



NWE-2301-4176

Ms. Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

December 19, 2022

Re: NorthWestern Energy files Mystic Project 2301 Renewed Six Year (2022-2027)
Fisheries Plan and Six Year (2016-2021) Fisheries Monitoring Report

Dear Secretary Bose,

Herein attached, per U.S. Forest Service Appendix B Condition 16 of the December 17, 2007 Commission Order Issuing New License, is NorthWestern Energy's Renewed Six Year (2022-2027 Fisheries Plan and Six Year (2016-2021) Fisheries Monitoring Report for the Mystic Lake Project. Signatures of approval from the U.S Forest Service (USFS), Montana Fish, Wildlife & Parks (MFWP), and Montana Department of Environmental Quality (MDEQ) for this Plan and Report filing appear on page two.

NorthWestern Energy worked with the USFS and MFWP to complete the required fisheries work from 2016-2021. Annual fisheries reports were prepared by MFWP and NorthWestern and we worked collaboratively to complete the Six Year Fisheries Monitoring Report. NorthWestern proposes to continue working with FWP and USFS to implement the 2022-2027 Fisheries Monitoring Plan.

NorthWestern Energy will file a renewed Fisheries Plan and Report with the Commission every six years for the term of the Mystic Project license. Annual reports under this Plan will continue to be submitted to the USFS, MFWP and MDEQ, and posted to the NorthWestern Mystic Lake Project public website.

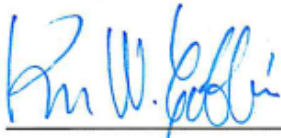
Sincerely,

Mary Gail Sullivan

Director, Environmental and Lands


CC: Andy Welch, NWE Keenan Storrar, DEQ Jake Chaffin, USFS
John Tabaracci, NWE Trevor Watson, FWP Bryan Giordano, FWP
Jon Hanson, NWE Ken Coffin, USFS

By signature of approval below, the USFS, MDEQ and MFWP approve the Renewed Six Year (2022-2027) Fisheries Plan and Six Year (2016-2021) Fisheries Monitoring Report for the Mystic Lake Project as filed herein with the Commission.

By: 

Title: District Ranger
Representing U.S. Forest Service

Date: 15 Dec 2022

By: 

Title: Fish Chief
Representing Montana Department of Fish, Wildlife, and Parks

Date: 12/14/22

By: Keenan Storrar

Title: 401 certification coordinator
Representing Montana Department of Environmental Quality

Date: 12/16/2022



**Mystic Lake Hydroelectric Project
FERC Project Number 2301**

**6-Year Fisheries Monitoring Plan
2022-2027**

December 2022



Submitted by:
NorthWestern Energy Corporation
Butte, Montana

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Executive Summary

The Mystic Lake Hydroelectric Project No. 2301 (Project) is operated and owned by NorthWestern Energy Corporation (NorthWestern, Licensee). On December 17, 2007 the Federal Energy Regulatory Commission (FERC or Commission) issued a new License to PPL Montana, the Licensee (now NorthWestern as of November 18, 2014) for the Mystic Lake Hydroelectric Project No. 2301 effective January 1, 2010. The new License includes US Forest Service (USFS) Section 4(e) Terms and Conditions filed on May 3, 2007. Section 4(e) Condition 16 requires the Licensee to prepare and implement a Fisheries Monitoring Plan that must be approved by the Mystic Lake Fisheries, Aquatic Habitats, and Water Quality Technical Advisory Committee known as the TAC.

On May 12, 2016, the Licensee filed the TAC-approved Fisheries Monitoring Plan for implementation between 2016 and 2021 with the Commission (NorthWestern Energy, 2016).

NorthWestern meets with the TAC, represented by Montana Fish, Wildlife and Parks (FWP), Montana Department of Environmental Quality (DEQ), and USFS, annually to review monitoring results and plan continuing studies. Cooperative efforts to monitor fish populations in the Mystic Project area began in 2006, using the Fisheries Monitoring Plan from the Final License Application (PPL Montana, 2006) as the basis of the work plan.

At the January 2022 TAC meeting, the TAC reviewed results from the previous 6 years of data collection and monitoring (2016 through 2021) and discussed the elements of the revised 6-Year (2022-2027) Fisheries Monitoring Plan to be implemented for the next 6-year cycle.

NorthWestern will summarize and present the results of the fisheries monitoring activities to the TAC annually. NorthWestern will prepare a 6-year comprehensive report summarizing fisheries activities completed between 2016 and 2021 along with an updated 6-Year Fisheries Monitoring Plan for implementation between 2022 and 2027. These two documents will be submitted to the TAC for review and approval prior to filing with the Commission no later than December 31, 2022.

1.0 Introduction

On December 17, 2007 the Federal Energy Regulatory Commission (FERC or Commission) issued an Order Issuing New License for the Mystic Hydropower Project (Project No. 2301), effective January 1, 2010. Included in this License are Section 4(e) Conditions, submitted by the U.S. Forest Service¹ (USFS).

Condition No. 16 of the 4(e) Conditions address fisheries management in the Project area,

Within one year of License issuance, the Licensee shall file with the Commission, a Fisheries Monitoring Plan approved by the Mystic Lake Fisheries, Aquatic Habitats and Water Quality Technical Advisory Committee USFS, Montana Division of Environmental Quality [DEQ], and Montana Fish, Wildlife, and Parks [FWP]). The monitoring shall be conducted for the duration of the License term to assess fisheries and aquatic habitat conditions in the project area to ensure that project operations are not adversely affecting aquatic resources. The Fisheries Monitoring Plan is a protective measure designed to detect trends, if any, in fish populations or aquatic habitat conditions that may be related to project activities. The Fisheries Monitoring Plan shall meet the protocol described in Section E.5.3.3.3 of Volume IA – Public, Final License Application, Applicant Prepared Environmental Assessment, Exhibit E (December 15, 2006). The Fisheries Monitoring Plan shall be conducted on a six-year cycle for the term of the new Mystic Lake project license and encompass Mystic Lake and West Rosebud Creek from Mystic Lake to below Emerald Lake.

NorthWestern Energy Corporation (NorthWestern, Licensee) meets with the Mystic Lake Fisheries, Aquatic Habitats and Water Quality Technical Advisory Committee (TAC) annually to review monitoring results and plan continuing studies. Cooperative efforts to monitor fish populations in the Project area began in 2006, using the Fisheries Monitoring Plan from the Final License Application dated December 15, 2006 (PPL Montana, 2006) as the basis of the work plan.

The Licensee filed the 2013 Annual Fisheries Monitoring Report with FERC on June 20, 2014. In the 2013 annual report, the Licensee proposed filing annual reports with the TAC, and a 6-year summary report with FERC by June 1, 2016, and every 6 years thereafter (PPL Montana, 2014). The 2013 annual report included concurrence with this request, from the USFS, DEQ, and FWP.

¹ See Appendix B of License, Section 4(e) Terms and Conditions filed May 3, 2007 and modified by filing of November 30, 2007.

On July 30, 2014 FERC issued a letter stating that,

...while FERC remains interested in your fisheries monitoring results, the request to discontinue filing annual reports with FERC is reasonable. The 2010 through 2013 reports demonstrated acceptable results, as well as a commitment to accurately representing fish populations in the project area and ensuring collaboration with the TAC. Additionally, you have not deviated from the requirements of the Fisheries Monitoring Plan since its implementation, and provided documentation of the TAC's concurrence with the modified reporting schedule. As such, we find the proposed reporting schedule acceptable.

The July 30, 2014 FERC letter stated that the 6-year summary report and updated Fisheries Monitoring Plan is due to FERC on June 1, 2016.

At the January 2022 TAC meeting, the TAC reviewed results from the previous 6 years of data collection and monitoring (2016-2021) and updated and agreed to the elements of the revised 6-Year (2022-2027) Fisheries Monitoring Plan. The details for the 2022-2027 Fisheries Monitoring Plan scheduled for implementation for the next 6-year cycle are provided in Section 2.0.

1.1 1.1 Funding

An agreement between NorthWestern, USFS and FWP provides funding for fisheries biologists from the USFS and FWP to assist NorthWestern in implementing the Fisheries Monitoring Plan.

1.2 1.2 Operation of the Technical Advisory Committee

FWP, USFS, NorthWestern, and other interagency biologists will report on findings and work performed each year at the annual TAC meeting. In addition, annual work plans and budgets for the coming year(s) are discussed and approved. Annual reports from biologists describe new adaptive management opportunities for Mystic fisheries management within the context of each work plan.

Adaptive management (change in management direction or scientific method based on monitoring results or emerging technologies) will be accomplished by consultation of NorthWestern and a quorum of resource agencies within the TAC. When a biological problem is identified, Protection, Mitigation, and Enhancement measures will be taken to address the problem.

2.0 Fisheries Monitoring Plan

The Fisheries Monitoring Plan (Plan) covers fisheries research in Mystic Lake, West Rosebud Creek between the dam and powerhouse, West Rosebud and Emerald lakes, and West Rosebud Creek below the powerhouse. Each of these locations is impacted by NorthWestern operations due to changes that are occurring to the natural hydrograph. The Plan includes a continuous 6-year (2022-2027) schedule for implementing the following PM&E measures:

A. Mystic Lake monitoring will occur every third year (2024, 2027) to record resident fishery trends and will include:

1. Summer netting with experimental floating and sinking gillnets in two standardized locations. Biological data collected will include number of fish caught by species and length and weight characteristics.
2. Angling to capture fish in two sections of Mystic Lake. Biological data collected will include catch-per-unit-effort (CPUE), length, and weight and physical characteristics.

B. West Rosebud Creek between the dam and powerhouse will be monitored every third year (2023, 2026) and include:

Electrofishing estimates of fish populations. An August or September estimate will be conducted in two established locations: 200-foot section at the downstream end of the reach and a 350-foot section below the falls. FWP will use a standardized analysis program to estimate and report fish populations. This sampling is the best trend indicator of relative change in the fish community.

C. West Rosebud Lake and Emerald Lake fish monitoring will occur every third year (2023, 2026) and will include:

West Rosebud and Emerald Lake fish populations will be sampled every third year using floating and sinking experimental gillnets in standardized locations. Sampling is conducted by FWP on these lakes as a trend indicator of relative changes to the fish assemblages. Biological data collected includes species, length, and weight.

D. Monitoring of fish populations in West Rosebud Creek downstream of Emerald Lake will occur every third year (2022, 2025) using electrofishing equipment.

An electrofishing estimate of the fish population will occur at an established location below Emerald Lake. This sampling is conducted by FWP and is the best trend indicator of relative change in the fish community.

- E. Brown trout redd counts will occur every year in the established electrofishing section in West Rosebud Creek below Emerald Lake.**

3.0 Schedule

The following outlines the schedule for continuation of fisheries monitoring activities between 2022 and 2027. Details of each activity is provided in the previous section.

**Mystic License
Proposed Fisheries Monitoring
6-Year Schedule**

Year	A	B	C	D	E
2022				X	X
2023		X	X		X
2024	X				X
2025				X	X
2026		X	X		X
2027	X				X

A = Mystic Lake monitoring

B = West Rosebud Creek between the dam and powerhouse

C = West Rosebud and Emerald lakes fish monitoring

D = West Rosebud Creek below Emerald Lake electrofishing

E = West Rosebud Creek fall redd counts

4.0 Reporting

Annual reports will be prepared that summarize the previous year's work and the proposed plan for the next year. The annual reports will be submitted to the TAC and posted on the Mystic Lake Project Coordination website (mysticlakeproject.com).

In 2028, a 6-year comprehensive report summarizing activities between 2022 and 2027 will be prepared along with an updated 6-Year (2027-2032) Mystic Fisheries Monitoring Plan. The comprehensive report and updated Fisheries Monitoring Plan will be submitted to the TAC for review and approval prior to filing with the Commission. The two reports will be filed with the Commission no later than December 31, 2032 and posted on the Mystic Lake Project Coordination website.

5.0 References

PPL Montana, LLC. 2014. Mystic Lake Hydropower Project, FERC Project Number 2301. 2013 Annual Fisheries Monitoring Report, Public. Submitted to FERC on June 20, 2014. Available: <http://www.mysticlakeproject.com>

PPL Montana, LLC. 2010. Fisheries Monitoring Plan, Mystic Lake Hydropower Project, FERC Project Number 2301. Submitted to FERC on August 2, 2010. Available: <http://www.mysticlakeproject.com>

PPL Montana, LLC. 2006. Mystic Lake Hydroelectric Project FERC No. 2301. Volume IA – Public Final License Application, Applicant Prepared Environmental Assessment (APEA) Exhibit E. Submitted to FERC on December 15, 2006. Available: <http://www.mysticlakeproject.com>



6-Year Fisheries Monitoring Report 2016-2021

Mystic Lake Hydroelectric Project FERC Project Number 2301

December 2022



Submitted by:
Northwestern Energy Corporation
Butte, MT

With Assistance From:
Montana Fish, Wildlife & Parks

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1. Introduction

The Mystic Lake Hydroelectric Project No. 2301 (Project) is situated in south-central Montana, primarily located in Stillwater County with a very small portion within Carbon County. The Project is located in the Beartooth Mountain Range and surrounded on three sides by the Absaroka-Beartooth Wilderness Area. Mystic Lake is located at the head of a high mountain canyon at an elevation of 7,673.5 feet above mean sea level in the upper reaches of West Rosebud Creek. Within West Rosebud Creek drainage (213.4 square miles), Mystic Lake is the fourth and largest lake in a chain of six hydraulically connected lakes (listed in order going downstream: Star, Silver, Island, Mystic, West Rosebud, and Emerald lakes). The Beartooth Ranger District of the Custer National Forest manages approximately 124.7 square miles of the West Rosebud Creek drainage while the remaining 88.7 square miles is privately-owned land.

On December 17, 2007, the Federal Energy Regulatory Commission (FERC or Commission) issued a new license for the Mystic Lake Hydroelectric Project No. 2301 effective January 1, 2010. The new license includes the U.S. Forest Services (USFS) Section 4(e) Terms and Conditions filed on May 3, 2007. Section 4(e) Condition 16 requires the Licensee [now NorthWestern Energy Corporation (NorthWestern)] to prepare and implement a Fisheries Monitoring Plan that must be approved by the Mystic Fisheries, Aquatic Habitats, and Water Quality Technical Advisory Committee (TAC), represented by USFS, Montana Department of Environmental Quality (DEQ), and Montana Fish, Wildlife and Parks (FWP).

In 2010, the Licensee developed the 6-Year (2010-2015) Fisheries Monitoring Plan for the Mystic Lake Project (PPL Montana, 2010). On September 30, 2010, the Commission issued a letter approving the Fisheries Monitoring Plan with a request for the Licensee to file a copy of each annual report to the Commission. Following the submittal of the 2013 annual report, the Licensee requested to modify the reporting schedule and only file annual reports to the TAC followed by a 6-year summary filing with the Commission. The first 6-year summary was filed with the Commission by June 1, 2016, and every 6 years thereafter. In a letter issued by the Commission on July 30, 2014, FERC accepted the proposed reporting schedule.

The first 6-year cycle (2010-2015) of the Fisheries Monitoring Plan was completed in 2015. In compliance with the Fisheries Monitoring Plan, this document provides the next comprehensive 6-year (2016-2021) summary report of all fisheries activities that occurred between 2016 and 2021. Some sections of this report include data previous to 2016, and is presented for a long term comparative option. Each monitoring activity, as identified in Table 1-1, has its own section in this report. A map of the Mystic Hydroelectric Project FERC boundary and the locations of the 2016-2021 monitoring activities are shown in Figure 1-1.

Table 1-1: Mystic License Fisheries Monitoring Schedule

Year	A	B	C	D	E	F
2016				X		X
2017		X	X		X	
2018	X					X
2019				X	X	
2020		X	X			
2021	X				X	

- A = Mystic Lake monitoring
- B = West Rosebud Creek between the dam and powerhouse
- C = West Rosebud and Emerald lakes fish monitoring
- D = West Rosebud Creek below Emerald Lake electrofishing
- E = West Rosebud Creek fall redd counts
- F = Water temperature monitoring

NorthWestern has revised the 6-year Fisheries Monitoring Plan, in consultation with the TAC, for implementation between 2022 and 2027. NorthWestern proposes to continue to provide a summary of the previous year’s fisheries activities to the TAC annually, followed by a 6-year summary report that will be filed with the Commission, and every 6-years thereafter for the term of the license. Annual summaries to the TAC and reports filed with the Commission will be posted to the Mystic Lake Project Coordination website (www.mysticlakeproject.com). The next 6-year summary report will be filed with the Commission no later than December 31, 2028. In addition, every 6 years, the TAC will re-evaluate and update the Fisheries Monitoring Plan, as necessary for the term of the Project license.

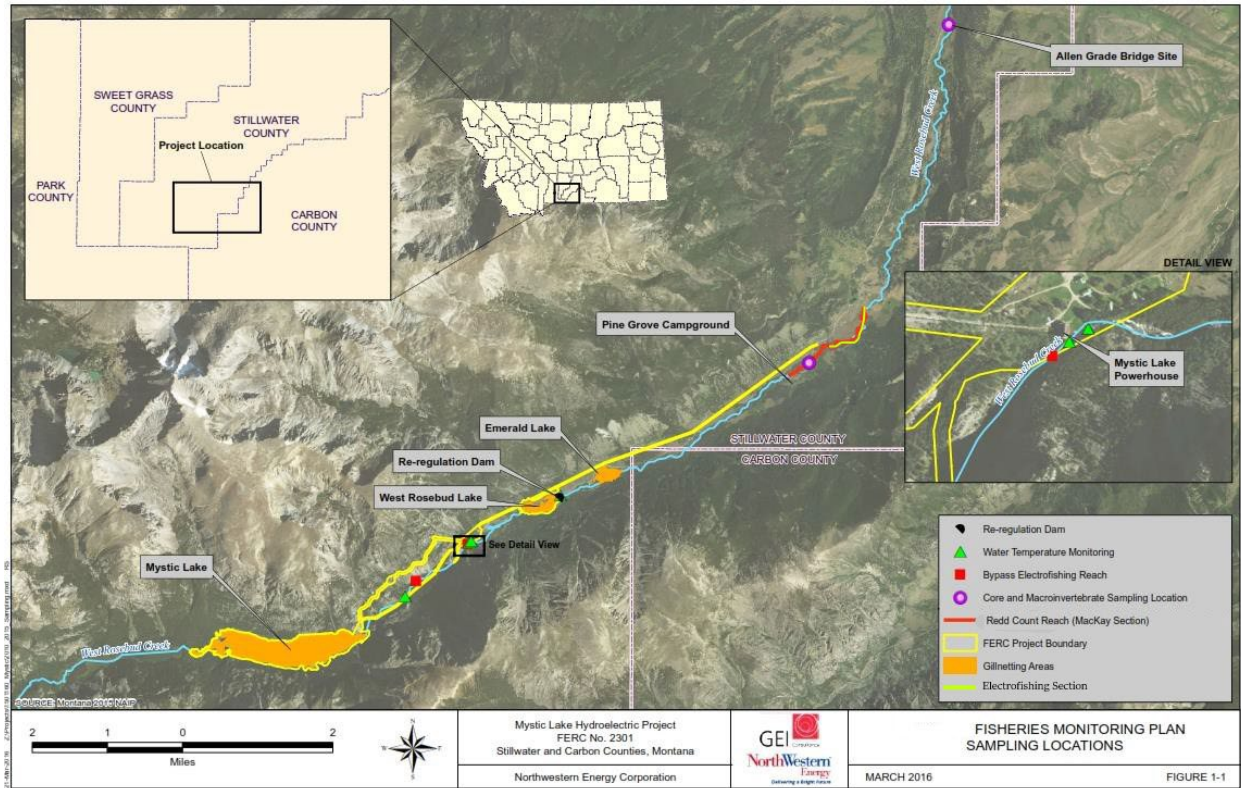


Figure 1-1: 2016-2021 Fisheries Monitoring Plan sampling locations

2. Mystic Lake Monitoring

Methods

As outlined in the Fisheries Monitoring Plan, Mystic Lake monitoring occurred every third year (2018 & 2021) to record resident fishery trends. Data collection in Mystic Lake included:

- Summer netting with experimental floating and sinking gillnets in two standardized locations. Biological data collected included the number of fish caught by species and length and weight.
- Angling to capture fish in the upper and lower areas of Mystic Lake. Biological data collected included catch per unit effort (CPUE), length and weight, and physical characteristics.

The sampling locations and methodologies from 2003, 2009, 2012, 2015, 2018 and 2021 are similar and data from 2018 and 2021 have been summarized below. The gillnet locations for sampling efforts are shown in Figure 2-1.

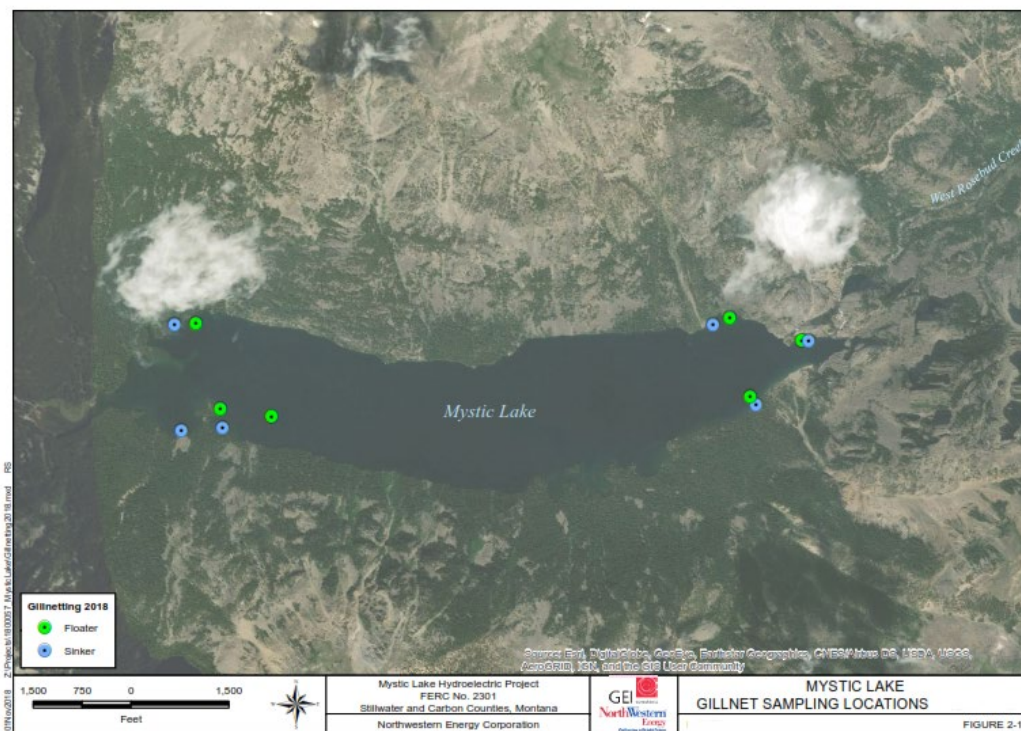


Figure 2-1. Mystic Lake gillnet sampling locations from 2018 and 2021.

Results

The Licensee completed a fisheries survey in Mystic Lake in 2018 and 2021. Each survey included both gillnetting and angling efforts. The data refer to the hybrid swarm rainbow trout population (referred to as rainbow trout in this report) observed in Mystic Lake and have been summarized by CPUE (fish per hour) and length-frequency histograms. This report does not go into details regarding weight-length relationships or fish condition based on no discernable differences from the previous 6-year report from 2003, 2009, 2012, and 2015.

A summary of the total number of rainbow trout captured, total duration of effort (hours), and CPUE (fish per hour) via gillnetting and angling in Mystic Lake in 2003, 2009, 2012, 2015, 2018 and 2021 is presented in Table 2-1 and Figure 2-2.

Table 2-1. Summary of the total fish, total hours of effort, and total CPUE (fish per hour) for angling and gillnetting efforts in Mystic Lake.

Year	Sampling Method	Total Fish Caught	Total Hours	Fish / Hour
2003	Angling	733	93.3	7.9
2003	Gillnetting	86	176.2	0.5
2009	Angling	124	16.5	7.5
2009	Gillnet	254	160.1	1.6
2012	Angling	52	13	4.0
2012	Gillnet	141	148.4	1.0
2015	Angling	86	18.8	4.6
2015	Gillnet	221	180.4	1.2
2018	Angling	101	10.6	9.5
2018	Gillnet	264	176.8	1.5
2021	Angling	102	13.1	7.8
2021	Gillnet	218	186.2	1.2

In 2018 and 2021 CPUE for angling was 9.5 fish per hour and 7.8 fish per hour respectively. Gillnetting catch rates for those years was 1.5 fish per hour and 1.2 fish per hour. Angling catch

rates in 2018 were the highest recorded since 2003, while fish captured via netting was within the long term range of catch rates for both 2018 and 2021.

Angling success can be highly variable based on the anglers skill level, environmental conditions such as weather, and time of day. While angling catch rates can be useful to look at angler satisfaction or general abundance it should be noted that gillnetting is a more standardized way to measure abundance and track trends in the fishery.

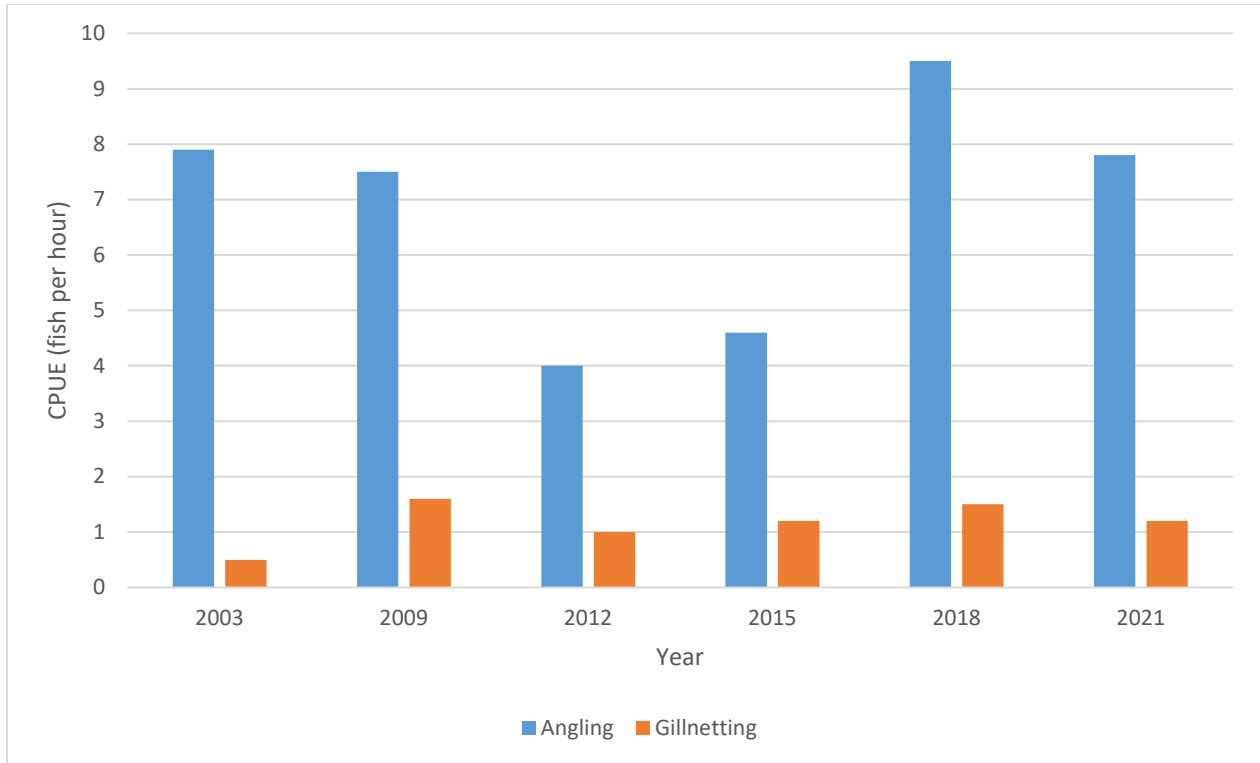


Figure 2-1: Summary of CPUE (fish per hour) via gillnetting and angling in Mystic Lake.

Length Frequency Distribution

Length-frequency histograms for rainbow trout captured in Mystic Lake via angling and gillnetting in 2018 are shown in Figure 2-3 and in Figure 2-4 for 2021. Angling efforts typically capture larger size classes of rainbow trout than gillnetting (Figure 2-3 and 2-4). Rainbow trout collected while angling ranged in size from 5.3-15.3 inches with an average length of 12.9 inches and a median length of 13 inches. The majority of rainbow trout collected angling were between 12.6-14.6 inches in length.

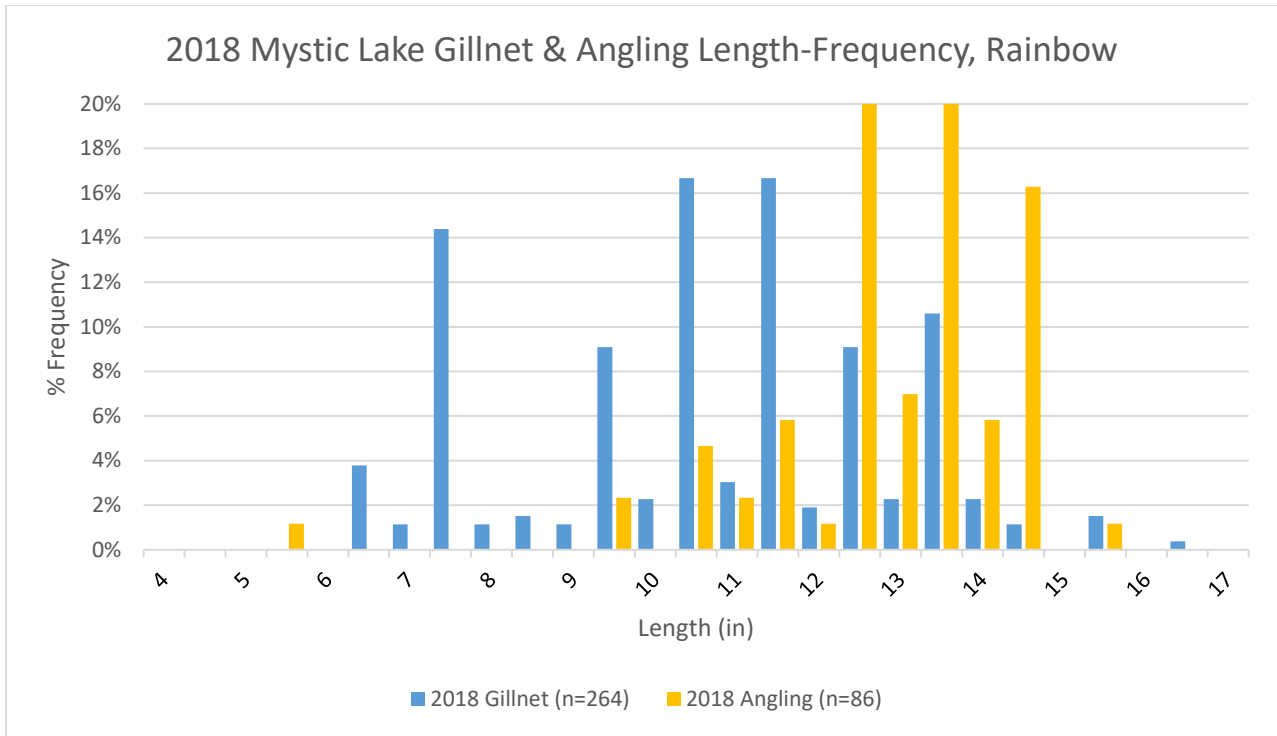


Figure 2-3: Length-frequency for rainbow trout sampled via gillnetting and angling in Mystic Lake in 2018.

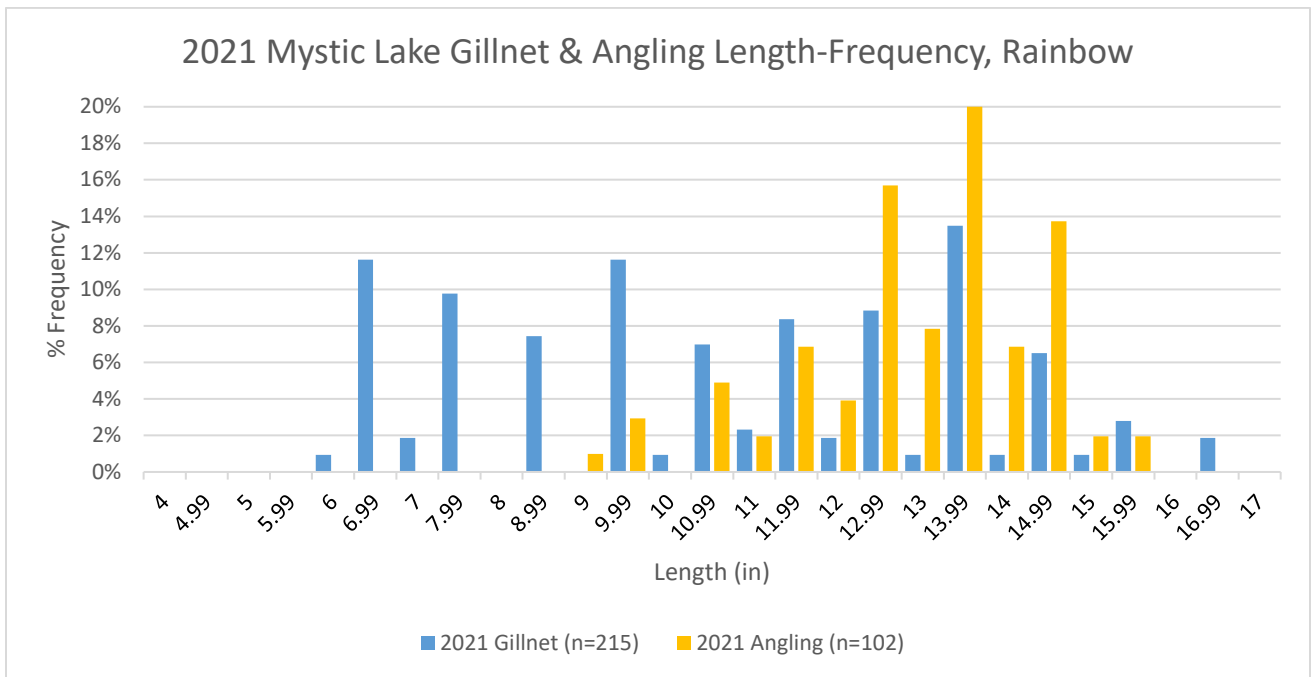


Figure 2-4: Length-frequency for rainbow trout sampled via gillnetting and angling in Mystic Lake in 2021.

3. West Rosebud Creek Bypass Fisheries

As part of the relicensing effort for the Mystic Hydroelectric Project, studies were completed in 2004 to determine the status of the fisheries in the bypass reach of West Rosebud Creek, which extends downstream of Mystic Lake Dam to the powerhouse, and to evaluate the impacts of power production on the fishery. Four sites on the bypass channel were sampled in 2004. The fisheries data collected in 2004 indicated that current alterations in the hydrograph of West Rosebud Creek in the bypass reach did not cause substantial negative effects on the fish population. Overall, in all four sections sampled in the bypass reach in 2004, the fishery appeared to be in excellent condition despite high gradient, very large substrate and low winter flows, and there appeared to be suitable habitat for spawning, rearing, and over-wintering. The 2016—2021 Fisheries Monitoring Plan includes sampling two sections of the bypass channel, upper and lower, on West Rosebud Creek via electrofishing every three years, typically in mid-September. For this monitoring period, the upper and lower sections were sampled in 2017 and 2020.

The upper bypass section is 300 feet in length and begins at the boundary of the Absaroka-Beartooth Wilderness, approximately 1.2 miles from the Mystic Lake trailhead. This section is characterized by slow-moving riffles and occasional boulder pools. The lower section is 200 feet in length and is located directly behind the NWE Powerhouse between Mystic and West Rosebud Lakes. This section is characterized by large boulders, fast-moving water, and slow pockets where the majority of fish hold. Sampling in the lower section is challenging due to the physical characteristics of the stream.

Methods

FWP personnel, USFS, and Licensee staff members survey the upper and lower reaches via electrofishing. On September 18, 2017, the upper bypass reach was electrofished and a multi-pass depletion population estimate was completed. The population estimate was provided by FWP and the analysis was completed using the agency's internal software. The lower reach was also sampled this day, but only one pass was completed. On September 16, 2020, two passes were completed at each reach. Fish population estimates were completed using the Zippin K Pass removal estimate.

Different shocking equipment has been used across survey years. Since 2012, both sections have been sampled with a bank electrofishing unit and handheld anode rather than a backpack electrofishing unit. The following text summarizes and compares results from the electrofishing efforts in the upper and lower bypass sections.

Upper Bypass Results

Rainbow trout is the only species of fish in the upper bypass section of West Rosebud Creek. In 2017, a total of 186 fish were collected; 163 fish were collected in 2020 (Table 3-1). Using the depletion estimate population model, these data provided an estimate of 193 rainbow trout per 300 feet in 2017, and 169 in 2020 with 95% confidence (Figure 3-1).

From data collected between 2008 and 2020, the rainbow trout population in the upper bypass reach appears to be stable with the population estimate ranging between 112 and 193 fish per 300 feet. The average length of the rainbow trout sampled each year has also remained similar over the years, ranging between 4.9 inches and 6.0 inches (Figure 3-2).

Historically, rainbow trout 4.0-4.9 inches in length were the most abundant (Figure 3-3). Fish captured in 2017 followed this trend. In 2020, fish were generally larger than 2017 and the long-term trend. Rainbow trout ranging from 5.0-8.9 inches were more abundant than the long-term average.

The first sampling of this section, done in 2004, was run as a mark-recapture population estimate. These data are not comparable to the depletion estimates done in the subsequent sampling years, and are not included below in the comparison.

Table 3-1: Summary of the upper bypass section sampling, including sample year, species, total fish caught, population estimate per the 300-foot reach, upper confidence interval (UCI), and average lengths.

Year	Species	Total captured	Population estimate per 300 feet	95% UCI	Avg. length (in.)
2004	Rainbow trout	255	NA	NA	4.8
2008	Rainbow trout	179	184	190	4.9
2011	Rainbow trout	126	127	127	5.7
2012	Rainbow trout	110	112	116	6.0
2014	Rainbow trout	150	161	173	5.8
2017	Rainbow trout	186	193	201	5.3
2020	Rainbow trout	163	169	177	5.9

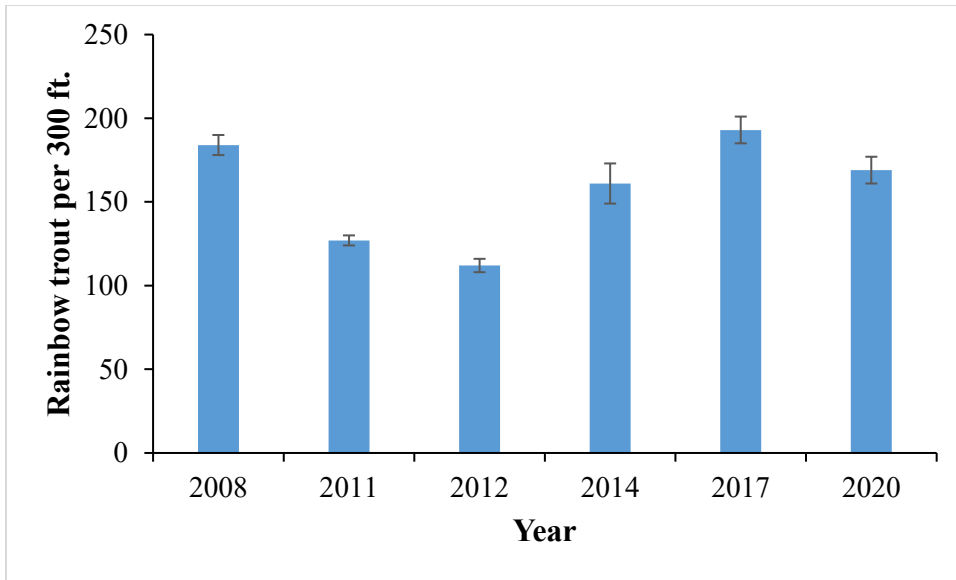


Figure 3-1: Population estimate with upper and lower confidence intervals of rainbow trout per 300 feet in the upper bypass section of West Rosebud Creek.

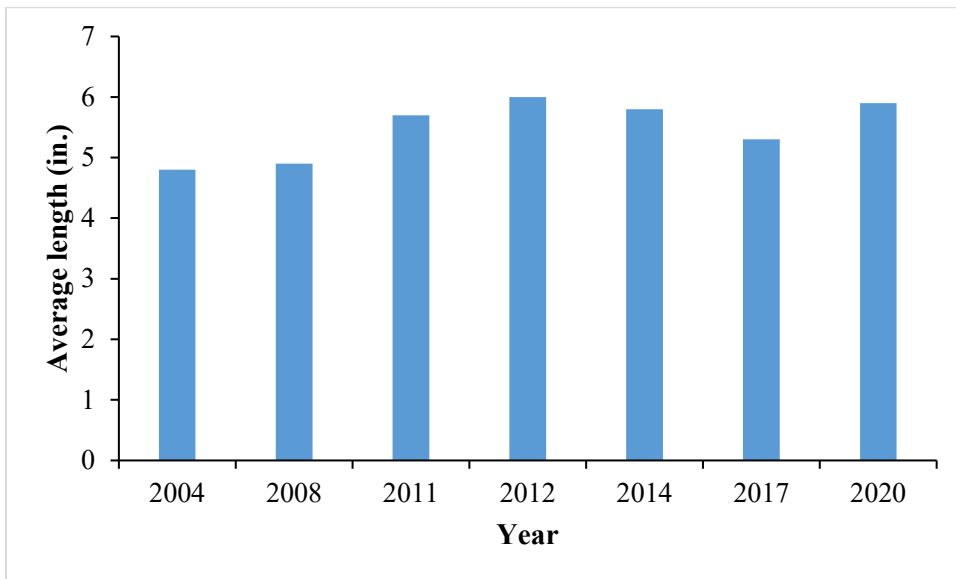


Figure 3-2: Average length (in.) of rainbow trout in the upper bypass section of West Rosebud Creek.

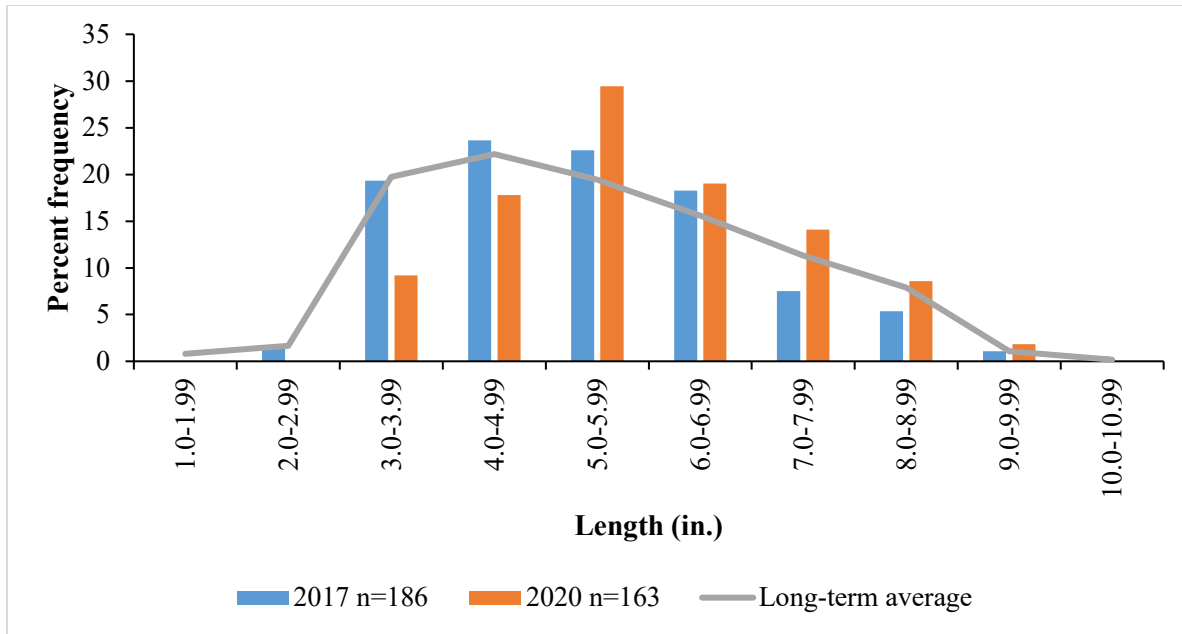


Figure 3-3: Length frequency of rainbow trout in the upper bypass section of West Rosebud Creek, 2017 and 2020 against long-term (2004-2020) average.

Lower Bypass Results

Two species of fish, including rainbow trout and brown trout, are found in the lower bypass section of West Rosebud Creek. Only single electrofishing passes were completed in 2004, 2011, and 2017. Depletion population estimates for the lower section were conducted in 2012, 2014, and 2020. First pass catch data from all survey years are compared below because of the lacking population estimates for so many sample years (Tables 3-2 and 3-3).

The first two sampling events on the lower bypass section in 2004 and 2011 saw the greatest change in first pass catch for rainbow trout, with 58 caught in 2004 and only 4 captured in 2011 (Figure 3-4). From 2012—2020, however, first pass catch numbers for rainbow trout were consistent, ranging from 21 to 26. In every sample year except 2017, more rainbow trout were sampled than brown trout. Brown trout first pass catch numbers increased from 0 to 26 between 2004 and 2017, but dropped to 9 in 2020.

The average length of rainbow trout has been relatively consistent from 2011-2020 but was significantly lower in 2004 (Figure 3-5). There has been much more variability in brown trout average length, ranging from 6.9 inches in 2014 to 11.8 inches in 2012.

Rainbow trout ranging from 7.0 to 7.9 inches were the most abundant in 2017 and 2020 (Figure 3-6). This also follows the long-term trend for rainbow trout in the lower bypass section. There was a higher abundance of both smaller (3.0-5.9 inch) and larger (above 9.0 inches) rainbow trout in 2020 compared to 2017.

Length frequency distribution for brown trout in the lower bypass section have differed more than rainbow trout across survey years (Figure 3-7). In 2017, there was a higher abundance of smaller fish (4.0-6.9 inches), while 2020 had more larger fish (above 9.0 inches). The long-term average for brown trout in this section of West Rosebud Creek has a fairly even distribution across length groups.

Table 3-2: Catch statistics, including first pass catch and average length, for brown trout in the lower bypass section of West Rosebud Creek.

Year	Species	First pass catch	Avg. length (in.)
2004	Brown trout	0	NA
2011	Brown trout	3	10.2
2012	Brown trout	6	11.8
2014	Brown trout	10	6.9
2017	Brown trout	26	7.9
2020	Brown trout	9	10.6

Table 3-3: Catch statistics, including first pass catch and average length, for rainbow trout in the lower bypass section of West Rosebud Creek.

Year	Species	First pass catch	Avg. length (in.)
2004	Rainbow trout	58	4.9
2011	Rainbow trout	4	7.2
2012	Rainbow trout	23	6.7
2014	Rainbow trout	26	6.7
2017	Rainbow trout	23	7.1
2020	Rainbow trout	21	7.1

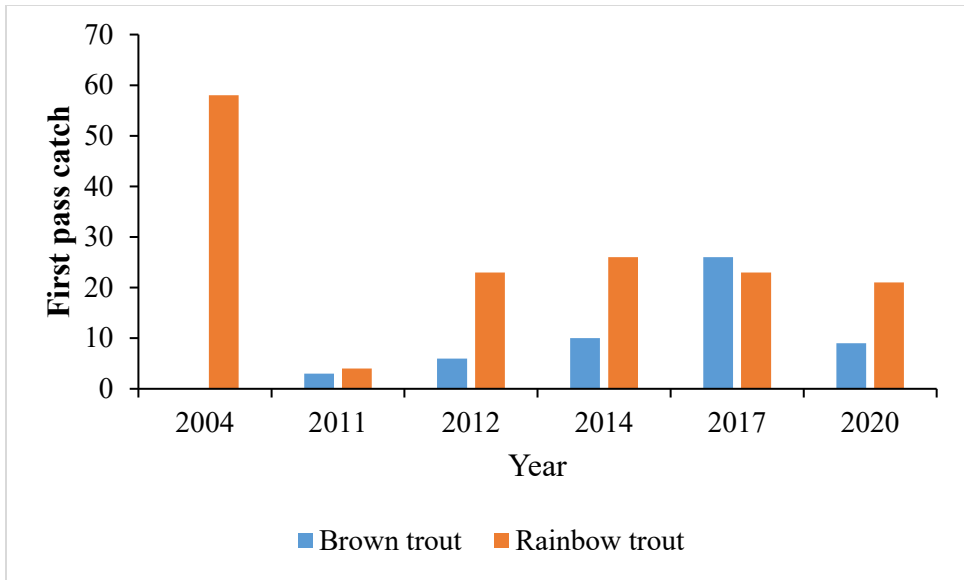


Figure 3-4: First pass catch numbers for brown and rainbow trout in the lower bypass section of West Rosebud Creek.

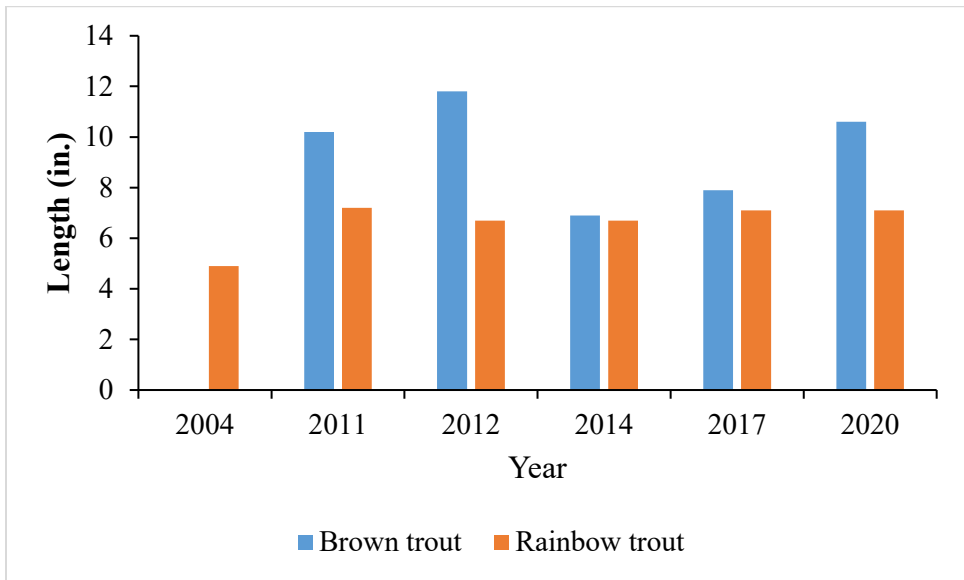


Figure 3-5: Average length (in.) for brown and rainbow trout in the lower bypass section of West Rosebud Creek.

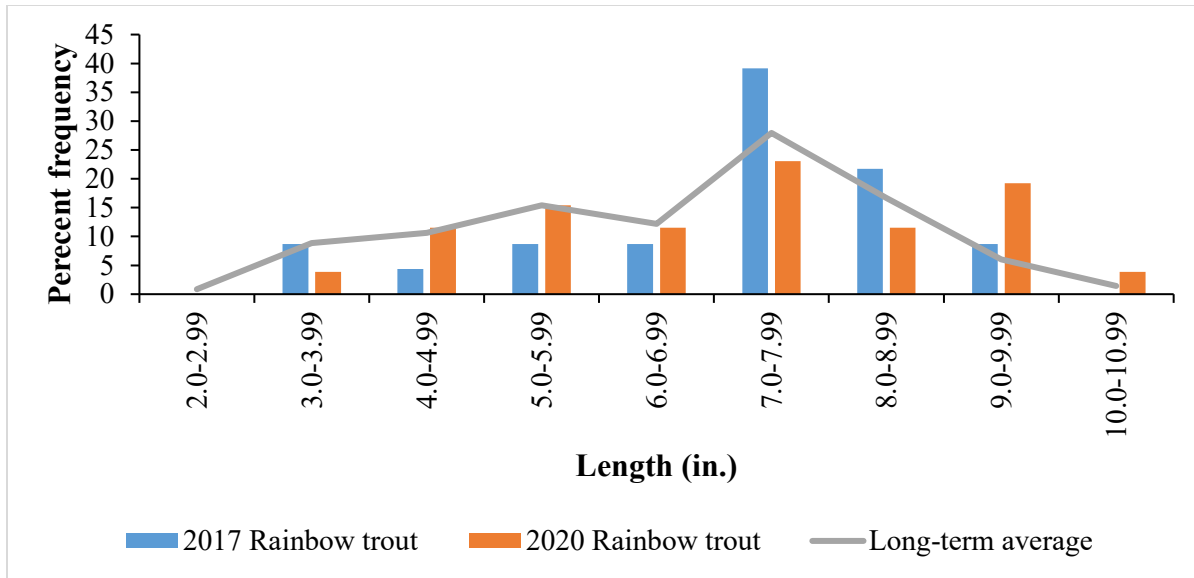


Figure 3-6: Length frequency of rainbow trout in the lower bypass section of West Rosebud Creek, 2017 and 2020 against long-term (2004-2020) average.

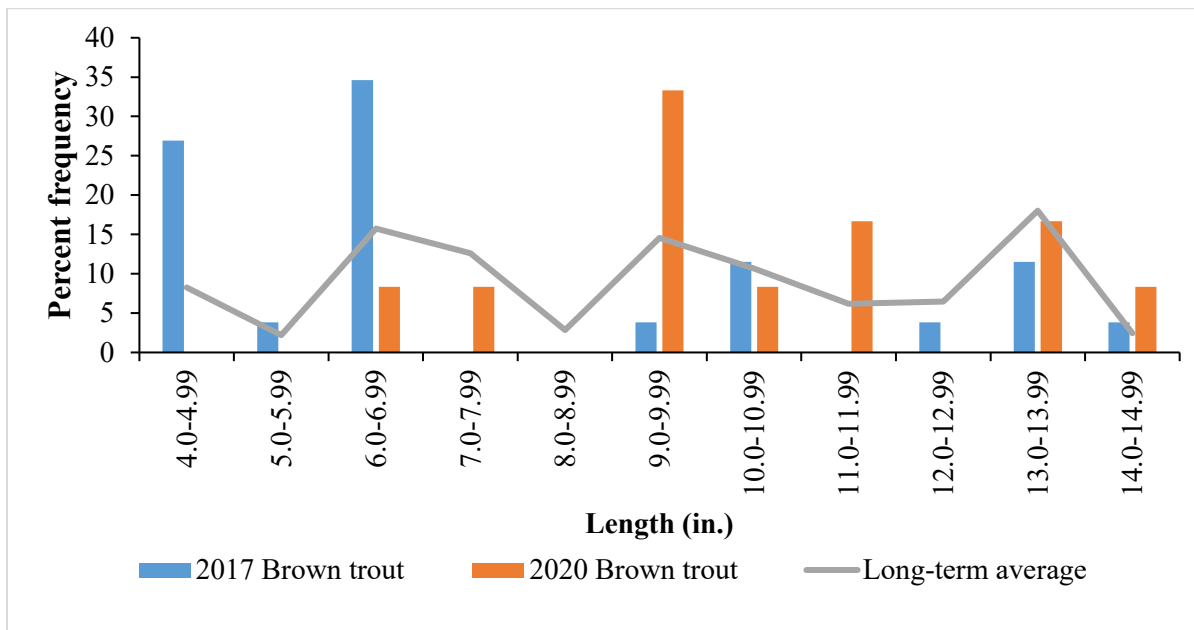


Figure 3-7: Length frequency of brown trout in the lower bypass section of West Rosebud Creek, 2017 and 2020 against long-term (2004-2020) average.

4. West Rosebud and Emerald Lakes Fisheries

West Rosebud and Emerald lakes are located within the West Rosebud Creek drainage. Both lakes are easily accessible by two-wheel drive vehicles in snow-less months. Surrounded by Forest Service land and bordering the Absaroka-Beartooth Wilderness, these lakes and surrounding areas are used regularly for fishing, hiking, camping, and other recreational activities. West Rosebud Lake features a fishing pier, established pathway, and boat launch. Both lakes receive a fair amount of fishing pressure, with an average of 1,992 angler days per year from 2011-2017 for West Rosebud and 1,907 for Emerald.

West Rosebud is a 19-acre man-made lake with a maximum depth of 6 feet and sits at an elevation of 6,596 feet. Emerald sits just downstream of West Rosebud and is a 28.5-acre lake with a maximum depth of 4 feet and sits at 6,396 feet.

Methods

The 2016—2021 Fisheries Monitoring Plan includes sampling West Rosebud and Emerald lakes every third year using floating and sinking experimental gillnets in standardized locations. Sampling conducted by FWP in West Rosebud and Emerald lakes has been used as a trend indicator of relative changes to the fish assemblages. For this monitoring period, West Rosebud and Emerald lakes were sampled in 2017 and 2020. One floating and two sinking gillnets are set in standardized locations on West Rosebud Lake, and one sinking gillnet is set at a standardized location in Emerald Lake.

FWP personnel sample fish populations in West Rosebud and Emerald lakes in early to mid-May. Gillnets are set overnight in each lake. The three nets in West Rosebud Lake were set for a combined total of 54.0 net hours in 2017 and 59.6 net hours in 2020. Emerald Lake had a net set of 24.5 hours in 2017 and 20.0 hours in 2020. The catch-per-unit-effort (CPUE) was calculated combining the total hours for the three nets in West Rosebud Lake and total hours for the one sinking net in Emerald Lake. Biological data collected includes species, length, and weight.

FWP stocks West Rosebud Lake and Emerald Lake with fish annually to support recreational fishing. Stocking history is presented for West Rosebud Lake in Table 4-1 and for Emerald Lake in Table 4-2.

West Rosebud Lake Fish Stocking

Rainbow trout have been stocked in West Rosebud Lake since 1931. Beginning in the 1950s, FWP began multiple annual stocks of rainbow trout in West Rosebud Lake. From 2016 to 2021, a total of 17,858 rainbow trout were stocked with an average length of 7.7 inches (Table 4-1). Rainbow trout are stocked across three events in May, June, and July.

Yellowstone cutthroat trout have been stocked intermittently in West Rosebud Lake, with the most recent stock of 8,238 fish in 2021. Previously, an average of 1,100 Yellowstone cutthroat trout had been stocked annually from 2011-2014. Arctic grayling were stocked a single time in West Rosebud Lake in 2009, with 270 total fish stocked, and were only recorded in the 2010 survey.

Though stocked with rainbow trout, West Rosebud Lake also has self-sustaining populations of brown trout, brook trout, mountain whitefish, and longnose sucker. Rainbow trout are not typically the most abundant species caught in nets. Angling pressure, predation from brown trout, and migration downstream are potential causes for the low number of rainbow trout observed despite extensive stocking.

Table 4-1: Stocking information for West Rosebud Lake, 2016-2021.

Date	Species	Number	Average Length (in.)
10/5/2021	Yellowstone Cutthroat Trout	8238	3.4
7/20/2021	Rainbow Trout	1008	8.6
6/16/2021	Rainbow Trout	1052	7.3
5/24/2021	Rainbow Trout	1001	7.5
2021 Total	3061	Rainbow Trout	
	8238	Yellowstone Cutthroat Trout	
7/28/2020	Rainbow Trout	1001	9.4
6/24/2020	Rainbow Trout	1000	8.2
5/27/2020	Rainbow Trout	1001	8.0
2020 Total	3002		
7/19/2019	Rainbow Trout	810	7.4

6/19/2019	Rainbow Trout	800	6.7
5/14/2019	Rainbow Trout	1000	7.3
2019 Total	2610		
8/1/2018	Rainbow Trout	1001	6.7
6/27/2018	Rainbow Trout	1073	7.7
5/18/2018	Rainbow Trout	1003	6.1
2018 Total	3077		
7/12/2017	Rainbow Trout	1005	8.3
6/19/2017	Rainbow Trout	1006	8.4
4/13/2017	Rainbow Trout	989	6.3
2017 Total	3000		
7/13/2016	Rainbow Trout	1010	8.7
6/20/2016	Rainbow Trout	1074	7.7
4/20/2016	Rainbow Trout	1024	8.2
2016 Total	3108		

Emerald Lake Fish Stocking

As in West Rosebud Lake, rainbow trout are the only species stocked annually. From 2016—2021, a total of 9,760 rainbow trout with an average length of 7.7 inches were stocked in Emerald Lake (Table 4-2). Emerald Lake is stocked three times annually, typically on the same schedule as West Rosebud Lake.

Yellowstone cutthroat trout were stocked intermittently in the 1990s and 1980s, though none have been recorded during gillnet surveys. Arctic grayling were stocked three times from 1943-2009, again with no presence in gillnet surveys following the stocking. Self-sustaining populations of brown trout, brook trout, mountain whitefish, and longnose sucker are also present in Emerald Lake.

Table 4-2: Stocking information for Emerald Lake, 2016-2021.

Date	Species	Number	Average Length (in.)
7/20/2021	Rainbow Trout	612	8.6
6/16/2021	Rainbow Trout	602	7.3
5/24/2021	Rainbow Trout	602	7.5
2021 Total	1816		
7/28/2020	Rainbow Trout	600	9.5
6/24/2020	Rainbow Trout	600	8.2
5/27/2020	Rainbow Trout	601	8.0
2020 Total	1801		
7/19/2019	Rainbow Trout	510	7.4
6/19/2019	Rainbow Trout	500	6.7
5/14/2019	Rainbow Trout	500	7.3
2019 Total	1510		
8/2/2018	Rainbow Trout	300	6.7
6/27/2018	Rainbow Trout	303	7.7
5/18/2018	Rainbow Trout	299	6.2
2018 Total	902		
7/12/2017	Rainbow Trout	612	8.3
6/19/2017	Rainbow Trout	608	8.4
4/13/2017	Rainbow Trout	643	6.3
2017 Total	1863		
7/13/2016	Rainbow Trout	610	8.7
6/20/2016	Rainbow Trout	644	7.7
4/20/2016	Rainbow Trout	614	8.2
2016 Total	1868		

West Rosebud Lake Fisheries

Four species of fish, including brook trout (*Salvelinus fontinalis*), brown trout, mountain whitefish, and longnose sucker (*Catostomus catostomus*) were collected during the 2017 and 2020 sampling (Table 4-3 and 4-4). Rainbow trout were observed during the 2017 sampling only. Brook trout were the most abundant species captured in both 2017 and 2020. Gillnets in 2017 were set on May 8 and pulled on May 9, for a total of 54.0 net hours. In 2020, gillnets were set on May 19 and pulled on May 20, for a total of 59.6 net hours. A total of 89 fish were collected in the nets in 2017, and 98 total fish were collected in 2020.

Gillnetting efforts in West Rosebud Lake for 2017 and 2020 occurred prior to annual stocking efforts implemented by FWP in May, June, and July (*refer to* Table 4-1), thus, the gillnetting efforts likely did not capture the influx of fish into the system via stocking.

In both 2017 and 2020, brook trout had the highest catch rate of all species, followed by brown trout (Figure 4-1). Brook trout have historically been the most abundant species caught in West Rosebud Lake. Catch rates for both brook and brown trout were higher in 2020 than in 2017, but still within historic ranges. Longnose sucker catch rates were consistent across the two sample years, and within historic ranges. Mountain whitefish catch rates saw a significant decrease between sample years, dropping from 0.26 fish per net hour in 2017 to 0.07 fish per hour in 2020. The catch rates from 2020 are the lowest on record for mountain whitefish.

Almost all species saw lower catch rates in 2017 and 2020 when compared to the long-term (2001-2020) average, with the exception of brook trout which have seen higher catch rates compared to the long-term average in the last three sampling events.

2020 was the first sample year with no rainbow trout captured during gillnetting. Since 2001, rainbow trout catch rates have varied significantly, with a peak of 0.93 fish per hour in 2001 and a low of 0.02 fish per hour in 2017.

Mountain whitefish had the longest average length of all species in both 2017 and 2020 (Figure 4-2). For all species, there was little variation in average lengths observed across the sample years. Compared to the twenty-year average, brook trout have been slightly smaller in the most recent sampling events, while mountain whitefish have been longer. Average lengths for all other species have been consistent with this long-term average in the most recent sampling events.

Longnose sucker had the highest average weight in both sample years, which is consistent with the long-term trend. Brook trout had the lowest average weight in both sample years. Rainbow trout have historically had the lowest average weight. Average weights for all species during 2017 and 2020 sampling were within historic ranges.

Table 4-3: Catch statistics by species on West Rosebud Lake, 2017.

2017 Species	Number Caught	Net hours	No. fish/ net hour	Avg. length (in.)	Length range (in.)	Avg. weight (lb.)	Weight range (lb.)
Brown Trout	23	54.0	0.43	13.2	9.3-16.4	0.77	0.28-1.58
Brook trout	42	54.0	0.78	11.1	8.7-13.1	0.51	0.30-0.85
Rainbow trout	1	54.0	0.02	10.8	10.8-10.8	0.52	0.52-0.52
Mountain whitefish	14	54.0	0.26	15.1	13.5-16.9	1.20	0.89-1.53
Longnose Sucker	9	54.0	0.17	14.2	11.3-18.2	1.35	0.65-2.48
TOTAL FISH	89						

Table 4-4: Catch statistics by species on West Rosebud Lake, 2020.

2020 Species	Number Caught	Net Hours	No. Fish/ Net Hour	Avg. Length (in.)	Length Range (in.)	Avg. Weight (lb.)	Weight Range (lb.)
Brown Trout	33	59.6	0.55	12.6	6.9-17.8	0.76	0.21-1.77
Brook trout	50	59.6	0.82	10.9	7.6-13.1	0.55	0.17-0.88
Mountain whitefish	4	59.6	0.07	15.2	13.9-16.2	1.30	0.95-1.94
Longnose Sucker	11	59.6	0.18	14.1	11.6-16.2	1.29	0.60-1.89
TOTAL FISH	98						

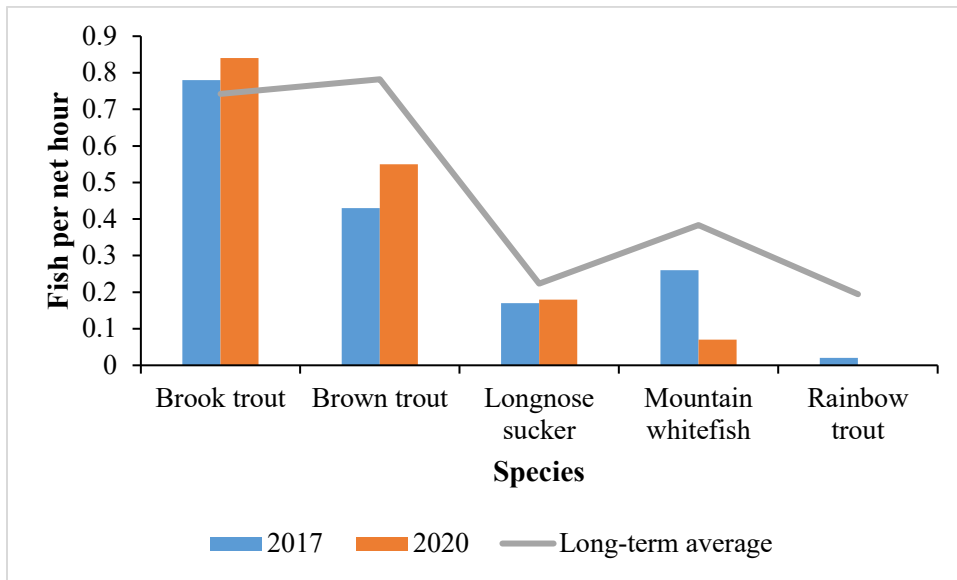


Figure 4-2: Catch per unit effort in fish per net hour by species for 2017 and 2020 against long-term average CPUE in West Rosebud Lake. Yellowstone cutthroat trout and arctic grayling are excluded from the graph, as neither species was caught in 2017 and 2020.

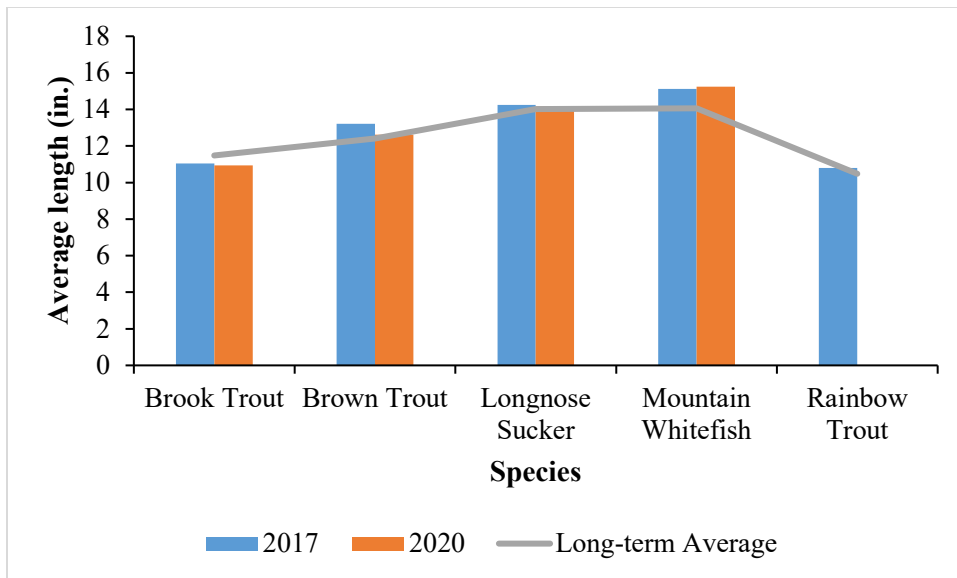


Figure 4-2: Average length (in.) by species in 2017 and 2020 against 20-year average, West Rosebud Lake.

Emerald Lake Fisheries

As in West Rosebud Lake, four species were sampled in both 2017 and 2020, including brook trout, brown trout, longnose sucker, and whitefish (Table 4-5 and 4-6). Rainbow trout were recorded in 2020 only. In 2017, 20 total fish were captured during gillnetting, and 22 total fish were collected in 2020. Brook trout were the most abundant species captured in 2017, while brown trout were the most abundant in 2020.

In 2017, gillnetting occurred from May 8 to May 9, for a total of 24.0 net hours. The net was set May 19 in 2020 and pulled on May 20, for a total of 20.0 net hours. Gillnetting efforts in Emerald Lake occurred prior to annual stocking efforts implemented by FWP in 2017 and 2020 (*refer to* Table 4-2). Thus, the gillnetting efforts likely do not capture the influx of fish into the system via stocking.

Between 2017 and 2020, there were significant differences in catch rates for all species except for longnose sucker, which remained fairly consistent across sample years (Figure 4-3). Catch rates for brook trout and mountain whitefish declined from 2017 to 2020, while catch rates for brown trout increased.

Catch rates for brook trout, mountain whitefish, and longnose sucker in 2017 and 2020 were below the long-term average (2001-2020). Brown trout catch rates were below this average in 2017, but above in 2020. Historically, rainbow trout have had the lowest catch rates, and have only been captured in 5 out of the last 8 survey years.

Average lengths for brook trout and longnose sucker were very similar in 2017 and 2020, and consistent with the twenty-year average (Figure 4-4). Mountain whitefish average lengths in 2017 and 2020 were above the long-term average, though only a single mountain whitefish was captured in 2020. There was a decrease in brown trout average length from 2017 to 2020, but the 2020 average was consistent with the long-term average.

In both 2017 and 2020, brown trout had the largest average weight and largest overall weight of all individuals sampled. However, the average weight in 2017 was more than twice the average weight in 2020 (2.15 lb average in 2017 compared to 0.91 lb average in 2020). Brook trout and longnose sucker had similar average weights in 2017 and 2020, and are within the historic range. Mountain whitefish have seen higher average weights the last two sample years compared to the long-term average.

Table 4-5: Catch statistics by species on Emerald Lake, 2017.

2017 Species	Number caught	Net hours	No. fish/net hour	Avg. length (in.)	Length range (in.)	Avg. weight (lb.)	Weight range (lb.)
Brown trout	4	24.0	0.17	15.95	11.6-25.5	2.15	0.55-6.34
Brook Trout	8	24.0	0.33	12.68	9.8-14.2	0.78	0.34-1.05
Mountain whitefish	5	24.0	0.21	17.22	14.8-19.0	1.67	1.13-2.34
Longnose Sucker	3	24.0	0.13	14.50	13.3-15.8	1.46	1.07-1.94
TOTAL FISH	20						

Table 4-6: Catch statistics by species on Emerald Lake, 2020.

2020 Species	Number caught	Net hours	No. fish/net hour	Avg. length (in.)	Length range (in.)	Avg. weight (lb.)	Weight range (lb.)
Brown trout	15	20.0	0.75	13.24	8.9-20.8	0.91	0.22-3.35
Brook Trout	3	20.0	0.15	12.73	12.5-13.1	0.71	0.68-0.75
Rainbow trout	1	20.0	0.05	18.0	18.0-18.0	2.32	2.32-2.32
Mountain whitefish	1	20.0	0.05	17.4	17.4-17.4	1.76	1.76-1.76
Longnose sucker	2	20.0	0.10	14.55	11.1-18.0	1.59	0.58-2.61
TOTAL FISH	22						

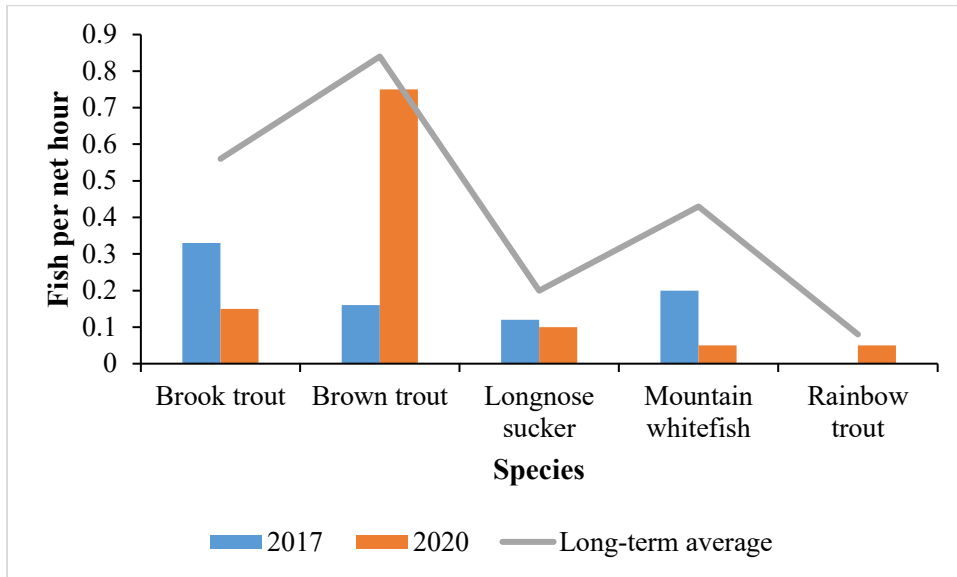


Figure 4-3: Catch per unit effort in fish per net hour by species for 2017 and 2020 against long-term average CPUE in Emerald Lake.

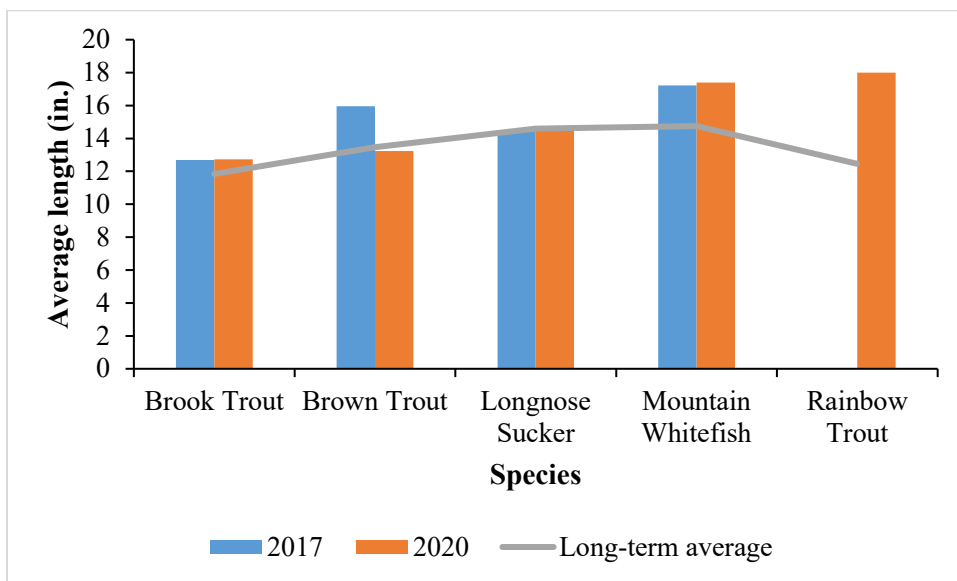


Figure 4-4: Average length (in.) by species in 2017 and 2020 against 20-year average, Emerald Lake.

5.0 West Rosebud Creek Water Temperature

Methods

The temperature loggers (HOBO Pendant Temperature Logger) deployed in designated locations in West Rosebud Creek, collected data in 15-minute intervals between April 5 and November 14, 2016. The four designated monitoring locations (using 5 temperature loggers) in West Rosebud Creek include the upper bypass (below Mystic Lake), West Rosebud Creek above the powerhouse (APH), West Rosebud Creek below the powerhouse (BPH), and West Rosebud Creek below West Rosebud Lake/Re-regulation Dam (BWRL).

Re-location of the Below Powerhouse Site

In 2016, NorthWestern proposed a new BPH site, located downstream of the historic BPH site because of safety concerns associated with accessing the historic BPH site. Thus, in 2016 there were a total of five temperature loggers deployed with two loggers representing the BPH site: one logger deployed in the “historic” BPH site and one logger deployed in the “new” BPH site (*refer to Figure 5-1*). The historic BPH location was at the bridge and the proposed new BPH site is located about 200 yards downstream of the bridge. The proposed new BPH site does not pose the same safety concerns as the historic BPH location.

The mean and maximum daily temperatures collected at the historic and new BPH sites remained similar throughout the monitoring season (Figures 5-1 and 5-2). The maximum difference between the mean and maximum daily stream temperatures in the historic and new BPH sites was 0.2 degrees and 0.32 degrees, respectively for the entire monitoring period. Because the mean daily temperature difference between the two BPH sites (historic and new) appeared to be minimal in 2016, NorthWestern proposed removing the temperature logger at the historic BPH site in favor of the more accessible new BPH location. USFS and FWP agreed to the proposed change during the TAC meeting in February 2017.

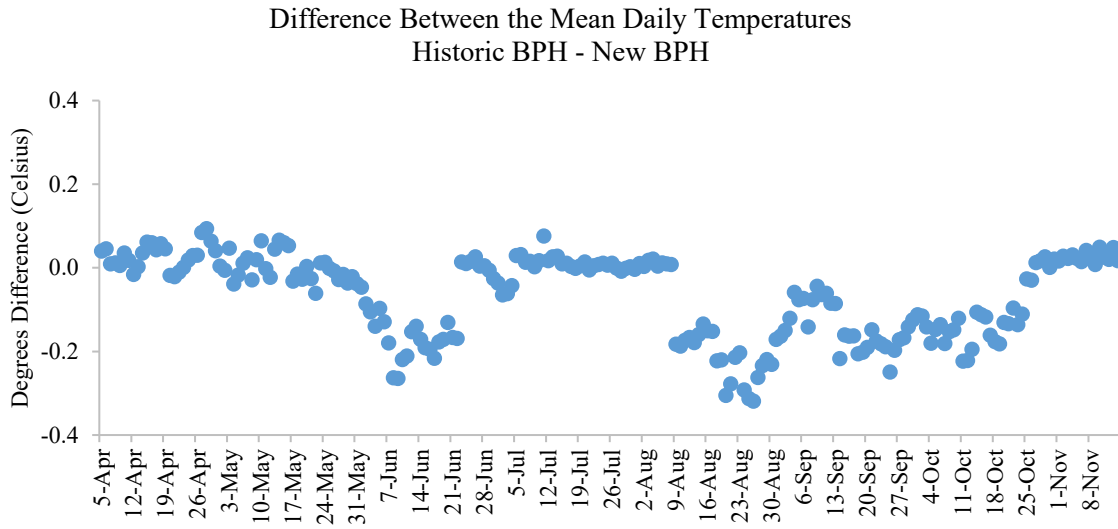


Figure 5-3: Difference between the Historic BPH and New BPH mean daily stream temperatures, 2016.

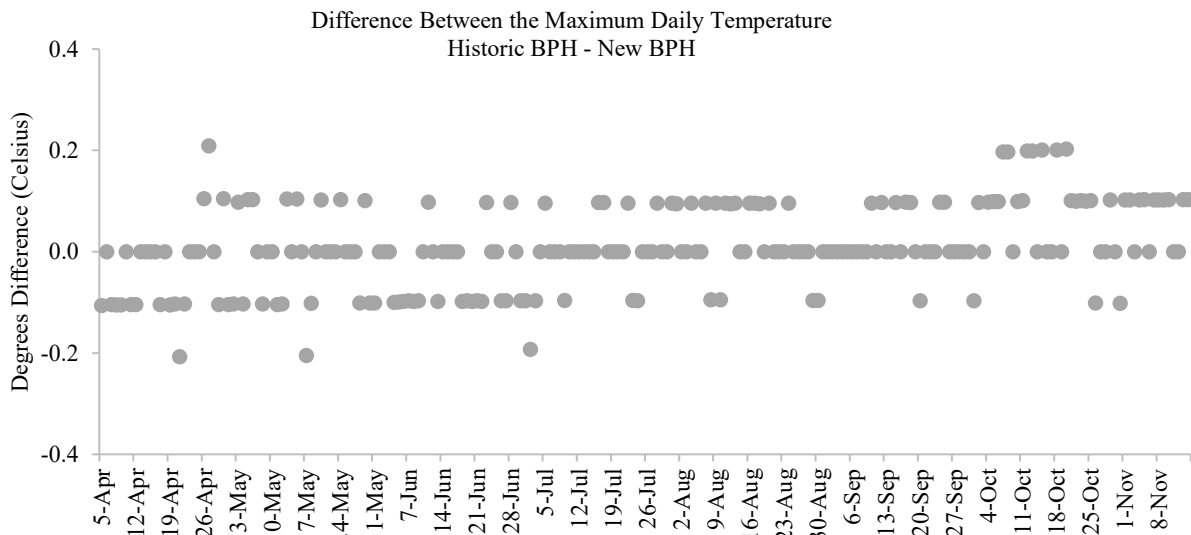


Figure 5-4: Difference between the Historic BPH and New BPH maximum daily stream temperatures, 2016.

The mean and range (minimum and maximum) of stream temperatures recorded in 2016 for each month at each site along West Rosebud Creek is summarized in Table 5-1. The warmest months at each site are in bold.

Table 5-5: Monthly mean and range (minimum – maximum) of stream temperatures recorded at each monitoring site along West Rosebud Creek in 2016.

2016 West Rosebud Creek Stream Temperature Monitoring Sites															
Month	Upper Bypass			APH			Historic BPH			New BPH			BWRL		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
APR	3.3	0.9	8.6	4.0	1.2	9.3	3.6	1.7	4.9	3.6	1.7	5.0	5.7	3.4	8.9
MAY	4.2	1.2	9.6	5.3	1.8	10.7	4.7	2.7	10.3	4.7	2.6	10.2	6.8	4.2	10.5
JUN	7.1	3.3	13.6	8.2	4.1	13.9	9.2	4.8	12.6	9.3	5.0	12.5	10.6	8.1	13.6
JUL	12.0	9.1	16.0	11.6	8.2	15.8	12.1	10.3	15.4	12.1	10.3	15.3	13.2	10.7	15.2
AUG	11.1	8.2	15.1	10.1	6.7	14.8	13.5	10.0	16.3	13.6	10.3	16.3	14.6	12.8	16.1
SEP	8.3	3.8	14.2	7.7	3.4	12.7	10.7	7.8	14.7	10.9	8.2	14.7	11.3	9.1	15.4
OCT	5.2	0.2	10.4	5.1	0.2	9.5	7.1	3.7	11.1	7.2	4.3	11.2	7.1	4.4	12.0
NOV	3.7	2.3	5.2	3.9	2.6	5.6	5.5	4.9	6.3	5.5	4.9	6.3	4.9	4.0	5.9

In 2016, the maximum daily stream temperatures recorded in West Rosebud Creek varied from 15.8 (APH) to 16.3 degrees Celsius (°C) (BPH). The maximum daily temperature recorded in the upper bypass and APH sites occurred in July, while the maximum temperature recorded downstream at the BPH and BWRL sites occurred in August (*refer to* Table 5-1). The average stream temperatures in July and August ranged from 11.6 to 14.6 °C with the cooler temperatures upstream and warmer temperatures downstream. The monthly median stream temperature varied a maximum of 0.7 degrees from the monthly average stream temperature. The mean and maximum daily stream temperatures for the 2016 monitoring season are shown in Figures 5-3 and 5-4, respectively.

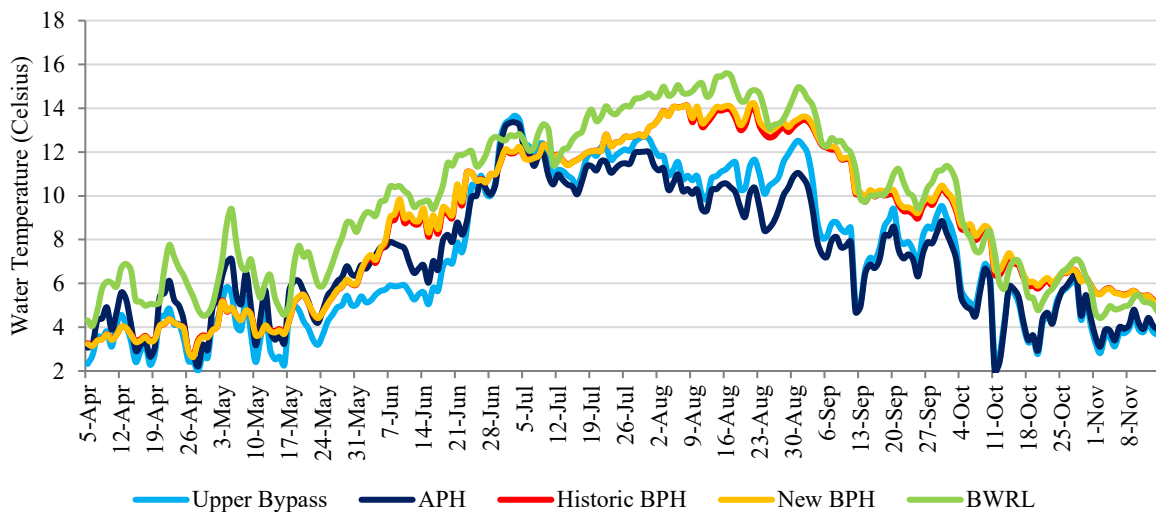


Figure 5-5: Mean daily stream temperatures recorded in West Rosebud Creek monitoring sites in 2016.

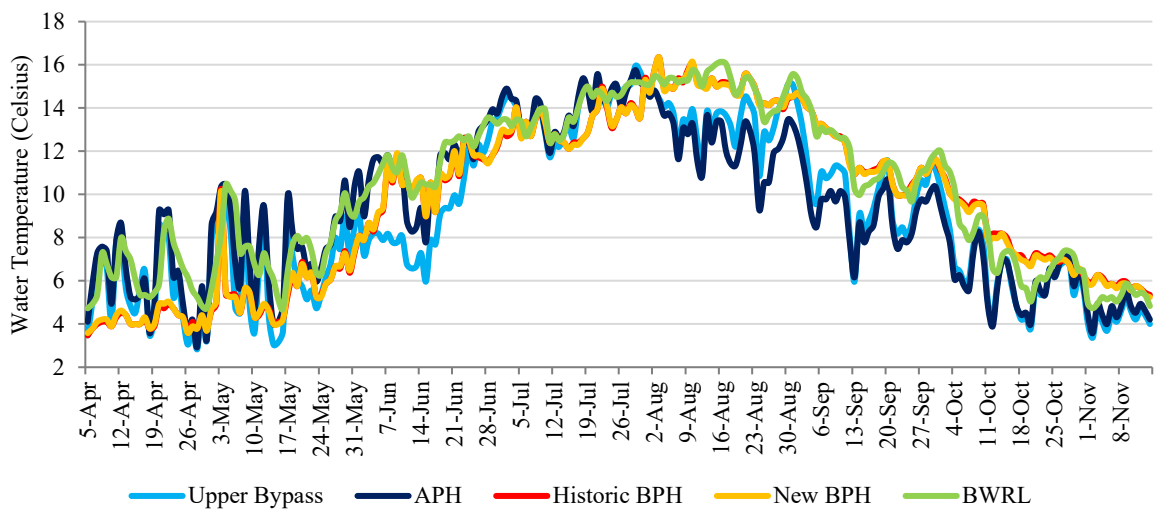


Figure 5-6: Maximum daily stream temperatures recorded in West Rosebud Creek monitoring sites in 2016.

Stream temperature was also monitored in previous years, but the dataset for the entire season (April-October) is only available for years 2012 and 2016. In other years, data collection was not available for the entire season at all sites due to various equipment issues. In 2012, the maximum daily temperatures ranged from 15.2 to 16.2 °C and were similar to 2016 results. The seasonal maximum daily temperatures at each site in 2012 and 2016 are provided in Table 5-2.

Table 5-6: Seasonal maximum daily water temperature recorded at each monitoring site along West Rosebud Creek in 2012 and 2016.

	Maximum Daily Temperature in Celsius			
	Upper Bypass	APH	BPH (Historic)	BWRL
2012	16.1	16.2	15.2	15.6
2016	16.0	15.8	16.3	16.1

2018 Results

Stream temperatures in West Rosebud Creek did not exceed 16.0 °C (60.8 °F) in 2018. In the summer months, maximum temperatures occurred in August at all sites in West Rosebud Creek. The peak stream temperature, 16.0 °C (60.8 °F), in West Rosebud Creek was recorded in the upper bypass on August 11. The maximum stream temperatures at the other three sites were less than 16.0 °C (60.8 °F). The peak stream temperatures at APH and BPH also occurred on August 11 and were 15.8 °C (60.4 °F) and 14.4 °C (57.9 °F), respectively. The peak stream temperature at BWRL occurred on August 24 and was 13.8 C (56.8 °F). Daily maximum stream temperatures for 2018 are shown in Figure 5-5.

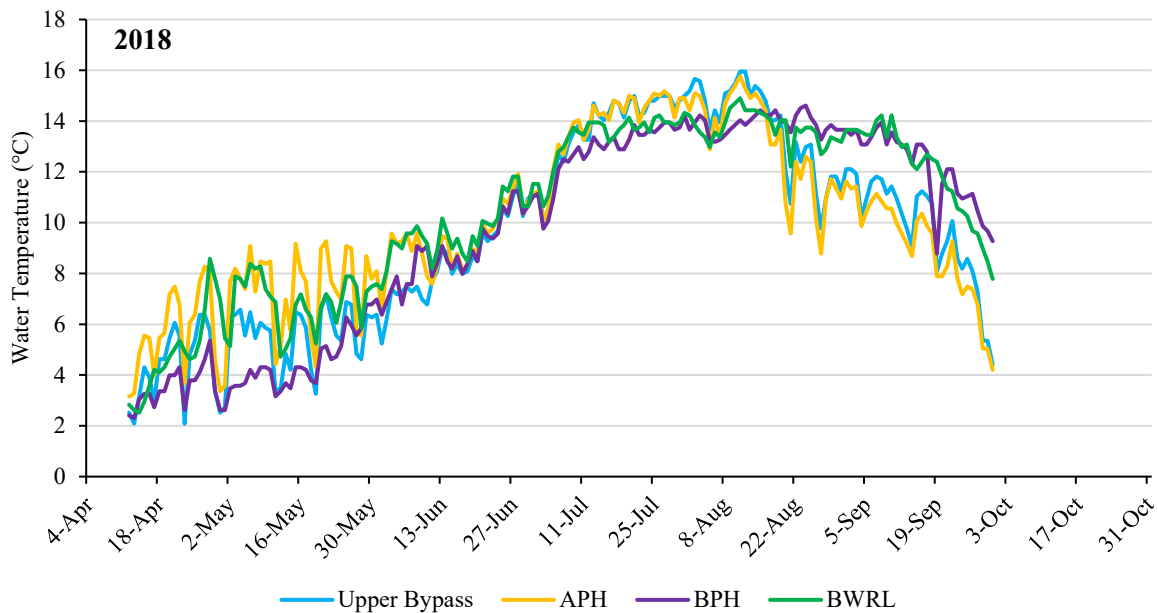


Figure 5-5: Maximum daily stream temperatures recorded in West Rosebud Creek monitoring sites in 2018. BPH = New Site selected in 2016.

Stream temperatures are important for cold-water fishery. Salmonids are cold-water fish with specific temperature requirements. Although some populations of salmonids have adapted to warmer temperatures, in general salmonids are not present if summer water temperatures consistently exceed 22 °C (71.6 °F) (Griffith, 1999). Brown trout can survive in warmer waters, 18 to 24 °C (64.4-75.2°F), compared to other species of trout (Wydoski and Whitney, 2003). Optimal growth for brown trout has been reported at temperatures ranging between 14 and 17 °C (57.2-62.6 °F) (Forseth and Jonsson, 1994). Rainbow trout generally prefer temperatures less than 21 °C (69.8 °F) (Wydoski and Whitney, 2003) and achieve optimal growth around 13.1 °C (55.6 °F) (Bear, 2005; Bear et al. 2007).

In 2018 and in previous years of monitoring stream temperatures in West Rosebud Creek remained well below thermal limits of rainbow and brown trout. During the warmest portion of the summer, stream temperatures in West Rosebud Creek were often within the optimum range (14-17 °C; 57.2-62.6 °F) for brown trout while sometimes exceeding the optimum growth temperature for rainbow trout (13.1 °C; 55.6 °F).

In conclusion, stream temperatures in 2018 (as in previous years) appear to be within the preferred range for salmonids in West Rosebud Creek.

6. West Rosebud Creek (Mackay Flat) Fisheries

The Mackay Flat section, located near the Custer National Forest boundary, of West Rosebud Creek extends 7,900 feet (1.5-mile) from below the Pine Grove Campground (N 45.27567, W 109.64538) downstream to the first set of cabins and bridge at the Mackay Ranch (N 45.28834, W 109.62402). FWP personnel electrofish the section using a drift boat and mobile anode. Two sampling events take place each survey year to conduct a mark-recapture population estimate. Brown trout, rainbow trout, brook trout, mountain whitefish, and sculpin (*Cottus* sp.) are present in this section with brown trout being the predominant fish. Only trout species had been collected before 2019, when FWP began sampling mountain whitefish as well. Sculpin are not collected or sampled, but presence is noted.

Fishing pressure within this section, particularly on the upstream end near the Pine Grove Campground, is relatively heavy. The section is also known to be an important spawning area for both resident fish and migratory rainbow and brown trout from the Yellowstone and Stillwater rivers. Many of the larger fish caught in this section may have spent at least a portion of their lives in the Yellowstone or Stillwater rivers. Rainbow trout spawn in the spring, and brown trout spawn in the fall. Migrations associated with spawning likely impact population estimates done on this section.

Between 2016 and 2021, fisheries monitoring of the Mackay Flat section of West Rosebud Creek was scheduled to occur every 3 years. This section was sampled in 2016 and 2019. The objective of these surveys is to evaluate changes or trends in the fish community over time. In 2014, the Mackay Flat survey was moved from a fall activity to a spring activity to more accurately develop a resident brown trout population estimate, as this is the predominant species of the section. Brown trout are fall spawners, so fall surveys likely did not capture a true resident population, as brown trout from the larger Yellowstone and Stillwater rivers migrate to West Rosebud Creek for spawning.

Methods

In 2016, FWP conducted the first electrofishing event (mark run) on April 25, and the second electrofishing event (recapture run) on May 2. In 2019, the section was marked on May 2 and recaptured on May 10. Mountain whitefish were collected and marked beginning in 2019, and will not be included in figures below.

Previous surveys conducted in the fall include 2004, 2007, and 2010. Spring surveys took place in 2014, 2016, and 2019. High streamflows resulting in dangerous sampling conditions caused the 2013 fall survey to be postponed until the spring of 2014. Below are comparisons of species lengths and brown trout population estimates across sample years.

Results

The first run in 2016 resulted in capturing and marking with a fin clip 122 brown trout, 19 rainbow trout, and two brook trout. During the recapture run, a total of 116 brown trout (30 recaptures), eight rainbow trout (1 recapture), and one brook trout (1 recapture) were sampled. Brown trout captured across both sampling events ranged in length from 3.5-19.5 inches; rainbow trout ranged from 3.4-16.0 inches; and brook trout ranged from 7.2-10.6 inches.

In 2019, FWP captured and marked 164 brown trout, 13 rainbow trout, 3 brook trout, and 26 mountain whitefish. On the recapture run, 103 brown trout (30 recaptures), 7 rainbow trout (no recaptures), 9 brook trout (one recapture), and 6 mountain whitefish (one recapture) were collected. Brown trout captured across both runs ranged from 2.9-19.1 inches; rainbow trout ranged from 4.3-15.1 inches; brook trout ranged from 4.1-8.1 inches; and mountain whitefish from 10.9-16.3 inches.

Length distribution

Average lengths decreased for all species between the 2016 and 2019 sampling events, however, they were all within historic ranges (Figure 6-1). Brown trout average lengths across sampling years have been relatively consistent, ranging from 8.9 to 11.4 inches. Rainbow trout have been more variable, ranging from 5.6 inches to 11.8 inches.

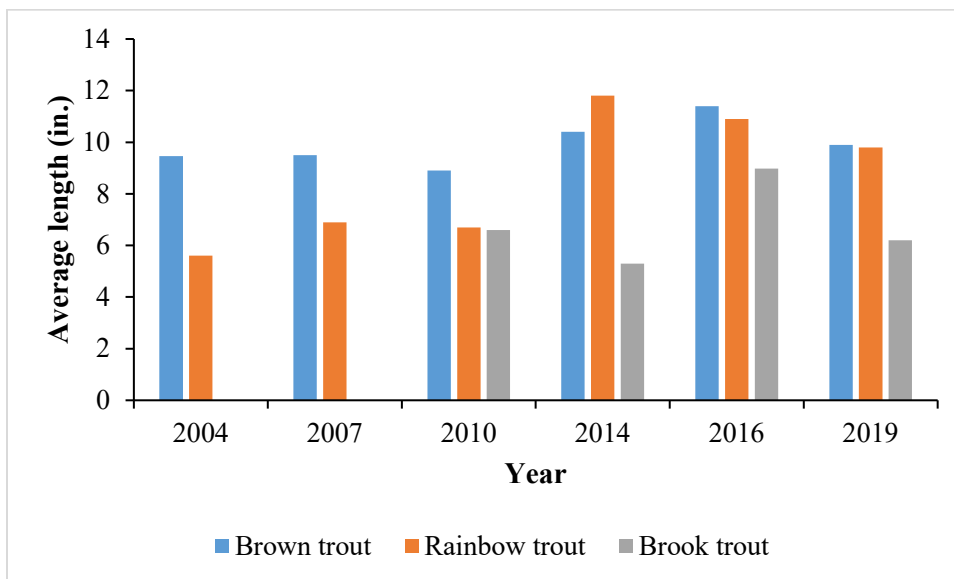


Figure 6-7: Average length for brown trout, rainbow trout, and brook trout by sample year in the Mackay Flat section of West Rosebud Creek.

In 2016, there was a higher abundance of larger size (12.0-13.9 inch) brown trout than in 2019 and the long-term average (Figure 6-2). The 2019 sample had a higher abundance of smaller

(5.0-6.9 inch) brown trout. Both size classes of fish, however, have been some of the more abundant length groups in the long-term average distribution.

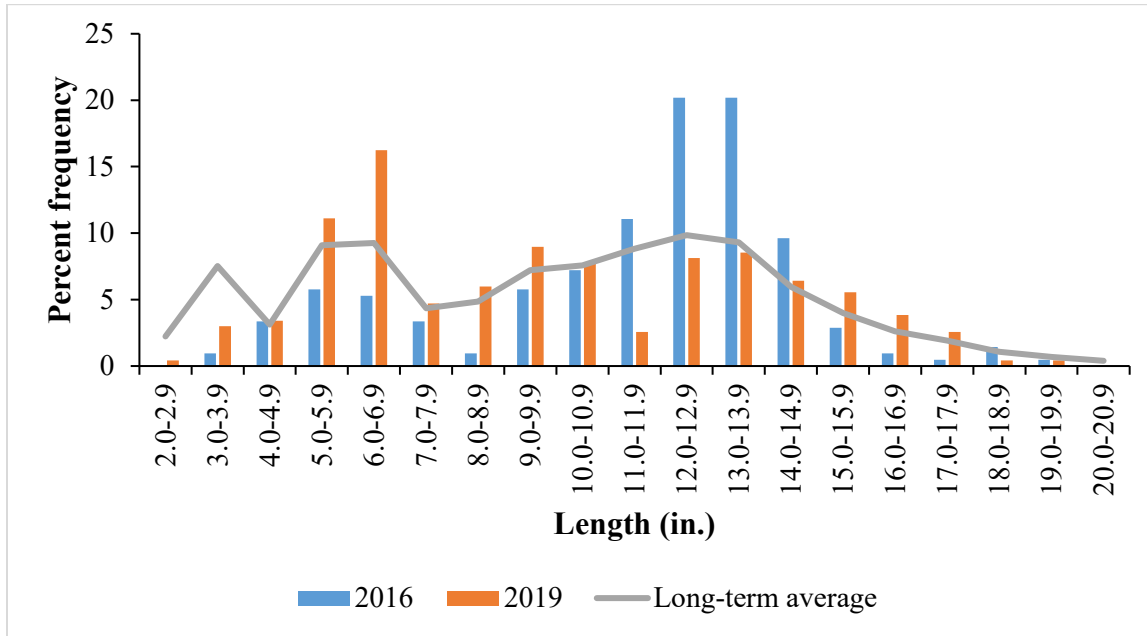


Figure 6-8: Length frequency distribution of brown trout in the Mackay Flat section of West Rosebud Creek, 2016 and 2019 against long-term (2004-2019) average.

In both the 2016 and 2019 sampling, the rainbow trout length distribution was fairly even across sizes (Figure 6-3). Fish in the 2.0-2.9 inch length group were absent in 2016 and 2019, while the

long-term average had nearly 10% frequency. Larger fish (13.0-14.9 inches) were more abundant in the 2016 and 2019 samples compared to the long-term average.

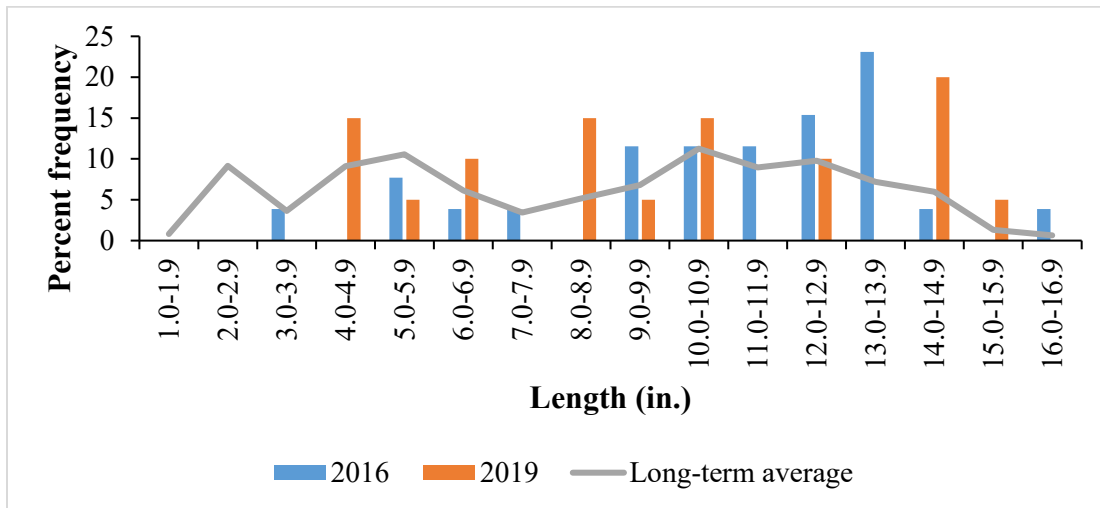


Figure 6-9: Length frequency distribution of rainbow trout in the Mackay Flat section of West Rosebud Creek, 2016 and 2019 against long-term (2004-2019) average.

Brook trout have been the least abundant species collected in each sample year. In 2016, only two were captured, and 12 were collected in 2019. Fish in the 6.0-6.9 inch length group were the most abundant in 2019 and in the long-term average (Figure 6-4). Although displayed, length frequency distributions for rainbow and brook trout are based on low sample sizes, and as such are of limited value.

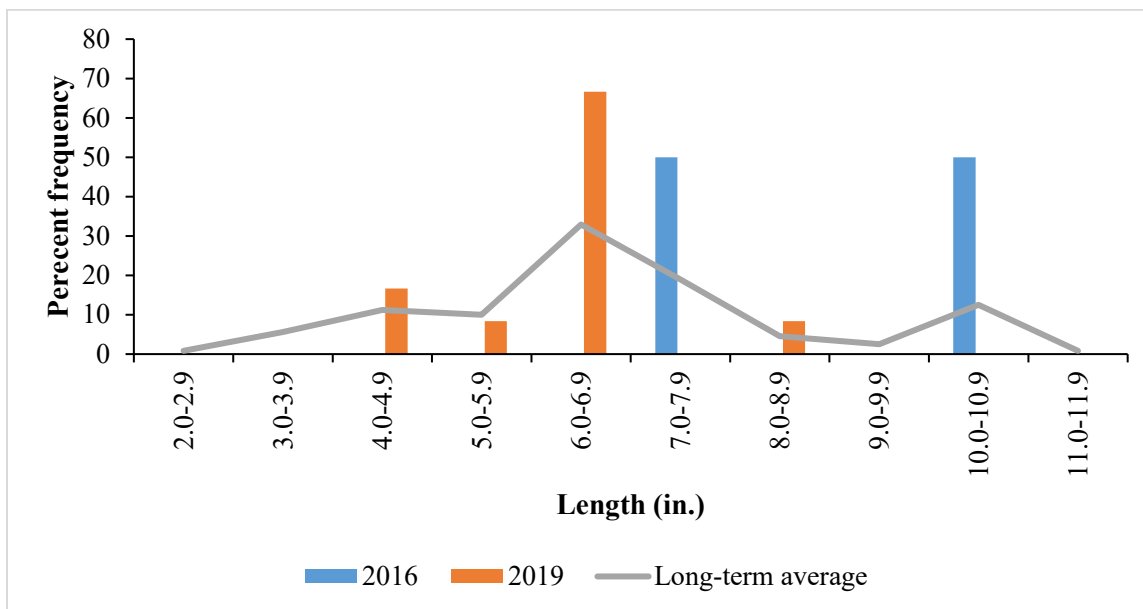


Figure 6-4: Length frequency distribution of brook trout in the Mackay Flat section of West Rosebud Creek, 2016 and 2019 against long-term (2004-2019) average.

Brown trout population estimate

Population estimates are conducted only for brown trout above 5 inches in this section, as the other species are typically captured in numbers too low to create a reliable estimate. Figures below show brown trout population estimates per river mile, separated into spring and fall sampling events (Figure 6-5 and 6-6).

Due to the life history of brown trout migrating in the fall to spawn, fall and spring population estimates vary. Population estimates conducted in the fall yielded higher population estimates per mile in every survey year.

The three most recent sampling events, all conducted in the spring (2014, 2016, and 2019), had similar population estimates. The estimates for these years ranged from 286 fish per mile in 2016 to 301 per mile in 2014. 2010 had the highest population estimate on record, at 1,260 fish per mile.

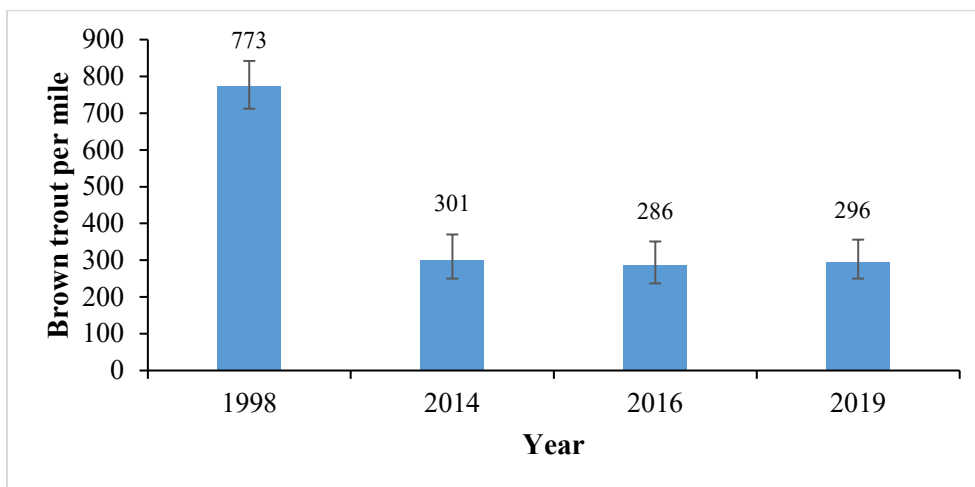


Figure 6-5: Population estimate in fish per mile for brown trout above 5 inches on the McKay Flat section of West Rosebud Creek. Bars represent upper and lower confidence intervals. Estimates from spring sampling events in 1998, 2014, 2016, and 2019.

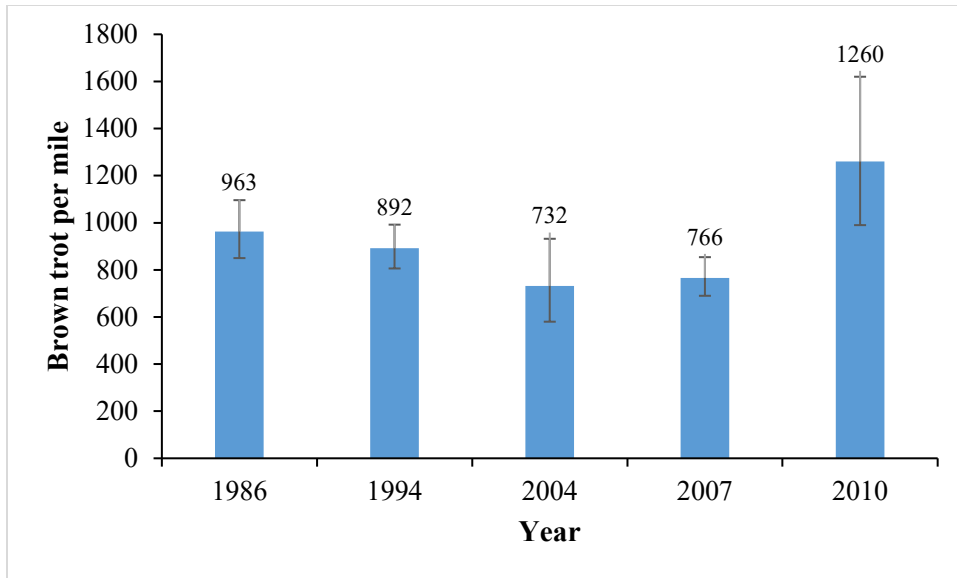


Figure 6-6: Population estimate in fish per mile for brown trout above 5 inches on the McKay Flat section of West Rosebud Creek. Bars represent upper and lower confidence intervals. Estimates from fall sampling events in 1986, 1994, 2004, 2007, and 2010.

7. West Rosebud Creek Redd Counts

The 2016-2021 Fisheries Monitoring Plan (PPL Montana, 2016) and subsequent FERC approval scheduled fall brown trout redd counts in West Rosebud Creek for every other year. Counts were completed during this approved schedule, in addition to supplemental sampling during other years.

Rainbow trout redd surveys, conducted in the spring, were part of the 2010-2015 Monitoring Plan. Due to low redd count numbers, these surveys were not included in the 2016-2021 Fisheries Monitoring Plan. A single rainbow trout redd survey was conducted during the 2016-2021 sampling period, and only one rainbow trout redd was recorded. Redd surveys for rainbow trout began in 2008 and 2009 for brown trout. A summary of the data collected between 2009 and 2021 for redd counts of brown trout is presented in this section.

Redd surveys are conducted on a 1.6-mile-long reach of West Rosebud Creek between the USFS Pine Grove Campground and the bridge on the Mackay property, referred to as the Mackay Flat section and the same section discussed in Section 6.0 (Figure 7-1). The Mackay Flat section serves as an important spawning area for both resident West Rosebud Creek fish and migratory rainbow and brown trout from the Stillwater and Yellowstone rivers. Redd counts are used as a metric to describe general salmonid abundance and can, over time, help track local population trends. Ideal spawning habitat for trout consists of gravel-sized substrate and shallow riffles, characteristics more often found in headwater streams such as West Rosebud Creek than on larger rivers. Redd counts are performed in the spring (typically mid-April to late May) for rainbow trout and in the fall (typically late October to early November) for brown trout. Multiple surveys are conducted if it is believed the peak of spawning was not reached during the first survey, and a later survey would yield a higher redd count.

Visual surveys are conducted by FWP and NWE staff members walking the stream and recording number and location of redds observed. GPS coordinates for redd locations were recorded for brown trout surveys in 2016, 2018, 2019, and 2021. Spawning trout observed in the area may also be recorded. Though staff members are trained to observe redds, this is a subjective survey, and there is always a potential that redds are overlooked or miscounted.



Figure 7-10: Rainbow and brown trout redd survey location on West Rosebud Creek. Survey begins at USFS Pine Grove Campground (45.2756, -109.64542) and ends at the bridge at the Mackay property boundary (45.2856, -109.62406).

Brown Trout Redd Surveys

While there has been some fluctuation in brown trout redd numbers, more brown trout redds have been observed than rainbow trout redds each survey year. The highest number of brown trout redds observed was in 2021, with a total of 51 redds, while the lowest was 6 observed in 2014 (Table 7-1 and Figure 7-2). The average number of redds observed from 2009-2021 was 28 redds. Redd counts were lower than the average in surveys from 2014-2016, but more recent surveys have been near or above this long-term average.

Due to scheduling errors, a survey was not completed in 2017. In 2010, early ice conditions prevented a survey from being conducted.

Depending on whether the spawning fish are resident of West Rosebud Creek or migrants from downstream, other factors such as hydrological conditions in the Yellowstone and Stillwater rivers may also be contributing to upstream migration of brown trout to spawning areas in West Rosebud Creek.

Brown trout redds are typically observed in consistent locations between survey years due to presence of ideal spawning characteristics are described above, as shown in Figures 7-3 and 7-4.

Table 7-1: Summary of West Rosebud Creek brown trout redd survey information, 2009-2021. If more than one survey was conducted in a year, only the highest number of redds observed is recorded in the table, not a cumulative total.

Year	Survey Dates	Brown Trout Redds
2021	Nov. 3	51
2020	Nov. 7	24
2019	Nov. 7	13
2018	Oct. 31 Nov. 12	32
2017	No survey	
2016	Nov. 22	16
2015	Oct. 27 Nov. 5	17
2014	Oct. 29	6
2013	Oct. 12 Nov. 7	37
2012	Oct. 31 Nov. 14 Nov. 15	47
2011	Oct. 31 Nov. 1 Nov. 15	26
2010	No survey	
2009	Nov. 11	34
Mean		28
Range		6-51

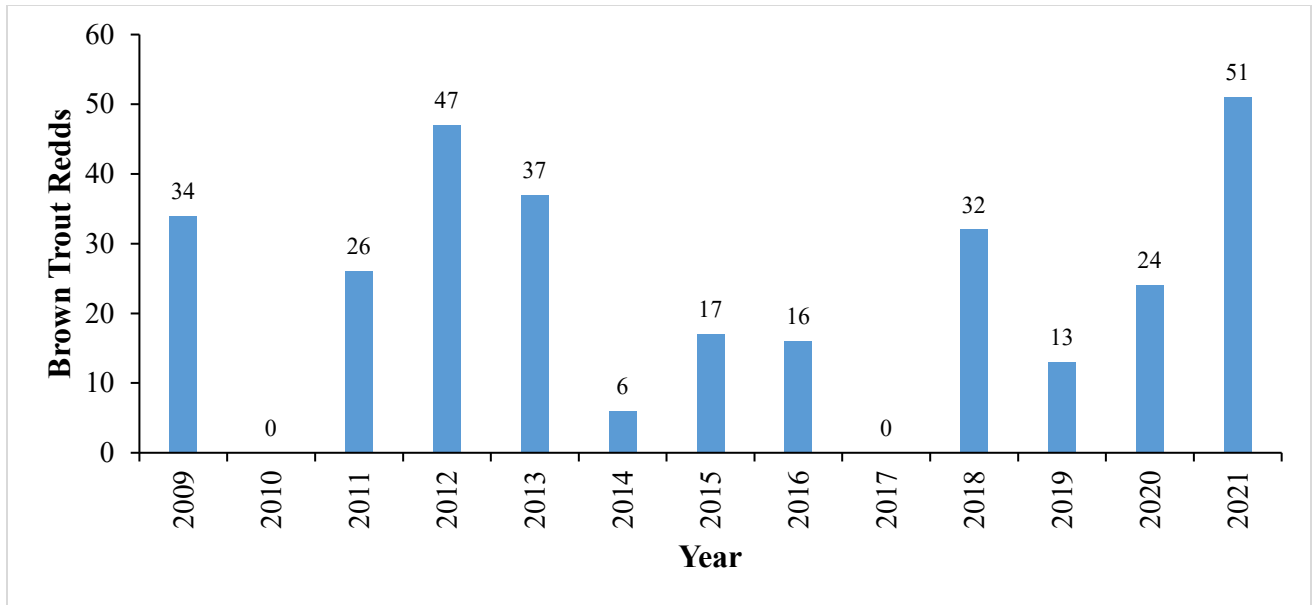


Figure 7-2: Brown trout redds observed on West Rosebud Creek, 2009-2021. Zeros indicate a survey was not conducted.

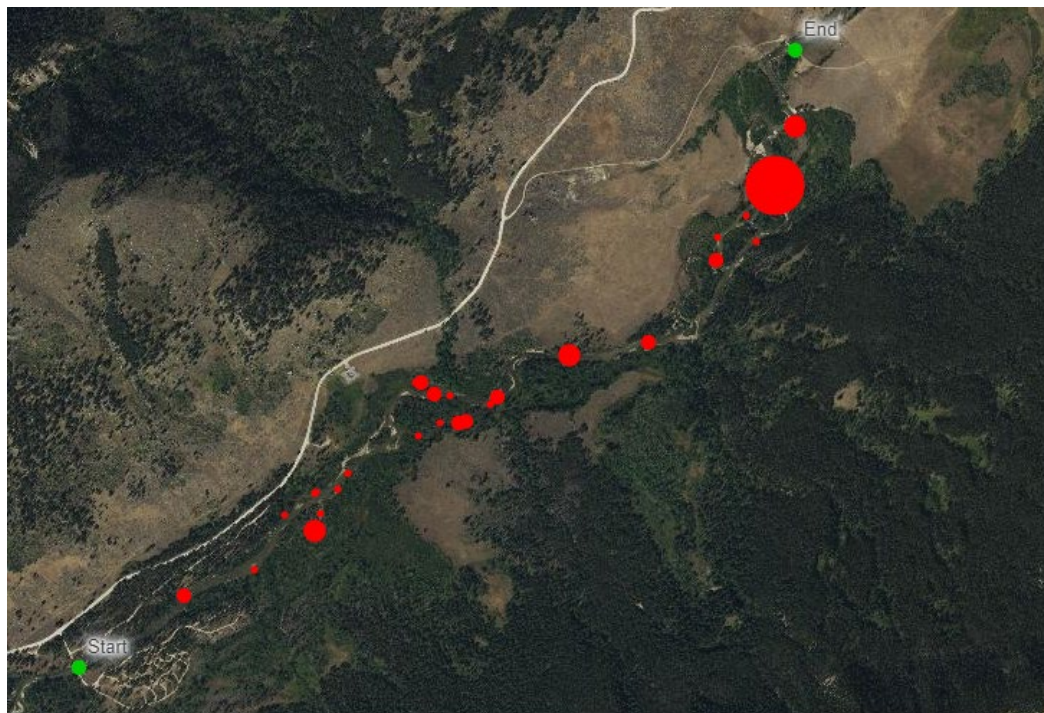


Figure 7-3: Redd locations from Nov. 3, 2021, brown trout spawning survey on West Rosebud Creek. Dot size correlates to number of redds observed in a location.

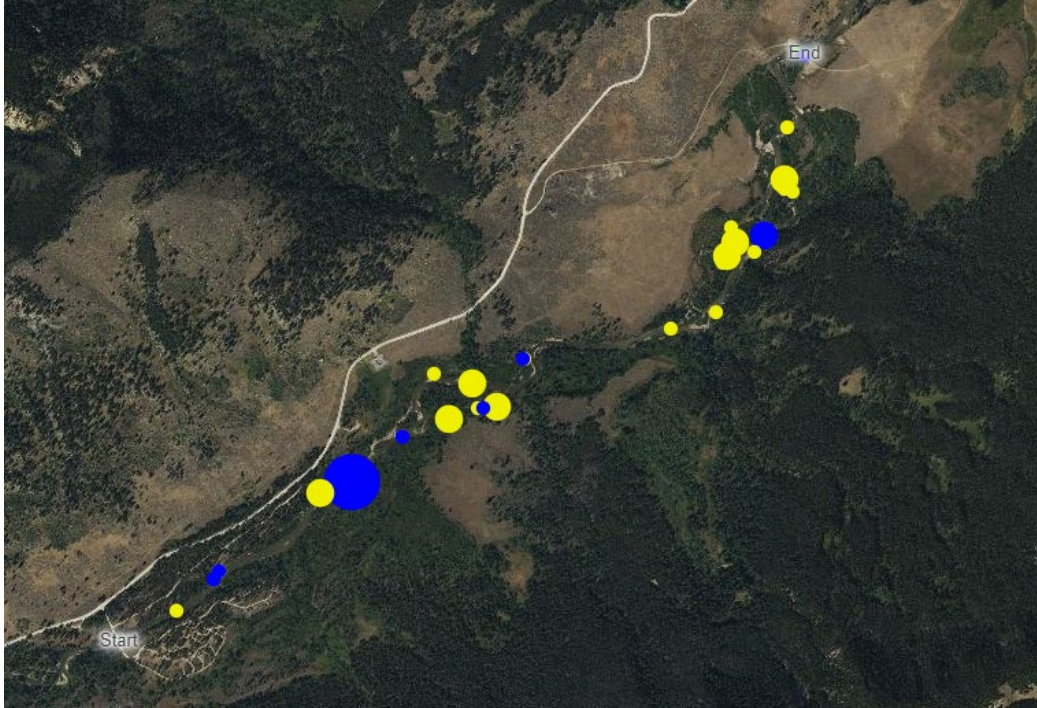


Figure 7-4: Redd locations from 2018 and 2019 brown trout spawning surveys. Yellow indicates 2018 data and blue indicates 2019 data. Dot size correlates to the number of redds observed in a location.

8. Monitoring Schedule 2022-2027

NorthWestern will continue to prepare and submit annually a report summarizing the previous year’s monitoring activities to the TAC and posting the reports on the Mystic Lake Project Coordination website (www.mysticlakeproject.com). A comprehensive 6-year (2016–2021) summary report with an updated 6-year (2022–2027) Fisheries Monitoring Plan will be prepared in 2022 and submitted to the TAC for review and approval prior to filing with the Commission. These two reports will be filed to the Commission no later than December 31, 2022. The final reports will also be posted on the Mystic Lake Project Coordination website (www.mysticlakeproject.com).

In a separate document, NorthWestern updated the Fisheries Monitoring Plan for the next 6-year cycle of fisheries monitoring activities scheduled to be implemented between 2022 and 2027. The proposed plan for the next 6 years is provided in Table 8-1. Every 6 years, the TAC will re-evaluate and update the Fisheries Monitoring Plan, as necessary for the term of the Project License (40 years).

Table 8-1: Mystic License Proposed Fisheries Monitoring 6-Year Schedule.

Year	A	B	C	D	E
2022				X	X
2023		X	X		X
2024	X				X
2025			X	X	X
2026		X			X
2027	X				X

A = Mystic Lake fish monitoring

B = West Rosebud Creek between the dam and powerhouse electrofishing

C = West Rosebud and Emerald lakes fish monitoring

D = West Rosebud Creek below Emerald Lake electrofishing

E = West Rosebud Creek autumn redd survey