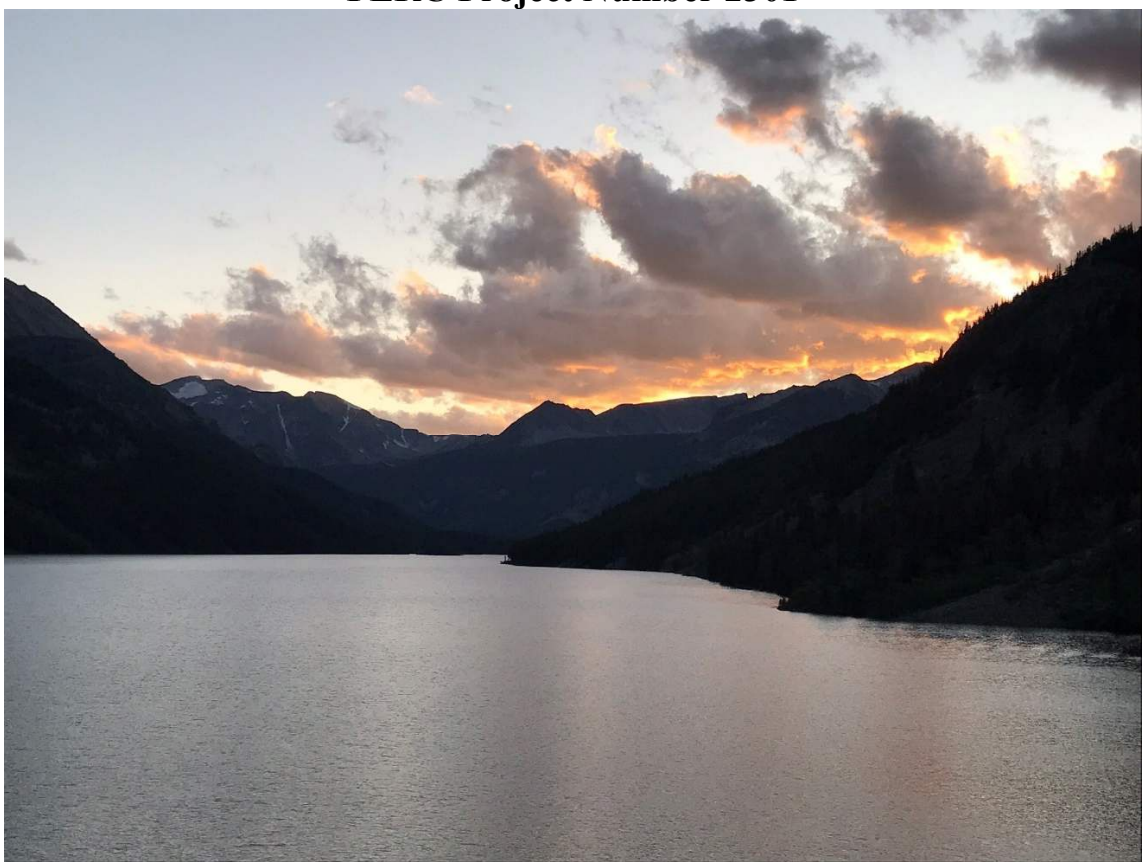
2022 Annual Fisheries Monitoring Report

Mystic Lake Hydroelectric Project
FERC Project Number 2301



January 2023
Public

Introduction

Mystic Lake Hydroelectric Project No. 2301 (Project) is operated and owned by NorthWestern Energy Corporation (NWE). The Project is situated in south-central Montana, 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, (El. 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). The Beartooth Ranger District of the Custer Gallatin 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 Project, effective January 1, 2010 (121 FERC ¶62, 198). 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 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 & Parks (FWP).

NWE revised the 6-year Fisheries Monitoring Plan (Plan), in consultation with the TAC, for implementation between 2022 and 2027. The schedule for fisheries monitoring activities between 2022 and 2027 is outlined in Table 1; the sampling locations are identified in Figure 1.

Sampling activities include Mystic Lake monitoring via floating and sinking gillnets and angling, West Rosebud Creek electrofishing between dam and powerhouse (Upper and Lower Bypass sections), West Rosebud and Emerald lakes fish monitoring via floating and sinking gillnets, West Rosebud Creek electrofishing below Emerald Lake (Mackay Flat section), and West Rosebud Creek fall redd counts. Sampling activities are conducted on a three-year cycle, with the exception of redd counts which are conducted annually.

Following the 6-Year Fisheries Monitoring Plan, sampling activities in 2022 included the annual brown trout *Salmo trutta* redd surveys on West Rosebud Creek and electrofishing on West Rosebud Creek below Emerald Lake in the Mackay section.

Planned sampling for 2023 includes the annual brown trout redd survey, electrofishing the upper and lower bypass sections of West Rosebud Creek between the dam and powerhouse, and West Rosebud and Emerald lakes fish monitoring via gillnets.

Table 1: Sampling activities by year in West Rosebud Creek drainage, Montana.

Year	A	B	C	D	E
2021	X				X
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 electrofishing between the dam and powerhouse (Upper and Lower Bypass sections)
C: West Rosebud and Emerald lakes fish monitoring via gillnetting
D: West Rosebud Creek electrofishing below Emerald Lake (Mackay Flat section)
E: West Rosebud Creek fall brown trout redd survey

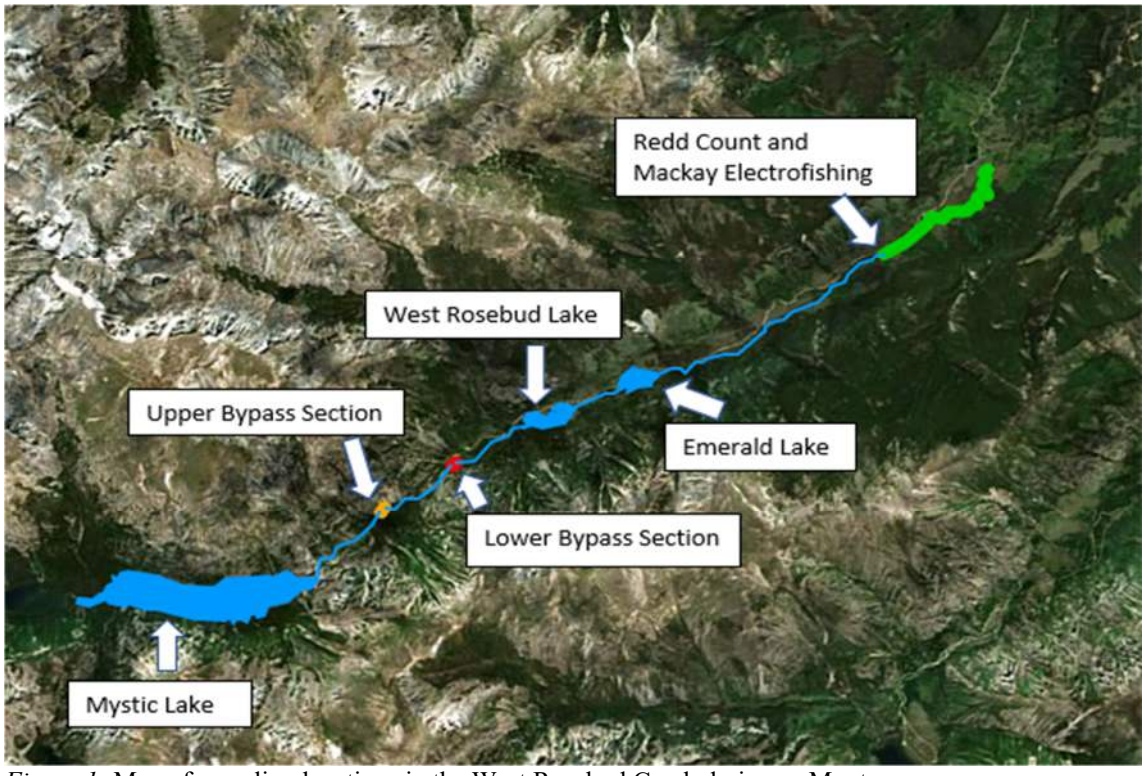


Figure 1: Map of sampling locations in the West Rosebud Creek drainage, Montana.

West Rosebud Creek Fall Redd Surveys

Introduction

The 2022-2027 Fisheries Monitoring Plan and subsequent FERC approval scheduled fall brown trout redd surveys in West Rosebud Creek for every year. Visual brown trout redd surveys are conducted annually by FWP staff members on a 1.6-mile-long section of West Rosebud Creek beginning at the bridge at USFS Pine Grove Campground and ending at the bridge at the boundary of the EL Ranch property (Figure 2). Location and number of redds and adult spawning brown trout are recorded on GPS units.

Surveys are conducted towards the end of the brown trout spawning period to capture the greatest number of redds, and have been conducted between Oct. 12 and Nov. 22 since surveys began in 2009. Multiple surveys may be 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. Although staff members are trained to observe redds, this is a subjective survey, and there is always a potential that redds are overlooked or miscounted.

The Mackay Flat section serves as an important spawning area for both resident West Rosebud Creek and migratory brown trout and rainbow trout *Oncorhynchus mykiss* from the larger Stillwater and Yellowstone rivers. Redd counts are used as a metric to describe general salmonid abundance and can help track local population trends over time. Preferred trout spawning habitat consists of gravel-sized substrate and shallow riffles, characteristics more often found in headwater streams such as West Rosebud Creek than on larger rivers (Figure 3). Spring redd counts for rainbow trout have been conducted in the past but, due to low redd numbers, are not included as part of the required fisheries sampling.

Results

A single redd survey was conducted for brown trout on Nov. 15, 2022. Sunny and calm weather made for good visibility. Forty-seven total redds and five adult spawning fish were observed, with locations recorded on GPS (Figure 4). Because so few adult fish were observed during this survey, it is likely the peak of spawning had passed, and an additional survey was not conducted. Redds are often observed in consistent locations from year to year due to the presence of preferred spawning habitat (Figure 5).

The 47 redds observed during the 2022 survey is the second highest number since surveys began in 2009 (Figure 6). In 2021, the highest number of brown trout redds was observed, totaling 51, while the lowest number of redds was observed in 2014 at only 6.

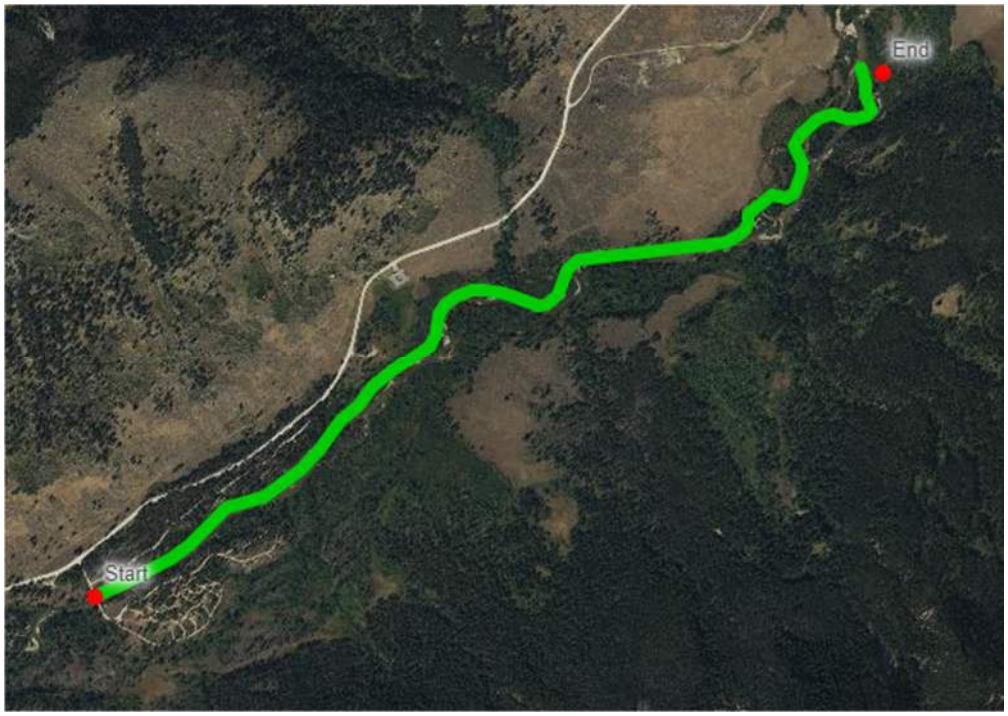


Figure 2: Brown trout redd survey location on West Rosebud Creek. Survey begins at USFS Pine Grove Campground (45.2756, -109.64542) and ends at the bridge at the EL Ranch property boundary (45.2856, -109.62406).


Figure 3: Brown trout redd observed during 2021 survey on West Rosebud Creek. Note the water depth, velocity, and substrate size.

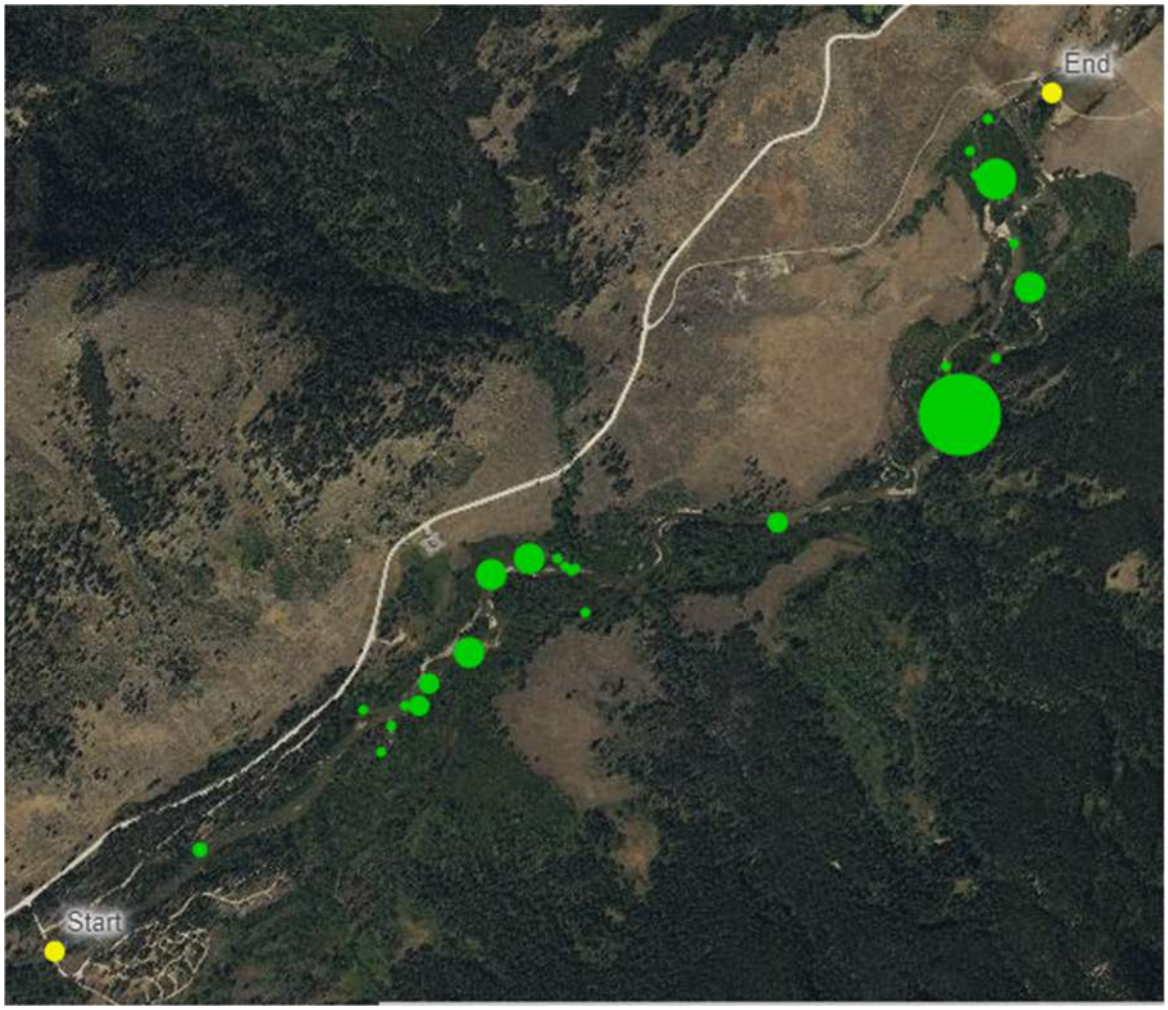


Figure 4: Brown trout redd locations from 2022 survey conducted on Nov. 15. Dot size correlates to the number of redds observed in a location.

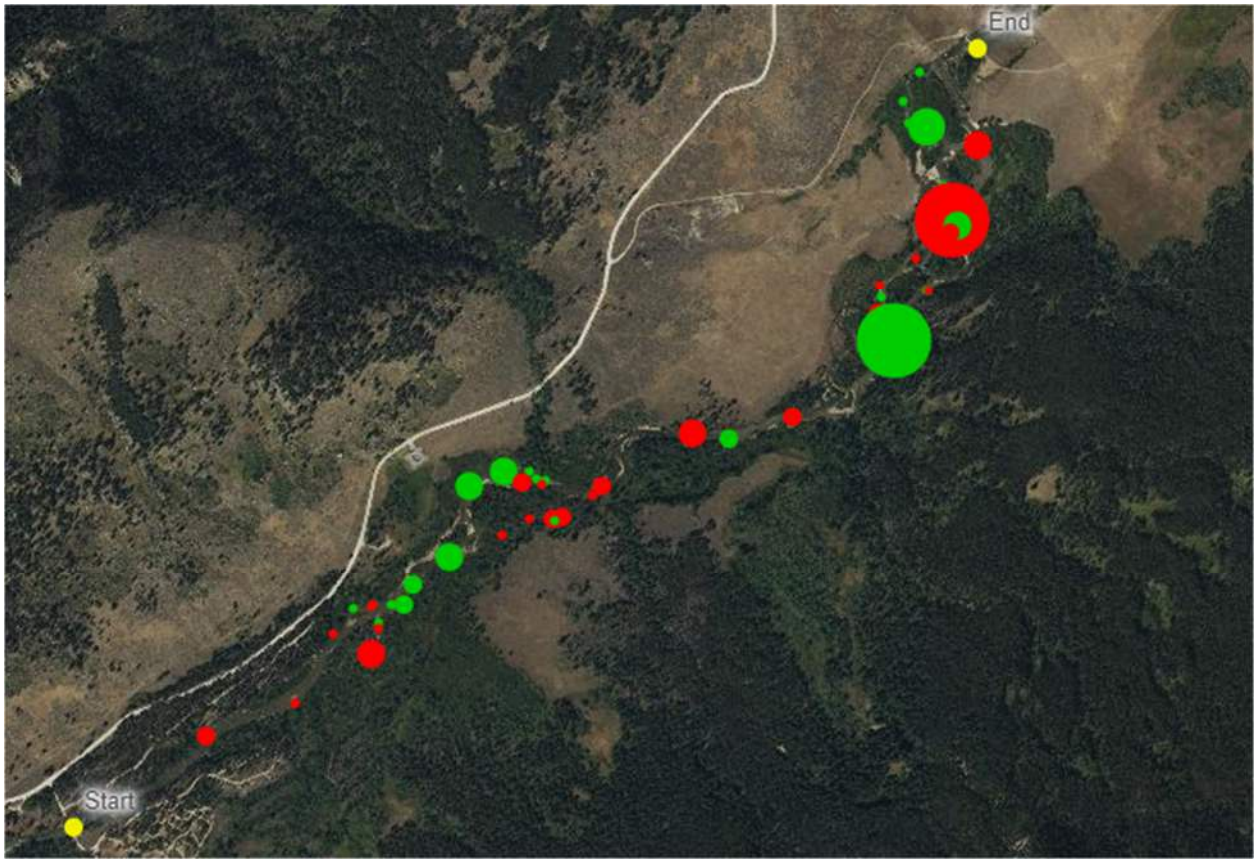


Figure 5: Brown trout redd locations from 2021, shown in red, and 2022, shown in green. Dot size correlates to the number of redds observed in a location.

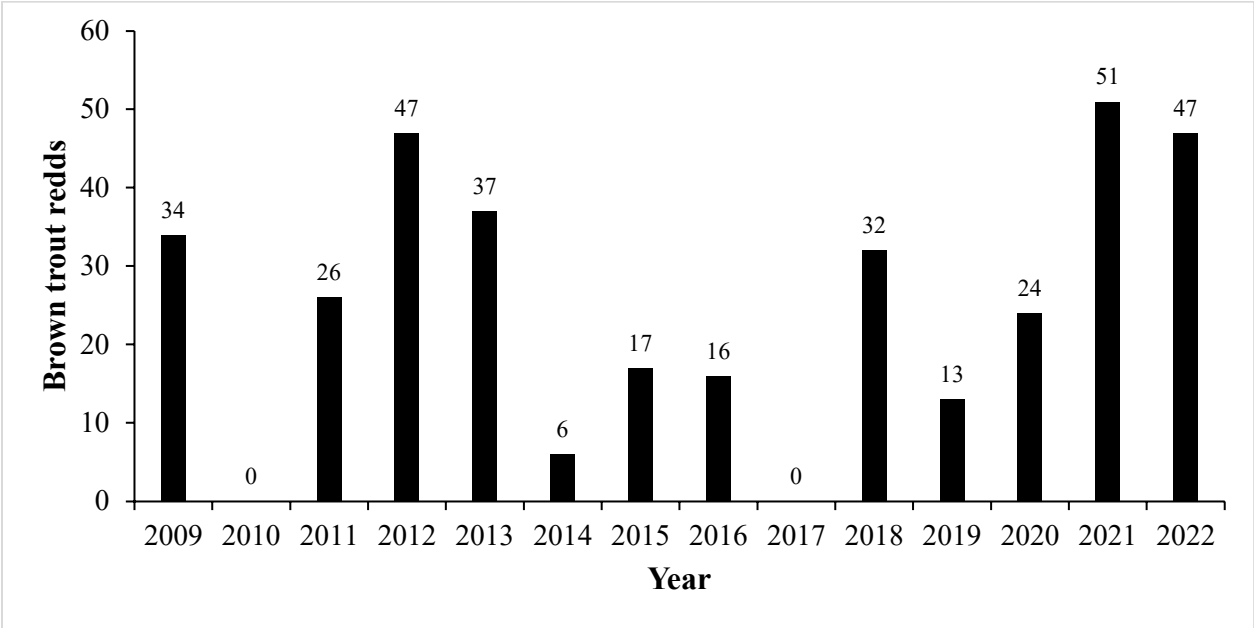


Figure 6: Brown trout redds observed on West Rosebud Creek, 2009-2022. Zeros indicate a survey was not conducted.

West Rosebud Creek Mackay Flat Fisheries Monitoring

Introduction

The Mackay Flat section, located near the Custer Gallatin National Forest boundary, of West Rosebud Creek begins at the USFS Pine Grove Campground and ends at the first set of cabins and bridge at the EL Ranch, formerly the Mackay Ranch (Table 2). The electrofishing section is within the redd survey stream described above. FWP personnel electrofish the section twice to conduct a mark-recapture population estimate. The objective of these surveys is to evaluate changes or trends in the fish community over time. Brown trout, rainbow trout, brook trout *Salvelinus fontinalis*, mountain whitefish *Prosopium williamsoni*, and sculpin *Cottus* sp. are present in this section with brown trout being the predominant fish. Sculpin are not collected or sampled, but presence is noted.

Because this section is known to be an important spawning area for both resident and migratory rainbow and brown trout from the Yellowstone and Stillwater rivers, migrations likely impact population estimates. 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. Because brown trout are fall spawners, fall surveys likely did not capture a true resident population and were inflated by migratory fish from the Yellowstone and Stillwater rivers.

Table 2: West Rosebud Creek Mackay Flat section details.

Section	Mark Run	Recapture Run	Start	End	Length (mi.)
Mackay Flat	5/1/22	5/11/22	45.27567, -109.64538	45.28834, -109.62402	1.5

Data Collection

FWP personnel electrofished the Mackay Flat section of West Rosebud Creek (*see* Figure 1) in spring 2022. Sampling is conducted using a drift boat with a mobile anode and Smith-Root VVP 15B electrofisher. Brown trout, rainbow trout, brook trout, and mountain whitefish were collected and marked with an anal fin clip. Historically, mountain whitefish were not collected in this section. Beginning in 2019, FWP began collecting and marking mountain whitefish.

Marking and recapture runs consisted of electrofishing the entire section or reach of river while netting all trout and mountain whitefish. Multiple fish-working stops occurred during each run where captured fish were anesthetized with MS-222 to minimize stress during handling. All trout caught were measured in total length to the nearest tenth of an inch and weighed in pounds when not impacted by the wind. During the marking run all fish were marked with a vertical clip into the anal fin with wire cutters or scissors, which can be detected during subsequent sampling events. The fish were then released back into the section and allowed to redistribute for 7 to 14 days prior to recapture runs. During recapture runs, fish were examined for marked fins and

those that had the fin clip were noted as recaptured. Only unmarked were measured and weighed during recapture runs.

Results

In total, 193 brown trout, 21 rainbow trout, 10 brook trout, and 37 mountain whitefish were caught across the mark and recapture runs on this section (Table 3).

In 2022, mountain whitefish had the largest average length of the species captured at 12.5 inches, while brook trout were the smallest at 5.7 inches. Average length for rainbow trout shows an apparent increase beginning in 2014 (Figure 8). This is likely due to the change in sampling timing, as sampling moved from a fall to a spring activity in 2014. Larger migratory rainbow trout from the Yellowstone and Stillwater rivers may influence average length in spring surveys due to spawning activity. The average length for brown trout has shown little variation across survey years (ranging from 8.9—11.4 inches), even when the survey season was changed in 2014 from fall to spring.

Table 3: Sampling information by species during mark and recapture surveys on the Mackay Flat section of West Rosebud Creek.

Species	Total	Mark	Capture	Recapture	Avg. length (in.)	Length range (in.)
Brown trout	193	114	108	29	9.1	3.2-16.8
Rainbow trout	21	8	13	0	10.2	2.9-19.3
Brook trout	10	5	5	0	5.7	3.9-9.1
Mountain whitefish	37	23	20	6	12.5	4.2-16.9

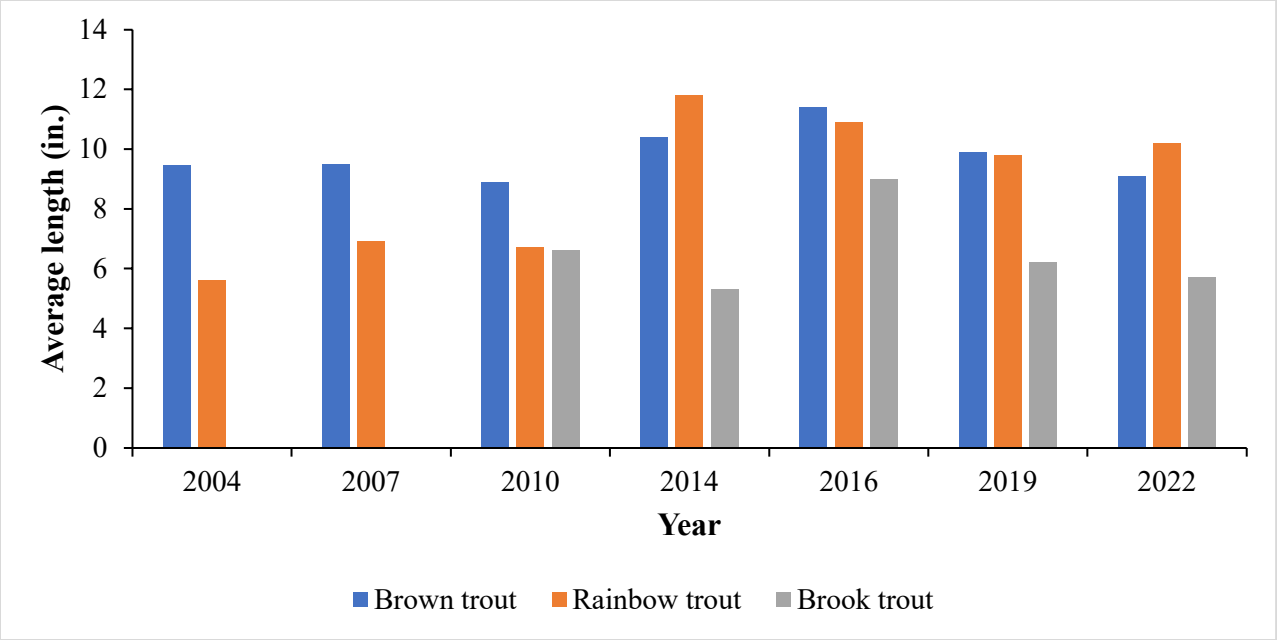


Figure 5: Average length in inches by species in Mackay Flat section of West Rosebud Creek. Mountain whitefish are not included, as sampling for this species began in 2019.

Length distribution

Brown trout

Brown trout ranging in length from 6.0 to 6.9 inches were the most abundant size class caught during sampling events in both 2019 and 2022 (Figure 9). In 2022, fish in this size class accounted for only 15.5% of the total catch, showing a fairly wide distribution of sizes. This size class is also the most abundant for the long-term average.

Sampling in 2022 saw a lower abundance of brown trout above 12.0 inches compared to the long-term average, but a higher abundance of fish ranging from 4.0 to 6.9 inches.

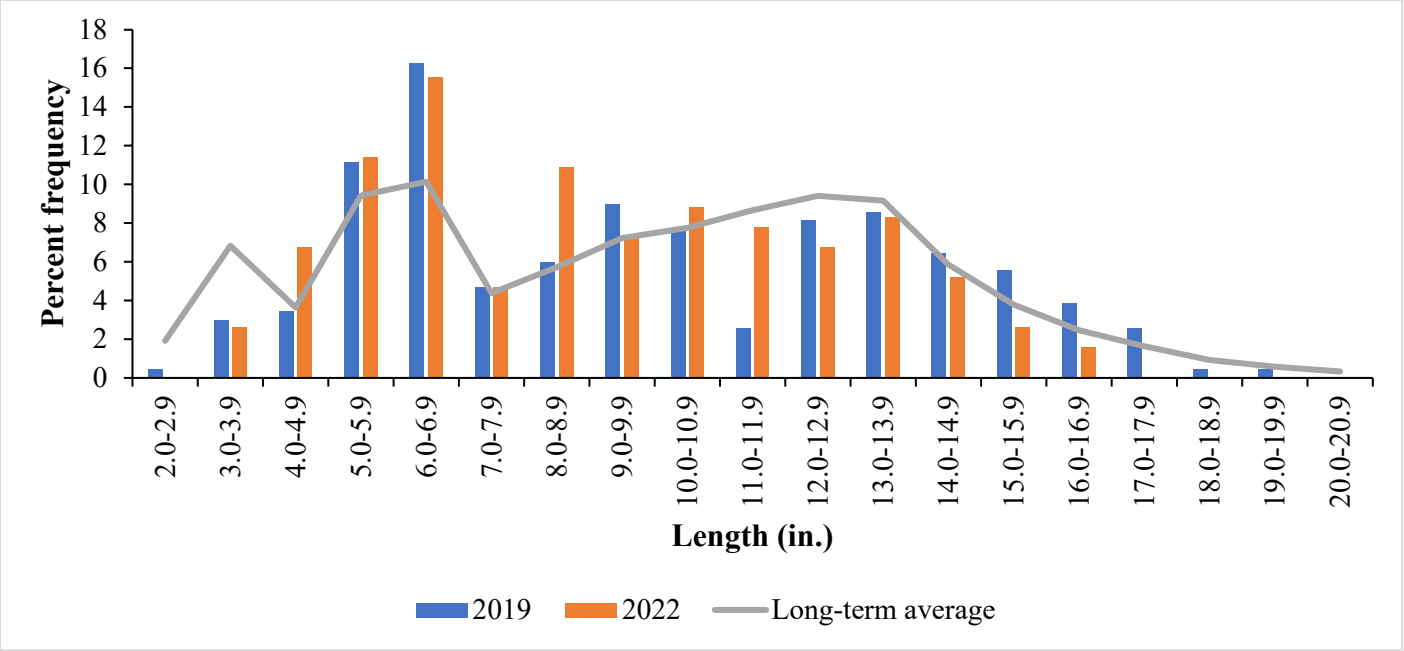


Figure 9: Length frequency distribution for brown trout in Mackay Flat section of West Rosebud Creek, 2019 and 2022 against long-term average.

Rainbow trout

In both the 2019 and 2022 sampling, rainbow trout ranging in length from 14.0 to 14.9 inches were the most abundant (Figure 10). This size class accounted for 19% of the total rainbow trout catch in 2022. The most abundant size class in the long-term average is 10.0 to 10.9 inches.

Rainbow trout are typically captured in relatively small numbers in this section, leading to high variability in length frequency distribution. In 2022, 21 total rainbow trout were sampled across

both sampling events, and 20 were sampled in 2019. A single induvial accounted for nearly 5% of the total catch in 2022.

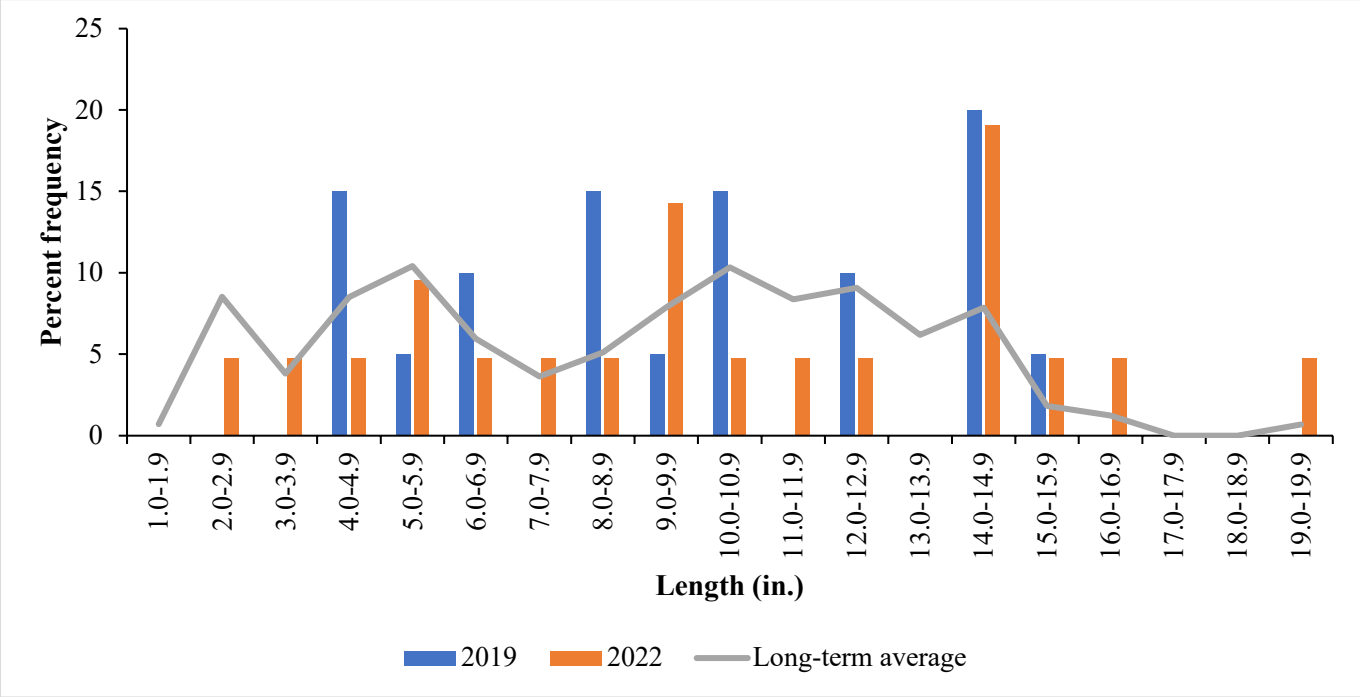


Figure 10: Length frequency distribution for rainbow trout in Mackay Flat section of West Rosebud Creek, 2019 and 2022 against long-term average.

Brook trout

Brook trout have historically been the least abundant species collected in this section, with only 10 total caught across both sampling events in 2022.

Six brook trout ranging in length from 4.0 to 5.9 inches accounted for 60% of the total catch in 2022 (Figure 11). As with rainbow trout, brook trout are caught in low enough numbers that analyzing length frequency trends can be difficult.

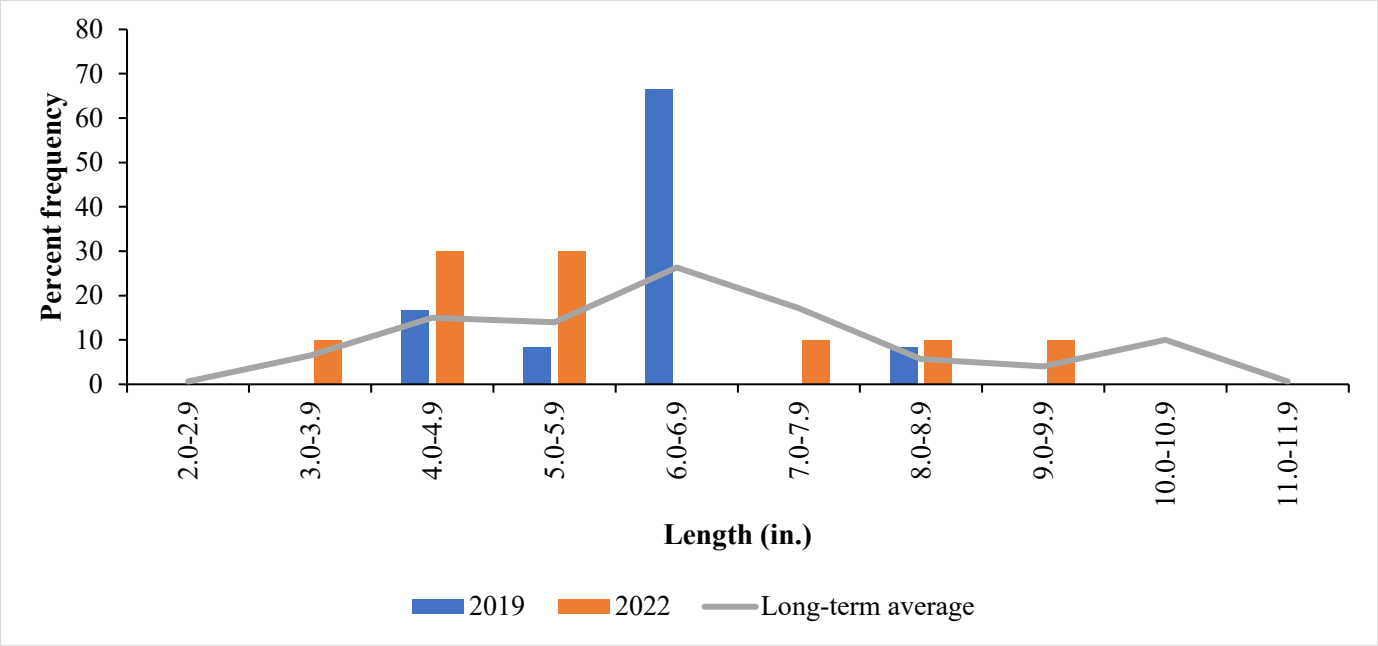


Figure 11: Length frequency distribution for brook trout in Mackay Section of West Rosebud Creek, 2019 and 2022 against long-term average.

Mountain whitefish

Long-term data on mountain whitefish is not available for this section, as sampling for this species began in 2019.

In both sampling events for this species, the majority of fish captured were 14.0 inches and above (Figure 12).

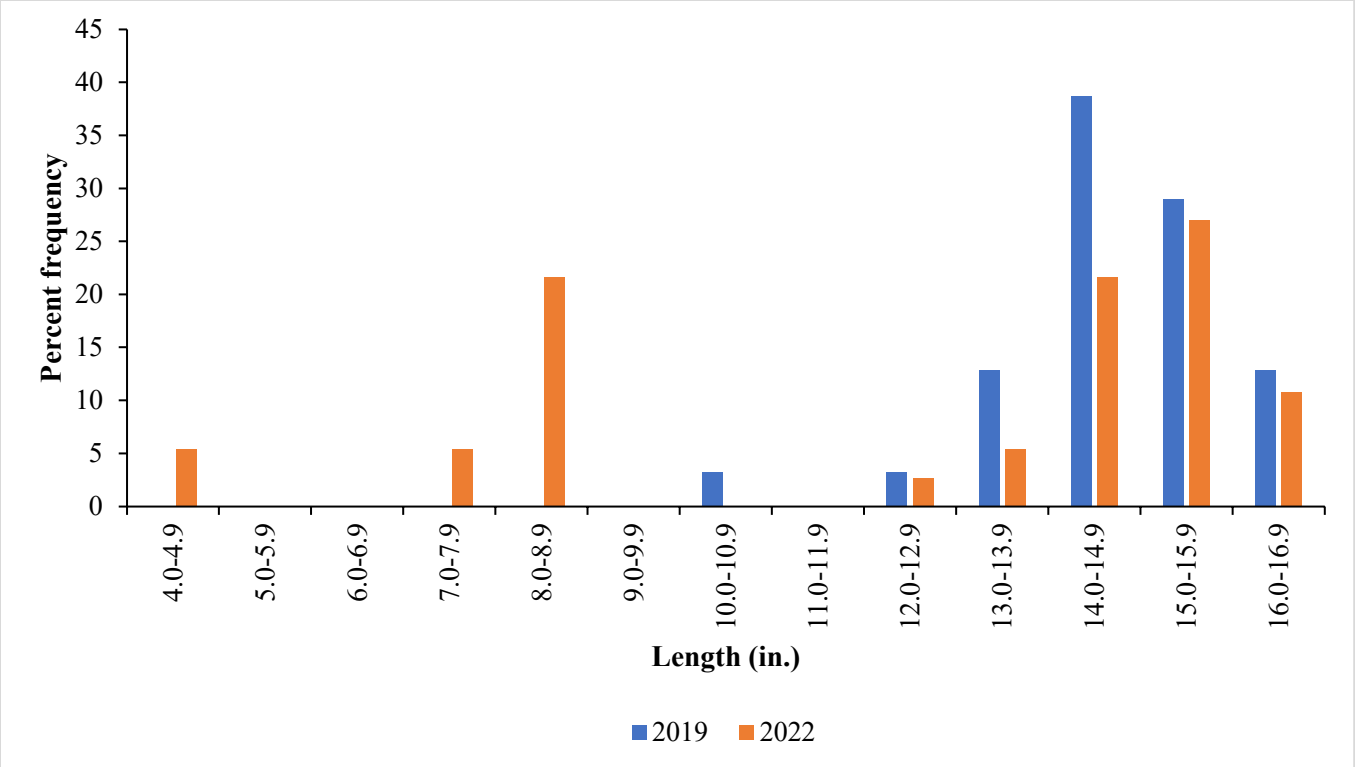


Figure 12: Length frequency distribution for mountain whitefish in Mackay Section of West Rosebud Creek, 2019 and 2022.

Population estimate

Brown trout

The Peterson with Chapman modification mark-recapture methodology was used to estimate the brown trout population in the Mackay Flat section of West Rosebud Creek. Population estimates are conducted only for brown trout measuring 7.0 inches and greater in this section, as recapture rates for smaller fish and other species are typically too low to create a reliable estimate. Estimates are run in FWP's internal database, Fisheries Information System, using a 95% confidence interval.

Due to the life history of brown trout migrating in the fall to spawn, fall and spring population estimates for the species vary. Surveys conducted in the fall yielded higher, likely inflated, population estimates in every sample year when compared to spring estimates (Figure 13).

Brown trout population estimates have been decreasing in this section since 2014 (Figure 14). The highest population estimate was from the fall survey in 2010 at 652 fish per mile. Sampling in 2022 produced the lowest population estimate on record, at just 131 fish per mile. There is no clear explanation as to what is driving this recent downward trend in the Mackay section. However, declines in other brown trout populations throughout Montana have been associated with a decrease in annual stream flows.

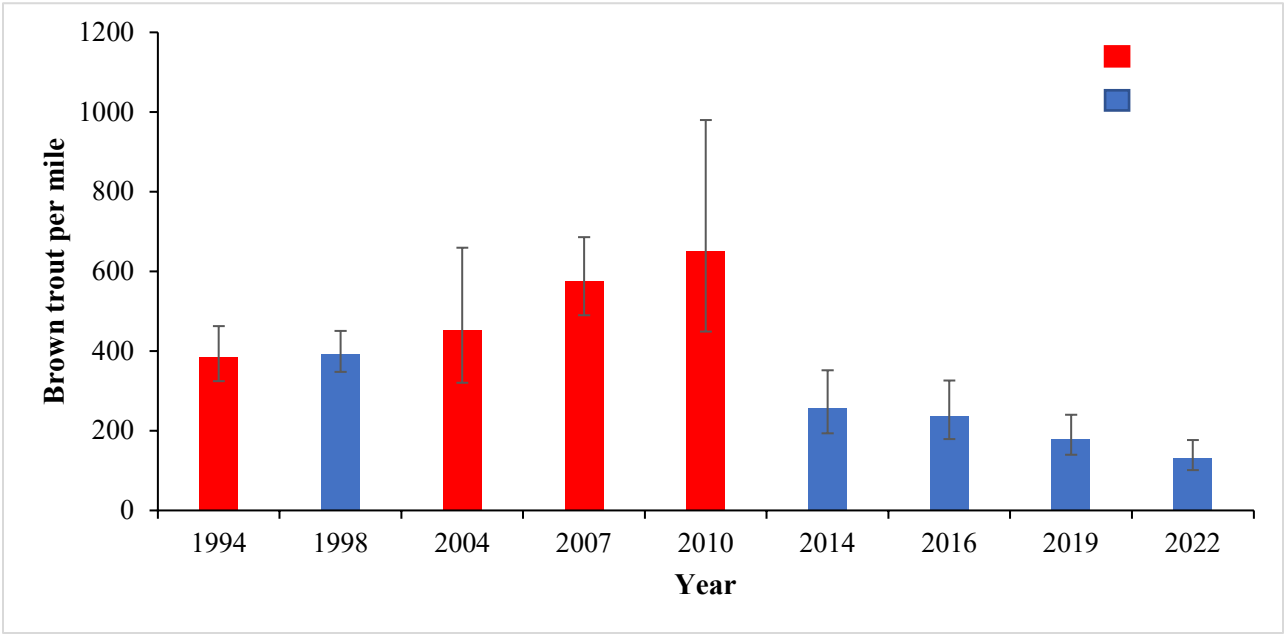
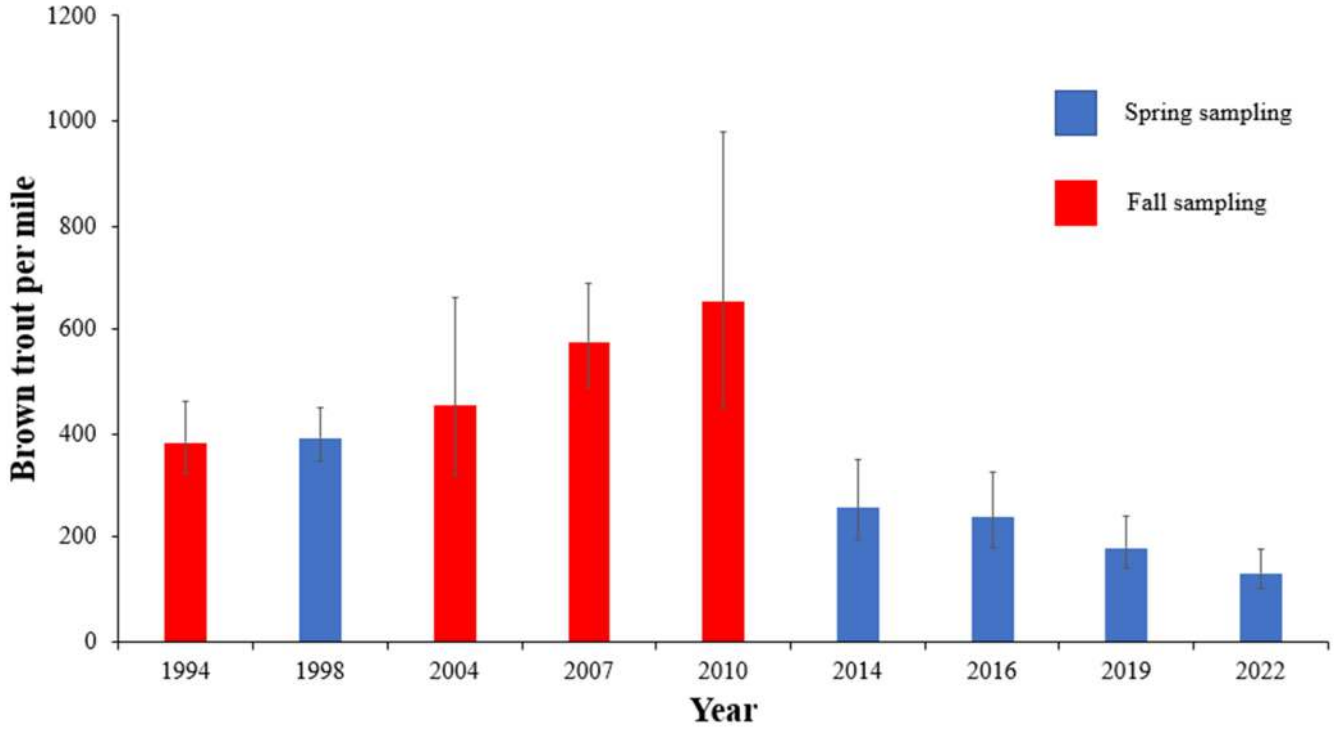


Figure 13: Population estimate in fish per mile for brown trout above 7 inches on the Mackay Flat section of West Rosebud Creek. Bars represent upper and lower confidence intervals. Red=fall sampling, blue=spring sampling.



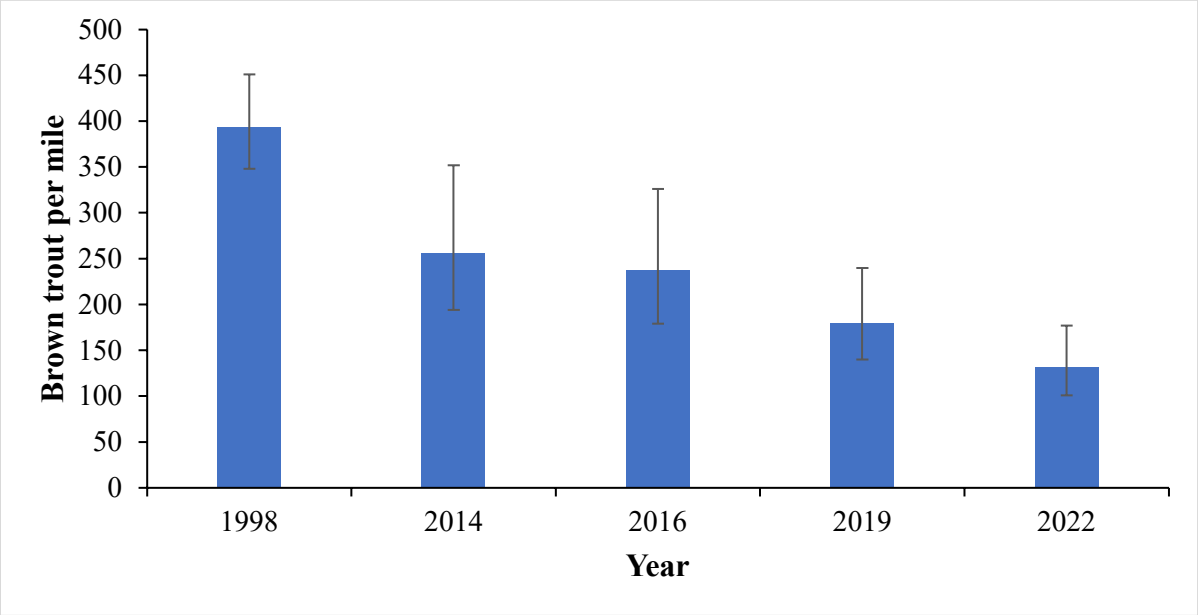


Figure 14: Population estimate in fish per mile for brown trout above 7 inches on the Mackay Flat section of West Rosebud Creek. Bars represent upper and lower confidence intervals. Estimates from spring sampling events in 1998, 2014, 2016, 2019, and 2022.

Fisheries Monitoring Schedule for 2023

Following the 6-Year Fisheries Monitoring Plan for 2022-2027, sampling for 2023 will include the annual brown trout redd survey, electrofishing the upper and lower bypass sections of West Rosebud Creek between the dam and powerhouse, and West Rosebud and Emerald lakes fish monitoring via gillnets (Table 1).

NorthWestern Energy will continue to prepare and submit annual reports summarizing the previous year's monitoring activities to the TAC and posting the reports on the Mystic Lake Project Coordination website (www.mysticlakeproject.com). 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).