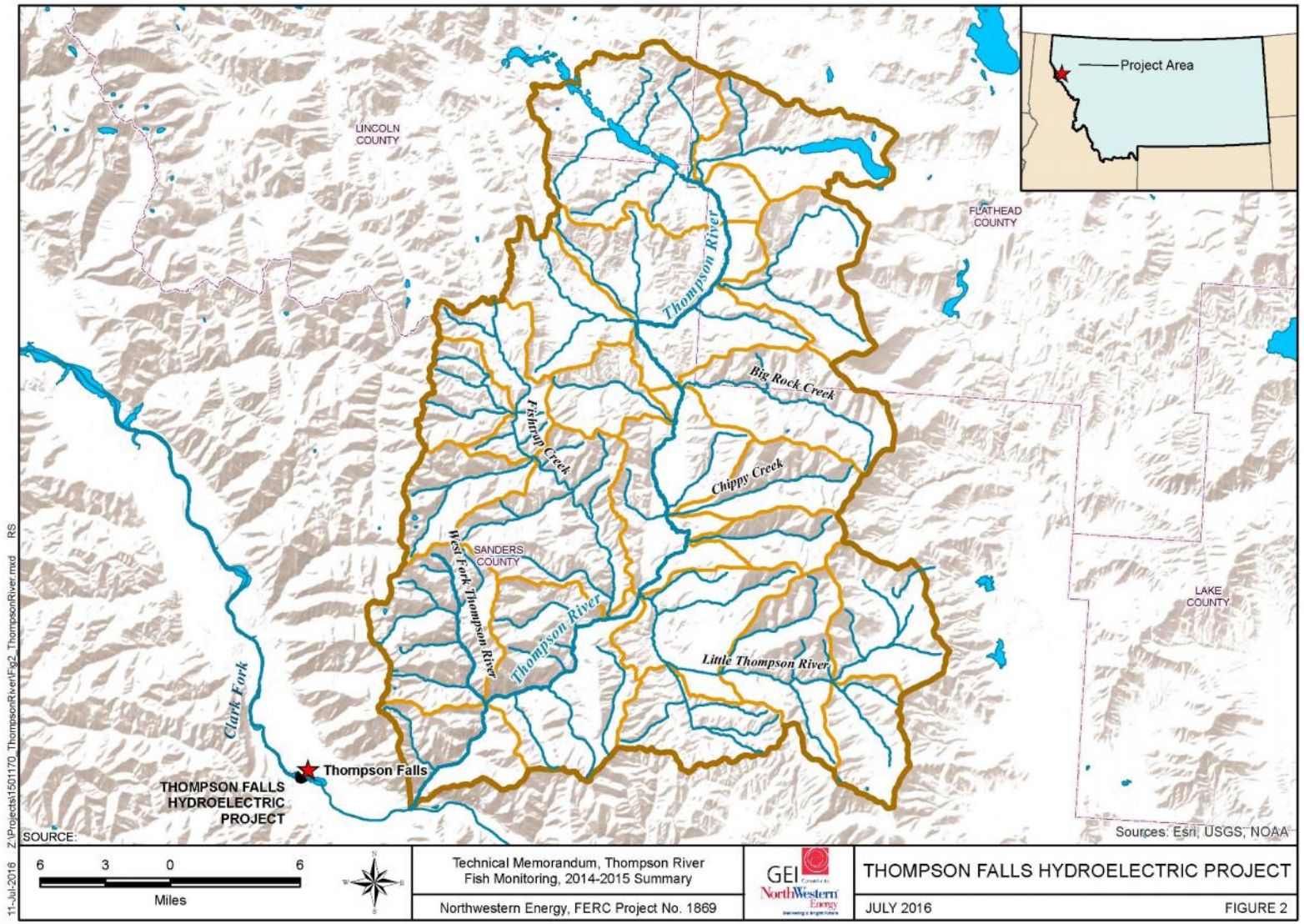


Figure 2: Map of the Thompson River drainage and tributaries.

Thompson River streamflows vary depending on snowpack and rain-on-snow events in the spring and summer months. Peak flows are most common in May and June, but in 2015, the spring freshet was early and occurred in March. In an above-average snow-pack year, spring flows may exceed 4,000 cfs, as was recorded in 2011. In 2015 (a below average year) the peak flow was about 1,700 cfs. A hydrograph for the Thompson River is provided in Figure 3 with the mean daily flow data recorded between 2011 and 2015, the same years the ladder has been in operation.

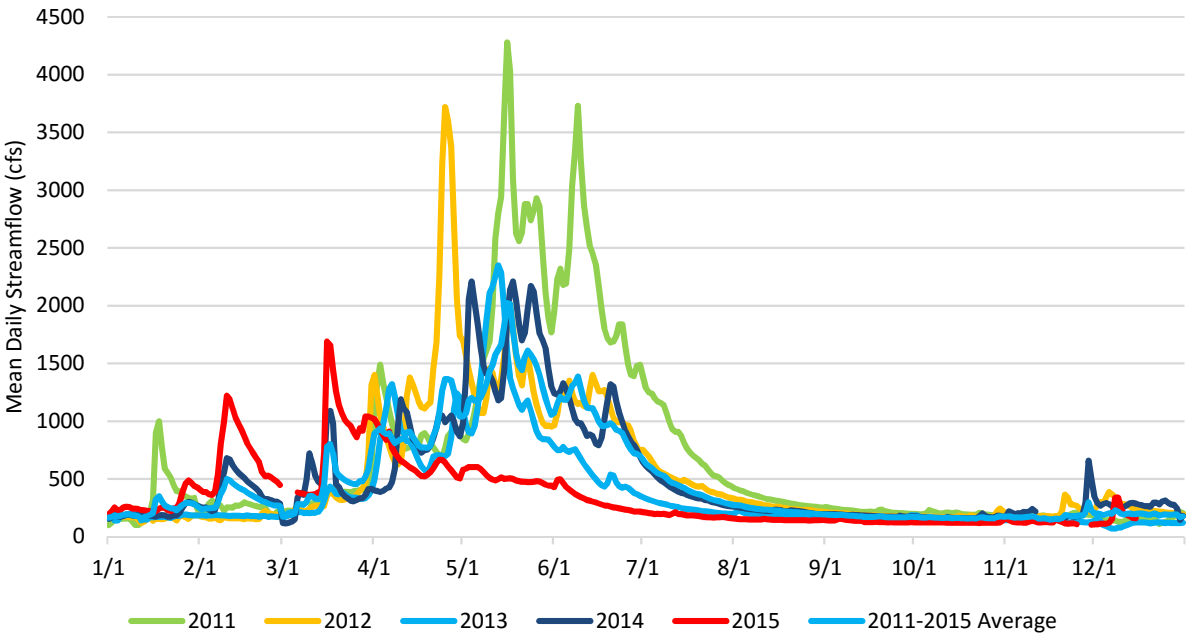


Figure 3: Mean Daily Streamflow Thompson River, USGS Gage Station #12389500, 2011 to 2015.

Thompson River Fisheries

The distribution of fish species found in the Thompson River drainage varies longitudinally. The downstream portion of the river contains primarily a rainbow trout fishery, which is most popular with anglers. Brown trout, which also provide an important recreational fishery, tend to dominate the upstream portion of the river where water temperatures are warmer. Westslope cutthroat trout are also captured by anglers in the Thompson River, but are more common in the tributaries to the river. Mountain whitefish are abundant in the mainstem Thompson River and provide primarily a winter and spring recreational fishery. The area between the mouth of the Thompson River and the confluence of Fishtrap Creek serves as a migratory corridor for bull trout. Other species known to inhabit the drainage include brook trout, and other game fish and non-game fish such as suckers and sculpin (Katzman, 2006).

Bull trout are currently known to be present in the following areas of the Thompson River drainage (GEI and Steigers, 2013):

- Fishtrap Creek and tributaries Beartrap (Fork) Creek, West Fork Fishtrap Creek, Beatrice Creek, and Jungle Creek
- West Fork Thompson River and tributaries Anne Creek, Four Lakes Creek, and Big Spruce Creek
- Big Rock Creek
- Mainstem of the Thompson River

Methods

In 2014 and 2015, a graduate student from MSU evaluated the impact of Thompson Falls Reservoir on the out-migration habits of juvenile bull trout. The primary objectives of the MSU project were aimed at assessing the outmigration characteristics and survival of subadult bull trout in the Thompson River Drainage and Thompson Falls Reservoir. Some of the key questions included:

- What time of year do subadult bull trout leave natal headwaters?
- How quickly do bull trout move through the Thompson River drainage?
- What is the estimated survival rate of subadult bull trout that transition into Thompson Falls Reservoir?

In autumn 2014, a multi-antenna PIT tag array (array) was installed in the mainstem of the Thompson River to detect PIT-tagged fish. The remote array in the mainstem Thompson River was operational between September 26, 2014 and December 22, 2014 and then again between February 12, 2015 and December 31, 2015.

In September 2014, a single unit PIT tag array was assembled near the mouth of the West Fork Thompson River and four stationary acoustic data-loggers were deployed in Thompson Falls Reservoir. Both PIT tag arrays read half-duplex (HDX) and full-duplex (FDX) PIT tags and detection was assessed to be approximately 100 percent. The four acoustic data-loggers were deployed roughly equidistant from each other throughout the length of Thompson Falls reservoir; the uppermost receiver being located approximately 1,300 meters upstream of the Thompson River confluence and the lowermost receiver being placed just upstream of the dam. Range detection testing showed that all stationary receivers operated at, or near, 100 percent detection efficiency.

Between October 3 and 17, 2014, a total of 54 subadult bull trout were sampled via electrofishing in the West Fork Thompson River. Twenty-nine of these fish were surgically implanted with Lotek MAP coded acoustic transmitters and both HDX and FDX injectable PIT tags. The other 25 bull trout were too small to receive an acoustic tag and received only an HDX PIT tag, courtesy of FWP.

In July and August of 2015, 36 sites were sampled via electrofishing within the Thompson River drainage tributaries (Figure 4). The sampling efforts encompassed 10 locations in the West Fork Thompson River and 26 locations in Fishtrap Creek and its tributaries. In addition to the mainstem Thompson River PIT tag array that was installed in 2014, two single-antenna PIT tag arrays were installed in July 2015 to assess the outmigration of PIT tagged bull trout in the Thompson River drainage, one in the West Fork Thompson River, and one in Fishtrap Creek at the confluence with the mainstem Thompson River (Figure 5). The remote-array system in West Fork Thompson River was operational in the autumn of 2014 and in 2015 from July through December 2015. The remote-array system in Fishtrap Creek was operational between July and December 2015.

A mobile PIT tag antenna (HPR Plus; BioMark) was used throughout autumn 2015 to obtain redetections of PIT-tagged bull trout in the Thompson River tributaries.

In order to capture actively outmigrating bull trout, downstream directional weir traps were operated from late-September to early-November 2015 immediately downstream of the tributary PIT tag arrays (Figure 5). All untagged bull trout measuring more than (or equal to) 100 mm were injected with a 12-mm FDX PIT tag. A total of 43 weir-caught bull trout measuring more than (or equal to) 180 mm and weighing at least 35 grams (g) were surgically implanted with either a Lotek MAP-coded acoustic transmitter or a Lotek NTC 3-2 radio transmitter. Subsequently, 18 acoustic tags and nine radio tags were implanted into bull trout outmigrating from Fishtrap Creek and 11 acoustic tags and five radio-telemetry tags were implanted into bull trout outmigrating from the West Fork Thompson River, for a total of 29 acoustically tagged bull trout and 14 radio-tagged bull trout.

The use of radio-tags was added to the study because no acoustically-tagged bull trout entered the Thompson Falls reservoir in 2014 and the tracking of acoustic tags in shallow river environments is rendered ineffective by entrained air, suspended sediment, and irregularly-shaped substrate. Radio telemetered fish were relocated a minimum of three times per week throughout the autumn field season.

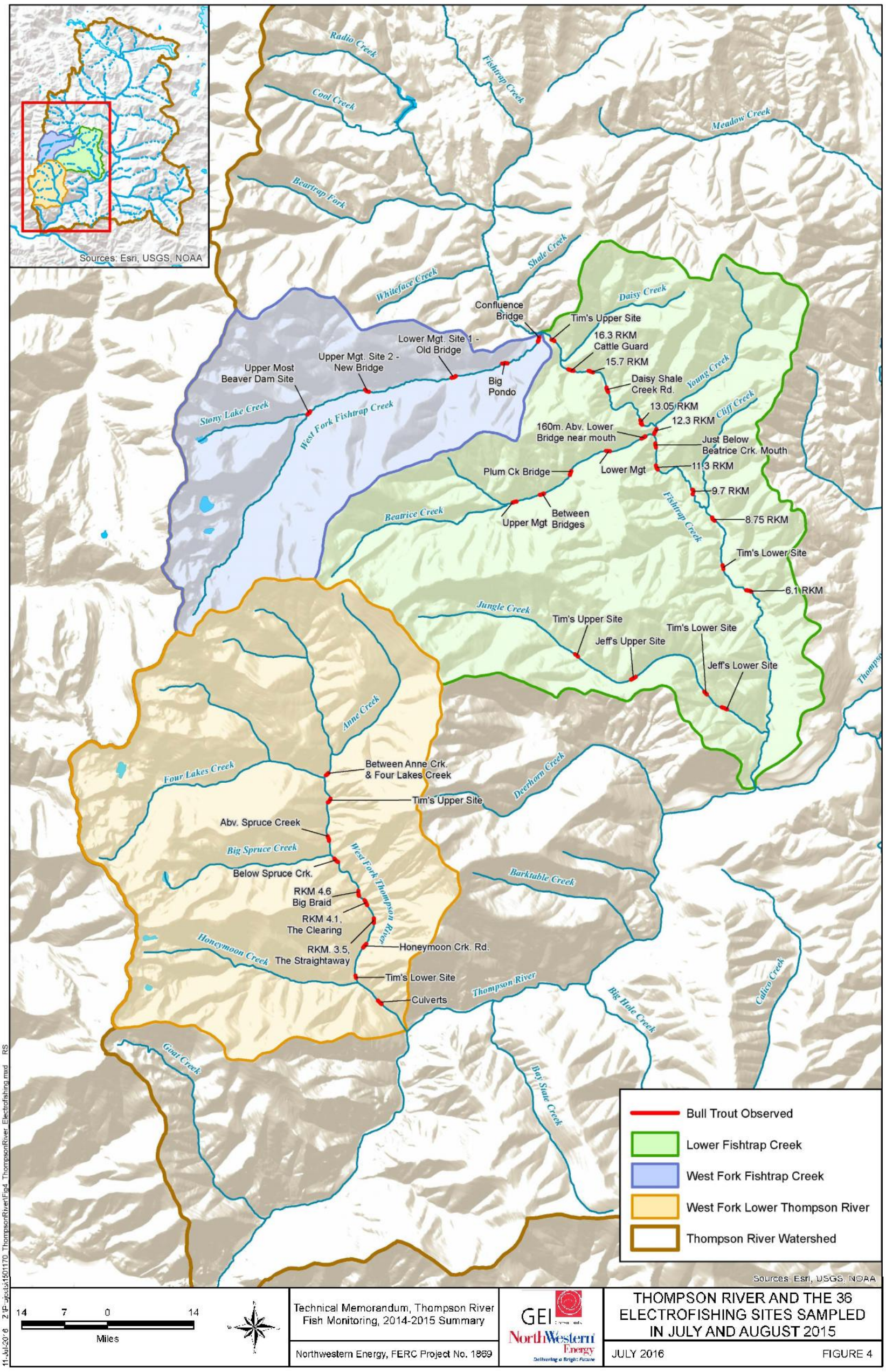


Figure 4: Map of the Thompson River and the 36 electrofishing sites sampled in July and August 2015.

During the autumn 2015 weir operations, species other than bull trout were recorded and implanted with a unique PIT tag. A summary of the fish, by species uniquely PIT-tagged in Fishtrap Creek and West Fork Thompson River in 2015 via summer electrofishing and autumn weir trap operations is summarized in Table 1.

Table 1: Number of fish, by species, receiving a PIT tag during 2015 sampled efforts via electrofishing and weir trap operations.

	BULL	RB	LL	WCT	RBxWCT	MWF	TOTALS
Fishtrap Creek							
Weir Traps	89	9	2	2	0	4	106
Electrofishing	424	0	0	0	0	0	424
Fishtrap Creek Totals	513	9	2	2	0	4	530
West Fork Thompson River							
Weir Traps	47	13	15	0	1	0	76
Electrofishing	151	0	0	0	0	0	151
West Fork Thompson River Totals	198	13	15	0	1	0	227
Both Tributaries							
Weir Trap Totals	136	22	17	2	1	4	182
Electrofishing Totals	575	0	0	0	0	0	575
Both Tributaries Totals	711	22	17	2	1	4	757

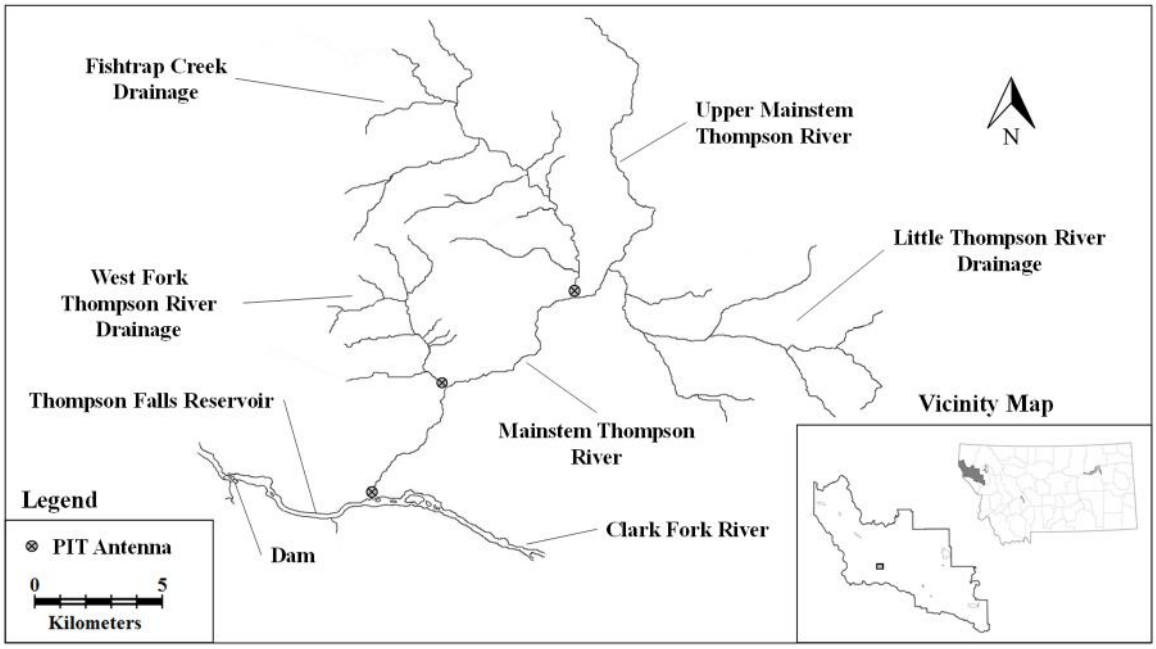


Figure 5: Locations of PIT tag antennas in Fishtrap Creek, West Fork Thompson River, and the Thompson River. Source: Glaid, 2016.

Results

Bull Trout Migration Study

As of December 2015, there were two acoustically tagged bull trout (1 from West Fork Thompson River; 1 from Fishtrap Creek) and one radio-tagged bull trout (from West Fork Thompson River) that moved into Thompson Falls Reservoir. Twenty-three PIT-tagged bull trout were detected moving into Thompson Falls Reservoir: 14 from West Fork Thompson River and nine from Fishtrap Creek (Table 2).

Table 2: Source of tagged bull trout detected in Thompson Falls Reservoir in 2015.

Origin of Bull Trout	Acoustically tagged	Radio-tagged	PIT-tagged
West Fork Thompson River	1	1	14
Fishtrap Creek	1		9
Totals	2	1	23

Preliminary results from 2015 indicate that 59 of the 575 bull trout that were PIT-tagged in the summer tributary sampling outmigrated to the mainstem Thompson River: nine bull trout from West Fork Thompson River and 50 bull trout from Fishtrap Creek.

Preliminary results from radio-telemetry indicated that outmigrating bull trout remain relatively stationary between incremental downstream movements.

Four mortalities out of 14 radio-tagged bull trout were recorded in the mainstem Thompson River. Mink predation was found to be the cause of three of these mortalities, with the fourth tag being weakly heard in the area near an active mink den but the fish was not located before the tag's expiration. Confirmation of status (i.e., alive or dead) for the remaining nine bull trout was obtained at the end of the 2015 field season by intentionally disturbing all sedentary fish. Subsequently, all nine fish were discovered to be alive as of mid-December 2015.

The results of the bull trout migration study will be presented in a form of a Master's Thesis and available to the TAC by December 31, 2016.

Electrofishing and Weir Operations 2015

A summary of all fish species recorded during the July and August 2015 electrofishing sampling period in the Fishtrap Creek drainage is provided in Table 3. Only bull trout were PIT-tagged during the 2015 electrofishing study.

Table 3: Summary of fish, by species observed during electrofishing efforts in July-August 2015 in the Fishtrap Creek drainage and its tributaries and West Fork Thompson River drainage.

Location	WCT	BULL	RBxWCT	RB	EB	MWF	LL	TOTALS
Mainstem Fishtrap	200	141	67	13	11	4	4	440
Beatrice	168	107	0	0	0	0	0	275
Jungle	125	44	0	1	2	0	0	172
West Fork Fishtrap	356	154	0	0	0	0	0	510
Fishtrap Subtotal	849	446	67	14	13	4	4	1,397
West Fork Thompson Subtotal	474	213	31	10	0	0	2	730
Totals	1,323	659	98	24	13	4	6	2,127

Of the previously PIT-tagged non-bull trout salmonids (46 fish shown in Table 1), one brown trout was detected via the remote PIT tag array in the mainstem Thompson River in 2015 (data collected through 12/31/15). This brown trout was initially tagged in the West Fork Thompson River weir on November 4, 2015 and was detected 2 days later in the mainstem Thompson River.

Ladder Fish Detected in the Thompson River

Ladder Fish Detected in Tributaries in 2014 and 2015

The tributary PIT tag arrays detected three fish that were released upstream of the Thompson Falls fish ladder. These fish included one bull trout and two brown trout and the detections were only in the West Fork Thompson River. The bull trout (#982000357016242) was recorded at the Thompson Falls fish ladder on June 3, 2015 measuring 520 mm and 1,112 g and was later detected in the West Fork Thompson River on July 15, 2015. This bull trout was not detected by the remote PIT tag array in the mainstem Thompson River.

Of the two brown trout detected in the West Fork Thompson River, the first fish (#985121027351918) was passed upstream of the Thompson Falls fish ladder on September 4, 2014, first detected in the mainstem Thompson River on October 13, 2014, then detected in the West Fork Thompson River on November 4, 2014, followed by a few additional detections in the mainstem Thompson River between November 4 and December 1, 2014. The second brown trout (#982000363519401) was released upstream of the Thompson Falls fish ladder on September 28, 2015, first detected in the mainstem Thompson River on October 2, 2015 and last detected in the West Fork Thompson River on November 1, 2015.

No fish released upstream of the fish ladder were detected in Fishtrap Creek in 2015.

Ladder Fish Detected in Thompson River

Between 2011 and 2015, the Licensee and FWP implanted PIT tags into a total of 1,566 fish at the Thompson Falls fish ladder and 585 fish via electrofishing below the Thompson Falls Dam (Table 4). Electrofishing efforts below the dam and subsequent tagging efforts were completed in 2011, 2012, and 2014.

Table 4: Number of PIT-tagged fish at the Thompson Falls fish ladder and below Thompson Falls Dam.

Species	Tagged Individuals at the Thompson Falls Ladder (2011-2015)	Tagged Individuals Below Thompson Falls Dam (2011, 2012, 2014)
BULL	9	5
EB	3	1
RB	898	169
WCT	152	28
RBxWCT	40	4
LL	384	33
MWF	71	83
LNSU	1	11
LSSU	6	242
N PMN	2	7
SMB	-	1
L WF	-	1
TOTAL	1566	585

Of the 585 fish the Licensee and FWP PIT-tagged during electrofishing efforts downstream of Thompson Falls Dam, 27 fish ascended the ladder and were recorded at the work station and released upstream into the Thompson Falls Reservoir. The 27 fish included 18 rainbow trout, four brown trout, three westslope cutthroat trout, one bull trout, and one mountain whitefish. Thus, a total of 1,593 PIT-tagged fish were released upstream of the Thompson Falls Dam between 2011 and 2015.

During the period of operation, the Thompson River PIT tag array detected 298 fish, representing approximately 19 percent of the fish released upstream from Thompson Falls Dam (Table 5). A fish detection represents the first record of an individual fish in the Thompson River and is assumed to indicate entry into the Thompson River drainage. The tagged fish detected in the Thompson River represent six species and one salmonid hybrid, including brook trout, brown trout, rainbow trout, rainbow trout x westslope cutthroat trout, westslope cutthroat trout, mountain whitefish, and largescale sucker.

Table 5: Fish, by species, released upstream of the fish ladder between 2011 and 2015 and detected in the mainstem Thompson River in autumn 2014 and during the calendar year of 2015.

Species	Tagged Fish Released Upstream of Dam	Number of Individual Fish Detected	% of Tagged Fish Detected
	2011-2015	2014-2015	2014-2015
BULL	10	-	-
EB	3	1	33%
RB	916	155	17%
WCT	155	17	11%
RBxWCT	40	3	8%
LL	388	120	31%
MWF	72	1	1%
LNSU	1	-	-
LSSU	6	1	17%
N PMN	2	-	-
TOTAL	1593	298	19%

Between September 26 and December 22, 2014, a total of 43 fish (27 brown trout; 15 rainbow trout; 1 westslope cutthroat trout) previously recorded at the Thompson Falls fish ladder between 2011 and 2014 were detected in the Thompson River. The detection system was closed for the winter (December 22, 2014) and resumed operation in February 2015. The remainder of the detections, 254, occurred between February and December 2015.

In 2015, the remote PIT tag array in the Thompson River collected data concurrent with the ladder's operational season and continued to collect data through the end of the calendar year. With these data, the percentage of fish PIT-tagged at the ladder in 2015 and the subsequent detection of the tagged fish in the Thompson River was evaluated. In 2015, 483 salmonids were PIT-tagged at the ladder (of the 558 salmonids released upstream of the dam). Of the 483 tagged fish, 158 individual fish (~ 1/3) were detected in the Thompson River. Details of the species and percentage of tagged salmonids at the ladder in 2015 and subsequently detected in the Thompson River in 2015 is summarized in Table 6.

Table 6: Summary of the fish PIT-tagged at the Thompson Falls fish ladder in 2015 and detected via the remote PIT tag array in the Thompson River in 2015.

Species	# PIT-tagged Fish at Ladder in 2015	# of 2015 Ladder Fish Detected in the Thompson River	% of 2015 Tagged Fish Detected in the Thompson River
BULL	2	*	*
EB	2	1	50%
LL	153	73	48%
RB	238	75	32%

Species	# PIT-tagged Fish at Ladder in 2015	# of 2015 Ladder Fish Detected in the Thompson River	% of 2015 Tagged Fish Detected in the Thompson River
RBxWCT	1	0	0%
WCT	33	9	27%
MWF	54	0	0%
Total	483	158	33%
*1 BULL recorded in the Thompson River via a FWP electrofishing survey, but not detected via remote PIT tag array			

There were two bull trout tagged at the ladder in 2015, neither bull trout was detected via the remote PIT tag array in the Thompson River in 2015. However, one of the bull trout (implanted with one HDX tag #982000363519407) recorded at the ladder on May 17, 2015 was later recaptured via electrofishing in the Big Hole section (upstream of the remote PIT tag array) of the Thompson River on June 2, 2015. The second bull trout recorded at the ladder on June 3, 2015 (implanted with 2 HDX tags) was later detected in the West Fork Thompson River on July 15, 2015.

Table 7: Year the fish were last recorded at the Thompson Falls fish ladder, and the year the fish were first detected in the Thompson River (2014 or 2015).

Year Fish Last Recorded at the Ladder	Thompson River	
	Detected in 2014	Detected in 2015
2011	0	1
2012	2	9
2013	2	14
2014	39	38
2015	-	192
Total	43	254*

*Plus one LS SU detected in the Thompson River with an unknown year of passage at the fish ladder

The 298 fish detected in the mainstem of the Thompson River in 2014 and 2015 comprise fish that ascended the ladder in all operational years (2011-2015) (Table 7). The majority of the fish were last recorded at the fish ladder and released upstream of Thompson Falls Dam in 2015 (~ 65%) and 2014 (~ 25%). However, 29 individual fish (~ 9%) remained upstream of Thompson Falls Dam for 1 or more years (last detected at the ladder in 2013, 2012, or 2011). The "by-species" breakdown can be found in Table 8.

Table 8: Fish, by species, detected at the Thompson River PIT tag array in 2014-2015 and the most recent year the fish were recorded at the fish ladder and released upstream of Thompson Falls Dam.

Species	# of Individual Fish Detected in the Thompson River	# of Fish Last Recorded at Ladder				
	2014-2015	2011	2012	2013	2014	2015
EB	1					1
RB	155		9	11	44	91
WCT	17			2	3	12
RBxWCT	3			1		2
LL	120		1	3	29	87
MWF	1	1				
LS SU	1		unknown			
TOTAL	298	1	10	17	76	193

The time of year when the first detections of the individual fish were recorded are illustrated in Figure 6 (which combines 2014 and 2015 detections). Rainbow trout was the first species to be detected in the Thompson River in February, followed by one largescale sucker in March. The first tagged brown trout and westslope cutthroat trout were not detected in the Thompson River until May. The only mountain whitefish (released upstream of the fish ladder in October 2011) was detected in June and the only brook trout (released upstream of the ladder in October 2015) was detected in December. Approximately 37 percent of the 255 fish documented in the Thompson River in 2015 were detected in June (Figure 7), which coincided with higher than normal water temperatures in the Clark Fork River, approaching 25 degrees Celsius (ºC).

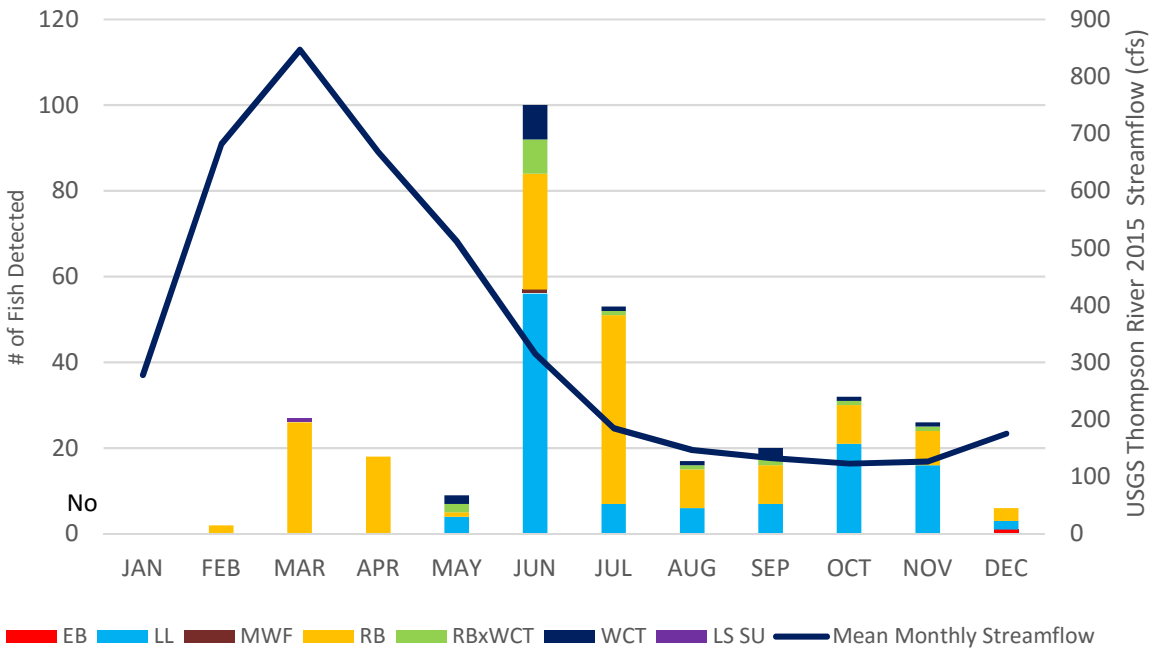


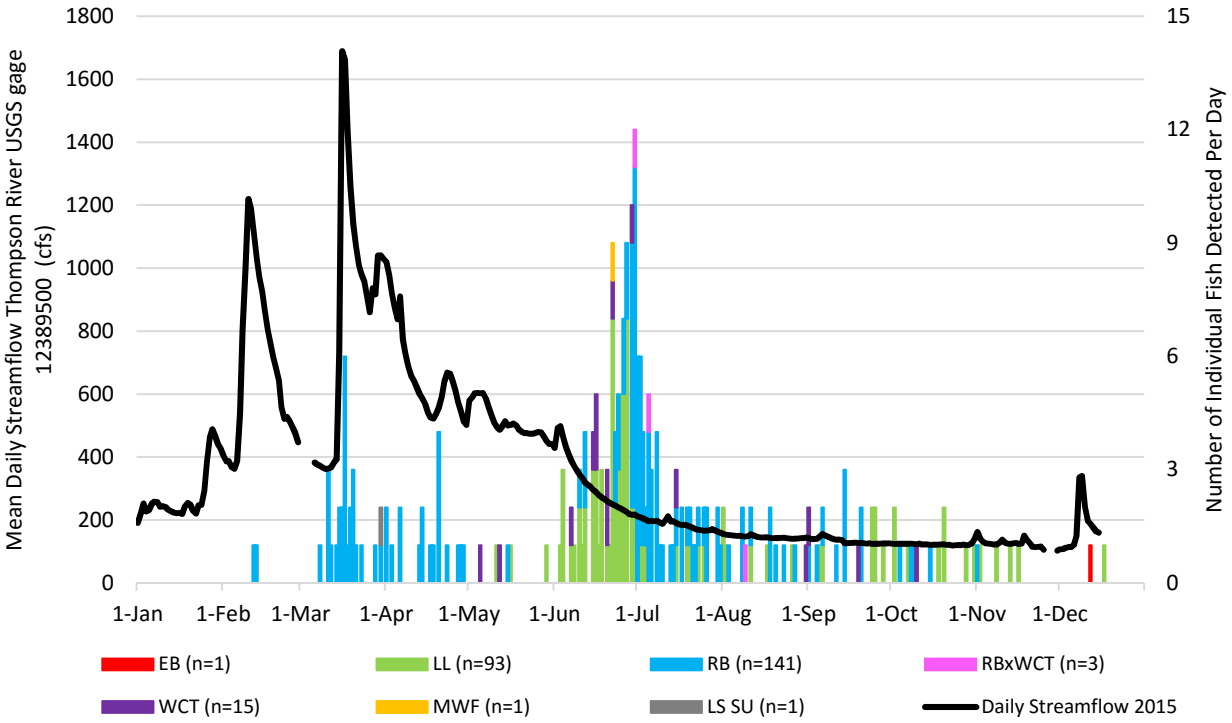
Figure 6: Fish (n=298), by species, detected monthly via the PIT tag array in the Thompson River in 2014 (43 fish) and in 2015 (255 fish). The PIT tag array was not operational in January.

The number of ladder visits and ascents of the 298 fish were also evaluated. The majority (84%) of the fish detected in the Thompson River had only ascended the ladder once, while approximately 16 percent had ascended the ladder more than one time. One rainbow trout detected in the Thompson River was recorded at the ladder four separate occasions. A summary of the fish, by species and the number of ladder ascents is provided in Table 9.

Table 9: Summary of how many ladder ascents have been recorded for the 298 fish detected in the Thompson River in 2014 and 2015.

Species	Fish with multiple ladder trips and at least one detection in Thompson River (2014-2015)				
	1 x Ladder	2x Ladder	3x Ladder	4x Ladder	Totals
EB	1				1
RB	125	26	3	1	155
WCT	15	2			17
RBxWCT	1	2			3
LL	107	12	1		120
MWF	1				1
LS SU	1				1
TOTAL	251	42	4	1	298

Figure 7: Summary of the first detections of individual fish (n=255), by species entering the Thompson River in 2015.



Travel Time between the Ladder and Thompson River

Four salmonids species and one salmonid hybrid represent the 192 fish released upstream of the ladder in 2015 and detected in the mainstem of the Thompson River in 2015. The species composition includes 91 rainbow trout, 87 brown trout, 11 westslope cutthroat trout, two rainbow trout x westslope cutthroat trout, and one brook trout. Travel time data for these fishes (estimated duration for a fish to move from the Thompson Falls Dam into the Thompson River) varied between a few hours to over 7 months (Table 10). Approximately 43 percent of the 192 fish (53 brown trout; 32 rainbow trout) traveled to the Thompson River in 1 day or less. Although the period of time for data collection in the Thompson River in 2014 was shorter than in 2015, similar results were observed with some fish taking hours and others taking months to reach the Thompson River from the fish ladder (NorthWestern, 2015).

Table 10: Summary of the approximate travel time for the 192 fish released upstream of the Thompson Falls fish ladder and detected in the Thompson River in 2015.

Species	# of Ladder Fish Released in 2015 and Detected in Thompson River 2015	Minimum Duration	Maximum Duration
EB	1	57 days	57 days
LL	87	Less than 1 day (5.5 hours)	178 days

Species	# of Ladder Fish Released in 2015 and Detected in Thompson River 2015	Minimum Duration	Maximum Duration
RB	91	Less than 1 day (6.5 hours)	215 days
RBxWCT	2	25 days	85 days
WCT	11	1 day	76 days
Total	192	Less than 1 day	215 days

Multiple Ladder-to-Thompson River Migrations

A total of four rainbow trout and two brown trout were recorded ascending the ladder and released upstream, recorded in the Thompson River, and then moving downstream and repeating this cycle (Table 11). Note that detections of fish into the Thompson River prior to the installation of the remote PIT tag array in September 2014 is unknown.

Table 11: Summary of fish completing more than one complete cycle of ascending the Thompson Falls fish ladder and moving upstream to the Thompson River and repeating the process.

Sample Date	Fish Species	PIT Tag #	First Detection in Thompson River	Last Ladder Record	Years at Ladder
5/15/2015	RB	985121010691233	Y-first	8/27/2014	2014
10/7/2015	RB	985121010691233	Y-return	10/5/2015	2014, 2015
11/25/2014	RB	985121010701345	Y-first	7/27/2014	2014
7/24/2015	RB	985121010701345	Y-return	7/22/2015	2014, 2015
10/9/2014	LL	985121010702760	Y-first	10/9/2014	2013, 2014
10/7/2015	LL	985121010702760	Y-return	10/7/2015	2013, 2014, 2015
11/3/2014	LL	985121010704520	Y-first	7/19/2014	2014
10/28/2015	LL	985121010704520	Y-return	6/24/2015	2014, 2015
3/28/2015	RB	985121027376749	Y-first	8/25/2014	2012, 2014
6/30/2015	RB	985121027376749	Y-return	5/6/2015	2012, 2014, 2015
3/21/2015	RB	989001004067259	Y-first	3/20/2015	2015
3/25/2016	RB	989001004067259	Y-return	5/26/2015	2015

Bull Trout Transported to Region 4 by Avista – Detections in the Thompson River

Avista Corporation (Avista) operates a trap and haul upstream fish program that includes the transport of bull trout initially captured downstream of Cabinet Gorge Dam and genetically assigned to Region 4 (upstream of Thompson Falls Dam). A summary of Avista's transport program for fish genetically assigned to Region 4 since 2011 is provided in the 2015 Annual Report Fish Passage Project (NorthWestern, 2016).

Avista transported and released in the Thompson River drainage a total of 10 bull trout in 2014 and seven bull trout in 2015 (NorthWestern, 2016). The remote PIT tag array in the mainstem Thompson River detected six of these bull trout; two fish transported and released in July 2014; one fish was transported and released in April 2015; and three fish were transported and released in August 2015 (Table 12). The majority of the transported fish were released in the Thompson River and/or its tributaries (West Fork Thompson River or Fishtrap Creek) with the exception of one fish that was released about 1 kilometer (km) downstream of the confluence with the Thompson River. The first detections of these bull trout in the mainstem Thompson River occurred between May and September 2015; however, these detections do not provide directionality. Several of these fish were detected multiple times. Table 12 provides details of the initial detection date and time for each bull trout in the mainstem Thompson River, the size of the fish when transported by Avista, the date of release, and location of the release.

Five of the six bull trout detected in the mainstem Thompson River in 2015 were also detected in one of the two tributary (Fishtrap Creek and West Fork Thompson River) remote PIT tag arrays. Three bull trout (included PIT tags 900226000570596, 900226000570690, 900228000078399) were detected in the West Fork Thompson River between August 23 and September 11, 2015. In Fishtrap Creek, two bull trout (including PIT tags 90022600570799 and 900228000078389) were detected in Fishtrap Creek on September 11 and September 6, 2015, respectively.

Table 12: Summary of 6 bull trout transported by Avista from below Cabinet Gorge Dam (CGB) in 2014 and 2015, released in Region 4, and detected in the mainstem Thompson River in 2015.

Detection Date	Sample Time	PIT Tag	Multiple Detections (y)	Length (mm)	Weight (g)	Capture Date	Release
5/22/2015	22:00:30	900226000730599		558	2041	4-17-2015	1km below TRiver confluence
6/5/2015	22:37:40	900226000570596	y	532	1304	7/17/2014	West Fork Thompson River
6/7/2015	1:39:47	900226000570799	y	566	1644	7/24/2014	Fishtrap Creek
8/11/2015	5:25	900228000078399	y	557	1585	8/3/2015	Thompson River
8/11/2015	23:00	900226000570690	y	531	1446	8/6/2015 TRiver	(also Below CGD Transport WFTR 9/26/2013) TRiver
9/28/2015	21:55:23	900228000078389		735	4082	8/27/2015	Thompson River

Discussion

The remote PIT tag arrays installed in the mainstem Thompson River for year-round monitoring of PIT-tagged fish and installed seasonally in the Fishtrap Creek and West Fork Thompson River tributaries are detecting fish released upstream of the Thompson Falls fish ladder; fish transported by Avista from below Cabinet Gorge Dam and released into Region 4 (upstream of Thompson Falls Dam); and fish tagged within the Thompson River drainage.

This dataset started in 2014 and continued into 2015 as more fish were tagged in the Thompson River drainage and at the Thompson Falls fish ladder. The results indicate some fish remain upstream of Thompson Falls Dam for multiple years following the release upstream of the fish ladder, while other fish outmigrate to the Clark Fork River and pass downstream of Thompson Falls Dam.

2016 Monitoring Activities

The primary focus on monitoring fish continues to be on bull trout, but the remote PIT tag arrays also provide insight to movements of other species into and out of the Thompson River. In 2016, the remote PIT tag array located in the mainstem Thompson River received a permanent power supply and starting in 2016, is remotely operated. The two PIT tag arrays in the tributaries (Fishtrap and West Fork Thompson) were removed in early April 2016 due to high streamflows and then reinstalled once streamflows subsided in June 2016.

The MSU graduate study evaluating outmigration of subadult bull trout from the Thompson River drainage into Thompson Reservoir will be summarized in a Master's Thesis, scheduled for completion by December 31, 2016.

NorthWestern proposes to continue to summarize data collected via the remote PIT tag arrays in the Thompson River drainage on an annual basis.

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Personal Communications

Glaid, Jeff. Graduate Student. Montana State University. 2016. Personal communications.

Abbreviations

#	number
%	percent
º	degree
Avista	Avista Corporation
BULL	bull trout
BO	Biological Opinion
C	Celsius
cfs	cubic feet per second
CGD	Cabinet Gorge Dam
EB	brook trout
FDX	full-duplex
FERC	Federal Energy Regulatory Commission
FWP	Montana Fish, Wildlife and Parks
FWS	U.S. Fish and Wildlife Service
g	gram
HDX	half-duplex
km	kilometer
L WF	lake whitefish
Licensee	NorthWestern Energy
LL	brown trout
LN SU	longnose sucker
LS SU	largescale sucker
mm	millimeter
MSU	Montana State University
MWF	mountain whitefish
N PMN	northern pikeminnow
n	number
No.	number
NorthWestern	NorthWestern Energy
PIT	passive integrated transponder
Project	Thompson Falls Hydroelectric Project
RB	rainbow trout
RBxWCT	rainbow trout x Westslope cutthroat trout hybrid
SMB	smallmouth bass
TAC	technical advisory committee
TC	terms and conditions
TR	Thompson River
TRiver	Thompson River
USGS	U.S. Geological Survey
WCT	Westslope cutthroat trout
WF	West Fork
WFTR	West Fork Thompson River