Montana Fish, Wildlife & Parks

# Trout and Whitefish Life History Study
# 2017 Update

Status Report for Northwestern Energy
FERC Project 2188

Prepared by

Jason Mullen, Montana Fish, Wildlife & Parks
Katie Vivian, Montana Fish, Wildlife & Parks
Grant Grisak, Montana Fish, Wildlife & Parks

January 2018

## Introduction

PPL Montana (now Northwestern Energy) awarded Montana Fish, Wildlife and Parks (MFWP) $84,600 following the December 2013 Missouri River Technical Advisory Committee meeting to investigate trout and mountain whitefish (*Prosopium williamsoni*) life history characteristics. This study follows a study that suggested the lack of spawning site fidelity in adult rainbow trout (*Oncorhynchus mykiss*) as the likely mechanism that reduces the risk of impacts from (*Myxobolus cerebralis*), the parasite that causes whirling disease in rainbow trout, by spreading the risk over spawning areas with a broad range of infection severity (Grisak et al. 2012).

The specific objectives of this study are to;

1. Compare outmigration timing with past studies (Leathe 2001),
2. Evaluate homing/straying from natal streams (Grisak et al. 2012),
3. Document level of straying over multiple years (Grisak et al. 2012),
4. Identify summer and winter locations of tagged fish in the Missouri River,
5. Use known age fish to evaluate historic ageing results and growth patterns over the past 31 years,
6. Identify connectivity of Missouri, Sun, and Smith River trout and whitefish populations.

To meet these objectives, Passive Integrated Transponder (PIT) technology is being used to monitor fish movement in the Missouri, Smith, and Sun river systems. Half duplex PIT tags were used with primarily 23 and 32 mm long tags to increase read range and tag detection efficiency. Most fish were tagged by making a small incision in the abdomen and placing the tag into the abdominal cavity. Fish movements are being monitored using a network of remote PIT tag monitoring stations and tracking with mobile antennae.

This project coincides with a corresponding trout and mountain whitefish life history study using PIT technology on the Smith River, which is being conducted by a graduate student at Montana State University (MSU). Given the ability of fish to utilize the entire Missouri River, Smith River, and Sun River system, a great deal of coordination has been and will continue to be conducted between MSU and MFWP to maximize data collection and analysis efficiency. While the money awarded by Northwestern Energy was not utilized to conduct Smith River investigations, some Smith River results are reported here because of the interconnected nature of these studies. Sampling efforts in 2017 focused on maintaining the remote PIT tag monitoring stations, and an additional study evaluating American white pelican (*Pelecanus erythrorhynchos*) (hereafter, white pelican) predation (Vivian and Mullen 2018). Past reports summarized data in detail through 2016 (Mullen et al. 2016, 2017). This report provides an update of the study through December 2017, focusing on the additional data collected in 2017.

## Methods

### *Remote Stations*

To date, five remote PIT tag monitoring stations have been installed in the Missouri River drainage, three in the Sun River drainage, and fifteen in the Smith River drainage (Table 1; Figure 1). The five monitoring stations in the Missouri River drainage were installed spring 2014 and the three stations in the Sun River drainage were installed spring 2015. Many of the stations in the Smith River drainage were installed during summer 2014, with the remaining stations installed in 2015 and 2016 by the graduate student at Montana State University.

### *Mobile Tracking*

Mobile tracking has been conducted using rafts, kayaks, and a backpack with a wand antenna to increase the number of detections and to determine fish locations in areas where remote monitoring stations are not present. Mobile tracking trips were conducted on the Sun River and Missouri River in 2015 and 2016. While detection efficiency is relatively high in the Smith River due to the smaller size of the river, it was poor in the Missouri River and thus mobile tracking was not completed in the Missouri or Sun rivers in 2017.

A mobile backpack antenna was built in spring 2016 and used throughout the year for scanning white pelican nesting islands, tributary streams, and islands on the Missouri River from Holter Dam to Pelican Point FAS. Mobile backpack antennae tracking was continued in 2017 at the white pelican nesting islands and known white pelican loafing islands on the Missouri River, as part of the pelican predation study. The white pelican predation study is described in detail in Vivian and Mullen (2018). Mobile backpack antennae tracking was also conducted in 2017 in the Smith River drainage by MSU personnel. Detections were noted as from non-live fish (dead or shed tags) or live fish based on if the tag could be located repeatedly and the visual presence or absence of live fish.

## Results

### *Fish Tagging*

A total of 11,936 fish have been tagged in the Missouri, Sun, and Smith River drainages since 2010, including 3,572 in the Missouri River drainage, 739 in the Sun River drainage, and 7,625 in the Smith River drainage (Tables 2, 3, and 4). Of the total, 777 fish were tagged from 2010 through 2012 as part of the Tenderfoot Creek MSU graduate study and 375 of these fish have been redetected since that time. In 2016, 61 fish tagged during the Tenderfoot study were detected 222 times. In 2017, 47 fish tagged during the Tenderfoot study were detected 85 times. Of these 47 fish, 14 were redetected at the Tenderfoot Creek stationary reader, one mountain whitefish was redetected at the lower Sheep Creek (Smith River tributary) reader, one mountain whitefish was detected at the Smith River Castle Bar reader, four tags were detected at the Canyon Ferry white pelican nesting colonies, one mountain whitefish tag was detected by a mobile backpack antenna in Sheep Creek-Smith, and the remainder were detected by mobile raft antenna in the Smith River. While a substantial number of these 777 fish are likely no longer active in the system due to mortality, the detection of the mountain whitefish several times over a two-week period at the lower Sheep Creek-Smith reader, which was originally tagged in the Tenderfoot in September 2012, provides evidence some remain active.

In 2014, 7,801 fish were tagged, which comprises 65% of the total fish tagged from 2010 through 2017. In 2015, 1,835 fish were tagged and in 2016, 656 fish were tagged. In 2017, an

additional 867 fish were tagged all within the Smith River drainage, including seven in Calf Creek, 40 in Indian Creek, 22 in Newlan Creek, and 798 in the Smith River as part of the white pelican predation study. All of the fish tagged in the Smith River were tagged in March and April. Of the 11,936 fish tagged, mountain whitefish, rainbow trout, and brown trout (*Salmo trutta*) are the most tagged species, comprising 24%, 50%, and 21% of the tagged fish, respectively.

The size distribution of fish tagged in the Missouri River drainage is shown in Figure 2. Most rainbow trout and brown trout tagged were less than 7 inches, whereas mountain whitefish were larger with most tagged fish between 14 and 19 inches (Figure 2). Proportionally, more large fish were tagged in the Sun River (Figure 3) than the Missouri River. In the Smith River, most rainbow trout tagged were between 5 and 9 inches while brown trout and mountain whitefish were larger (generally 10 to17 inches) (Figure 4).

In the Missouri River drainage, the average mountain whitefish tagged was 14.8 inches (n=277), the average rainbow trout tagged was 7.0 inches (n=2,486), and the average brown trout tagged was 8.1 inches (n=633). In the Sun River drainage, the average mountain whitefish tagged was 12.5 inches (n=223), the average rainbow trout was 12.4 inches (n=153), and the average brown trout was 13.4 inches (n=353). In the Smith River drainage, the average mountain whitefish tagged was 11.9 inches (n=2,346), the average rainbow trout was 8.3 inches (n=3,298), and the average brown trout was 12.6 inches (n=1,509).

***Detection Summaries***

*Missouri River drainage*

Of the 3,572 fish that have been tagged in the Missouri River drainage since 2014, 982 of these fish have been redetected (27%) through 2017 compared to 931 fish redetected through 2016 (26%). In 2017, 180 unique fish were detected in the Missouri River drainage, including 51 fish that hadn't been detected before.

Six of these 51 newly detected fish in 2017 were rainbow trout tagged in the Dearborn River and five of these six (5.0 to 9.4 inches at tagging in 2014) were detected at the Dearborn River reader. The remaining rainbow trout was 17.5 inches at tagging on November 5, 2014 and was detected at the Little Prickly Pear Creek (LPPC) reader on March 26th and at the Wolf Creek Reader on March 28th.

Eleven of the 51 newly detected fish were tagged in LPPC in March 2014 (between 4.2 and 10.3 inches at tagging), with 10 of them rainbow trout and one a brown trout. Seven of the ten rainbow trout and the one brown trout were detected at the LPPC reader between February 18th and May 31st, which corresponds with the rainbow trout spawning period. One rainbow trout was detected at the Lyons Creek reader on March 16th, and one was detected at the Canyon Ferry white pelican nesting colony. The remaining fish was a rainbow trout that was detected at the LPPC reader on March 17th, the Lyons Creek reader from March 27th through April 12th, and during electrofishing estimates in the Missouri River upstream of Craig on September 27th. This fish was 5.5 inches at tagging on March 28, 2014 and was 17.0 inches and 1.7 lbs on September 27, 2017 during the electrofishing estimate (Table 5, rainbow trout #1).

Five of the 51 newly detected fish were tagged in Lyons Creek in March 2014 (between 4.7 and 8.2 inches) with four of them being rainbow trout and one brown trout. Two of the four rainbow trout and one brown trout were detected at the Lyons Creek Reader between March 18th and June 21st. One of those rainbow trout was also detected at the LPPC reader on March 25th, before being detected at the Lyons Creek reader from March 30th through June 21st. Two

additional rainbow trout were detected at the LPPC reader in April. Based on the timing of the detections, all of these rainbow trout movements appear associated with spawning in Lyons Creek or LPPC and three of the four rainbow trout appeared to move into the LPPC drainage from the Missouri River.

Ten of the 51 newly detected fish were rainbow trout tagged in North Fork Sheep Creek, South Fork Sheep Creek, or the mainstem Sheep Creek (Missouri drainage) in March and April 2014 between 4.7 and 10.0 inches. Nine of these ten rainbow trout were detected at the Sheep Creek reader in March and April. Of these nine, one was detected at the Dearborn River reader on March 20 before being detected at the Sheep Creek reader on March 23rd. The remaining rainbow trout was detected for the first time at the Dearborn River reader in April. The movements of nine of the ten rainbow trout appear associated with spawning in Sheep Creek, with the remaining fish moving into the Dearborn River during the spawning period.

Six of the 51 newly detected fish were rainbow trout tagged in Wolf Creek in March and April 2014 and were between 4.0 and 7.5 inches long at tagging. All the rainbow trout were detected in 2017 between March 27th and May 18th, during the spawning period. Two of the rainbows were detected at the LPPC reader only, while the remaining four fish were detected at both the LPPC and Wolf Creek readers.

Thirteen of the 51 newly detected fish were tagged in the Missouri River with the tagging location varying from near Broadwater Bay in Great Falls to upstream of Craig. The one fish detected in 2017 from tagging in the Missouri River near Broadwater Bay was a mountain whitefish (6.6 inches at tagging on 10/26/2015) that was detected at the Dearborn Reader on October 29th. One tag from a brown trout that was tagged upstream of Craig was relocated at the Canyon Ferry white pelican nesting colony. Seven rainbow trout that were tagged upstream of Craig in 2014 and ranged in size from 5.5 to 10.1 inches at tagging were detected in 2017. Three of these were detected at the lower LPPC reader, two were detected at the lower Dearborn River reader, and one was detected at the lower Sheep Creek reader during March and April, thus all movement appeared associated with spawning. One was detected during fall electrofishing in the same reach of the Missouri River where it was tagged. This rainbow trout had grown from 10.0 inches at tagging on the Missouri River in Billings Slough on April 28, 2014 to 16.0 inches and 1.62 lbs on September 27, 2017 when sampled in the Craig electrofishing section (Table 5, rainbow trout #2). Three white suckers (11.4 to 14.6 inches at tagging) that were tagged in the Missouri River downstream of the Dearborn River confluence in May 2015 were detected in April and May 2017, with two of the white suckers detected at the Dearborn River reader and one at the lower LPPC reader. The last fish that was tagged in the Missouri River and detected in 2017 was a rainbow trout that was tagged downstream of Ulm on March 23, 2016 when it was 15.5 inches. This fish was detected in the Smith River at the Truly Bridge reader on March 31st, the Castle Bar reader on April 14th, and the Tenderfoot Creek reader on April 15th.

In addition to the two rainbow trout described above that were handled during the electrofishing estimates and represent the first encounter since the initial tagging event, several additional fish were scanned during spring and fall electrofishing estimates in the Craig section that had been detected in the past (Table 5). Rainbow trout #3 was tagged in Wolf Creek on March 12, 2014 and was 4.0 inches at tagging (Table 5). This fish was detected at the Wolf Creek reader in June 2014, the LPPC reader July 2014 and March 2017, before being detected at the Wolf Creek reader again in March and May 2017, and finally in September 2017 during electrofishing in the Missouri River when the fish was measured to be 18.3 inches and 2.2 lbs. The detection history of this fish, would suggest it returned to its natal stream, Wolf Creek, in

2017 to spawn. Rainbow trout #4 was tagged in Sheep Creek (Missouri River drainage) on April 2, 2014 and was 4.7 inches. This fish was detected at the Sheep Creek reader in May 2015, and was not detected again until it was handled in October 2017 during electrofishing estimates and measured 18.1 inches and 2.5 lbs. Rainbow trout #5 and #6, exhibited similar life histories being tagged April and May 2014 in the Missouri River. Both rainbows have been detected several times at the LPPC reader in 2016 and 2017. Rainbow trout #6 has only been detected at the LPPC reader in either late winter or early spring before being detected in October 2017 during electrofishing in the Missouri River. Rainbow trout #5 has been detected several times during both the spring and fall at the LPPC reader, before being detected during electrofishing in October 2017 near LPPC, and again detected at the LPPC reader in November. The frequency of detections at the LPPC reader and the detection during electrofishing in the Missouri River near LPPC suggest this fish typically resides in this area near the confluence. This fish had grown approximately 10.7 inches over the approximate 3 years and 5 months between tagging and handling during electrofishing compared to only 5.9 inches for rainbow trout #6 over nearly the same period.

Four brown trout were sampled during spring electrofishing estimates in the Craig section that had been tagged previously in spring 2014 (Table 5). Brown trout #7 had been tagged in Wolf Creek in March 2014 and was 6.7 inches at tagging (Table 5). This fish has been detected numerous times including first at the Wolf Creek Reader April 2014, the LPPC reader August 2015, the Wolf Creek reader October through December 2015, followed by being detected at the LPPC reader one day later in December 2015. This fish was then detected at the LPPC reader in September and October 2016 before being detected in the Missouri River during electrofishing in May 2017. The fish was then detected at the LPPC reader in September 2017, the Wolf Creek reader October 5$^{th}$ and October 24$^{th}$, and the LPPC reader again a day later on October 25$^{th}$. This fish appeared to make spawning migrations to its natal stream, Wolf Creek, in 2015 and 2017, with detections only at the LPPC reader in 2016. This brown trout grew 10.3 inches over approximately 3 years and 2 months.

The three remaining PIT tagged brown trout that were handled during electrofishing estimates were all tagged in the Missouri River upstream of Craig. Brown trout #8 and #9 were both first detected at the LPPC reader in September 2016 and again in October 2016. Both fish were sampled May 3, 2017 during electrofishing, and then were detected at the LPPC reader in October 2017. Thus, it would appear these two fish spawned in LPPC in 2016 and 2017. Brown trout #8 was also detected at the LPPC reader in June 2017. Over a three-year period, brown trout #8 and #9 grew 12.3 and 10.6 inches, respectively.

Brown trout #10, which was also tagged in spring 2014 in the Missouri River upstream of Craig and was 9.6 inches, was first detected at the LPPC reader in September 2014, followed by detections at the LPPC reader in September and October of 2015, 2016, and 2017. It appears this fish has spawned in LPPC the last three or four years. This fish was also sampled during electrofishing in May 2017, and had grown 8.2 inches over 3 years.

Overall, based on handling of tagged fish during electrofishing in 2017, rainbow trout growth varied from 5.9 to 14.3 inches over an approximate 3.5-year period. Brown trout growth varied from 8.2 to 12.3 inches over an approximate 3-year period.

*Sun River drainage*

A total of 739 fish have been tagged in the Sun River drainage since 2015. Brown trout and mountain whitefish comprised the most fish tagged (47.7% and 30.1%, respectively). Of the

739 fish tagged, 155 of these fish have been redetected (21%) through 2017 compared to 150 fish redetected through 2016 (20%). Of the five newly detected fish in 2017, two were brown trout tagged in Elk Creek in June 2015 near the Elk Creek reader. One of these fish was detected at the Elk reader on October 27th and October 28th, while the other was detected at the Elk Creek reader on April 13th. One of the five newly detected fish, was a mountain whitefish that was 15.1 inches at tagging in March 2015 in the electrofishing section upstream of Highway 287. This fish was detected at the nearby reader just upstream of Highway 287 on March 15th, April 15th, and April 16th. One of the newly detected fish was a rainbow trout that was 13.6 inches at tagging and was tagged just downstream of the town of Sun River in March 2015. This fish was detected further downstream at the lower Sun River reader on June 7th. The last newly detected fish was a white sucker that was 11.0 inches at tagging and was tagged downstream of the town of Sun River in March 2015. This fish was detected at the lower Sun River reader in April 2017.

*Smith River drainage*

A total of 7,625 fish have been tagged in the Smith River drainage since 2010 and 3,823 (50%) unique fish have been detected through 2017, compared to 2,819 unique fish detected (37%) through 2016, an increase of 1,004 fish. Of the 1,004 newly detected fish, 71 were tags detected at the Canyon Ferry white pelican nesting colony, including three fish that were tagged in Hound Creek, one in Moose Creek, one in Sheep Creek, and 66 in the Smith River from as far upstream as upstream of the Birch Creek confluence and as far downstream as Eden Bridge. Mobile backpack antennae were used by MSU personnel to search for tags in the Smith River, Moose Creek, Sheep Creek, Rock Creek, and Birch Creek. A total of 555 tags were detected, 353 of which had never been detected. Of the 555 total tags 441 were from non-live fish (dead fish or expelled tags). Of 353 newly detected tags, 288 were from non-live fish. Overall, backpack scanning at the white pelican nesting colonies and the Smith River and tributaries, accounted for 424 of the newly detected 1,004 tags, most of which were no longer active.

Of the remaining 580 newly detected tags, 206 were detected by mobile raft or kayak tracking, and two were sampled during fall electrofishing estimates on the Smith River in the Eagle Creek section. Of these 580 newly detected tags in 2017, 399 of the tags were from the 867 new fish tagged in the Smith River drainage in 2017, 81 were from fish tagged in 2016, 50 were from fish tagged in 2015, 49 were from fish tagged in 2014, and one was from a fish tagged in 2012.

Four rainbow trout that were tagged in the Eagle Creek section in September 2014 were handled during electrofishing estimates on the Smith River in the Eagle Creek section in October 2017 (Table 5). Rainbow trout #1 and #2 represent the first detections of these fish since tagging (Table 5). Rainbow trout #3 was detected at the lower Sheep Creek reader on May 1, 2015, detected by raft near the confluence with Sheep Creek in April 2016, detected at the lower Sheep Creek reader in April 2017, before being detected during electrofishing the Eagle Creek section in October 2017. Rainbow trout #4 was tagged in the Eagle Creek section of the Smith River in September 2014, was handled during electrofishing estimates in the Eagle Creek section in September or October 2015, 2016, and 2017, and was detected in the Eagle Creek section by raft in July 2016. While both rainbow trout #3 and #4 were tagged in the Smith River Eagle Creek section, they appear to exhibit different life histories with #3 being detected repeatedly during the spawning period in or near Sheep Creek, while #4 has only been detected in the Eagle Creek section close to where it was tagged. Rainbow #4 was 6.9 inches at tagging in September 2014, 11.0 inches and 0.5 lbs in September 2015, 13.3 inches and 0.9 lbs in September 2016, and 13.9

inches and 1.0 lbs in October 2017. The growth of the four rainbow trout recaptured in October 2017, varied from 1.6 to 7.0 inches over a three year and one month period (Table 5). These growth rates are less than the growth rates observed of similar sized rainbow trout in the Missouri River that varied from 5.9 to 14.3 inches over a three and a half year period (Table 5).

**Acknowledgements**
We thank the following people involved with data collection in 2017; Matt Pumfery, Colton Wennerberg, Keenan Blackbird, Charlie Williams, Michael Lance, and Megan Heinemann.

## References

Grisak, G.G, A.C. Strainer and B.B. Tribby. 2012. Rainbow Trout Spawning Characteristics and Relation to the Parasite *Myxobolus cerebralis* in the Missouri River, Montana. Intermountain Journal of Sciences. 18:6-19.

Leathe, S. 2001. An evaluation of juvenile trout production of Little Prickly Pear Creek and Dearborn River Montana using rotary screw traps. Montana Fish, Wildlife & Parks, Great Falls.

Mullen, J., G. Grisak, and D. Owensby. 2016. Trout and whitefish life history study – April 2016 update. Status report for Northwestern Energy, FERC Project 2188. Montana Fish, Wildlife & Parks. Great Falls, MT.

Mullen, J., K. Vivian, and G. Grisak. 2017. Trout and whitefish life history study – 2016 update. Status report for Northwestern Energy, FERC Project 2188. Montana Fish, Wildlife & Parks. Great Falls, MT

Vivian, K. and J. Mullen. 2018. American white pelican predation of upper Smith River fisheries. Status report for Northwestern Energy, FERC Project 2188. Project # 2017-20. Montana Fish, Wildlife & Parks. Great Falls, MT

## Figures

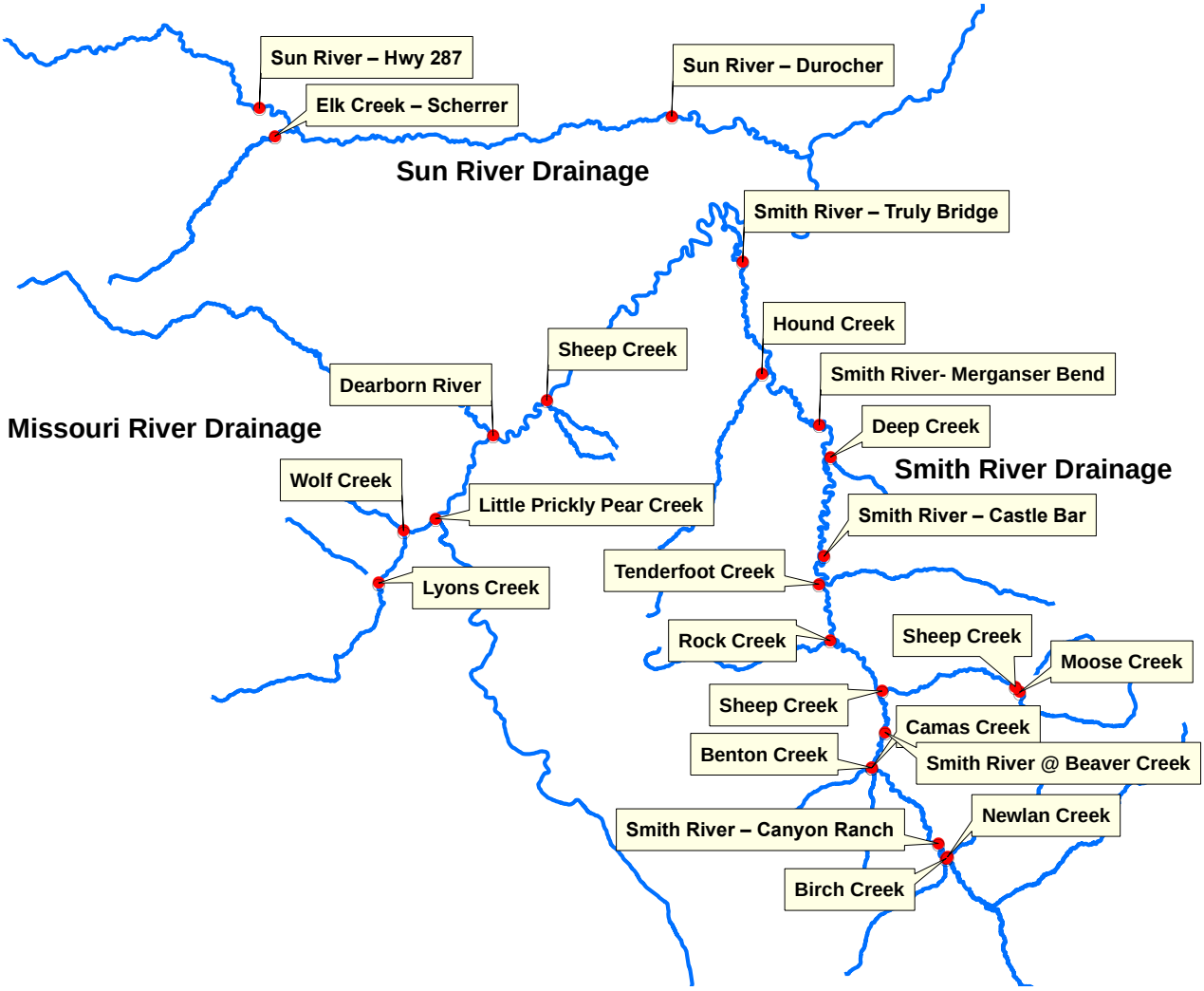


**Figure 1.** Map of fixed passive integrated tag (PIT) antennas in the Missouri, Smith, and Sun River drainages.

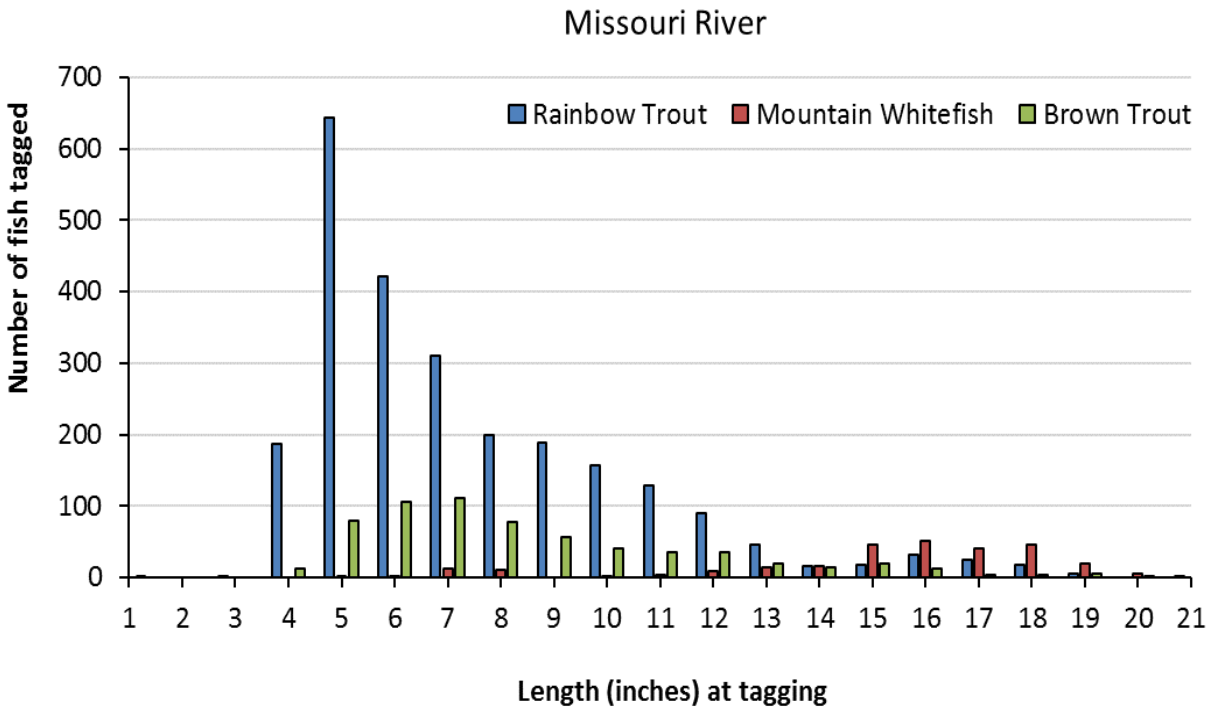


**Figure 2.** Size distribution of rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), and mountain whitefish (*Prosopium williamsoni*) tagged from 2014-2016 in the Missouri River drainage.

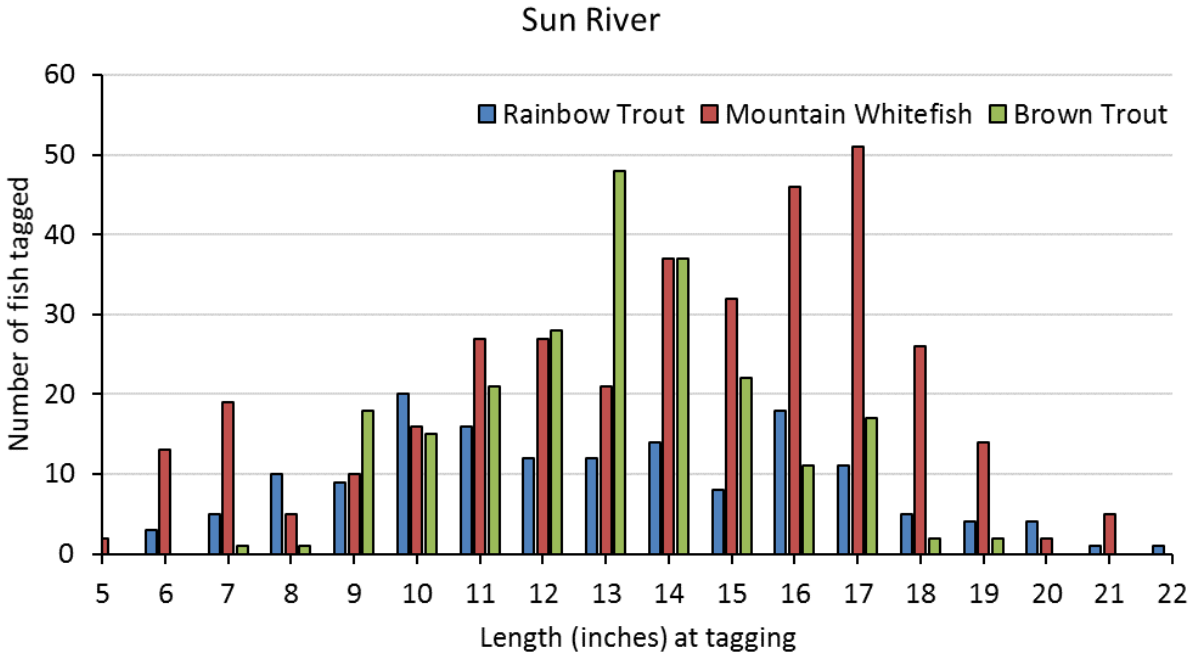


**Figure 3.** Size distribution of rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), and mountain whitefish (*Prosopium williamsoni*) tagged from 2015-2016 in the Sun River drainage.

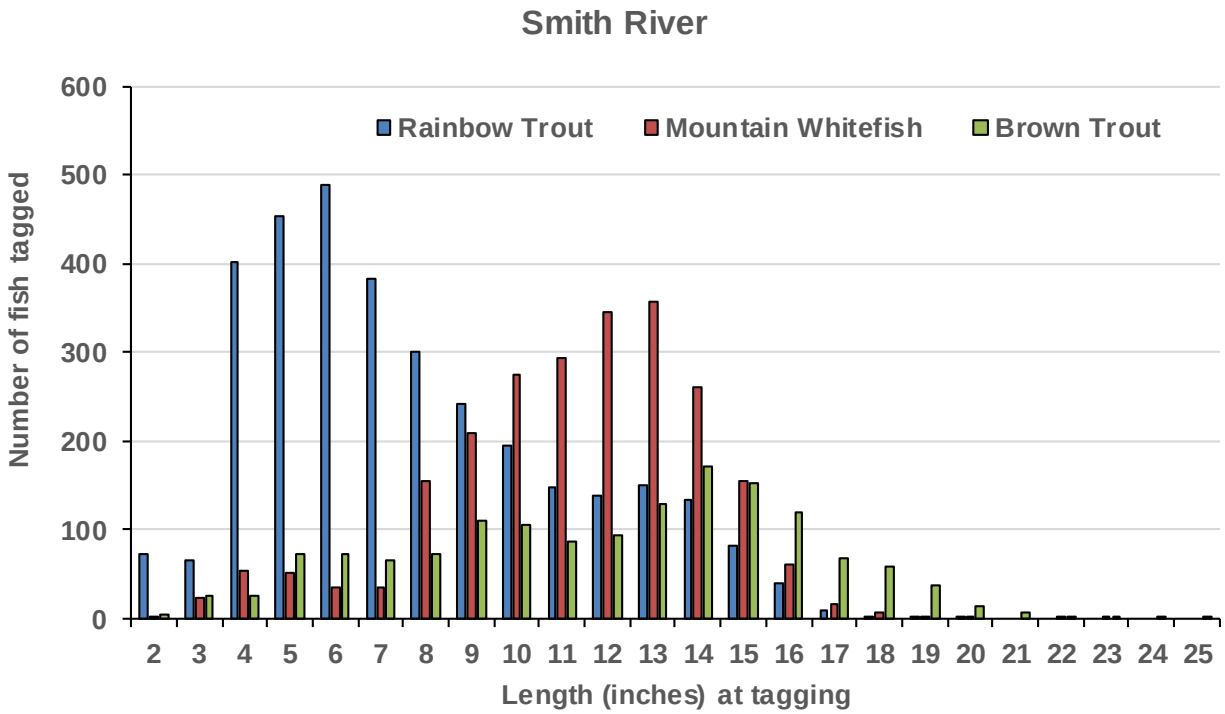


**Figure 4.** Size distribution of rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), and mountain whitefish (*Prosopium williamsoni*) tagged from 2010-2017 in the Smith River drainage.

## Tables

**Table 1.** Remote station locations in the Missouri, Sun, and Smith River drainages arranged from upstream to downstream.

| Drainage/ Stream | Lat | Long | Comments |
|---|---|---|---|
| **Missouri River** | | | |
| Lyons Creek | 46.93827 | -112.12581 | Located just upstream of confluence with Little Prickly Pear Creek. |
| Wolf Creek | 47.00597 | -112.08026 | Located just upstream of confluence with Little Prickly Pear Creek. |
| Little Prickly Pear Creek | 47.02251 | -112.02018 | Located just upstream of confluence with Missouri River. |
| Dearborn River | 47.13017 | -111.91295 | Located just upstream of confluence with Missouri River. |
| Sheep Creek | 47.17681 | -111.81165 | Located just upstream of confluence with Missouri River. |
| **Sun River** | | | |
| Sun River – Hwy 287 | 47.54768 | -112.36674 | Located just upstream of Hwy 287 near Augusta at river 67.6. |
| Elk Creek – Scherrer | 47.51229 | -112.33641 | Located at approx. river mile 2.8. |
| Sun River – Durocher | 47.54413 | -111.57848 | Located upstream of Vaughn at river mile 20. |
| **Smith River** | | | |
| Birch Creek | 46.58884 | -111.05305 | Located just upstream of confluence with Smith. |
| Newlan Creek | 46.59094 | -111.05070 | Located just upstream of confluence with Smith. |
| Smith River – Canyon Ranch | 46.60810 | -111.06760 | Located approx. river mile 107. |
| Benton Creek | 46.70542 | -111.19305 | Located just upstream of confluence with Smith. |
| Camas Creek | 46.70542 | -111.19305 | Located just upstream of confluence with Smith. |
| Smith River @ Beaver Creek | 46.75143 | -111.16839 | Located at approximately river mile 87.5. |
| Moose Creek | 46.80292 | -110.91484 | Located just upstream of confluence with Sheep Creek. |
| Sheep Creek | 46.81047 | -110.92272 | Located approximately 0.6 miles downstream of Moose Creek. |
| Sheep Creek | 46.80443 | -111.17403 | Located approximately 0.5 miles upstream of confluence with Smith River. |
| Rock Creek | 46.86935 | -111.27185 | Located just upstream of confluence with Smith. |
| Tenderfoot Creek | 46.94185 | -111.29404 | Located just upstream of confluence with Smith. |
| Smith River – Castle Bar | 46.97789 | -111.28427 | Located at approximately river mile 60.3. |
| *Deep Creek | 47.10581 | -111.27255 | Located just upstream of confluence with Smith. |
| Smith River-Merganser Bend | 47.14734 | -111.294 | Located downstream of Merganser Bend campground |
| Hound Creek | 47.21261 | -111.40371 | Located at approximately river mile 1.5. |
| Smith River – Truly Bridge | 47.35658 | -111.44140 | Located at approximately river mile 9.1. |

*****Deep Creek reader was removed in 2016 and placed in the mainstem of the Smith River at Merganser Bend.

**Table 2.** Number of tagged fish from 2014 to 2016 by species and waterbody in the Missouri River drainage.

| Tagging location | Mountain whitefish | Rainbow trout | Brown trout | Brook trout | White sucker | Longnose sucker | Burbot | Misc* | Total fish tagged |
|---|---|---|---|---|---|---|---|---|---|
| Dearborn River | 46 | 390 | 131 | | 40 | 46 | | 2 | 655 |
| Little Prickly Pear Creek | 1 | 521 | 86 | | 9 | 2 | | | 619 |
| Lyons Creek | | 263 | 113 | | 1 | | | | 377 |
| Missouri River | 230 | 128 | 138 | | 51 | 4 | 17 | 2 | 570 |
| Sheep Creek | | 424 | 72 | | 2 | | | | 498 |
| Wolf Creek | | 760 | 93 | | | | | | 853 |
| **Total tagged fish** | **277** | **2,486** | **633** | **0** | **103** | **52** | **17** | **4** | **3,572** |

* Misc. = mountain sucker, yellow perch, and walleye.

**Table 3.** Number of tagged fish from 2015 to 2016 by species and waterbody in the Sun River drainage.

| Tagging location | Mountain whitefish | Rainbow trout | Brown trout | Brook trout | White sucker | Longnose sucker | Burbot | Misc* | Total fish tagged |
|---|---|---|---|---|---|---|---|---|---|
| Sun River – Hwy 287 | 75 | 48 | 100 | | | | | | 223 |
| Sun River – Simms | 64 | 55 | 54 | | | | | | 173 |
| Sun River – Sun River | 81 | 41 | 74 | | 5 | | | | 201 |
| Elk Creek – Scherrer | | 4 | 99 | 3 | | | | | 106 |
| Elk Creek – at Smith Creek | 3 | 5 | 26 | | 2 | | | | 36 |
| **Total fish by species** | **223** | **153** | **353** | **3** | **7** | **0** | **0** | **0** | **739** |

**Table 4.** Number of tagged fish from 2010 to 2017 by species and waterbody in the Smith River drainage.

| | Mountain whitefish | Rainbow trout | Brown trout | Brook trout | White sucker | Longnose sucker | Burbot | Misc* | Total fish tagged |
|---|---|---|---|---|---|---|---|---|---|
| Smith R. | 1,253 | 804 | 748 | 15 | 58 | 36 | 24 | 23 | 2,961 |
| Sheep C. | 212 | 987 | 143 | 6 | 13 | 1 | | 2 | 1,364 |
| Moose C. | 271 | 906 | 6 | 21 | | | | | 1,204 |
| Tenderfoot C. | 577 | 522 | 106 | 94 | | | | | 1,299** |
| Hound C. | 11 | 24 | 367 | | 48 | 19 | | | 469 |
| Newlan C. | 5 | 1 | 21 | 33 | 46 | | 8 | | 114 |
| Rock C. | 17 | 13 | 68 | | | | | | 98 |
| Birch C. | | 6 | 50 | 11 | 2 | | | | 69 |
| Indian C. | | 31 | | 9 | | | | | 40 |
| Calf C. | | 4 | | 3 | | | | | 7 |
| **Total fish tagged by species** | **2,346** | **3,298** | **1,509** | **192** | **167** | **56** | **32** | **25** | **7,625** |

* Totals include one mountain sucker tagged in the Smith River.

** 777 of the Tenderfoot tags are from David Ritter's graduate work and many of which are likely no longer active.

**Table 5.** Summary of tagged fish recaptured during population estimate electrofishing events on the Missouri River in the Craig section and on the Smith River in the Eagle Creek section. Time between tagging and recapture is described as the year and nearest month between events.

| No. | Species | Tag Date | Tag Location | Length at Tagging (in) | Recap Date | Length at Recap (in) | Weight at Recap (lbs) | Time between tag and recap (year, month) | Growth (in) between tag and recap |
|---|---|---|---|---|---|---|---|---|---|
| **Missouri River – Craig Electrofishing Section Recaptures** | | | | | | | | | |
| 1 | Rainbow | 3/28/2014 | Little Prickly Pear Creek | 5.5 | 9/27/2017* | 17.0 | 1.7 | 3 yr, 6 months | 11.5 |
| 2 | Rainbow | 4/28/2014 | Missouri – US of Craig | 10.0 | 9/27/2017* | 16.0 | 1.6 | 3 yr, 5 months | 6.0 |
| 3 | Rainbow | 3/12/2014 | Wolf Creek | 4.0 | 9/28/2017 | 18.3 | 2.2 | 3 yr, 6 months | 14.3 |
| 4 | Rainbow | 4/2/2014 | Sheep Creek (Missouri) | 4.7 | 10/10/2017 | 18.1 | 2.5 | 3 yr, 6 months | 13.4 |
| 5 | Rainbow | 5/6/2014 | Missouri – US of Craig | 8.3 | 10/10/2017 | 19.0 | -- | 3 yr, 5 months | 10.7 |
| 6 | Rainbow | 4/29/2014 | Missouri – US of Craig | 11.1 | 10/11/2017 | 17.0 | 1.9 | 3 yr, 5 months | 5.9 |
| 7 | Brown | 3/11/2014 | Wolf Creek | 6.7 | 5/3/2017 | 17.0 | 1.8 | 3 yr, 2 months | 10.3 |
| 8 | Brown | 5/7/2014 | Missouri – US of Craig | 9.2 | 5/3/2017 | 21.5 | 3.7 | 3 yr | 12.3 |
| 9 | Brown | 5/5/2014 | Missouri – US of Craig | 7.1 | 5/3/2017 | 17.7 | 1.9 | 3 yr | 10.6 |
| 10 | Brown | 4/28/2014 | Missouri – US of Craig | 9.6 | 5/3/2017 | 17.8 | 2.9 | 3 yr | 8.2 |
| **Smith River – Eagle Creek Electrofishing Section Recaptures** | | | | | | | | | |
| 1 | Rainbow | 9/17/2014 | Smith – Eagle Cr. | 14.7 | 10/4/2017* | 16.3 | 1.8 | 3 yr, 1 month | 1.6 |
| 2 | Rainbow | 9/8/2014 | Smith – Eagle Cr. | 10.8 | 10/5/2017* | 13.8 | 0.8 | 3 yr, 1 month | 3.0 |
| 3 | Rainbow | 9/9/2014 | Smith – Eagle Cr. | 9.5 | 10/5/2017 | 14.6 | 1.3 | 3 yr, 1 month | 5.1 |
| 4 | Rainbow | 9/8/2014 | Smith – Eagle Cr. | 6.9 | 10/5/2017 | 13.9 | 1.0 | 3 yr, 1 month | 7.0 |

* Indicates the first detection of the fish since the initial tagging.