Fisheries Investigations in the Blackfoot River Watershed, 2021-2023

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INTRODUCTION

The Blackfoot River is an important stronghold for migratory westslope cutthroat trout and bull trout. It also supports a valuable sport fishery of nonnative rainbow trout and brown trout. Brook trout are present in many of the tributaries with very low densities in the mainstem river downstream of the Landers Fork. In the Clearwater River system, many nonnative species have been introduced including northern pike, smallmouth bass, largemouth bass, and pumpkinseed. Despite the significant declines in bull trout abundance, the Blackfoot River supports one of the most stable and robust metapopulations (Kovach et al. 2018) in the upper Clark Fork Geographic Region of the Columbia River Headwaters Recovery Unit (USFWS 2015).

The Blackfoot River flows 132 miles from its source near Roger's Pass to its confluence with the Clark Fork River near Bonner, MT. The river's outstanding natural resources and diversity of recreational opportunities, combined with its proximity to Missoula, contribute to its popularity. The 2,320 square mile watershed is a topographically, geologically, and geographically diverse basin with elevations ranging from 9,414 feet at Red Mountain to 3,280 feet near Bonner, Montana. The drainage contains over 1,900 miles of perennial stream length, including more than 70 direct tributaries to the Blackfoot River (Pierce et al. 2005). The Blackfoot River has a 1971-appropriated "Murphy" instream flow water right of 700 cfs during the summer at the USGS Bonner (#12340000) gage station. This value represents the minimum flow necessary for maintaining high habitat potential and food production during the trout growing season based on the wetted perimeter inflection point method (reviewed in Leathe and Nelson 1986). In 2015, this 700 cfs water right received a 1904 priority date associated with the Milltown Water Right when the Montana Legislature ratified the Confederated Salish and Kootenai (CSKT) Water Compact with Senate Bill 262 (Pierce et al. 2019). The CSKT are co-owners of this water right, but the enforcement of the new priority date is deferred until April of 2025. The implementation of the Milltown Water Right will be incorporated into the Blackfoot Drought Response Plan.

The Blackfoot River is managed as a wild trout fishery, emphasizing natural reproduction of native and nonnative trout. In response to perceived declines in trout abundance and fishing quality in the Blackfoot River, a Blackfoot-specific fisheries program was developed in the late-1980s to identify potential limiting factors and opportunities to address those issues (Peters and Spoon 1989). These initial investigations established recommendations for subsequent management and research needs and catalyzed the extensive conservation and habitat restoration program in the drainage.

Limiting factors

Historical land use and overharvest contributed to significant declines in trout abundance in the 20th century. Angler habits through the late-1980s exhibited a high propensity to harvest fish. Harvest mortality was implicated as a significant source of mortality, particularly for large rainbow trout in the lower river. With native trout species already in low abundance, the potential for adverse effects from even minimal harvest was identified as a primary threat (Peters and Spoon 1989). Creel surveys indicated a strong preference for anglers to harvest fish greater than 12 inches, preventing the abundant small size classes transitioning into large size classes (Peters and Spoon 1989). To alleviate controllable sources of mortality and prevent them from exacerbating other limiting factors, harvest restrictions for westslope cutthroat trout and bull trout were established in 1990 (Peters 1990) and have remained in effect.

Agricultural practices have contributed to stream degradation throughout the drainage, particularly in tributary spawning and rearing habitats. Furthermore, irrigation has resulted in significant dewatering issues throughout the drainage, but these issues are most pronounced in specific tributaries and discrete locations. Riparian degradation has resulted in severe erosion and subsequent habitat simplification within stream channels. Channel over-widening and lack of vegetation has led to considerable warming in some tributaries and has created downstream effects in the mainstem river. Habitat degradation and simplification within the tributaries has facilitated shifts in species composition from native to nonnative species, as well as shifts from salmonid-bearing to only supporting non-game species (e.g., dace, redside shiner, sucker). Many limiting factors have been addressed throughout the drainage, with some streams undergoing complete restoration related to historical limiting factors (e.g., Chamberlain Creek, Pierce et al. 2019). However, contemporary limiting factors in spawning and rearing habitats still exist, including low flows, passage issues, habitat degradation, elevated temperatures, and nonnative species. Moreover, the ongoing abiotic and biotic changes associated with climate change are exacerbating anthropogenic impacts to streamflow and water temperature. Regional trends in temperature attributed to climate change are having deleterious effects on bull trout (Al-Chokhachy et al. 2016), leading to localized declines and extirpations over broad geographic scales.

Connectivity issues associated with anthropogenic disturbances have not been exclusive to migration corridors within the Blackfoot River basin. Milltown Dam, downstream of the confluence with the Clark Fork River, prevented upstream passage and impacted broader connectivity within the Clark Fork drainage. The dam was completed in 1907, blocking upstream passage from the Clark Fork River. Research studies documented bull trout and westslope cutthroat trout passed above the dam migrating significant distances to spawn in several tributaries in the lower and middle Blackfoot River drainage (Schmetterling 2003). Milltown Dam was breached in 2008 as part of the larger dam removal project, including channel and floodplain restoration through the previous reservoir location. The spawning year of 2008 was the first time in a century that trout could volitionally migrate from the Clark Fork River into spawning tributaries in the Blackfoot River watershed.

The history of intensive logging on commercial timberlands and public lands (e.g., USFS lands) has contributed to significant legacy stream impacts. Early logging practices included riparian harvest and frequent manipulation of the stream channel to facilitate easier harvest and timber removal. Heavily logged tributaries had poor recruitment of large woody debris, which contributed to low habitat complexity. Furthermore, the infrastructure to support logging (i.e., roads) created passage barriers in the form of undersized culverts and contributed significant sediment loads to the channel. Riparian roads also channelized and straightened many streams, further reducing habitat complexity and natural stream function. Collectively, the issues associated with historical land uses reduced habitat capacity and ultimately production in tributaries, which contributed to reduced trout recruitment observed in Blackfoot River (Peters and Spoon 1989; Peters 1990). Nearly 20% of the watershed was privately-owned commercial timberlands in the 1990s (Pierce and Schmetterling 1999). Although logging practices have changed considerably in the past few decades, legacy effects persist throughout large portions of the drainage.

In 1975, the Mike Horse tailings dam in the Upper Blackfoot Mining Complex (UBMC) failed, releasing 100,000 tons of toxic mine waste that deposited in wetlands and floodplains upstream of Lincoln. Observations of tailings were evident at the Landers Fork confluence and likely continued downstream of there (Spence 1975). Fish populations were severely depressed in the upper drainage, and the most heavily impacted tributaries and upper Blackfoot River sections were devoid of aquatic life. In 2009, Montana Department of Environmental Quality (DEQ), Montana Natural Resource Damage Program (NRDP), and the U.S. Forest Service (USFS) initiated cleanup efforts with the start of the water treatment plant and subsequent remediation and stream restoration.

History of habitat restoration and fisheries management

Following public concern regarding the health of the Blackfoot River, the Big Blackfoot Chapter of Trout Unlimited (BBCTU) was formed to generate funding to hire a biologist to investigate the status of the fishery and identify potential limiting factors and opportunities to address those issues (Peters and Spoon 1989). Fisheries inventories were limited prior to this time, and assessments had not been completed since 1972 (Peters and Spoon 1989). BBCTU has been integral to fundraising, gaining landowner support, and managing restoration projects. In the early years of the program, BBCTU handled project fundraising while FWP conducted most of the project implementation (Pierce et al. 2019). As the restoration and conservation program matured, FWP's role transitioned into technical oversight, identifying limiting factors, assessing the effectiveness of restoration projects, and providing the biological rationale for developing specific habitat actions. BBCTU transitioned into active implementation and hired a restoration project manager responsible for developing, managing, and implementing projects. The Blackfoot Partnership (i.e., all NGOs and government agencies working in the watershed) facilitates effective watershed-scale restoration with a robust fisheries emphasis. This has enabled efficient use of public funds to implement biologically meaningful projects and the monitoring efforts demonstrate that projects are working (Pierce et al. 2013; Pierce et al. 2019). The science-based approach has leveraged continued investment from a diverse set of funding entities.

Harvest restrictions were among the first actions implemented to address declines in native trout abundance. Regulations to restrict harvest of bull trout and westslope cutthroat trout were implemented in 1990 in the Blackfoot River watershed in response to detailed fisheries investigations (Peters and Spoon 1989; Peters 1990). After conducting angler studies and creel surveys in the late-1990s and early-2000s, further restrictions were implemented that required artificial lures in key bull trout tributaries and artificial lures within the mainstem Blackfoot River within 100-yard radius of the mouths of tributaries where bull trout were known to concentrate. Tributaries with these regulations currently include Gold Creek (only near the mouth), Belmont Creek (only near mouth), Monture Creek, Copper Creek, and the North Fork Blackfoot River. To facilitate further bull trout recovery in 2002, the Fish and Wildlife Commission adopted regulations to restrict harvest of brook trout in the mainstem river to prevent incidental harvest of Bull Trout due to misidentification (Schmetterling and Long 1999), which had been identified as a pervasive problem from creel surveys and angler interviews (Pierce et al. 2002). In 2016, additional special regulations were enacted in the North Fork Blackfoot River to restrict tackle to single-point barbless hooks between North Fork Falls and the Highway 200 bridge.

The Blackfoot Challenge was established in 1993 with a board comprised of private landowners, conservation organizations, and state and federal government agencies. The group represents the diverse interests of local landowners and provides a forum for collaborative decision making, project implementation, and coordinated watershed management efforts across public and private lands. The group has been effective in establishing landowner trust and participation in the conservation program. They have been involved with project implementation in the form of water conservation projects, and recently, some habitat restoration projects.

The Challenge plays a critical role in assisting FWP with administration of the "Murphy" instream flow water right. They have been instrumental in development and management of the Blackfoot Drought Response Plan. This plan is a proactive program to help water users conserve water, implement voluntary restrictions, and conduct actions that minimize the need for FWP to make call on junior water rights. Participants in the drought plan make meaningful conservation measures to be shielded from call when flows drop below 700 cfs but remain above 500 cfs. When flows drop below 500 cfs, FWP makes call on all participating junior users without a 1-to-1 exchange of senior water rights for junior water rights (Drought Committee 2016). The Drought Committee is comprised of representatives from FWP, CKST, DNRC, DEQ, Blackfoot Challenge, local guides, anglers, recreationists, and private landowners. An adjudication process for all water rights in the Blackfoot watershed was completed in 2011 and the drainage is currently closed to the development of new water right claims.

Private landowners have been essential to the success of the restoration program (Pierce et al. 2019). Early engagement of the landowners in the drainage paved the way for current and future actions. Establishing relationships between private landowners and agency personnel has garnered trust and facilitated projects on neighboring lands that may not have been possible otherwise. Agency personnel and practitioners seek opportunities for mutually beneficial actions that provide a benefit to the landowner while also improving the aquatic resource. Demonstrating the coexistence of working landscapes in conjunction with productive and functioning stream systems has created many opportunities for implementing additional projects in the valley. Working with cooperative landowners to implement demonstration projects has been an effective way of broadening the scope of work in the drainage.

Stream restoration efforts have dovetailed with land conservation and terrestrial projects to leverage additional opportunities. Land protection through conservation easements has retained large blocks of land in single ownership, which has facilitated effective restoration compared to subdivided areas with multiple landowners that may preclude comprehensive restoration actions. Conservation easements not only provide assurances that management will protect existing high-quality aquatic and riparian habitats but facilitate opportunities to conduct restoration projects on large sections of single-ownership property to address major limiting factors. Easements have facilitated positive management changes to riparian and upland areas in key areas, as well as protected the investment of stream restoration projects after degradation issues have been addressed. A total of 184,635 acres are enrolled in conservation easements, including several new easements executed in the last five years. Approximately 31% of private lands in the drainage are protected with conservation easements.

Land conservation through fee title acquisitions held in public trust has been a valuable tool used frequently throughout the Blackfoot Valley. Land ownership in the drainage continues to change because of comprehensive land conservation efforts. The Blackfoot Challenge acquired 5,609 acres of former Plum Creek Timber Company land in 2008. The Blackfoot Community Conservation Area Council manages this property as the core area within a larger mixed ownership landscape through a novel public/private community forest model that maintains public recreation and sporting opportunities, while allowing for more management flexibility and timely implementation of actions compared to traditional land management agencies. The core area combined with additional adjacent public and private land includes 41,000 acres in cooperative ecosystem management that spans large portions of McCabe Creek, Dick Creek, Warren Creek, and Murphy Spring Creek drainages (BCCAC 2017).

The Nature Conservancy purchased the remaining 117,152 acres of Plum Creek Timber Company holdings in 2014. In 2019, the BLM purchased 7,268 acres in the Belmont Creek drainage and the Forest Service acquired 16,400 acres in the Gold Creek and Placid Creek drainages. In 2020, the BLM acquired another 5,600 acres in Belmont Creek. The Forest Service acquired 12,039 acres across Twin Creek, upper Belmont Creek, and Placid Lake drainages. Consolidated ownership in the Gold Creek and Belmont Creek drainages will enable holistic management in the drainage and facilitate restoration opportunities. The BLM is currently in the public scoping phase for the proposed acquisition of the remaining Montana Checkerboard, LLC holdings in the lower Blackfoot drainage. As of 2024, land ownership in the basin is approximately 31% private (including 4% Montana Checkerboard LLC.), 57% federal, and 12% state (Figure 1).

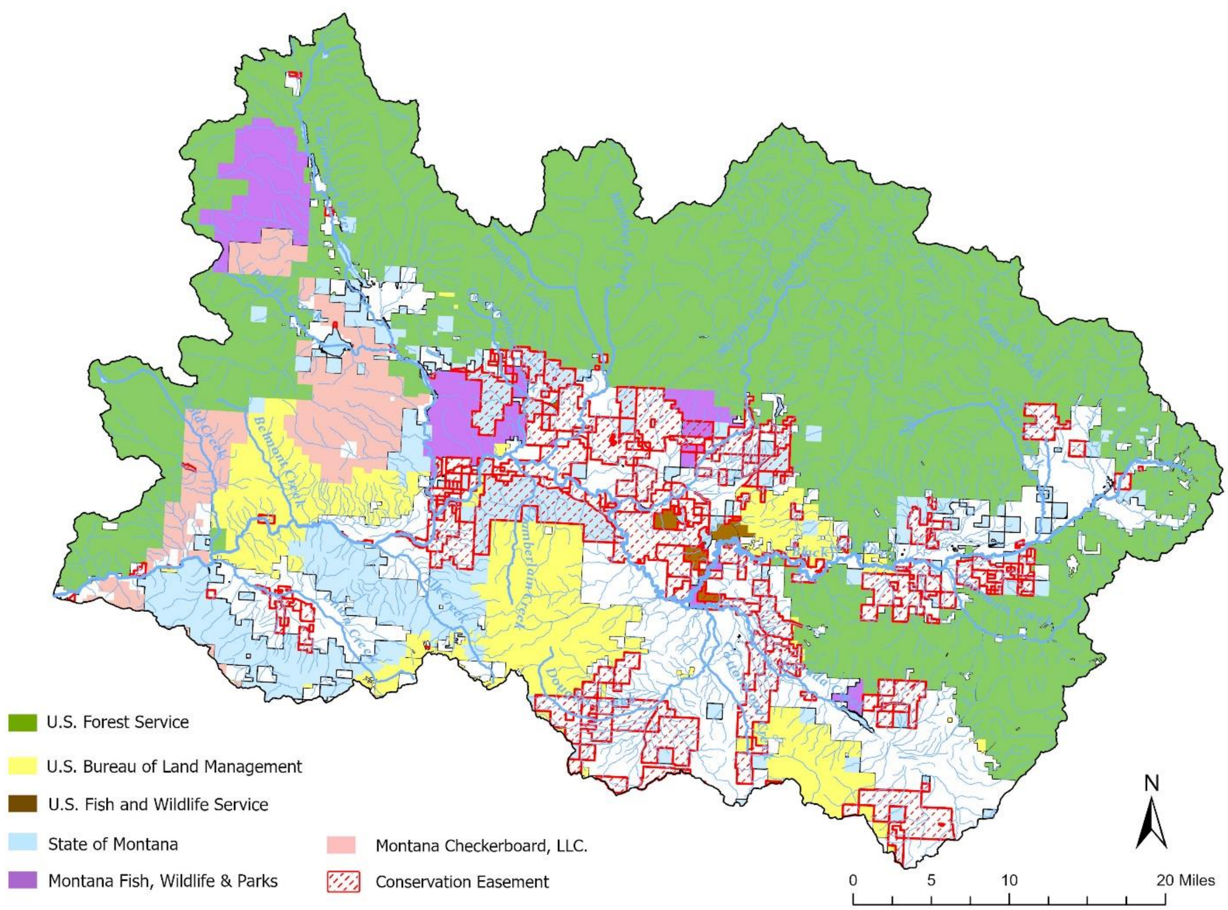

Figure 1. Map of the Blackfoot River watershed with land ownership in January 2024. Privately owned parcels (excluding Montana Checkerboard, LLC.) are shown in white.

Over 200 individual projects have been completed throughout the watershed. Projects are designed to meet the specific biological limiting factors of streams based on contemporary sampling results and recommendations in Pierce et al. (2005). Opportunistic projects with willing landowners are also implemented in important areas. Projects employ a diversity of habitat actions ranging from culvert and barrier removal to complete channel reconstruction. As the restoration program progressed over the decades, the effectiveness of projects has been demonstrated and landowners have gained trust in the practitioners and their methods, creating opportunities for additional restoration efforts. Moreover, projects have increased in scale in recent years, with many projects encompassing several thousand feet of channel reconstruction and activation of historical channel alignments (e.g., Nevada Creek and Poorman Creek).

A variety of fish screens have been installed throughout the drainage including, Coanda screens, paddle-wheel McKay style fish screens, rotary drum screens, and Farmers screens. Specific designs are selected to minimize maintenance, maximize screening efficacy, and reduce the burden on water users. Water users are encouraged to take part in the operation and maintenance of fish screens, particularly small, user-friendly screens (e.g., Coanda, farmers, and Zinvent). Annual maintenance of several priority screens is completed by a contractor funded by BBCTU. Screening has been prioritized in important spawning tributaries with migratory native trout. Given the lack of dedicated screen tenders, prioritization of screens is critical to ensuring that the initial cost and long-term operation and maintenance is commensurate with the fishery benefits. All active diversions on the North Fork Blackfoot River, Cottonwood Creek, Monture Creek, and Dunham Creek are screened.

The Upper Blackfoot Mining Complex cleanup has been a top priority since the dam failure occurred in 1975. Many biological (Spence 1975; Moore et al. 1991; Peters and Spoon 1989), ecological (Wilcox et al. 2014), and geomorphic (Vandeberg et al. 2011; Pierce et al. 2012) surveys were completed to inform development of the remediation and subsequent channel restoration plans. In 2009, Montana DEQ, Montana NRDP, and the USFS initiated cleanup and completed a water treatment plant. Since that time, over one million cubic yards of contaminated material have been removed and hauled to the repository. The restoration and mine waste removal have been completed downstream of the water treatment facility to the Pass Creek marsh. Prior to restoration, multiple survey sites were sampled to develop a rigorous effectiveness monitoring study. Post-reclamation monitoring has been encouraging with rapid recolonization by trout in all impacted monitoring sections downstream of the old tailings reservoir (see *Results and Discussion*).

Fisheries inventories and project monitoring

Periodic surveys of the Blackfoot River occurred in the 1970s through the mid-1980s, but lacked consistent frequency. The first comprehensive survey of the Blackfoot River designed to investigate fisheries status and potential limiting factors was conducted in 1988 (Peters and Spoon 1989). The initial surveys sought to identify limiting factors in primary tributaries and were expanded in subsequent years to include many other tributaries with limited fisheries and habitat information. Following the first decade of targeted inventories and monitoring, practitioners and biologists developed two prioritization documents that synthesized sampling information, ranked restoration candidate streams according to biological, social, and financial considerations, and described project categories to address limiting factors (Pierce et al. 2002;

Pierce et al. 2005). Furthermore, the prioritization documents are pragmatic about working in areas that provide the most meaningful conservation benefit for the particular investment. Several telemetry studies were integral to understanding life history characteristics (Swanberg 1997, Pierce et al. 2007), habitat use, potential limiting factors, and project effectiveness (Pierce et al. 2014).

Novel genetic techniques have enabled new tools for monitoring bull trout populations in the drainage. Genetic assignment models allow individual bull trout to be assigned to their natal tributary (Knotek et al. 2016). Relative contribution of various tributaries to mainstem bull trout abundance can be assessed and evaluated through time to determine if projects in spawning and rearing tributaries are increasing recruitment to the mainstem Blackfoot River. Furthermore, this tool provides a baseline by which to compare future mainstem captures. In tributaries with declining migratory or presumed resident bull trout populations, this tool allows evaluation of reestablishment of migratory life histories following extensive restoration actions. This tool also contributes information on life history diversity and expands knowledge of unique movement patterns, such as adults produced in Monture Creek and North Fork Blackfoot River overwintering in Salmon Lake (Knotek et al. 2016).

Previous synthesis efforts have highlighted many of the long-term case studies associated with the Blackfoot restoration program. Pierce et al. (2019) describe the origin of the Blackfoot River restoration program, the key components responsible for its success, and highlight several valuable case studies associated with abiotic and biotic responses to restoration efforts in a variety of stream types in the watershed. Direct linkages between natural channel design and reductions in temperatures have been documented in many streams (e.g., Kleinschmidt Creek, Pierce et al. 2014). Other key findings include a shift in species composition in the mainstem river, suggesting the targeted restoration approach in priority tributaries has increased production of native species. Tributary monitoring has enabled inferences between increased spawning and rearing activity in restored tributaries to increased native species abundance in the mainstem Blackfoot River. Multiple case studies were published demonstrating the effectiveness of restoration through natural channel design principles and represent some of the most informative long-term evaluations in the stream restoration literature (e.g., Pierce et al. 2013; Pierce et al. 2015; Pierce et al. 2019).

Several robust case studies in the Blackfoot River watershed provide valuable insight that continue to inform restoration and conservation efforts (Pierce et al. 2019). With the long history of projects in low and mid-elevation sections on ranchland and former industrial timberland, the increasing focus of native species conservation work in pristine headwater areas will complement the ongoing habitat restoration work in the valley. The proposed North Fork Blackfoot Native Fish Conservation project in the Scapegoat Wilderness above North Fork Falls (Pierce et al. 2018), provides a great opportunity to initiate a type of project with demonstrated success in other parts of Montana, such as the South Fork Flathead River (Boyer et al. 2008) and Cherry Creek (Clancey et al. 2019). The future of the Blackfoot River conservation and restoration program will benefit from implementing similar projects to provide the best chance of long-term persistence of westslope cutthroat trout and bull trout as climate change contracts thermally suitable habitat and restricts distributions to these important headwater areas.

Objectives

The overarching goal of this monitoring report is to disseminate fisheries information and provide robust data to guide future conservation and restoration efforts in the Blackfoot River watershed. We also include a summary report (see *Standalone Reports*) documenting recent surveys in the North Fork Blackfoot River upstream of North Fork Falls to support implementation of the proposed native fish conservation project. This report builds upon the previous 15 reports covering fisheries investigations from 1988-2020. Specific objectives of sampling activities in 2021-2023 were:

1) Monitoring river temperatures in priority, long-term locations to evaluate drought plan triggers.
2) Monitoring completed restoration projects to assess fish population response and evaluate longevity of habitat project components.
3) Conducting pre-restoration surveys in project areas to establish biological baselines to assess restoration response with before-after study designs. Specific focal areas include Nevada Creek and Cottonwood Creek.
4) Evaluating long-term trends in trout abundance and species composition in the mainstem Blackfoot River.
5) Assessing genetic integrity of westslope cutthroat trout in the Blackfoot River and North Fork Blackfoot River monitoring sections.
6) Evaluating UBMC remediation efforts and fish population responses to completed restoration actions.
7) Monitoring spawning index sections to assess status and trends of adult bull trout.
8) Conducting additional baseline surveys in the upper Nork Fork Blackfoot River drainage to inform development of the native fish conservation project and increase the robustness of effectiveness monitoring.
9) Conducting gill net surveys in lowland lakes, mountain lakes, and reservoirs to evaluate the stocking program.

METHODS

Electrofishing

Tributary surveys were conducted with backpack, barge, or boat electrofishing units depending on bankfull width and discharge (Figure 2). Tributaries were surveyed using single-pass, multi-pass, or mark-recapture methods depending on section length, habitat complexity, and sampling objectives. For example, effectiveness monitoring sections were established in Poorman Creek using mark-recapture techniques rather than multi-pass depletion because of significant project length (>1,000 feet) and the goal of evaluating changes in trout abundance with a before-after study design. Mark recapture techniques provide an unbiased estimate of abundance in wadeable streams, whereas multi-pass techniques can underestimate population abundance when model assumptions are violated (e.g., constant capture probability among passes, Rosenberger and Dunham 2005).

We commonly used single-pass electrofishing to provide a simple measure of relative abundance in small streams where species presence and distribution were primary survey goals.

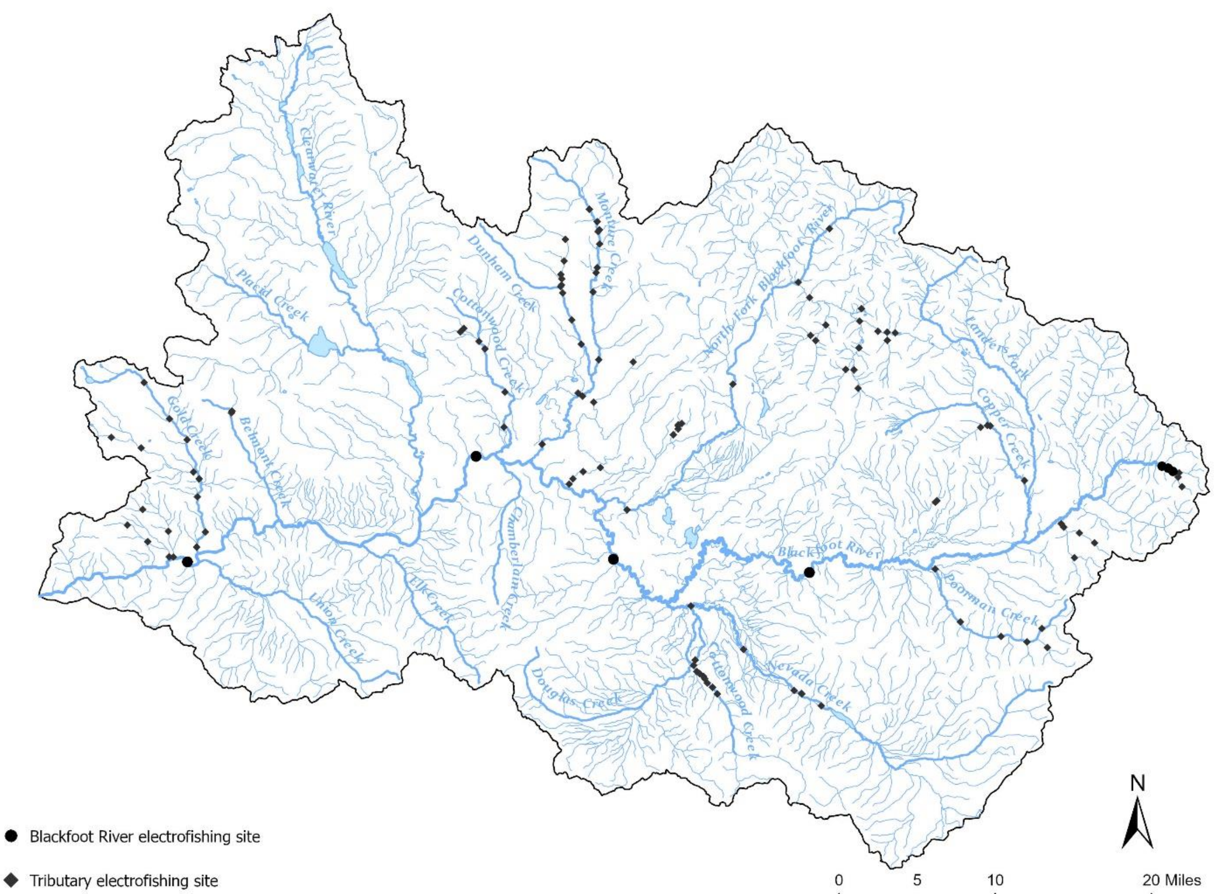

Figure 2. Map of electrofishing sites in the Blackfoot River (circles) and tributaries (diamonds), 2021-2023.

Single-pass electrofishing estimates can provide robust trend evaluations when capture efficiencies are high and remain relatively constant through time and space (Hanks et al. 2018). Catch per unit effort (CPUE) refers to the number of fish collected in a single electrofishing pass standardized per 100 feet of stream length. We switched to multi-pass depletion techniques for recent monitoring needs in some streams, but retained CPUE figures in this report because historical results were limited to relative abundance estimates. A summary table with CPUE statistics is located in Appendix A. Depletion estimates are located in Appendix B. Mark-recapture estimates of abundance for the Blackfoot River and tributaries are located in Appendix C.

Blackfoot River surveys in the Johnsrud, Scotty Brown, and Wales Creek sections were conducted using two drift boat electrofishing units operating separately along each bank. Typically, a single marking event and recapture event were conducted in each section. However, two marking runs were conducted in the Johnsrud section in 2023 due to low sample size during the initial marking run. Durations between mark and recapture events were seven days in 2021 and 6-7 days in 2023. Surveys were conducted on the ascending limb of the hydrograph in 2021 and the descending limb in 2023. In 2021, surveys were conducted between 4,892 cfs and 6,812 cfs (measured at the USGS Bonner Gage). In 2023, surveys were conducted between 3,315 cfs and 7,048 cfs.

The Canyon Section was surveyed with a single drift boat at baseflow conditions in September 2023. We also used a single drift boat to electrofish the Harry Morgan section in the North Fork Blackfoot River. A barge shocking unit was used to sample Nevada Creek Phase 3 and Phase 7, but a drift boat shocker was used in Phase 1 and the section at stream mile 4.6. Backpack electrofishing units were used in all other tributary shocking surveys. A single backpack shocker covered the stream in those surveys.

Following capture, all fish were anesthetized with clove oil. After fish were sufficiently anesthetized, measurements of total length and weight were taken on each individual. Adult bull trout captured in the Blackfoot River were scanned for passive integrated transponder (PIT) tags. If fish were selected for genetic sampling, a tiny portion of the anal fin was removed and placed in a vial with 95% ethanol. Individuals were inspected for visible signs of hook scarring as they were weighed and measured. If sampling included mark recapture techniques, a small portion of the upper or lower caudal fin was clipped to create an identifiable mark. After processing, individuals were placed in a live well (metal frame with mesh netting) in the stream until they were fully recovered and then released in slow water.

All age class breaks (e.g., age-0 versus age-1+) were based on length-frequency histograms. All estimates of abundance in this report were calculated with 95% confidence intervals. Trout species composition in the Blackfoot River was calculated as a percent of the total catch for fish six inches and longer. All sampling locations are referenced by river-mile or stream-mile. Sampling personnel differentiated westslope cutthroat trout from rainbow trout and hybrids based on phenotypic characteristics (e.g., slash and spotting patterns). Hybrid trout with predominately westslope cutthroat trout characteristics were included in the cutthroat trout abundance estimates. However, hybrid trout with predominately rainbow trout characteristics were included in the rainbow trout abundance estimates.

We estimated abundance using a Chapman estimator (Seber 1982) as follows:

$$N = \frac{(m+1)(c+1) - 1}{r+1},$$

where N is the population estimate, m *is* the number of marked fish, c is the number of fish captured in the recapture sample, and r is the number of marked fish captured in the recapture sample.

For fish population estimates in small streams, we used a Zippin two-pass depletion estimator (Zippin 1956) and standard equations for calculating variance. We estimated abundance as,

$$N = \frac{(n_1)^2}{n_1 - n_2}$$

$$P = \frac{n_1 - n_2}{n_1} \ ,$$

where N is the point estimate, n_1 is the number of fish collected on the first pass, n_2 is the number of fish captured on the second pass, and P is the probability of capture. In the few situations where a three passes were necessary, we used a maximum likelihood estimator described by Carle and Strub (1978). We estimated abundance as,

$$N = [n + 1 / n - T + 1]\ [kn - X - T + 1 + (k - i) / kn - X + 2 + (k - i)]_{\mathrm{i}} \ ,$$

where N is the population estimate, i is survey pass number, k is total number of passes, C_i is number of fish caught in i^{th} sample, X is an intermediate statistic, and T is total number of fish caught in all passes.

Gill net surveys

Lakes and reservoirs were sampled using experimental gill nets deployed during single overnight sets. Lowland lakes and reservoirs were surveyed with a combination of sinking and floating gill nets. Both styles of nets were 125’ x 6’ (five 25’ panels: 0.75", 1", 1.25", 1.5", 2" square mesh). Mountain lakes were sampled using sinking gill nets that were 125’ x 4’ (five 25’ panels: 0.75", 1", 1.25", 1.5", 2" square mesh). Nets were deployed late-evening (usually between 17:00 and 20:00) and retrieved the following morning. This resulted in typical soaking durations of 10-15 hours. Nets in lowland lakes were deployed using a motorboat, whereas nets in mountain lakes were set using a float tube or packraft. In mountain lakes, nets were typically tied off to shore (small mesh) and the remainder of the net was stretched out and attached to a float. Nets deployed in lowland lakes had the small mesh side deployed near the shore in 5-6 ft of water and the larger mesh end was tied to a float after it was extended out perpendicular to the shore until taught. Gill net catch was standardized as fish per net night. Most mountain lakes have not been surveyed since a basin-wide lake survey effort in 2005-2006 (Pierce et al. 2008).

Bull trout genetic assignment model

We collected a small tissue sample from the anal fin of all bull trout captured in the Blackfoot River for assignment to natal tributaries. The genetic assignment model was developed with baseline sampling from all known bull trout tributaries in the Blackfoot River and Clearwater River drainages. Bull trout populations typically exhibit a high degree of genetic differentiation because of their high propensity to home to natal tributaries to reproduce. Therefore, genetic assignment models can assign individual bull trout to their natal tributary (Knotek et al. 2016). This technique is undergoing refinements with increased sample size for tributary baselines, incorporating additional tributaries into the model, and leveraging advancements in genetic tools to increase accuracy of assignments. As new samples are analyzed, previous assignments are reanalyzed with the new baseline information to increase assignment accuracy. The development and validation of the Blackfoot and Clearwater genetic assignment model is described in detail by Knotek et al. (2016).

Bull trout redd counts

Single-pass spawning ground surveys were conducted annually in late-September in the North Fork Blackfoot River, Monture Creek, Dunham Creek, Copper Creek, Snowbank Creek, Belmont Creek, and Gold Creek (Table 1). The BLM fisheries staff conducted surveys in Belmont Creek during 2021-2023 and USFS fisheries staff conducted surveys in the Copper Creek drainage. Surveys in Dunham Creek were expanded in 2018 to include the entire section of perennial flow downstream of Cottonwood Lakes Road to the confluence with Monture Creek following observations of zero redds in the index section in 2018 and 2019 (Uthe et al. 2021). Redds were counted if they included all defining features (i.e., pit and tail) with a minimum diameter of approximately one meter. An expanded redd count was conducted in Monture Creek in 2022 from the upstream extent of the upper section (Monture guard station trail crossing) to the confluence of Wedge Creek. With declining redd counts in recent years (see *Results and Discussion*), the expanded survey was conducted to determine if spawning activity was occurring upstream of the typical spawning section to develop a better understanding of current bull trout status. Several constrictions and a prominent waterfall were observed in the canyon section between the confluences of Yellowjacket Creek and Wedge Creek (see *Results and Discussion*).

Redd counts are reported by tributary drainage. Although some additional sections were incorporated into annual surveys after index sections were established, we report combined totals for each tributary drainage to provide a better understanding of contemporary bull trout status. Therefore, assessments of long-term trends prior to expanded redd counts need to account for these temporal biases.

Table 1. Survey sections consistently monitored for bull trout spawning activity in tributary streams.

Drainage	Stream	Section	Initial Year
Gold Creek	Gold Creek	Index	1998
Belmont	Belmont Creek	Index	1996
Monture	Monture	Index	1988
Monture	Monture	Upper	1996
Monture	Dunham	Index	1999
Monture	Dunham	Lower	2018
North Fork Blackfoot River	North Fork Blackfoot River	Index	1988
Copper Creek	Copper Creek	Index	1984
Copper Creek	Copper Creek	Upper	1996
Copper Creek	Snowbank Creek	Index	2008

Water temperature monitoring and streamflow

Tributary temperature loggers were operated in priority native trout areas, locations of past restoration projects, and specific areas to help inform potential restoration projects (Figure 3). We deployed several temperature loggers in Cottonwood Creek (Nevada Creek drainage) to assess longitudinal temperature changes and evaluate restoration opportunities and strategies (see *Standalone Reports*). Additional loggers were installed in lower Nevada Creek to assess longitudinal temperature changes downstream of the Douglas Canal to understand fish composition changes and inform restoration strategies (see *Standalone Reports*). Loggers were reinstalled in lower and upper Arrastra Creek to evaluate current suitability for the extant bull trout population. We also maintained loggers in bull trout spawning index sections in Monture Creek, North Fork Blackfoot River, Copper Creek, Snowbank Creek, and Gold Creek.

We maintained long-term temperature logger locations in the Blackfoot River and added new monitoring locations at the HWY 141 bridge (river mile 83) and the 4x4 Road upstream of Lincoln (river mile 111). The upper North Fork Blackfoot River backcountry loggers were decommissioned in 2021 (see *Standalone Reports*). We deployed new loggers throughout the

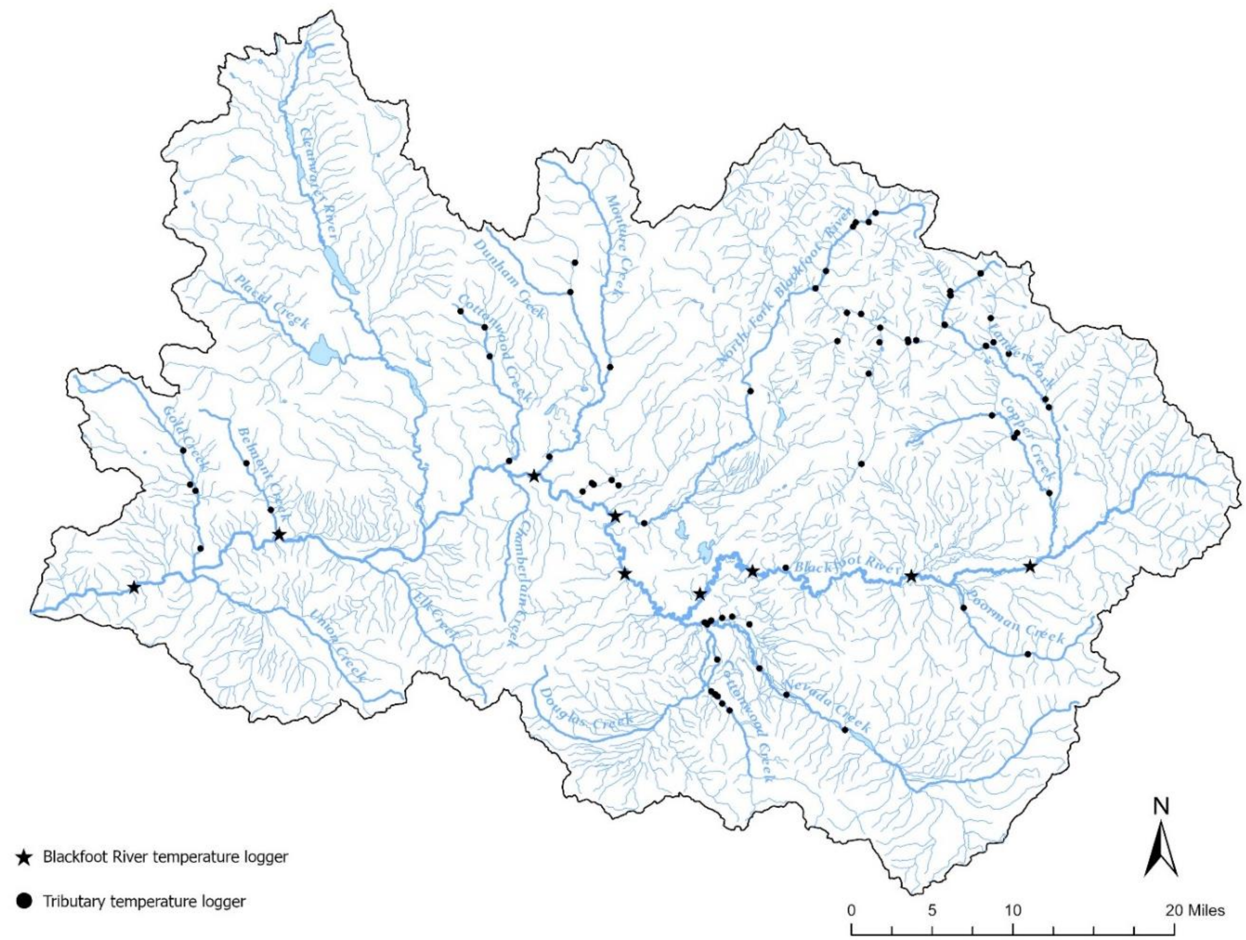

Figure 3. Map of temperature loggers in the Blackfoot River (stars) and tributaries (circles), 2021-2023.

upper Landers Fork drainage (upstream of Silver King Falls) to assess thermal regimes, thermal heterogeneity, and overall thermal suitability for bull trout. We did not deploy any streamflow loggers, but monitored USGS and DNRC gages for Drought Plan discussions and implementation of seasonal fishing restrictions.

RESULTS AND DISCUSSION

Blackfoot River water temperature and discharge

The Blackfoot Drought Response Plan was implemented each summer 2021-2023, but fishing restrictions were not enacted because hoot owl criteria were not met (Figure 4). River temperatures approached the threshold by early-July in 2021. Temperatures were expected to exceed criteria, but prolific smoke cover mediated the solar radiation and kept temperatures lower than expected for the duration of the summer despite ambient air temperatures above 90°F. Maximum temperatures declined more than three degrees on July 7, 2021, following an exceedance of 70°F on July 6, 2021. Water temperatures in the Blackfoot River exceeded the 71°F threshold for two days in 2022 and remained below the threshold in 2023 (Figure 5).

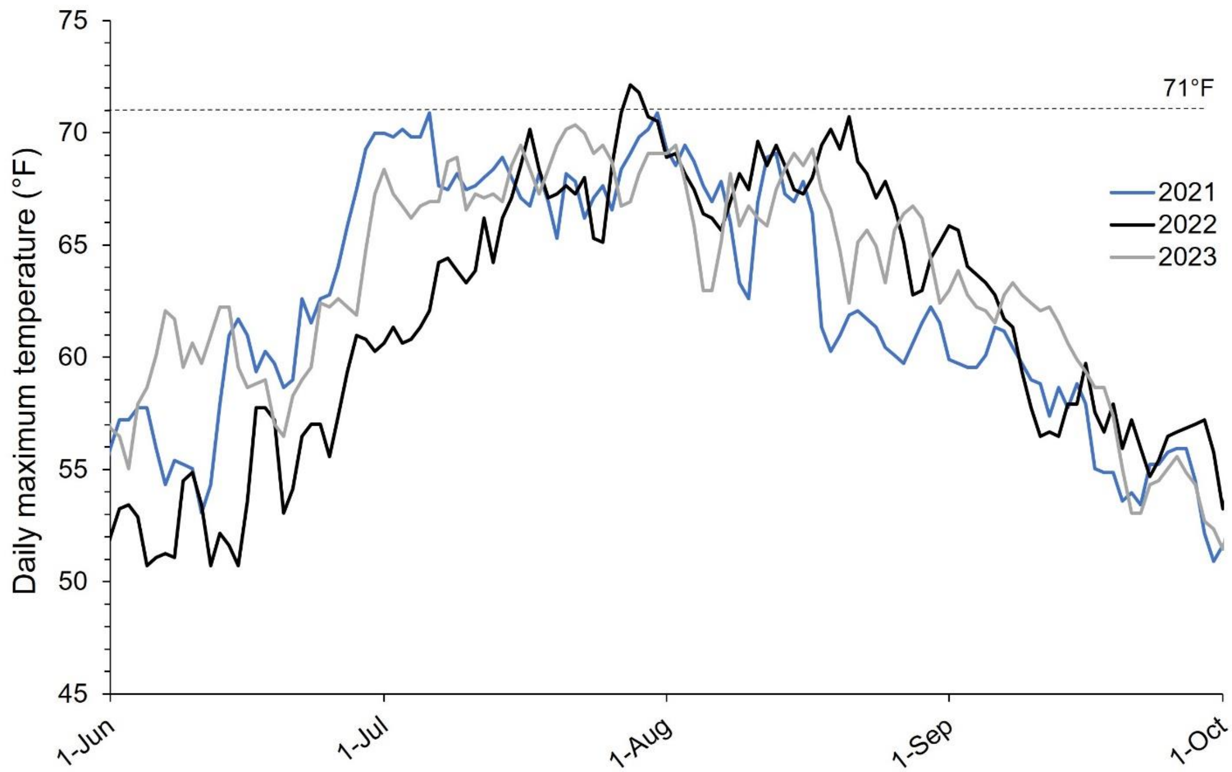

Figure 4. Daily maximum summer water temperatures in the Blackfoot River at the USGS gage station in Bonner, 2021-2023. The dashed line represents the 71°F temperature trigger for hoot owl restrictions in the Blackfoot Drought Response Plan.

Discharge was highly variable among years. Peak discharge was above normal in 2021 and 2023, but flows dropped below the median by July. In 2023, discharge peaked nearly a month earlier than normal and fell below the median by June 1 (Figure 6). Record air temperatures during the first week of May (≥ 90°F measured in Missoula) accelerated melting of the snowpack, causing

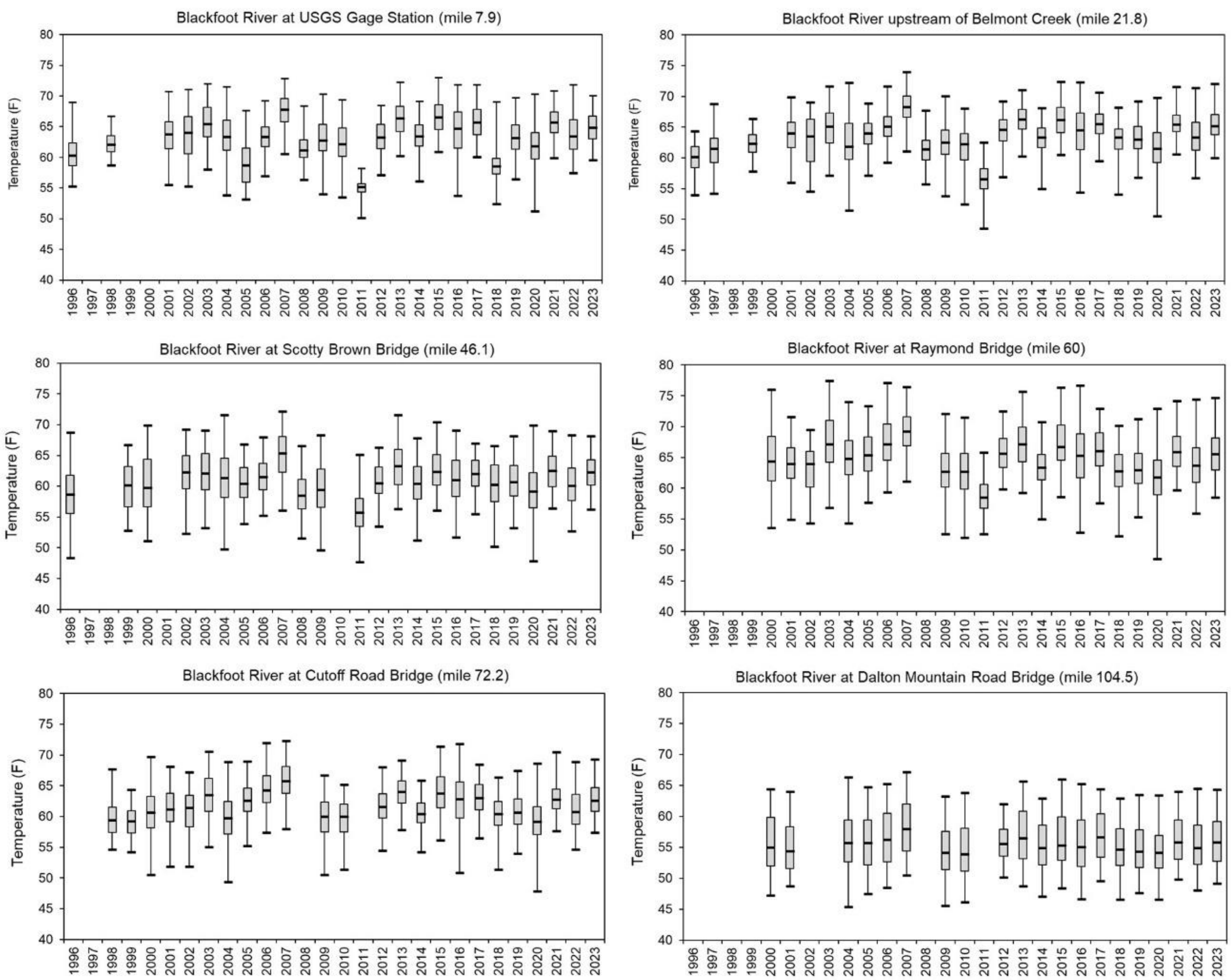

Figure 5. July water temperature summaries at six locations in the Blackfoot River, 1996-2023. Box plots show the minimum, median, maximum, and 25^{th} and 75^{th} percentiles.

early peak runoff. Peak discharge was only slightly above median in 2022, yet late season flows were much better than 2021 and 2023 despite above-normal peak flows in those years. The 2022 peak was slightly later than usual, which kept flows above median until mid-August. Discharge dropped below the 700 cfs trigger on August 11, 2021, August 14, 2022, and July 28, 2023. With

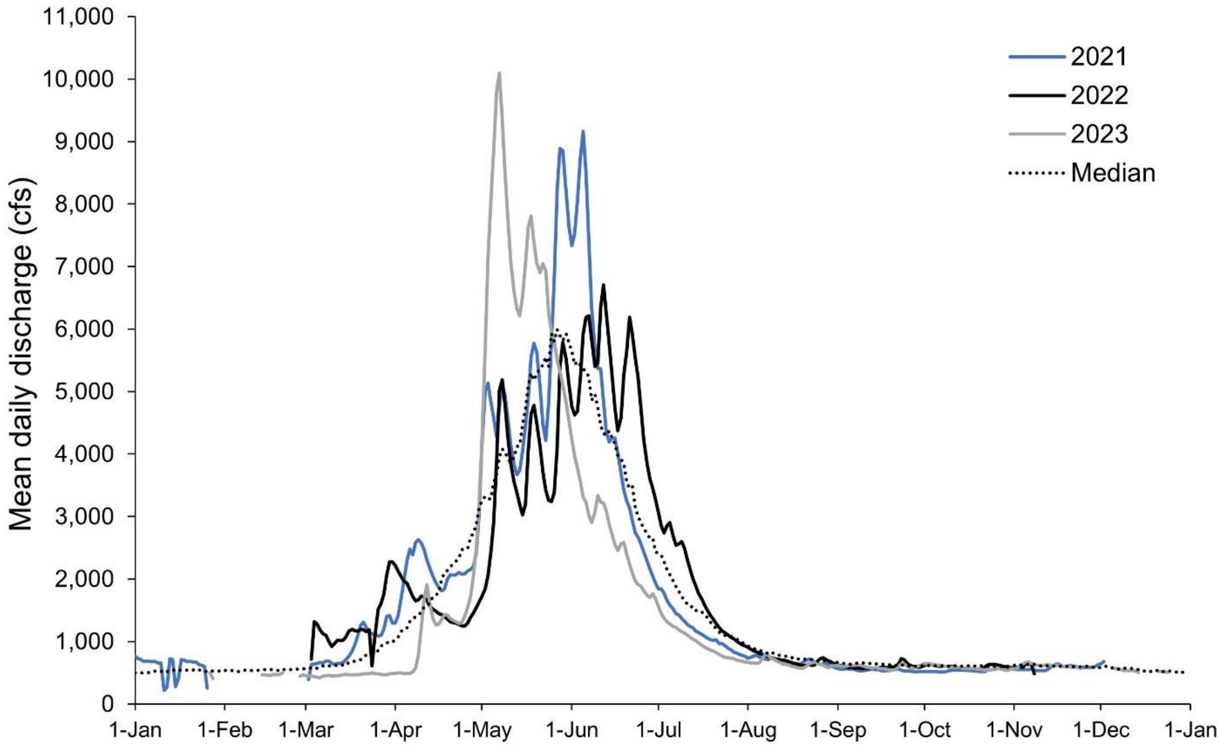

Figure 6. Mean daily discharge in the Blackfoot River at the USGS gage in Bonner, 2021-2023.

annual implementation of the Blackfoot Drought Response Plan over the last three years, the plan has been activated in 15 of the last 24 years.

Blackfoot River salmonid populations

Total trout abundance has been stable to increasing over the last decade (Figure 7). Abundance in the Johnsrud section is slightly below the previous long-term average (1989-2021) of 709 trout/mile. Abundance declined from 2013 to 2015 but remained relatively stable through 2021. Abundance increased considerably from 2021 to 2023, reaching a level very similar to the 2013 abundance. Abundance was elevated in the Scotty Brown section and significantly higher than the long-term average of 403 trout/mile. Similar to Johnsrud, the abundance of trout dropped from 2013 to 2014. However, the abundance has increased since then from a low of 338 trout/mile in 2014 to a recent high point of 575 trout/mile in 2023. The 2023 estimate is the second highest on record, and only slightly lower than the highest estimate of 587 trout/mile in 2012. Abundance in the Wales Creek section in 2023 was nearly double the long-term average of 68 trout/mile. The trend in the Wales Creek section over the last decade is very similar to the trend in the Scotty Brown section.

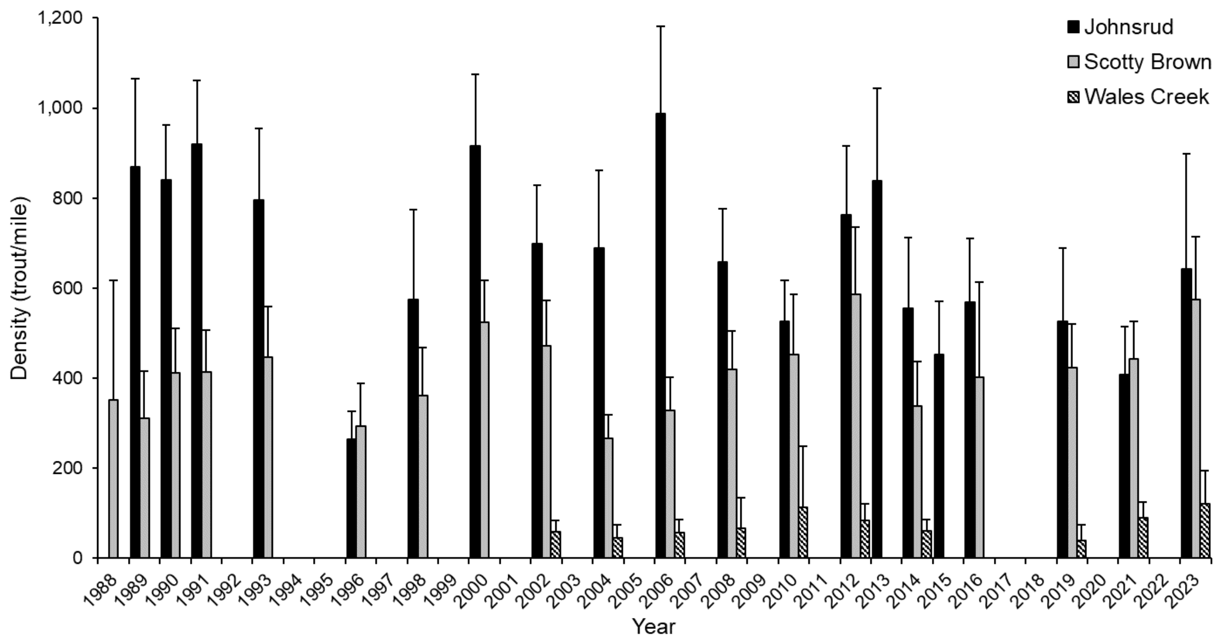

Figure 7. Abundance estimates and 95% confidence intervals (vertical bars) of trout with lengths six inches and greater, 1988-2023. Surveys in the Wales Creek section began in 2002. Surveys were not conducted in years without estimates.

Although trout abundance in the Blackfoot River has been relatively stable over the last few decades, short-term trends and variability exist among species (Figures 9-11). Rainbow trout abundance in the lower Blackfoot River declined through the early 1990s, likely due to the cessation of stocking in Seeley Lake in 1984 (Peters 1990). Estimates of juvenile rainbow trout were as high as 2,600 trout/mile in 1981 (Peters 1990), more than double the estimate of total rainbow trout when the Johnsrud surveys resumed in 1989. Hatchery-origin trout were documented moving downstream in the Clearwater River in 1983, indicating that the high abundance in the lower Blackfoot River during the early to mid-1980s was driven by the presence of stocked individuals. The decline in the late-1980s initiated a return to the natural baseline for rainbow trout at the time. Furthermore, the harsh winter of 1995-1996 also contributed to the record low 1996 estimate. A significant ice jam that was several miles long flowed from Nevada Creek to the Clark Fork River, scouring littoral zones and shifting substrate (Pierce et al. 1997). The impacts were particularly pronounced in the lower river, and most reflected in the subadult estimates since overwintering habitats used by juveniles were impacted most by this disturbance. Shoreline willow stands were reduced to 50-90% of previous densities, removing an important slow-water refuge during periods of high flow (Pierce et al. 1997). Trout densities have remained above that low point in both sections, except for 2004 in the Scotty Brown section.

Rainbow trout abundance has fluctuated more in the Johnsrud section than in the Scotty Brown section. This is largely driven by high variability in the 6–12-inch size class, indicating variable recruitment. Interestingly, adult rainbow trout (≥ 12 inches) have remained relatively stable over the period of record, fluctuating around a long-term average of 117 trout/mile in the Johnsrud section and 76 trout/mile in the Scotty Brown section. The abundance of adult rainbow trout in the Johnsrud section between 1989 and 2023 fluctuated from 41 to 174/trout mile.

Between 1980 and 1989, the abundance ranged from 48 to 238 trout/mile, including the time that hatchery origin trout were migrating into this section (Peters 1990). The estimate of 41 trout/mile in 2021 was the lowest on record, followed by one of the higher estimates in 2023, indicating that these fluctuations are within the natural range of long-term variability for rainbow trout in the lower Blackfoot River. The relative stability of the larger size class suggests that adult trout are at or near carrying capacity, while the subadult size class is highly influenced by sporadic bouts of increased spawning activity, which do not carry through as strongly to the adult age class. Lower Blackfoot River tributaries provide spawning habitat for Clark Fork River rainbow trout (Frey et al. 2021), so a proportion of the subadult age class may out-migrate to the Clark Fork River before transitioning to maturity. This might contribute to the more damped variability in adult rainbow trout compared to subadult trout. Rainbow trout have increased in recent years in the Wales Creek section, indicating a potential improvement in river conditions in the reach between Nevada Creek and the North Fork Blackfoot River. No rainbow trout were captured in the Canyon section in 2023, suggesting that rainbow trout distribution has remained relatively static in the Blackfoot River with little to no presence upstream of Nevada Creek.

There has been a basinwide increase in westslope cutthroat trout abundance. The trend has been most pronounced in the Scotty Brown section, which is the primary monitoring section for assessing westslope cutthroat trout status and trends. The middle Blackfoot River contains a high concentration of primary spawning and rearing tributaries for cutthroat trout, and this is reflected in the higher abundance in the Scotty Brown section. The long-term increase is due to a combination of harvest restrictions enacted in the early 1990s and comprehensive restoration actions over the last three decades. The consistent presence of westslope cutthroat trout and the increased abundance in recent years in the Wales Creek section is an encouraging indication that the long-term increase has extended over a broader spatial area. Ongoing restoration in Nevada Creek, as well as ongoing drought response actions, are likely creating improved conditions within this section of river and providing additional recruitment and increased survival, leading to increased abundance within the monitoring section. The abundance in 2021 was the highest on record, with a slight decrease in 2023. However, the recent years are still significantly higher than the 2002-2008 period. Continued restoration focus in tributaries within this section of the Blackfoot River will be important for facilitating the ongoing improvements in westslope cutthroat trout abundance. The Canyon section exhibits a similar long-term positive trend, although the abundance has remained relatively stable over the last decade. Similar trends within the lower North Fork Blackfoot River (*see Tributary Restoration Evaluations and Fisheries Monitoring*), provide compelling evidence of basinwide improvement in westslope cutthroat trout abundance.

We assessed the genetic integrity of westslope cutthroat trout in four mainstem sections. Johnsrud, Scotty Brown, and Wales Creek were assessed in 2021 while the Canyon Section was surveyed in 2023. Samples were collected from individuals classified as westslope cutthroat trout in the field based on phenotypic characteristics. The 2021 samples were analyzed using a single nucleotide polymorphic loci (SNPs) "chip", whereas the 2023 samples were analyzed using genomic techniques. Therefore, our power to detect small amounts of nonnative ancestry was greater in the Canyon section than the other three sections. The majority of westslope cutthroat trout in all sections were genetically unaltered. The proportion of westslope cutthroat trout without nonnative ancestry was 61% in Johnsrud, 80% in Scotty Brown, 90% in Wales Creek, and 74% in the Canyon section (Figure 8). The proportion of westslope cutthroat trout

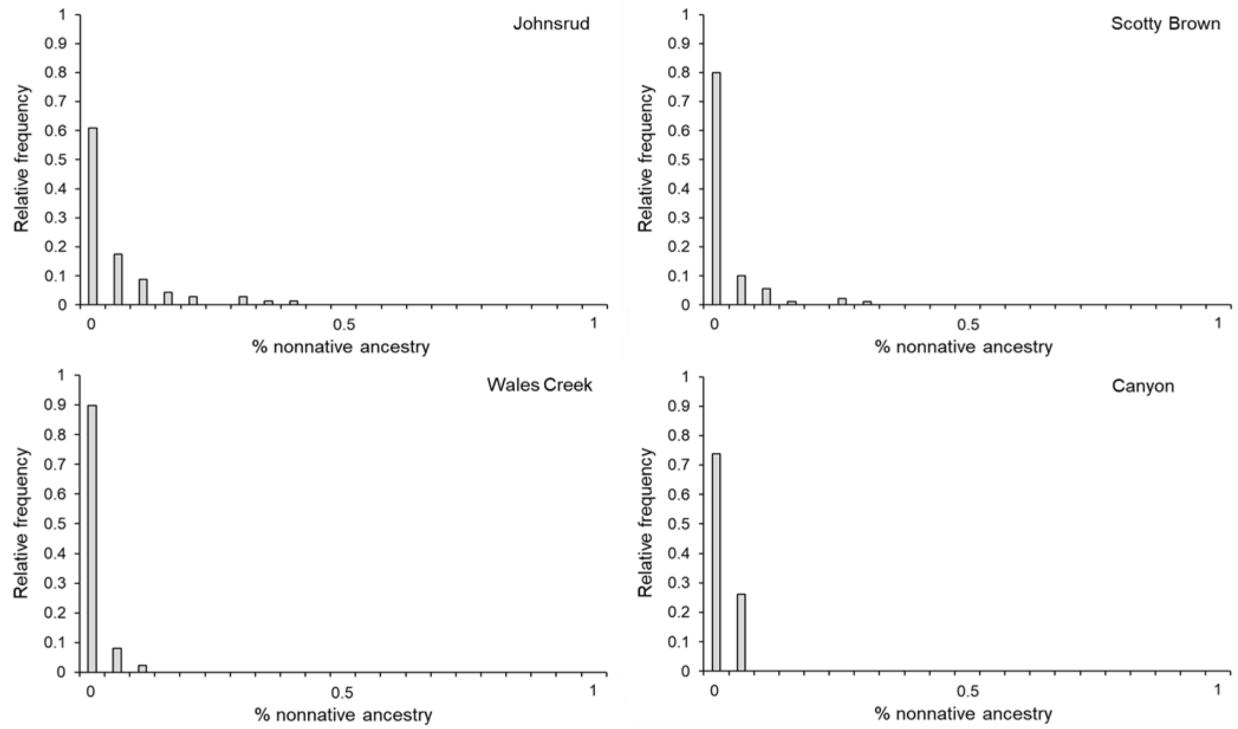

Figure 8. Relative frequency of percent nonnative ancestry in westslope cutthroat trout captured in four mainstem sections of the Blackfoot River. Samples in Johnsrud, Scotty Brown, and Wales Creek sections were collected in 2021 and analyzed using single nucleotide polymorphic loci (SNPs) "chips". Samples in the Canyon section were collected in 2023 and analyzed using genomic techniques.

with more than 90% cutthroat trout ancestry was 87% in Johnsrud, 96% in Scotty Brown, 100% in Wales Creek, and 100% in the Canyon section demonstrating that our phenotypic methods for distinguishing westslope cutthroat trout from rainbow trout and hybrid trout are relatively accurate. This is similar to other studies that have demonstrated relatively high accuracy for distinguishing highly hybridized individuals, but less accuracy if rainbow trout ancestry is less than 10% (Wiegel et al. 2002; Dangora et al. 2023). Interestingly, four trout from the Wales Creek section had small amounts of Yellowstone cutthroat trout ancestry (2-5%). Yellowstone cutthroat trout ancestry was not detected in any hybrid trout from the other sections (Kovach et al. 2021).

Brown trout abundance has generally been stable, except for a decline from 2012 to 2014. This decline was primarily driven by decreases in 6–12-inch brown trout. Similar to rainbow trout, the abundance of larger brown trout (12-18 and ≥18 inches) have remained relatively stable in both sections and oscillated around the long-term average. Despite the relative stability since the post-2012 decline, densities of most size classes in the Johnsrud and Scotty Brown sections were all below the long-term averages. The 12–18-inch size class was above the long term average of 24 trout/mile. Abundance in the Wales Creek section had declined from 2012 to 2021, but the estimate of 42 trout/mile in 2023 is consistent with the long-term average of 41 trout/mile. Similarly, brown trout have remained relatively stable in the Canyon section.

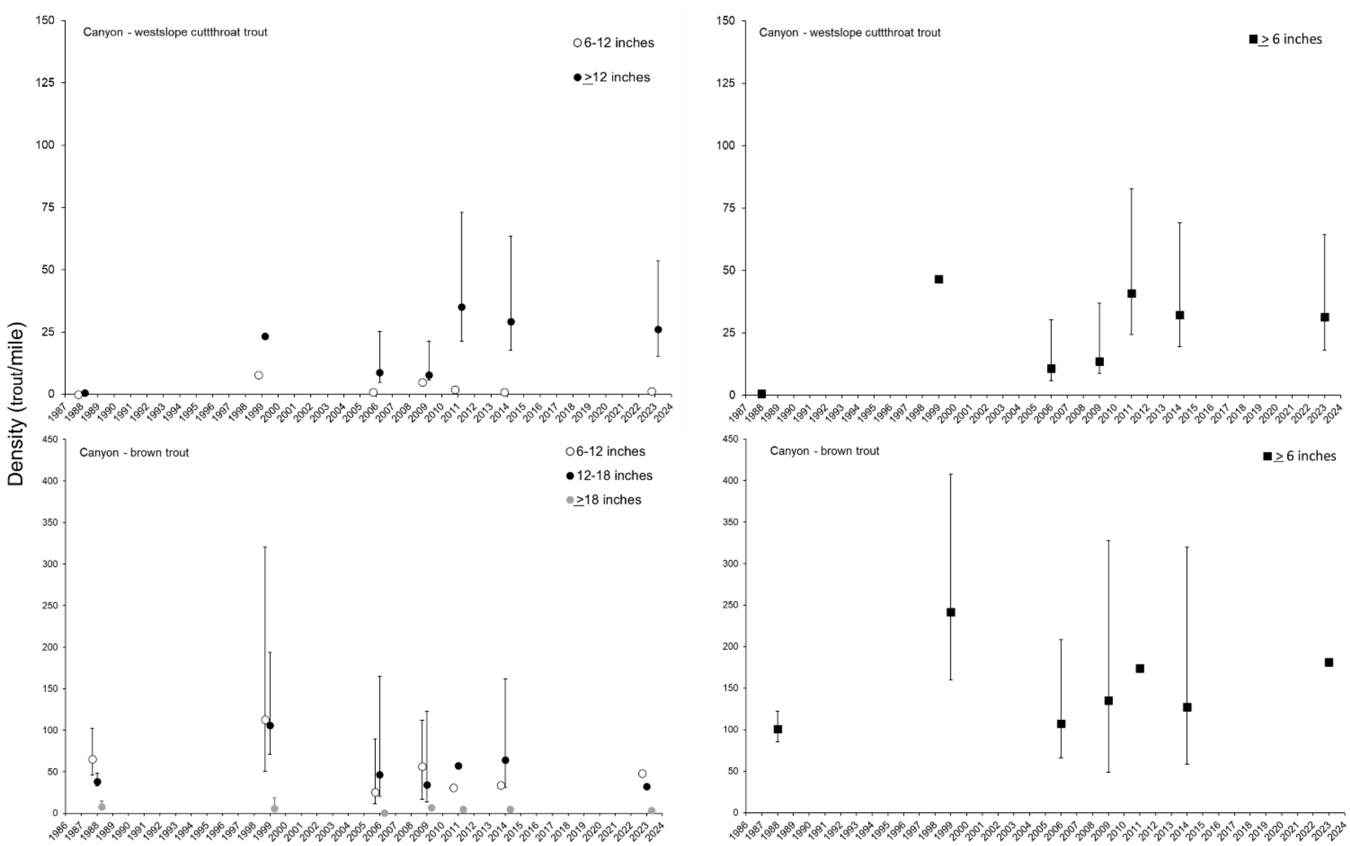

Figure 9. Estimates of trout density (95% confidence intervals) by species in the Canyon section, 1988 - 2023. The left panel displays estimates by size class and the right panel displays estimates for all trout ≥ 6 inches.

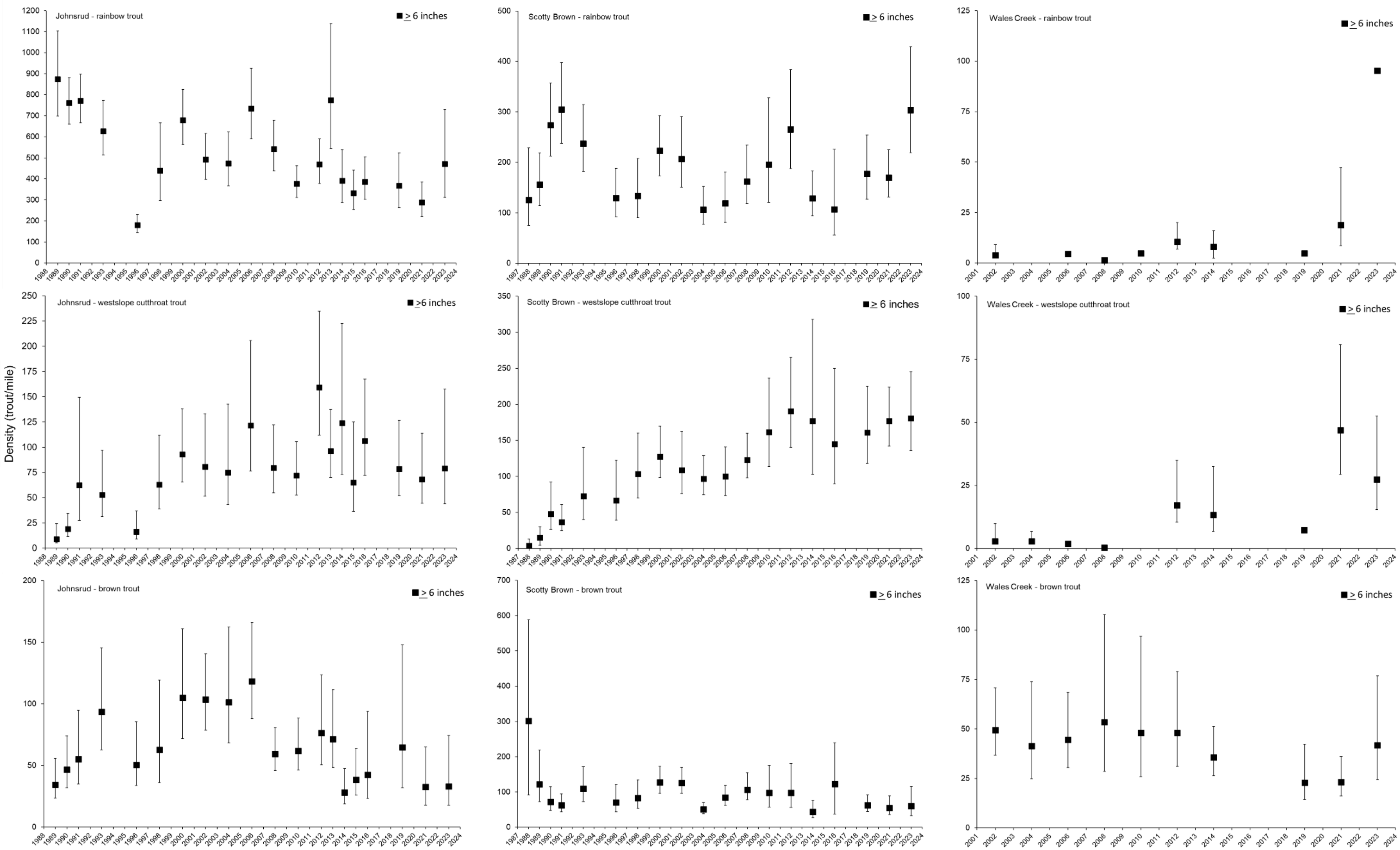

Figure 10. Density estimates of trout ≥ 6 inches in the Johnsrud, Scotty Brown, and Wales Creek sections of the Blackfoot River, 1988-2023. Surveys in the Wales Creek section did not begin until 2002. Note different Y-axis scales among species and sections. Estimates are shown with 95% confidence intervals.

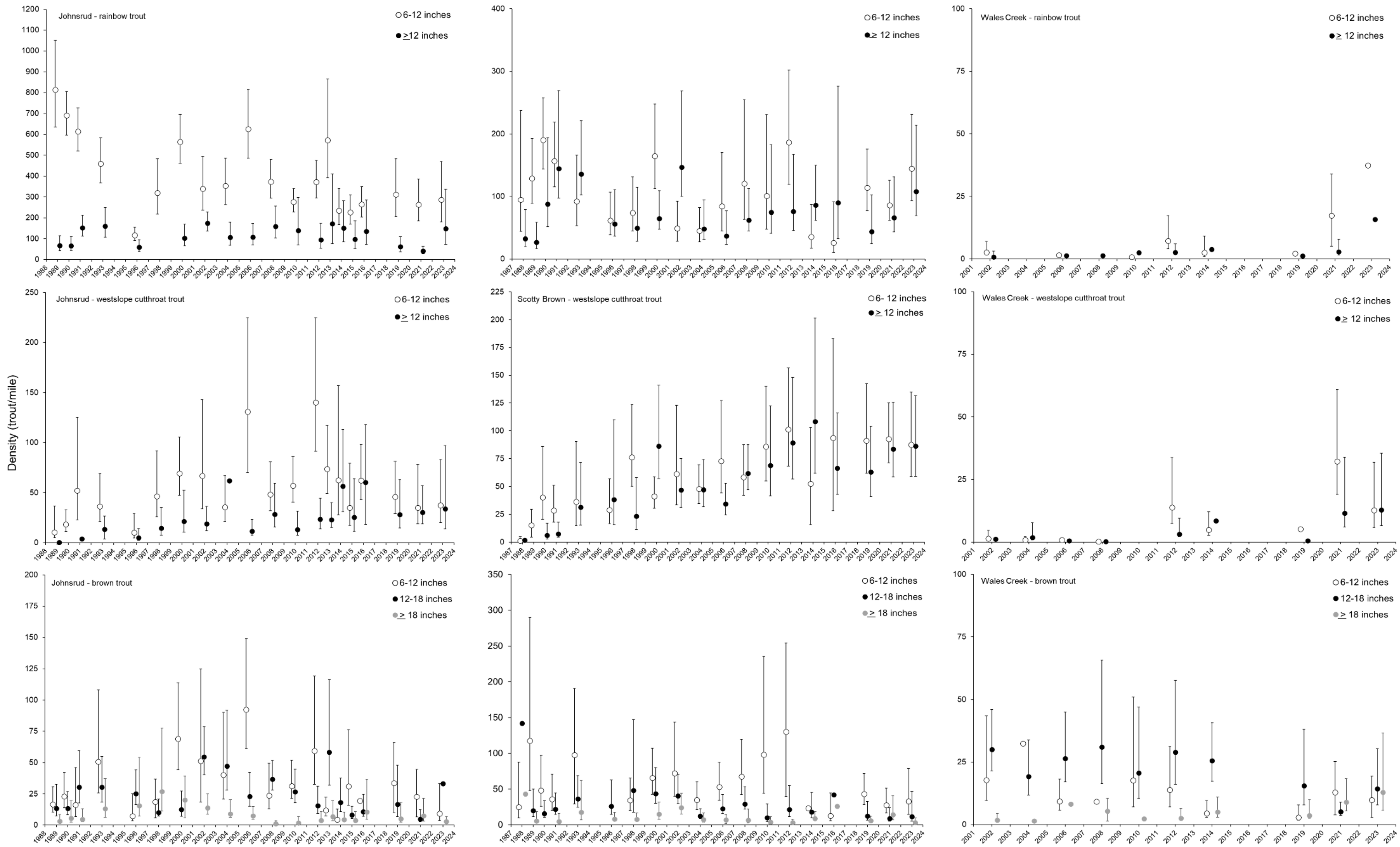

Figure 11. Density estimates of trout by 6-inch length class in the Johnsrud, Scotty Brown, and Wales Creek sections of the Blackfoot River, 1988-2023. Surveys in the Wales Creek section did not begin until 2002. Note different Y-axis scales among species and sections. Estimates are shown with 95% confidence intervals.

Mountain whitefish abundance in the Wales Creek section has remained very stable since monitoring began in 2008 and no significant differences have existed among years (Figure 12). Abundance of mountain whitefish is relatively similar between the Wales Creek and Canyon sections of the Blackfoot River. The Canyon section has been surveyed less frequently than the

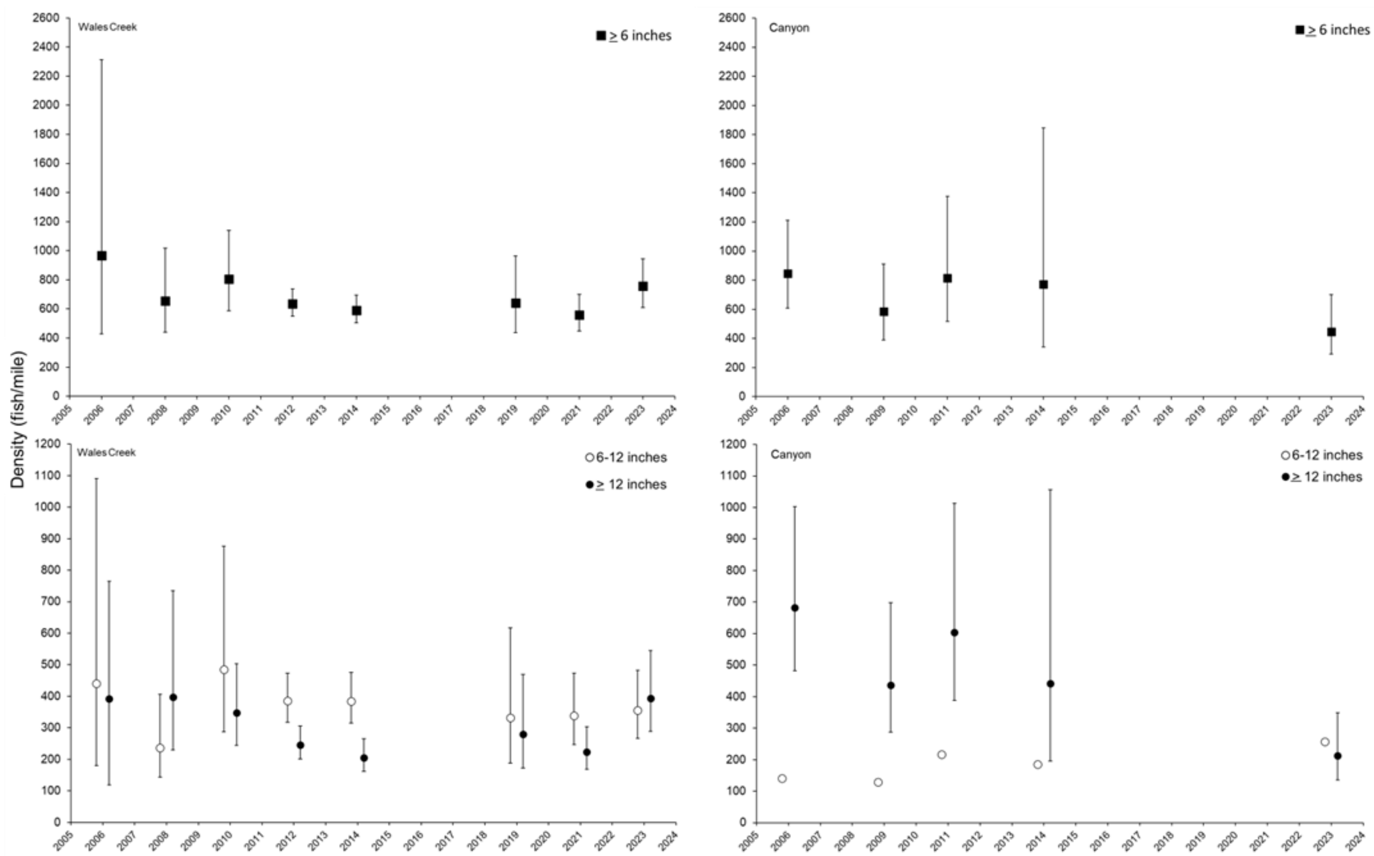

Figure 12. Estimates of mountain whitefish density in the Wales Creek (left panel) and Canyon (right panel) sections of the Blackfoot River. Top panel displays estimates for all individuals with lengths six inches and greater. The bottom panel displays estimates partitioned by size class for individuals with lengths of 6 to 12 inches (open circles) and lengths greater than or equal to 12 inches (closed circles). Surveys were not conducted in years without estimates.

Wales Creek section, but overall trends have been similar. However, mountain whitefish in the Canyon section exhibited a decline from the previous survey in 2014. Abundance in the Wales Creek section was very stable from 2012 to 2021 but exhibited an increase in 2023. Overall, the estimates in these two sections suggest that mountain whitefish populations in the Blackfoot River are stable and doing well. Lack of recaptures of 6-12-inch mountain whitefish precluded reliable estimates in the Canyon section (lack of confidence intervals in Figure 12). The channel morphology (e.g., deep scour pools) characteristic of the upper Blackfoot River reduces sampling efficiency of the drift boat electrofishing unit. Therefore, the Wales Creek section provides more reliable estimates. Continued monitoring will provide a better understanding of the long-term status and trends. It is unknown how well these sections represent the status and trends of mountain whitefish in the lower Blackfoot River.

Species composition varied among monitoring sections. Rainbow trout comprised the largest proportion of the trout community in the lower Blackfoot River (68% in 2021, 67% in 2023). Their proportion of the trout assemblage in the Scotty Brown section was similar to westslope cutthroat trout, but rainbow trout composition was higher in 2023 (47%) than 2021 (38%). Species composition exhibits a significant shift above the confluence with the North Fork Blackfoot River. Rainbow trout comprise a lower proportion than brown trout and westslope cutthroat trout, comprising only 18% and 23% in 2021 and 2023, respectively. Westslope cutthroat trout have exhibited a long-term increase in their proportion of the trout community, and it has remained relatively stable over the last several years. They comprised 18% in 2021 and 16% in 2023 in the Johnsrud Section. They had one of the highest proportions in the Scotty Brown section in 2021 with 44% but dropped down to 38% in 2023. However, this is consistent with the post-2010 average of 39%. Westslope cutthroat trout had the largest proportion on record in the Wales Creek section in 2021. They comprised 47% of the trout community in 2021 but dropped down to 33% in 2023. However, this is still above the post-2010 average of 22%. Bull trout proportions were similar to the long-term averages in the Scotty Brown and Wales Creek sections, but slightly above average in 2021 and 2023 in the Johnsrud section.

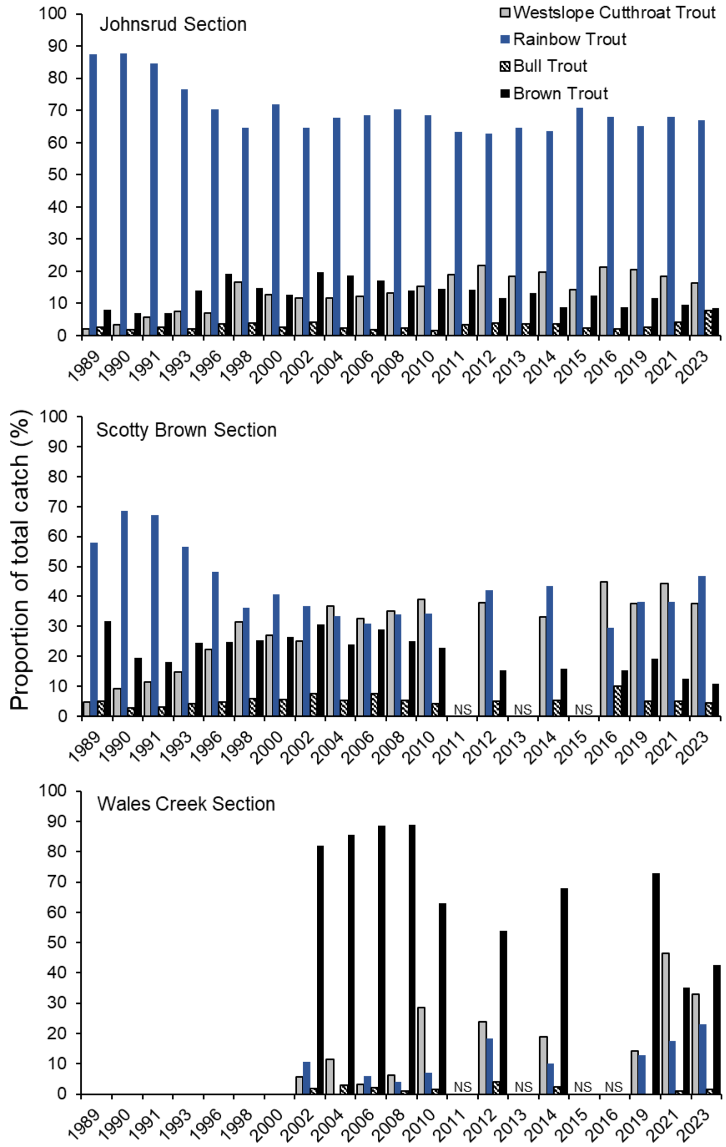

Figure 13. Species composition of trout (≥ 6 inches) in three mainstem Blackfoot River electrofishing survey sections, 1989-2023. Surveys in the Wales Creek section began in 2002. NS denotes years in which surveys did not occur.

The proportion of the community comprised by brown trout has declined slightly in all three sections. Brown trout are a larger percentage of the overall fishery in the Wales Creek section, followed by the Scotty Brown section, and then the Johnsrud section. The proportion in Johnsrud dropped from 12% in 2019 to about 9% in 2021 and 2023. The proportion in Scotty Brown dropped from 19% in 2019 to 12% in 2021 and 11% in 2023. Wales Creek had the most pronounced drop from 73% in 2019 to 35% in 2023. It increased to 43% in 2023, which is closer to the post-2010 average of 46%.

Bull trout monitoring

We collected 53 bull trout genetic samples from the Johnsrud section during the reporting period (2021, n = 21; 2023, n=32). Five additional samples were collected downstream of the Johnsrud section in 2023 during sampling efforts associated with a fish health study throughout the Clark Fork River basin. The updated assignment model performed well, with assignment probability greater than 99.9 % for all samples (Kovach et al. 2024). The majority of fish assigned to the North Fork Blackfoot River, which was similar to previous surveys (Figure 16). Bull trout from Rock Creek were captured in both years in the lower Blackfoot River, making this a consistent occurrence during electrofishing surveys since 2016 (Uthe et al. 2021). This indicates that movement among large rivers in the Clark Fork basin is common and bull trout are utilizing foraging, migrating, and overwintering (FMO) habitat across a large geographic area.

We collected 66 bull trout genetic samples in the Scotty Brown section during the reporting period (2021, n = 35; 2023, n = 31). Similar to assignments in the Johnsrud section, most fish assigned to the North Fork Blackfoot River (Figure 16). In 2023, the proportion of bull trout that assigned to Monture Creek was lower in the Scotty Brown section than in the Johnsrud section, which was contrary to the pattern documented in 2019 and 2021 (Uthe et al 2021). Furthermore, the overall proportion of bull trout in the Blackfoot River that assigned to Monture Creek was lower in 2023 than in 2019 and 2021. Interestingly, an individual captured in 2023 assigned to Fish Creek. However, Fish Creek was recently added to the genetic assignment model, and has genetic similarities to Monture Creek and Rock Creek, so results should be interpreted with caution. This was also the first time Clearwater River individuals were detected in the middle Blackfoot River. This provides additional confirmation of connection between the Clearwater River drainage and broader Blackfoot River watershed, similar to bull trout in Salmon Lake that assigned to the North Fork Blackfoot River and Monture Creek (Knotek et al. 2016).

We collected five bull trout genetic samples in the Wales Creek section during the reporting period (2021, n = 2; 2023, n = 3). All individuals assigned to the North Fork Blackfoot River. Bull trout are captured sporadically in the Wales Creek section. The last bull trout captured during electrofishing surveys occurred in 2014 (Pierce and Podner 2016). With such a small sample size it is hard to assess trends, but it is encouraging that bull trout were captured in consecutive sampling events through the reporting period.

Electrofishing surveys have illuminated a pronounced shift in size distribution of bull trout encountered in the lower and middle Blackfoot River (Figure 14). Following harvest restrictions in 1990, as well as other restoration actions to reduce and eliminate controllable sources of mortality (e.g., fish screens), larger individuals have been encountered with increased frequency. This suggests longevity of bull trout in the drainage has increased. The median length of bull trout captured during surveys in 2021 and 2023 was very similar in both events, and the lowest since 2008. The median indicated that about half of the bull trout encountered were mature and half were subadults. As part of the Milltown Dam removal evaluation, bull trout were PIT tagged in the Clark Fork River and Blackfoot River from 2010 through 2015. We captured three bull trout in 2021 that were originally tagged in 2012, 2013, 2014. Bull trout ageing studies have not been conducted in the Blackfoot River, but age and demographic studies have been conducted in Eastern Oregon (Al-Chokhachy and Budy 2008), the Flathead River drainage (Fraley and Shepard 1988), and St. Mary's River (Mogen and Kaeding 2006).

Table 2. Recapture history and estimated age range of PIT-tagged bull trout captured in the Blackfoot River.

Tag number	Tag Year	Recapture Year	Mark Length (in)	Mark weight (lbs)	Estimated age range at marking	Recapture Length (in)	Recapture weight (lbs)	Growth in Length (in)	Growth in Weight (lbs)	Estimated age range at recapture
380180914265693	2014	2021	18.3	1.84	5-8	26.0	5.51	7.68	3.67	12-15
985121021899124	2012	2021	11.2	0.49	3-5	30.1	7.32	18.90	6.83	12-14
982000357032707[a]	2013	2021	20.8	2.92	7-8	31.0	--	10.20	--	15-16

[a] Scale malfunction precluded accurate weight measurement in 2021.

Assuming relatively similar growth of migratory bull trout in the Blackfoot River, we estimate that these individuals were 3 to 8 years old at time of tagging and were likely 12-16 years old when recaptured in 2021 (Table 2). Interestingly, these individuals were not the largest encountered during surveys. A 34.6-inch (880 mm), 14-pound bull trout was captured in the Scotty Brown Section in 2023. It is the longest bull trout that has ever been captured during electrofishing surveys in the Blackfoot River (Figure 14). These results are similar to recaptured PIT-tagged bull trout encountered in 2019 (Uthe et al. 2021). Collectively, these results indicate that bull trout in the Blackfoot River are surviving to very large sizes and old ages (Figure 14).

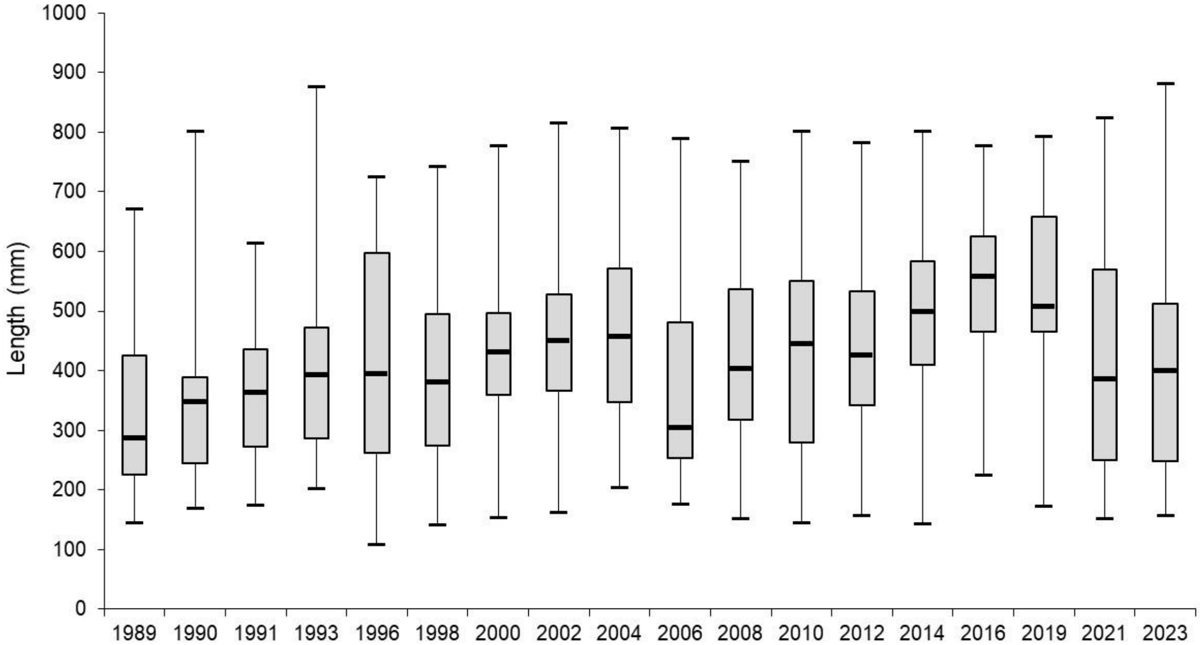

Figure 14. Lengths of bull trout captured in the Johnsrud and Scotty Brown Bridge monitoring sections of the Blackfoot River, 1989-2023; horizontal line illustrates the median values, boxes represent the 25th and 75th percentiles, and whiskers represent the minimum and maximum values.

Redd counts have been declining in the Monture Creek and Copper Creek drainages since 2012 (Figure 15). Aside from a short increase in Copper Creek from 2010 to 2012, a general declining trend has existed since the record high point of 2008. The 2023 counts in both drainages represent the lowest number of redds observed since consistent monitoring began in the late-1980s and early-1990s. Moreover, 2023 was the first year in which redds were not observed in the index section. Redds in the North Fork Blackfoot River have been declining since 2017. The redd count of 44 redds was the lowest since 2005. The six consecutive years of declining redds is longer than the three consecutive years of declining redds in the early 2000s. That previous decline was followed by a multi-year trough before increasing to the record high point in 2011. It is unclear if the current trend is similar to the early 2000s, with a slight decline rather than a trough, or if the North Fork will follow a similar long-term decline like the populations in Monture and Copper drainages.

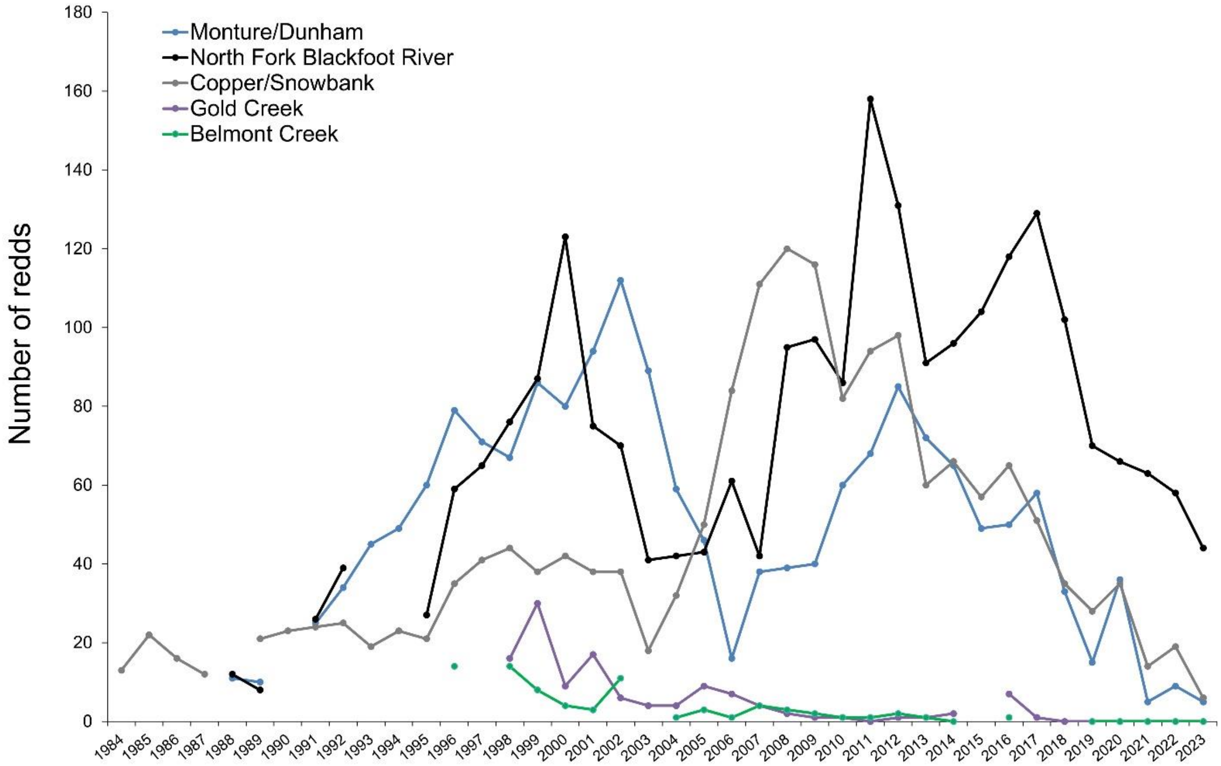

Figure 15. Redd counts from annual spawning surveys in priority bull trout tributaries, 1984-2023.

Redd counts in Gold Creek and Belmont Creek suggest local extirpation of migratory bull trout. Redds have not been observed in either drainage in several years, although surveys in Gold Creek identified seven redds in 2016 and one redd in 2017. However, no adult bull trout were observed and these redds may have been constructed by brook trout given that subsequent electrofishing surveys failed to locate juvenile bull trout (Uthe et al. 2021). Furthermore, expanded redd survey sections in Gold Creek in 2019 and 2020 did not observe any evidence of bull trout spawning despite an abundance of high-quality spawning and adult holding habitat in the upper section. It's unclear when the migratory component may have become extirpated because electrofishing surveys throughout the index reach in 2019 did not capture any juvenile bull trout (Uthe et al. 2021) and surveys in 2015 did not capture any either (Pierce and Podner 2016). Nonetheless, the continued lack of bull trout captured in electrofishing surveys throughout the spawning reach and the two individuals captured in lower Gold Creek that assigned to the North Fork Blackfoot River (see *Tributary Restoration Evaluations and Fisheries Monitoring*), suggest local extirpation. Unlike Gold Creek, bull trout continue to be captured consistently in upper Belmont Creek suggesting an extant population of resident bull trout in the headwaters. Redd count abundance among tributaries is consistent with assignment proportions of bull trout captured in the mainstem Blackfoot River.

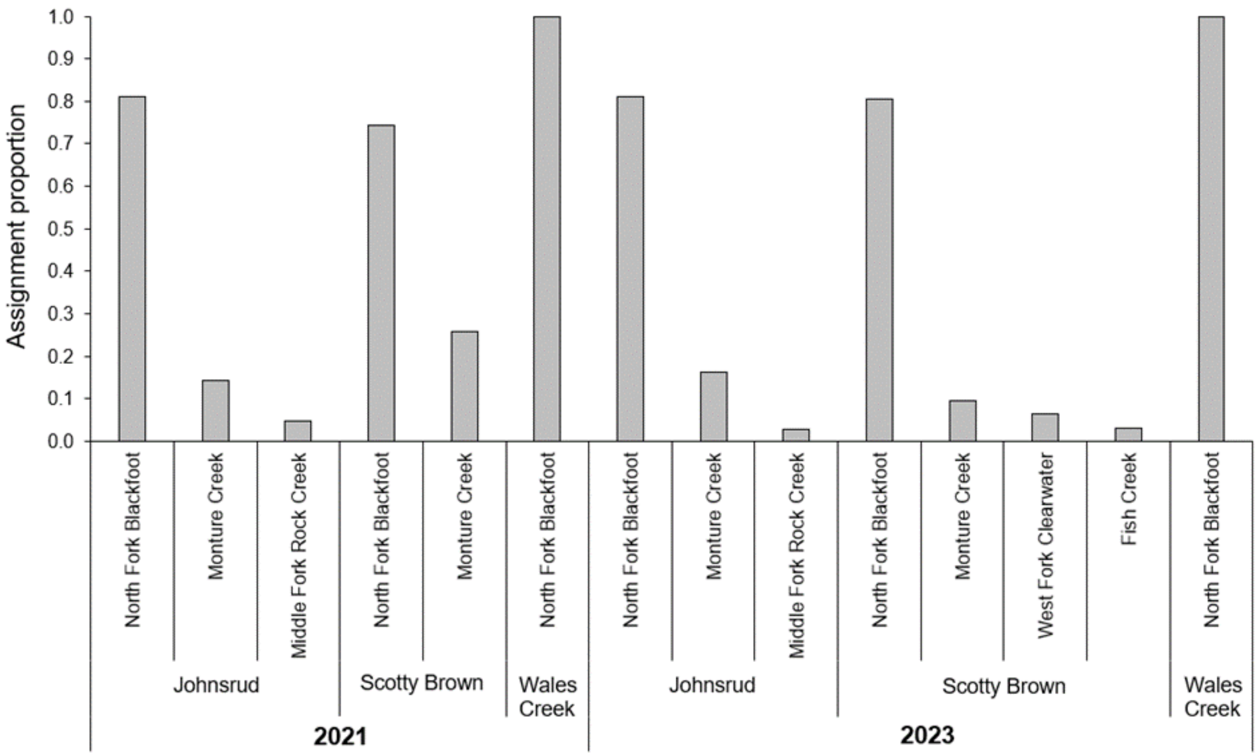

Figure 16. Assignment proportions of bull trout captured in the Blackfoot River electrofishing surveys, 2021-2023.

Stream temperatures in bull trout tributaries were warmer in 2023 than in 2022 and 2021 (Figure 17). The lower portions of many bull trout spawning tributaries continue to exhibit marginal to unsuitable thermal regimes (i.e., > 59°F, Fraley and Shepard 1989; Dunham et al. 2003). Lower Monture Creek had the highest median July temperature among all bull trout streams. The median exceeded the 59°F threshold in 2021 and 2023. Belmont Creek and the North Fork Blackfoot River consistently had lower maximum temperatures than all other tributaries. Temperatures in lower Gold Creek are consistently approaching or exceeding 65 °F. Interestingly, upper Gold Creek still has a suitable thermal regime for bull trout (see Appendix D). Recently installed loggers in the spawning index sections of the North Fork Blackfoot River and Monture Creek identified ideal thermal conditions persist in those portions of the drainages (see Appendix D). Moreover, temperatures within the upper portions of Cottonwood Creek and Copper Creek remain suitable (see Appendix D). Even though cold temperatures still exist in the upper portions of all drainages, bull trout abundance and distribution are highly variable among these streams. Although migratory components are apparently lacking in Cottonwood Creek and Belmont Creek, they support extant populations of presumed resident individuals. It is unclear what factors beyond temperature promote the existence of these remnant resident populations, but the decline and extirpation of the migratory life history form is correlated with a pattern of unsuitable water temperatures, which is consistent with previous analyses of statewide bull trout trends (Al-Chokhachy et al. 2016; Bell et. al 2021).

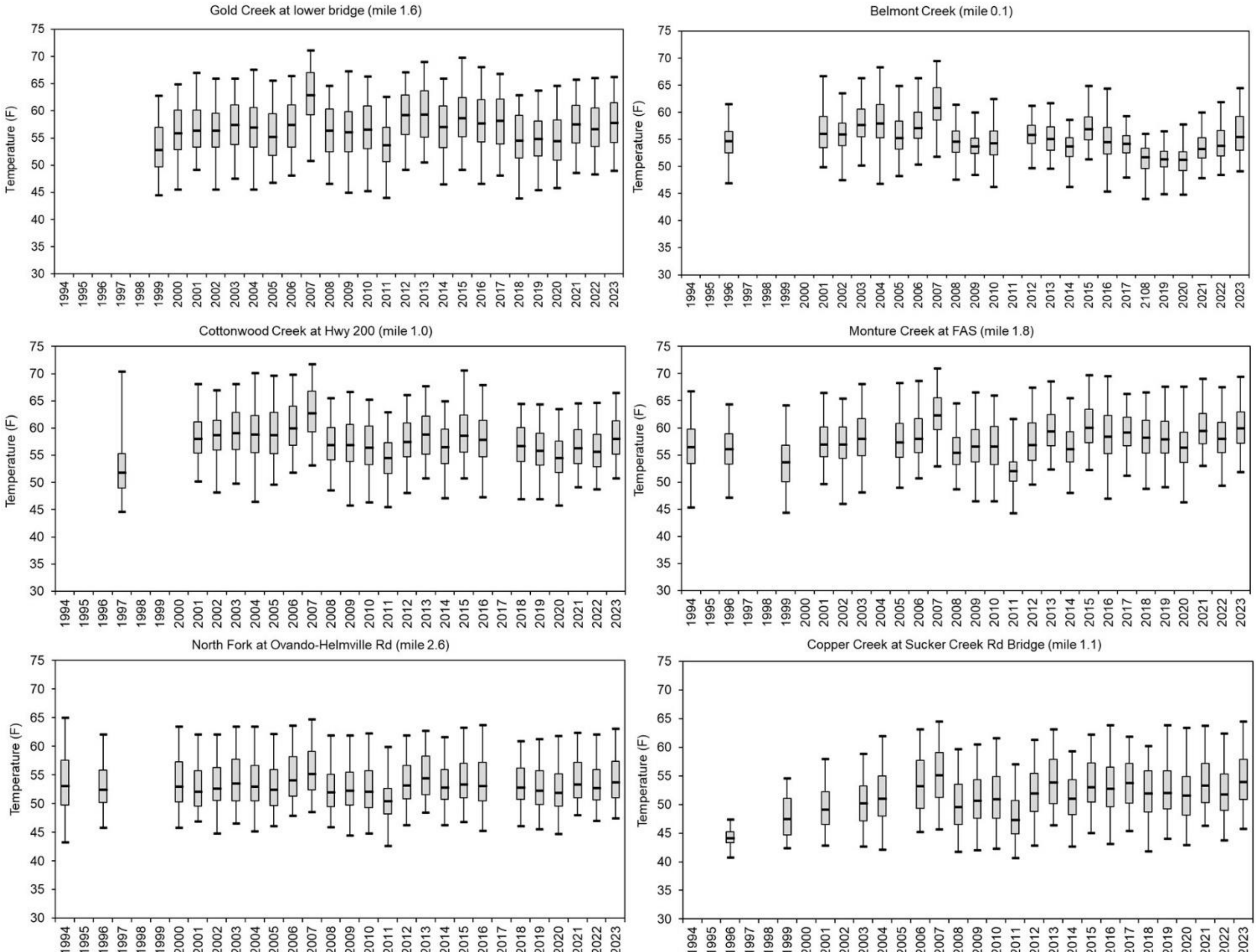

Figure 17. July water temperature summaries in six bull trout streams, 1994-2023. Box plots show the minimum, median, maximum, and 25th and 75th percentiles.

Tributary restoration evaluations and fisheries monitoring

Anaconda Creek

Anaconda Creek is a 2nd-order stream that flows from Continental Divide to its confluence with Beartrap Creek where they form the Blackfoot River. Anaconda Creek is located within the historical Upper Blackfoot Mining Complex (UBMC) about 15 miles east of Lincoln, MT. Anaconda Creek is located entirely on the Helena National Forest. Mining operations only affected the lower reaches of Anaconda Creek while leaving much of the mid to upper reaches unimpacted. Therefore, Anaconda Creek maintained a robust westslope cutthroat trout population while they were extirpated elsewhere in the UBMC. The restoration objectives in Anaconda Creek were to remediate historical mining impacts in the lower section and reconnect with Beartrap Creek to facilitate connectivity and migratory life history expression throughout the UBMC project area. The impaired lower section of Anaconda Creek was reconstructed and connected to the reconstructed Beartrap Creek channel in 2018.

In 2021-2023, we conducted post-restoration surveys in all reference reach and treatment reach locations. Prior to reclamation and restoration of the UBMC, we conducted electrofishing surveys in 2011 and 2012 to establish baseline abundance estimates in the reference reach at mile 0.5 in Anaconda Creek. Average trout densities were 26.8 trout/100 ft. Westslope cutthroat trout density decreased to the lowest on record in 2022 but increased slightly in 2023. However, the density estimate of 12.1 trout/100 ft is significantly lower than densities in 2011-2012 and 2020 (Figure 18). It is unclear if the recent low points are within the expected natural range of variability, or the reconnection facilitated considerable outmigration and a new post-reconnection baseline will take time to stabilize. Brook trout abundance has consistently increased since 2019. Densities were stable from 2011 through 2020, but have increased significantly since then. Brook trout comprised 32% of the trout community in the 2023 survey. Continued monitoring is necessary for understanding potential species composition changes and long-term westslope cutthroat trout status and trends associated with reconnecting Anaconda Creek.

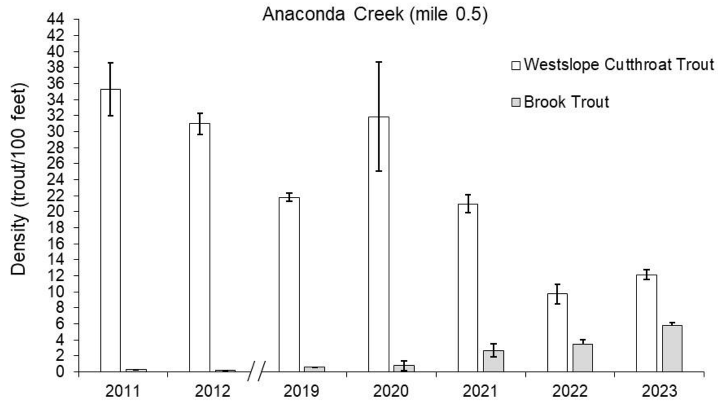

Figure 18. Abundance estimates for age -1 and older trout in Anaconda Creek at mile 0.5, 2011 – 2023.

Beartrap Creek

Beartrap Creek is a 2nd-order stream that flows from the Continental Divide to its confluence with Anaconda Creek where they form the Blackfoot River. Mike Horse Creek, a small 1st order stream, enters near stream mile 0.5 and contributes approximately 0.3 cfs to Beartrap Creek's average base flow of 2-4 cfs**.** Beartrap Creek is located entirely on the Helena National Forest. Beartrap Creek is located within the Upper Blackfoot Mining Complex (UBMC) area. Previous research identified high concentrations of toxic mining waste (e.g., heavy metals) in the floodplain, surface and ground water, and within fish and insects (Moore et al. 1991; Stratus 2007; Vandeberg et al. 2011). From 2009 through 2011, several studies investigated geomorphic and biotic conditions of streams in the UBMC Beartrap Creek to help develop restoration plans and serve as a basis for long-term monitoring of ecological response associated with reclamation efforts (Pierce et al. 2012; Wilcox et al. 2014). Remediation of the tailings pond and subsequent channel reconstruction of Beartrap Creek occurred in multi-year phases, with completion of Beartrap Creek restoration and floodplain reconstruction in 2018 (Figure 19). The goal of restoration work was to reconstruct the channel and floodplain through and downstream of the old Mike Horse tailings pond to restore full connectivity and facilitate migratory life history expression throughout the UBMC project area.

We conducted electrofishing surveys following completion of Beartrap Creek reclamation and channel reconstruction. The lower site (mile 0.35) was downstream of the Mike Horse Creek confluence (Figure 20). The upper site (mile 1.1) was upstream of the old tailings

Figure 19. Beartrap Creek below the dam in 1975 (left) and Beartrap Creek after restoration in 2023 (right).

pond. Both sites were devoid of fish in 2009 when baseline surveys were conducted before restoration actions. We observed rapid recolonization by brook trout at the lower site with a 6-fold increase in abundance from 2019 to 2023. A single westslope cutthroat trout was captured in 2022. The visual observation of a westslope cutthroat trout just upstream of the Anaconda Creek confluence in 2020, and this recent capture in 2022, suggest that westslope cutthroat trout are starting to pioneer into this area. The high density of brook trout may be precluding the consistent presence and establishment of westslope cutthroat trout in this section. We did not capture any fish at the upper site, indicating recolonization has not progressed that far upstream. The addition of another monitoring section in the old tailings pond footprint would help assess the spatial progression of recolonization.

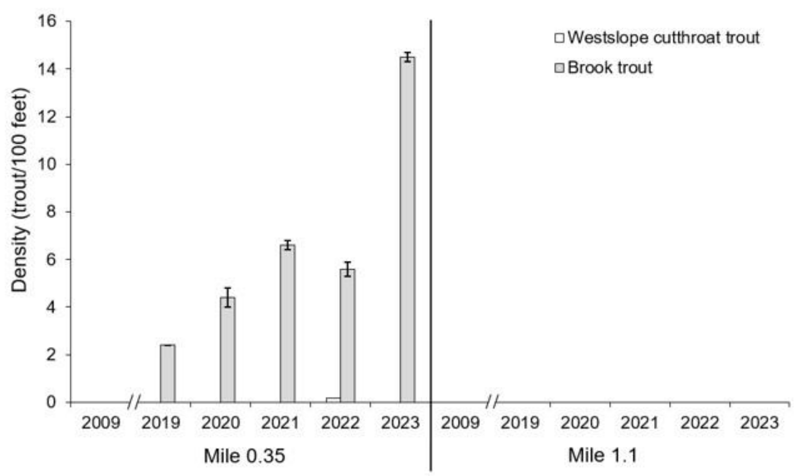

Figure 20. Abundance estimates for age -1 and older trout in Beartrap Creek, 2009 – 2023.

Belmont Creek

Belmont Creek, a 2nd-order stream with an average baseflow of 10-12 cfs, drains a 29.2 mi^2 watershed and flows southeast for 11 miles before entering the lower Blackfoot River near mile 21.8. Ninety-two percent of the Belmont Creek watershed was managed as industrial forest by Plum Creek Timber Company prior to The Nature Conservancy (TNC) purchases. Recently completed land transactions by the USFS and BLM have converted the TNC-purchased lands into public ownership, consolidating management of the Belmont Creek drainage. The three remaining sections of Montana Checkerboard, LLC land in Belmont Creek are currently under consideration and scoping for purchase by the BLM as part of the Gold Creek and Twin Creeks Proposed Land Acquisition.

Two prominent waterfalls are located in the bedrock-confined middle section of Belmont Creek. The lower waterfall is approximately 3 feet high and located near stream mile 4.6 (46.99208; -113.59253). There is a series of cascades directly above the primary waterfall. The upper waterfall near stream mile 4.7 (46.99268; -113.59322) is approximately 6-7 feet high. Westslope cutthroat trout genetic testing results from lower Belmont Creek (n=20) show relatively high introgression (32.6%) with rainbow trout, whereas genetic results from directly upstream of the upper waterfall indicate the population is 99.8% pure (Uthe et al. 2021). The significant difference in genetic integrity over a relatively short stream distance suggests that the waterfall is a periodic barrier to upstream fish movement. Alternatively, it may currently function as a complete barrier and nonnative fish could have migrated upstream when accessible in the past to cause the very low level of hybridization. Belmont Creek supports strong production of migratory rainbow trout for the lower Blackfoot River (Uthe et al. 2021).

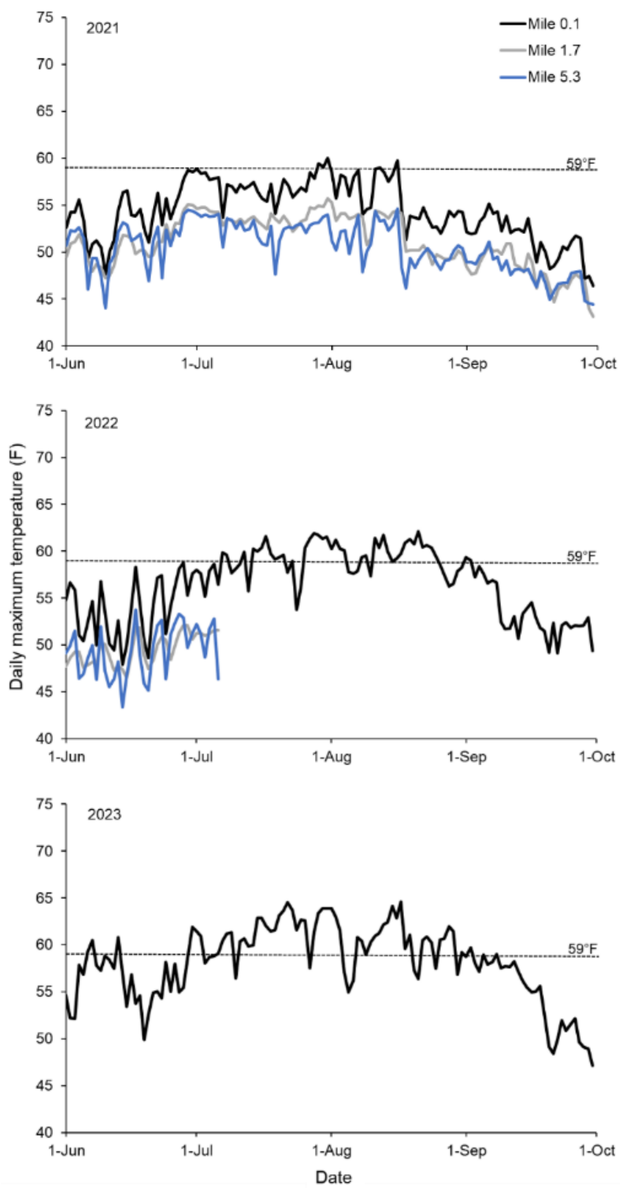

Figure 21. Daily maximum water temperatures at three locations in Belmont Creek, 2021-2023. The dashed line denotes the 59°F threshold for bull trout suitability.

Restoration actions have been implemented in Belmont Creek since the early years of the Blackfoot River restoration program. In the early 1990s, Plum Creek Timber Company and partners removed two undersized culverts that were seasonal passage impediments. In the early 2000s, BLM implemented habitat improvement projects and grazing management in the lower portion of the drainage. There were also several sediment reduction measures associated with logging roads including the installation of rolling dips, seeding, and closing roads after logging. In 2015, TNC completed road inventories to identify additional sediment reduction actions and riparian improvements (Inroads Consulting 2015). TNC removed an undersized bridge in 2016 that was blocking channel function and replaced it with an appropriately sized bridge to accommodate flows and passage of large woody debris. TNC also removed and decommissioned an undersized crossing structure near mile 8.4. In 2019, BLM and BBCTU decommissioned 5,295 feet of riparian road to reduce sediment input and riparian encroachment. They also removed an existing bridge and abutments at stream mile 1.7 to facilitate natural channel processes and floodplain connection. They also upgraded an undersized culvert on an unnamed, non-fish bearing tributary stream immediately upstream of the old bridge crossing. In 2020, BLM replaced the undersized 25-foot bridge on the corridor road with a 35-foot prefabricated steel bridge structure.

We conducted surveys in upper Belmont Creek in 2022 to collect additional bull trout genetic samples to develop a baseline for the population. Several bull trout were captured during electrofishing surveys in 2019 in lower and middle Belmont Creek (Uthe et al. 2021), but their origin could not be determined because the genetic assignment model did not have a robust baseline for the drainage. In 2022, we electrofished approximately 1,400 feet of stream length in the upper reaches of Belmont Creek, including a portion of the west fork (Township 15N, Range 16 W, Section 17). We captured 13 bull trout ranging in length from 80-268 mm. The size distribution and spatial context strongly supports the notion that this is a resident population. These bull trout were genetically similar to bull trout captured at stream mile 4.3 and 8.4 in 2019 and were combined to establish the genetic baseline for Belmont Creek. The bull trout collected in 2019 at stream mile 0.1 and 2.2 assigned to the North Fork Blackfoot River. The 2022 CPUE of 0.9 trout/100’ is lower than the relative abundance of a presumed resident bull trout population in upper Arrastra Creek (Uthe et al. 2021). Additional bull trout monitoring should be conducted throughout the Belmont Creek drainage to gain a better understanding of their distribution, population status, and trend.

Longitudinal temperature investigations revealed a consistently cold thermal regime throughout much of Belmont Creek (Figure 21). Daily maximum temperatures remained well below the 59°F threshold at stream mile 1.7 and 5.3. Moreover, daily maximum temperatures near the mouth were generally below the threshold in 2021, but consistently exceeded it in 2022 and 2023. The temperature loggers at stream mile 1.7 and 5.3 were discontinued in 2022, but recorded similar daily maximum temperatures in 2019 and 2020 (Uthe et al. 2021). Although the lower section of Belmont Creek frequently reaches temperatures considered marginal, and at times unsuitable for bull trout, most of the stream length appears thermally ideal for bull trout.

Copper Creek

Copper Creek is a 3rd order tributary to the Landers Fork, flowing 17.6 miles before entering the Landers Fork near mile 4.1. Copper Creek originates from two small cirque lakes (Upper and Lower Copper Lakes) within the Helena National Forest. Headwater tributaries are

Red Creek (mile 11.6), Cotter Creek (mile 11.5) and the North Fork of Copper Creek (mile 8.8). Snowbank Creek enters Copper Creek at mile 6.2. The upper 13.8 miles of Copper Creek are within the Helena National Forest, whereas the lower 3.8 miles flow through a mix of state, private, and Helena National Forest lands.

The Snow-Talon wildfire burned through the Copper Creek drainage during August 2003. The high intensity, stand-replacement fire burned significant portions of the basin, including the bull trout spawning section approximately three weeks prior to the spawning season. The basin continues its post-fire recovery and succession, which has recruited significant amounts of large woody debris to the channel. In 2019, a collaborative project between BBCTU and the USFS eliminated a problematic section of riparian road that was encroaching the stream channel and contributing sediment to upper Copper Creek.

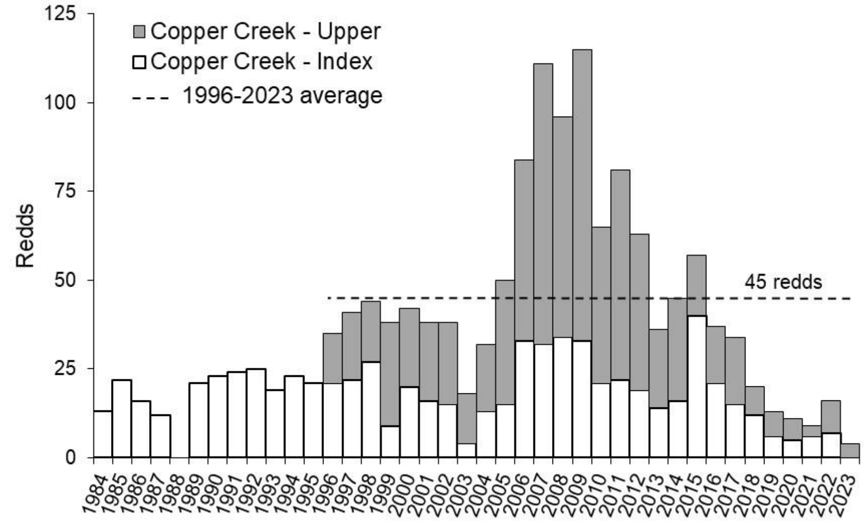

Figure 22. Bull trout redd counts in Copper Creek. White bars show redd counts in the long-term index section, 1984-2023. Grey bars show the redd counts in the upstream section monitored 1996-2023. The dashed horizontal line shows the combined long-term mean of 45 redds, 1996-2023.

Copper Creek supports an entirely native fish community. The mainstem provides spawning and rearing habitat for migratory bull trout and westslope cutthroat trout.
The USFS has conducted annual bull trout redd count surveys at an established index section since 1984. The survey section was expanded to include an additional section in 1996 when a telemetry study identified a major spawning area in upper Copper Creek. Since initiation of the additional survey section, the average total redd count in Copper Creek has been 45 redds. Recent redd counts have been significantly below the long-term average (Figure 22). In fact, 2023 was the first year without any redds in the index section.

Similar to trends identified by redd counts, 2021-2022 electrofishing surveys at mile 6.2 documented substantial declines in abundance of age-1 and older bull trout (Figure 23). Relative abundance of age-1+ bull trout was slightly higher in 2021 and 2022 compared to the overall low point in 2020, but the CPUE has remained well below the long-term average. Abundance of westslope cutthroat trout has been relatively stable since 2020 and similar to levels prior to the 2003 Snow-Talon Fire, which was hypothesized as a primary driver for the pronounced increase in abundance due to increased productivity following the fire (Pierce and Podner 2011). If the conditions responsible for driving the post-fire increase have subsided, the population may be reverting to pre-disturbance baseline levels.

The monitoring section near the Sucker Creek Road bridge (mile 1.1) was surveyed in 2022 after a lapse in sampling since 2004. Westslope cutthroat trout and sculpin were the only species captured, indicating that brown and brook trout have not expanded into Copper Creek. This is noteworthy because Copper Creek is the only bull trout tributary without established populations of brook trout or brown trout. The only record of brown trout presence within the Landers Fork drainage was a single individual captured at stream mile 4.6 in 1999. No surveys have been conducted since that time, so updated assessments are critical to determine if brown trout have become established. Brook trout are very abundant in the Blackfoot River upstream of the Landers Fork, so additional survey effort is needed to assess whether their distribution has expanded into the Landers Fork. The relative abundance of westslope cutthroat trout was slightly higher than previous surveys. Notably, 2022 was the only year except 2002 without any bull trout captured. The relative abundance of bull trout is usually low in this section, even following years of high bull trout spawning activity (i.e., production). Therefore, it is not surprising that they were absent in this section given the overall decline of bull trout in Copper Creek.

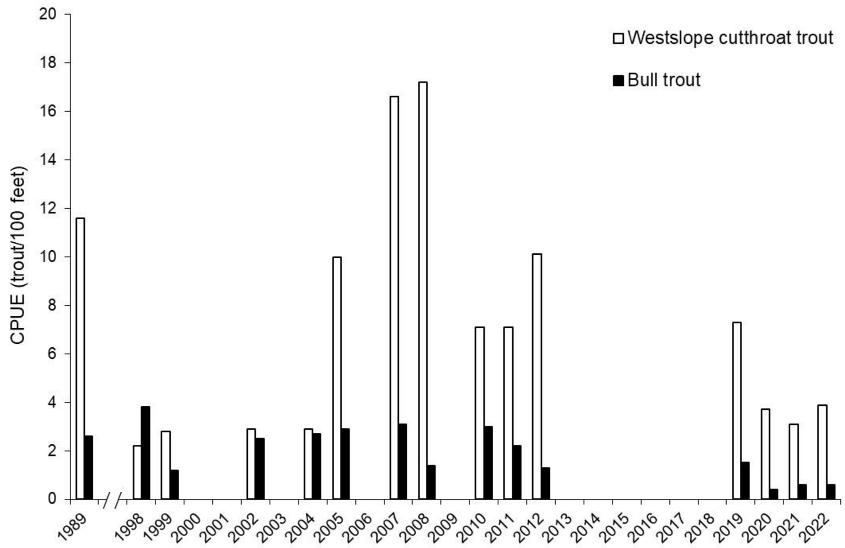

Figure 23. Relative abundance estimates of age-1 and older native trout in Copper Creek at mile 6.2, 1989-2022.

Annual water temperature monitoring at stream mile 1.1 recorded maximum water temperatures above 63 °F during each summer from 2021 through 2023. Additionally, the warmest daily maximum temperature reached 65.1 °F in August 2023. A new logger was deployed within the bull trout spawning area in 2020 (mile 6.3). Maximum summer temperatures remained at or below 59 °F in 2021, but reached 61 °F in July and August of 2023. This indicates that the primary spawning area has thermal conditions exceeding the threshold considered ideal for bull trout habitat (Fraley and Shepard 1989; Dunham et al. 2003). All water temperature monitoring data can be found in Appendix D.

Cottonwood Creek

Cottonwood Creek, a 3rd order stream, drains a 70-square mile watershed and flows approximately 18 miles south from Morrell Mountain to the Blackfoot River near river mile 43. It has an average baseflow of 15-20 cfs. The largest tributary to the upper mainstem of Cottonwood Creek is North Fork Cottonwood Creek that enters near stream mile 13.4. Shanley Creek is the largest tributary to the lower mainstem and enters near stream mile 5.6. Cottonwood Creek originates on the Lolo National Forest before entering state owned lands (FWP, DNRC, and University of Montana) and small sections of private land near mile 12.

Cottonwood Creek has been the focus of ongoing restoration efforts since 1996. All significant anthropogenic limiting factors have been addressed. Fisheries improvements began with a fish-friendly irrigation project at mile 12.0 that enhanced flows, improved fish passage, and eliminated fish entrainment at an irrigation ditch. Prior to this work, a portion of Cottonwood Creek was completely dewatered from irrigation withdrawals during late summer and fall. Subsequent projects included the removal of two diversions, instream flow enhancement on lower Cottonwood Creek, and riparian fencing projects on the Blackfoot Clearwater Game Range to remediate livestock degradation of the channel. In 2007, the USFS upgraded a small culvert with a concrete bridge near mile 16. In 2014, the USFS conducted a channel reconstruction project in the intermittent section and conducted follow-up construction after the 2018 floods damaged a portion of the original project.

The high snowpack in the Rice Ridge Burn area contributed to significant runoff in 2018 that caused a channel avulsion upstream of the Dreyer Diversion and damaged the ditch liner. DNRC completed a bank reconstruction project in 2019 at the site of the avulsion location. The avulsion occurred at a gabion wall that was the former site of an irrigation diversion, which was decommissioned when that water user's point of diversion was moved to the Dreyer Ditch. FWP reinstalled a new liner through the damaged section of ditch in 2019. The focus of restoration efforts is to improve degraded habitat, eliminate fish losses to irrigation ditches, enhance instream flows, and restore migration corridors for native fish. Cottonwood Creek is included in a Lolo National Forest Watershed Restoration Plan with ongoing road decommissioning efforts comprising major components of the plan. The overarching objective of work within Cottonwood Creek has been to increase recruitment of westslope cutthroat trout to the Blackfoot River and improve conditions for the extant population of bull trout.

The headwaters of Cottonwood Creek support non-hybridized and hybridized westslope cutthroat trout, brook trout, and very low abundance of bull trout. The Cottonwood Lake complex supports a population of rainbow trout. Following recent surveys in upper Cottonwood Creek in 2020 (Uthe et al. 2021), we sampled sections in lower and middle Cottonwood Creek to investigate current status and community composition. Brown trout have declined since the previous surveys in 2015 (Figure 24). The decline has been more pronounced in the section at mile 7.5. Brook trout are fairly stable in lower Cottonwood Creek and have increased slightly in the middle section. Westslope cutthroat trout were captured for the first time at mile 3.3 in 2022, whereas none were captured at mile 7.5. This reflects the general species distribution where westslope cutthroat trout are the most abundant species

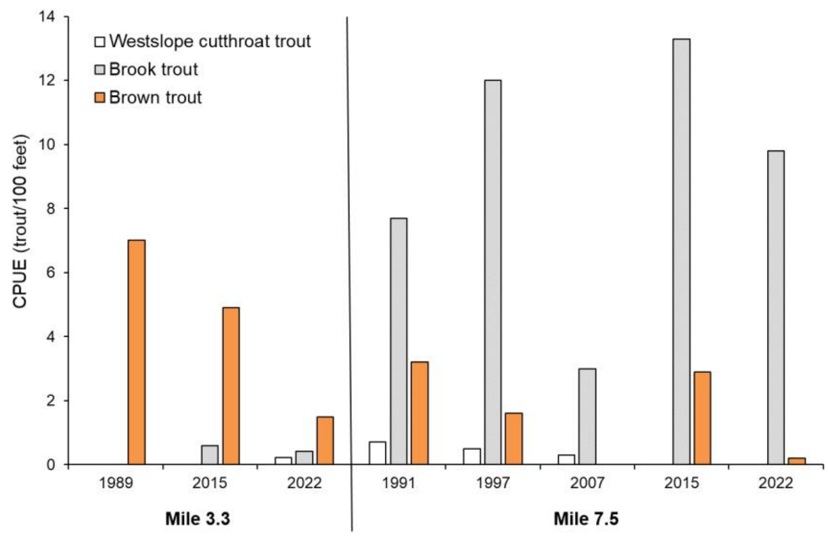

Figure 24. Relative abundance estimates for age-1 and older trout at stream mile 3.3 and 7.5 in Cottonwood Creek.

in upper Cottonwood Creek, and the community shifts towards mostly nonnative trout downstream of Woodworth Road on the Blackfoot Clearwater Wildlife Management Area (Uthe et al. 2021). Numerous spring creek tributaries enter Cottonwood Creek in that vicinity and brook trout become the primary species.

Twenty-five years of long-term water temperature monitoring continued at stream mile 1.0 (Highway 200 crossing). We continued operating two additional water temperature sensors within the upper Cottonwood Creek drainage at stream miles 12 and 16 that were originally deployed in 2020. All water temperature results are published in Appendix D. Most notably, the logger at Highway 200 recorded maximum summer temperatures of 66.5°F in July 2023. This was the highest maximum summer temperature since 2016 when water temperatures reached 68.0 °F. Maximum summer temperatures remained slightly below 65 °F in 2021 and 2022. Maximum temperatures remained below 59 °F at the Dreyer Diversion (mile 12) in 2021 and 2022. The logger was not recovered in 2023. Maximum temperatures in upper Cottonwood Creek (mile 16) also remained below 59 °F in all three years, indicating thermal suitability for bull trout. Interestingly, the maximum temperatures at the Dryer Diversion and upper logger deviated by less than a degree, which demonstrates cold-water suitability for bull trout over more than 4 miles of stream length. Opportunistic redd counts by USFS personnel identified six redds in 2022 downstream from the confluence of North Fork Cottonwood Creek (S. Hendrickson, Lolo National Forest, personal communication). Future targeted monitoring (electrofishing and redd counts) is necessary to better understand the contemporary status of bull trout in the Cottonwood Creek drainage.

Cottonwood Creek (Nevada Creek drainage)

Cottonwood Creek, a 2nd-order tributary to Douglas Creek, flows approximately 8 miles through public land (BLM) before flowing through private ranchland in the lower 10 miles of the drainage. The headwaters are within the Hoodoo Mountain Wilderness Study Area. The upper reaches support high densities of non-hybridized resident westslope cutthroat trout and brook trout. Lower Cottonwood Creek only supports long nose sucker and redside shiner. Fisheries impairments in the lower reaches include: 1) livestock induced stream bank degradation and riparian vegetation suppression, 2) lack of complex fish habitat (instream wood), 3) undersized road crossing culverts causing erosion, and 4) dewatering. A project was completed in 2001 that removed a streamside feedlot, restored 0.4 miles of stream, improved grazing management, planted shrubs, and installed a fish-friendly irrigation diversion structure. We deployed temperature sensors and conducted electrofishing in middle Cottonwood Creek in 2022 to assess thermal conditions and species composition (see *Standalone Reports*).

Dunham Creek

Dunham Creek is 3rd-order stream and the largest tributary to Monture Creek. It drains 32.8 miles^2 and flows approximately 14.4 miles before entering Monture Creek at mile 11.5. It originates in subalpine basins near the southern slopes of Monture Mountain located on the southern boundary of the Bob Marshall Wilderness. Most of its stream length flows through heavily forested sections on the Lolo National Forest before entering private ranchland near stream mile 1.6. Dunham Creek has a base flow discharge of 15-20 cfs, which is fed primarily by Lodgepole Creek that enters Dunham Creek near stream mile 6.8 and contributes approximately 8-12 cfs. Dunham Creek has two intermittent reaches in the middle and lower reaches that are fish passage barriers during base flow conditions. Past restoration projects have sought to improve recruitment of bull trout and westslope cutthroat trout to the Blackfoot River by eliminating the loss of native fish to irrigation canals, enhancing habitat conditions, and restoring migration corridors.

The 2017 Rice Ridge wildfire burned 155,900 acres between Seeley Lake and Ovando, including a large portion of the Dunham Creek drainage. The impacts were most pronounced in the upper drainage and Lodgepole Creek. The wildfire impacts contributed to significant instability of hillsides throughout the drainage. Mass wasting events occurred in Nome and Spruce Creeks in the Lodgepole Creek drainage, transporting large amounts of sediment through the Dunham Creek drainage and the bull trout spawning reach during high flow events. Specifically, a large precipitation event in July 2019 caused landslides and debris flows in Spruce Creek. A significant amount of sediment was mobilized downstream into Lodgepole, Dunham, and Monture creeks, and ultimately the Blackfoot River. Sediment pulses were common following precipitation events, but the severity of those disturbances appeared to wane in 2023, which may indicate sediment has worked its way through the system and new slope failures have not occurred.

Dunham Creek supports fluvial westslope cutthroat trout, fluvial bull trout, and resident brook trout. Migratory bull trout spawning occurred consistently through 2015 but has become intermittent in recent years as evidenced by inconsistent observations of redds in the index reach (Figure 25). A new survey section was added to annual redd counts in 2018 when several redds were observed in the perennial section downstream of Cottonwood Lakes-Monture Road. However, no redds were observed in either section in 2023, highlighting the overall long-term decline within the Dunham/Monture drainage.

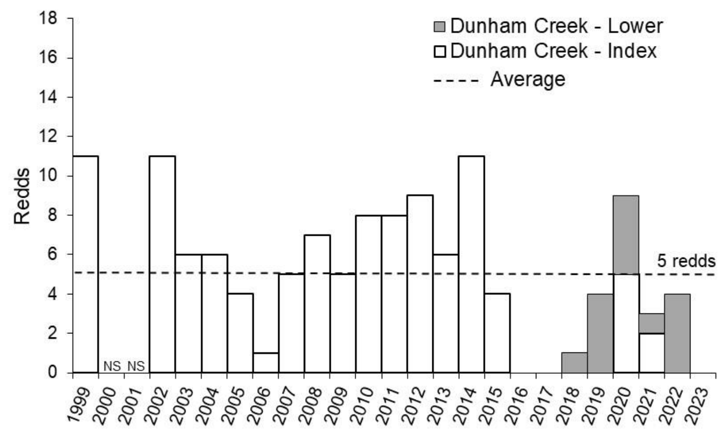

Figure 25. Bull trout redd counts in Dunham Creek. White bars show redd counts in the long-term (1999-2023) index section. Grey bars show the redd counts in the lower section monitored 2018-2023. The dashed horizontal line shows the combined long-term mean of 5 redds, 1999-2023.

We conducted electrofishing surveys in long-term monitoring sections at stream mile 2.3 and 4.2 that were originally established in 1996, and a site at mile 7.0 that was established in 2017 (Figure 26). Recent surveys at all sites show a decline in bull trout abundance. This coincides with the substantial decline in migratory bull trout spawning activity and frequent lack of redds within this part of Dunham Creek. Conversely, westslope cutthroat trout have exhibited an increase, with the highest CPUE on record at stream mile 4.2 and 7.0 in 2023. Brook trout CPUE has been relatively stable, with a slight increase at the lower site and decreases at the middle and upper sites. The first documentation of brown trout presence in Dunham Creek occurred in 2020. However, no brown trout were encountered from 2021-2023. The single brown trout captured at the mile 2.3 site suggests that brown trout have started pioneering into Dunham Creek from lower Monture Creek. Their absence in 2021-2023 indicates that brown trout have not become established.

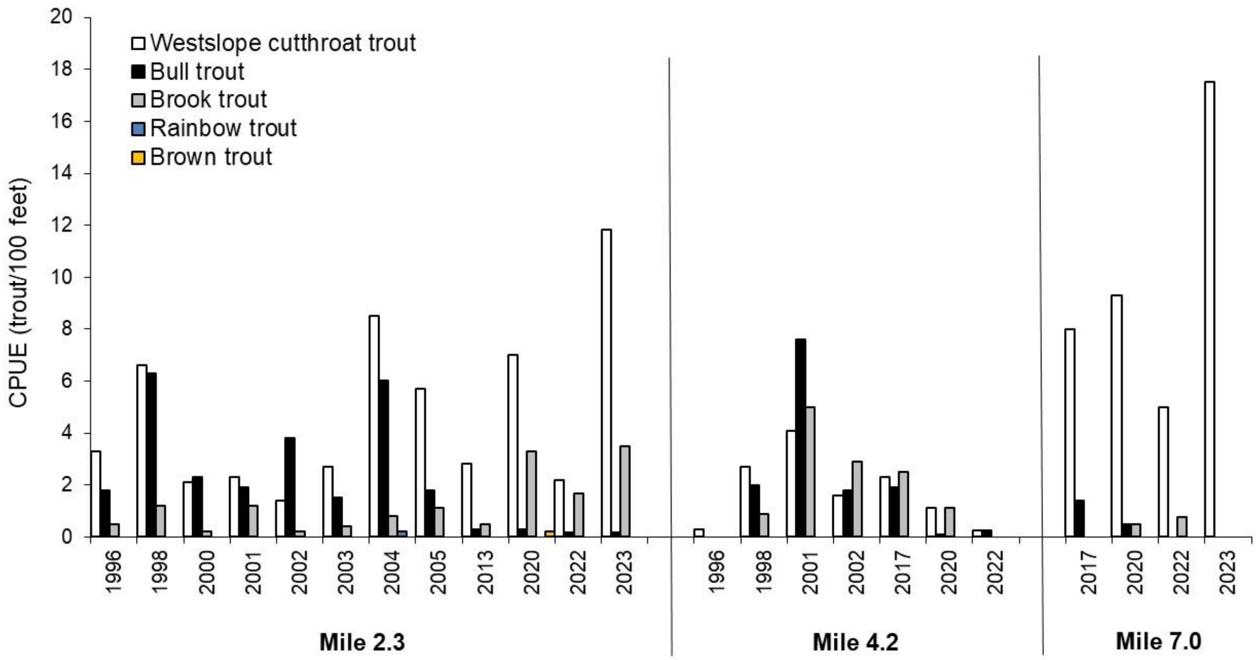

Figure 26. Relative abundance estimates for age-1 and older trout at three locations on Dunham Creek, 1996-2023.

East Twin Creek

East Twin Creek is a small 2nd order tributary to the lower Blackfoot River. It ranks moderate on the restoration priority list due to low potential for improving downstream water quality and increasing flows to the Blackfoot River. However, it has a high native species value because it supports fluvial westslope cutthroat trout production and bull trout rearing. East Twin Creek provides a high sport fishery value to the Blackfoot River by supporting a diverse fish assemblage of fluvial westslope cutthroat trout, rainbow trout, brown trout, and resident brook trout. In general, densities are low for all species in the lower to middle reaches.

We sampled three sections to assess longitudinal changes in species composition and collect *Oncorhynchus* spp. genetic samples for the Blackfoot River hybridization study (in progress). Species composition was markedly different among the three sections (Figure 27). The assemblages in the lower and middle sites were comprised entirely of nonnative trout. Rainbow trout were most abundant at the lower site, whereas brook trout were

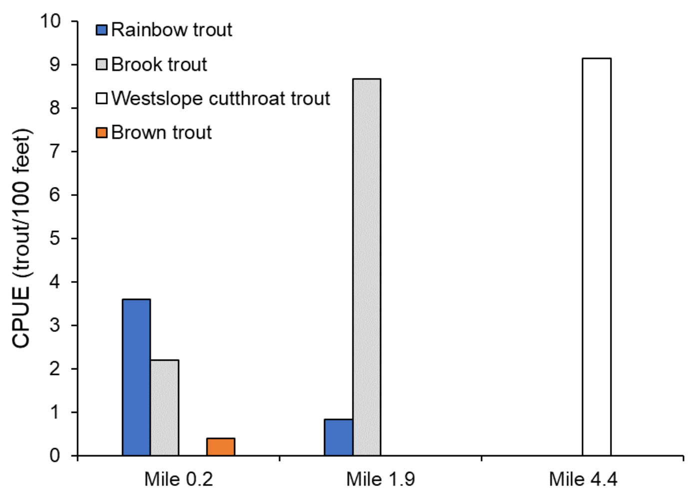

Figure 27. Relative abundance estimates for age-1 and older trout in three sections in East Twin Creek, 2023.

most abundant at the middle site. Brown trout were not captured at the middle site. Westslope cutthroat trout were the only species present at the upper site. This longitudinal pattern is similar to neighboring West Twin Creek. Further investigation is warranted to understand if any specific stream attributes are contributing to the lack of upstream expansion of nonnative trout.

Gold Creek

Gold Creek, a large 3rd order tributary, originates in headwater lakes in the Rattlesnake Wilderness. Gold Creek drains a 62.6 mi^2 watershed and flows approximately 20 miles to its confluence with the lower Blackfoot River at mile 13.5. West Fork Gold Creek is the largest tributary to Gold Creek and enters near mile 6.8. Approximately 66% of the Gold Creek watershed was managed as industrial forest (Plum Creek Timber Company) prior to 2014 when those lands were purchased by TNC. The upper drainage is currently under public ownership managed by the Lolo National Forest. Recent acquisitions have been completed by the BLM and the remainder of the TNC parcels are expected to be acquired by the BLM over the next several years. A few parcels of private inholdings (non-Montana Checkerboard, LLC) are present in the lower and middle portions of the drainage.

Numerous restoration actions have been completed since the 1990s. Several sediment reduction measures associated with logging roads were implemented, including the installation of rolling dips, seeding and closing roads after logging, and mechanical ripping of decommissioned roadbeds. In 1996, a cooperative project installed 66 habitat structures made of native material (rock and wood) constructing 61 new pools in a three-mile section that had simplified habitat due wood removal and lack of large wood recruitment (Schmetterling and Pierce 1999). Bridge upgrades have occurred in the upper drainage and in West Fork Gold Creek. Floodplain restoration has become a major focus in portions of the drainage. The BLM completed a wet-meadow restoration project on Wild Horse Creek using beaver restoration techniques. Phase 1 was implemented in 2022 near the confluence with Gold Creek and Phase 2 was implemented further upstream in 2023. The drainage will continue to be a focal area for watershed and stream-specific restoration efforts as part of BLM's Blackfoot-Clark Fork Landscape restoration effort. Overall objectives in Gold Creek include restoring pool habitat and morphological complexity, enhancing thermal refugia for Blackfoot River native fish species, and reducing road sediment sources.

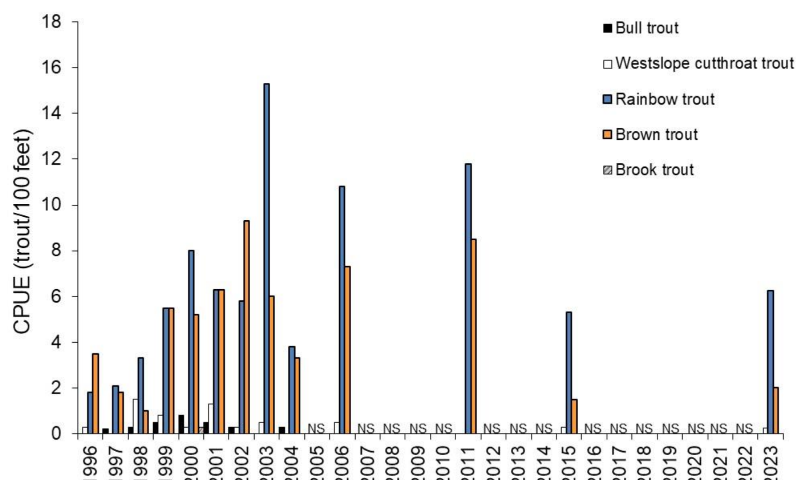

Figure 28. Relative abundance estimates for age-1 and older trout at the long-term monitoring section at stream mile 1.9 in Gold Creek, 1996-2023.

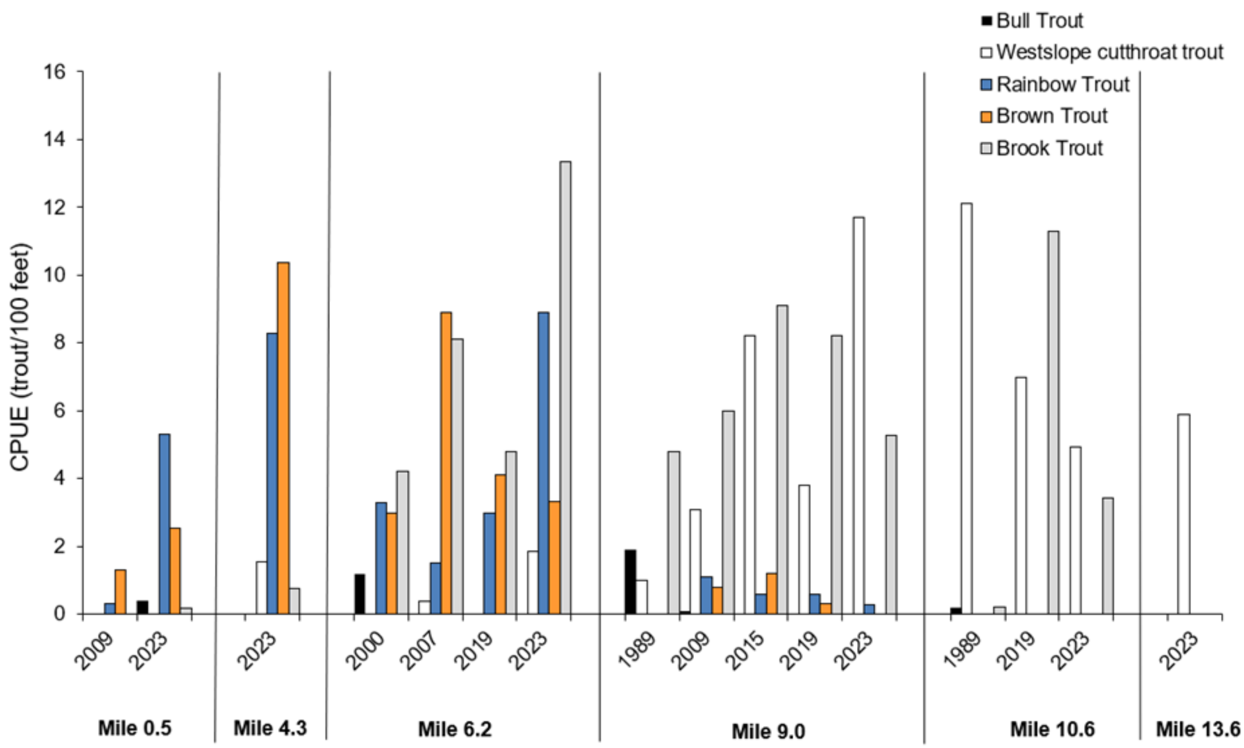

Figure 29. Relative abundance estimates for age-1 and older trout in six sections in Gold Creek.

Gold Creek provides important spawning and rearing habitat for migratory westslope cutthroat trout, rainbow trout, and brown trout. Resident brook trout also inhabit the drainage. Gold Creek historically supported migratory bull trout spawning and rearing, but distribution and abundance of bull trout have declined substantially over the past 15 years. In 2023, we surveyed Gold Creek longitudinally at seven locations (stream mile 0.5, 1.9, 4.3, 6.2, 9.0, 10.6, 13.6) to assess bull trout presence, investigate current longitudinal species composition, and collect genetic samples for the Blackfoot River westslope cutthroat trout hybridization study (in progress). The site at stream mile 6.2 was established in 2000 and is within the historical bull trout spawning index reach. Bull trout were not captured at any of the survey sites where they were present in prior surveys. However, two subadult bull trout were capture at mile 0.5, but they assigned to the North Fork Blackfoot River. The continued lack of bull trout observations in the middle and upper reaches along with the out-of-drainage assignment of the only bull trout captured in 2023, provide supporting evidence that the Gold Creek population has become extirpated. Consistent with bull trout declines at all electrofishing sites, redd counts conducted by Plum Creek Timber Company from 2004 through 2014 and by FWP personnel through 2023, show a similar declining trend. Bull trout have not been observed at stream mile 1.9 since 2004 (Figure 28) or stream mile 6.2 since 2000 (Figure 29). We have not observed any confirmed or suspected bull trout redds since 2017.

Westslope cutthroat trout are only consistently found at the upstream survey locations (miles 9.0, 10.6, and 13.6) where their abundance has remained relatively stable at low to moderate levels (Figure 29). Interestingly, they were the only species present at mile 13.6, whereas brook trout were a major component of the fishery at mile 10.6. Further investigation is needed to understand the mechanism responsible for this abrupt change in species composition. Brook trout CPUE continued to increase at mile 6.2, but has remained relatively stable upstream at mile 9.0 and mile 10.6. Overall, the long-term trend has exhibited a pronounced increase in brook trout abundance since the late 1980s. Brown trout remain very abundant in the lower reaches, but have declined in the middle reaches and have not established a foothold in the upper drainage. We did not encounter any brown trout at mile 9.0 in 2023.

We also surveyed three sections in West Fork Gold Creek to investigate longitudinal species composition changes and collect *Oncorhynchus* spp. genetic samples. We surveyed two previously sampled sections (stream mile 0.1 and 4.6) as well as a new section at the upper road crossing (stream mile 6.6). Rainbow trout were the most abundant species near the confluence with Gold Creek and westslope cutthroat trout were the most abundant species at mile 4.6 (Figure 30). Interestingly, we only captured brook trout at the upper site. Brown trout have been relatively stable at stream mile 0.1 over the last two decades. We did not capture any brown trout at survey sites upstream of stream mile 0.1. It is unclear what is limiting their distribution within West Fork Gold Creek. Bull trout have not been captured since the survey in 2000, providing additional evidence that bull trout have become locally extirpated from the Gold Creek drainage.

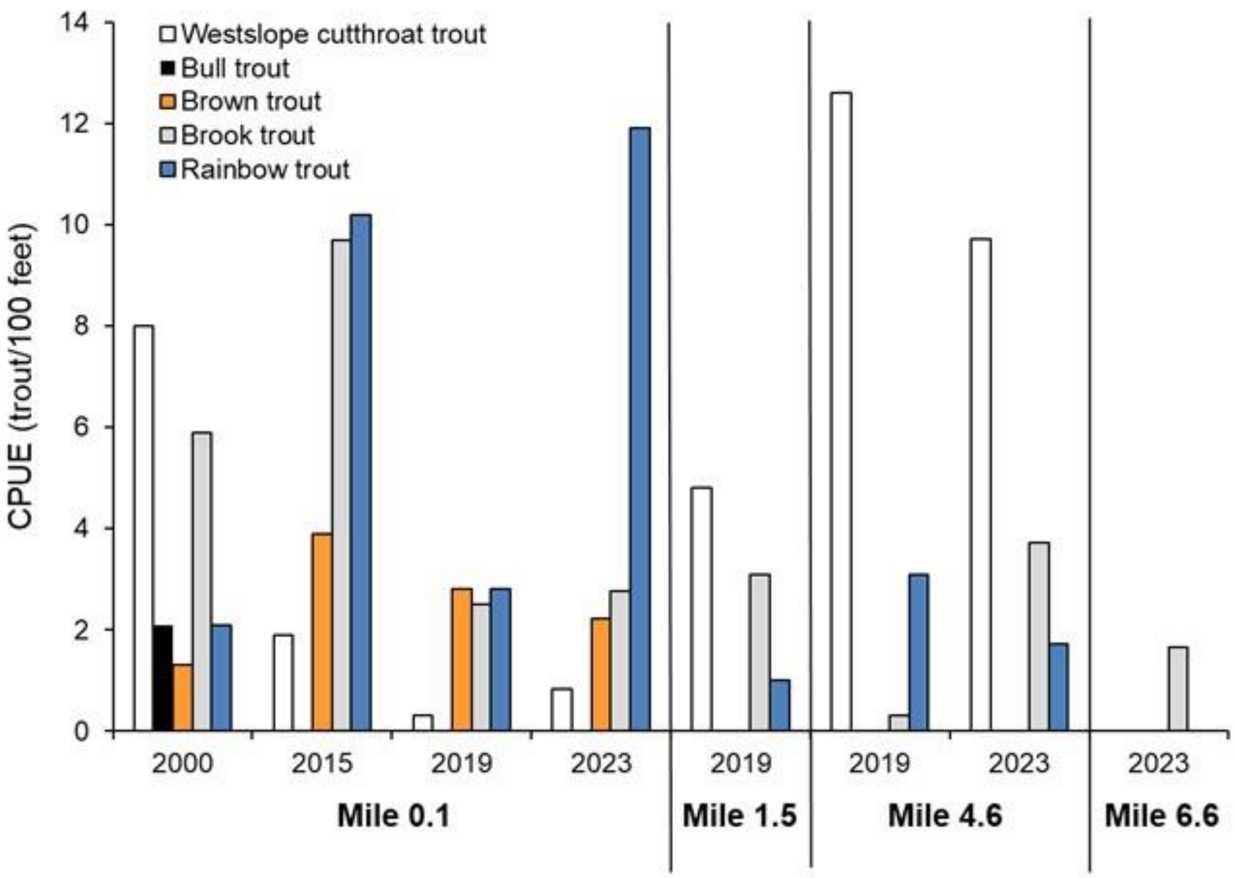

Figure 30. Relative abundance estimates for age-1 and older trout in four sections in West Fork Gold Creek.

Annual water temperature monitoring has occurred in Gold Creek at stream mile 1.6 since 1998. Daily maximum temperatures in July and August exceeded 65°F each summer during 2021-2023. In 2019, we redeployed a temperature sensor in the bull trout spawning index section at mile 6.2 that was previously monitored in 1999 and 2002-2005. Daily maximum temperatures at this site reached 62°F during 2021-2022 and reached 61°F in 2023. We also installed a logger in lower West Fork Gold Creek (mile 0.2) in 2019 and continued to operate it through 2023. West Fork Gold Creek flows into the historical bull trout spawning reach and daily maximum temperatures reached 64.1°F in 2022 and exceeded 63.0°F in 2021 and 2023. The primary spawning reach where near-natal rearing would occur is consistently above the 59°F threshold for bull trout. Maximum temperatures at mile 9.0 did not exceed this threshold in 2021-2023, indicating continued thermal suitability in upper Gold Creek, despite the absence of bull trout from this portion of the drainage. The daily maximum temperatures highlight that more than half of the length of mainstem Gold Creek has temperatures exceeding ideal conditions for bull trout (Figure 31). Despite the reduced suitability for sustaining a viable bull trout population, lower Gold Creek still provides important thermal refugia because it is colder than the Blackfoot River (Appendix D).

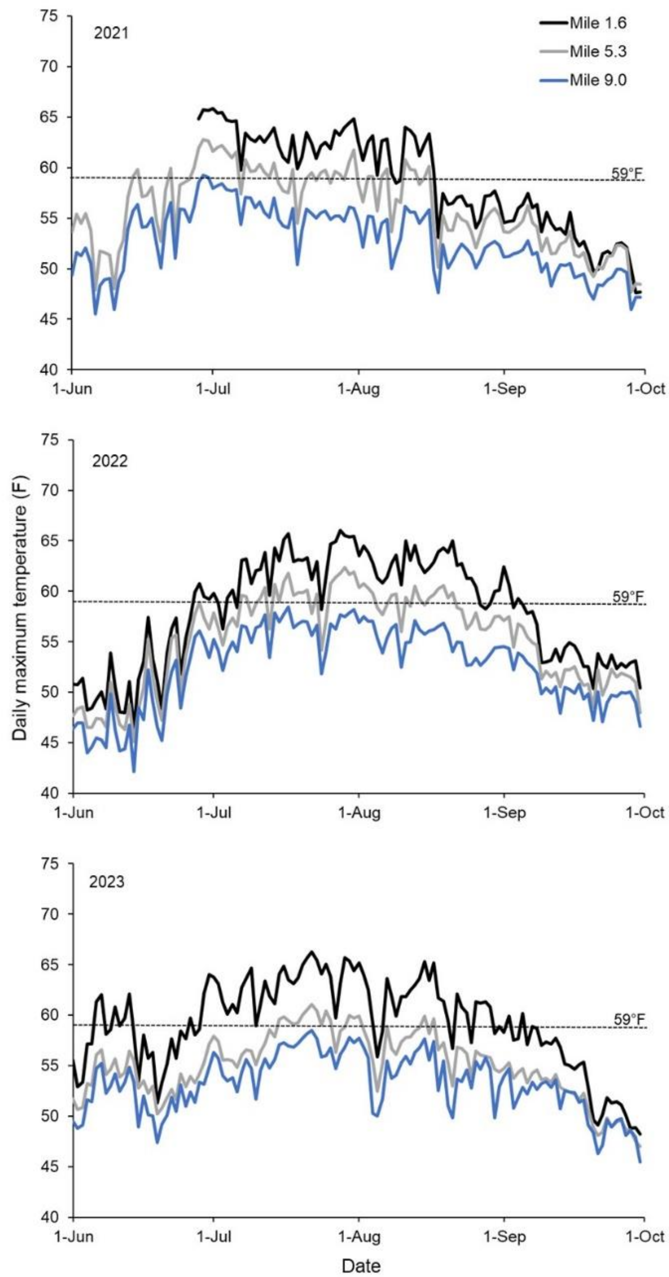

Figure 31. Daily maximum water temperatures at three locations in Gold Creek, 2021-2023. The dashed line denotes the 59°F threshold for bull trout suitability.

Lodgepole Creek

Lodgepole Creek is a 2nd-order tributary to Dunham Creek that drains a 14 square-mile watershed. It originates near the southern boundary of the Bob Marshall Wilderness and flows entirely through public land managed by the Lolo National Forest. The middle section of Lodgepole Creek is fed by two small 1st-order tributaries, Spruce Creek and Nome Creek.

Lodgepole Creek is ranked as a moderate restoration priority due to its high native species value, moderate biological priority rank, and lack of anthropogenic impacts.

The 2017 Rice Ridge wildfire burned 155,900 acres between Seeley Lake and Ovando, including a large portion of the Dunham Creek drainage. The wildfire impacts contributed to significant instability of hillsides throughout the drainage. Specifically, a large precipitation event in July 2019 caused mass wasting events and debris flows in Spruce Creek and Nome Creek. A significant amount of sediment was mobilized downstream into Lodgepole, Dunham, and Monture creeks.

Figure 32. Waterfall near Nome Creek confluence.

Lodgepole Creek supports westslope cutthroat trout, bull trout, and brook trout. We sampled six sections in 2022 to assess species composition and fish presence above suspected passage barriers. Three sections (stream mile 0.1, 0.2, 0.7) were downstream of two large waterfalls near the confluence of Nome Creek. There is a 20-30-ft waterfall slightly upstream of the Nome Creek confluence. Another large waterfall with an estimated height of 30-feet is 400 feet upstream of the lower falls (Figure 32, 47.19562; -113.20360). The survey section at stream mile 0.9 commenced upstream of this waterfall and we sampled the entire stream length upstream to Lodgepole Falls, a 90-ft barrier (Figure 33, 47.20624; -113.20073). Finally, we electrofished two sections upstream of Lodgepole Falls.

Figure 33. Lodgepole Falls.

Brook trout, bull trout, and westslope cutthroat trout were present at the lower two sites, whereas westslope cutthroat trout were the only species present at stream mile 0.7 and upstream of Lodgepole Falls (Appendix A). At stream mile 0.1, we conducted a two-pass depletion survey and estimated age-1 and older trout abundance as 11.8/ 100 feet (Appendix B). Overall trout density and species composition suggest no short-term impacts from the recent post-fire disturbance (Figure 34). We did not capture any brown trout in 2022, indicating they have not become established after their initial discovery in 2020. (Uthe et al. 2021).

We did not capture any fish in the 1-mile-long reach between the lower waterfall (first large barrier upstream of Nome Creek) and Lodgepole Falls (Figure 35). Westslope cutthroat trout were the only species present above Lodgepole Falls. Interestingly, the area above Lodgepole Falls was presumed fishless based on previous surveys conducted by the USFS. Downstream of the falls near Nome Creek, the westslope cutthroat trout fishery was a mix of non-hybridized and hybrid individuals (Kovach et al. 2023). Eighty-three percent of the individuals were non-hybridized westslope cutthroat. The remainder were hybrids with as much as 27% rainbow trout ancestry. The westslope cutthroat trout above Lodgepole Falls were non-hybridized. However, the sample contained an excess of heterozygotes, which strongly suggests that the effective population size is very small or it recently went through a major bottleneck (R. Kovach, personal communication).

Figure 34. Relative abundance estimates for age-1 and older trout at stream mile 0.1 in Lodgepole Creek.

The USFS conducted eDNA sampling above Lodgepole Falls in 2020 and all three sites tested negative for salmonid DNA. They also electrofished four sites and only caught a 12-inch westslope cutthroat trout near the bridge. They expanded eDNA sampling in 2021 and all sites tested negative except for a site below the bridge. We captured 60 westslope cutthroat trout throughout that same area that tested negative for eDNA. The discrepancy between previous eDNA sampling and the current electrofishing effort highlights uncertainty about the history of this population. Additional monitoring is necessary to understand the genetic status of this isolated, non-hybridized population and determine if intervention (i.e., genetic rescue) is warranted to improve the genetic diversity. Moreover, future monitoring should investigate if this upstream population contributes to colonization of the downstream isolated reach between Lodgepole Falls and Nome Creek.

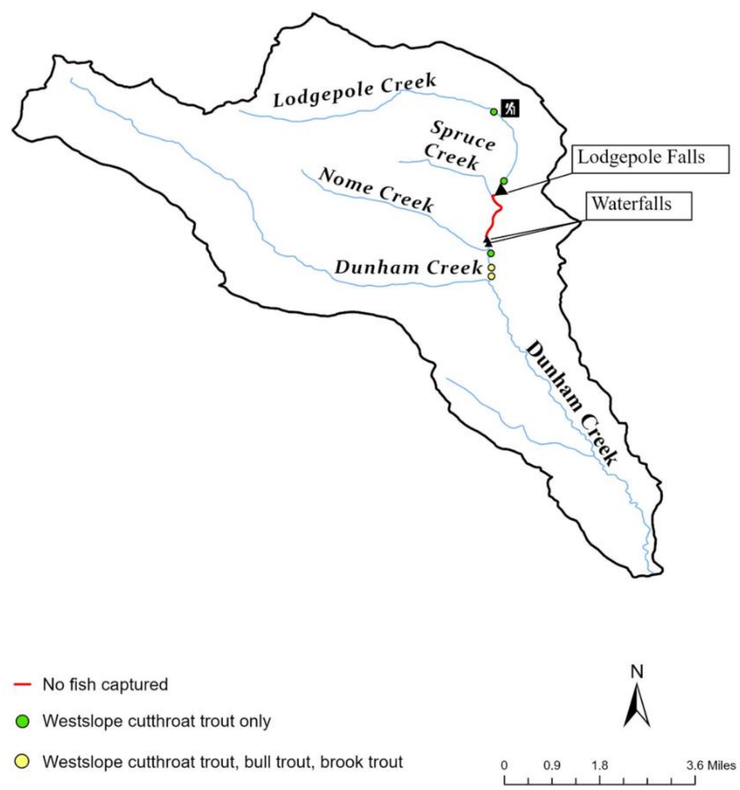

Figure 35. Map of electrofishing sites and waterfalls in Lodgepole Creek.

McCabe Creek

McCabe Creek is a tributary to lower Dick Creek within the Monture Creek watershed. McCabe Creek begins as a steep mountain stream on USFS property, before entering private ranch land in the lower basin. In the lower reaches, McCabe Creek passes through a beaver-influenced wetland before entering Dick Creek near stream mile 3.8.

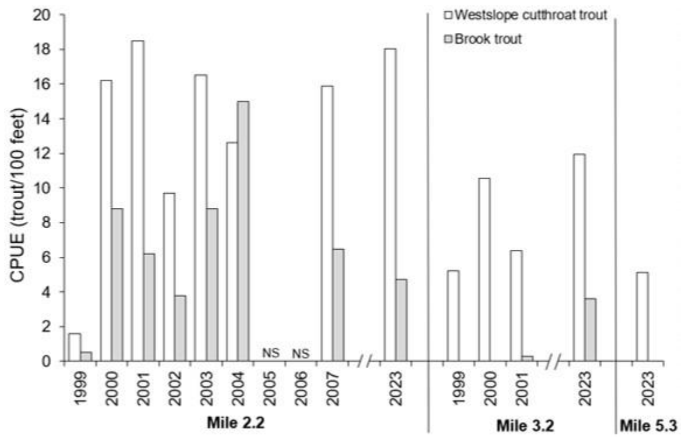

Figure 36. Relative abundance estimates for age-1 and older trout in three sections in McCabe Creek, 1999-2023.

McCabe Creek has a long history of fisheries impacts related to channel alterations and agricultural activities. These include intensive riparian grazing, channel alterations, problematic road crossings, chronic dewatering, and fish entrainment in irrigation ditches. A comprehensive restoration project began in 1999 and continued through 2002 (Pierce et al. 2004). This multifaceted project 1) consolidated four irrigation ditches into one pipeline and screened the intake; 2) converted flood to sprinkler irrigation to enhance stream flows by 3-5 cfs; 3) restored habitat conditions including the placement of instream wood and shrub plantings along 1/2 mile of stream; 4) implemented grazing changes and developed off-stream livestock water; and 5) replaced a county road culvert with an open-bottom box culvert. The fisheries objectives within McCabe Creek include restoring instream flows, improving habitat conditions, and eliminating entrainment of westslope cutthroat trout.

The fish community in McCabe Creek is primarily comprised of westslope cutthroat trout, but brook trout are present in the lower stream reaches. In 1999, we established a monitoring section (stream mile 2.2) prior to restoration in a degraded section of stream with low habitat complexity and chronic low flows. The survey section had been monitored regularly through 2007, but had not been revisited until our 2023 survey. We also surveyed an established site at stream mile 3.2 and added a new site in the upper portion of the drainage at stream mile 5.3. At stream mile 2.2, we documented sustained high CPUE of westslope cutthroat trout and a stable abundance of brook trout (Figure 36). Interestingly, both species increased after the restoration project, but westslope cutthroat trout have remained the most abundant species. Westslope cutthroat trout represented 76% of the trout community before the project was implemented, but varied between 46 and 75% after the project until 2007. However, they comprised 79% of the trout community in 2023, suggesting that the overall fishery benefits have not given brook trout a competitive advantage over cutthroat trout. Westslope cutthroat trout have been stable at stream mile 3.2. Brook trout abundance increased considerably after they were first captured in 2001. However, this increase did not appear to impact the status of westslope cutthroat trout because 2023 had the highest CPUE on record. The upper site at mile 5.3 had the lowest westslope cutthroat trout CPUE, but brook trout were not present. This suggests that the upstream portion is likely cold with low productivity, contributing to the lower CPUE of westslope cutthroat trout. It is unclear if environmental conditions are providing resistance to colonization or brook trout have not pioneered upstream from established locations. Nonetheless, the survey results demonstrate the encouraging status of westslope cutthroat trout in McCabe Creek and suggest the presence of brook trout is not precluding a robust population of westslope cutthroat trout. Periodic monitoring should be focused on assessing long-term trends in westslope cutthroat trout abundance, shifts in species composition, and changes in brook trout distribution. Moreover, East Fork Monture Creek should be investigated for westslope cutthroat trout presence because no survey records exist.

Monture Creek

Monture Creek, a 4th-order tributary, drains a 152-square mile basin and flows 29.5 miles before entering the Blackfoot River near river mile 46. The headwaters drain the southern slopes of Monahan, Foolhen, and Youngs Mountains on the edge of the Bob Marshall Wilderness Complex. Major tributaries include Dunham Creek at stream mile 11.5 and Dick Creek at stream mile 4.2. The majority of the Monture Creek drainage is on the Lolo National Forest. The lower portion of Monture Creek drains private lands, most of which are protected under conservation easement. A natural barrier located near stream mile 25 (Monture Falls), marks the upper extent of bull trout distribution, but westslope cutthroat trout are present upstream (Pierce et al. 2008). A narrow canyon section between Yellowjacket Creek and Wedge Creek contains several constrictions and falls that may impede upstream passage. Therefore, westslope cutthroat trout and bull trout occupying the reach between Wedge Creek and Monture Falls may have some degree of reproductive isolation. There is an intermittent reach between stream mile 13.5 and 14.5. However, investigations during September 2022 documented surface water connection through this reach. It is unclear if this section remained perennial because of post-fire effects or factors related to snowpack and water supply.

The 2017 Rice Ridge wildfire burned 155,900 acres between Seeley Lake and Ovando, including a large portion of the Monture Creek drainage. The wildfire impacts resulted in frequent avulsions and mass wasting events on hillsides in the upper Monture Creek drainage. Specifically, a large precipitation event in autumn 2019 caused landslides in Yellowjacket Creek, Bill Creek, Falls Creek, and Spread Creek. Falls Creek also had additional debris flows in 2020. A significant amount of sediment was mobilized downstream into Monture Creek and the Blackfoot River. There were several additional disturbances in these areas in 2021 and sediment mobilization continued through spring 2023. By late-summer 2023, sediment pulses were becoming less severe. Several thunderstorms during July and August of 2023 did not significantly increase sediment mobilization and turbidity in Monture Creek, suggesting that excess sediment has worked its way through the system and disturbed areas are stablizing. Moreover, vegetation has started establishing on the alluvial fans near the mouths of these tributary drainages.

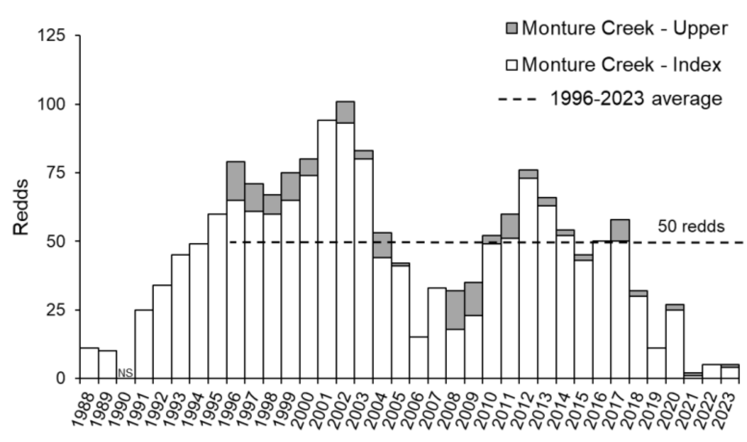

Figure 37. Bull trout redd counts in Monture Creek. White bars show redd counts in the long-term (1988-2023) index section. Grey bars show the redd counts in the upper section monitored 1993-2023. The dashed horizontal line shows the combined long-term mean of 50 redds, 1996-2023.

The lower reaches of Monture Creek have a long history of agricultural and forestry land uses that caused adverse impacts to riparian habitats (Fitzgerald 1997). The primary instream habitat and riparian issues were corrected through decades of cooperative restoration (Pierce et al. 1997; Pierce et al. 2001). Some of the earliest restoration projects in the Blackfoot River watershed were implemented in Monture Creek. In 1991, a fencing project in lower Monture Creek created a grazing exclosure to improve degraded riparian conditions. This was followed by instream work in the mid-1990s that placed LWD structures throughout 0.75 miles of stream in this section. Additional grazing management projects occurred further upstream in 1994 and 1995 that included off-channel stockwater development and grazing exclosures through the primary bull trout spawning section. In 2004, a major water conservation project converted wheel lines to center pivots and shifted the point of diversion from Monture Creek to a screened ditch on McCabe Creek. In 2016, a significant fencing project installed nearly 8.5 miles of riparian fencing along Monture Creek and Dunham Creek. Concurrently, an eroding bank at the pump station on Monture Creek was also repaired and the intake was upgraded with a fish screen. Collectively, these projects have sought to restore spawning and rearing habitat for migratory bull trout and westslope cutthroat trout while improving recruitment to the Blackfoot River. Additional goals include improving adult staging areas and thermal refugia for fluvial bull trout.

Monture Creek is a primary spawning and rearing tributary for fluvial bull trout and fluvial westslope cutthroat trout (Swanberg 1997, Schmetterling 2001). Reproduction and rearing of westslope cutthroat trout and bull trout occurs primarily in the mid-to-upper basin. Lower Monture Creek supports the largest spawning run of fluvial rainbow trout upstream of Gold Creek (Pierce et al. 2009). Brook trout have historically been absent upstream of an intermittent reach near stream mile 14, but occupy lower Monture Creek and its tributaries downstream of the intermittent reach (Pierce et al. 2008).

Monitoring efforts conducted in the 2021-2023 period include 1) annual bull trout redd counts; 2) water temperature monitoring at stream miles 1.8 and 13.1; 3) electrofishing surveys within the bull trout spawning index section at mile 12.9; 4) collection of bull trout genetic samples between Wedge Creek and Monture Falls; and 5) collection of westslope cutthroat trout genetic samples at seven sites between the mouth and Monture Falls as part of the Blackfoot River hybridization study (in progress). The long-term survey section at stream mile 12.9 is located in the upstream portion of the bull trout spawning index section and has been sampled annually since the surveys were reinitiated in 2020. Debris flows and sediment disturbances in 2021 were more significant than previous years and landowners reported observations of dead

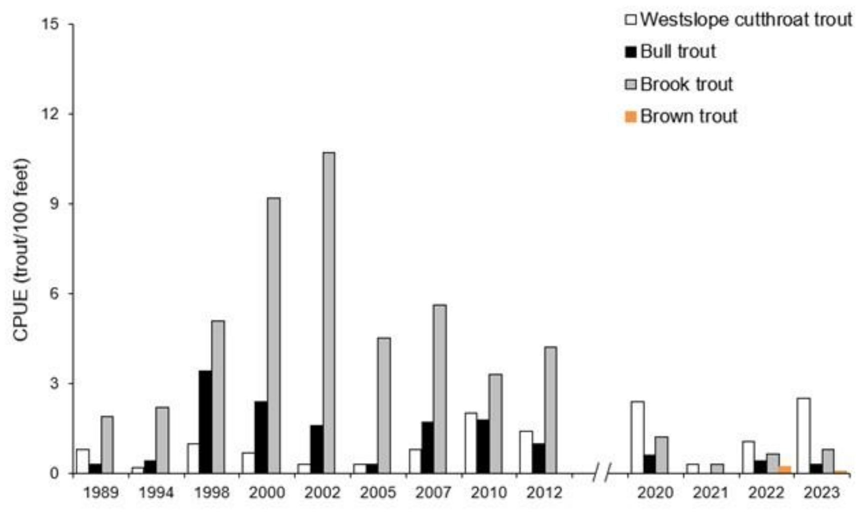

Figure 38. Relative abundance estimates for age-1 and older trout in the long-term monitoring section at mile 12.9 in Monture Creek, 1989-2023.

fish. In fact, bull trout were absent from surveys in 2021. Relative abundance has been increasing since 2021 and westslope cutthroat trout CPUE in 2023 was similar to pre-2020 estimates (Figure 38). Interestingly, brown trout were captured for the first time in 2022 and they were also captured in 2023. Continued monitoring will be important for understanding if brown trout distribution is expanding within Monture Creek. Brook trout distribution appears relatively stable because individuals were not captured at the site near Bill Creek, which is upstream of the historically intermittent section that was expected to limit brook trout distribution. Declining juvenile bull trout numbers are consistent with declining redd counts in the index section (Figure 37). Regular sampling at mile 12.9 is warranted to document post-fire disturbance impacts on the fishery, assess species composition shifts, and assess trends in juvenile bull trout abundance.

Table 3. Relative abundance estimates for bull trout in the upper Monture Creek drainage between Wedge Creek and Monture Falls, 2006 and 2023.

Stream	Site	2006 CPUE (bull trout/100')	2023 CPUE (bull trout/100')
Monture Creek[a]	SM 20	--	1.3
Monture Creek	SM 23	4.5	2.7
Monture Creek[a]	SM 24	--	6.3
East Fork Monture Creek	SM 0.1	2.3	0.8
Hayden Creek	SM 0.1	1.8	3.6

[a] Site was not sampled in 2006

Surveys in the upper portion of Monture Creek revealed broad distribution and robust CPUE of bull trout between Wedge Creek and Monture Falls (Figure 39). Preliminary westslope cutthroat trout genetic results indicate an F2 hybrid was captured at the site near Wedge Creek (Ryan Kovach, MTFWP, personal communication), which is upstream of suspected passage impediments. This noteworthy result underscores the need for additional sampling to better understand the spread of hybridization in upper Monture Creek and passage impediments in the canyon section. This area was only previously sampled once in 2006. Interestingly, CPUE is relatively similar between the two surveys (Table 3). This contrasts with comparisons between the same time period in the section at stream mile 12.9. This asynchrony suggests that bull trout in this segment of Monture Creek are functioning independently and are relatively stable. This population may be important for maintaining persistence of downstream migratory individuals via dispersal, as well as a potential source for founding new populations because of their demographic status.

Long term water temperature monitoring at mile 1.8 (Monture FAS) continued from 1994 through 2023. Temperature monitoring was also initiated at mile 13.1 in the bull trout spawning index section in 2020 after a hiatus since 2008 to understand the contemporary thermal regime in this important section of stream. Daily maximum temperatures at mile 1.8 reached 69.1°F in 2021 and 69.4°F in 2023. This is significantly warmer than the standard bull trout threshold of 59°F. Conversely, daily maximum temperatures at mile 13.1 reached 58.8°F and 59.9°F in 2021 and 2022, respectively. However, maximum temperatures were only 55.2°F in 2023. This demonstrates a significant disparity in thermal regimes between the spawning section and lower Monture Creek. This highlights the influence of groundwater upwelling and hyporheic exchange within the spawning section. Therefore, the spawning index section remains highly suitable for bull trout spawning and rearing. It is unclear how far downstream the groundwater influence persists and provides suitable thermal conditions for bull trout before transitioning to unsuitable conditions at Monture FAS. Complete water temperature data for Monture Creek is in Appendix D.

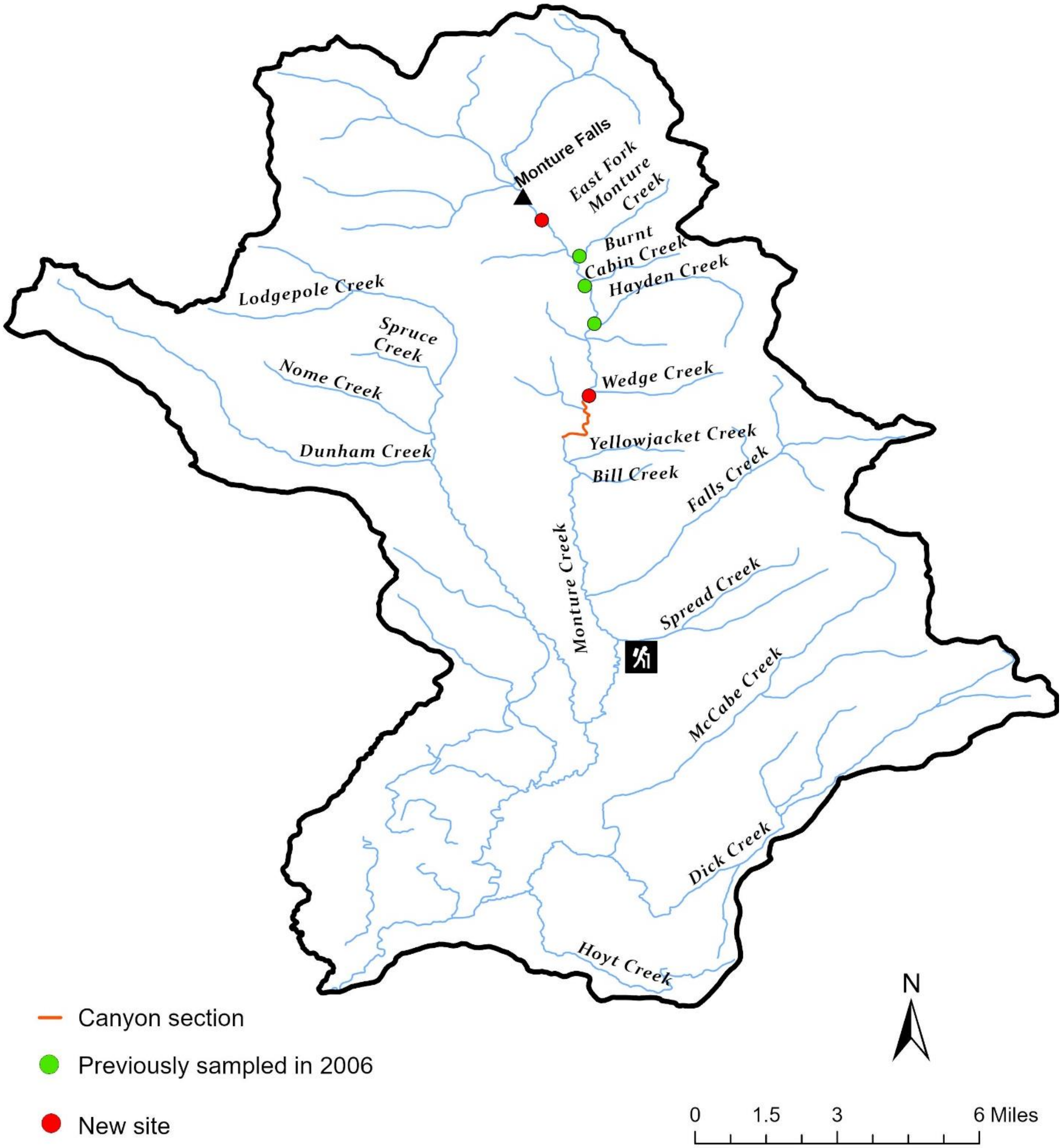

Figure 39. Map showing electrofishing survey sites in upper Monture Creek in 2023. Green circles represent sites that were sampled in 2006 and 2023, and red dots represent new sites sampled in 2023. The orange segment represents the canyon section between Yellowjacket Creek and Wedge Creek.

Nevada Creek

Nevada Creek is a 4th order stream originating on the Continental Divide near Nevada Mountain. It enters the Blackfoot River near river mile 68. Nevada Creek leaves the Helena-Lewis & Clark National Forest and enters private ranchlands near stream mile 46 and flows another 12 miles to Nevada Creek Reservoir. Downstream of the reservoir, Nevada Creek flows through private ranchland with a small amount of state and federal land in the lower reaches. Major tributaries include Nevada Spring Creek at mile 5.7 and Douglas Creek at mile 4.7. Downstream of the Reservoir, there are two large unscreened canals (mile 28.5 and 25.7) and several unscreened smaller ditches that divert a large proportion of total discharge in Nevada Creek. Nevada Creek is a TMDL 303(d) water quality impaired stream (DEQ 2008).

An early restoration project in Nevada Creek occurred upstream of the reservoir in 2007 and included approximately 600 feet of channel restoration, 15,000 feet of riparian fencing, and off-stream stock water development. The first significant instream restoration project in Nevada Creek was implemented in 2010 directly downstream of the reservoir. Phase 1 included 4,400 feet of channel restoration and riparian vegetation enhancement to increase instream complexity, restore floodplain connection, and restore riparian health and streambank stability. Following this demonstration project, a project on lower Nevada Creek was implemented in 2014 between the junction of Douglas Creek (mile 4.7) and Nevada Spring Creek (mile 5.7) that included channel restoration on 3,200 feet of stream. This project reestablished a vegetated bankfull bench in a reach with highly erosive and vertical streambanks. In 2017, Phase 2 was implemented at the downstream end of Phase 1 and restored 3,700 feet of channel using similar techniques employed in Phase 1.

Following the success of Phases 1 and 2, similar restoration actions were implemented in the Phase 3 project section. Phase 3 was completed in 2019 and included 9,000 feet of channel restoration. In 2020, Phase 4 was implemented above the reservoir and represented the first significant project in Upper Nevada Creek. This project involved restoration of 7,100 feet of stream, including some channel realignment of short sections as well as stream bank treatments on most of the project section. Phase 5 was completed in 2022 downstream of Nevada Creek Ranch Road. Phase 6 was implemented directly downstream of the Douglas Canal diversion in 2023. The design for Phase 7 has been completed for the section downstream of Phase 5 and it is expected to be implemented in 2024.In addition to active channel restoration actions, grazing management plans were developed on all phases that maintained the agricultural viability of the properties while protecting riparian resources. The overall objectives of restoration efforts are to 1) create functioning stream and riparian areas capable of maintaining complex habitat and providing environmental conditions favorable for trout; 2) restoring connectivity through Nevada Creek downstream of the reservoir; and 3) increasing recruitment of multiple species to the Blackfoot River.

We surveyed Nevada Creek in 2022 to 1) continue long-term monitoring at previously established sites; 2) conduct a post-restoration fisheries survey in the Phase 3 project section; 3) evaluate longitudinal temperature changes; and 4) assess fishery composition changes between the reservoir and the mouth (see *Standalone Reports*).

North Fork Blackfoot River

The North Fork Blackfoot River is a 4th order tributary that flows south from the Continental Divide near Scapegoat Mountain and enters the Blackfoot River at river mile 54.

The upper 24 miles flow through the Scapegoat Wilderness (Lolo National Forest). Shortly downstream of the confluence of the North Fork and East Fork of the North Fork Blackfoot River there is a 50 ft natural barrier, North Fork Falls. The North Fork enters private land near stream mile 16.5. Upon exiting the mountains near stream mile 13.0, the North Fork enters Kleinschmidt Flat, a large glacial outwash plain where the North Fork loses water to alluvium before gaining groundwater and discharge from several spring creeks near Highway 200. Several large irrigation ditches are present in this part of the drainage.

The North Fork has been the focus of comprehensive restoration projects since the 1990s, which include 1) the screening of all irrigation canals on the mainstem North Fork; 2) instream restoration of all spring creeks (Rock Creek, Kleinschmidt Creek, Enders Spring Creek, Jacobsen Spring Creek and Murphy Spring Creeks); 3) instream flow enhancement on the mainstem and its tributaries; 4) improved riparian grazing practices; and 5) conservation easements on a

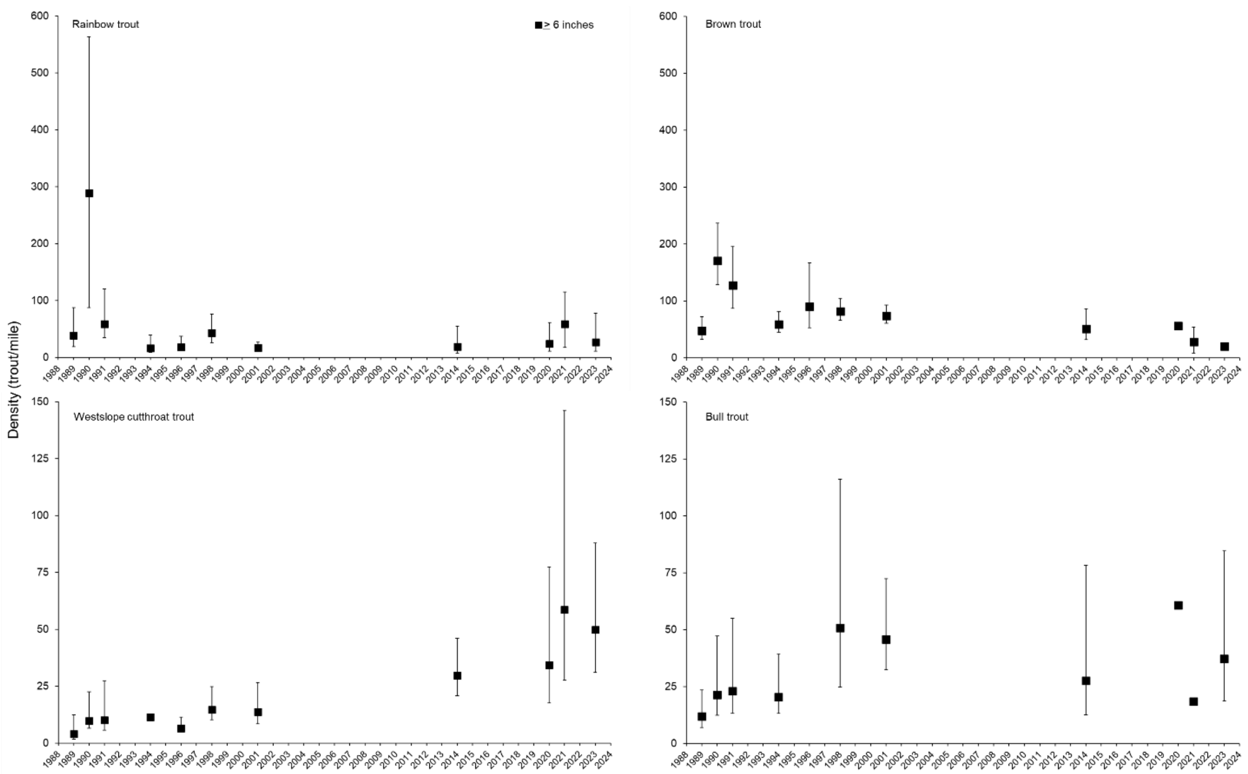

Figure 40. Density estimates of trout ≥ 6 inches in the Harry Morgan section of the North Fork Blackfoot River, 1989-2023. Note different Y-axis scales among species. Estimates are shown with 95% confidence intervals.

majority of the riparian areas located on private land. Restoration effort is primarily in the maintenance phase with project monitoring and upgrading previous screening infrastructure as it becomes outdated. However, practitioners continue to work with landowners to identify and execute water conservation measures and land management changes to facilitate additional improvements. Overall, restoration efforts are focused on eliminating entrainment of westslope cutthroat trout and bull trout and improving instream flows to increase recruitment of trout to the Blackfoot River. A large-scale native fish conservation project was planned for implementation in the Scapegoat Wilderness upstream of North Fork Falls in 2021, but litigation postponed that effort (see *Standalone Reports*).

The North Fork Blackfoot River supports migratory westslope cutthroat trout, bull trout, mountain whitefish, resident rainbow trout, brown trout, and brook trout. The North Fork supports the largest run of migratory bull trout in the upper Clark Fork River Basin. A genetic assignment study not only identified North Fork stock as distinct (Knotek et al. 2016) but also identified the North Fork bull trout as the most prevalent stock in the lower Blackfoot River. This study also connected the North Fork stock with Salmon Lake within the Clearwater drainage for the first time.

To monitor the North Fork stock of fluvial bull trout, FWP relies on annual spawning surveys as an index of population trends. Redd counts increased during the 1990s after protective angling regulations and the screening of all the North Fork ditches were enacted (see *Bull Trout Monitoring*). Following the removal of Milltown Dam in 2008, bull trout spawning activity increased to a record high in 2011. The recent declining trend between 2017 and 2023 is concerning because it represents the most years of consecutive declining redd counts in the monitoring period. However, it could be similar to the multi-year trough during the early 2000s rather than a true decline, given the redd counts have observation error. Alternatively, the North Fork population could be lagging several years behind the Monture and Copper Creek populations and exhibit the sustained decline in redds observed in those two drainages. The next few years will be critical in understanding how abnormal this recent trend is and whether the increased spawning activity from the recent high point in 2017 will translate into stronger adult returns because the cohort has started to reach sexual maturity.

In addition to bull trout redd counts, we conducted electrofishing surveys in 2021 and 2023 at a long-term monitoring site on the lower North Fork (Harry Morgan section, mile 4.0) originally established in 1989. This section had been surveyed infrequently since 2001, but was reestablished in 2020. We anticipate sampling the Harry Morgan section in years when the mainstem Blackfoot River sections are surveyed. We conducted a single marking and single recapture event using one drift boat shocking unit. Overall trout abundance increased in 2021 to the third highest on record, but declined in 2023 to slightly less than the long-term average of 181 trout/mile (Figure 40). In general, rainbow trout and brown trout have exhibited slight declines since 1989, whereas westslope cutthroat trout and bull trout have increased over that period. This has resulted in relatively stable total trout densities over this period. We did not recapture any bull trout in 2020 and 2021, precluding a valid estimate, but the 2023 estimate is consistent with densities from the late 1990s and early 2000s.

We conducted a genetic investigation in the Harry Morgan section in 2021 to understand the genetic integrity of westslope cutthroat trout and provide a baseline for future monitoring because genetic surveys have never been conducted downstream of North Fork Falls. Overall, we captured a 101 *Oncorhynchus* spp. and randomly collected tissue samples for genetic analysis from 95 individuals. Not surprisingly, *Oncorhynchus* spp. individuals covered the spectrum of non-hybridized westslope cutthroat trout to non-hybridized rainbow trout (Figure 41). Interestingly, 80% of the individuals phenotypically identified as westslope cutthroat trout for abundance estimates were non-hybridized and 96% had less than 10% rainbow trout admixture. The highest rainbow trout admixture in an individual identified as a westslope cutthroat trout was 19%. These genetic results provide a valuable baseline for future assessments to evaluate changes in genetic composition and introgression. Moreover, these results provided confirmation that we are relatively accurate in differentiating westslope cutthroat trout, rainbow trout, and hybrids in our electrofishing surveys.

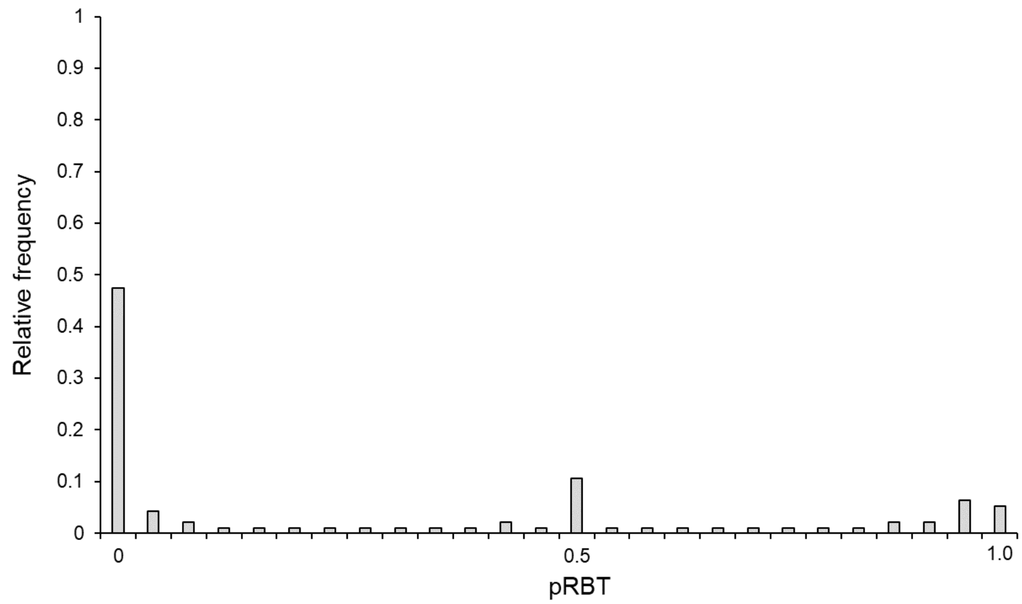

Figure 41. Relative frequency of percent rainbow trout ancestry (pRBT) in *Oncorhynchus* spp. collected in the Harry Morgan section of the North Fork Blackfoot River, 2021.

We continued operating a water temperature logger near stream mile 16.3 that was reestablished in 2020. This logger was installed near the USFS bridge downstream of the North Fork Trailhead, providing a better understanding of temperatures in the primary spawning reach compared to the long-term site in the lower North Fork. We recorded the warmest daily maximum water temperature of 56.4°F in July 2023, whereas daily maximum temperatures remained below 56 °F in 2021 and 2022. Annual long-term monitoring also continued for the 29th year at stream mile 2.6 in the lower North Fork, documenting a daily maximum water temperature of 63.1°F during July 2023. Daily maximum temperatures remained below 62.4 °F in 2021 and 2022. Overall, recent temperature monitoring indicates highly suitable temperatures throughout the North Fork. Although the warmest daily maximum temperatures exceed the recommended 59 °F threshold, the temperature regime is relatively similar over the last three decades suggesting that bull trout inhabiting this section are unimpacted for the brief duration above 59 °F or they find areas of refugia during those timeframes.

Park Creek

Park Creek is a 1st order stream that drains the southern slope of Stonewall Mountain near Lincoln, MT. Park Creek flows 4.2 miles southwest through Helena National Forest and state land to its confluence with Stonewall Creek at stream mile 2.5. Due to past harvest of riparian conifers and the subsequent lack of large woody debris recruitment, Park Creek lacks habitat complexity in lower reaches. A substantial amount of Park Creek's flow was diverted for irrigation and lost to in-stream fords during high water. Lower Park Creek has been damaged with a network of roads and fords. Several restoration actions were completed in Park Creek in 2017 including the removal of an unscreened diversion at mile 1.4, an instream flow lease, and replacing an existing ford on DNRC property with a bridge. Collectively, these projects restored connectivity through this system and eliminated entrainment. The objectives of restoration efforts in Park Creek have been to increase abundance and distribution of westslope cutthroat trout.

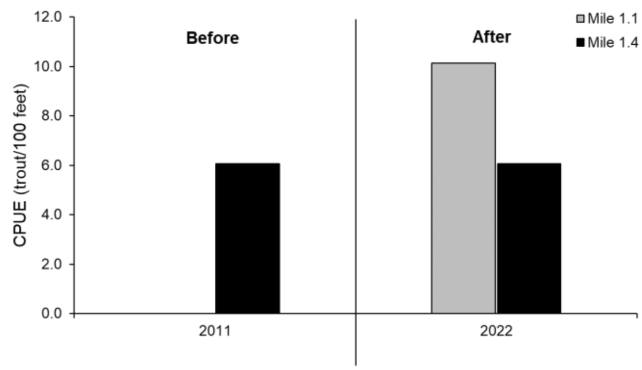

Figure 42. Relative abundance estimates for age-1 and older westslope cutthroat trout in two sections of Park Creek, before (2011) and after (2022) restoration.

Past surveys in Park Creek are limited to a baseline survey in 2011 which included two sections (miles 1.1 and 1.4). At the time, the unscreened ditch at mile 1.4 was diverting most of the water and had a CPUE of 2.1 (Pierce and Podner 2013). Prior to the restoration project, the CPUE was 6.1 trout/100 feet at stream mile 1.4, whereas no fish were encountered downstream of the ditch at mile 1.1. The post-restoration survey in 2022 documented the same CPUE of 6.1 trout/100 feet at mile 1.4, but a CPUE of 10.1 at mile 1.1 (Figure 42). The recent survey indicates the water lease and removal of the unscreened irrigation ditch has led to westslope cutthroat trout presence in an area they were previously absent from, thereby increasing their distribution and abundance within Park Creek.

Poorman Creek

Poorman Creek is a 3rd-order tributary that drains a 43-square mile watershed and flows 14 miles to its junction with the Blackfoot River at river mile 108. The stream originates at the Continental Divide near Stemple Pass. Landownership in the upper 11.6 miles of Poorman Creek consists primarily of Helena National Forest land mixed with small parcels of privately-owned land adjacent to the stream channel (old, patented mining claims). The lower 2.5 miles of stream flows entirely through private ranchland.

Impairments in Poorman Creek are caused by legacy and contemporary effects of hard rock and placer mining, subdivision impacts, road encroachment, and undersized crossings. Agricultural practices have also caused issues related to irrigation withdrawals, fish entrainment, channel instability, excessive riparian grazing pressure, and sedimentation. Restoration efforts have been ongoing since 2002 with the primary objective of increasing recruitment of native trout to the Blackfoot.

Fisheries-related improvements initially focused on lower Poorman Creek and included instream flow enhancement (water lease) and ditch screening through flood-to-sprinkler irrigation conversion, stream crossing upgrades, riparian grazing changes (corridor fencing, off-stream water), and shrub plantings. Furthermore, several road crossings on the mainstem of Poorman Creek have been upgraded to improve habitat connectivity for native trout. In 2014, the USFS removed four fords, one undersized culvert, and decommissioned 2,200 feet of streamside road in the South Fork of Poorman Creek. In 2019, BBCTU and the USFS constructed 1,500 feet of new stream channel through a historically channelized placer mining area at stream mile 8.0. Project actions provided additional fish habitat by increasing channel sinuosity, creating more complex pools with large woody debris, and reconnecting the channel to a new floodplain. An undersized culvert at the upstream end of the project section was removed in 2019 and replaced with a free spanning bridge in 2020. An undersized, perched culvert at stream mile 5.0 was replaced with a bridge in 2021. A Phase 2 restoration project was implemented in lower Poorman Creek in 2021. This project improved approximately 8,400 feet of stream using a suite of treatment actions including channel reconstruction and shaping, pool development, and installation of vegetated wood matrices and large woody debris structures. Moreover, a grazing management plan was developed for 550 acres encompassing this section of stream. The riparian area will be excluded from grazing for a minimum of 10 years to ensure recovery. Late-season flows have been very minimal or intermittent in the project reach following completion. Consequently, survival of riparian vegetation was low. The longevity of perennial flow has increased each year and the project reach did not go dry until late-August in 2023. Future revegetation efforts are anticipated after perennial flow returns to the project section.

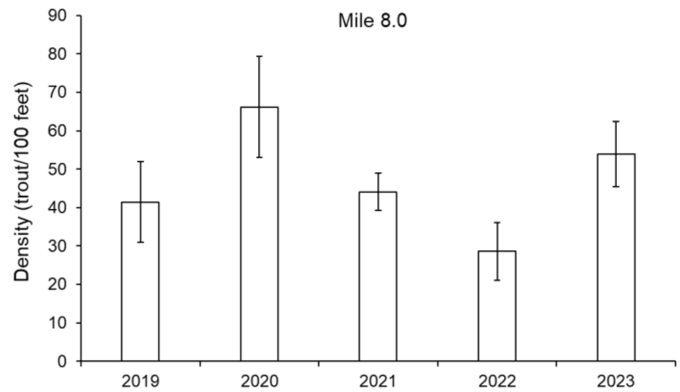

Figure 43. Density of age-1 and older westslope cutthroat trout in the upper restoration project location (stream mile 8.0) in Poorman Creek, 2019-2023. Estimates are shown with 95% confidence intervals.

Poorman Creek supports genetically pure westslope cutthroat trout, brown trout, and brook trout. It is the only tributary stream south of the Blackfoot River that still supports bull trout reproduction. The relative abundance of native trout tends to increase in the upstream direction, whereas nonnative fish are more abundant in lower Poorman Creek. We conducted a pre-restoration survey in 2019 at mile 8.0 followed by annual post-restoration surveys since 2020. Monitoring results from 2019 documented considerable abundance of age-1 and older westslope cutthroat trout, which indicates the overall productivity of Poorman Creek. No bull trout were captured in the pre-restoration survey, although they have been documented upstream and downstream of the project section in the past. Moreover, bull trout were also captured during the post-restoration surveys in 2020-2022, but not in 2023 (Appendix A). Surveys also documented the limited presence of brown and brook trout, indicating their abundance has not expanded following the project. There was an initial rapid increase in cutthroat trout density in the year following project implementation. However, declines through 2022 dropped below the pre-restoration abundance. The 2023 density estimate was higher than the pre-treatment estimate (Figure 43). The post-

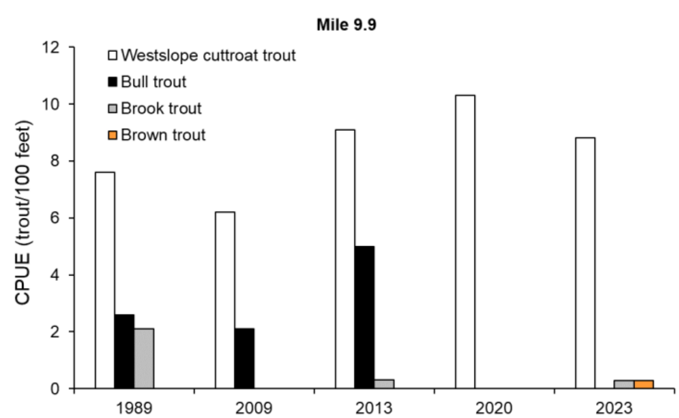

Figure 44. Relative abundance of age-1 and older trout in the long-term monitoring section at stream mile 9.9 in Poorman Creek, 1989-2023.

restoration mean of 48.3 trout/100 ft is only slightly higher than the 2019 estimate of 41.4 trout/100 ft. Unfortunately, the single year of pre-treatment data limits our inference about project-specific effects on habitat capacity.

We also surveyed a section at stream mile 9.9 that has been sampled infrequently since 1989. This portion of Poorman Creek historically supported bull trout and westslope cutthroat trout, along with the inconsistent presence of brook trout. Westslope cutthroat trout relative abundance has been stable over the last few decades. Bull trout have not been captured since the 2013 survey (Figure 44). Interestingly, a single brown trout was captured for the first time in 2023. The contemporary status of bull trout in Poorman Creek remains unclear because they have been captured recently at steam mile 8.0, but we have not captured them at mile 9.9, where CPUE was consistently moderate from 1989 to 2013. Future targeted monitoring is needed to fully understand the contemporary status of bull trout in Poorman Creek.

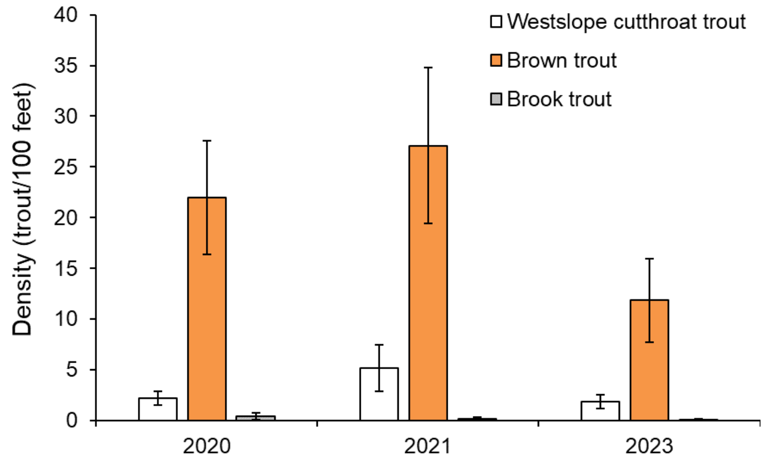

Figure 45. Density estimates of age-1 and older trout in the restoration project section in lower Poorman Creek (mile 0.55), 2020-2023. Estimates are shown with 95% confidence intervals.

A new survey site (stream mile 0.55) was established in 2020 within the Phase 2 restoration project reach in lower Poorman Creek. The site length (3,970 ft) covers a large portion of the total project section. Previous surveys have been conducted in the project vicinity (stream miles 1.3 and 1.5), but the new section was established to provide a larger spatial scope, and therefore, more robust effectiveness monitoring. Two years of pre-restoration surveys occurred during 2020-2021 (Uthe et al. 2021). Post-restoration surveys did not occur until 2023 because the channel was primarily dry by August. Overall trout density was much lower in 2023 than the pre-restoration surveys and the decline was most pronounced for brown trout (Figure 45). Interestingly, westslope cutthroat trout comprised a larger proportion of the trout community in 2023. Species composition will be an important metric to continue evaluating with future monitoring. This section will be particularly valuable for effectiveness monitoring because it has more than one year of pre-treatment data to establish the natural range of variability and strengthen our inference about project-specific benefits.

We operated water temperature sensors at the Stemple Pass Road bridge (mile 2.2) and the Phase 1 restoration project section (mile 8.0) since 2020. Prior to these recent installations, monitoring occurred at mile 0.2 in 2012 and at mile 2.2 in 2007. The warmest daily maximum temperature within the current monitoring period at mile 8.0 was 55.3°F in August 2021. Daily maximum temperatures remained below 54.1°F during 2022 and 2023, indicating the current thermal regime in upper Poorman Creek is ideal for bull trout. Water was slightly warmer downstream at mile 2.2 with the warmest daily maximum temperature of 60.0°F in August 2021. Overall, Poorman Creek provides a suitable thermal regime for bull trout.

Snowbank Creek

Snowbank Creek is a 1st-order tributary to Copper Creek, entering at mile 6.2 with a base flow of approximately 4 cfs. The mainstem of Snowbank Creek is 5.1 miles in length and drains a small watershed on the northeast slopes of Stonewall Mountain within the Helena National Forest. In 2003, the Snow Talon wildfire burned significant portions of the Copper Creek drainage. Prior to 2003, lower Snowbank Creek was chronically dewatered downstream of a diversion at mile 0.4, which also created fish passage and entrainment problems. Following identification of these issues, baseflows were restored to a target 4 cfs in 2004. In 2009, the diversion was replaced with a rock weir structure to accommodate fish passage and a Coanda fish screen was installed in the ditch to eliminate entrainment. In 2013, an undersized culvert at stream mile 0.2 was replaced with a bridge to facilitate fish passage. In 2019, the bypass outlet on the Coanda screen channel was disconnected due to excessive scour below the screen. Material was excavated prior to the irrigation season in 2020. During the 2020 survey, visual inspection of the bypass channel indicated that surface water connection existed at baseflow conditions. All known primary anthropogenic impacts have been addressed. The goal of restoration efforts has been to improve recruitment of native trout to the Blackfoot.

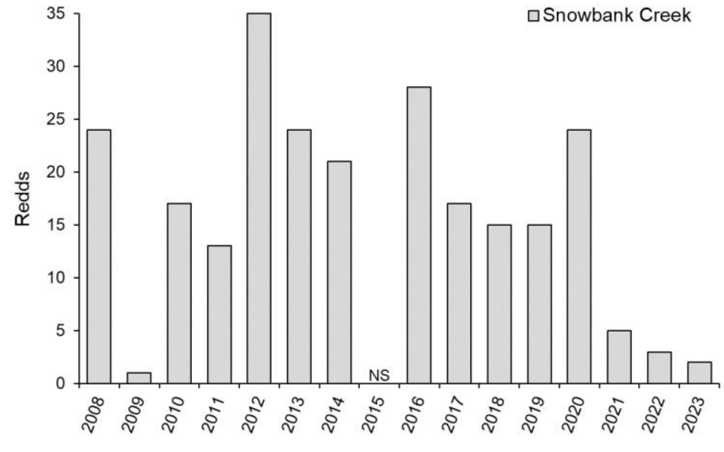

Figure 46. Bull trout redd counts in Snowbank, 2008-2023.

Snowbank Creek supports genetically unaltered westslope cutthroat trout and bull trout. We continued long-term electrofishing surveys at mile 0.4 in 2021 and 2022 to assess project effectiveness and contribute to bull trout status monitoring in the Copper Creek drainage. Prior to restoration, westslope cutthroat trout were present in low abundance, and bull trout were absent from electrofishing survey sites in 2003 (Pierce et al. 2004, 2006). Following restoration, a pronounced increase in westslope cutthroat trout abundance was observed, which was probably due to a combination of restoration actions and post-fire productivity increases in the drainage. Bull trout presence was documented in 2005, followed by successful spawning within and upstream of the dewatered stream segment in 2008. Westslope cutthroat trout densities have increased since the lows in 2013-2020, but are still below the highest densities directly after the fire (Figure 47). The trend is similar to nearby Copper Creek, which may

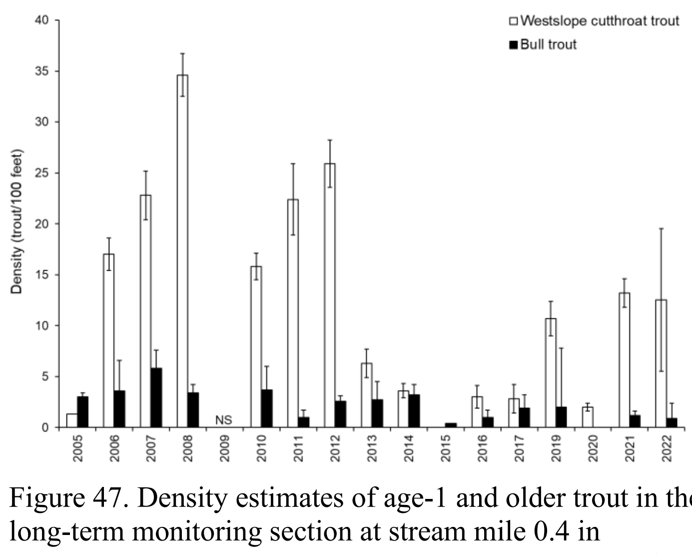

Figure 47. Density estimates of age-1 and older trout in the long-term monitoring section at stream mile 0.4 in Snowbank Creek, 2005-2022. Estimates are shown with 95% confidence intervals.

indicate both streams are returning to pre-fire baseline conditions. Bull trout densities were low in recent years and the overall trend is consistent with redd counts (Figure 46).

Spring Creek (Cottonwood Creek drainage)

Spring Creek and an unnamed tributary (stream mile 0.45) combine to form a small 2nd order tributary to upper Cottonwood Creek. Spring Creek supports westslope cutthroat trout and brook trout. Bull trout presence was documented in the 1980s. Spring Creek has been diverted on a year-round basis since 1989 and its 1.0-2.0 cfs baseflow is now disjunct from Cottonwood Creek. The entire discharge is captured downstream of Cottonwood Lakes Road and diverted into Woodworth Meadows.

Spring Creek historically flowed through private timber and agricultural lands. Following land acquisitions, nearly all of the Spring Creek drainage is on public land managed by the Lolo National Forest. However, the lower portion of the channel is captured and diverted onto private agricultural land in Woodworth Meadows. An early project completed by the USFS replaced an undersized culvert on Cottonwood Lakes Road with a bottomless arch culvert. In 2020, the USFS and BBCTU completed a collaborative project that decommissioned approximately 0.4 miles of riparian road and removed two undersized culverts from Spring Creek.

Spring Creek has been surveyed infrequently since 1989. We conducted surveys in 2021 to investigate contemporary species composition and assess genetic integrity of westslope cutthroat trout. We resurveyed a long-term survey site at mile 0.2 and resampled recently established survey sites at stream mile 1.4 on Spring Creek and at stream mile 0.9 on an unnamed tributary. Since 1989, brook trout abundance has increased considerably, and now brook trout are the most abundant species at mile 0.2 and mile 1.4 (Figure 48). Westslope cutthroat trout CPUE has generally been stable with short-term fluctuations. Given that bull trout were present in very low abundance in 1989 and not captured during recent surveys, it is very likely that long-term disconnection from Cottonwood Creek has led to local extirpation of bull trout in Spring Creek. Moreover, the increase in brook trout abundance may have been a contributing factor.

Surveys in the unnamed tributary stream (stream mile 0.9) documented moderate CPUE of westslope cutthroat trout. Interestingly, brook trout were not found in the unnamed tributary. The perched culvert at the upstream end of the sampling section is probably a complete passage barrier (47.14139; -113.33396). A USFS survey in 2008 documented westslope cutthroat trout above this location, so those fish may be functioning as an isolated population. Future surveys should confirm if the

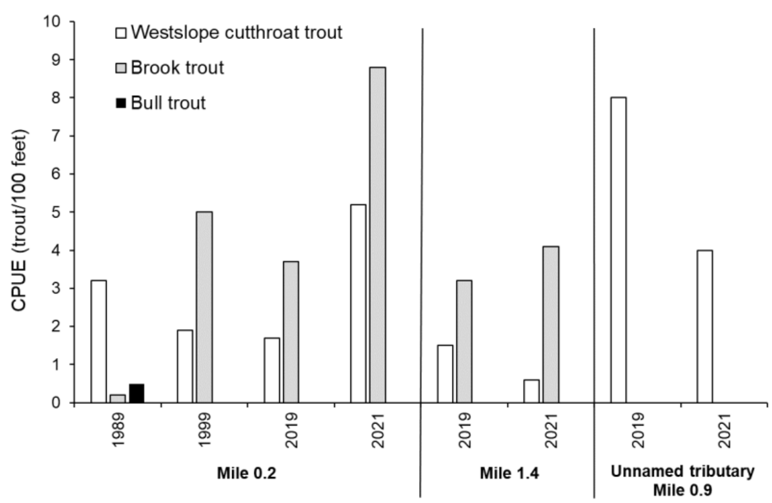

Figure 48. Relative abundance estimates for age-1 and older trout in three monitoring sections in the Spring Creek drainage.

culvert is a complete barrier, assess distribution and abundance upstream of the culvert, and assess genetic integrity.

We collected genetic samples from westslope cutthroat trout at all three survey sections in 2021. All individuals were non-hybridized except for a single hybrid trout captured at stream mile 0.2. The individual had 12% rainbow trout admixture. The presence of a single hybrid is concerning because it may indicate the recent invasion of Spring Creek by rainbow or hybrid trout. Spring Creek has been considered disconnected since the stream was diverted in 1989, but the genetics results raise uncertainty about that assumption. If rainbow trout or hybrid trout were present in 1989, we would have expected more widespread hybridization in the 2021 genetic results. Further reconnaissance is needed to determine if partial or seasonal connections exist between Spring Creek and Cottonwood Creek. The non-hybridized westslope cutthroat trout population has high conservation value because of its high degree of genetic variation compared to other populations throughout the Columbia River drainage in Montana (Kovach et al. 2022). With recent efforts to expand connectivity within the Spring Creek drainage, it will be prudent to assess existing barriers that can be used for strategic isolation of non-hybridized westslope cutthroat trout.

Warren Creek

Warren Creek, a small tributary to the middle Blackfoot River, originates on Ovando Mountain and flows 12 miles southwest to its confluence with the Blackfoot River at river mile 50. The headwaters are located on the Blackfoot Clearwater Wildlife Management area. Warren Creek flows though the Blackfoot Community Conservation Area before entering private ranch land in the lower 8-9 miles. Warren Creek has been influenced by agricultural activities that include stream channel straightening, dewatering, and the clearing and overgrazing of riparian vegetation.

Since 1995, Warren Creek has been the focus of extensive restoration actions that involved the removal of several streamside corrals, implementation of grazing plans, shrub plantings, and several miles of channel reconstruction. Some of the private lands were enrolled in conservation easements and an instream flow enhancement occurred near the mouth. The goals of restoration have been restoring riparian vegetation and stream habitat for all life stages of trout; improving spawning and rearing conditions; and increasing recruitment of trout to the middle Blackfoot River.

Fisheries surveys in lower Warren Creek were conducted annually during the early-2000s but had not been conducted since 2009. Stream temperature monitoring and fisheries surveys were conducted in Warren Creek in 2021 to evaluate contemporary stream conditions and fish population status (Figure 49). Temperature loggers were installed in Warren Creek on June 23 and removed on September 15. Temperatures were monitored at five historical locations (see Shields et al. 2009). We conducted electrofishing surveys at three previously sampled sites (stream miles 3.6, 2.2,1.1) and a new site at stream mile 0.5. We conducted two-pass depletion surveys at all sites.

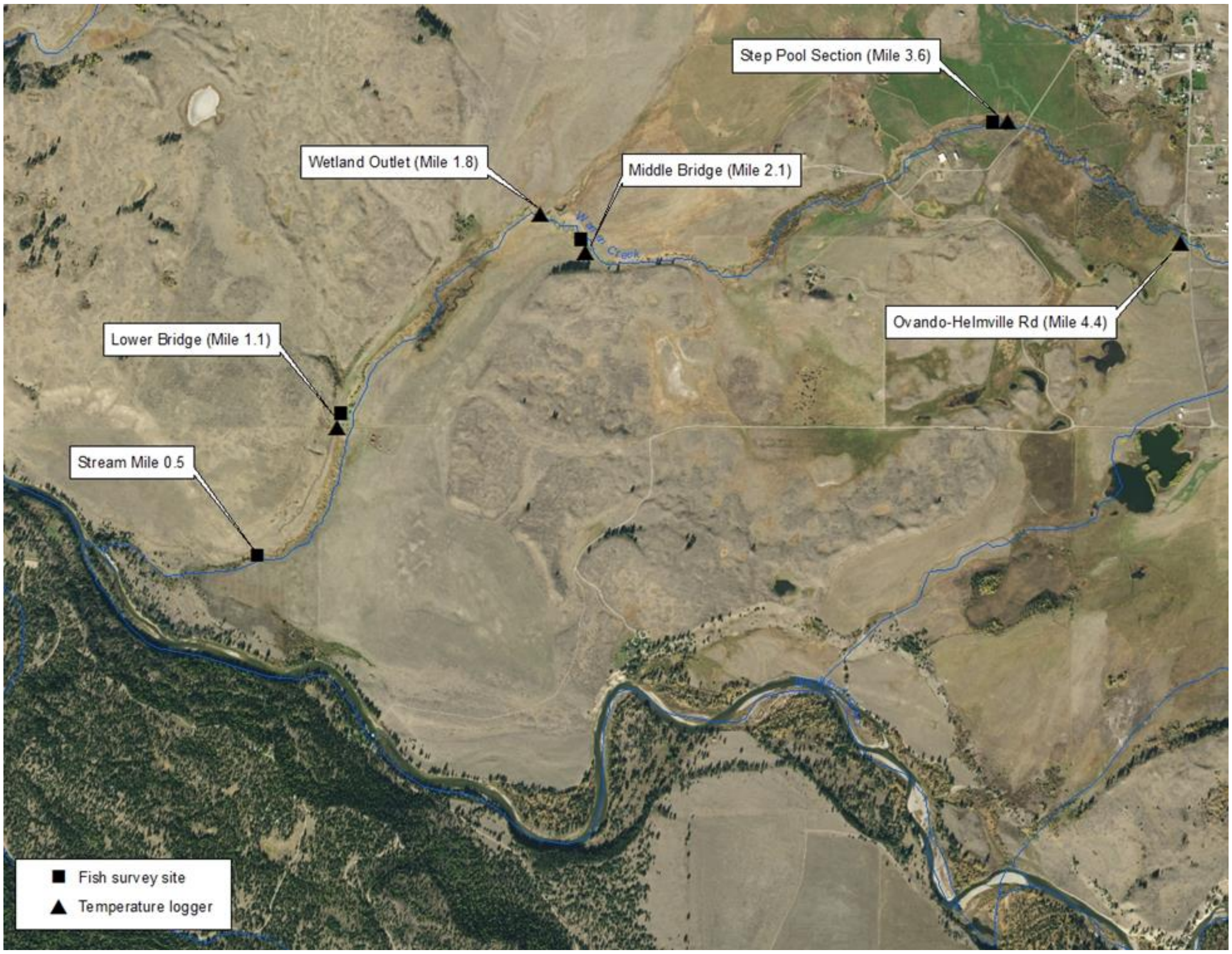

Figure 49. Map of fish survey sites (black squares) and temperature loggers (black triangles) in Warren Creek, 2021.

Temperatures increased in the downstream direction, with a pronounced increase between stream mile 3.6 (step pool restoration section) and the middle bridge. We also documented a significant increase between the wetland outlet channel and the lower outlet channel and the lower bridge at mile 1.1. Interestingly, the lower bridge site had elevated temperatures even after the wetland outlet channel cooled in mid-July. The constructed wetland outlet is undoubtedly having a strong influence on water temperature in the lower section of Warren

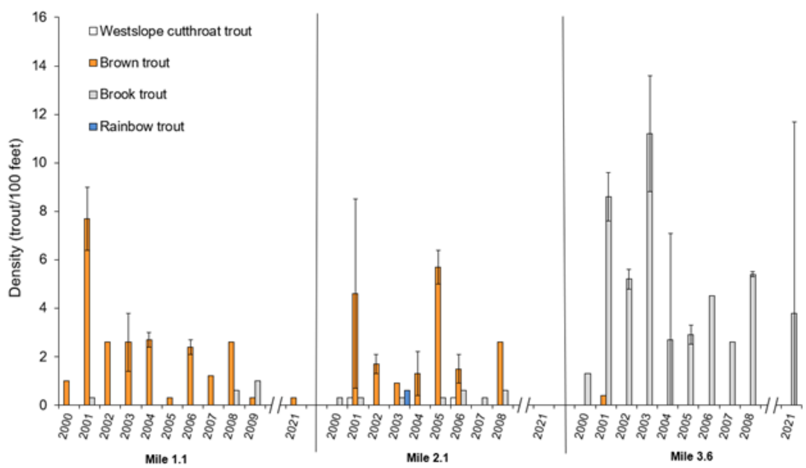

Figure 50. Density estimates of age-1 and older trout at three long-term monitoring sites in Warren Creek. Estimates are shown with 95% confidence intervals.

Creek, but the wetland complex on the southeast side of the channel is probably contributing warm water to the channel as well. Furthermore, the lack of overhanging woody vegetation throughout this section probably exacerbates the warming caused by these inputs.

Trout abundance was consistently lower at all survey sites in 2021 compared to previous surveys (Figure 50). The survey site at stream mile 0.5 had an estimated density of 0.8 brown trout per 100 feet (not shown in Figure 50), which was similar to the survey section at the lower bridge. No fish were captured in the survey section at the middle bridge. In sites where fish were present, nongame species (sucker and redside shiner) were the most abundant species. The fish assemblage generally reflected the temperature regime at each site.

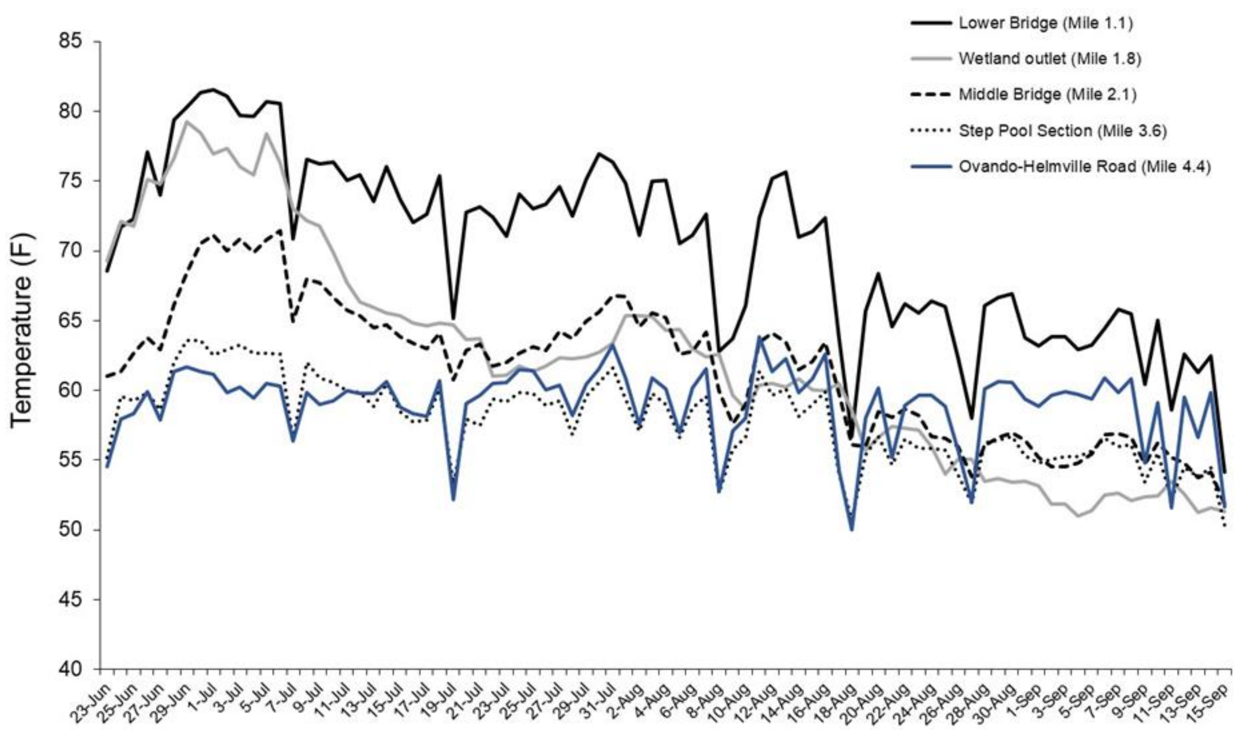

Figure 51. Stream temperature measured at five locations in Warren Creek, June – September, 2021.

The downstream sampling sections consistently had maximum daily temperatures above the threshold considered suitable for most trout species (> 73°F). However, the step pool section had suitable temperatures throughout the entire summer, but low trout abundance (Figure 51). The middle bridge section had marginal temperatures early in summer, but relatively suitable temperatures for the remainder of the season. Therefore, the lack of trout in this section is surprising because we did not observe any obvious issues that would preclude trout presence. Temperature is probably the primary limiting factor in the lower section of Warren Creek, with additional stressors related to excessive sedimentation and lack of instream complexity. High sedimentation may be affecting spawning success, macroinvertebrate production, and subsequent foraging opportunities.

We also surveyed several sites in the upper portion of the Warren Creek drainage in 2022 (Figure 52). All sites were located on the Blackfoot Clearwater Wildlife Management Area. The surveys were conducted to assess fish presence because this unnamed tributary that connects to the outlet channel of Doney Lake had not been surveyed before. Westslope cutthroat trout and brook trout were present in both forks of the unnamed stream. Genetic analyses of westslope cutthroat trout revealed a trivial amount of hybridization with rainbow trout (0.2%) in much of this drainage (Kovach et al. 2023). However, rainbow trout admixture was not detected in fish upstream of an undersized, perched culvert in Township 15N, Range 11W, Section 18. The culvert may be functioning as a barrier to upstream migration, thereby protecting the genetic integrity of westslope cutthroat trout.

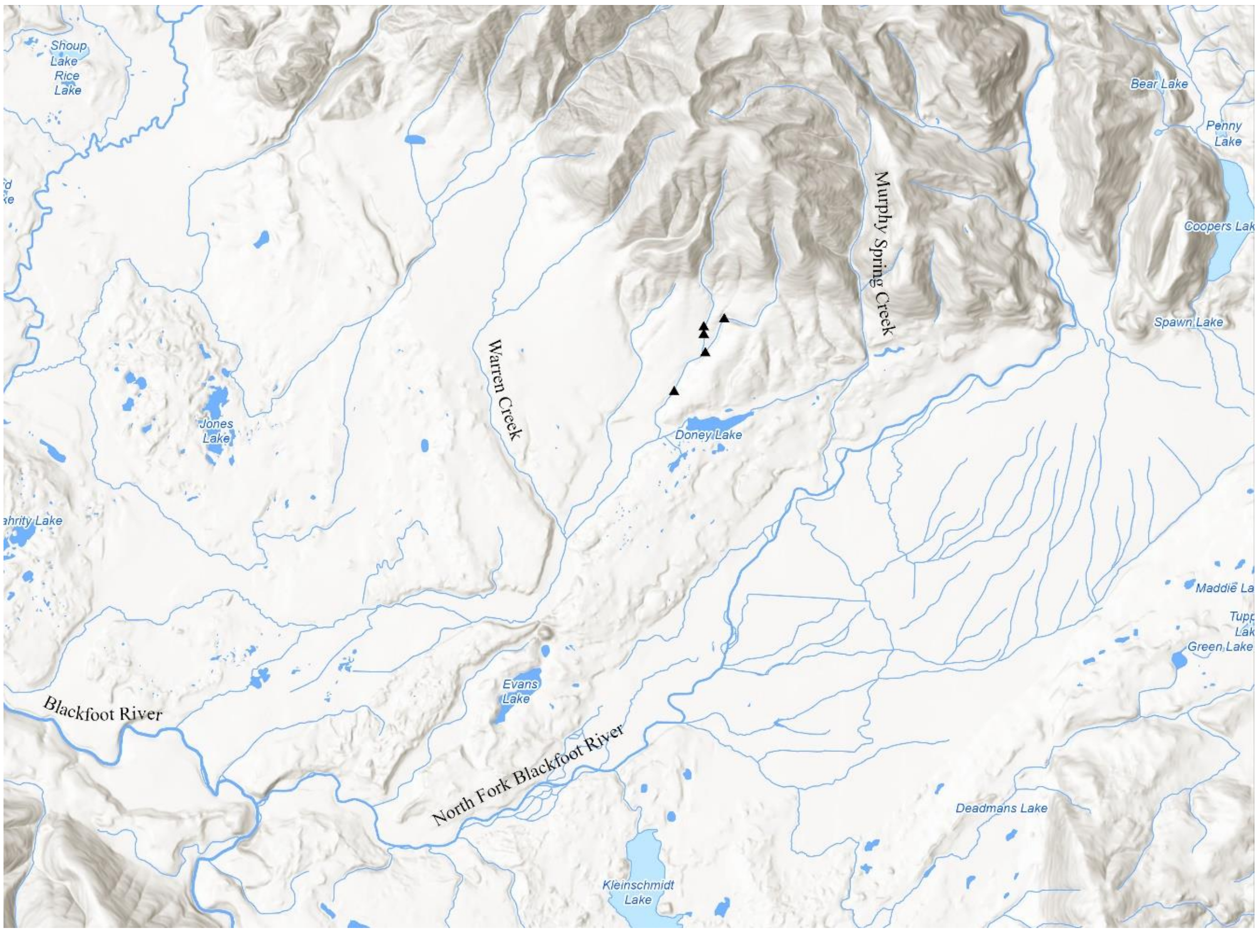

Figure 52. Map of electrofishing sites (black triangles) in an unnamed tributary to the Doney Lake outlet channel, 2022.

West Twin Creek

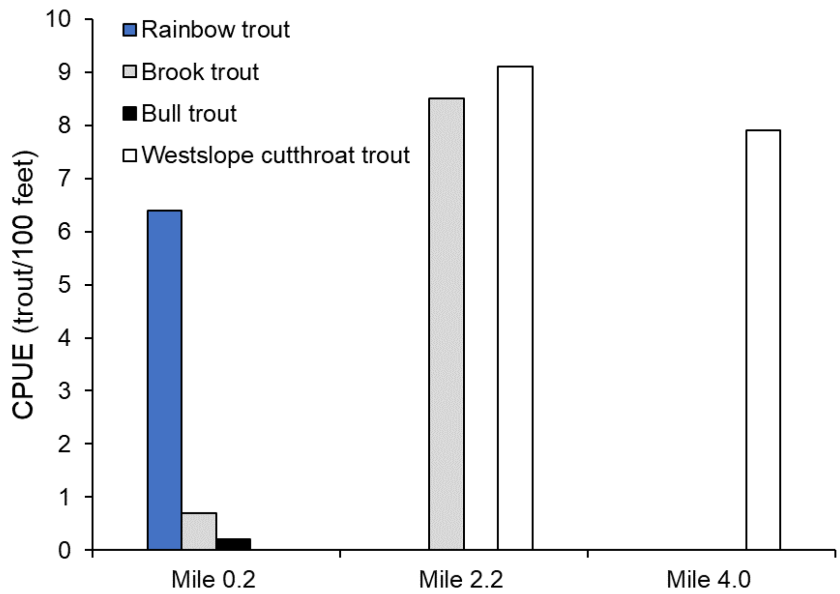

Figure 53. Relative abundance estimates for age-1 and older trout in three monitoring sections in West Twin Creek, 2023.

West Twin Creek is a small 3rd-order tributary to the lower Blackfoot River that originates from the slopes of Wisherd Ridge and Sheep Mountain. It flows south through public and private land. Several of the private parcels are currently owned by Montana Checkerboard LLC., with anticipated transfer to public ownership in the future. The BLM is currently scoping this acquisition through a public process. West Twin Creek is a previous restoration focal stream in which the primary impairment was addressed with the completion of a fish passage project at Highway 200. The Nature Conservancy also decommissioned a riparian road that paralleled West Twin Creek for 1-2 miles and converted it to a single-track trail. West Twin Creek supports a high value sport fishery with a mixed species composition of westslope cutthroat trout, rainbow trout, brown trout, and brook trout in low numbers.

Fisheries surveys have been very limited over the last few decades. We surveyed three sections to assess longitudinal changes in species composition and collect genetic samples for the Blackfoot River hybridization study. Although survey effort has been limited, we captured bull trout for the first time in West Twin Creek. The subadult bull trout assigned to the North Fork Blackfoot River. Longitudinal species composition changes were similar to East Twin Creek with nonnative trout comprising the majority of the trout assemblage in the lower reaches and transitioning to an exclusively westslope cutthroat trout fishery in the upper reaches (Figure 53). Interestingly, the nonnative species community shifted drastically between the lower and middle site. Brook trout were not captured at mile 0.2, whereas rainbow trout were not captured at mile 2.2. Moreover, only westslope cutthroat trout were captured at mile 4.0. The stark change in species composition, particularly between the middle and upper site, warrants further investigation to determine if physical stream attributes limit upstream expansion of nonnative trout.

Lake and reservoir monitoring

Coopers Lake

Coopers lake is a 215-acre glacial lake in the North Fork Blackfoot River drainage. The lake is surrounded by private land except for the USFS Big Nelson Campground at the south end of the lake. The campground has several campsites and a primitive boat ramp. McDermott Creek is the only substantial tributary and flows into the north end of the lake. A large portion of the creek is intermittent. An unnamed, perennial tributary flows into the lake from the east, along with a few small springs. The outlet channel forms Salmon Creek, which combines with Dry Creek to form Rock Creek, a tributary to the North Fork Blackfoot River.

Coopers Lake supports abundant populations of northern pikeminnow and longnose sucker. Westslope cutthroat trout and brook trout are also present and provide the recreational fishing opportunity. The lake was treated with rotenone in 1967 to eradicate nongame species to improve the cutthroat trout fishery. Although westslope cutthroat trout abundance increased immediately after the project, the piscicide treatment was unsuccessful because longnose sucker and northern pikeminnow were captured in gill nets during a 1969 survey. Nongame fish became the most abundant catch by the next survey in 1976. Periodic surveys over the subsequent decades documented the lake trending back to pre-treatment conditions with the fishery biomass dominated by northern pikeminnow and longnose sucker.

Predation by northern pikeminnow has been hypothesized as a primary limiting factor for hatchery-origin westslope cutthroat trout. Using published relationships of maximum prey length to northern pikeminnow size (Zimmerman 1999), the 2016 gill netting data indicated that 71.5% of northern pikeminnow could consume a 4-inch cutthroat trout, 21.5% could consume a 5-inch cutthroat trout, 2.7% could consume a 6-inch westslope cutthroat trout, and 0.4% could consume a 7-inch cutthroat trout. Therefore, a stocking change was proposed to use indoor-raised trout that had an average length of 5.5 inches, rather than the outdoor-raised trout with an average length of 4.3-4.9 inches. Fish raised indoors at Washoe Park Hatchery have a larger average size than the fish kept outside over the winter.

The stocking change was initiated with the 2022 stocking event. The 2022 gill net survey was conducted approximately one week after stocking occurred. Surprisingly, no 2022 plants were captured in the nets. Therefore, the 2022 results can be considered a pre-treatment CPUE because the catch was not biased high from recently stocked trout. Northern pikeminnow increased in CPUE in the 2023 survey, but other species remained relatively stable. Westslope cutthroat trout have not exhibited a substantial increase in abundance as of 2023 (Figure 54). Notably, a single 29-inch, adult bull trout was captured in 2022. Genetic assignment results indicated this individual was from the North Fork Blackfoot River. It most likely ascended Rock

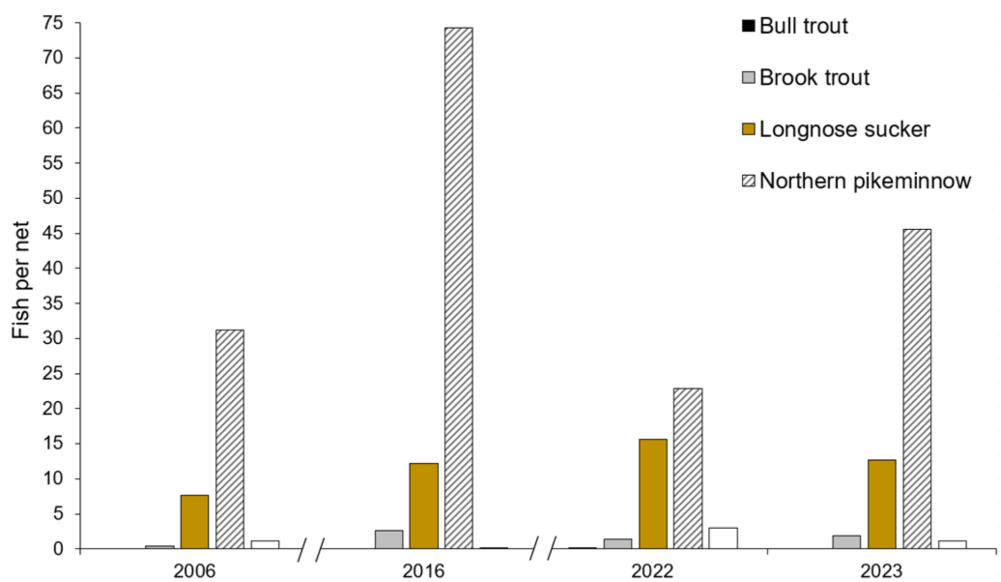

Figure 54. Relative abundance estimates from overnight gill net surveys in Coopers Lake, 2006-2023.

Creek and Salmon Creek and entered Coopers Lake as a subadult before rearing to maturity within Coopers Lake. The only previous record of bull trout presence was a single 17.4-inch individual captured in a 1976 gill net survey. Consistent ongoing monitoring is critical to adaptively managing the stocking program to increase the abundance of westslope cutthroat trout in Coopers Lake.

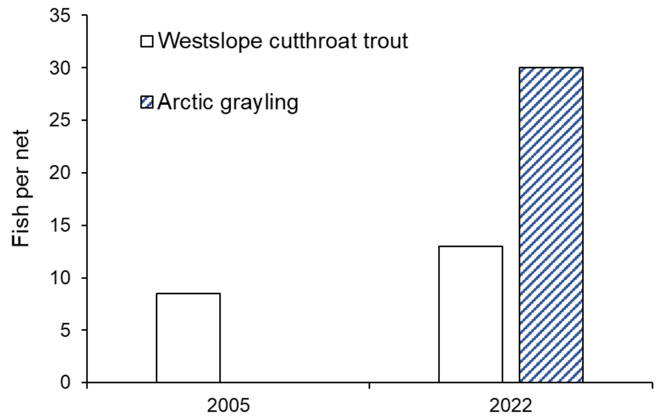

Figure 55. Relative abundance estimates from overnight gill net surveys in Heart Lake in 2005 and 2022.

Heart Lake

Heart Lake is a popular mountain lake fishery located in the Scapegoat Wilderness. The 32-acre lake does not have an inlet or outlet. Heart Lake has a long history of stocking with Arctic grayling and westslope cutthroat trout. Stocking occurred sporadically from the 1930s-1960s, but a long lapse occurred until 1988. Consistent stocking on 5–7-year intervals has occurred since 2001. Heart Lake has been surveyed infrequently since stocking began. The only survey records are from 1968 and 2005. Interestingly, the 1968 survey only captured Arctic grayling and the 2005 survey only captured westslope cutthroat trout. Cutthroat trout had not been stocked since 1952. Conversely, Arctic Grayling had not been stocked since 1989. Although

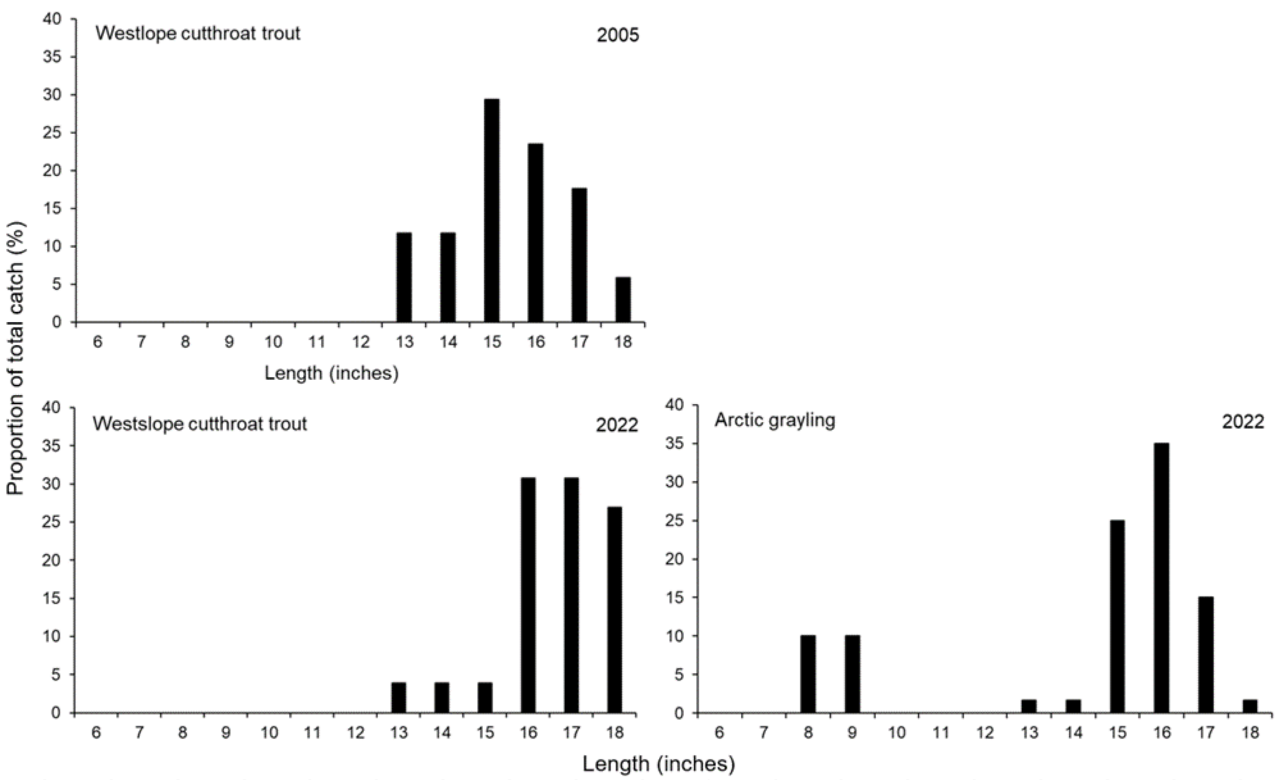

Figure 56. Length frequency histograms for westslope cutthroat trout and grayling captured in overnight gill net surveys in Heart Lake in 2005 (top) and 2022 (bottom).

Spence (1968) asserted that Arctic grayling reproduction was evident, the observed species compositions from these two prior surveys in the context of when stocking occurred provide strong evidence that natural reproduction is not capable of sustaining the Heart Lake fishery. The 2022 survey indicated two distinct age classes of Arctic grayling and westslope cutthroat trout. Relative abundance of westslope cutthroat trout was significantly higher than 2005 (Figure 55). Moreover, the relative abundance of arctic grayling was over two times higher than westslope cutthroat trout in 2022. The high relative abundance and size structure indicates the fishery is healthy and should provide excellent angling opportunity with quality fish (Figure 56). Current stocking rates and stocking intervals are achieving management objectives. Consistent monitoring should be maintained into the future to evaluate any needed changes in the stocking program to maintain the quality of this extremely popular fishery.

Lower Copper Lake

Lower Copper Lake is a 6-acre glacial cirque lake. The outlet channel combines with the outlet channel from Upper Copper Lake to form the headwaters of Copper Creek. Rainbow trout were stocked once in 1959 and westslope cutthroat trout were stocked several times from 1969-1979. The only survey records include a 1968 survey and a 2006 survey. The 1968 survey captured a single rainbow trout x cutthroat trout hybrid. Spence (1968) mentioned very little reproduction was occurring and recommended stocking with cutthroat trout. Interestingly, the single rainbow trout stocking event was the only stocking record prior to 1968, so the presence of a cutthroat trout hybrid suggests this lake was previously stocked with cutthroat trout or may have supported a natural population of cutthroat trout prior to rainbow trout stocking. Alternatively, a rainbow trout may have been misidentified as a hybrid trout.

A single gill net captured eight cutthroat trout in 2022. This CPUE was considerably higher than the two trout captured during the 2006 survey. The 2006 survey included only one age class, whereas the 2022 survey included at least two distinct age classes (Figure 57). The consistency of natural reproduction remains unclear given the limited number of surveys over the years and the small sample size in the 2006 survey, but natural reproduction appears adequate to support a recreational fishery. Additional monitoring should be conducted to assess if

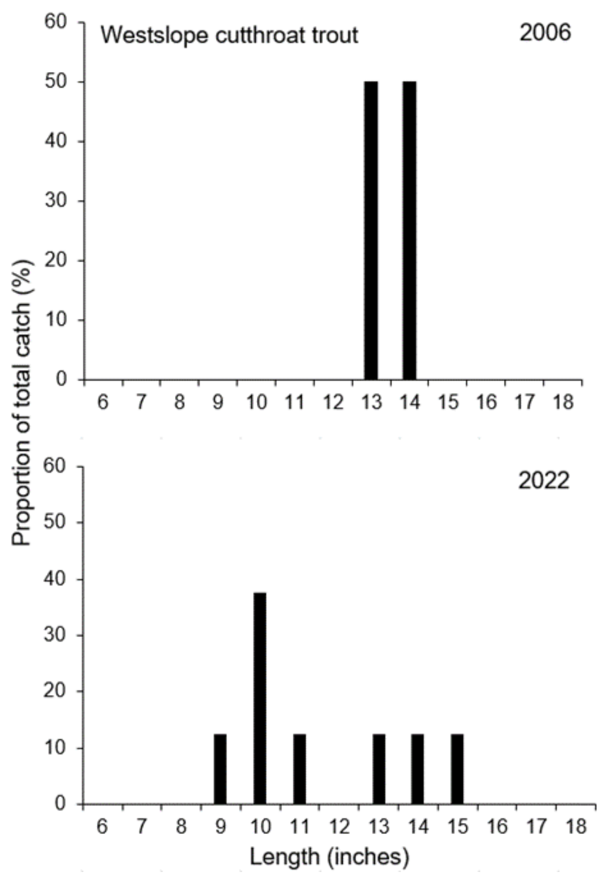

Figure 57. Length frequency histograms for westslope cutthroat trout captured in overnight gill net surveys in Lower Copper Lake in 2006 (top) and 2022 (bottom).

Lower Copper Lake would benefit from periodic stocking to supplement natural reproduction to enhance angling opportunity.

Middle Cottonwood Lake

Middle Cottonwood Lake is the largest of three glacial trough lakes in the headwaters of Cottonwood Creek. The lake supports a self-sustaining population of rainbow trout. Rainbow trout were first stocked in the lake in the 1940s. Following the initial stocking event, rainbow trout were stocked regularly from the 1970s until 2000. The stocking program shifted to westslope cutthroat trout from 2001 to 2005. Downstream of the lake complex, Cottonwood Creek supports a robust population of pure westslope cutthroat trout that transitions to a mixed fishery of rainbow trout, brook trout, and brown trout in the middle and lower reaches (see Cottonwood Creek section above). No cutthroat trout were captured in the 2006 survey suggesting that several years of stocking were unsuccessful.

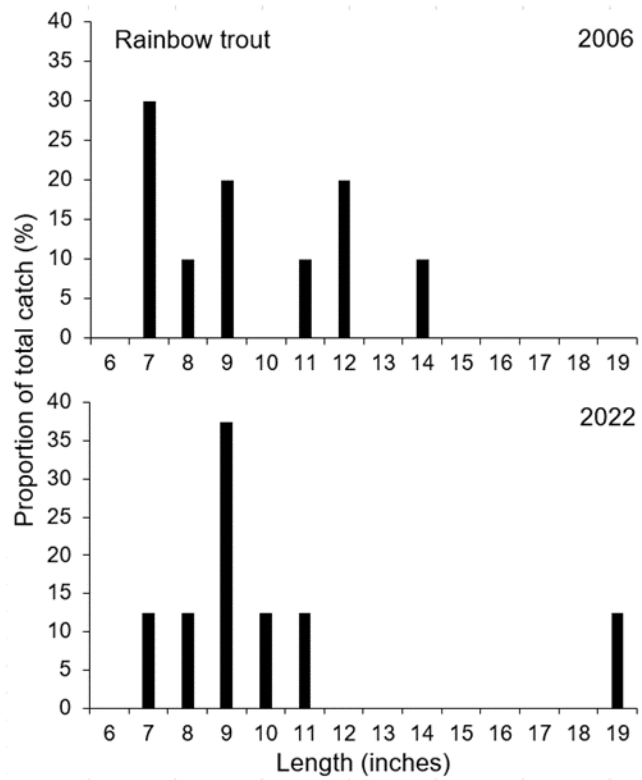

Figure 58. Length frequency histograms for rainbow trout captured in overnight gill net surveys in Middle Cottonwood Lake in 2006 (top) and 2022 (bottom).

The gill net survey in 2022 documented a wide range of sizes and a significantly higher maximum length than the 2006 survey. Relative abundance was similar between surveys with 10 trout captured in 2006 and eight captured in 2022. However, trout of intermediate sizes (12-14 inches) that were captured in 2006 survey were not captured in the 2022 survey (Figure 58). All individuals captured in 2022 were analyzed to determine their genetic composition. Three of the eight trout were non-hybridized rainbow trout and the remaining five trout were rainbow trout with 1% cutthroat trout ancestry. Resumption of cutthroat trout stocking should occur with more frequent monitoring to assess the success of future stocking efforts and determine if Middle Cottonwood Lake would be a suitable location to pursue genetic swamping to address the abundant rainbow trout population. Recent genetic assessments in Cottonwood Creek in 2020 identified probable downstream movement of rainbow trout and F1 hybrids into an otherwise non-hybridized westslope cutthroat trout population (Uthe et al. 2021).

Nevada Lake (Reservoir)

Nevada Reservoir was constructed by the State of Montana near Helmville in 1938 to provide irrigation water to ranches in the valley. The reservoir and downstream canal systems are operated by the Nevada Creek Water Users Association. Nevada Reservoir experiences large seasonal fluctuations and considerable drawdown during dry years. Water quality issues are also pronounced in Nevada Reservoir, which has frequent algal blooms. Rainbow trout were stocked frequently in Nevada Reservoir between 1939 and 2001. Those stocking events established self-sustaining populations of rainbow trout in the reservoir and adjacent sections of Nevada Creek. Westslope cutthroat trout stocking has occurred in the reservoir on an annual basis since 2002, but a robust population has not been established in the reservoir. The reservoir also supports a significant number of yellow perch, which contributes to the incidental presence of individuals in lower Nevada Creek.

Westslope cutthroat trout have been stocked in Nevada Reservoir since 2002, but gill net surveys have revealed consistently low abundance since then. In 2020, stocking rates were increased from 2,000/year to 20,000/year. The increased stocking rate was scheduled to occur for three consecutive years, with initial post-stocking evaluation occurring in 2022. The 2022 survey indicated stable CPUE of westslope cutthroat trout, suggesting that increased stocking did not lead to improved cutthroat trout status (Figure 59). Moreover, rainbow trout relative abundance was stable over the entire survey period and rainbow trout remain the most abundant trout species. The natural reproduction of rainbow trout is providing a higher quality fishing opportunity than stocked westslope cutthroat trout. Therefore, stocking should be curtailed to devote hatchery resources elsewhere.

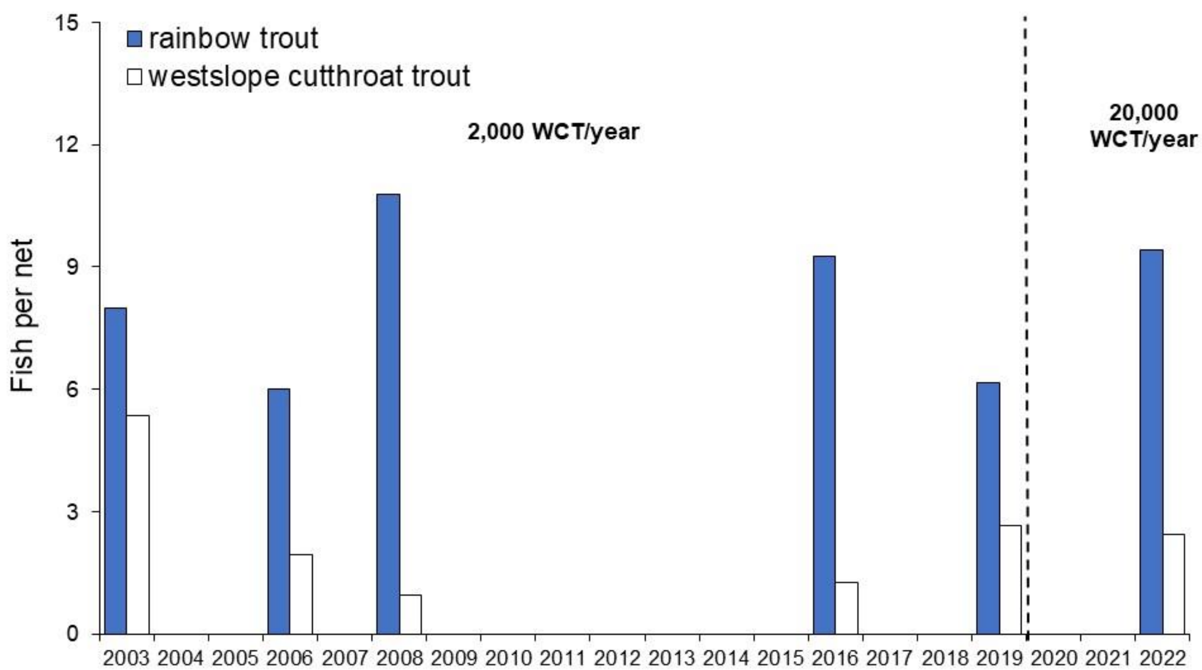

Figure 59. Relative abundance estimates of rainbow trout and westslope cutthroat trout captured in overnight gill net surveys in Nevada Reservoir, 2003-2022. Stocking rates were increased in 2020.

Upper Copper Lake

Upper Copper Lake is a 10-acre, high elevation glacial cirque lake that forms the headwaters of Copper Creek. A 1968 survey did not capture any fish and the lake was presumed fishless (Spence 1968). Westslope cutthroat trout were stocked in 1969, 1975, and 1978. The only post-stocking survey record was a 2006 survey (Pierce et al. 2008), which documented a thriving cutthroat trout population.

A gill net survey in 2022 captured eight trout compared to the 37 captured in the 2006 survey. The 2006 survey was conducted at the end of June, whereas the 2022 survey was conducted in August. The lower relative abundance could indicate fish were using the lake differently in late-summer compared to early summer. Interestingly, the range of sizes in the 2022 survey was identical to the 2006 survey (6-15 inches), but trout of several size classes were absent from the 2022 survey (Figure 60). The outlet channel is on the same side of the lake as the net, so more fish may have been congregated around the outlet when it was flowing in June. Moreover, approximately 1/6th of the lake still had ice cover during the 2006 survey. Visual observations during the evening of the 2022 survey documented very active surface feeding by trout throughout the entire lake, providing additional evidence that the cutthroat trout fishery is healthy. The status quo of relying on natural reproduction appears adequate based on the combination of gill net data, visual observations, and angling. Increased future monitoring would provide a better understanding of the lake status and if management changes are necessary.

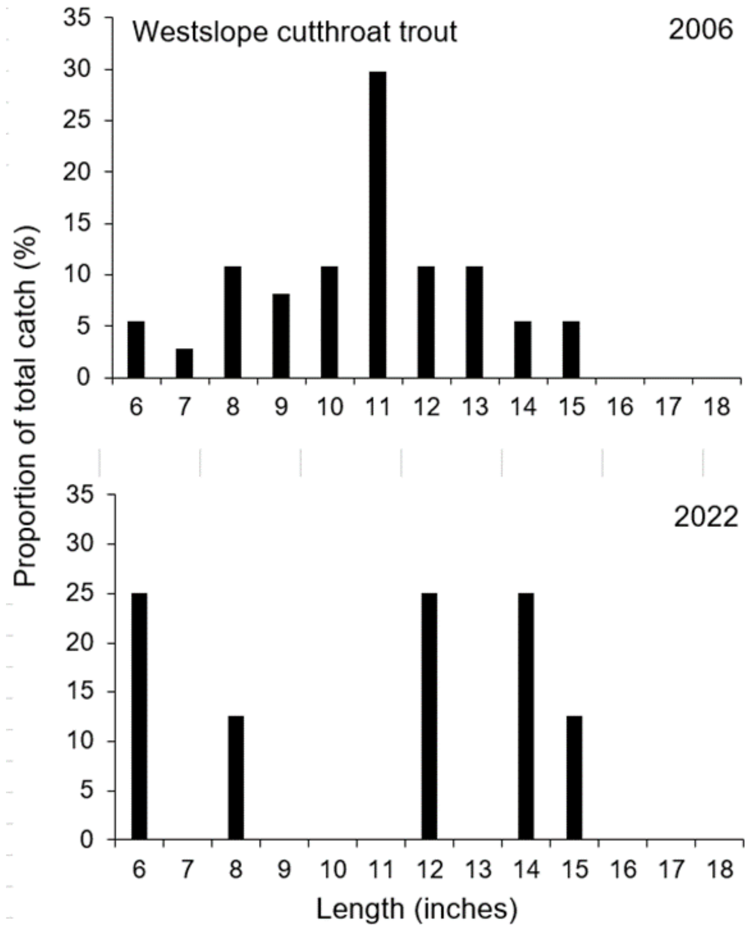

Figure 60. Length frequency histograms for westslope cutthroat trout captured in overnight gill net surveys in Upper Copper Lake in 2006 (top) and 2022 (bottom).

Upsata Lake

Upsata Lake is a glacial pothole lake northeast of Ovando. The 90-acre lake is a popular largemouth bass fishery that also supports an abundance of northern pike and yellow perch. Upsata Lake was inaccessible until the State of Montana purchased the 8-acre fishing access site in 1957. A stunted population of perch inhabited the lake, so the department conducted a piscicide treatment in 1957 to eradicate perch. Rainbow trout were introduced in 1958 and stocked annually until 1992. An angler reported catching perch in 1981, and by 1983, there were many angler reports of 14-inch perch. By the winter of 1986-1987, the perch population was stunted and resembled the size structure of the pre-1957 fishery with an abundance of 5–6-inch fish. Largemouth bass were introduced to the lake by FWP in 1988 to serve as a predator source for yellow perch and provide another fishing opportunity.

Northern pike were illegally introduced at an undetermined date in the late-1980s. An angler reported a visual observation of a suspected northern pike in shallow water in July 1989. The department received a report from an ice angler that caught a pike in January 1990. Adult largemouth bass were translocated from the Lee Metcalf Wildlife Refuge into Upsata Lake periodically throughout the 1990s and early 2000s. Stocking of adult bass has stopped, but juvenile bass have been stocked biannually since 2012 to supplement the natural reproduction in the lake.

A significant winterkill event occurred during the winter of 2022-2023. Following ice-off on April 28, 2023, visual surveys throughout the lake identified thousands of dead fish. Yellow perch were the most common fish observed, but dead northern pike and largemouth bass were also noted. A gill net survey was conducted in mid-May to assess winterkill impacts to the fishery. Six nets were set throughout the lake to accomplish full spatial coverage and coincide with netting locations from previous surveys. Fish were captured in every net. The average catch per net (pike and perch) was very similar to the most recent survey in 2013 (Figure 61). No largemouth bass were captured in nets. Regular monitoring should occur at more frequent intervals in the future to assess the status of the fishery and provide surveillance for illegal fish introductions.

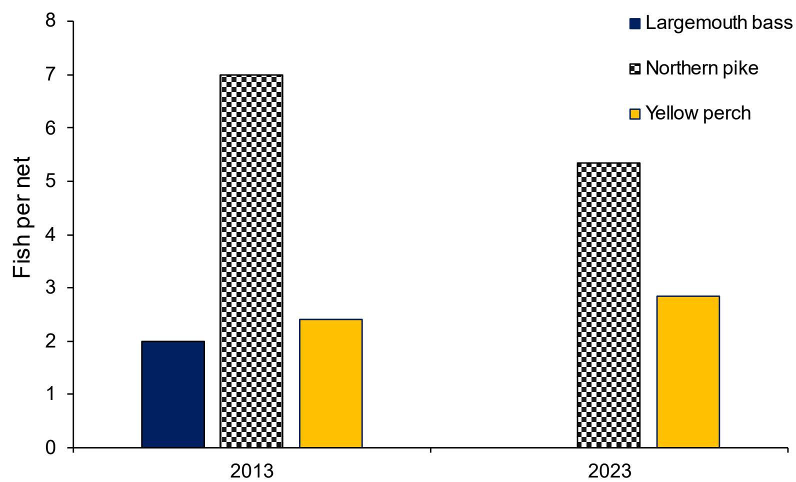

Figure 61. Relative abundance estimates from overnight gill net surveys in Upsata Lake in 2013 and 2023.

West Fork Gold Creek Lake

West Fork Gold Creek Lake is 7.5-acre lake in the Gold Creek drainage. The lake does not have an inlet stream, but a small outlet depression is present that may connect to a downstream seasonal wetland at certain flow levels. The land around this lake was historically corporate timberland and was recently acquired by the USFS following intermediate ownership by The Nature Conservancy. Stocking of westslope cutthroat trout occurred throughout the 1970s and 1980s, but ceased in 1988. It is unclear why stocking was curtailed, but may have been due to land ownership and management considerations. The lake was assessed for fish suitability in 2019. The lake was presumed fishless after no fish were captured in the 2019 gill net survey. Observations throughout the survey indicated high suitability to support a recreational trout fishery, so westslope cutthroat trout were stocked on July 31, 2019. A follow-up survey was conducted in 2022 to assess the success of the stocking event and evaluate growth. A single gill net captured 14 trout. The absence of additional year classes, and the fishless survey in 2019, suggest that West Fork Gold Creek Lake is unlikely to support natural reproduction. All individuals captured in 2022 exhibited high body condition and their sizes indicated exceptional growth over the previous 3 years (Figure 62).

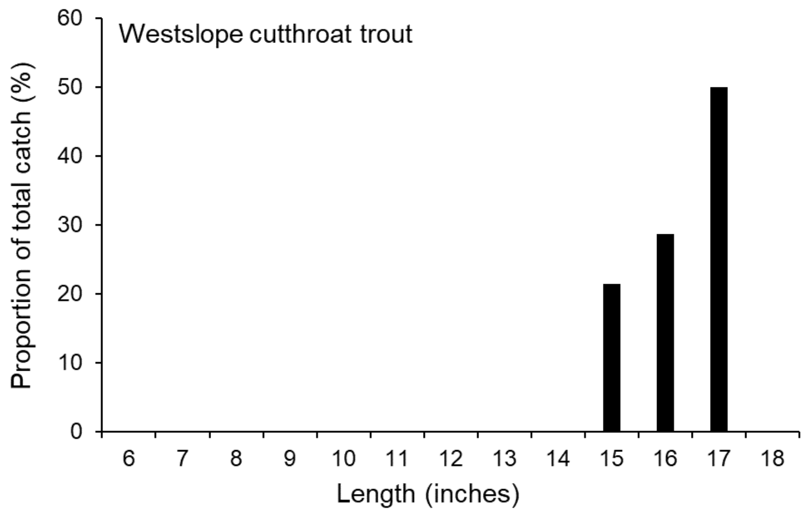

Figure 62. Length frequency histogram for westslope cutthroat trout captured in an overnight gill net survey in West Fork Gold Creek Lake, 2022.

MANAGEMENT RECOMMENDATIONS

1) Continue biannual electrofishing surveys in the Johnsrud, Scotty Brown, and Wales Creek sections. Increase the frequency of sampling in the Canyon section.

2) Consider incorporating mountain whitefish monitoring in the Johnsrud section of the Blackfoot River.

3) Incorporate North Fork Blackfoot River- Harry Morgan Section (mile 4.0) sampling into routine biannual electrofishing surveys.

4) Incorporate genetic monitoring into future mainstem sampling to assess spatial and temporal changes in genetic integrity of westslope cutthroat trout.

5) Continue annual electrofishing surveys to monitor fisheries response to UBMC remediation.

6) Increase frequency of electrofishing surveys in lower Copper Creek to monitor changes in species composition and the potential expansion of brown trout.

7) Conduct electrofishing surveys in lower Landers Fork to assess species composition and monitor potential expansion of brown trout.

8) Continue restoration efforts in westslope cutthroat trout tributaries to maintain and enhance recruitment to the Blackfoot River.

9) Seek opportunities to collect more than one year of pre-restoration data to provide more robust before-after evaluations of restoration projects.

10) Evaluate the lake sampling program to identify knowledge gaps. Increase sampling effort in important waterbodies to better understand fishery status and provide surveillance for potential illegal fish introductions.

11) Curtail westslope cutthroat trout stocking in Nevada Reservoir.

12) Evaluate the westslope cutthroat trout fishery in Coopers Lake and adaptively manage stocking program through consistent monitoring. Assess the contribution of natural-origin westslope cutthroat trout to the fishery.

13) Evaluate suitable areas for potential bull trout translocation projects. Assess recipient habitats and identify potential donor sources.

14) Continue assessing status and distribution of isolated westslope cutthroat trout populations and seek opportunities to expand their distribution within those areas. Furthermore, investigate suitability of stream segments for introduction of westslope cutthroat trout above natural barrier falls in currently fishless habitats to establish secure, core populations.

ACKNOWLEDGMENTS

We thank all the private landowners who graciously allowed access to their properties to conduct surveys. We thank Craig Podner (FWP, *retired 2021*) for contributions during the first portion of the reporting period. We also thank Pat Saffel, Tracy Elam, Reuben Frey, Ben Armstrong, Ladd Knotek, Caleb Uerling, Nathan Cook, Shane Hendrickson, Ryen Neudecker, and Dylan Ritter for assisting with Blackfoot River electrofishing surveys. We also thank the Big Blackfoot Chapter of Trout Unlimited for recruiting volunteers and assisting with restoration project fish salvage events. Furthermore, the private landowners, public land managers, and restoration practitioners engaged in conservation efforts deserve a special thanks for their ongoing dedication to protecting and improving the aquatic resources in the watershed.

REFERENCES

Al-Chokhachy, R., and P. Budy. 2008. Demographic characteristics, population structure, and vital rates of a fluvial population of bull trout in Oregon. Transactions of the American Fisheries Society 137:1709–1722.

Al-Chokhachy, R., D. Schmetterling, C. Clancy, P. Saffel, R. Kovach, L. Nyce, B. Liermann, W. Fredenberg, and R. Pierce. 2016. Are Brown Trout replacing or displacing bull trout populations in a changing climate? Canadian Journal of Fisheries and Aquatic Sciences 73:1395–1404.

BCCAC (Blackfoot Community Conservation Area Council). 2017. Blackfoot Community Conservation Area: management plan for the core, 2nd edition. Blackfoot Challenge, Ovando, Montana.

Bell, D. A., R. P. Kovach, C. C. Muhlfeld, R. Al-Chokhachy, T. J. Cline, D. C. Whited, D. A. Schmetterling, P. M. Lukacs, and A. R. Whiteley. 2021. Climate change and expanding invasive species drive widespread declines of native trout in the northern Rocky Mountains, USA. Science Advances 7(52) Article eabj5471.

Boyer, M.C., G. Michael, M. Schnee, L. Fried, and K. Tempel. 2008. Hungry Horse Mitigation Program, 2007 Annual Report. BPA Project Number 19910.

Carle, F. L., and M. R. Strub. 1978. A new method for estimating population size from removal data. Biometrics 34: 621-630.

Clancey, P. T., B. B. Shepard, C. G. Kruse, S. A. Barndt, L. Nelson, B. C. Roberts, and R. B. Turner. 2019. Collaboration, commitment, and adaptive learning enable eradication of nonnative trout and establishment of native westlope cutthroat trout into one-hundred kilometers of Cherry Creek, a tributary to the Madison River, Montana. American Fisheries Society Symposium 91:589-647.

Dangora, A. J., L. A. Eby, C. A. Barfoot, and A. R. Whiteley. 2023. Evaluating the effects of selective passage of migratory westslope cutthroat trout on nonnative admixture. Transactions of the American Fisheries Society 152:772-787.

DEQ [Montana Department of Environmental Quality]. 2008. Middle Blackfoot Nevada Creek total maximum daily loads and water quality improvement plan, Helena, Montana.

Drought Committee. 2016. Blackfoot drought response plan, Revised April 2016.

Dunham, J., B. Rieman, and G. Chandler. 2003. Influences of temperature and environmental variables on the distribution of bull trout within streams at the southern margin of its range. North American Journal of Fisheries Management 23:894–904.

Fitzgerald G. 1997. Analysis and inventory of riparian vegetation along Nevada and Monture Creeks using ADAR imagery. MS. Thesis University of Montana, Missoula

Fraley, J. J., and B. B. Shepard. 1989. Life history, ecology, and population status of migratory bull trout (*Salvelinus confluentus*) in the Flathead Lake and River system, Montana. Northwest Science 63: 133–143.

Frey, R., C. Podner, L. Knotek, P. Uthe, R. Roberts, and W. Pfeiffer. 2021. Fluvial trout spawning populations, movement, and habitat use in the lower Blackfoot and Middle Clark Fork River systems. Montana, Fish, Wildlife and Parks, Missoula, Montana.

Hanks, R.D., Y. Kanno, and J. M. Rash. 2018. Can single-pass electrofishing replace three-pass depletion for population trend detection? Transactions of the American Fisheries Society 147:729-739.

InRoads Consulting 2015. The Nature Conservancy in Montana Clearwater-Blackfoot Project Road and Stream Crossing Inventory Report, Missoula, Montana.

Knotek, W. L., W. Schreck, R. Pierce, C. Podner, R. Leary, S. Amish, S. Painter, and A. Lodmell. 2016. Genetic assignment of bull trout in Clearwater Basin lakes and Blackfoot River to natal tributaries. Montana Fish, Wildlife and Parks, Missoula, Montana.

Kovach, R.P., J. B Armstrong, D. A. Schmetterling, R. Al-Chokhachy, and C.C. Muhlfeld. 2018. Long-term population dynamics and conservation risk of migratory bull trout in the upper Columbia River basin. Canadian Journal of Fisheries and Aquatic Sciences 75: 1960–1968.

Kovach, R., S. Painter, and A. Lodmell. 2021. Report for westslope cutthroat trout samples collected in the Blackfoot River in 2021. University of Montana Conservation Genetics Laboratory, Missoula, Montana.

Kovach, R., S. Painter, and A. Lodmell. 2022. Genetics Report # 5387: report for westslope cutthroat trout samples collected in the Blackfoot River, Bitterroot River, and Clark Fork River drainages in 2020-2021. University of Montana Conservation Genetics Laboratory, Missoula, Montana.

Kovach, R., S. Painter, and A. Lodmell. 2023. Genetics Report # 5532: report for westslope cutthroat trout samples collected in the Blackfoot River, Bitterroot River, and Clark Fork River drainages in 2021-2023. University of Montana Conservation Genetics Laboratory, Missoula, Montana.

Kovach, R., S. Painter, and A. Lodmell. 2024. Genetics Report #5608: report for bull trout samples collected in the Blackfoot, Clearwater, Rock Creek, and Clark Fork drainages. University of Montana Conservation Genetics Laboratory, Missoula, Montana.

Leathe, S. A., and F. A. Nelson. 1986. A literature evaluation of Montana's wetted perimeter inflection point method for deriving instream flow recommendations. Montana Fish, Wildlife & Parks, Helena, Montana.

Mogen, J.T., and L. R. Kaeding. 2005. Identification and characterization of migratory and nonmigratory bull trout populations in the St. Mary River drainage, Montana. Transactions of the American Fisheries Society 134, 841– 852.

Moore, J. N., S. N. Louma, and D. Peters. 1991. Downstream effect of mine effluent on intermontane riparian system. Canadian Journal of Fisheries and Aquatic Sciences 48:222-232.

Peters, D., and R. Spoon. 1989. Preliminary fisheries investigation of the Big Blackfoot River. Montana Fish, Wildlife and Parks, Missoula, Montana.

Peters, D. 1990. Inventory of fishery resources in the Blackfoot River and major tributaries to the Blackfoot River. Montana Department of Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., D. Peters and T. Swanberg. 1997. Blackfoot River restoration progress report. Montana Fish Wildlife and Parks, Missoula, Montana.

Pierce, R., and D. A. Schmetterling. 1999. Blackfoot River restoration project progress report, 1997-1998. Montana Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., C. Podner, and J. McFee. 2001. Blackfoot River fisheries inventory, monitoring and restoration report. Montana Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., C. Podner, and J. McFee. 2002. Blackfoot River fisheries inventory, monitoring and restoration report for 2001. Montana Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., R. Anderson, and C. Podner. 2004. The Big Blackfoot River restoration progress report for 2002 and 2003. Montana Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., R. Aasheim and C. Podner. 2005. An integrated stream restoration and native fish conservation strategy for the Big Blackfoot River basin. Montana Fish Wildlife and Parks, Missoula, Montana.

Pierce, R., and C. Podner. 2006. The Big Blackfoot River fisheries restoration report for 2004 and 2005. Montana Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., R. Aasheim, and C. Podner. 2007. Fluvial westslope cutthroat trout movements and restoration relationships in the upper Blackfoot Basin, Montana. Intermountain Journal of Sciences 13:72–85.

Pierce, R., C. Podner, M. Davidson, L. Knotek, and J. Thabes. 2008. Big Blackfoot River fisheries and restoration investigations for 2006 and 2007. Montana Fish, Wildlife and Parks. Missoula, Montana.

Pierce, R., C. Podner, and M. Davidson. 2009. Correlation of fluvial rainbow trout spawning life history with the severity of infection by *Myxobolus cerebralis* in the Blackfoot River Basin, Montana. Transactions of the American Fisheries Society 138:251-263.

Pierce, R., and C. Podner. 2011. Fisheries investigations in the Big Blackfoot River Basin, 2008-2010. Montana Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., C. Podner, and K. Carim. 2013. Response of wild trout to stream restoration over two decades in the Blackfoot River Basin, Montana. Transactions of the American Fisheries Society 142:68-81.

Pierce, R., C. Podner, L. Marczak and L. Jones. 2014. Instream habitat restoration and stream temperature reduction in a whirling disease positive spring creek in the Blackfoot River Basin, Montana. *Transactions of the American Fisheries Society* 143:1188–1198.

Pierce, R., C. Podner and L. Jones. 2015. Long-term increases in trout abundance following channel reconstruction, instream wood placement, and livestock removal from a Spring Creek in the Blackfoot Basin, Montana. Transactions of the American Fisheries Society 144:184-195.

Pierce, R., and C. Podner. 2016. Fisheries investigations in the Big Blackfoot River Basin Montana, 2013-2015. Montana Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., C. Podner, D. Atkinson, D. Rosgen, L. Chavez, R. Kasum, T. Sylte, G. Mullen, S. Haaland, R. Neudecker, L. Eby, and J. Muhlfeld. 2012. Geomorphic and biological investigations associated with restoration of the upper Blackfoot River, Upper Blackfoot Mining Complex, Blackfoot Valley, Montana. Montana Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., C. Podner, and P. Saffel. 2018. Aquatic and associated investigations to guide conservation planning for bull trout and westslope cutthroat trout in the North Fork Blackfoot River upstream of the North Fork Falls, 2002-2017. Montana Fish, Wildlife & Parks. Missoula, Montana.

Pierce, R., W. L. Knotek, C. Podner, and D. Peters. 2019. Blackfoot River restoration: a thirty-year review of a wild trout conservation endeavor. Pages 649–682 in D. C. Dauwalter, T. W. Birdsong, and G. P. Garrett, editors. Multispecies and watershed approaches to freshwater fish conservation. American Fisheries Society, Symposium 91, Bethesda, Maryland.

Rosenberger, A. E., and J. B. Dunham. 2005. Validation of abundance estimates from mark-recapture and removal techniques for Rainbow Trout by electrofishing in small streams. North American Journal of Fisheries Management 25:1395–1410

Seber, G. A. F. 1982. The estimation of animal abundance and related parameters. MacMillan Press, New York, New York, USA.

Schmetterling, D. A. 2001. Seasonal movements of fluvial Westslope Cutthroat Trout in the Blackfoot River drainage, Montana. North American Journal of Fisheries Management 21: 507-520.

Schmetterling, D. A. 2003. Reconnecting a fragmented river: Movements of westslope cutthroat trout and bull trout after transport upstream of Milltown Dam, Montana. North American Journal of Fisheries Management 23:721–731.

Schmetterling D. A. and M. H. Long. 1999. Montana anglers' inability to identify bull trout and other salmonids. Fisheries 24:24-27.

Schmetterling, D. A., and R. W. Pierce. 1999. Success of instream habitat structures after a 50-year flood in Gold Creek, Montana. Restoration Ecology 7:369–375.

Shields, R., C. Podner, and R. Pierce. 2009. Aquatic resource surveys on lower Warren Creek on Blackfoot Valley Ranch, Ovando, MT, Summer 2009. Water Legend Hydrology, Helena, Montana.

Spence, L. 1968. Mountain lake survey – Blackfoot River drainage. F-32-R-5 Job Completion Report, Montana Fish and Game Department, Missoula, Montana.

Spence, L. 1975. Upper Blackfoot River study: a preliminary inventory of aquatic and wildlife resources. Montana Department of Fish and Game, Helena, Montana.

Stratus Consulting. 2007. Preliminary evaluation of injuries and damages: Upper Blackfoot Mining Complex, Lewis and Clark County Montana. A report to Rob Collins, Natural Resources Damage Program, Department of Justice, Helena, Montana

Swanberg, T.R. 1997. Movements and habitat use by fluvial bull trout in the Blackfoot River, Montana. Transactions of the American Fisheries Society 126:735-746.

USFWS. 2015. Recovery plan for the coterminous United States population of bull trout (*Salvelinus confluentus*). United States Fish and Wildlife Service, Pacific Region, Portland, Oregon.

Uthe, P., C. Podner, and R. Pierce. 2021. Fisheries investigations in the Blackfoot River watershed, 2016-2020. Montana, Fish, Wildlife and Parks, Missoula, Montana.

Vandeberg, G.S., C.W. Martin and G.M. Pierzynski. 2011. Spatial distribution of trace metal elements in floodplain alluvium of the upper Blackfoot River, Montana. Environmental Earth Science 62:1521-1534.

Weigel, D. E., J. T. Peterson, and P. Spruell. 2002. A model using phenotypic characteristics to detect introgressive hybridization in wild westslope cutthroat trout and rainbow trout. Transactions of the American Fisheries Society 131:389–403.

Wilcox, A. C., H. Langner, L. Eby, and S. Sullivan. 2014. Monitoring linkages among river restoration, physical habitat, ecosystem processes, and water quality: Upper Blackfoot River, Mike Horse Mine, Montana. Project completion report for Challenge cost share agreement # 09-CS-11011600-01 University of Montana, Missoula, Montana.

Zimmerman, M. P. 1999. Food habits of smallmouth bass, walleyes, and northern pikeminnow in the lower Columbia River basin during out-migration of juvenile anadromous salmonids. Transactions of the American Fisheries Society 128:1036–1054.

Zippin, C. 1956. An evaluation of the removal method of estimating animal populations. Biometrics 12:163–169.

STANDALONE REPORTS

Investigations in the North Fork Blackfoot River Native Fish Conservation Project Area, 2021

Patrick Uthe and Craig Podner

Montana Fish, Wildlife & Parks

March 2023

Introduction and Methods

Fisheries investigations in the North Fork Blackfoot River above North Fork Falls have been ongoing since 2005 (Pierce et al. 2018). Collectively, these studies have informed development of the proposed North Fork Blackfoot River Native Fish Conservation Project. The piscicide application and subsequent introduction of westslope cutthroat trout were scheduled for implementation in 2021. However, litigation against the USFS halted the project immediately before project actions were scheduled to commence in July 2021. Project personnel were planning to work in the backcountry and outfitters were contracted, so we used the opportunity to conduct additional baseline data collection in lieu of the piscicide treatment. The primary objectives of these surveys were to 1) resample sites to compare trout abundance and distribution, thereby providing a more robust baseline dataset for assessing project effectiveness; 2) collect environmental DNA (eDNA) in streams where the upstream extent of trout occupancy had not been identified; 3) inspect key portions of the drainage where surveys and investigations had not occurred; and 4) identify suitable locations for detoxification stations.

FWP personnel conducted eDNA sampling using standard protocols (Carim et al. 2015) in the East Fork of the North Fork drainage August 7-12, 2021. The eDNA samples were tested for the presence of any salmonid DNA fragments, rather than a single species, because previous investigations determined the genetic composition of the trout populations (Peirce et al. 2018) and we were only interested in trout presence/absence for this investigation. Samples were collected in streams without previous fish surveys, or in streams where the upstream extent of trout distribution had not been determined (Figure 1).

Electrofishing surveys were conducted at 15 previously sampled sections in the East Fork of the North Fork and North Fork Blackfoot River drainages (Figure 2). One backpack electrofishing unit was used at each site to conduct single-pass surveys to estimate relative abundance using catch per unit effort (CPUE). Results were standardized per 100 feet of stream length. Section lengths varied from 251-1,560 feet. Personnel also conducted reconnaissance throughout the lower North Fork and East Fork of the North Fork to identify suitable detoxification station locations.

Results

The eDNA sampling effort yielded 10 samples (Table 1). Nine samples tested negative for salmonid DNA. The sample in the West Fork of the East Fork of Mineral Creek tested positive for salmonid DNA (Figure 1).

Electrofishing surveys revealed low trout densities throughout the project area (Figure 2). Relative abundance ranged 0.0-3.2 trout/100’ among the 15 sections. Meadow Creek mile 2.6 was the only section where fish were not captured. However, we observed five trout (estimated lengths 8-10 inches) swimming in the section. Therefore, our capture efficiency was very low. Densities were consistently lower at all sites in 2021 compared to previous survey events (Table 2). Moreover, the variability in relative abundances among sites was lower than previous years. The highest relative abundance was in Scotty Creek with 3.2 trout/100’. Only three sections had a relative abundance greater than 1 trout/100’.

The lower portion of the East Fork of the North Fork was investigated below the Camp Creek confluence. A box canyon was located approximately 0.8 miles downstream of Camp Creek and prevented further instream exploration (Figure 3). A waterfall barrier (estimated 8-12 ft) was identified near the upstream end of the box canyon (Appendix, Figure A1). There were three distinct flow pathways over this channel spanning bedrock falls at baseflow conditions. While hiking from the river towards the trail, several additional cascades and falls were identified, as well as a narrow chute (Appendix, Figure A2). The upstream waterfall appeared to be a barrier at the observed flow levels, but uncertainty remains about passage status under moderate or high flow conditions. However, the presence of several challenging obstacles in the box canyon suggests cumulative passage probability through this section of the East Fork is very low. The limited risk of upstream passage would enable the project to occur in a phased approach with the East Fork of the North Fork and North Fork drainages treated in separate years.

Table 4. Sampling locations and eDNA results in the East Fork of the North Fork Blackfoot River drainage, 2021.

Site	Stream	Date	Latitude	Longitude	Salmonid DNA Detected?	Positive Wells (#/3)
1	Camp Creek	8/7/2021	47.19978	-112.83731	N	0
2	Camp Creek	8/7/2021	47.20067	-112.82566	N	0
1	East Fork Meadow Creek	8/12/2021	47.09738	-112.78496	N	0
1	Kenny Creek	8/9/2021	47.18161	-112.86617	N	0
1	Spaulding Creek	8/7/2021	47.17594	-112.81996	N	0
2	Spaulding Creek	8/7/2021	47.17874	-112.82008	N	0
3	Spaulding Creek	8/7/2021	47.18043	-112.81915	N	0
1	Unnamed Spring Creek	8/11/2021	47.17968	-112.83874	N	0
1	Unnamed tributary to Mineral Creek	8/8/2021	47.15651	-112.84044	N	0
1	West Fork of East Fork Meadow Creek	8/12/2021	47.10131	-112.79341	Y	3

Table 5. Relative trout abundance (trout/100’) at survey sections in the North Fork Blackfoot River Native Fish Conservation Project Area, 2006-2021.

Stream	Section (river mile)	2006	2007	2008	2013	2014	2016	2021
Blondie Creek	0.2	--	--	--	6.9	--	--	0.5
Broadus Creek	0.1	--	1.4	--	--	--	--	--
Camp Creek	0.1	--	--	--	1.2	--	--	--
	1.6	--	--	--	--	--	--	--
Cooney Creek	0.2	--	0.2	--	0.3	--	--	--
	0.4	--	--	--	0.3	--	--	--
	2.4	--	--	--	--	--	--	--
East Fork of the North Fork	0.1	--	--	--	--	--	--	--
	1.9	--	--	--	4.1	--	--	0.8
	7.0	1.6	--	--	8.6	--	--	0.1
	11.7	--	--	--	--	--	--	--
Kenny Creek	0.1	--	--	--	--	--	0.8	--
Lost Pony Creek	0.8	--	--	--	9.2	--	--	1.6
Meadow Creek	2.0	--	--	--	0.1	--	--	--
	2.6	--	--	2.6	--	--	--	0.0
	5.2	--	--	1.5	0.4	--	--	0.1
East Fork Meadow Creek	0.8	--	--	0.5	0.9	--	--	0.4
	2.2	--	--	--	--	--	--	0.2
	2.4	--	--	--	--	--	--	--
Mineral Creek	2.1	--	--	2.7	--	--	--	0.3
	4.2	--	--	5.2	--	--	--	2.3
East Fork Mineral Creek	0.6	--	--	1.9	--	--	--	0.4
North Fork of the Blackfoot River	27.2	--	--	--	--	0.3	--	1.5
	32.0	--	1.2	--	--	--	--	0.1
	34.7	--	3.9	--	--	--	--	--
	36.4	--	--	--	--	--	--	--
	36.9	--	--	--	--	--	--	--
Sarbo Creek	0.1	--	--	--	--	--	--	--
Scotty Creek	0.2	5.7	--	--	8.7	--	--	3.2
South Channel of East Fork of the North Fork	9.0	--	--	--	4.0	--	--	0.3
South Creek	0.4	--	--	--	--	--	2.3	--
	1.2	--	--	--	--	--	--	--
Spaulding Creek	0.1	--	--	--	0.7	--	--	--
Twin Lake outlet	0.8	1.1	--	--	--	--	--	--
Unnamed tributary near North Fork Blackfoot River stream mile 27.8	0.1	--	--	--	--	0	--	--
West Fork of East Fork Meadow Creek	0.1	--	--	0	--	--	--	--

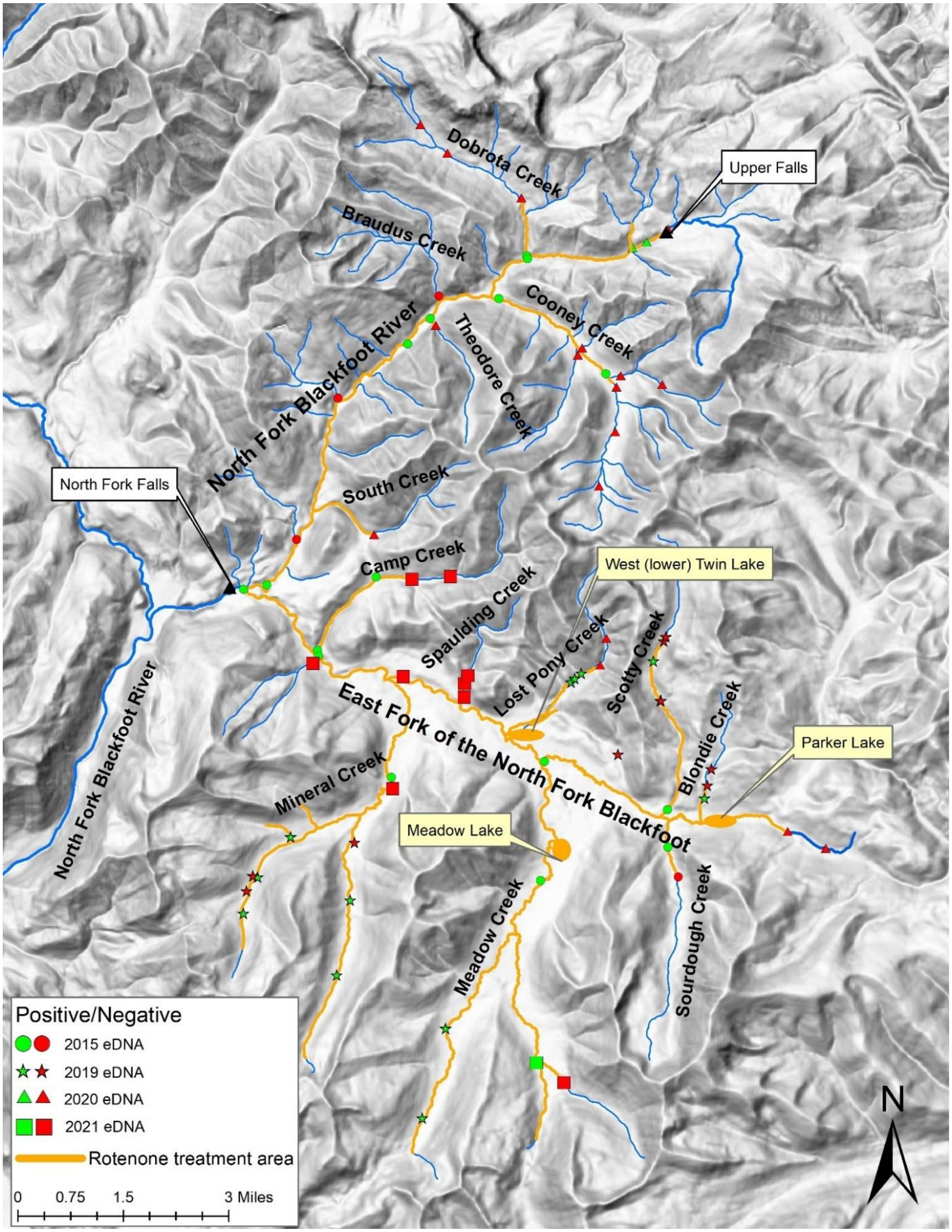

Figure 6. Environmental DNA (eDNA) sampling locations in 2015 (circles), 2019 (stars), 2020 (triangles), and 2021 (squares) with negative (red) and positive (green) results. Predicted rotenone treatment area (orange line).

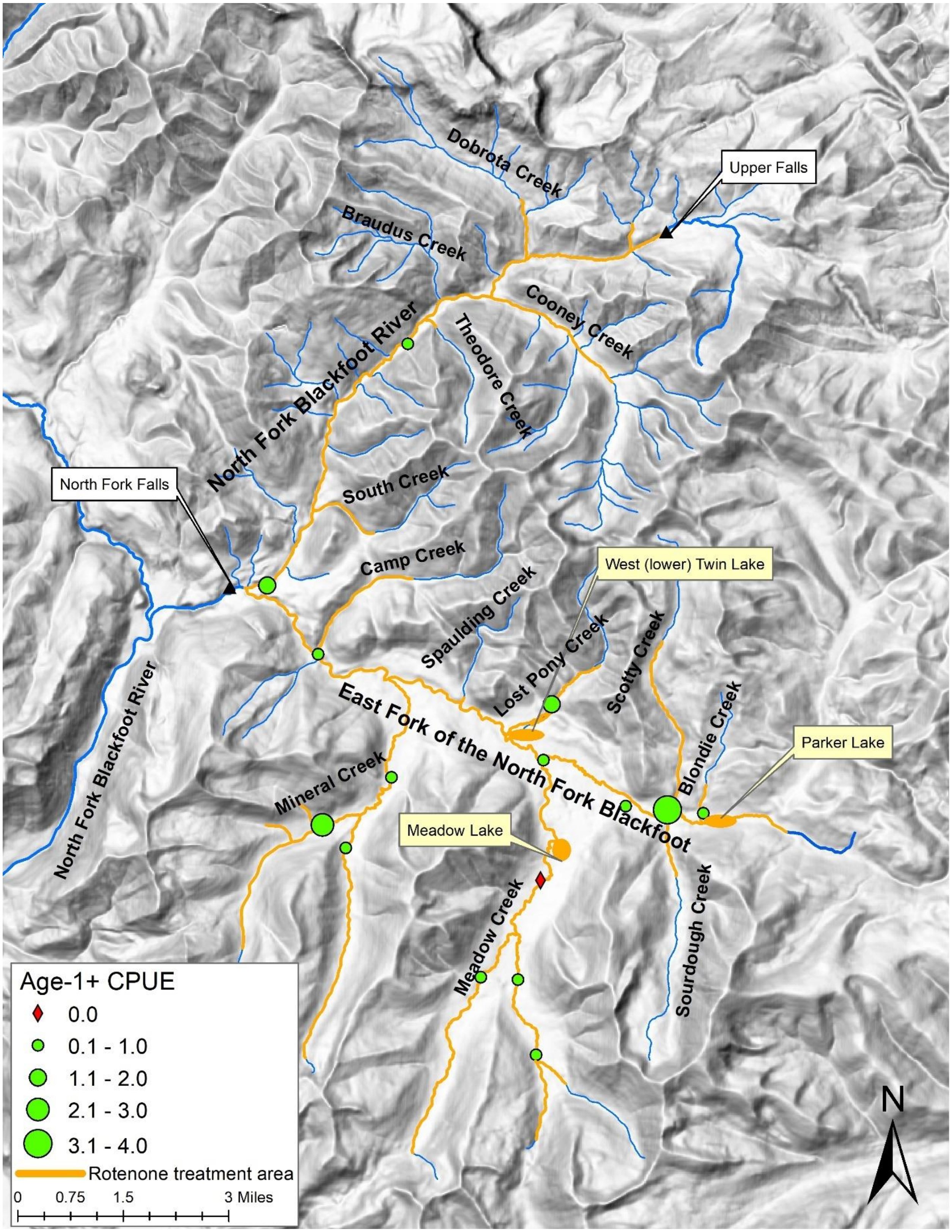

Figure 7. Locations of single-pass electrofishing surveys in 2021. Graduated symbols indicate relative abundance (trout/100') of age-1 and older trout.

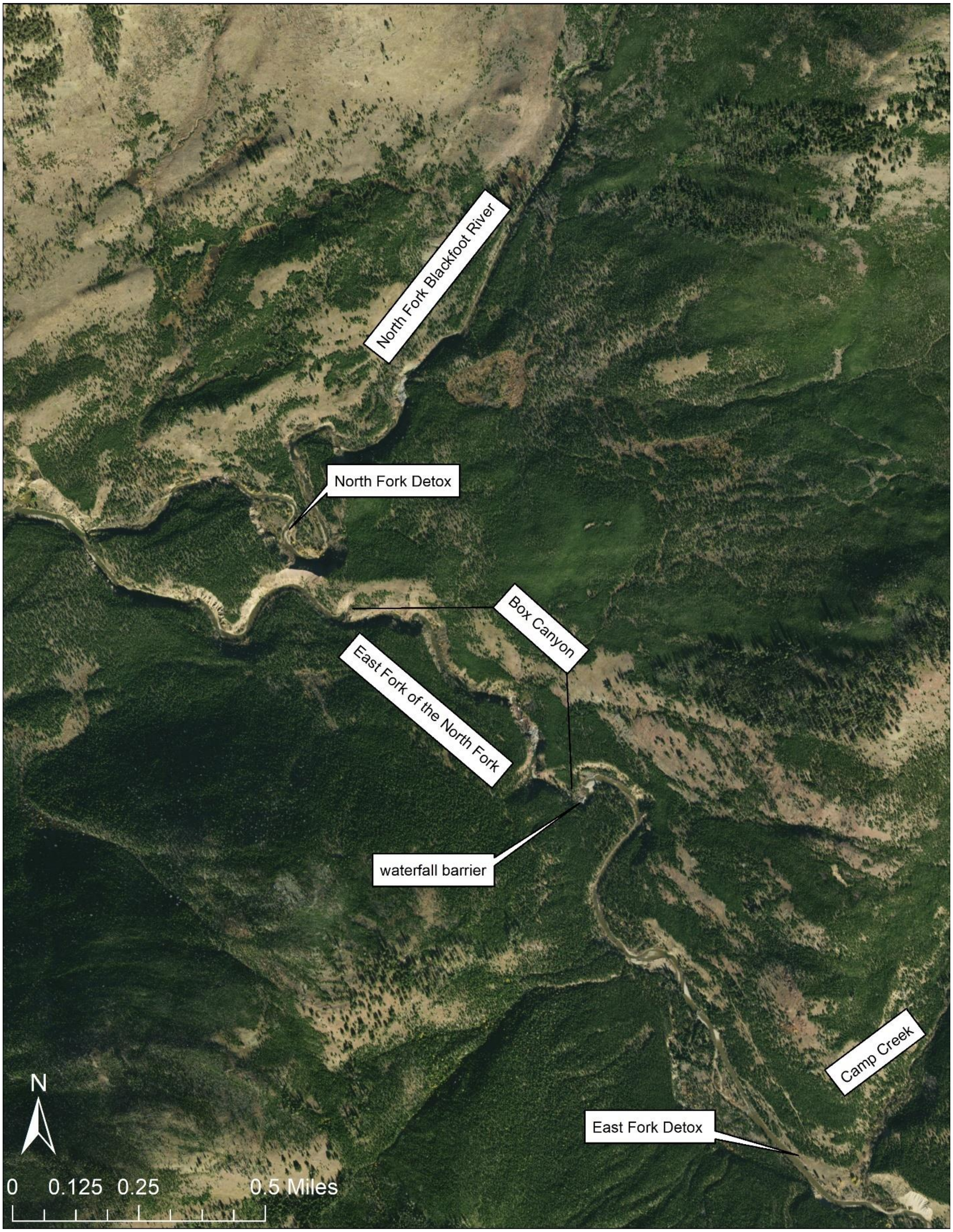

Figure 8. Map of the lower North Fork and East Fork of the North Fork showing detoxification station locations, waterfall barrier, and box canyon.

Discussion

The results from eDNA investigations have been integral to the development of a reliable trout distribution model. The negative eDNA results in Spaulding Creek and Camp Creek reduced the known fish distribution by 1.43 miles and 0.8 miles, respectively. The site in the West Fork of East Fork Meadow Creek tested positive for DNA, although no fish were captured during previous electrofishing surveys. This stream has high quality habitat and sufficient flow near the sampling site, providing evidence that trout are probably distributed further upstream. Therefore, the upper trail crossing was selected as an approximate location for the upper extent of trout occupancy, adding 1.2 miles of predicted trout distribution. Accordingly, the estimated stream length for rotenone treatment has increased from 45 miles (Pierce et al. 2018) to approximately 55 miles. Mineral Creek and Meadow Creek drainages are the largest tributary drainages and support the broadest distributions of trout, making them among the highest priority areas for effective piscicide applications. In addition to the East Fork of Meadow Creek, the other forks of Mineral and Meadow Creeks tested positive at the uppermost eDNA sites, indicating the rotenone application should start near the source of water in those forks to ensure these priority areas receive adequate treatment effort.

Interestingly, all sites in Spaulding Creek tested negative for salmonid DNA, including a site at the trail crossing where trout were captured during an electrofishing survey in 2013. Fish were not captured during a 2013 electrofishing survey in Camp Creek at mile 1.6, whereas the 2015 eDNA sample tested positive for salmonid eDNA. The 2021 sample was collected approximately 0.5 miles upstream of that location and tested negative. These apparent shifts in occupancy near the upper extents of trout-bearing streams suggest that overall densities are low, and trout are sparsely distributed in the project area. This further emphasizes the need for strategic piscicide effort in areas with consistently high trout abundance and broad distribution (e.g., Meadow Creek, Mineral Creek, and Scotty Creek). Several age-0 and age-1 trout were observed in the inlet channel of West (Lower) Twin Lake. This lake supports a robust population of hybrid trout, so it will be prudent to treat the entirety of the inlet channel during the lake treatment.

The electrofishing surveys indicated trout abundance was lower than previous years. The highly variable, but generally low abundances observed over the last two decades indicate that trout populations are small and sparsely distributed. Areas such as Scotty Creek are consistently near the upper range of abundance within a given year, demonstrating that trout are concentrated in key sections throughout the project area and warrant targeted piscicide effort. The 2021 data also provide valuable baseline information to establish pre-restoration variances to enable robust project effectiveness monitoring. The electrofishing data coupled with the eDNA analyses will provide a comprehensive evaluation of changes in abundance and distribution associated with converting the hybrid trout fishery to a conservation population of westslope cutthroat trout.

Comparisons of relative abundance among streams should be viewed cautiously because sampling efficiency influenced CPUE variability. We conducted all surveys with a single backpack electrofishing unit, so sampling efficiency was lower in large streams. This may have contributed to the low relative abundance in the East Fork of the North Fork, North Fork, and large tributaries. For example, we failed to capture any trout at Meadow Creek mile 2.1, but we observed several trout evading the electric field. Furthermore, we only captured four trout in the lower portion of the East Fork of the North Fork (mile 1.9), but angling directly downstream of the sampling section revealed high catch rates.

The reconnaissance of the lower East Fork of the North Fork highlighted an undocumented waterfall downstream of Camp Creek. Furthermore, a box canyon downstream of this location contained several waterfalls, cascades, and narrow chutes. Collectively, these passage impediments are expected to have a low cumulative passage probability. Therefore, upstream fish passage into the East Fork of the North Fork is likely precluded. This enables the option of a phased treatment, where the East Fork of the North Fork and the North Fork could be treated in separate years. The exploration of the lower portions of both forks also enabled identification of suitable detoxification locations. The flat area downstream of the mouth of Camp Creek is large enough for a helicopter landing location and provides an inclusive spot for camping facilities, supplies, and auger operation (Appendix, Figure A3). A river meander downstream of the Trail #481 crossing on the lower North Fork has a suitable location for the detoxification station equipment (Appendix, Figure A4). The adjacent clearing is large enough to accommodate equipment transport with a helicopter cargo sling.

The results of these investigations provide valuable insight for planning and executing the piscicide application. Except for the upper portions of Meadow Creek and Mineral Creek drainages, all tributaries have upstream eDNA collection sites that have tested negative for salmonid DNA. Therefore, upper drip station locations have been surveyed and identified in all treatment areas outside of these two subdrainages, enabling logistical planning based on empirical travel-time information. Overall, the backcountry investigations from 2018 through 2021 provided critical information to inform and guide effective implementation of the North Fork Blackfoot River Native Fish Conservation Project.

Acknowledgments

Funding for eDNA sampling and analysis was provided by the Montana Natural Resources Damage Claim Program. We thank Pat Saffel and Reuben Frey for assisting with field work and data collection. We also thank K Lazy 3 Outfitters for providing stock, camp facilities, and travel assistance during all field activities.

References

Carim, K. J., T. M. Wilcox, M. K. Young, M. K. Schwartz, and K. McKelvey. 2015. Protocol for collecting eDNA samples from streams. V2.3. USDA Forest Service- Rocky Mountain Research Station, Missoula, Montana.

Pierce, R., C. Podner, and P. Saffel 2018. Aquatic and associated investigations to guide conservation planning for bull trout and westslope cutthroat trout in the North Fork Blackfoot River upstream of the North Fork Falls, 2002-2017. Montana Fish, Wildlife & Parks. Missoula, Montana.

Appendix

Figure A1. Waterfall in lower East Fork of the North Fork Blackfoot River (47.19117; -112.87315).

Figure A2. Looking upstream at a bedrock chute (47.19299; -112.87497) in the box canyon in lower portion of the East Fork of the North Fork.

Figure A3. Looking downstream at the proposed detoxification station location on the East Fork of the North Fork. A suitable location for the auger and associated equipment is in the northwestern edge of the open area downstream of the Camp Creek confluence (47.18422; -112.86677).

Figure A4. Looking downstream at the proposed detoxification station location on the North Fork Blackfoot River (47.19656; -112.88141).

Water Temperature and Fishery Evaluations in Nevada Creek, 2022

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Montana Fish, Wildlife & Parks
April 2023

Methods

Water temperature monitoring and fisheries surveys were conducted in Nevada Creek in 2022 to evaluate contemporary stream conditions and fishery status (Figure 1). Temperature loggers were installed at two long-term temperature monitoring sites, as well as two new sites to increase spatial coverage in the drainage. Loggers recorded temperature at hourly intervals. The long-term sites were monitored between January 1 and October 26. However, the temperature logger downstream of Douglas Creek was dewatered on October 1. The loggers at Nevada Creek Ranch Road and Wineglass Bridge were installed on July 22 and removed on October 26.

We conducted electrofishing surveys at four sites from July through September. Three of the sites were surveyed within a mark-recapture sampling framework, whereas a single-pass survey was conducted in the new section at stream mile 15.7 (Phase 7 project area). The Phase 3 and Phase 7 sections were surveyed using an electrofishing tote barge. The Phase 1 section and the section at stream mile 5.0 (below NSC) were surveyed using a drift boat electrofishing unit. All captured trout (≥ 4 inches) were identified by species and measured for lengths and weights. We estimated abundance from mark-recapture surveys using a Chapman estimator (Seber 1982) as follows:

$$N = \frac{(m+1)(c+1) - 1}{r+1},$$

where *N* is the population estimate, *m is* the number of marked fish, *c* is the number of fish captured in the recapture sample, and *r* is the number of marked fish captured in the recapture sample. Abundance estimates are reported with 95% confidence intervals. For the single pass surveys, relative abundance refers to the number of fish collected in a single electrofishing pass and is standardized per mile of stream length.

Results and Discussion

The thermal regime in lower Nevada Creek exhibited considerable spatial and temporal variation. Water temperature increased moderately between the reservoir and Wineglass Bridge and increased more significantly between Wineglass Bridge and Douglas Creek (Figure 2). Water temperature increased at an average rate of 0.42 degrees/mile between the reservoir and Nevada Creek Ranch Road. The outflow of the reservoir provides consistent cold water to Nevada Creek, which is reflected by the relatively moderate temperatures several miles below the dam. This influence was evident at Nevada Creek Ranch Road where maximum daily temperatures remained below 68.1°F despite the effect of low discharge downstream of the Douglas Canal. Water temperature increased at an average rate of 0.66 degrees/mile between Nevada Creek Ranch Road and Wineglass Bridge. Maximum daily temperatures reached 71.4°F at Wineglass Bridge in July. The rate of warming between Wineglass Bridge and Douglas Creek was 0.32 degrees/mile, while maximum temperatures below Douglas Creek reached 77.5°F in late-August (Figure 3).

The distribution of trout species and spatial variation in abundance indicate persistent issues in the middle section of lower Nevada Creek. Abundance of age-1 and older trout was highest in the Phase 1 and Phase 3 project sections, declined to near zero in the reach upstream of Helmville, and increased near the mouth of NSC (Figure 4). Trout abundance below NSC was not significantly different from Phase 1, but was significantly lower than Phase 3 (Figure 6 and Figure 7). The Phase 3 section had the highest combined trout abundance, as well as the highest westslope cutthroat trout abundance. Trout abundance in Phase 3 was higher than abundance in Phase 1 in 2019 and 2022. It is unclear whether Phase 3 has greater habitat capacity, or the results reflect seasonal changes in habitat use because Phase 3 was sampled in July, whereas Phase 1 was sampled in September. Nevertheless, these results demonstrate the overall capacity and productivity of the section between Nevada Reservoir and the Douglas Canal.

Rainbow trout and westslope cutthroat trout were the most abundant trout species in Phase 1 and Phase 3, whereas brown trout and westslope cutthroat trout were the most abundant species below NSC. Brown trout was the only trout species captured in the Phase 7 section. Although the only age-1+ trout captured was a single 12-inch individual, we captured sixteen age-0 brown trout. The presence of age-0 brown trout indicates successful spawning likely occurred in or adjacent to this section. Mountain whitefish were very prevalent in Phase 7 with a relative abundance of 274 age-1+ whitefish per mile. Longnose sucker, redside shiner, and longnose dace were also abundant in Phase 7.

Interestingly, all previously sampled sites had lower trout abundance in 2022 compared to prior years. This synchrony suggests that common factors among the sites, such as broad scale regional influences (e.g., drought), may be responsible for the current reductions in abundance. Wild trout populations fluctuate in response to abiotic and biotic factors, and generally oscillate around a long-term average. The 2022 surveys may have coincided with a low-point in the range of natural variability. Although the abundance below NSC was the lowest in the recent portion of the dataset (2011-present), it is still significantly higher than the 1990s (Figure 5). We also sampled this section earlier than usual, so the excessive temperatures may have resulted in fewer trout than if we had sampled during mid-September when daily maximum temperatures were below 70°F.

A sharp decline in rainbow trout in Phase 1 contributed to the lowest overall trout abundance since surveys began in 2010. The consecutive years of drought could have reduced habitat carrying capacity and manifested as a dramatic decrease in rainbow trout since they had exceptional abundance in 2019. Moreover, rainbow trout trends exhibit a wide range of variability suggesting a “boom and bust” pattern in which favorable conditions provide dramatic pulses of recruitment, followed by years of average or below average abundance (Figure 8). The high variability in the small size class and relative stability in the large size class suggests regulating factors are limiting juvenile-to-adult survival rates. Alternatively, a proportion of individuals in the smaller size class could be emigrating out of the reach when abundance exceeds a certain threshold. The lack of surveys in 2020 or 2021 hinders speculation about the primary drivers because the population could have declined gradually from the 2019 abundance level or experienced a precipitous decline since 2021. The disproportionate decrease of rainbow trout compared to cutthroat trout, and the relative stability of 4–12-inch cutthroat trout from 2019 to 2022, suggests that factors influencing spawning success may be responsible because spawn timing is a primary life history difference between the two species.

The results demonstrate the challenge of relying on a single year of pre-treatment data to assess project effectiveness. The sparse sampling in Phase 1 since 2016 makes it challenging to determine if the sampling occurred during a low point in the natural cycle. Likewise, the exceptionally high abundance during the Phase 3 pre-restoration survey in 2019 may have resulted by chance from sampling at a high point in the natural range of variability. Therefore, the lower abundance in 2022 should not be interpreted as a negative fishery response to restoration actions in that section. Although overall trout abundance in Phase 1 was as low as the pre-restoration survey, the abundance of westslope cutthroat has remained higher than the 2010 estimate. Furthermore, a short survey section was sampled within the larger Phase 1 section in 1990 and 2000 and found no westslope cutthroat trout and very low densities of rainbow trout (Pierce et al. 2001), providing additional evidence that the Phase 1 project had a sustained fisheries benefit. The riparian areas are recovering well, and the instream habitat represents a marked improvement over pre-restoration conditions in the Phase 1 and Phase 3 project sections.

The imprecise estimates of brown trout abundance make it challenging to ascertain factors driving their trends. The sporadic presence of 4-12-inch brown trout indicates recruitment is highly variable and may be driven by low reproductive success. This could be due to problematic low flow conditions during the spawning and egg incubation periods in late-fall and winter, or potential redd scouring if high flows occur before eggs hatch in early-spring. The potential high and low flows during the shoulder seasons as a result of reservoir management may contribute to the increased variability in rainbow trout and brown trout population sizes compared to westslope cutthroat trout.

The 2022 survey in the Phase 7 section provides the only recent fisheries data between the Douglas Canal and the NSC confluence. Previous surveys were completed upstream of the North Helmville Canal Diversion at stream mile 20 (1994) and upstream of the Lincoln Slough Confluence at stream mile 12.7 (1994, 2000). No trout were captured during surveys at either site, indicating that large portions of lower Nevada Creek were unsuitable for trout. Given the dramatic shifts in species composition below NSC compared to the early 1990s (Peters 1990), improvements over the last few decades have made large portions of lower Nevada Creek suitable for trout. However, the rest of the area between NSC and the Douglas Canal could be devoid of trout or only support extremely low densities. Further investigation is needed to assess contemporary trout distribution and abundance throughout the remainder of lower Nevada Creek.

Mountain whitefish were the most abundant species in the Phase 7 section. In areas where thermal regimes are unsuitable for trout, fish assemblages are generally dominated by sucker and redside shiner. Therefore, the abundance of mountain whitefish suggests that temperature is not solely responsible for the lack of trout. Mountain whitefish can withstand slightly warmer temperatures than trout, but their preferred temperature range is very similar to trout. Moreover, water temperatures below Douglas Creek were significantly warmer than Nevada Creek at Wineglass Bridge, yet more trout were present. The robust population of mountain whitefish suggests water temperatures are suitable for brown trout, but may be slightly higher than preferred temperatures of cutthroat trout. However, temperatures were probably not high enough to preclude cutthroat trout presence. Maximum daily temperatures peaked at 71.4°F while average daily temperatures remained below 68°F over the entire summer.

Maximum daily temperatures above 70°F only occurred for nine days during the monitoring period. However, the late deployment of temperature loggers could have missed similarly hot days during the first three weeks of July.

The low abundance of trout in Phase 7 despite suitable temperatures indicates that spawning habitat may be limiting recruitment in this reach. The low trout recruitment in Phase 7 could be the result of poor spawning habitat quality within this section, passage impediments that preclude migration from upstream or downstream spawning areas, or the lack of tributaries draining into this section. Previous telemetry studies upstream (Uthe et al. 2021) and downstream (Pierce et al. 2014) of this vicinity did not document any tagged trout migrating through this middle section, indicating this portion of lower Nevada Creek may be functioning as an isolated section. Furthermore, the reach lacks ideal spawning habitat such as high-quality riffles and pool tailouts. Age-0 mountain whitefish were very abundant and represented 15% of the total catch, suggesting that whitefish spawning and recruitment is successful in this section. Contrary to trout that use specific substrate and deposit eggs in gravel, whitefish are broadcast spawners without regard to substrate size and composition (Pierce et al. 2012). They often use slower habitat (e.g., glides and pool margins), which is characteristic of much of Phase 7 and could further explain the species composition observed.

Management Recommendations

The fisheries and water temperature results demonstrate the significant habitat improvements in Nevada Creek over the last few decades and the considerable potential for further progress. Trout densities below NSC increased from near-zero in 1990 to an average of 167 trout/mile. This provides compelling evidence that the area around Phase 7, which is nearly devoid of trout, has the potential to support moderate densities of trout if limiting factors are corrected. Aside from addressing potential migration issues, restoration actions within this reach could improve conditions through reductions in erosion and sedimentation, increasing habitat diversity and complexity, and improving the quality of riffles and pool tailouts for spawning. The Phase 7 electrofishing section will serve as a valuable long-term monitoring site to assess the effectiveness of future restoration actions because the low trout abundance will provide statistical power to detect a fisheries response.

Phase 1 and Phase 3 are both upstream of the Douglas Canal and had decreases in trout abundance between 2019 and 2022. Stream discharge is a primary driver of population dynamics and the flow regime is very different in this reach compared to downstream of the Douglas Canal. Therefore, the Phase 1 and Phase 3 sections are both representative of the broader area between the canal and reservoir and should be considered separately from other sections of Nevada Creek when assessing habitat capacity and fisheries potential. Since the two sections are surveyed in different seasons at different flow levels, inferences about differences in habitat quality and trout densities are challenging. A possible future investigation could survey both sections in the same month to illuminate site-specific differences and make the estimates more comparable. Unless there is a specific need or question of interest in Phase 3, continued monitoring of Phase 1 will reduce redundancy and serve as a sufficient monitoring section because it has a longer time series, and its trends can be considered representative of the entire reach between the Douglas Canal and the reservoir. The present investigation contributes to the understanding of contemporary status and trends of fisheries resources in

Nevada Creek, but additional information is needed to inform restoration planning and develop specific project actions. Future sampling efforts should prioritize the following investigations to address remaining knowledge gaps:

1. Additional fisheries surveys to identify species composition upstream and downstream of the Phase 7 project area to determine the extent of stream length with exceptionally low trout densities.
2. Inventory of passage impediments and entrainment issues downstream of the Douglas Canal.
3. Investigate water inputs and withdrawals downstream of the Douglas Canal to assess and prioritize water conservation opportunities.

References

Peters, D. 1990. Inventory of fishery resources in the Blackfoot River and major tributaries to the Blackfoot River. Montana Department of Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., R. Aasheim, and C. Podner. 2005. An integrated stream restoration and native fish conservation strategy for the Big Blackfoot River basin. Montana Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., M. Davidson, and C. Podner. 2012. Spawning behavior of mountain whitefish and co-occurrence of *Myxobolus cerebralis* in the Blackfoot River Basin, Montana. Transactions of the American Fisheries Society 141:720-730.

Pierce, R., and D. Peters. 1990. Aquatic investigations in the middle Blackfoot River, Nevada Creek and Nevada Spring Creek corridors. Montana Department of Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., C. Podner, and J. McFee. 2001. Blackfoot River fisheries inventory, monitoring and restoration report. Montana Fish, Wildlife and Parks, Missoula, Montana.

Pierce, R., C. Podner, T. Wendt, K. Carim and R. Shields. 2014. Westslope cutthroat trout movements through restored habitat and Coanda diversions in the Nevada Spring Creek complex, Blackfoot Basin, Montana. Transactions of the American Fisheries Society 143:230–239.

Seber, G. A. F. 1982. The estimation of animal abundance and related parameters. MacMillan Press, New York, New York, USA.

Uthe, P., C. Podner, and R. Pierce. 2021. Fisheries investigations in the Blackfoot River watershed, 2016-2020. Montana Fish, Wildlife and Parks, Missoula, Montana.

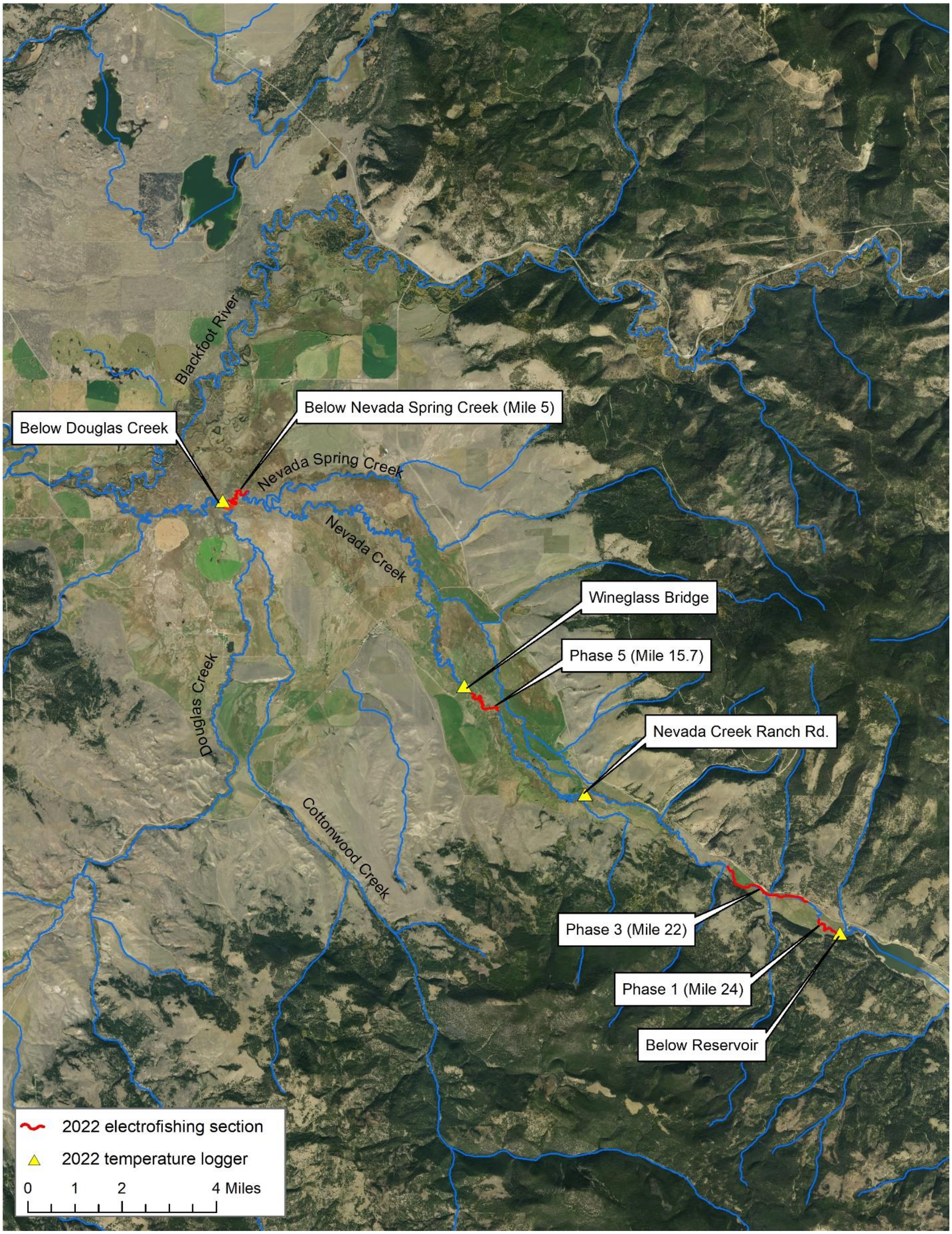

Figure 1. Map of electrofishing sections and stream temperature loggers.

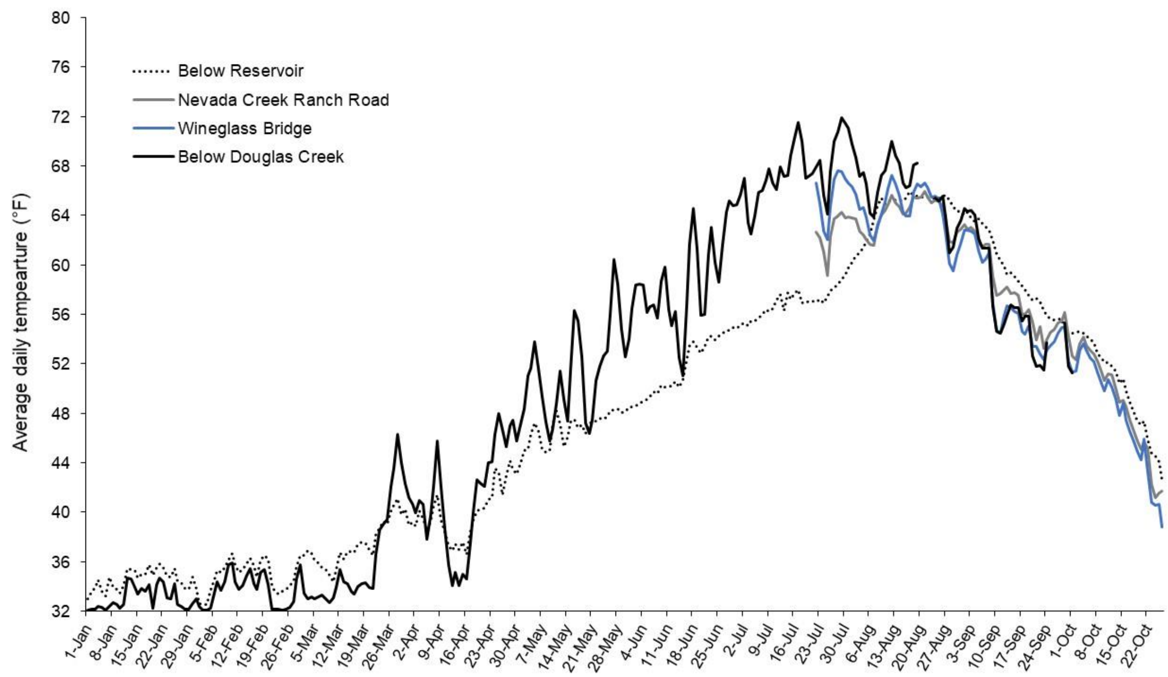

Figure 2. Average daily temperatures at four locations in Nevada Creek, 2022. The loggers below the reservoir and below Douglas Creek are long-term monitoring sites and were deployed for the entire year. The loggers at Wineglass Bridge and Nevada Creek Ranch Road were additional sites in 2022 and were deployed July 22-October 26.

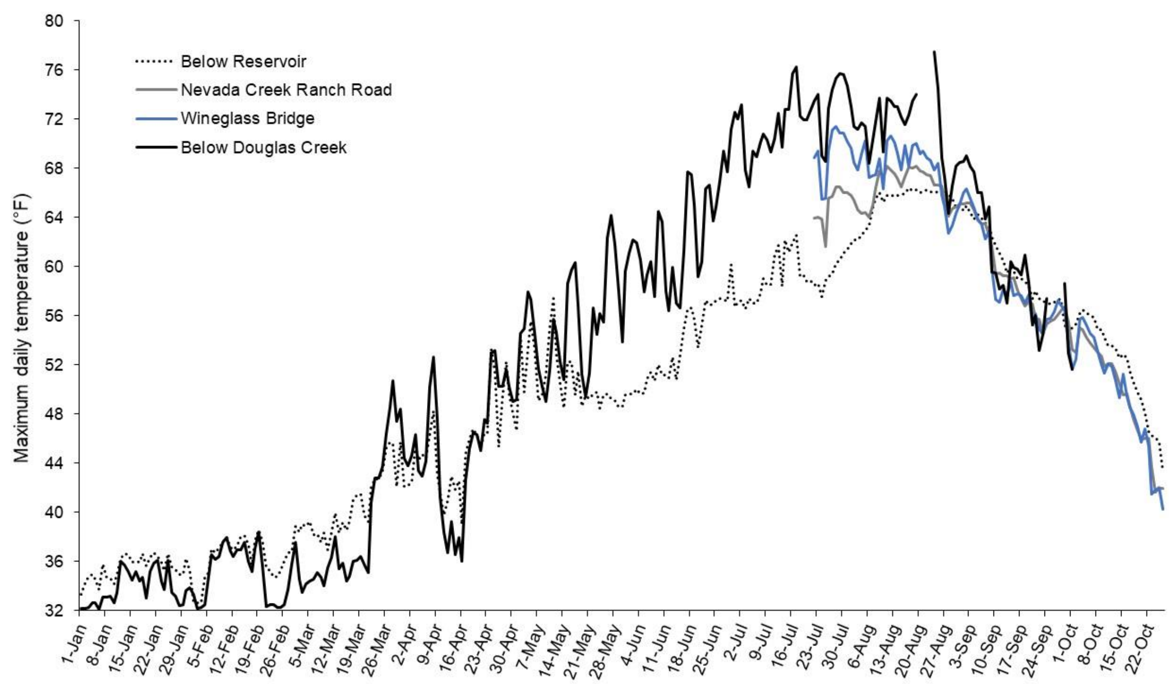

Figure 3. Daily maximum water temperatures measured at four locations in Nevada Creek, July – October, 2022.

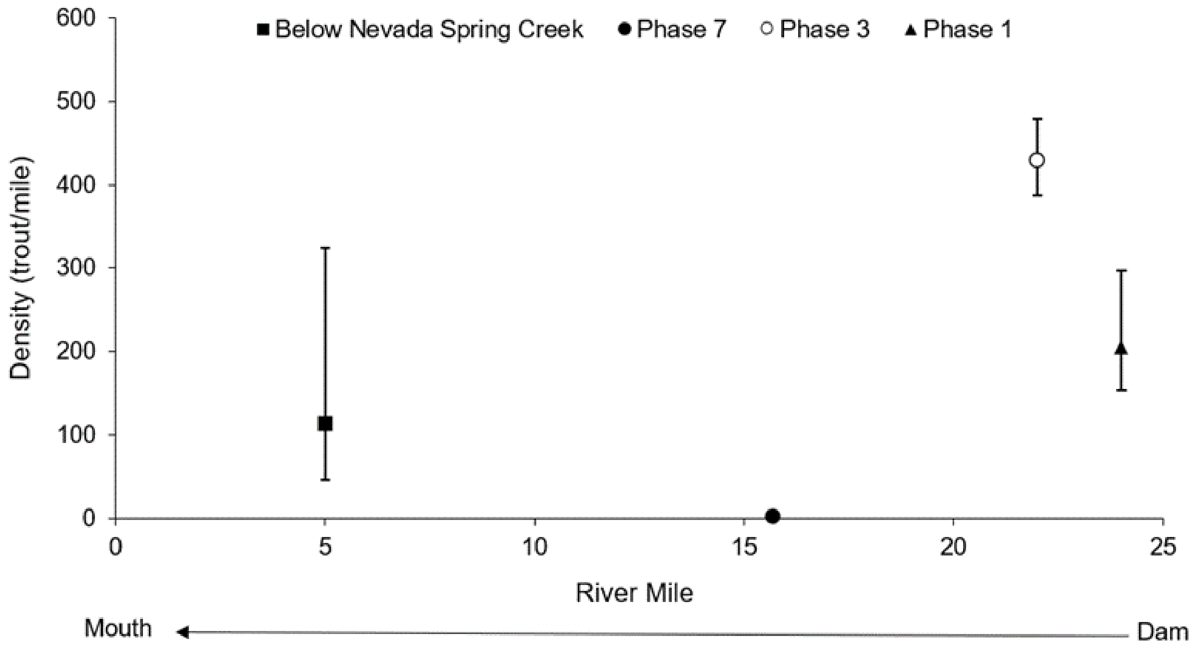

Figure 4. Density of trout (≥ 4 inches) at four electrofishing sections in Nevada Creek, 2022. Sites are arranged by river mile (confluence of Nevada Creek and the Blackfoot River is River Mile 0).

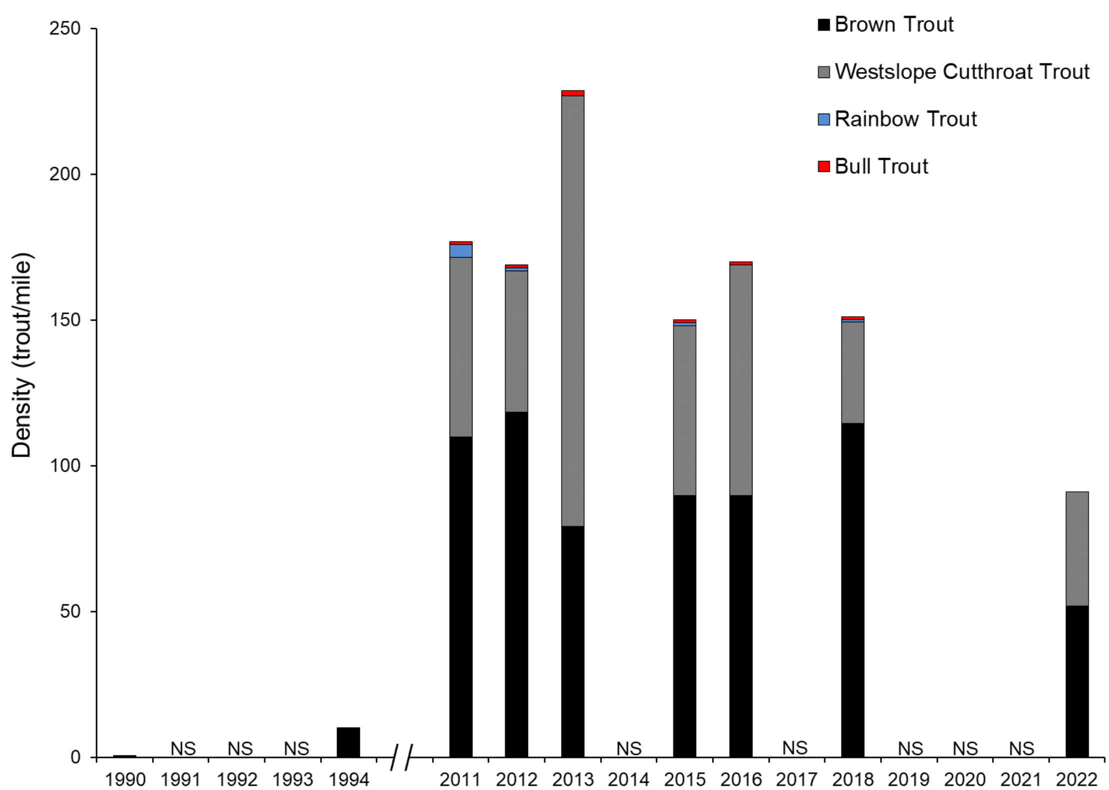

Figure 5. Density (trout/mile) of trout ≥ 4 inches in the Below NSC electrofishing section. NS = not sampled.

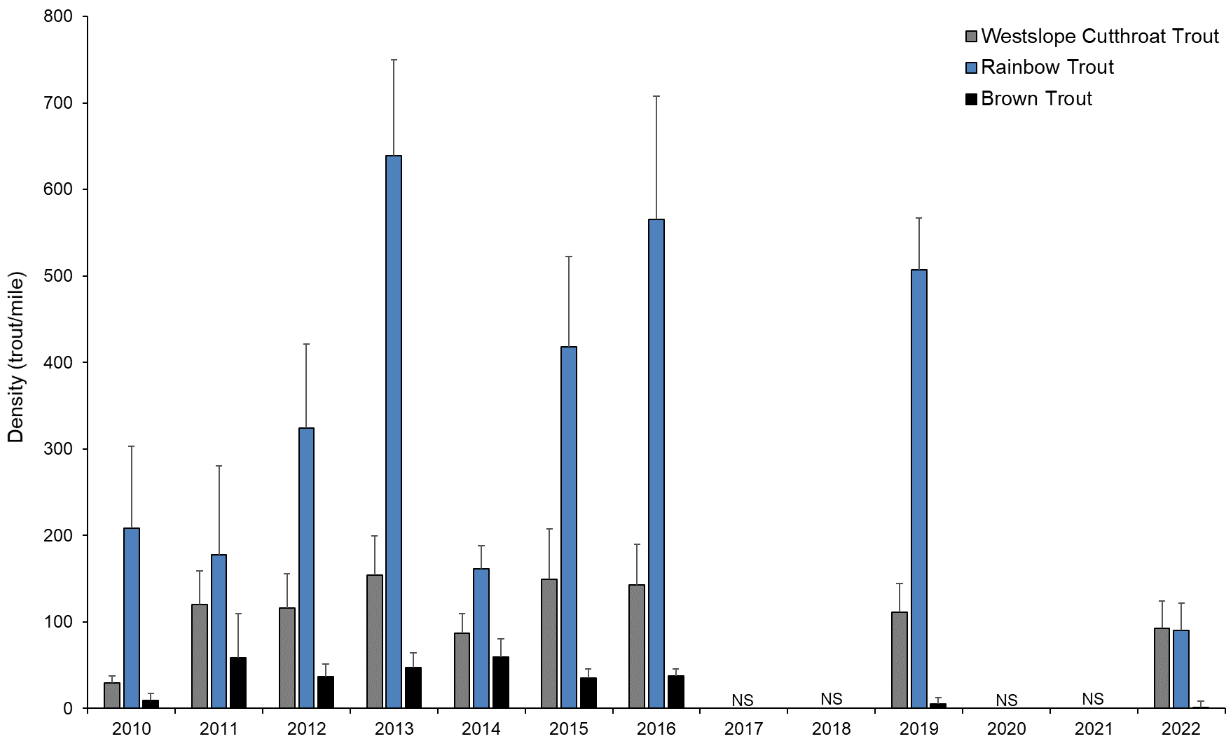

Figure 6. Density (trout/mile) of westslope cutthroat trout (grey), rainbow trout (blue), and brown trout (black) with length 4 inches and greater in the Phase 1 project section. NS = not sampled.

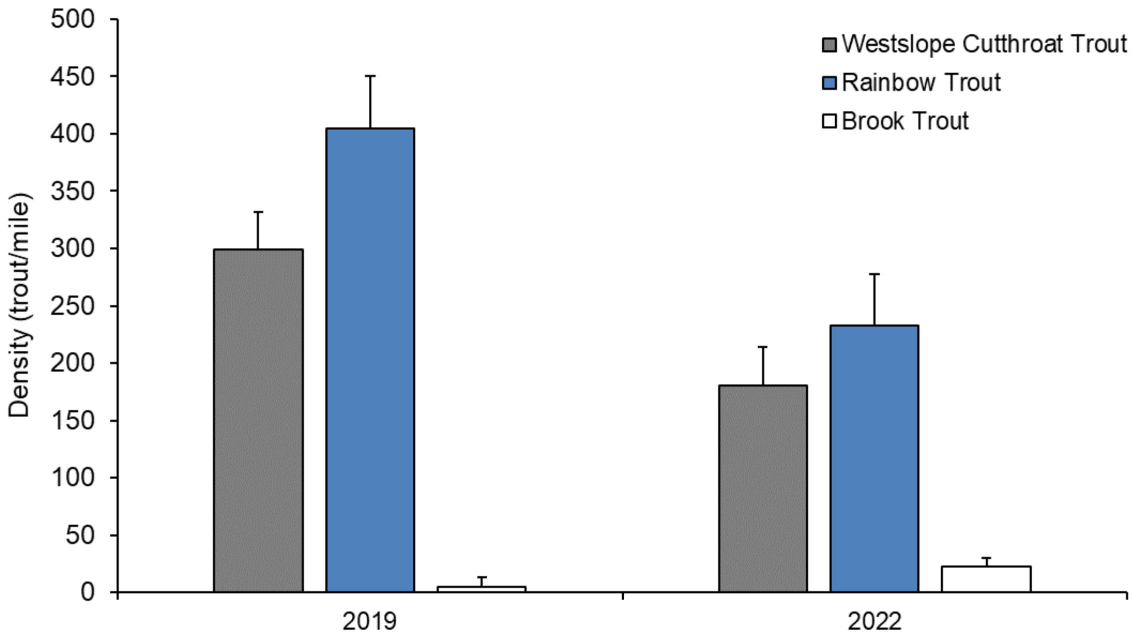

Figure 7. Density (trout/mile) of westslope cutthroat trout (grey), rainbow trout (blue), and brook trout (white) with length 4 inches and greater in the Phase 3 project section

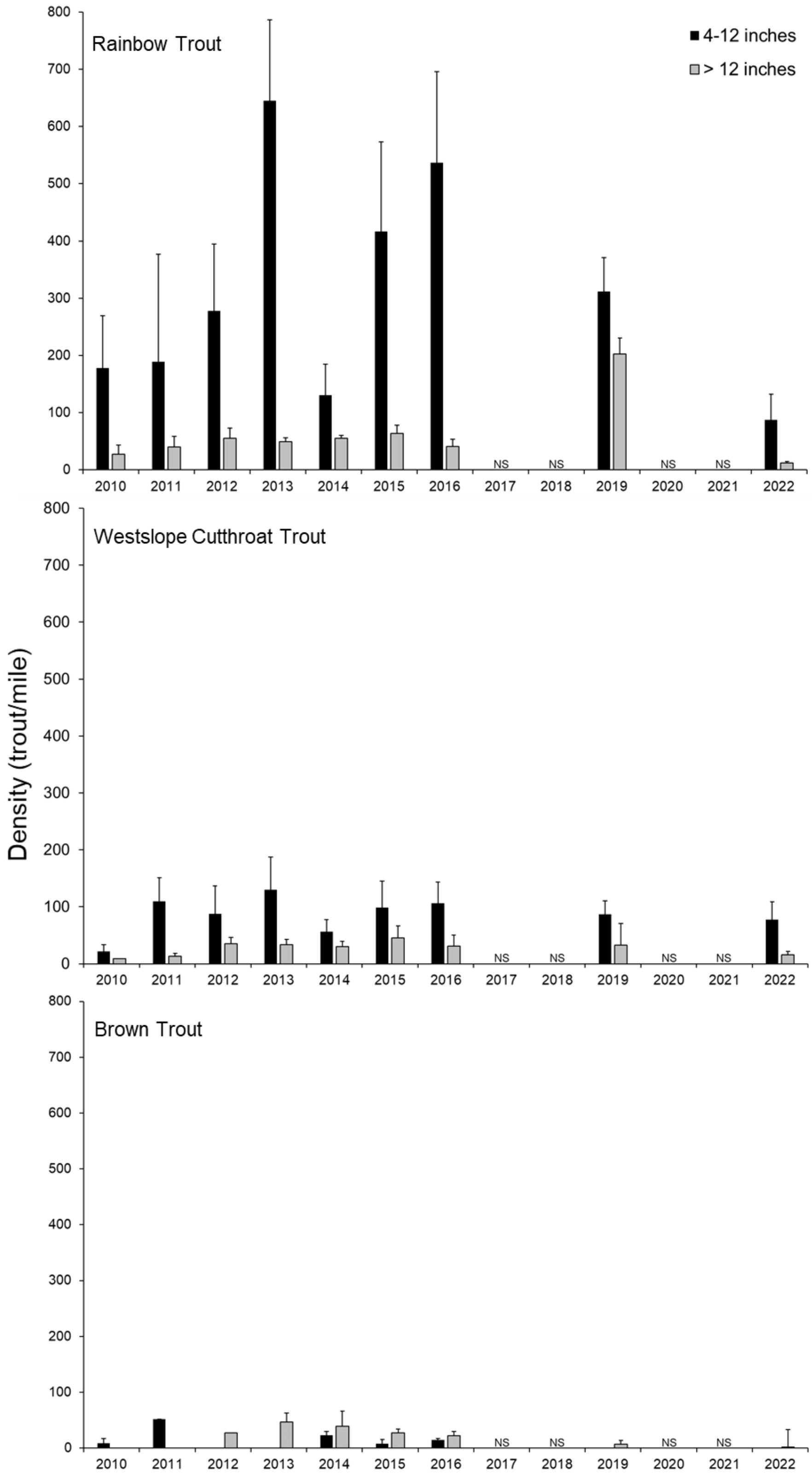

Figure 8. Density (trout/mile) of rainbow trout (top), westslope cutthroat trout (middle), and brown trout (bottom) 4-12 inches (black) and ≥ 12 inches (grey) in the Phase 1 project section. NS = not sampled.

Summary of fisheries and water temperature surveys in Cottonwood Creek, 2022

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December 2022

Water temperature monitoring and fisheries surveys were conducted in Cottonwood Creek in 2022 to evaluate contemporary stream conditions and fishery status (Figure 1). Temperature loggers were installed in Cottonwood Creek on June 29 and removed on October 21. Temperature logger locations were selected to describe longitudinal temperature changes and assess the influence of the two ponds in this section of the drainage. We conducted electrofishing surveys at nine sites on August 22-23 (Figure 1). A single-pass electrofishing survey was conducted in each section to assess species composition and estimate relative abundance of trout. The primary objectives of the 2022 investigations were to 1) address knowledge gaps in this section of Cottonwood Creek, 2) describe stream temperature changes throughout the ranch, 3) determine the extent of suitable trout habitat, and 4) inform restoration strategies.

Abundance of age-1 and older trout was similar among Sections 1, 2 and 3, but declined progressively at each downstream section until an absence of trout in Section 9 (Figure 2). Brook trout exhibited a pronounced decline downstream of Section 4, whereas westslope cutthroat trout declined abruptly downstream of Section 3. All sections had areas of localized habitat degradation (e.g., eroding banks, low pool quality, low pool frequency, and simplified habitat). However, Sections 1-3 had the highest prevalence of quality habitat, reflected by the higher westslope cutthroat trout abundance in those areas. We captured age-0 westslope cutthroat trout in Sections 1, 3, and 4, indicating successful spawning had occurred nearby. One brook trout was captured in Section 8, while no trout were captured in Section 9. Fish biomass in Section 9 was comprised entirely of longnose sucker and redside shiner, which is typical of tributary stream sections unable to support cold-water fish species.

Section 1 had the highest combined trout abundance, as well as the highest abundance of westslope cutthroat trout. However, the total abundance in Section 1 was significantly lower than the average of 27 trout/100 ft documented in the electrofishing site at stream mile 9.3 in 2000 and 2017. Moreover, the westslope cutthroat trout abundance at stream mile 9.3 was 26 trout/100 in 2017. This comparison suggests that even though Section 1 had the highest relative abundance in our investigation, all the sections in the 2022 investigation are below the expected capacity for the reference condition of Cottonwood Creek.

Stream temperatures exhibited moderate warming between the upper ditch and Highway 271, but increased more significantly downstream of the highway (Figure 3). We did not have a temperature sensor at the Douglas Canal input, but since it provides a significant portion of the total stream discharge, it probably contributed to the excessive temperatures observed at Ovando-Helmville Road. Maximum daily temperatures at Highway 271 did not reach or exceed 68°F, but this location was consistently warmer than upstream areas. The level of warming between the ford crossing and Highway 271 suggests that the ponds are contributing to elevated water temperatures. By mid-August, maximum daily temperatures at Highway 271 were almost three degrees higher than at the ford crossing. From late-July until the upper pond spillway dewatered on August 7th, maximum temperatures in the spillway were considerably warmer than Cottonwood Creek above the spillway, providing evidence that the pond is contributing to warmer temperatures. The outlet channel of the lower pond approached 68°F in mid-August and the logger at Highway 271 had very similar maximum temperatures during this timeframe.

Although westslope cutthroat trout can survive short durations of temperatures approaching 75 °F, prolonged exposure to temperatures above 67°F is considered unsuitable. The only area that had extended periods above this temperature threshold was the site at Ovando-Helmville Road. Preferred temperatures for westslope cutthroat trout range from 54°F to 64°F. Several sites had long periods within this range, but some had consecutives days near or above the 67 °F threshold. This likely influenced the species composition we observed in all electrofishing sections because brook trout have a broader thermal tolerance than westslope cutthroat trout.

Interestingly, the spillway of the lower pond had consistently lower maximum daily temperatures than other locations. Given the low flows in this channel, there may have been subsurface flow through the bottom of the pond dike that was moderating the water temperature. Another interesting observation was the logger above the upper ditch consistently had higher maximum temperatures than the logger upstream of the ford, which was less than a mile downstream. This may have been due to small-scale temperature variation related to specific logger locations or an unknown factor near the area. Otherwise, the maximum temperatures at these two locations were generally within one degree of each other, and both remained below 67°F for the entire season.

The fisheries and temperature results demonstrate that pursuing restoration work in this section of Cottonwood Creek has considerable potential to improve the abundance and distribution of westslope cutthroat trout. The presence of a single westslope cutthroat trout downstream of Highway 271 indicates that some level of downstream migration is probably occurring. Projects that promote the successful outmigration of trout and enable subsequent upstream passage will provide the best chance of reestablishing a migratory component of the westslope cutthroat trout population. The frequency of maximum daily temperatures exceeding 73°F in lower Cottonwood Creek presents an overarching limiting factor that may preclude the potential benefits of certain actions implemented in this lower reach. Therefore, it may be prudent to focus restoration actions on passage improvements and manage it as a migratory corridor until comprehensive restoration of lower Douglas Creek and lower Cottonwood Creek becomes feasible. Stream temperatures were not a significant problem in most of the monitored areas, but they were warmer than temperatures documented upstream at stream mile 9.0 in 2000. This suggests restoration efforts could moderate temperatures and increase the amount of stream habitat with ideal thermal regimes for westslope cutthroat trout. Potential restoration actions upstream of the Douglas Canal siphon should focus on improving connectivity, instream flow, instream habitat quality, and riparian habitat conditions. This investigation provides initial recommendations to inform restoration discussions, but development of specific action plans will benefit from additional knowledge of:

1. Irrigation use and infrastructure upstream of the areas surveyed in 2022.
2. Suitable reference reaches to inform habitat restoration efforts.
3. Ideal minimum instream flow targets to inform water management discussions.

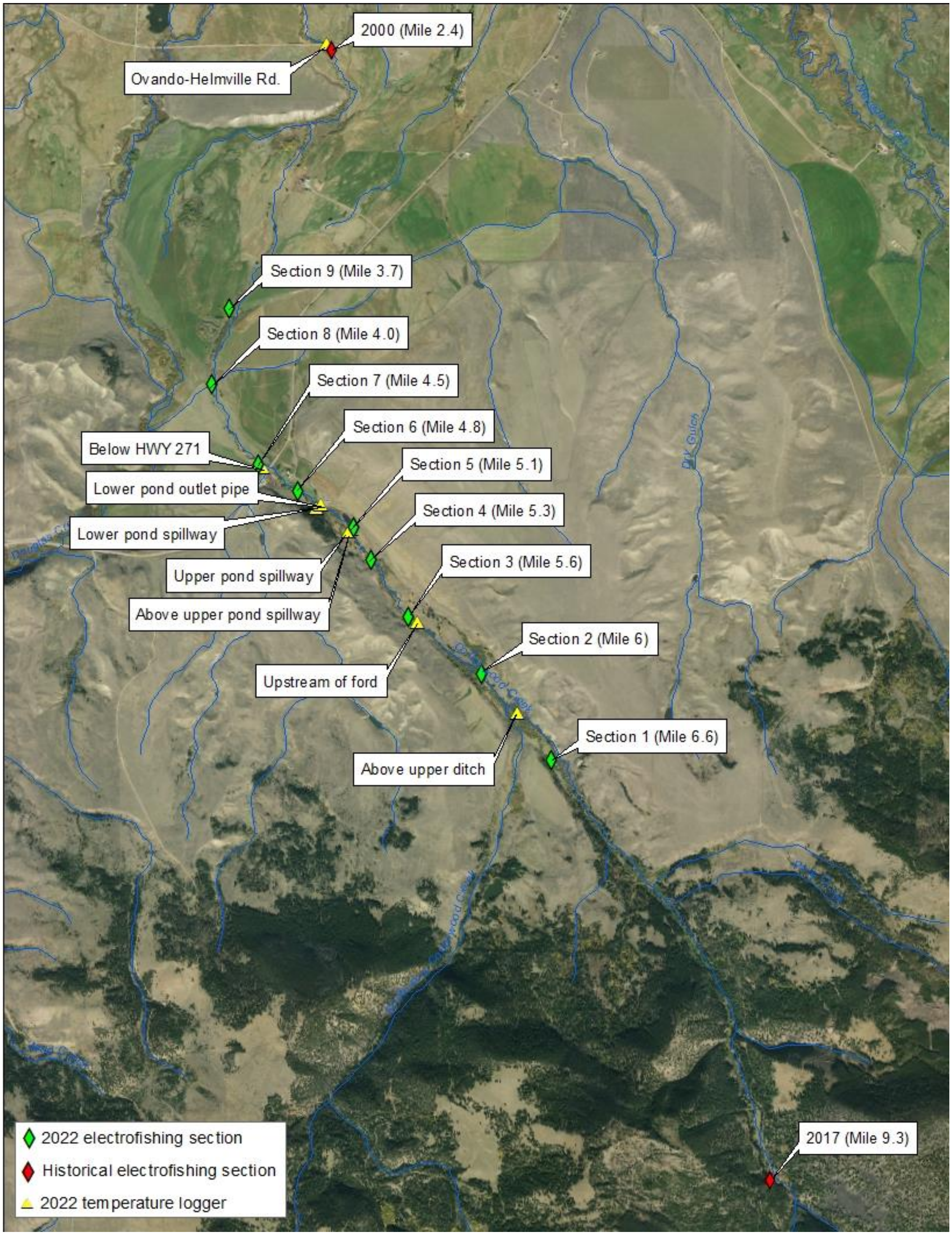

Figure 1. Map of electrofishing sections and stream temperature loggers.

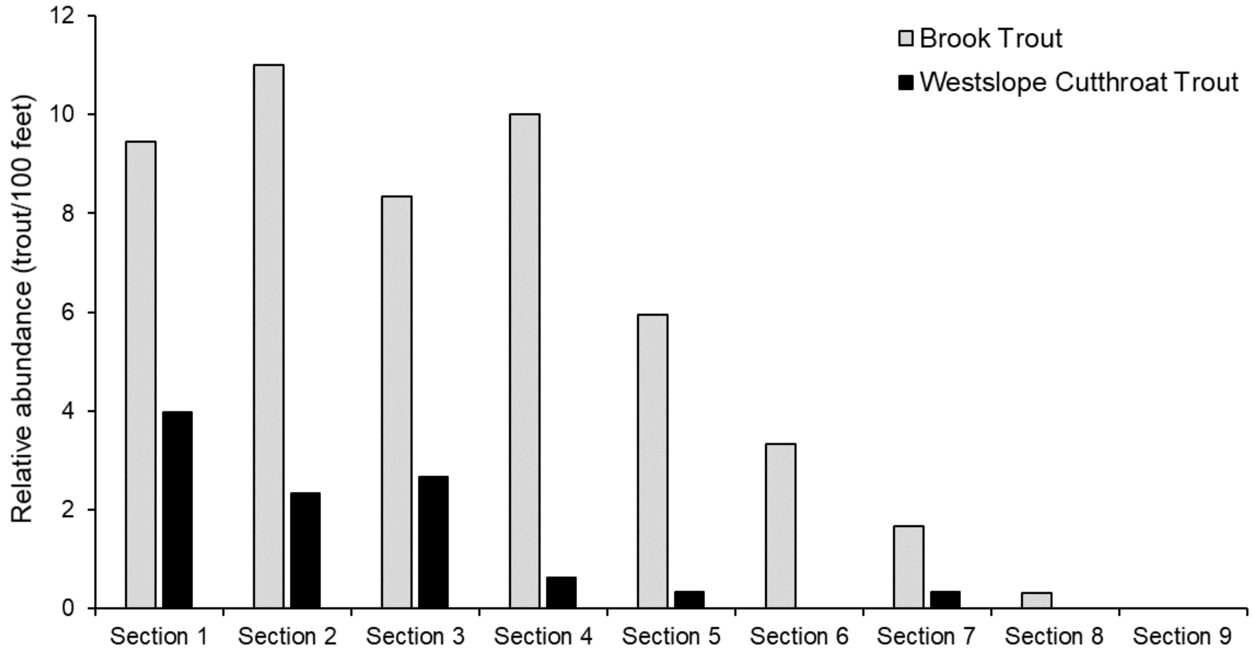

Figure 2. Relative abundance of age-1+ brook trout and westslope cutthroat trout at nine electrofishing sections in Cottonwood Creek, 2022.

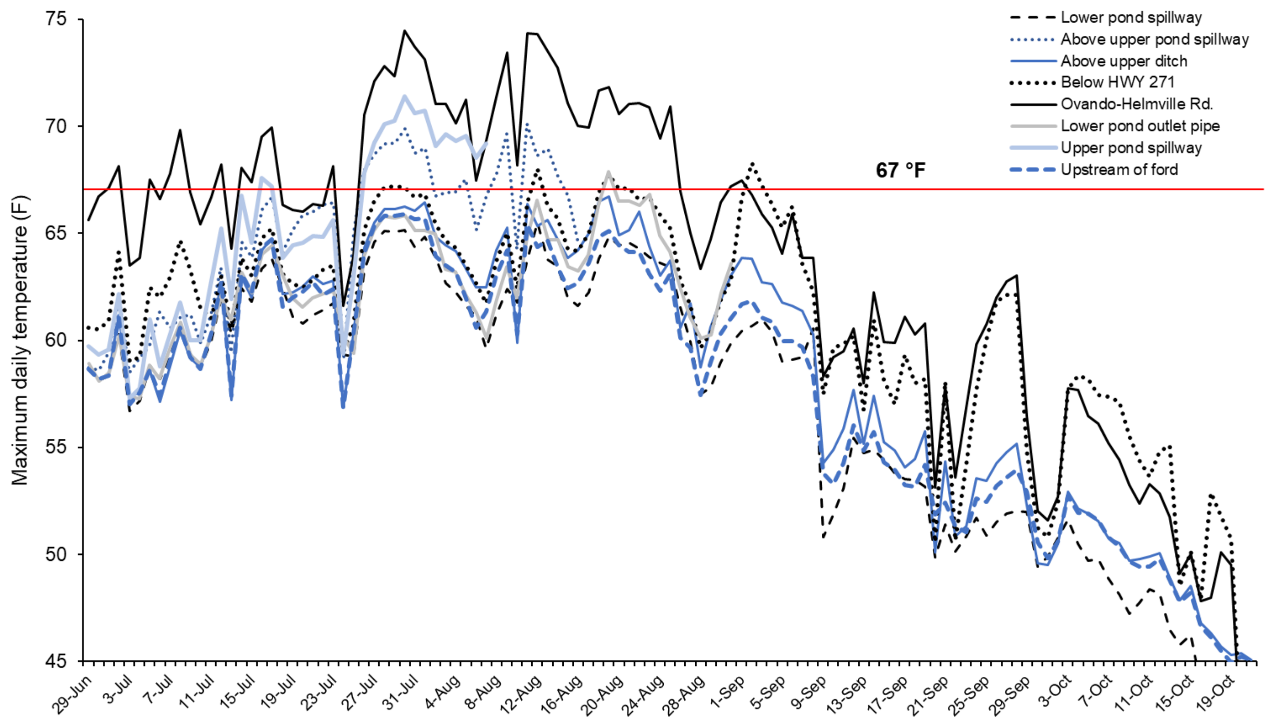

Figure 3. Daily maximum water temperatures measured at eight locations in Cottonwood Creek, July – October, 2022. The red line denotes the threshold of 67 °F to indicate unsuitable conditions for westslope cutthroat trout.

Appendix A: Catch and size statistics for tributaries to the Blackfoot River, 2021 – 2023.

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Range of Lengths (in)	Mean Length (in)	YOY CPUE (#/100' in 1st Pass)	Age 1+ CPUE / 100ft
Anaconda Creek	0.1	15N,6W,27B	13-Sep-21	530	WCT	105	88	0	3.2 - 8.5	4.9	0.0	16.6
					EB	13	10	0	4.4 - 7.2	5.5	0.0	1.9
					Spotted frog	observed						
			1-Sep-22	530	WCT	48	38	0	2.4 - 7.0	4.4	0.0	9.1
					EB	18	15	0	4.6 - 8.2	5.7	0.0	2.8
			29-Aug-23	530	WCT	63	55	1	2.8 - 7.9	4.8	0.2	10.2
					EB	45	35	9	2.2 - 8.7	4.8	1.7	4.9
Beartrap Cr	0.35	15N,6W,27B	13-Sep-21	656	EB	58	54	14	2.7 - 10.2	6.2	2.1	6.1
			1-Sep-22	656	EB	149	124	92	2.0 - 9.4	3.8	14.0	4.9
					WCT	1	1	0	8.5	8.5	0.0	0.2
			30-Aug-23	656	EB	114	108	18	2.2 - 10.3	5.4	2.7	13.7
	1.1	15N,6W,27D	13-Sep-21	328	No fish							
			1-Sep-22	328	No fish							
			29-Aug-23	328	No fish							
Belmont Creek	8.4	15N,16W,20A	5-Jul-22	360	WCT	7	7	1	2.2 - 6.9	4.3	0.3	1.7
Blackfoot River	131	15N,6W,21C	16-Sep-21	600	WCT	46	31	0	3.7 - 11	7.2	0.0	5.2
					EB	377	278	144	2.6 - 9.3	4.9	24.0	22.3
			31-Aug-22	600	WCT	19	17	0	5.7 - 11.6	8.4	0.0	2.8
					EB	465	324	175	2.2 - 8.6	4.2	29.2	24.8
					LNSU	8	3					
			19-Sep-23	600	WCT	17	12	0	4.1 - 12.2	7.3	0.0	2.0
					EB	478	379	96	2.6 - 9.5	5.3	16.0	47.2
					LNSU	2	1					
	131.8	15N,6W,21D	14-Sep-21	656	EB	263	190	127	2.8 - 10.6	4.7	19.4	9.6
					WCT	8	5	0	4.6 - 8.3	5.8	0.0	0.8
					LNS	4	3	0	4.7 - 7.6	5.9	0.0	0.5
			31-Aug-22	656	EB	264	207	136	2.4 - 10.2	4.0	20.7	10.8
					WCT	2	2	0	8.7 - 8.9	8.8	0.0	0.3
					LNSU	5	3					
			19-Sep-23	656	EB	290	231	43	2.9 - 9.2	5.6	6.6	28.7
					WCT	9	7	0	4.8 - 9.9	6.2	0.0	1.1
					LNSU	6	6					
	132	15N,6W,21D	14-Sep-21	682	WCT	53	44	0	4.7 - 9.4	6.2	0.0	6.5
					EB	362	293	103	2.9 - 9.5	5.4	15.1	27.9
			12-Sep-22	682	WCT	24	21	0	5.7 - 9.7	8.4	0.0	3.1
					EB	497	369	190	2.6 - 10.5	4.6	27.9	26.2
					LNSU	1						
			30-Aug-23	682	WCT	9	7	0	4.8 - 10.7	7.3	0.0	1.0
					EB	389	321	35	2.4 - 9.4	5.6	5.1	41.9
Black Diamond Creek	0.85		15-Jul-23	330	WCT	23	23	14	2.4 - 6.2	3.2	4.2	2.7
					EB	4	4	0	4.0 - 4.3	4.1	0.0	1.2
	2		19-Jul-23	580	WCT	24	24	1	2.9 - 5.7	3.7	0.2	4.0
					EB	4	4	1	3.9 - 4.4	4.2	0.2	0.5
Blondie Creek	0.2	16N,9W,9C	5-Aug-21	405	RB	2	2	0	4.3 - 4.6	4.4	0.0	0.5
					Sotted frogs	& tadpoles	common,					
Burnt Cabin Creek	0.1		8-Aug-23	300	WCT	4	4	1	2.7 - 5.9	4.3	0.3	1.0

Appendix A: Catch and size statistics for tributaries to the Blackfoot River, 2021 – 2023.

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Range of Lengths (in)	Mean Length (in)	YOY CPUE (#/100' in 1st Pass)	Age 1+ CPUE / 100ft
Copper Creek	1.1	15N,8W,25C &26A	24-Aug-22	550	WCT	11	11	0	4.4 - 9.3	6.4	0.0	2.0
					COT	~ 30 observed						
	6.2	15N,8W,9A	2-Sep-21	515	BULL	4	4	1	2.3 - 4.8	4.0	0.2	0.6
					WCT	23	17	1	1.9 - 11.5	5.8	0.2	3.1
					Sculpins	common						
			24-Aug-22	515	BULL	3	3	0	4.0 - 18.4	9.0	0.0	0.6
					WCT	27	20	0	3.4 - 11.7	5.5	0.0	3.9
Cottonwood Creek	3.65		23-Aug-22	255	LNSU	6	6		4.9 - 7.5	6.3		
trib to Douglas Creek					RSS	20	20		2.8 - 4.1	3.3		
	4.03		23-Aug-22	312	EB	1	1		225	225		
	4.52		23-Aug-22	300	EB	14	14	11	2.0 - 8.3	4.5	3.7	1.0
					WCT	1	1	1	145	145	0.3	0.3
	4.75		23-Aug-22	330	EB	15	15	4	2.4 - 10.0	6.1	1.2	3.3
					COT	present						
	5.05		23-Aug-22	303	EB	48	48	32	2.0 - 7.3	5.7	10.6	5.3
					WCT	1	1	0	287	287	0.0	0.3
	5.25		23-Aug-22	320	EB	67	67	36	2.2 - 8.3	4	11.3	9.7
					WCT	4	4	2	1.9 - 14.0	5.3	0.6	0.6
	5.6		23-Aug-22	300	EB	35	35	10	2.0 - 9.3	5.1	3.3	8.3
					WCT	10	10	2	1.6 - 11.0	7.3	0.7	2.7
					COT	common						
	6.03		23-Aug-22	300	EB	54	54	20	2.2 - 8.1	4.6	6.7	11.3
					WCT	7	7	0	4.8 - 11.9	7.9	0.0	2.3
					COT	common						
	6.6		23-Aug-22	580	EB	114	114	83	2.6 - 8.6	4.7	14.3	5.3
					WCT	15	15	1	1.5 - 10.3	5	0.2	2.4
					COT	common						
Cottonwood Creek	3.3	15N,13W,17D	30-Aug-22	473	EB	2	2	0	9.5 - 9.9	9.7	0.0	0.4
	7.5	15N,13W,5C	30-Aug-22	480	EB	47	47	14	2.8 - 11.5	5.8	2.9	6.9
					LL	1	1	0	6.0	6.0	0.0	0.2
					COT	20 observed						
Doney Lake												
Unnamed trib to Doney Lake outlet	0.7		21-Jul-22	260	EB	26	26	14	1.6 - 6.0	4.0	5.4	4.6
					WCT	13	13	2	2.2 - 6.6	4.4	0.8	4.2
East Fork Unnamed trib to Doney Lake outlet (above c	0.01		21-Jul-22	312	EB	1	1	0	135	135.0	0.0	0.3
					WCT	1	1	0	154	154.0	0.0	0.3
	0.45		21-Jul-22	225	No fish							
West Fork unnamed trib near doney lake (below culver	0.2		7-Jul-22	300	EB	1	1	0	5.8	5.8	0.0	0.3
					WCT	21	21	6	1.9 - 6.4	4.1	2.0	5.0
	0.3		7-Jul-22	300	WCT	18	18	6	1.9 - 6.6	3.9	2.0	4.0
Dunham Creek	2.3	16N,12W,19B	27-Jul-22	600	BULL	2	1	0	5.9 - 6.4	6.2	0.0	0.2
					EB	21	13	3	1.9 - 8.5	4.9	0.5	1.7
					WCT	19	13	0	2.8 - 11.7	5.2	0.0	2.2
			26-Jul-23	600	BULL	4	2	1	2.9 - 9.7	4.7	0.2	0.2
					EB	59	42	21	2.1 - 12.2	4.2	3.5	3.5
					LL	1	1	0	12.2	12.2	0.0	0.0
					WCT	90	71	3	2.5 - 11.7	4.8	0.5	0.0
	4.2	16N,13W,12D	27-Jul-22	790	BULL	5	2	0	5.5 - 6.0	5.7	0.0	0.6
					WCT	3	2	0	3.4 - 3.6	3.5	0.0	0.4
					EB	8	5	0	5.2 - 6.6	5.7	0.0	1.0
	7	16N,13W,2A	28-Jul-22	400	EB	4	3	0	4.8 - 6.5	5.5	0.0	0.8
					WCT	29	20	1	2.6 - 12.0	5.2	0.3	4.8
			14-Aug-23	400	EB	1	0	0	5.7	5.7	0.0	0.0
					WCT	106	82	14	1.5 -10.7	4.2	3.5	17.0

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Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Range of Lengths (in)	Mean Length (in)	YOY CPUE (#/100' in 1st Pass)	Age 1+ CPUE / 100ft
East Fork Monture Creek	0.2	17N,12W,8B	8-Aug-23	690	BULL	2	2	0	6.3 - 6.9	6.6	0.0	0.3
					WCT	31	31	0	3.0 - 8.3	5.0	0.0	4.5
East Fork of NFBLKFT	1.9	17N,10W,34C	9-Aug-21	490	RB	4	4	0	3.8 - 6.8	5.2	0.0	0.8
	7	16N,9W,7B	7-Aug-21	750	RB*	1	1	0	7.4	7.4	0.0	0.1
South Channel of East Fork	9	16N,9W,8C	6-Aug-21	630	RB	2	2	0	5.1 - 5.7	4.5	0.0	0.3
East Twin Creek	0.15		5-Jul-23	500	EB	12	12	1	1.9 - 7.5	5.3	0.2	2.2
					LL	2	2	0	4.4 - 5.4	4.9	0.0	0.4
					RB	18	18	5	2.2 - 6.5	3.4	1.0	2.6
	1.85		5-Jul-23	600	EB	54	54	25	1.5 - 7.8	4.5	4.2	4.8
					RB	5	5	4	2.5 - 3.6	2.9	0.7	0.2
	4.35		5-Jul-23	350	WCT	32	32	2	2.1 - 6.0	4.5	0.6	8.6
Gold Creek	0.5	14N,16W,31C	22-Aug-23	510	BULL	2	2	0	7.9 - 8.5	8.2	0.0	0.4
					EB	1	1	0	10.4	10.4	0.0	0.2
					LL	14	14	1	2.6 - 11.9	5.7	0.2	2.5
					RB	30	30	3	1.7 -9.1	5.0	0.6	5.3
	1.9	14N,16W,30D	22-Aug-23	400	LL	9	8	0	2.4 - 11.5	6.5	0.0	2.0
					RB	46	36	11	1.6 - 12.3	4.4	2.8	6.3
					WCT	8	1	0	4.0 - 11.2	5.8	0.0	0.3
	4.3		28-Aug-23	520	EB	5	5	1	2.9 - 8.5	6.4	0.2	0.8
					LL	35	35	1	2.7 - 11.1	6.6	0.2	6.5
					RB	46	46	2	2.3 - 7.8	4.9	0.4	8.5
					WCT	8	8	0	3.8 - 7.0	5.4	0.0	1.5
	6.2	14N,16&17W,7B	21-Aug-23	270	EB	44	44	9	2.3 - 8.5	5.3	3.3	13.0
					LL	9	9	0	5.4 - 10.5	8.2	0.0	3.3
					RB	34	34	7	1.8 - 9.1	4.4	2.6	10.0
					WCT	5	5	0	4.2 - 6.6	5.4	0.0	1.9
	9	15N,17W,25C	21-Aug-23	342	EB	18	18	0	4.0 - 7.3	5.8	0.0	5.3
					RB	1	1	0	7.0	7.0	0.0	0.3
					WCT	49	49	0	3.2 - 7.9	4.7	0.0	14.3
	10.6	15N,17W,22D	21-Aug-23	730	EB	26	26	1	2.5 - 7.2	5.0	0.1	3.4
					WCT	40	40	0	3.4 - 7.3	4.8	0.0	5.5
	13.6		28-Aug-23	390	WCT	49	49	2	2.6 - 7.3	4.3	0.5	12.1
West Fork Gold Creek	0.1	14N,17W,1D	3-Oct-23	361	EB	10	10	0	5.2 - 7.5	6.6	0.0	2.8
					LL	8	8	1	3.9 - 9.6	7.6	0.3	1.9
					RB	43	43	8	2.4 - 7.8	4.6	2.2	9.7
					WCT	3	3	0	4.5 - 6.4	5.3	0.0	0.8
	4.6	15N,17W,33C	3-Oct-23	350	EB	13	13	6	2.8 - 7.3	4.4	1.7	2.0
					RB	6	6	0	4.0 - 8.7	5.3	0.0	1.7
					WCT	34	34	2	2.2 - 8.8	4.9	0.6	9.1
	6.5		3-Oct-23	180	EB	5	5	2	1.9 - 6.5	4.0	1.1	1.7
Hayden Creek	0.1	17N,12W,17D	8-Aug-23	250	BULL	9	9	1	3.9 - 9.1	5.7	0.4	3.2
					WCT	2	2	0	5.6 - 6.9	6.2	0.0	0.8
Hogum Creek	0.4	14N,7W,8A	12-Jul-23	411	EB	11	11	0	3.5 - 8.2	5.9	0.0	2.7
					LL	3	3	0	4.3 - 7.4	5.3	0.0	0.7
					WCT	20	20	0	3.5 - 9.7	5.2	0.0	4.9
	0.7	14N,7W,8D	12-Jul-23	390	EB	5	5	1	2.0 - 6.5	4.7	0.3	1.0
					WCT	25	25	0	3.3 - 9.4	4.8	0.0	6.4
	3.05		18-Jul-23	510	EB	5	5	1	3.9 - 7.4	4.7	0.2	0.8
					WCT	28	28	4	2.6 - 6.9	4.3	0.8	4.7

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Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Range of Lengths (in)	Mean Length (in)	YOY CPUE (#/100' in 1st Pass)	Age 1+ CPUE / 100ft
Lodgepole Creek	0.1	17N,13W,36B	28-Jul-22	560	BULL	2	2	0	6.0 - 6.0	6.0	0.0	0.4
					EB	4	1	0	5.4 - 9.5	7.4	0.0	0.2
					WCT	49	36	0	3.2 - 11.9	5.9	0.0	6.4
	0.2		4-Aug-22	390	BULL	1	1	0	6.2	6.2	0.0	0.3
					EB	4	4	0	5.6 - 10.2	7.2	0.0	1.0
					EBxBULL	1	1	0	9.0	9.0	0.0	0.3
					WCT	54	54	0	3.2 - 8.9	5.2	0.0	13.8
	0.65		3-Aug-22	420	WCT	23	16	0	4.3 - 13.1	6.8	0.0	3.8
	0.9		3-Aug-22	5068	No fish							
	1.95		8/10/22, 8/15/2	5750	WCT	60	60	0	2.8 - 5.8	4.7	0.0	1.0
	3.45		12-Sep-22	1425	WCT	7	7	0	4.5 - 6.5	5.3	0.0	0.5
Lost Pony Creek	0.8	16N,9W,6B	6-Aug-21	251	RB	4	4	0	4.8 - 7.3	6.0	0.0	1.6
					Spotted frogs	& tadpoles	common					
McCabe Creek	1.4		2-Aug-23	510	EB	24	24	4	2.0 - 9.7	5.2	0.8	3.9
					WCT	92	92	8	2.5 - 9.7	4.6	1.6	16.5
	3.2	15N,12W,5D	10-Jul-23	360	EB	13	13	4	3.3 - 7.8	5.1	1.1	2.5
					WCT	43	43	7	2.4 - 7.2	4.1	1.9	10.0
	5.3		11-Jul-23	450	WCT	23	23	1	2.8 - 8.6	5.2	0.2	4.9
Meadow Creek	2.6	16N,9W,18C	12-Aug-21	1530	No fish netted							
					5 fish observed	8-10" range						
	5.2	16N,10W,24D	12-Aug-21	986	RB	1	1	0	7.6	7.6	0.0	0.1
Meadow Creek, East Fork	0.8	16N,10W,25A	12-Aug-21	970	RB	4	4	0	9.1 - 9.9	9.4	0.0	0.4
	2.2	16N,9W,31B	12-Aug-21	500	RB	1	1	0	8.8	8.8	0.0	0.2
Mineral Creek	2.1	16N,10W,10A	8-Aug-21	669	RB	2	2	0	5.4 - 6.5	5.9	0.0	0.3
	4.2	16N,10W,16A	11-Aug-21	400	RB	9	9	0	4.9 - 6.9	6	0.0	2.3
Mineral Creek, East Fork	0.6	16N,10W,15B	11-Aug-21	516	RB	2	2	0	5.5 - 5.6	5.55	0.0	0.4
Monture Creek	1.9		26-Jul-23	1070	EB	1	1	1	2.7	2.7	0.1	0.0
					LL	19	19	1	2.5 - 10.2	6.0	0.1	1.7
					RB	10	10	1	1.6 - 5.7	4.3	0.1	0.8
					WCT	5	5	0	5.0 - 14.0	8.4	0.0	0.5
	8.6	15N,12W,6C	2-Aug-23	1725	EB	11	11	8	2.0 - 12.8	4.5	0.5	0.2
					LL	25	25	16	2.2 - 12.0	4.3	0.9	0.5
					RB	5	5	0	3.8 - 12.3	5.8	0.0	0.3
					WCT	16	16	0	4.1 - 8.9	5.0	0.0	0.9
	12.9	16N,12W,29B	6-Oct-21	1400	WCT	5	4	0	4.2 - 6.5	5.5	0.0	0.3
					RB	1	0	0	8	8.0	0.0	0.0
					EB	5	4	0	6.3 - 9.6	8.0	0.0	0.3
					Sculpins	present in low	numbers					
			9-Aug-22	1400	WCT	17	15	0	3.7 - 17.3	6.2	0.0	1.1
					LL	3	3	0	4.4 - 6.4	5.2	0.0	0.2
					EB	24	18	9	2 - 8.7	4.8	0.6	0.6
					BULL	8	8	2	3.1 - 7.5	5.9	0.1	0.4
					COT	present						
			10-Aug-23	1400	BULL	5	4	0	6.6 - 9.0	7.9	0.0	0.3
					EB	29	25	14	2.6 - 10.5	5.1	1.0	0.8
					LL	2	1	0	5.5	5.5	0.0	0.1
					WCT	51	35	0	3.4 - 14.4	6.0	0.0	2.5
	18.2	17N,12W,32C	7-Aug-23	495	BULL	1	1	0	6.5	6.5	0.0	0.2
					WCT	27	27	2	1.4 - 12.4	5.3	0.4	5.1
	18.5		9-Aug-23	620	BULL	8	8	1	2.7 - 7.8	5.3	0.2	1.1
					WCT	11	11	0	5.4 - 9.5	7.8	0.0	1.8
	20		7-Aug-23	450	BULL	2	2	0	5.2 - 9.0	7.1	0.0	0.4
					WCT	5	5	0	4.8 - 9.8	7.5	0.0	1.1
	23	17N,12W,17B & 8C	9-Aug-23	630	BULL	17	17	5	2.2 - 9.3	4.8	0.8	1.9
					WCT	14	14	0	3.0 - 8.7	5.7	0.0	2.2
	24		8-Aug-23	510	BULL	32	32	4	2.0 - 9.6	6.5	0.8	5.5
					WCT	19	19	0	3.0 - 9.3	5.2	0.0	3.7

Appendix A: Catch and size statistics for tributaries to the Blackfoot River, 2021 – 2023.

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Range of Lengths (in)	Mean Length (in)	YOY CPUE (#/100' in 1st Pass)	Age 1+ CPUE / 100ft
Nevada Creek	5.0 - 6.3	13N,11W,9C &8D	29-Aug-22	6500	LL	20	12	0	6.4 -18.5	9.6	0.0	0.2
					WCT	17	8	0	7.8 - 14.8	10.6	0.0	0.1
	16.6		20-Jul-22	6300	LL	17	17	16	2.0 - 12.5	2.9	0.3	0.0
					MWF	385	385	58	2.4 - 13.4	7.3	0.9	5.2
					LN DC	111	111					
					LN SU	55	55					
					LS SU	120	120					
					RS SH	780	780					
	28.6	12N,10W,10AB	19-Jul-22	8500	WCT	222	160	0	3.7 - 13.9	7.9	0.0	1.9
					RB	265	174	0	3.2 - 13.6	6.5	0.0	2.0
					EB	39	28	0	3.0 - 10.8	6.4	0.0	0.3
					All trout	526	362	0	3.0 - 13.9	7.3	0.0	4.3
					RMCOT	abundant						
					RSS	present						
					MWF	present						
					LNSU	present						
	30.5	12N,10W,11C	7-Sep-22	3695	EB	1	1	0	9.2	9.2	0.0	0.0
					LL	1	0	0	14.2	14.2	0.0	0.0
					RB	42	32	0	5.3 - 17.3	9.8	0.0	0.9
					WCT	42	24	0	7.1 - 15.4	10.5	0.0	0.6
					All trout	86	57	0	5.3 - 17.3	10.9	0.0	1.5
					YP	2	2	0	5.9 - 7.9	6.9	0.0	0.1
North Fork Blackfoot River	17.2	16N,11W,35B	19-Aug-21	1100	BULL	3	2	1	2.5 - 5.8	4.6	0.1	0.1
					WCT	5	5	0	6.0 - 11.1	8.1	0.0	0.5
					RB*	1	1	0	12.2	12.2	0.0	0.1
					Sculpins	common						
	27.2	17N,10W,28D	10-Aug-21	720	RB	11	11	0	3.3 - 8.4	4.8	0.0	1.5
	32	17N,10W,2C	10-Aug-21	1560	RB	1	1	0	6.1	6.1	0.0	0.1
Park Creek	1.1	14N,9W,1B	12-Oct-22	375	WCT	38	38	0	3.0 - 8.7	5.6	0.0	10.1
	1.4	14N,9W,1B	12-Oct-22	165	WCT	10	10	0	4.6 - 8.1	6.5	0.0	6.1
Poorman Creek	0.55-1.15	14N,9W,25C	8-Jul-21	3970	WCT	85	53	1	1.7 - 11.9	6.4	0.0	1.3
			14-Jul-21		LL	338	183	0	3.0 - 14.9	5.4	0.0	4.6
					EB	5	3	0	5.9 - 10.2	7.9	0.0	0.1
					Sculpins	present						
			25-Jul-23	3970	BULL	1	1	0	7.1	7.1	0.0	0.0
			1-Aug-23		EB	5	4	1	3.2 - 11.2	7.4	0.0	0.1
					LL	267	114	48	1.9 - 13.5	4.5	1.2	1.7
					WCT	46	30	0	4.3 - 14.3	6.4	0.0	0.8
	4.85		19-Jul-23	480	EB	1	1	0	8.3	8.3	0.0	0.2
					LL	21	21	1	3.6- 14.6	7.1	0.2	4.2
					WCT	29	29	0	3.0 - 12.5	7.0	0.0	6.0
	8	13N,8W14C,23B	17-Aug-21	1492	WCT	431	255	3	2.7 - 10.5	6.0	0.2	16.9
			23-Aug-21		BULL	1	1	0	9.3	9.3	0.0	0.1
					LL	2	1	0	5.2 - 11.7	8.4	0.0	0.1
					EB	2	2	0	9.3 - 9.5	9.4	0.0	0.1
					Scuplins	present						
			18-Jul-22	1492	WCT	205	94	1	2.4 - 9.9	6.0	0.1	6.2
					BULL	2	1	0	4.5 - 12.1	8.3	0.0	0.1
			17-Jul-23	1492	LL	2	2	0	6.2 - 7.8	7.0	0.0	0.1
			24-Jul-23		WCT	440	217	5	2.4 - 10.3	5.4	0.3	14.2
	9.9	13N,8W,24A	20-Jul-23	340	EB	1	1	0	5.6	5.6	0.0	0.3
		13N,7W,19B			LL	1	1	0	6.8	6.8	0.0	0.3
					WCT	30	30	0	4.3 - 11.7	7.4	0.0	8.8
	11.25		20-Jul-23	480	EB	27	27	0	3.7 - 6.5	4.7	0.0	5.6
					WCT	25	25	7	2.6 - 6.9	4.2	1.5	3.8
					TRT	1	1	1	1.3	1.3	0.2	0.0
Poorman Creek, South Fork	0.95		20-Jul-23	650	WCT	30	30	7	2.0 - 9.1	4.2	1.1	3.5

Appendix A: Catch and size statistics for tributaries to the Blackfoot River, 2021 – 2023.

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Range of Lengths (in)	Mean Length (in)	YOY CPUE (#/100' in 1st Pass)	Age 1+ CPUE / 100ft
Scotty Creek	0.2	16N,9W,8D	5-Aug-21	475	RB*	15	15	0	3.6 - 7.1	5.2	0.0	3.2
Snowbank Creek	0.4	15N,8W,9A	2-Sep-21	450	BULL	7	5	1	2.1 - 17.8	7.7	0.2	0.9
					WCT	64	45	0	2.8 - 12	6.2	0.0	10.0
					Sculpins	common						
			1-Aug-22	450	BULL	3	2	0	4.0 - 5.6	4.6	0.0	0.4
					WCT	40	26	1	2.4 - 12.3	6.1	0.2	5.6
Sourdough Creek	0.6	16N,9W,17A,D	6-Aug-21	650	RB	4	4	0	5.1 - 6.0	5.4	0.0	0.6
					WCT	1	1	0	8.2	8.2	0.0	0.2
Spring Creek	0.2	16N,14W,24D	19-Aug-21	250	WCT	13	13	0	2.9 - 8.3	5.4	0.0	5.2
(trib to Cottonwood Creek)					EB	35	35	13	2.0 - 9.3	4.6	5.2	8.8
	1.4	16N,14W,14C	31-Aug-21	340	WCT	2	2	0	3.2 - 5.6	4.4	0.0	0.6
					EB	17	17	3	2.1 - 6.1	3.9	0.9	4.1
Un-named trib to Spring Creek	0.9	16N,14W,14D	19-Aug-21	300	WCT	12	12	0	2.7 - 5.4	4.2	0.0	4.0
Warren Creek	0.5	14N,13W,1A	15-Sep-21	510	LL	4	4	0	4.8-9.2	6.8	0.0	0.8
					LNS	18	15	3	3.7-6.6	5.1	0.6	2.4
					Sculpins	common	RSS	present				
	1.1	15N,12W,31C	15-Sep-21	345	LL	1	1	0	4.2	4.2	0.0	0.3
					LNS	9	7	2	3.4-7.3	4.6	0.6	
					Sculpins	present	RSS	present				
	2.1	15N,12W,31A	15-Sep-21	345	No salmonids							
	3.6	15N,12W,32C	15-Sep-21	468	EB	17	11	5	3.4-8.4	4.7	1.1	1.3
					Sculpins	common						
West Twin Creek	0.2	13N,17W,2C	6-Jul-23	420	BULL	1	1	0	7.1	7.1	0.0	0.2
					EB	3	3	0	4.4 - 6.1	5.3	0.0	0.7
					RB	27	27	8	2.4 - 9.2	3.3	1.9	4.5
	2.2		16-Aug-23	340	EB	29	29	8	1.6 - 8.8	4.9	2.4	6.2
					WCT	31	31	4	2.6 - 7.8	4.8	1.2	7.9
	3.95		15-Aug-23	390	WCT	31	31	0	3.4 - 7.9	4.6	0.0	7.9
	4.05		15-Aug-23	180	WCT	1	1	0	7.4	7.4	0.0	0.6

***** Sample may include rainbow trout / cutthroat trout hybrids

****** Sample may include bull trout / brook trout hybrids

******* Sample maybe Yellowstone cutthroat- genetics pending

WCT = Westslope Cutthroat trout
BULL = Bull trout
LL = Brown trout (Loch Leven)
RB = Rainbow trout
EB = Eastern brook trout
MWF = Monutain whitefish
LNS = Longnose sucker
LSS = Largescale sucker
LND = Longnose dace
RSS = Redside shiner
ONC = Oncorhynchus (Belonging to trout family)
TRT = unidentified trout

Appendix B: Two-pass depletion estimates of abundance for Blackfoot River and tributaries, 2021 – 2023.

Stream	River Mile	Location (T,R,S)	Date Sampled	Section Length (ft)	Species	Size Class	1st Pass	2nd Pass	3rd Pass	Prob. of Capture	Total Estimate ± CI	Estim/100' ± CI
Anaconda Creek	0.5	15N6W22C	13-Sep-21	530	WCT	Age 1+	88	17		0.81	109 ± 6.0	21 ± 1.1
					EB	Age 1+	10	3		0.70	14 ± 4.3	2.7 ± 0.8
					All trout	Age 1+	98	20		0.80	123 ± 7.0	23.2 ± 1.3
			1-Sep-22	530	WCT	Age 1+	38	10		0.74	51 ± 6	9.7 ± 1.2
					EB	Age 1+	15	3		0.80	18 ± 2	3.5 ± 0.5
					All trout	Age 1+	53	13		0.54	70 ± 5	13.3 ± 1.3
			29-Aug-23	530	WCT	Age 1+	55	8		0.85	64 ± 3	12.1 ± 0.6
					EB	Age 1+	26	4		0.85	30 ± 2	5.8 ± 0.4
					All trout	Age 1+	81	12		0.85	95 ± 4	17.9 ± 0.7
Beartrap Creek	0.35	15N,6W,27B	13-Sep-21	656	EB	YOY	14	1		0.93	15 ± 0.6	2.3 ± 0.1
						Age 1+	40	3		0.93	43 ± 1.1	6.6 ± 0.2
			1-Sep-22	656	WCT	Age 1+	1	0		1.00	1.0 ± 0	0.2 ± 0
					EB	YOY	92	21		0.77	119 ± 8	18.2 ± 1.2
						Age 1+	32	4		0.88	36 ± 2	5.6 ± 0.3
			31-Aug-23	656	EB	YOY	18	1		0.94	19 ± 1	2.9 ± 0.1
						Age 1+	90	5		0.94	95 ± 2	14.5 ± 0.2
Blackfoot River	131.0	15N,6W,21C	16-Sep-21	600	WCT	Age 1+	31	15		0.52	60 ± 24	10 ± 4.0
					EB	YOY	144	46		0.68	211 ± 19	35.3 ± 3.1
						Age 1+	134	53		0.60	221 ± 29	37 ± 5.0
					All trout	YOY	144	46		0.68	211 ± 19	35.3 ± 3.1
						Age 1+	165	68		0.59	280 ± 36	47 ± 6.0
			31-Aug-22	600	WCT	Age 1+	17	2		0.88	19 ± 1	3.2 ± 0.2
					EB	YOY	175	98		0.44	397 ± 93	66.3 ± 15.6
						Age 1+	149	43		0.71	209 ± 15	34.9 ± 2.6
					All trout	YOY	175	98		0.44	397 ± 93	66.3 ± 15.6
						Age 1+	166	45		0.63	227 ± 14	38.0 ± 2.4
			19-Sep-23	600	WCT	Age 1+	12	5		0.58	20 ± 9	3.4 ± 1.6
					EB	YOY	103	33		0.68	151 ± 15	25.3 ± 2.6
						Age 1+	276	66		0.76	362 ± 15	60.5 ± 2.5
					All trout	YOY	103	33		0.68	151 ± 15	25.3 ± 2.6
						Age 1+	288	71		0.75	382 ± 16	63.7 ± 2.7
	131.8	15N,6W,21D	14-Sep-21	656	WCT	Age 1+	5	3		0.40	12 ± 20	2.0 ± 3.2
					EB	YOY	127	52		0.59	215 ± 30	33 ± 4.7
						Age 1+	63	21		0.67	94 ± 13	14.4 ± 2.1
					LNSU	Age 1+	3	1		0.67	4 ± 2	0.7 ± 0.4
					All trout	YOY	127	52		0.59	215 ± 30	33 ± 4.7
						Age 1+	71	25		0.65	109 ± 16	17 ± 2.5
			31-Aug-22	656	WCT	Age 1+	2	0		1.00	2 ± 0	0.3 ± 0.0
					EB	YOY	136	42		0.69	196 ± 16	30.0 ± 2.6
						Age 1+	71	15		0.79	90 ± 6	13.7 ± 0.9
					LNSU	Age 1+	3	2		0.33		
					All trout	YOY	137	42		0.69	197 ± 16	30.1 ± 2.5
						Age 1+	72	15		0.72	90 ± 6	13.9 ± 0.9
			19-Sep-23	656	WCT	Age 1+	7	2		0.71	9 ± 3	1.5 ± 0.5
					EB	YOY	43	13		0.70	61 ± 9	9.4 ± 1.4
						Age 1+	276	66		0.76	362 ± 15	55.3 ± 2.3
					LNSU	Age 1+	6	0		1.00	6 ± 0	0.9 ± 0
					All trout	YOY	43	13		0.70	61 ± 9	9.4 ± 1.4
						Age 1+	283	68		0.76	372 ± 15	56.8 ± 2.3

Appendix B: Two-pass depletion estimates of abundance for Blackfoot River and tributaries, 2021 – 2023.

Stream	River Mile	Location (T,R,S)	Date Sampled	Section Length (ft)	Species	Size Class	1st Pass	2nd Pass	3rd Pass	Prob. of Capture	Total Estimate ± CI	Estim/100' ± CI
Blackfoot River	132.0	15N,6W,21D	14-Sep-21	682	WCT	Age 1+	44	0		1.00	44 ± 0.0	6.5 ± 0.0
					EB	YOY	103	32		0.69	149 ± 14	22 ± 2.2
						Age 1+	190	37		0.81	235 ± 8	35 ± 1.3
					All	YOY	103	32		0.69	149 ± 14	22 ± 2.2
						Age 1+	234	37		0.84	277 ± 7	41 ± 1.1
			12-Sep-22	682	WCT	Age 1+	21	3		0.86	24 ± 1	3.6 ± 0.3
					EB	YOY	190	87		0.54	350 ± 50	51.4 ± 7.5
						Age 1+	179	41		0.77	232 ± 11	34 ± 1.6
					LNSU	Age 1+	1	0		1.00		
					All trout	YOY	190	87		0.54	350 ± 50	51.4 ± 7.5
						Age 1+	200	44		0.78	256 ± 11	37.6 ± 1.6
			30-Aug-23	682	WCT	Age 1+	7	2		0.71	9 ± 3	1.4 ± 0.5
					EB	YOY	36	16		0.56	64 ± 20	9.5 ± 3.0
						Age 1+	285	52		0.82	348 ± 9	51.1 ± 1.4
					All trout	YOY	36	16		0.56	64 ± 20	9.5 ± 3.0
						Age 1+	292	54		0.82	358 ± 10	52.5 ± 1.5
Copper Creek	6.2	15N,8W,9A	2-Sep-21	515	BULL	YOY	1	0		1.00	1 ± 0	0.2 ± 0.0
						Age 1+	3	0		1.00	3 ± 0	0.6 ± 0.0
					WCT	YOY	2	0		1.00	2 ± 0	0.4 ± 0.0
						Age 1+	16	6		0.63	25 ± 8	5.0 ± 1.7
					All	YOY	3	0		1.00	3 ± 0	0.6 ± 0.0
						Age 1+	19	6		0.68	27 ± 6	5.4 ± 1.3
			24-Aug-22	515	BULL	Age 1+	3	0		1.00	3 ± 0	0.6 ± 0.0
					WCT	Age 1+	20	7		0.65	30 ± 8	6.0 ± 1.6
					All trout	Age 1+	23	7		0.70	33 ± 6	6.4 ± 1.3
Dunham Creek	2.3	16N, 12W, 19B	27-Jul-22	600	WCT	Age 1+	13	6		0.54	21 ± 7	
					BULL	Age 1+	1	1		0.00	invalid estimate	
					EB	YOY	3	0		1.00	3 ± 0	0.5 ± 0.0
						Age 1+	10	8		0.20	50 ± 166	8.3 ± 27.7
					All trout	YOY	3	0		1.00	3 ± 0	0.5 ± 0
						Age 1+	24	15		0.38	64 ± 54	10.7 ± 9.1
			26-Jul-23	600	WCT	Age 1+	71	19		0.73	96 ± 9	16.2 ± 1.5
					BULL	Age 1+	1	0		1.00	1 ± 0	0.2 ± 0
					EB	YOY	21	9		0.57	36 ± 14	6.1 ± 2.3
						Age 1+	21	8		0.62	33 ± 10	5.7 ± 1.7
					All trout	YOY	22	11		0.50	44 ± 22	7.3 ± 3.8
						Age 1+	94	27		0.71	131 ± 12	22.0 ± 2.0
	4.2	16N, 13W, 12D	27-Jul-22	790	BULL	Age 1 +	2	2	1	0.26	5 ± 3	0.6
					WCT	Age 1+	2	0	1	0.41	3	0.4
					EB	Age 1+	5	3	0	0.67	8 ± 2	1 ± 2.6
					All trout	Age 1+	9	5	2	0.21	16 ± 3	2 ± 2.6
	7.0	16N,13W,2A	28-Jul-22	400	WCT	Age 1+	20	9		0.55	33 ± 10	9.1 ± 3.9
					EB	Age 1+	3	1		0.67	4 ± 2	1.1 ± 0.7
					All	Age 1+	23	10		0.57	34 ± 4	10.2 ± 3.8
			14-Aug-23	400	WCT	Age 1+	70	20		0.71	98 ± 10	24.5 ± 2.6
					EB	Age 1+	0	1			invalid estimate	
					All trout	Age 1+	70	21		0.70	100 ± 11	25 ± 2.9

Appendix B: Two-pass depletion estimates of abundance for Blackfoot River and tributaries, 2021 – 2023.

Stream	River Mile	Location (T,R,S)	Date Sampled	Section Length (ft)	Species	Size Class	1st Pass	2nd Pass	3rd Pass	Prob. of Capture	Total Estimate ± CI	Estim/100' ± CI
Gold Creek	1.9	14N,16W,30D	22-Aug-23	400	RB*	YOY	11	4		0.64	17 ± 6	4.3 ± 1.7
						Age 1+	25	6		0.76	32 ± 4	8.2 ± 1.1
					WCT	Age 1+	1	7			invalid estimate	
					LL	YOY	0	1			invalid estimate	
						Age 1+	8	0		1.00	8 ± 0	2.0 ± 0
					All trout	Age 1+	34	13		0.62	55± 13	13.8 ± 3.4
Lodgepole Creek	0.1	17N,13W,36B	28-Jul-22	560	WCT	Age 1+	36	13		0.64	56 ± 12	10.1 ± 2.2
					BULL	Age 1+	2	0		1.00	2	0.4 ± 0.0
					EB	Age 1+	1	3			invalid estimate	
					All trout	Age 1+	39	16		0.59	66 ± 17	11.8 ± 3.1
	0.7		3-Aug-22	420	WCT	Age 1+	16	7		0.56	28 ± 13	6.8 ± 3.1
Monture Creek	12.9	16N,12W,29B	6-Oct-21	1400	WCT	Age 1+	4	1		0.75	5 ± 1	0.4 ± 0.1
					EB	Age 1+	4	1		0.75	5 ± 1	0.4 ± 0.1
					RB	Age 1+	0	1			invalid estimate	
					All trout	Age 1+	8	3		0.63	12 ± 6	0.9 ± 0.4
			9-Aug-22	1400	WCT	Age 1+	15	2		0.87	17 ± 1	1.2 ± 0.1
					EB	YOY	9	3		0.67	13 ± 5	1.0 ± 0.4
						Age 1+	9	3		0.67	13 ± 5	1.0 ± 0.4
					BULL	YOY	2	0		1.00	2	0.1 ± 0.0
						Age 1+	6	0		1.00	6	0.4 ± 0.0
					LL	Age 1+	3	0		1.00	3	0.2 ± 0.0
					All trout	YOY	11	3		0.73	15 ± 3	1.1 ± 0.3
						Age 1+	33	5		0.85	38 ± 2	2.8 ± 0.2
			10-Aug-23	1400	WCT	Age 1+	35	16		0.54	64 ± 21	4.6 ± 1.6
					EB	YOY	14	2		0.86	16 ± 1	1.2 ± 0.1
						Age 1+	11	2		0.82	13 ± 1	1.0 ± 0.1
					BULL	Age 1+	4	1		0.75	5 ± 1	0.4 ± 0.1
					LL	Age 1+	1	1			invalid estimate	
					All trout	YOY	14	2		0.86	16 ± 1	1.2 ± 0.1
						Age 1+	43	20		0.53	80 ± 25	6.8 ± 1.2
Snowbank Creek	0.4	15N,8W,9A	2-Sep-21	450	BULL	YOY	1	1		0.00	invalid estimate	
						Age 1+	4	1		0.75	5 ± 1	1.2 ± 0.4
					WCT	Age 1+	45	11		0.76	59± 6	13.2 ± 1.4
					All trout	YOY	1	1		0.00	invalid estimate	
						Age 1+	49	12		0.76	64 ± 6	14.4 ± 1.5
			1-Aug-22	450	BULL	Age 1+	2	1		0.50	4 ± 6	
					WCT	Age 1+	26	14		0.46	56 ± 31	
					All trout	Age 1+	28	15		0.46	60 ± 31	
Warren Creek	0.5	14N,13W,1A	15-Sep-21	510	LL	Age 1+	4	0		1.00	4 ± 0	0.8 ± 0.0
	1.1	15N,12W, 31C	15-Sep-21	345	LL	Age 1+	1	0		1.00	1 ± 0	0.3 ± 0.0
	2.1	15N,12W,31A	15-Sep-21	345		No salomnids						
	3.6	15N,12W,32C	15-Sep-21	468	EB	YOY	5	2		0.60	8 ± 5	1.8 ± 1.2
						Age 1+	6	4		0.33	18 ± 37	3.8 ± 7.9

* Sample may include rainbow trout / cutthroat trout hybrids

WCT = Cutthroat trout
BULL = Bull trout
LL = Brown trout (Loch Leven)
RB = Rainbow trout
EB = Eastern brook trout
LNSU = Longnose sucker

Appendix C: Mark-recapture estimates of abundance for Blackfoot River and tributaries, 2021 – 2023.

Stream	River Mile Mid-point	Date Sampled	Section Length (ft)	Species	Size Class (inches)	M	C	R	Total Estimate	95%CI Lower Bound	95%CI Upper Bound
Blackfoot River,	13.5	17-May-21	17,680	RB	≥ 6	204	183	38	966	740	1287
Johnsrud Section		24-May-21			6 - 11.9	152	132	22	884	621	1295
					12 - 17.9	44	48	15	137	96	211
					≥ 18	8	3	1	17	10	59
				LL	≥ 6	21	34	6	109	60	218
					6 - 11.9	10	13	1	76	22	149
					12 - 17.9	6	9	3	16	9	41
					≥ 18	5	12	2	25	11	72
				WCT	≥ 6	63	42	11	228	149	381
					6 - 11.9	30	18	4	117	63	262
					12 - 17.9	32	24	7	102	63	191
					≥ 18	1	0	0	--	--	--
				BULL	≥ 6	11	14	4	35	20	78
					6 - 11.9	1	5	0	--	--	--
					12 - 17.9	4	2	1	6	4	23
					18 - 23.9	3	3	1	7	4	26
					24 - 29.9	2	1	1	2	2	8
					≥ 30	1	3	1	3	1	12
				All trout	≥ 6	299	273	59	1369	1103	1722
		22-May-23	17,680	RB	≥ 6	221	127	17	1578	1049	2443
		30-May-23			6 - 11.9	139	95	13	959	608	1574
		5-Jun-23			12 - 17.9	79	30	4	495	244	1127
					≥ 18	3	2	0	--	--	--
				LL	≥ 6	27	19	4	111	59	249
					6 - 11.9	7	7	1	31	13	111
					12 - 17.9	15	6	0	111	--	--
					≥ 18	5	6	3	10	6	23
				WCT	≥ 6	52	34	6	264	147	527
					6 - 11.9	34	17	4	125	68	279
					12 - 17.9	18	17	2	113	47	325
					≥ 18	0	0	0	0	0	0
				BULL	≥ 6	28	13	2	134	60	382
					6 - 11.9	3	5	0	--	--	--
					12 - 17.9	13	4	1	34	17	118
					18 - 23.9	7	1	0	--	--	--
					24 - 29.9	5	3	1	11	6	39
					≥ 30	0	0	0	0	0	0
				All trout	≥ 6	328	195	29	2148	1565	3007

Appendix C: Mark-recapture estimates of abundance for Blackfoot River and tributaries, 2021 – 2023.

Stream	River Mile Mid-point	Date Sampled	Section Length (ft)	Species	Size Class (inches)	M	C	R	Total Estimate	95% CI Lower Bound	95% CI Upper Bound
Blackfoot River,	43.9	18-May-21	20,064	RB	≥ 6	178	136	37	644	500	854
Scotty Brown Section		25-May-21			6 - 11.9	92	73	20	327	234	479
					12 - 17.9	66	48	12	252	165	412
					≥ 18	20	15	5	55	33	113
				LL	≥ 6	55	47	12	206	136	337
					6 - 11.9	27	29	7	104	62	196
					12 - 17.9	14	8	3	33	19	78
					≥ 18	14	10	2	54	26	153
				WCT	≥ 6	193	179	51	671	539	851
					6 - 11.9	110	104	32	352	271	475
					12 - 17.9	82	72	18	318	223	478
					≥ 18	1	3	1	3	1	12
				BULL	≥ 6	18	20	1	198	60	388
					6 - 11.9	8	7	0	--	--	--
					12 - 17.9	4	5	0	--	--	--
					18 - 23.9	3	1	0	--	--	--
					24 - 29.9	2	6	1	10	4	35
					≥ 30	1	1	0	--	--	--
				EB	≥ 6	2	2	0	--	--	--
				All trout	≥ 6	446	384	101	1686	1435	2000
		25-May-23	20,064	RB	≥ 6	152	218	28	1154	832	1630
		1-Jun-23			6 - 11.9	62	139	15	550	354	879
					12 - 17.9	79	71	13	410	265	668
					≥ 18	11	8	0	--	--	--
				LL	≥ 6	31	56	7	227	125	438
					6 - 11.9	13	44	4	125	55	300
					12 - 17.9	14	5	1	44	20	154
					≥ 18	4	7	2	12	6	36
				WCT	≥ 6	134	177	34	686	516	931
					6 - 11.9	61	96	17	333	225	513
					12 - 17.9	73	79	17	328	225	501
					≥ 18	0	1	0	--	--	--
				BULL	≥ 6	13	21	2	102	36	247
					6 - 11.9	1	12	0	--	--	--
					12 - 17.9	5	3	0	--	--	--
					18 - 23.9	2	5	2	5	3	15
					24 - 29.9	4	1	0	--	--	--
					≥ 30	1	0	0	--	--	--
				EB	≥ 6	1	1	0	--	--	--
				All trout	≥ 6	331	473	71	2185	1774	2712

Appendix C: Mark-recapture estimates of abundance for Blackfoot River and tributaries, 2021 – 2023.

Stream	River Mile Mid-point	Date Sampled	Section Length (ft)	Species	Size Class (inches)	M	C	R	Total Estimate	95%CI Lower Bound	95%CI Upper Bound
Blackfoot River,	63	19-May-21	31,635	RB	≥ 6	18	23	3	113	52	283
Wales Creek Section		26-May-21			6 - 11.9	10	18	1	104	31	203
					12 - 17.9	8	5	2	17	10	47
					≥ 18	0	0	0	0	0	0
				LL	≥ 6	49	41	14	139	97	216
					6 - 11.9	12	11	1	77	23	151
					12 - 17.9	16	16	8	31	22	54
					≥ 18	21	14	5	54	33	110
				WCT	≥ 6	65	46	10	281	176	484
					6 - 11.9	46	32	7	193	114	365
					12 - 17.9	19	13	3	69	36	170
					≥ 18	0	1	0	--	--	--
				BULL	≥ 6	1	1	0	--	--	--
					6 - 11.9	1	1	0	--	--	--
					12 - 17.9	0	0	0	0	0	0
					18 - 23.9	0	0	0	0	0	0
					24 - 29.9	0	0	0	0	0	0
					≥ 30	0	0	0	0	0	0
				All trout	≥ 6	133	111	27	535	396	748
		24-May-23	31,635	RB	≥ 6	25	21	0	571	--	--
		31-May-23			6 - 11.9	14	14	0	224	--	--
					12 - 17.9	11	7	0	95	--	--
					≥ 18	0	0	0	0	0	0
				LL	≥ 6	46	47	8	250	146	460
					6 - 11.9	9	11	1	59	17	116
					12 - 17.9	20	24	5	86	47	182
					≥ 18	17	12	2	77	35	219
				WCT	≥ 6	27	46	7	164	92	314
					6 - 11.9	13	21	3	76	35	191
					12 - 17.9	14	25	4	77	39	175
					≥ 18	0	0	0	0	0	0
				BULL	≥ 6	1	2	0	--	--	--
					6 - 11.9	0	1	0	--	--	--
					12 - 17.9	0	0	0	0	0	0
					18 - 23.9	1	1	0	--	--	--
					24 - 29.9	0	0	0	0	0	0
					≥ 30	0	0	0	0	0	0
				All trout	≥ 6	99	116	15	730	474	1162

Appendix C: Mark-recapture estimates of abundance for Blackfoot River and tributaries, 2021 – 2023.

Stream	River Mile Mid-point	Date Sampled	Section Length (ft)	Species	Size Class (inches)	M	C	R	Total Estimate	95%CI Lower Bound	95%CI Upper Bound
Wales Creek Section "MWF estimates"	63.6	19-May-21	23,760	MWF	≥ 6	467	337	62	2510	2022	3151
		26-May-21			6 - 11.9	253	179	29	1523	1113	2128
					12-18	214	158	33	1004	756	1366
	63.6	24-May-23	23,760	MWF	≥ 6	429	545	68	3402	2740	4253
		31-May-23			6 - 11.9	221	266	36	1601	1198	2170
					12-18	208	279	32	1772	1298	2453
Blackfoot River, Canyon Section	95.3	12-Sep-23	18,020	WCT	≥ 6	33	18	5	107	62	220
		18-Sep-23			6 - 11.9	4	0	0	--	--	--
					12 - 17.9	29	17	5	89	52	183
					≥ 18	0	1	0	--	--	--
				LL	> 6	30	19	0	619	--	--
					6 - 11.9	14	10	0	164	--	--
					12 - 17.9	13	7	0	111	--	--
					> 18	3	2	0	11	--	--
				All trout	≥ 6	63	37	5	404	209	859
Canyon Section "MWF estimates"	95.3	12-Sep-23	18, 020	MWF	≥ 6	200	128	16	1524	999	2394
		18-Sep-23			6 - 11.9	89	38	3	876	358	2167
					12-18	111	90	13	727	462	1192

Appendix C: Mark-recapture estimates of abundance for Blackfoot River and tributaries, 2021 – 2023.

Stream	River Mile Mid-point	Dates Sampled	Section Length (ft)	Species	Size Class (inches)	M	C	R	Total Estimate	95% CI Lower Bound	95% CI Upper Bound
Nevada Creek,	5	29-Aug-22	6,500	WCT	≥ 4.0	8	10	1	48	14	96
Danforth Section		6-Sep-22			4 - 11.9	7	8	1	35	14	126
					≥ 12	1	2	0	5	0	5
				LL	≥ 4.0	12	9	1	64	24	228
					4 - 11.9	11	7	1	47	19	167
					≥ 12	1	2	0	5	0	5
				All trout	≥ 4.0	20	19	2	139	57	400
Nevada Creek,	27	19-Jul-22	8,500	WCT	≥ 4.0	158	135	74	287	250	339
Phase 3 project section		26-Jul-22			4 - 11.9	153	127	70	277	240	328
					≥ 12	5	8	4	10	6	22
				RB	≥ 4.0	167	164	73	374	319	447
					4 - 11.9	163	162	71	370	315	445
					≥ 12	4	2	2	4	4	10
				EB	≥ 4.0	25	29	20	36	30	49
					4 - 11.9	25	29	20	36	30	49
				All trout	≥ 4.0	350	328	167	686	621	767
Nevada Creek,	29	7-Sep-22	3,695	WCT	≥ 4.0	24	28	10	65	44	109
Phase 1 project section		13-Sep-22			4 - 11.9	19	21	7	54	34	100
					≥ 12	5	7	3	11	7	27
				RB	≥ 4.0	31	19	9	63	45	106
					4 - 11.9	24	14	5	62	38	125
					≥ 12	7	5	4	9	7	17
				EB	≥ 4.0	1	0	0	--	--	--
				LL	≥ 4.0	0	1	0	--	--	--
				YP	≥ 4.0	2	0	0	--	--	--
				All trout	≥ 4.0	56	48	19	139	103	201

Appendix C: Mark-recapture estimates of abundance for Blackfoot River and tributaries, 2021 – 2023.

Stream	River Mile Mid-point	Dates Sampled	Section Length (ft)	Species	Size Class (inches)	M	C	R	Total Estimate	95% CI Lower Bound	95% CI Upper Bound
North Fork Blackfoot River,	4.0	26-Aug-21	19,700	WCT	≥ 6	39	21	3	219	103	546
Harry Morgan Section		1-Sep-21			6 - 11.9	12	2	0	--	--	--
					12 - 17.9	26	17	2	161	68	462
					≥ 18	1	2	1	2	1	9
				BULL	≥ 6	9	6	0	69	--	--
					6 - 11.9	4	3	0	19	--	--
					12 - 17.9	4	2	0	14	--	--
					18 - 23.9	1	0	0	--	--	--
					24 - 29.9	0	1	0	--	--	--
					≥ 30	0	0	0	--	--	--
				LL	≥ 6	18	10	1	104	31	203
					6 - 11.9	4	5	0	--	--	--
					12 - 17.9	14	3	1	29	17	99
					≥ 18	0	2	0	--	--	--
				RB	≥ 6	21	19	1	219	66	428
					6 -12	12	9	0	--	--	--
					12 - 18	5	6	0	--	--	--
					≥ 18	4	4	1	12	5	42
				EB	≥ 6	6	1	0	--	--	--
				All trout	≥ 6	93	57	5	908	429	2077
		27-Jul-23	19,700	WCT	≥ 6	47	38	9	186	116	328
		3-Aug-23			6 - 11.9	14	9	1	74	28	264
					12 - 17.9	33	29	8	112	70	203
					≥ 18	0	0	0	0	0	0
				BULL	≥ 6	26	25	4	139	70	316
					6 - 11.9	9	6	1	34	15	121
					12 - 17.9	13	10	3	38	21	91
					18 - 23.9	4	8	0	--	--	--
					24 - 29.9	0	1	0	--	--	--
					≥ 30	0	0	0	0	0	0
				LL	≥ 6	10	6	0	--	--	--
					6 - 11.9	2	3	0	--	--	--
					12 - 17.9	5	2	0	--	--	--
					≥ 18	3	1	0	--	--	--
				RB	≥ 6	15	18	2	100	42	289
					6 - 11.9	4	7	0	--	--	--
					12 - 17.9	10	11	2	--	--	--
					≥ 18	1	0	0	--	--	--
				EB	0.00	0	0	0	0	0	0
				All trout	≥ 6	98	92	15	574	378	909

Appendix C: Mark-recapture estimates of abundance for Blackfoot River and tributaries, 2021 – 2023.

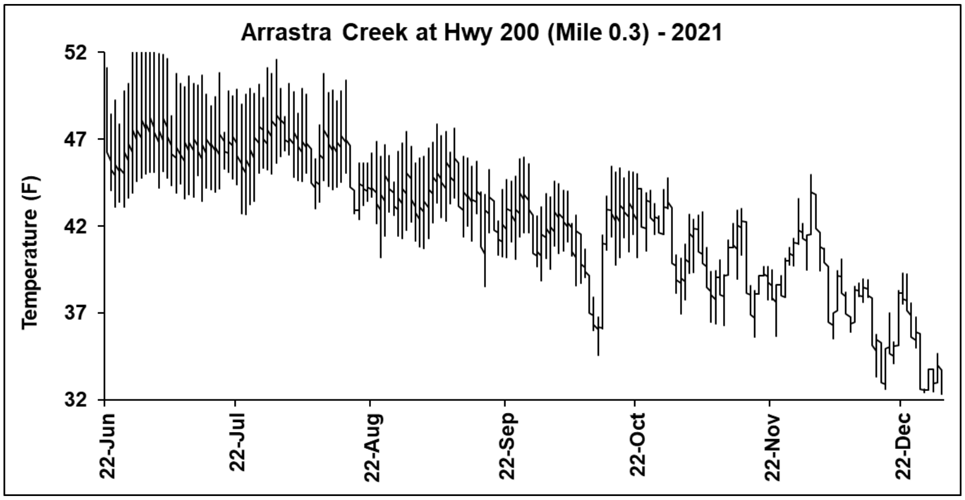
Stream	River Mile Mid-point	Dates Sampled	Section Length (ft)	Species	Size Class (inches)	M	C	R	Total Estimate	95% CI Lower Bound	95% CI Upper Bound
Poorman Creek	0.5	8-Jul-21	3,970	WCT	≥3.0	52	42	10	206	116	296
		14-Jul-21		LL	≥3.0	183	186	31	1074	771	1378
				EB	≥ 4.0	3	3	1	7	3	12
				All	Age 1+	238	231	42	1289	977	1600
		25-Jul-23	3,970	WCT	≥3.0	30	26	10	75	48	102
		1-Aug-23		BULL	≥ 4.0	1	0	0	--	--	--
				LL	≥3.0	73	120	18	470	307	634
				EB	≥ 4.0	3	3	2	4	3	6
				All	Age 1+	106	149	30	517	382	651
Poorman Creek	8	17-Aug-21	1,492	WCT	≥3.0	252	283	108	658	585	731
		23-Aug-21		BULL	≥ 4.0	1	0	0	--	--	--
				LL	≥ 4.0	1	1	0	--	--	--
				EB	≥ 4.0	2	1	1	2	2	2
				All trout	Age 1+	256	285	109	667	593	741
		18-Jul-22	1,492	WCT	≥ 3.0	91	134	28	427	315	597
		25-Jul-22		BULL	≥ 4.0	1	1	0	--	--	--
				All trout	Age 1+	92	135	28	435	320	608
		17-Jul-23	1,492	WCT	≥ 3.0	213	278	73	806	678	932
		24-Jul-23		LL	≥ 4.0	2	0	0	--	--	--
				All trout	Age 1+	215	278	73	813	684	942

Appendix D: Water temperature monitoring summaries in the Blackfoot River drainage, 2021-2023.

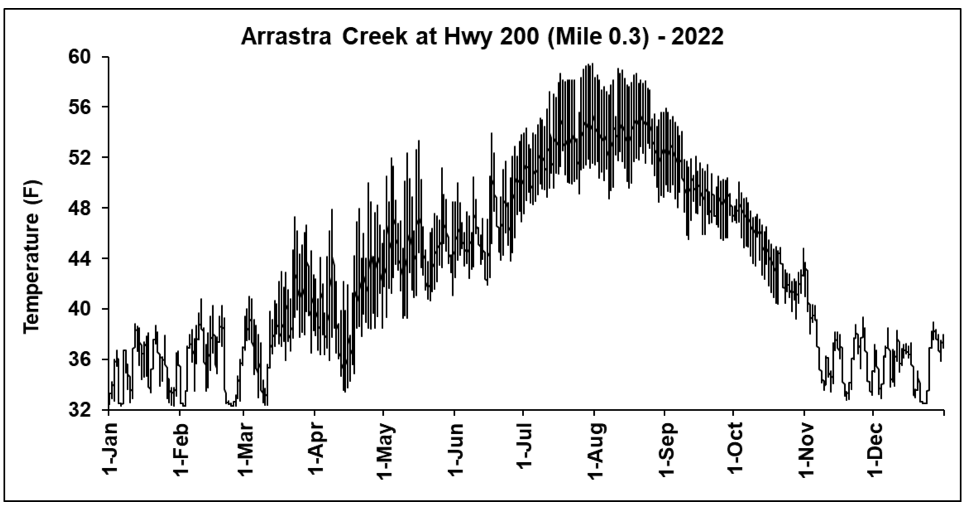
Stream name	Stream Mile	Legal Description	Latitude	Longitude	Duration
Arrastra Creek at Hwy 200	0.3	14N10W29B	46.94584	-112.90474	6/22/21 - 10/24/23
Arrastra Creek at Huckleberry Pass Rd	9.6	15N10W24C	47.0416	-112.81138	6/22/21 - 10/13/22
Belmont Creek at mouth	0.1	14N16W24C	46.95494	-113.57029	1/1/21 - 11/20/23
Belmont Creek at mile 1.7	1.7	14N16W14A	46.97553	-113.5821	1/1/21 - 7/6/22
Belmont Creek at mile 5.3	5.3	15N16W33A	47.01596	-113.61716	1/1/21 - 7/6/22
Bighorn Creek near trail crossing	0.4	16N8W08C	47.15558	-112.64446	7/11/22 - 9/5/23
Bighorn Creek mile 2.2	2.2	16N8W05B	47.17683	-112.64936	7/12/22 - 9/6/23
Blackfoot River at USGS Gage Station	7.9	13N17W09B	46.89992	-113.75539	1/1/21 - 11/2/23
Blackfoot River above Belmont Creek	21.8	14N16W24C	46.95399	-113.56914	1/1/21 - 11/20/23
Blackfoot River at Scotty Brown Bridge	46.1	15N13W33A	47.01804	-113.2394	1/1/21 - 11/8/23
Blackfoot River at River Junction FAS	52.5	14N12W9B	46.98536	-113.13062	8/30/22 - 10/20/22
Blackfoot River at Raymond Bridge	60	14N12W28D	46.93426	-113.11462	1/1/21 - 10/24/23
Blackfoot River at Cutoff Bridge	72.2	14N11W32D	46.91931	-113.01502	1/1/21 - 10/24/23
Blackfoot River at Hwy 141	82.4	14N11W26A	46.94172	-112.94769	8/5/21 - 10/24/23
Blackfoot River at Dalton Mtn Rd Bridge	104.5	14N09W28B	46.94336	-112.73949	1/1/21 - 10/24/23
Blackfoot River at 4x4 Rd	110.9	14N8W23B	46.9563	-112.58466	6/22/21 - 10/24/23
Copper Creek at Sucker Creek Bridge	1.1	15N08W25C	47.02248	-112.56364	1/1/21 - 10/24/23
Copper Creek at mile 6.3	6.3	15N08W09A	47.0752	-112.60875	6/22/21 - 10/24/23
Copper Creek at mile 8.9	8.9	15N8W05B	47.0898	-112.64258	6/22/21 - 10/11/21
Cottonwood Creek at Hwy 200	1	15N13W29B	47.03015	-113.27287	1/1/21 - 10/31/23
Cottonwood Creek at Dryer Diversion	10.8	16N14W24D	47.1227	-113.3052	1/1/21 - 10/24/22
Cottonwood Creek at Cottonwood Lakes Rd bridge	14.8	16N14W10A	47.1619	-113.34621	1/1/21 - 11/9/23
Cottonwood Creek (Douglas) @ Ovando-Helmville Rd	2	16N11W21D	46.86085	-112.98862	6/29/22 -10/20/22
Cottonwood Creek (Douglas) below HWY 271	4.5	13N11W33C	46.83223	-112.99495	6/29/22 - 10/20/22
Cottonwood Creek (Douglas) upstream of ford	5.6	12N11W04D	46.82174	-112.97965	6/29/22 -10/21/24
Cottonwood Creek (Douglas) above upper ditch	6.25	12N11W10B	46.8156	-112.96971	6/29/22 - 10/21/24
Crow Creek near mouth	0.1	17N08W19A	47.21672	-112.66503	7/13/22 - 9/6/23
Falls Creek near trail crossing	0.1	16N08W36A	47.10626	-112.57331	7/11/22 - 9/5/23
Gold Creek at lower bridge	1.6	14N16W30C	46.9375	-113.6712	6/28/21 - 11/8/23
Gold Creek upstream of Cow Creek bridge	5.3	14N17W12A	46.98916	-113.68201	1/1/21 - 11/8/23
Gold Creek at upper bridge	9	15N17W25C	47.02436	-113.70054	1/1/21 - 11/8/23
Landers Fork at mile 11.0	11	16N08W35D	47.0992	-112.56808	7/11/22 - 9/5/23
Landers Fork at mile 18.5	18.5	16N08W07D	47.15196	-112.65442	7/12/22 - 9/5/23
Landers Fork near Maryanne Creek	22	16N09W02C	47.16925	-112.70923	7/13/22 - 9/7/23
Landers Fork near Middle Fork Creek	25	17N09W26D	47.19577	-112.70348	7/13/22 - 9/6/23
Landers Fork near Crow Creek	27	17N08W19A	47.21684	-112.66469	7/13/22 - 9/6/23
Lodgepole Creek at lower bridge	0.1	17N13W36C	47.18383	-113.20345	6/23/21 - 10/20/22
Lodgepole Creek at upper bridge	2.15	17N13W24C	47.21027	-113.19903	8/11/22 - 10/31/23
Lookout Creek near trail crossing	0.8	16N08W16B	47.14574	-112.62376	7/11/22 - 9/5/23
Maryanne Creek	0.1	16N09W02C	47.16943	-112.70957	7/13/22 - 9/7/23
Middle Fork Creek near mouth	0.1	17N09W26D	47.19595	-112.7037	7/13/22 - 9/6/23
Middle Fork Creek near trail crossing	0.3	17N09W26A	47.19946	-112.70419	7/13/22 - 9/6/23
Monture Creek at FAS	1.8	15N13W22D	47.03558	-113.2205	1/1/21 - 11/2/23
Monture Creek at USFS Bridge	13.1	16N12W29B	47.118323	-113.14671	1/1/21 - 10/31/23

Appendix D: Water temperature monitoring summaries in the Blackfoot River drainage, 2021-2023.

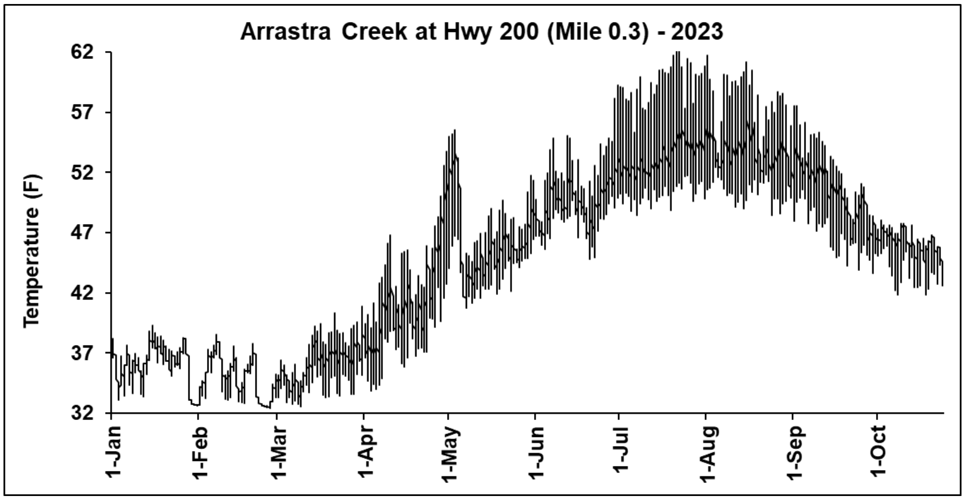
Stream name	Stream Mile	Legal Description	Latitude	Longitude	Duration
Nevada Creek downstream of Douglas Creek	4.5	13N11W08D	46.89346	-113.007551	1/1/21 - 10/24/23
Nevada Creek upstream of Douglas Creek	4.8	13N11W09C	46.89194	-113.00379	1/1/21 - 10/19/21
Nevada Creek upstream of Nevada Spring Creek	5.8	13N11W09C	46.89505	-112.99953	1/1/21 - 10/19/21
Nevada Creek at Wineglass Ranch bridge	15.7	13N11W25A	46.85471	-112.93345	7/22/22 - 10/26/22
Nevada Creek at Nevada Creek Ranch Rd	19	13N10W32C	46.831897	-112.89643	7/22/22 - 10/24/23
Nevada Creek downstream of Nevada Reservoir	24.4	12N10W11D	46.80265	-112.818	6/23/21 - 10/24/23
Nevada Spring Creek at mouth	0.1	13N11W09C	46.89562	-112.99908	1/1/21 - 10/19/21
Nevada Spring Creek at lower bridge	1.1	13N11W10B	46.89837	-112.98491	1/1/21 - 10/19/21
Nevada Spring Creek at lower fenceline	2.1	13N11W10A	46.89967	-112.97162	1/1/21 - 10/19/21
North Fork Blackfoot River at Ovando-Helmville Rd xing	2.6	14N12W10D	46.97976	-113.09237	1/1/21 - 10/24/23
North Fork Blackfoot River USFS Bridge	16.3	16N11W35B	47.10228	-112.96091	1/1/21 - 10/31/23
North Fork Cottonwood Creek	0.1	16N14W13A	47.14874	-113.31385	1/1/21 - 11/8/23
Poorman Creek at Stemple Pass Rd	2.2	14N09W36D	46.91647	-112.66937	1/1/21 - 10/23/23
Poorman Creek (upper)	8	13N08W23B	46.8773	-112.58295	1/1/21 - 10/23/23
Snowbank Creek near forest bridge	0.1	15N08W09A	47.07095	-112.61260	6/22/21 - 10/24/23
Warren Creek at lower bridge	1.1	15N12W31C	47.0056	-113.17476	6/23/21 - 9/15/21
Warren Creek "wetlands outlet"	1.8	15N12W31A	47.01382	-113.16329	6/23/21 - 9/15/21
Warren Creek at middle bridge	2.1	15N12W31A	47.01221	-113.16102	6/23/21 - 9/15/21
Warren Creek at step pool section	3.6	15N12W32A	47.01714	-113.13751	6/23/21 - 9/15/21
Warren Creek at Ovando-Helmville Rd	4.4	15N12W33C	47.01287	-113.12806	6/23/21 - 9/15/21
Wasson Creek near mouth	0.1	13N11W11D	46.89362	-112.94879	1/1/21 - 10/19/21
West Fork Gold Creek at mile 0.2	0.2	14N17W1D	46.99426	-113.68942	1/1/21 - 11/8/23



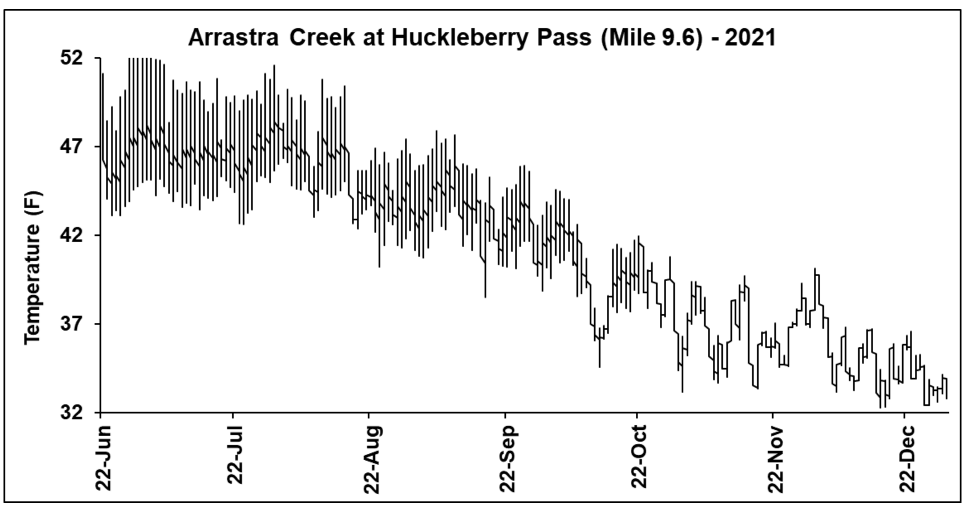
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	43.1	43.1	46.6	2.4	6.0
July	42.7	42.7	46.8	2.2	4.7
August	40.2	40.2	45.3	2.1	4.5
September	38.5	38.5	43.0	1.9	3.5
October	45.4	34.6	41.4	2.2	5.0
November	43.6	35.6	39.6	1.7	2.8
December	44.9	32.3	36.7	2.9	8.4



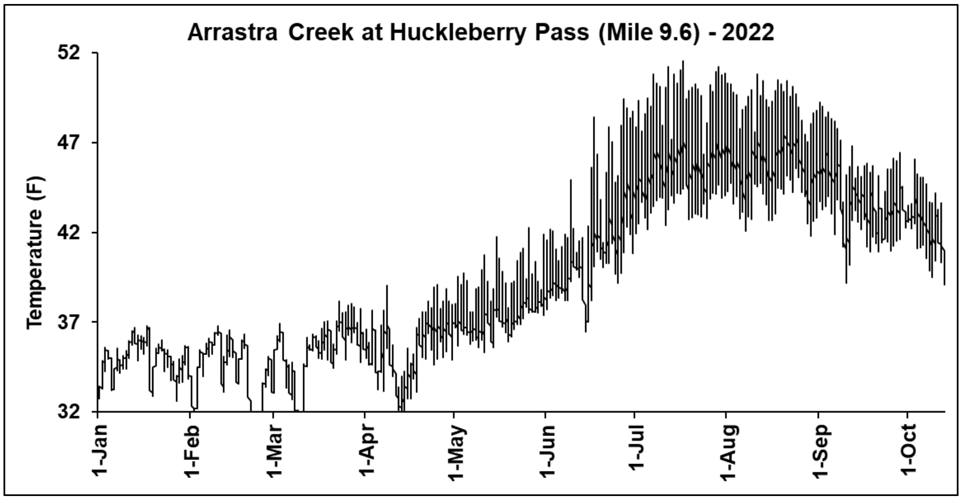
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	38.8	32.3	35.2	1.8	3.3
February	40.8	32.3	35.6	2.4	5.6
March	47.3	32.4	38.6	3.1	9.6
April	50.0	33.4	40.0	3.4	11.4
May	53.3	39.3	44.8	2.8	7.8
June	54.0	41.9	46.7	2.6	6.9
July	59.4	47.6	52.9	2.6	7.0
August	59.1	48.5	53.8	2.4	5.8
September	55.9	45.4	49.4	2.2	4.9
October	50.0	39.2	44.2	2.4	6.0
November	43.7	32.8	36.5	2.5	6.1
December	38.9	32.5	35.5	1.8	3.1



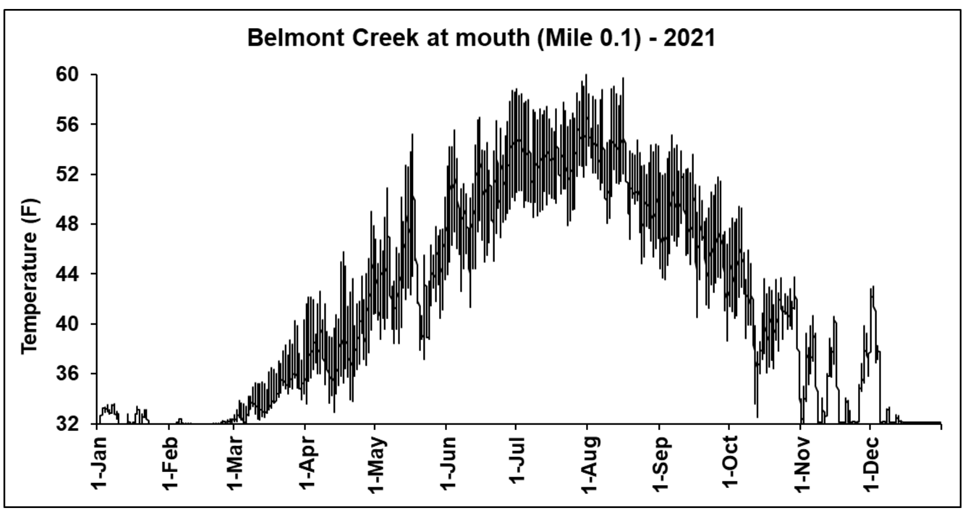
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	39.3	32.6	35.9	1.6	2.7
February	38.6	32.4	34.7	1.6	2.7
March	40.9	32.6	35.6	1.8	3.1
April	53.7	33.9	40.5	3.6	13.3
May	55.6	40.8	45.8	2.9	8.4
June	59.2	44.8	49.8	2.4	5.9
July	62.2	48.5	54.1	3.3	10.8
August	61.7	48.5	53.6	2.9	8.3
September	57.5	43.6	49.4	2.9	8.7
October	48.0	41.9	45.2	1.5	2.2
November					
December					



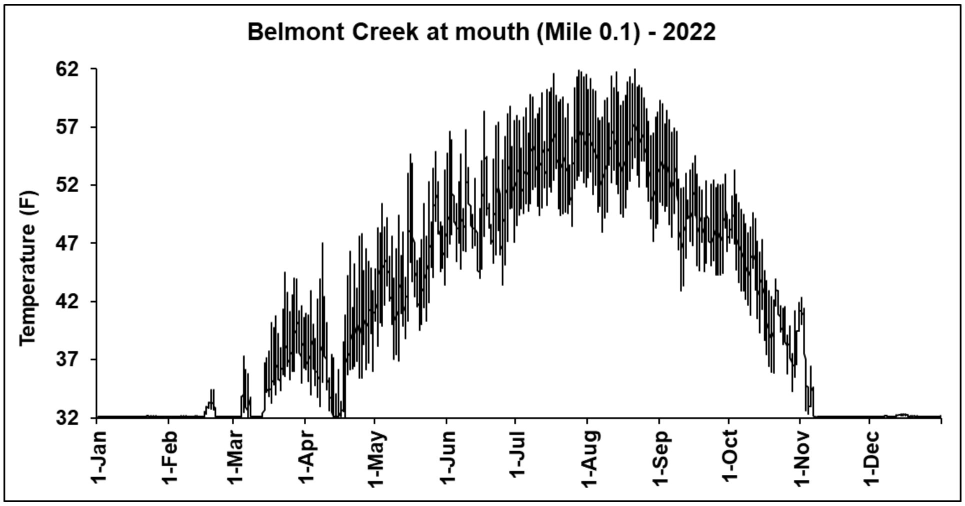
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	52.3	43.1	46.6	2.4	6.0
July	52.3	42.7	46.8	2.2	4.7
August	50.8	40.2	45.3	2.1	4.5
September	47.9	38.5	43.0	1.9	3.5
October	44.6	34.4	39.4	2.1	4.3
November	39.7	33.1	36.4	1.5	2.4
December	40.1	32.2	34.9	1.7	2.9



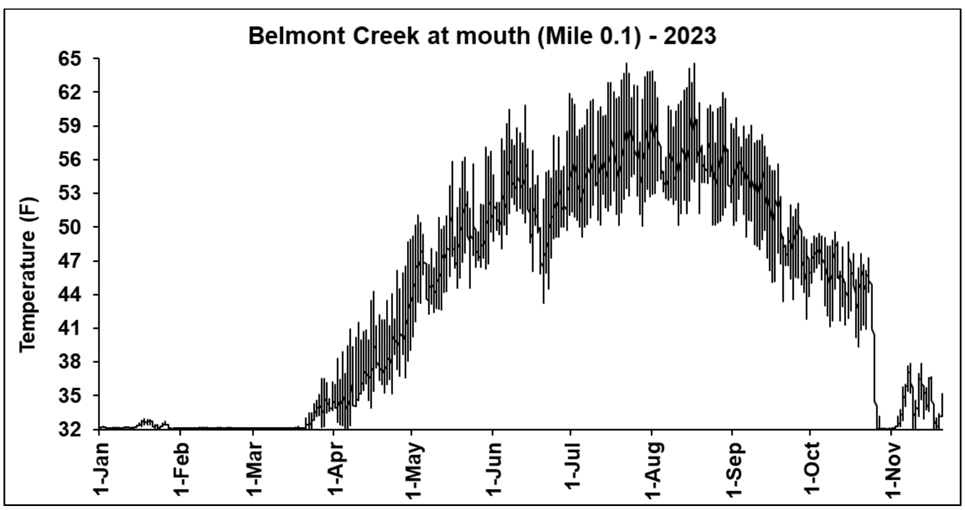
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.8	32.6	34.9	0.9	0.9
February	36.8	19.1	33.2	4.1	16.9
March	38.2	27.9	35.2	1.8	3.2
April	39.1	32.0	35.4	1.6	2.6
May	42.2	35.3	37.7	1.3	1.6
June	49.4	36.5	41.3	2.6	6.9
July	51.5	41.9	46.0	2.3	5.1
August	50.8	41.8	46.0	2.1	4.4
September	49.2	39.2	43.7	1.9	3.4
October	46.1	39.1	42.3	1.4	2.0
November					
December					



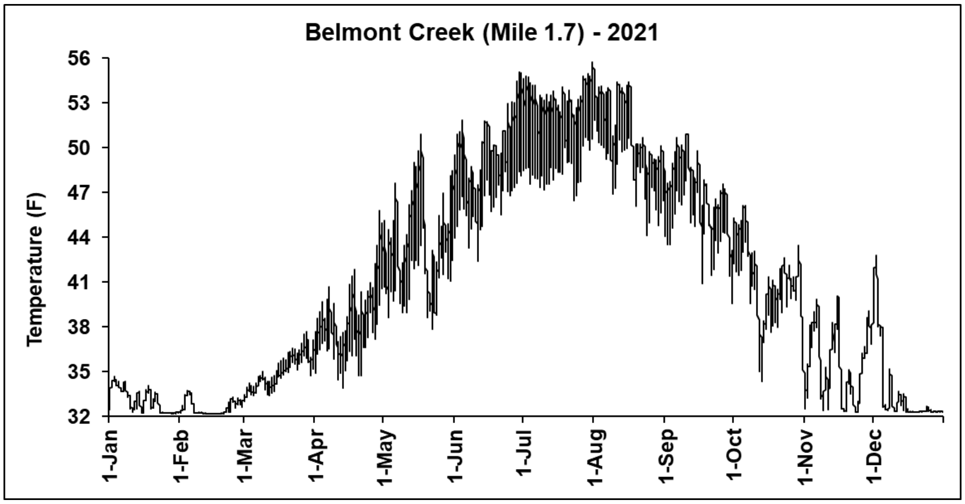
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	33.6	31.9	32.4	0.5	0.3
February	32.4	31.9	32.0	0.1	0.0
March	40.3	32.0	34.4	1.7	2.9
April	49.0	32.9	38.8	2.9	8.7
May	55.2	37.2	43.8	3.4	11.5
June	58.7	41.3	50.1	3.4	11.3
July	60.0	47.9	53.5	2.5	6.4
August	59.7	44.8	52.2	3.1	9.6
September	55.1	38.7	47.5	3.2	10.5
October	49.4	32.5	40.9	3.1	9.6
November	40.6	31.9	34.7	2.5	6.4
December	43.0	32.0	33.2	2.7	7.3



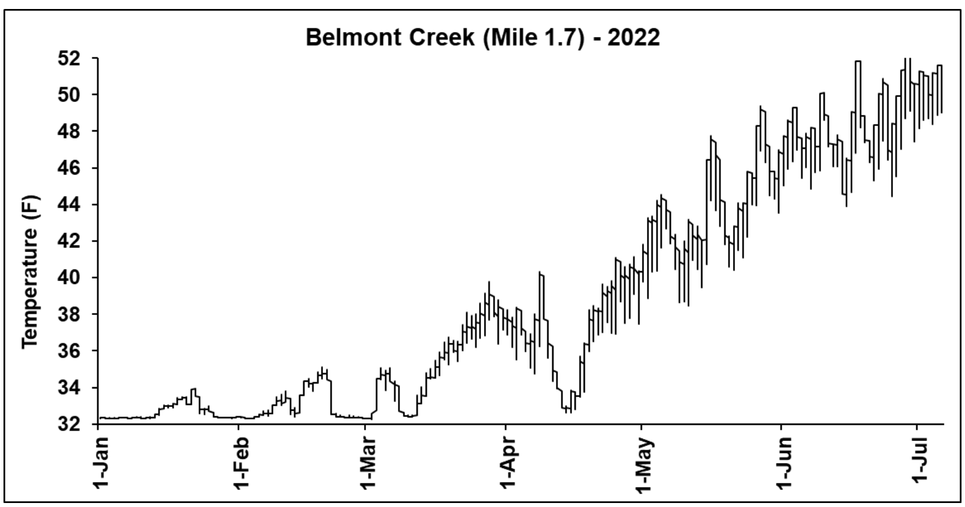
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.2	32.1	32.1	0.0	0.0
February	34.4	32.1	32.3	0.4	0.2
March	44.5	32.1	35.4	3.1	9.8
April	47.8	32.0	37.7	3.8	14.4
May	54.9	36.9	45.0	3.8	14.1
June	58.8	43.4	50.0	3.2	10.4
July	61.9	48.5	54.4	3.2	10.0
August	62.1	47.2	54.9	3.3	10.6
September	59.3	42.9	49.8	3.4	11.3
October	53.3	34.3	42.6	4.1	16.9
November	42.3	32.0	32.9	2.2	4.9
December	32.3	32.1	32.1	0.1	0.0



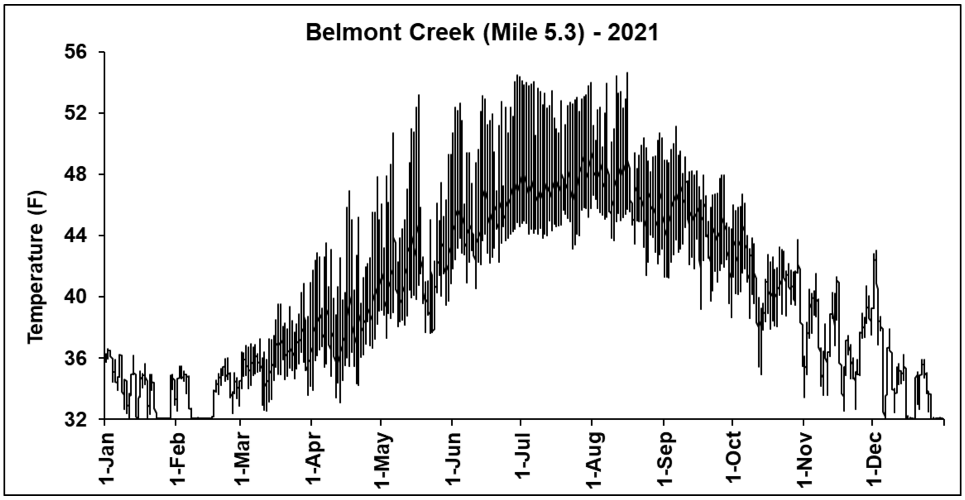
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.9	32.0	32.3	0.2	0.0
February	32.2	32.0	32.1	0.0	0.0
March	36.6	32.1	32.6	1.0	1.0
April	48.9	32.0	38.0	3.4	11.6
May	57.1	40.3	47.9	3.3	10.6
June	61.9	43.3	52.3	3.3	11.2
July	64.5	49.2	56.1	3.7	14.0
August	64.6	50.2	56.1	3.2	10.5
September	59.7	41.8	50.7	4.0	16.3
October	49.6	32.0	42.4	5.7	32.5
November	37.8	32.0	34.1	1.6	2.7
December					



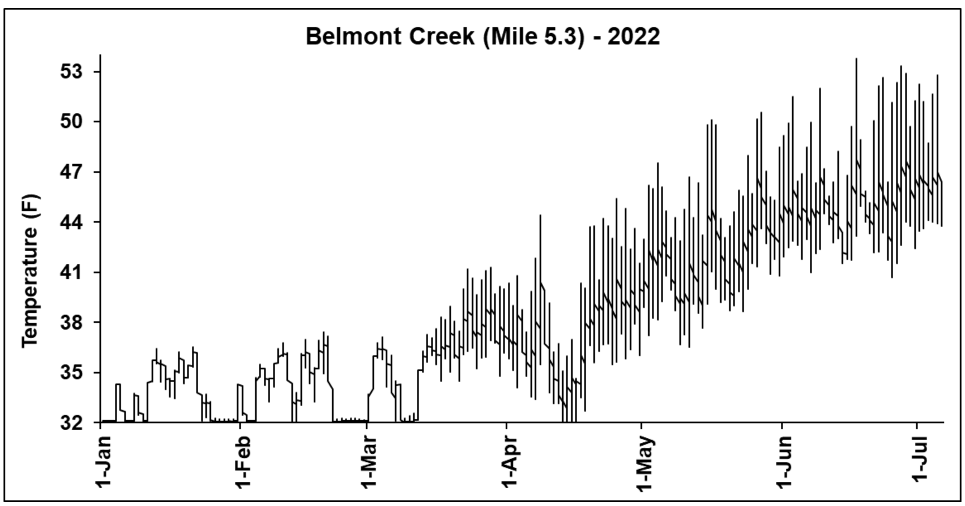
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	34.7	32.2	33.1	0.8	0.6
February	33.7	32.2	32.6	0.5	0.2
March	37.7	33.0	34.9	1.1	1.1
April	45.8	33.9	38.3	2.7	7.3
May	50.9	37.8	43.0	2.7	7.3
June	55.1	42.4	48.4	2.5	6.1
July	55.7	46.5	51.4	2.0	4.2
August	55.3	44.1	50.3	2.3	5.3
September	50.9	39.5	46.5	2.2	5.0
October	46.1	34.4	41.0	2.4	5.8
November	40.1	32.3	35.5	2.2	5.0
December	42.8	32.3	33.6	2.6	6.7



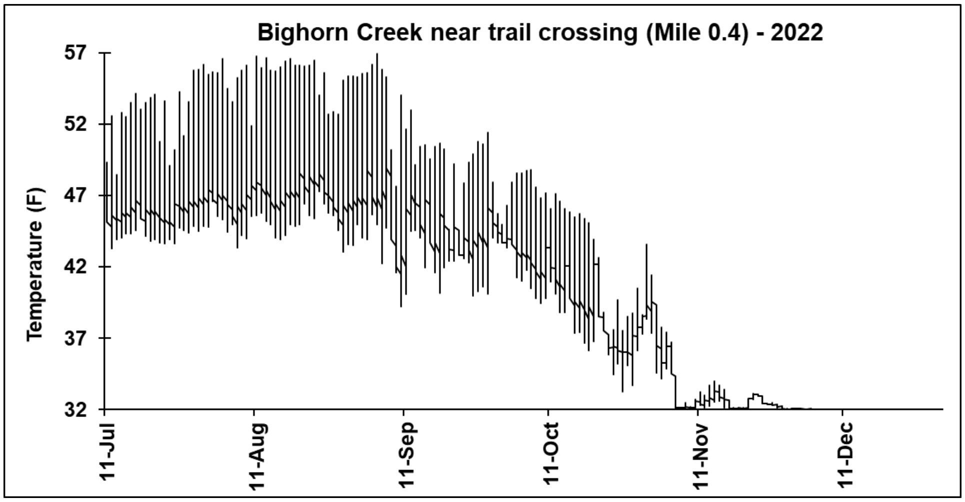
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	33.9	32.3	32.7	0.4	0.2
February	35.1	32.3	33.0	0.8	0.7
March	39.8	32.2	35.3	2.0	4.1
April	41.1	32.6	36.9	2.3	5.1
May	49.4	38.5	43.1	2.3	5.4
June	52.1	43.9	47.6	1.7	2.9
July	51.6	48.1	50.0	0.9	0.9
August					
September					
October					
November					
December					



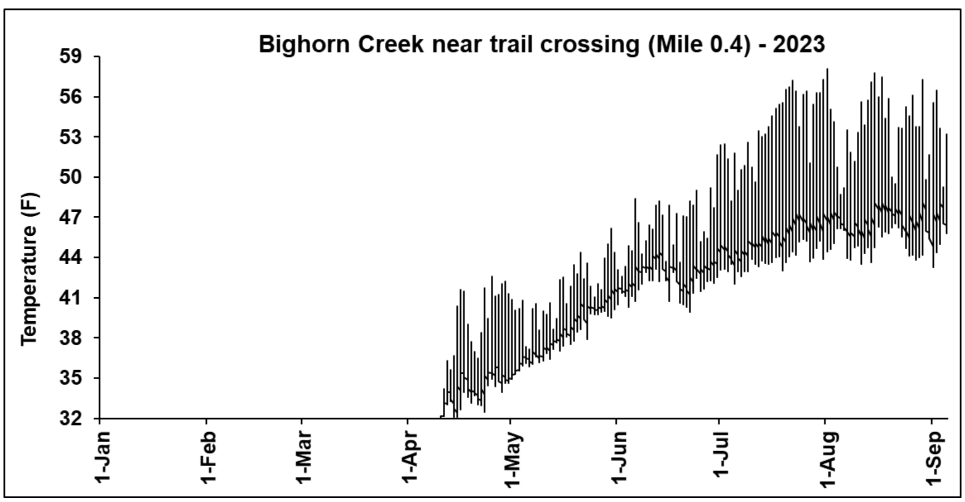
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.6	32.0	33.9	1.4	2.1
February	36.0	32.0	33.5	1.3	1.6
March	40.9	32.5	36.1	1.4	2.1
April	47.8	33.1	38.7	2.7	7.6
May	53.2	37.3	42.2	3.0	9.2
June	54.5	40.5	46.3	3.0	9.0
July	54.1	43.1	47.9	2.8	7.8
August	54.6	41.4	47.1	2.5	6.0
September	51.1	38.7	44.8	2.3	5.5
October	46.7	34.9	41.0	2.2	4.8
November	41.5	32.5	37.2	2.1	4.2
December	43.0	32.0	34.5	2.7	7.1



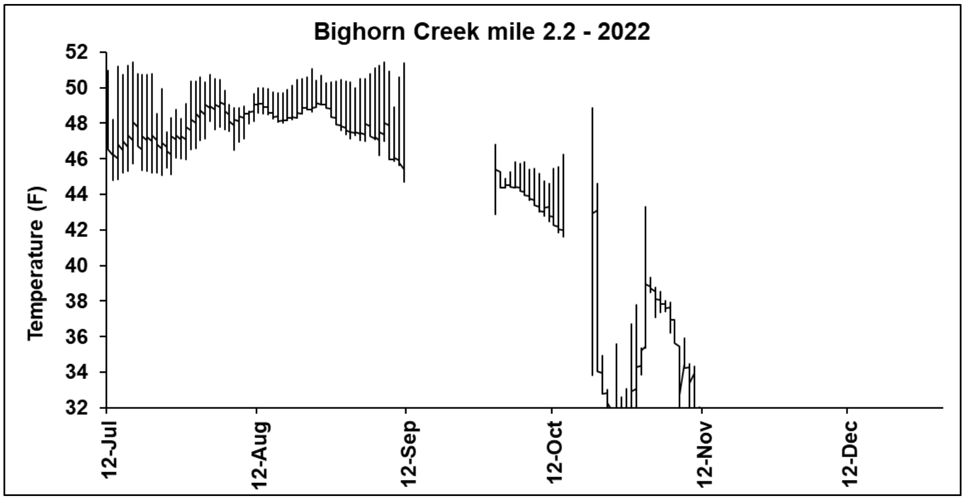
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.5	32.0	33.4	1.4	1.9
February	37.4	32.0	33.9	1.7	2.9
March	41.3	32.0	36.0	2.3	5.3
April	45.4	32.0	37.4	3.0	8.9
May	50.5	36.5	42.4	2.9	8.3
June	53.8	40.7	45.5	2.8	7.6
July	52.8	43.4	46.7	2.6	6.7
August					
September					
October					
November					
December					



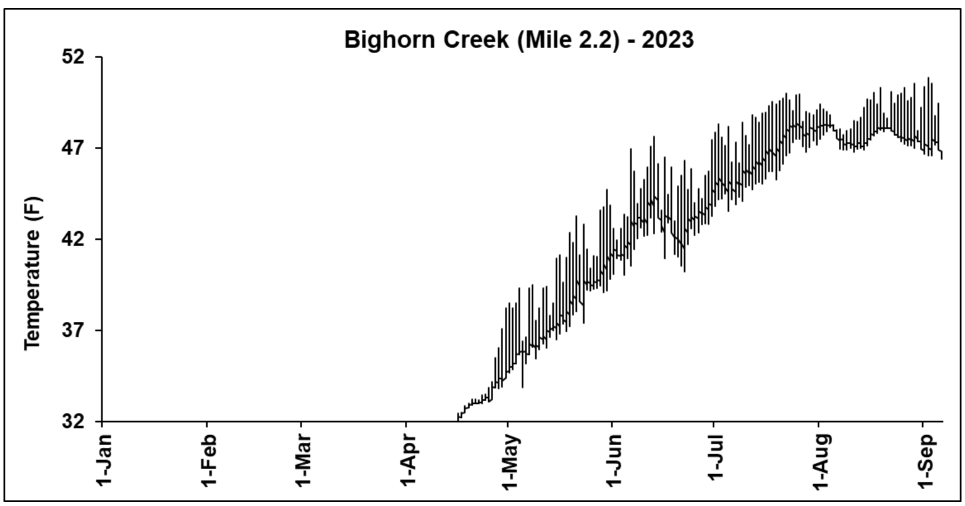
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	56.2	43.3	47.3	3.0	9.2
August	56.8	43.1	48.6	3.6	12.7
September	56.9	39.2	46.0	3.5	12.0
October	48.8	33.3	40.7	3.5	11.9
November	41.4	31.4	33.2	1.8	3.3
December	32.1	31.6	31.9	0.1	0.0



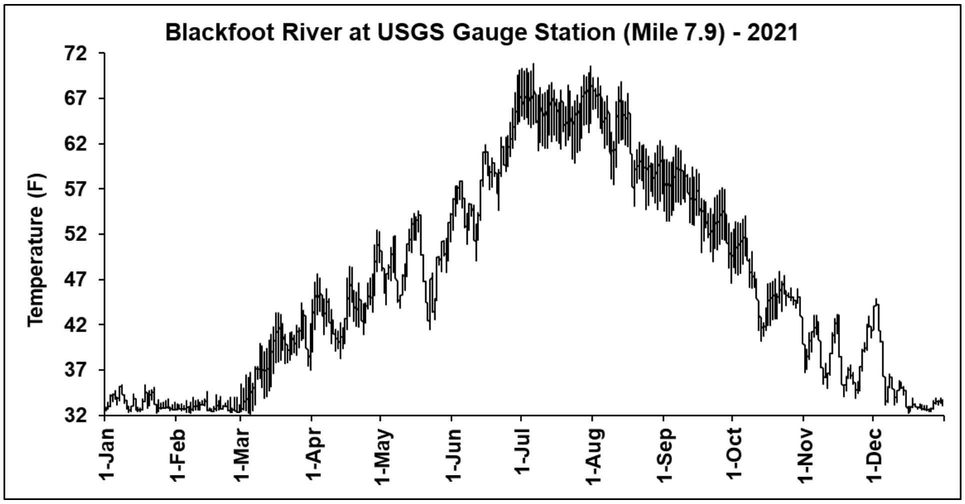
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.0	31.3	31.6	0.1	0.0
February	31.7	31.4	31.6	0.1	0.0
March	31.7	31.3	31.5	0.1	0.0
April	42.6	31.6	34.2	2.6	6.9
May	46.2	35.0	39.0	2.2	4.9
June	51.6	39.9	43.4	1.9	3.7
July	57.3	42.1	47.1	3.5	12.3
August	58.1	43.5	48.2	3.2	10.2
September	56.5	43.3	48.1	3.3	11.0
October					
November					
December					



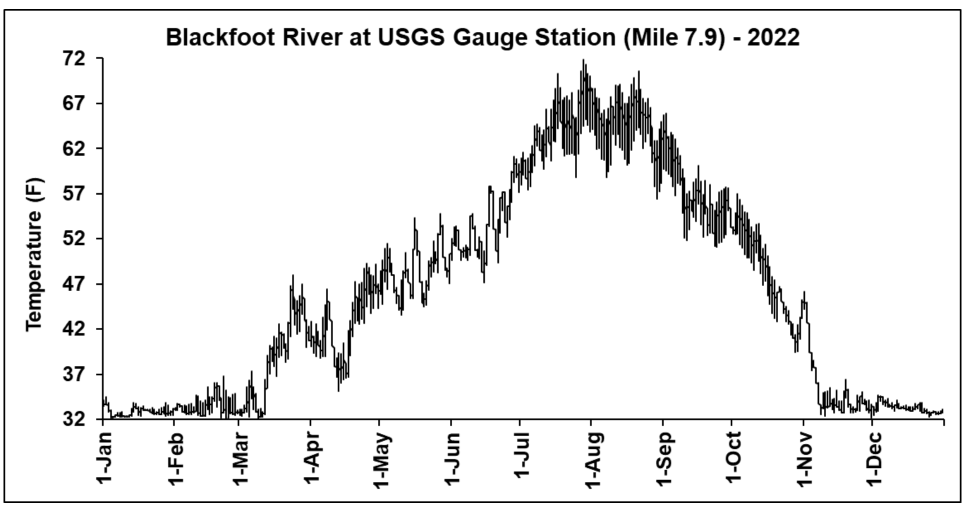
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	51.5	44.8	47.4	1.5	2.3
August	51.1	46.5	48.7	0.8	0.6
September	76.4	35.9	47.6	1.6	2.6
October	59.2	25.3	39.5	5.7	32.9
November	39.3	10.7	29.1	6.0	36.2
December	31.8	15.4	27.1	3.4	11.7



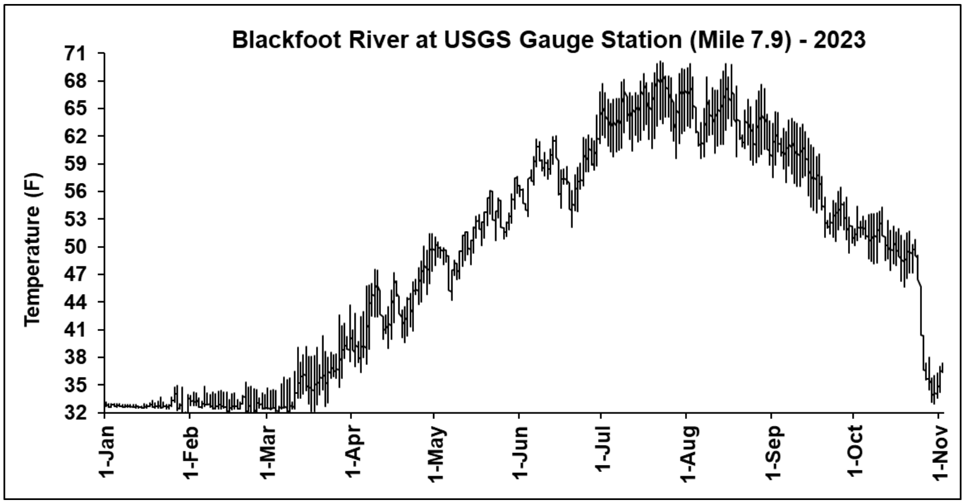
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	30.8	17.6	26.7	2.9	8.4
February	29.8	17.4	26.2	2.8	7.6
March	31.9	23.1	28.4	2.2	5.0
April	38.2	29.4	32.4	1.4	1.9
May	44.7	33.9	38.3	2.1	4.5
June	47.6	40.0	43.1	1.5	2.1
July	50.0	43.5	46.7	1.5	2.3
August	50.5	46.8	47.9	0.7	0.5
September	50.8	46.4	47.6	1.0	0.9
October					
November					
December					



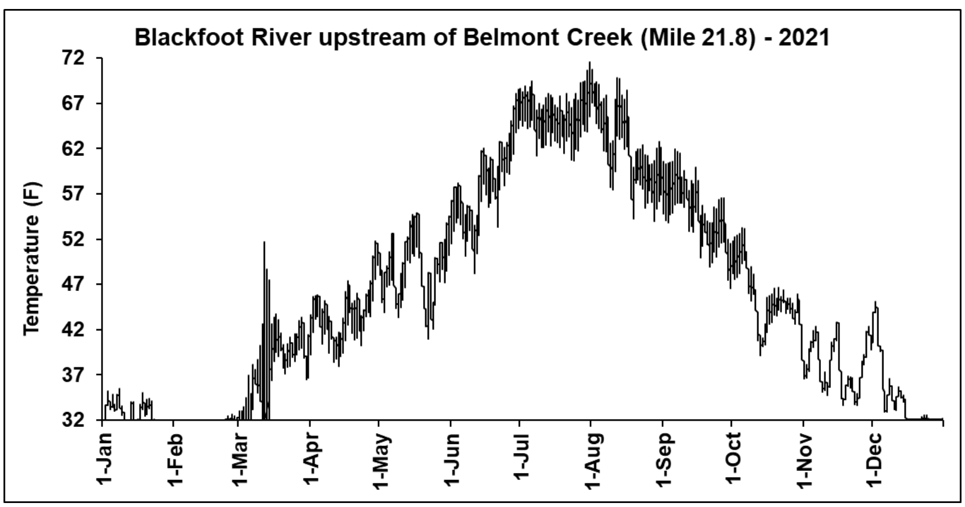
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.4	32.3	33.4	0.8	0.6
February	34.7	32.3	32.9	0.4	0.2
March	44.4	32.2	38.2	2.9	8.5
April	52.5	38.3	43.9	2.8	8.0
May	54.6	41.5	48.5	3.2	10.0
June	70.2	49.1	58.2	4.3	18.5
July	70.8	59.9	65.7	2.3	5.3
August	69.3	54.8	62.0	3.6	13.0
September	61.8	46.6	55.2	3.0	8.9
October	54.0	40.0	46.1	3.1	9.6
November	43.2	33.9	38.5	2.5	6.4
December	44.9	32.3	35.0	3.3	10.9



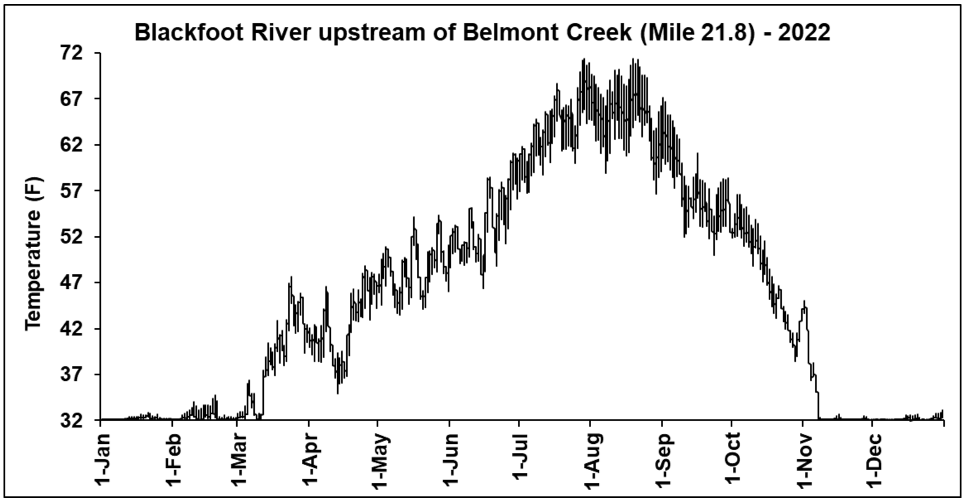
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	34.5	32.2	32.8	0.4	0.2
February	36.7	29.9	33.3	0.9	0.7
March	48.0	32.1	38.4	4.5	20.5
April	49.3	35.2	42.3	3.5	12.0
May	54.7	43.5	48.3	2.4	5.5
June	61.1	47.1	53.3	3.3	10.7
July	71.8	57.5	63.8	3.2	10.2
August	70.6	56.4	64.6	2.6	7.0
September	65.9	51.1	56.8	3.2	10.5
October	56.9	39.5	48.0	4.5	20.4
November	46.2	32.1	35.1	3.1	9.8
December	34.6	32.3	33.2	0.5	0.2



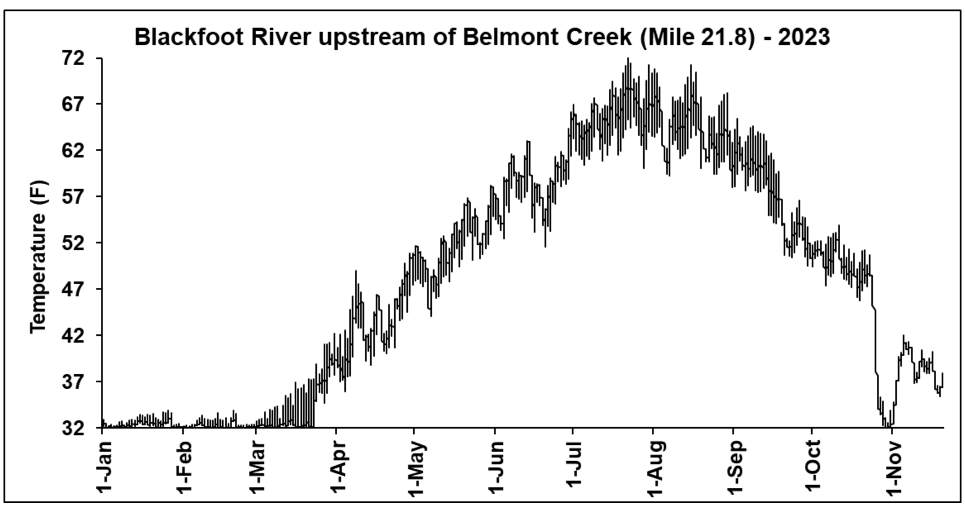
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	34.9	29.8	32.8	0.6	0.3
February	35.3	28.9	32.9	0.7	0.5
March	43.7	31.9	35.4	2.5	6.4
April	51.4	36.4	43.3	3.2	10.1
May	57.6	44.2	51.1	2.8	8.0
June	66.8	52.1	58.1	2.6	6.5
July	70.1	59.6	64.9	2.4	5.6
August	69.9	58.9	63.8	2.5	6.0
September	64.7	49.3	57.2	3.9	15.0
October	54.4	32.9	47.2	6.1	37.2
November	37.4	34.2	36.1	0.9	0.8
December					



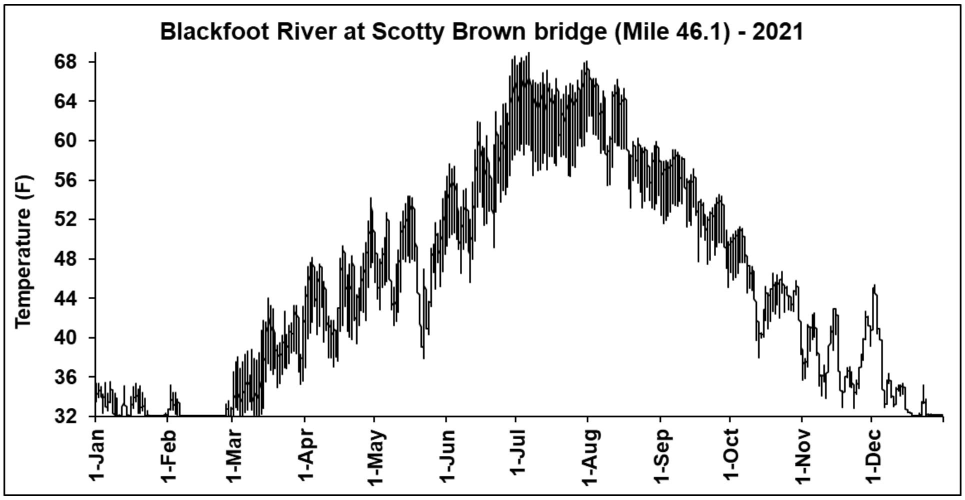
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.4	23.2	32.1	2.2	4.9
February	32.7	29.6	31.9	0.4	0.1
March	51.7	28.3	37.5	3.8	14.7
April	51.8	37.9	43.6	2.8	7.8
May	54.9	41.0	48.3	3.2	10.5
June	68.5	48.2	57.7	4.3	18.7
July	71.6	60.6	65.6	2.0	3.9
August	70.7	54.0	62.1	3.9	15.2
September	61.9	46.6	54.9	3.2	10.1
October	53.3	38.7	45.4	3.2	10.0
November	42.8	33.7	37.9	2.5	6.4
December	45.1	32.0	34.3	3.4	11.5



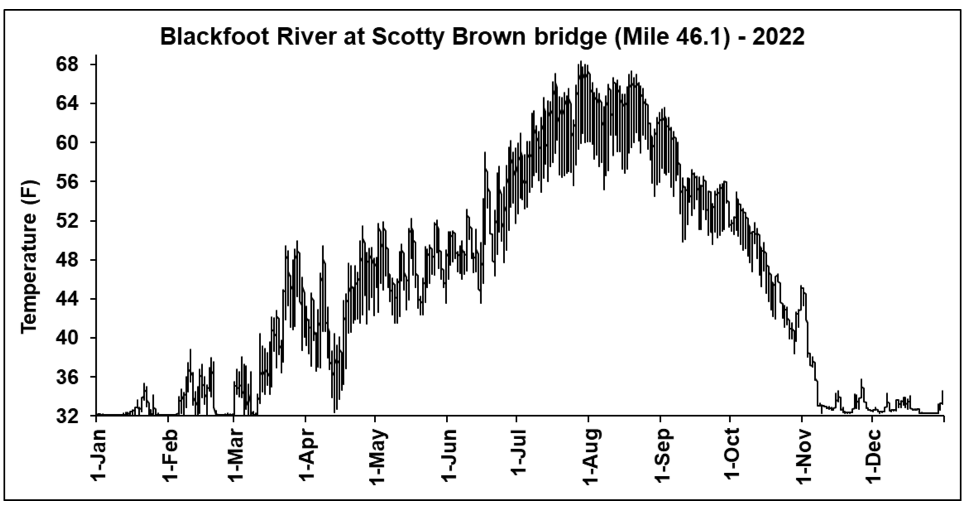
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.8	32.0	32.2	0.1	0.0
February	34.8	32.0	32.5	0.5	0.2
March	47.6	32.0	38.2	4.6	20.7
April	48.9	34.9	42.2	3.4	11.5
May	54.3	43.5	48.2	2.4	5.6
June	61.1	46.4	53.0	3.4	11.5
July	71.4	56.7	63.6	3.2	10.5
August	71.4	56.6	65.2	2.8	8.1
September	67.1	50.0	57.0	3.5	12.2
October	56.6	38.4	47.6	4.7	22.5
November	45.0	32.0	33.7	3.3	11.1
December	33.1	32.0	32.2	0.2	0.0



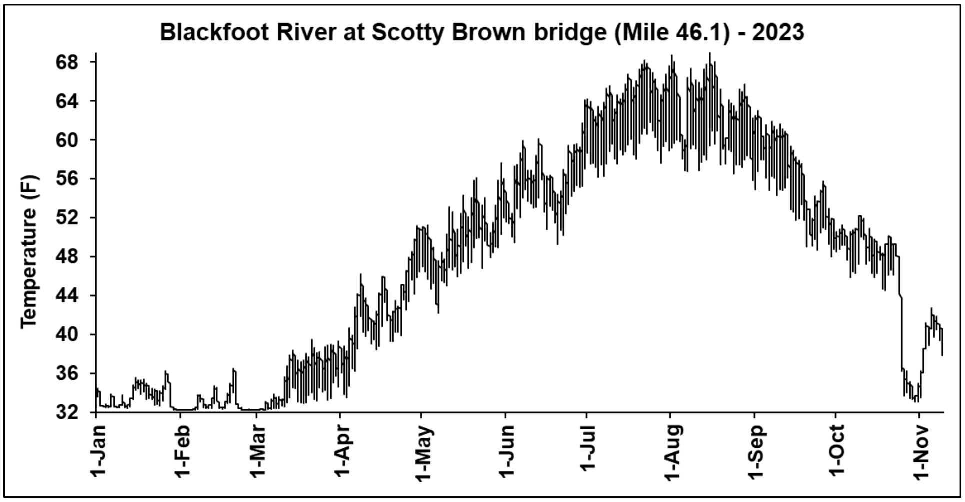
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	33.9	32.0	32.4	0.4	0.1
February	33.9	32.0	32.3	0.3	0.1
March	42.2	32.0	34.3	2.6	6.6
April	50.9	35.9	43.2	3.3	10.8
May	58.2	44.1	51.1	2.9	8.4
June	66.1	51.6	58.0	2.7	7.2
July	721.0	60.0	65.5	2.4	5.7
August	71.2	58.0	64.1	2.7	7.1
September	65.4	49.6	57.0	4.1	16.9
October	53.9	32.0	46.1	6.7	44.3
November	42.1	32.4	38.2	1.9	3.8
December					



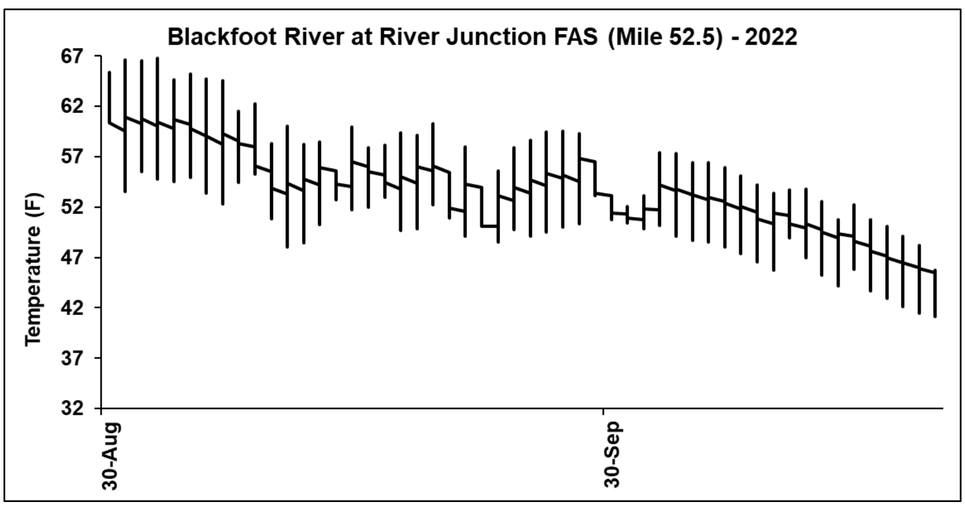
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.5	32.0	33.0	1.0	1.1
February	35.2	32.0	32.3	0.5	0.3
March	44.0	32.1	37.2	3.0	9.0
April	54.2	36.9	43.9	3.4	11.8
May	54.9	37.9	47.0	3.8	14.2
June	68.6	45.6	55.5	4.6	20.9
July	69.0	56.4	62.5	3.0	9.1
August	67.1	53.0	59.7	3.5	12.1
September	59.1	45.1	53.4	2.9	8.6
October	51.2	38.0	44.8	3.0	9.0
November	42.9	32.8	37.8	2.6	6.7
December	45.4	32.0	34.5	3.4	11.9



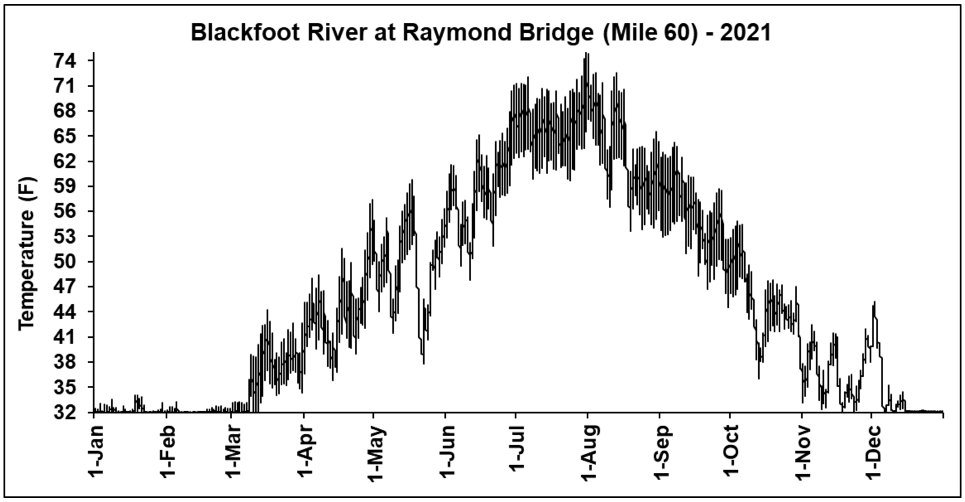
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.3	32.0	32.4	0.6	0.4
February	38.8	32.0	33.5	1.7	2.9
March	50.0	32.0	38.6	5.0	25.4
April	51.4	32.3	42.0	4.1	17.0
May	52.2	41.5	46.6	2.5	6.2
June	60.2	43.5	50.7	3.7	13.4
July	68.4	52.7	60.4	3.5	12.6
August	67.3	54.5	62.0	2.8	8.0
September	63.6	49.6	55.3	3.2	9.9
October	54.9	38.4	46.8	4.2	17.6
November	45.1	32.2	34.4	3.0	9.2
December	34.6	32.2	32.7	0.5	0.2



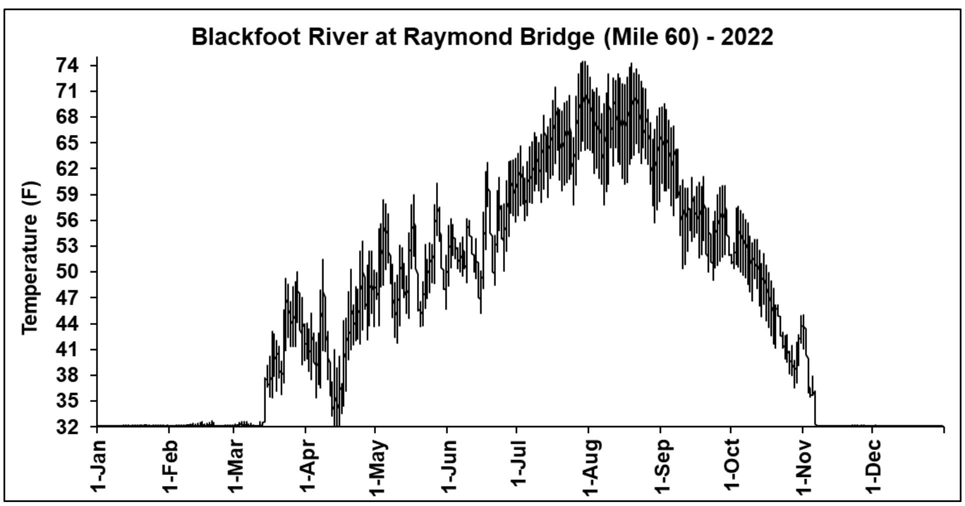
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.2	32.2	33.4	1.0	1.0
February	36.5	32.2	32.8	0.8	0.7
March	39.5	32.2	34.7	2.0	4.2
April	51.1	33.5	42.0	3.6	12.7
May	57.6	42.2	49.5	2.9	8.3
June	64.1	49.2	55.1	2.7	7.1
July	68.2	56.2	62.3	2.7	7.3
August	69.0	55.9	61.9	3.0	9.1
September	63.0	48.0	55.5	3.8	14.3
October	52.2	33.1	45.6	6.1	37.2
November	42.7	33.5	39.4	2.2	5.0
December					



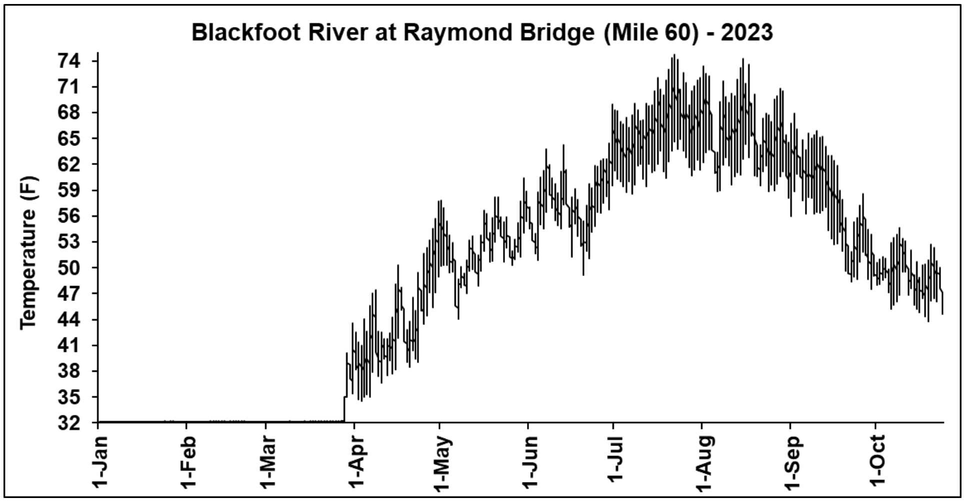
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July					
August	66.6	53.6	60.2	4.2	17.2
September	66.8	48.0	55.1	3.8	14.7
October	57.4	41.1	49.6	3.5	11.9
November					
December					



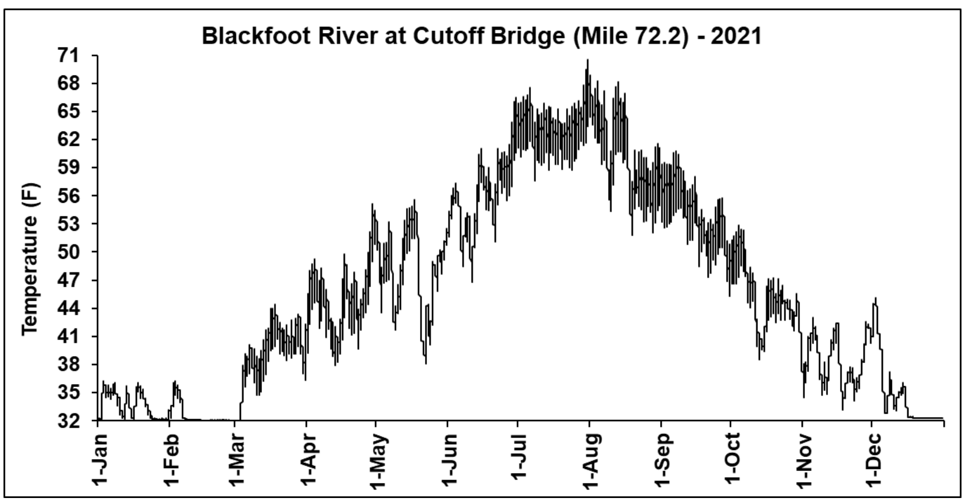
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	34.1	31.9	32.2	0.4	0.2
February	33.3	32.0	32.1	0.2	0.0
March	44.2	31.9	36.2	3.1	9.4
April	57.4	35.8	43.9	4.1	17.0
May	59.7	37.8	49.2	4.8	22.6
June	71.1	47.8	58.4	4.5	20.0
July	75.0	59.7	66.1	3.1	9.9
August	74.9	53.6	62.8	4.8	23.0
September	64.2	44.5	55.1	4.1	16.5
October	54.8	36.0	44.8	3.9	15.3
November	42.5	32.0	36.5	2.7	7.6
December	45.3	32.0	33.7	3.3	10.9



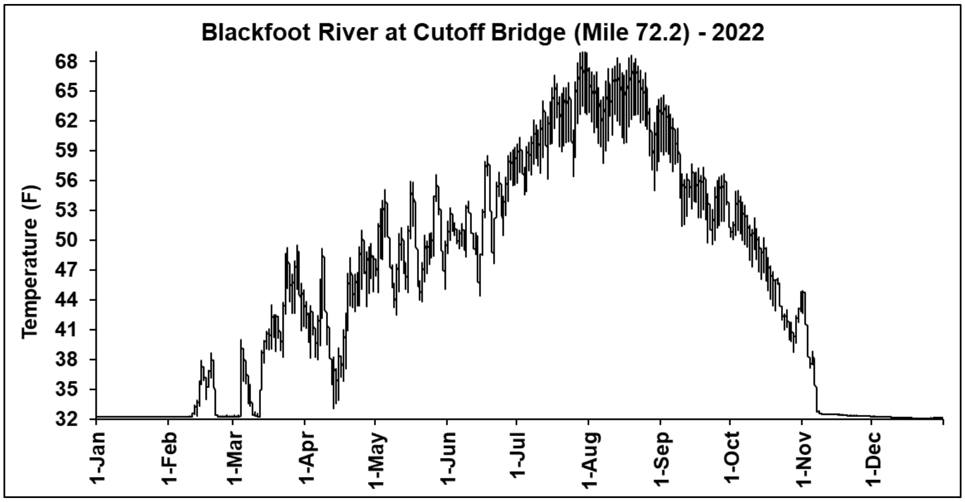
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.2	32.1	32.1	0.0	0.0
February	32.7	32.1	32.2	0.1	0.0
March	50.0	32.1	37.6	5.5	30.2
April	53.6	32.1	42.1	5.0	25.0
May	60.3	41.7	50.3	3.8	14.8
June	63.2	45.2	54.1	3.9	14.9
July	74.5	55.9	64.0	4.1	16.6
August	74.3	55.8	66.3	3.9	15.1
September	69.5	49.1	57.3	4.5	20.1
October	57.6	36.6	47.0	5.3	27.6
November	45.0	32.1	33.4	2.9	8.5
December	32.2	32.1	32.1	0.0	0.0



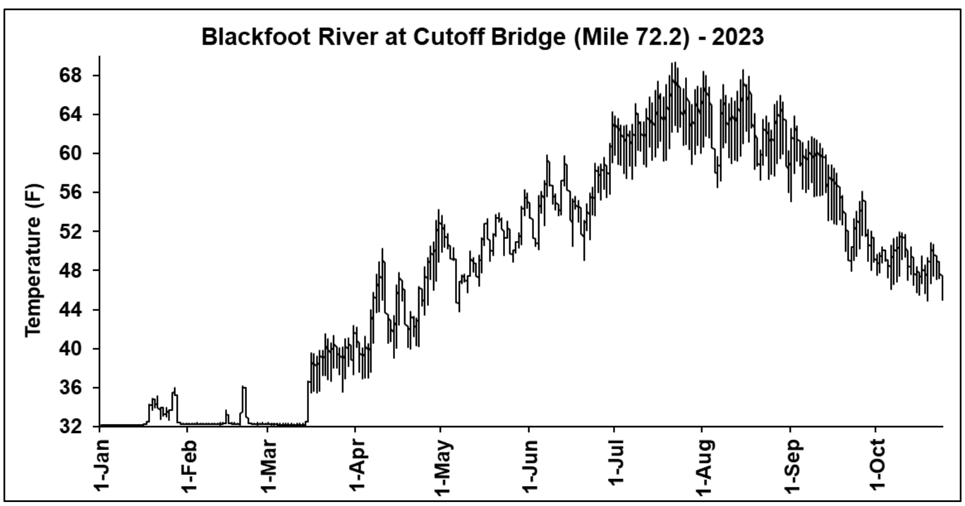
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.2	32.1	32.1	0.0	0.0
February	32.2	32.1	32.1	0.0	0.0
March	43.5	32.1	32.7	1.9	3.7
April	57.7	34.6	43.2	4.8	23.0
May	60.4	44.1	52.4	3.0	9.1
June	69.0	49.1	57.4	3.3	11.2
July	74.7	58.5	65.8	3.5	12.1
August	74.3	58.1	65.0	3.6	13.0
September	67.9	47.6	57.0	4.9	24.4
October	54.6	43.8	48.8	2.1	4.6
November					
December					



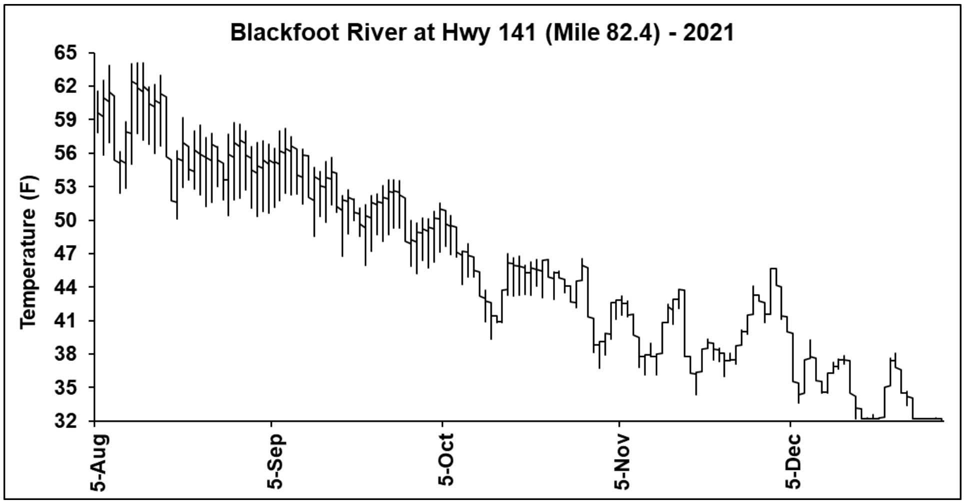
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.2	32.1	33.6	1.3	1.8
February	36.2	32.0	32.5	1.1	1.1
March	44.4	32.0	38.8	3.0	8.8
April	55.2	37.9	44.7	3.5	12.2
May	55.6	38.1	47.9	4.1	16.8
June	66.5	46.8	56.0	3.7	13.8
July	70.5	57.6	62.9	2.3	5.1
August	68.8	51.8	60.2	4.1	16.9
September	60.8	45.3	53.8	3.2	10.3
October	52.8	37.3	45.1	3.3	10.9
November	43.0	33.2	38.2	2.4	6.0
December	45.1	32.2	34.5	3.4	11.8



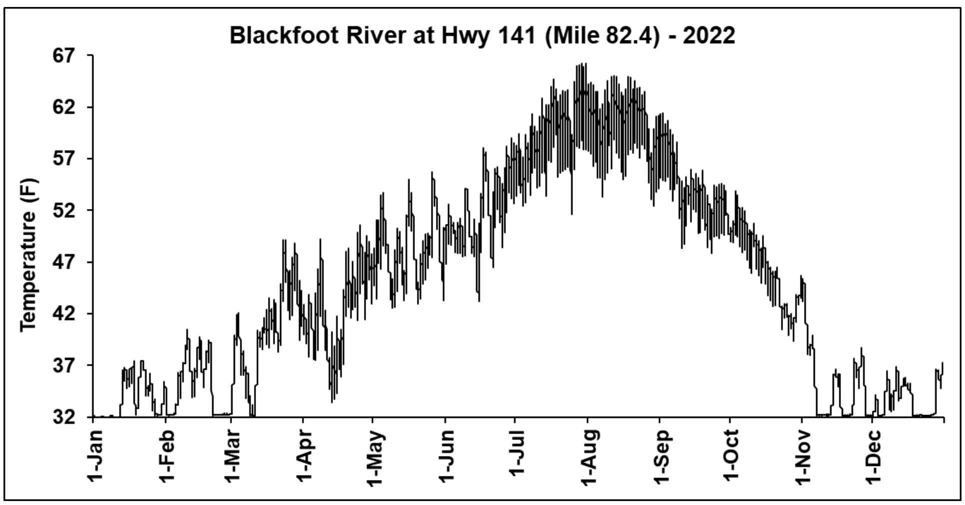
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.2	32.2	32.2	0.0	0.0
February	38.7	32.2	33.3	1.8	3.2
March	49.5	32.2	39.3	5.1	26.1
April	51.0	33.1	42.4	4.2	17.4
May	56.6	42.5	49.0	3.1	9.7
June	59.3	44.4	52.4	3.2	10.3
July	68.9	54.6	61.2	3.2	10.5
August	68.6	55.0	63.4	2.7	7.3
September	64.6	49.6	55.8	3.5	12.2
October	55.0	38.7	47.0	4.2	17.8
November	44.9	32.2	33.9	3.2	10.3
December	32.3	32.1	32.1	0.1	0.0



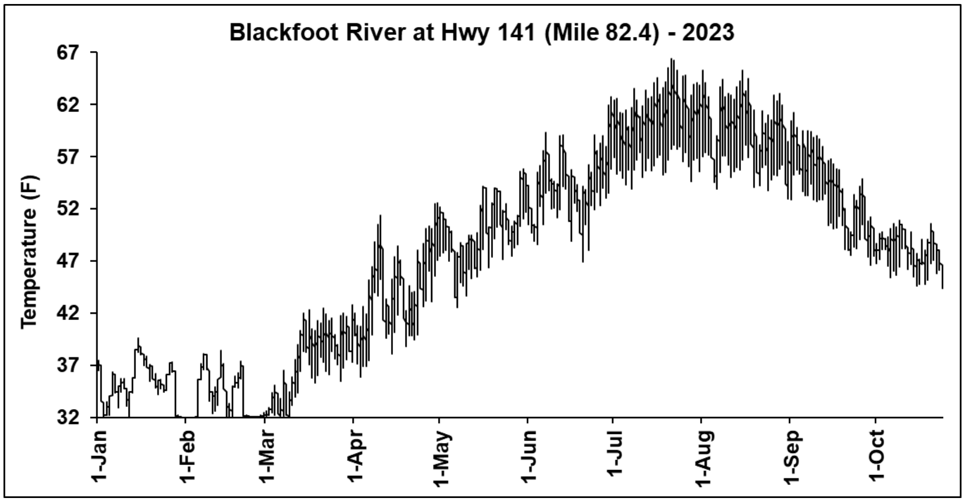
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.0	32.1	32.8	1.0	1.0
February	36.1	32.2	32.5	0.7	0.5
March	42.4	32.2	35.6	3.3	11.1
April	54.3	36.9	43.8	3.7	13.3
May	56.3	43.8	50.3	2.5	6.4
June	64.2	49.0	55.2	2.7	7.2
July	69.3	57.4	62.8	2.5	6.5
August	68.6	56.0	62.1	2.8	7.9
September	63.9	48.0	55.6	4.0	15.7
October	51.9	44.9	48.6	1.5	2.2
November					
December					



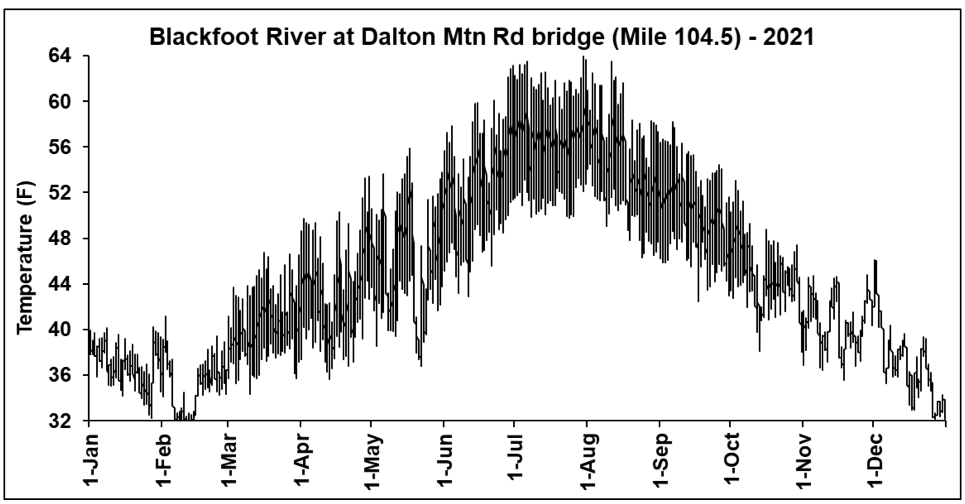
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July					
August	64.1	50.1	56.6	3.2	10.5
September	58.2	45.2	52.0	2.7	7.3
October	51.5	38.2	45.1	2.7	7.0
November	44.1	34.4	39.5	2.3	5.2
December	45.7	32.1	32.1	3.5	12.5



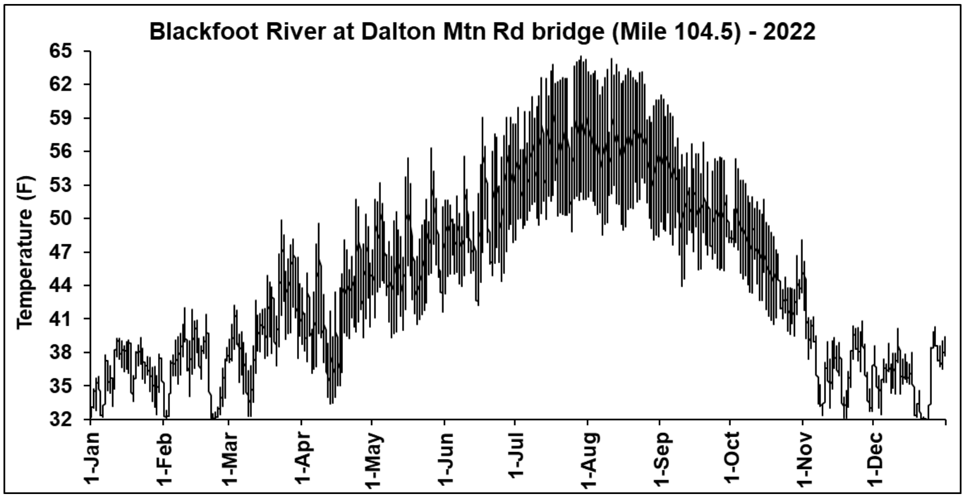
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	37.5	31.3	33.5	1.9	3.5
February	40.4	32.1	34.8	2.6	7.0
March	49.1	32.1	40.0	4.2	17.9
April	50.6	33.4	42.0	3.9	15.1
May	55.7	42.6	47.9	3.0	9.0
June	59.0	43.2	51.3	3.3	10.8
July	66.3	51.6	58.8	3.2	10.0
August	65.0	52.5	59.7	2.9	8.2
September	61.4	47.8	53.5	2.9	8.7
October	53.9	39.3	46.3	3.5	12.0
November	45.4	32.1	35.0	3.3	11.2
December	37.3	32.0	33.6	1.5	2.4



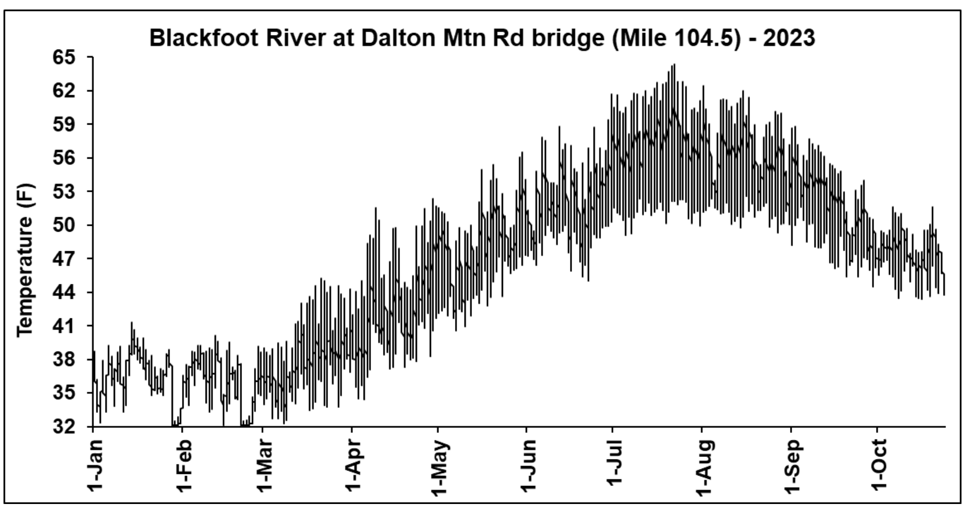
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	39.6	31.7	35.1	2.0	3.9
February	38.4	31.4	33.8	2.0	4.1
March	42.8	32.1	37.0	3.1	9.6
April	52.6	35.9	43.7	3.7	13.4
May	55.8	42.5	49.4	2.7	7.3
June	62.7	46.9	53.9	2.9	8.1
July	66.4	53.9	59.7	2.7	7.3
August	65.3	52.9	58.7	2.7	7.5
September	61.2	46.6	53.4	3.4	11.6
October	50.9	44.4	47.8	1.4	2.1
November					
December					



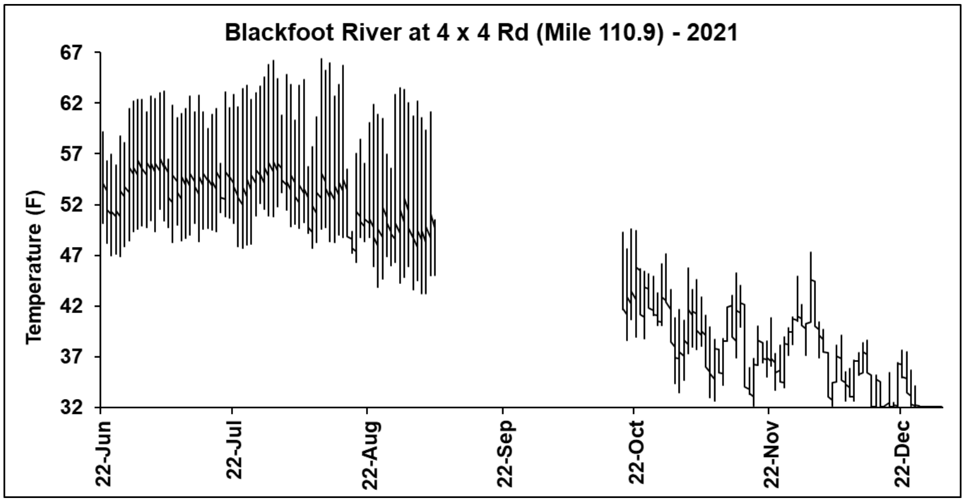
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	40.3	32.2	36.8	1.7	2.8
February	41.2	32.0	35.0	2.2	4.8
March	46.8	34.4	40.0	2.5	6.2
April	53.4	35.6	42.8	3.7	13.9
May	55.9	36.8	45.3	4.2	17.9
June	63.1	42.9	52.0	4.2	17.6
July	64.0	49.8	56.2	3.6	13.2
August	63.5	46.3	54.0	3.7	14.0
September	58.2	42.5	49.9	3.3	10.7
October	53.1	38.0	44.7	2.6	6.9
November	44.8	35.6	40.4	2.1	4.4
December	46.1	32.2	36.8	3.2	10.3



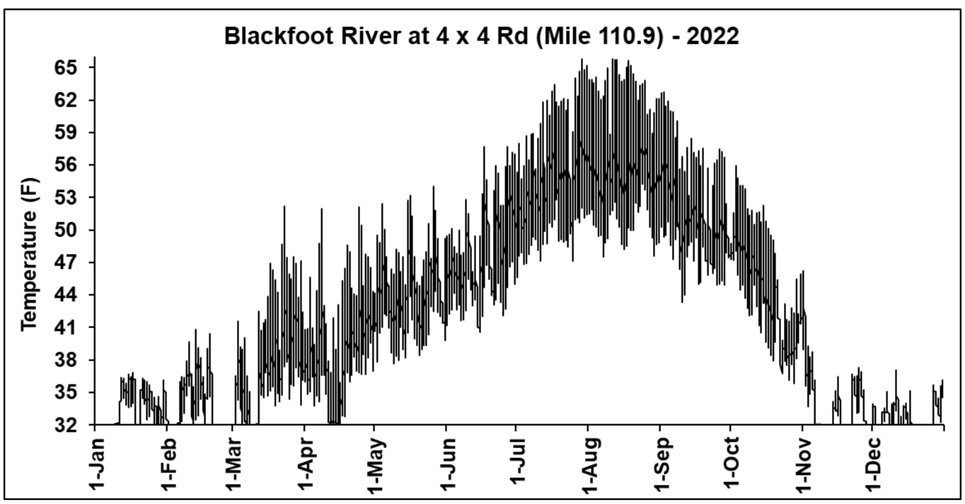
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	39.3	32.2	35.9	1.9	3.5
February	42.0	32.1	36.3	2.7	7.2
March	49.8	32.3	40.1	3.5	12.5
April	51.7	33.4	41.3	3.9	15.0
May	56.3	39.4	46.2	3.4	11.8
June	59.1	42.2	49.5	3.8	14.6
July	64.5	48.0	55.5	4.0	16.0
August	64.3	48.0	56.0	4.0	16.0
September	61.0	43.9	51.2	3.4	11.6
October	55.3	39.5	45.8	3.3	11.1
November	46.2	32.1	36.9	2.9	8.2
December	40.3	31.7	35.8	2.2	4.9



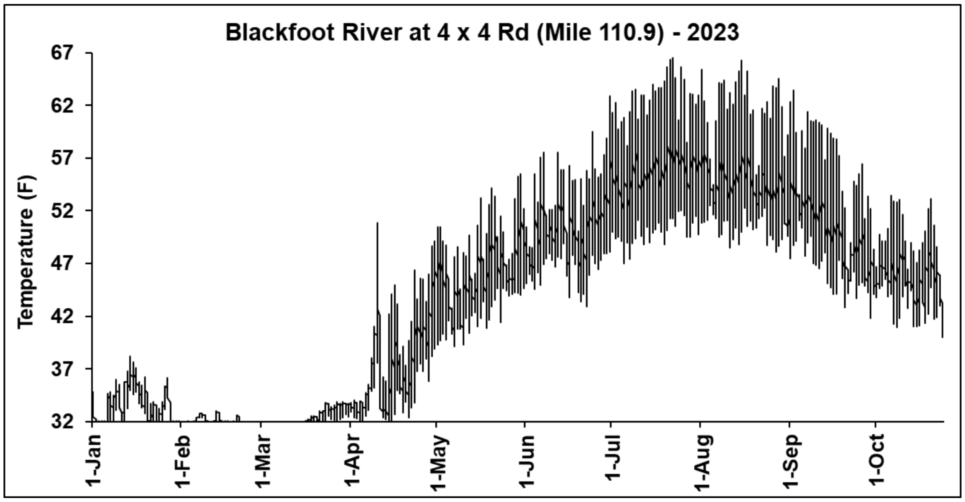
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	41.3	32.0	36.3	2.1	4.6
February	40.1	32.0	35.8	2.1	4.2
March	45.3	32.2	37.7	2.8	7.9
April	52.3	34.4	42.4	3.8	14.3
May	56.5	40.5	47.4	3.3	11.1
June	61.7	45.0	51.6	3.2	9.9
July	64.3	49.1	56.1	3.7	13.4
August	62.4	49.3	54.9	3.1	9.6
September	58.8	44.5	50.9	3.2	10.0
October	51.6	43.4	47.1	1.8	3.4
November					
December					



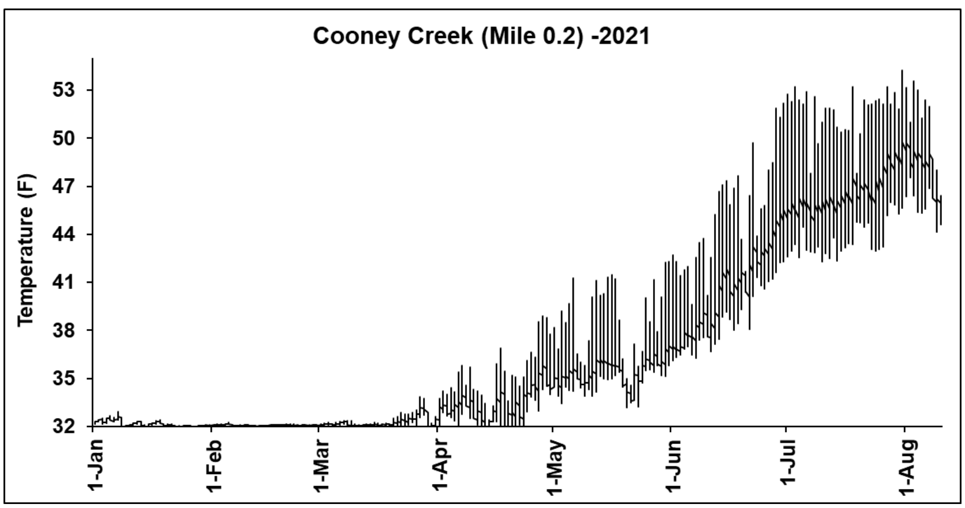
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	62.3	46.9	53.4	4.0	16.4
July	66.2	47.7	55.4	4.3	18.6
August	66.3	43.9	53.4	5.1	25.7
September	62.2	43.3	50.9	5.6	31.5
October	49.6	34.4	42.5	2.9	8.7
November	45.7	32.2	38.2	2.8	8.1
December	47.3	32.0	34.8	3.2	10.3



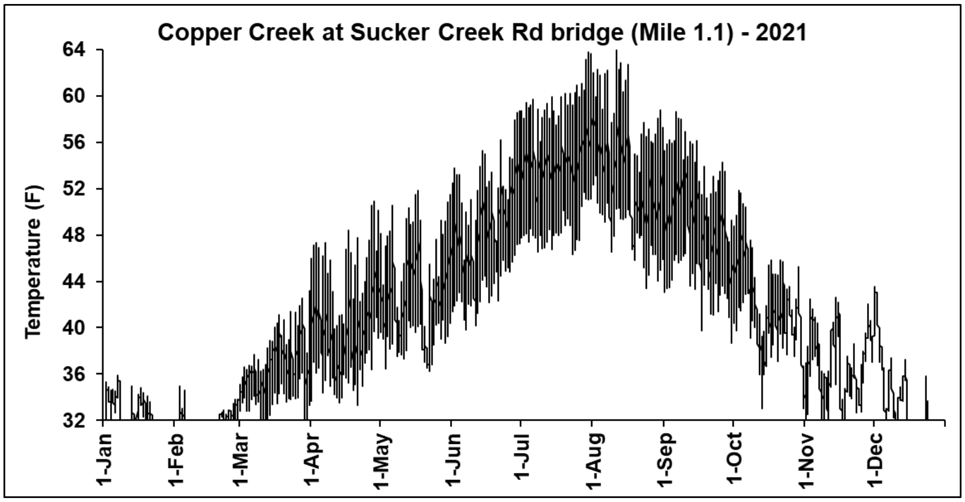
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.8	32.0	33.4	1.5	2.2
February	40.8	26.7	33.6	2.3	5.1
March	52.2	29.1	37.2	4.4	19.1
April	52.1	32.0	39.0	4.3	18.3
May	54.0	37.7	44.0	3.4	11.6
June	57.7	40.6	47.4	3.9	15.4
July	65.8	45.6	54.5	4.5	19.8
August	65.8	47.5	56.2	4.7	21.8
September	62.7	43.4	51.5	4.1	17.1
October	55.9	35.8	44.4	4.5	20.1
November	46.2	32.0	33.9	2.6	6.8
December	37.1	31.9	32.7	1.1	1.2



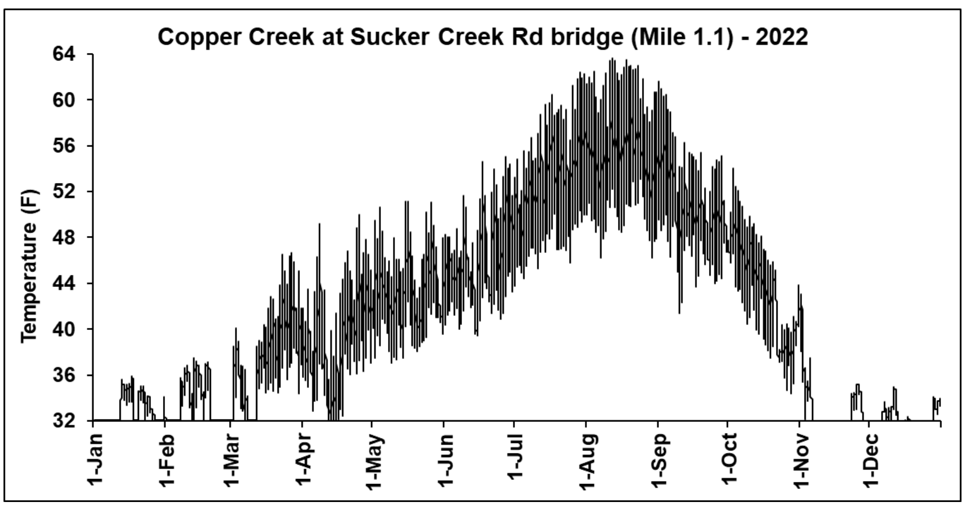
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	38.2	32.0	33.3	1.5	2.3
February	33.0	28.4	32.0	0.4	0.2
March	33.9	31.7	32.3	0.5	0.3
April	50.8	32.0	37.1	4.2	17.7
May	55.5	39.1	45.6	3.5	11.9
June	62.9	42.9	50.3	3.6	12.7
July	66.5	47.0	56.1	4.5	20.0
August	66.3	48.1	55.2	4.2	17.9
September	63.4	41.8	50.7	4.6	21.1
October	53.4	40.0	45.8	2.8	8.1
November					
December					



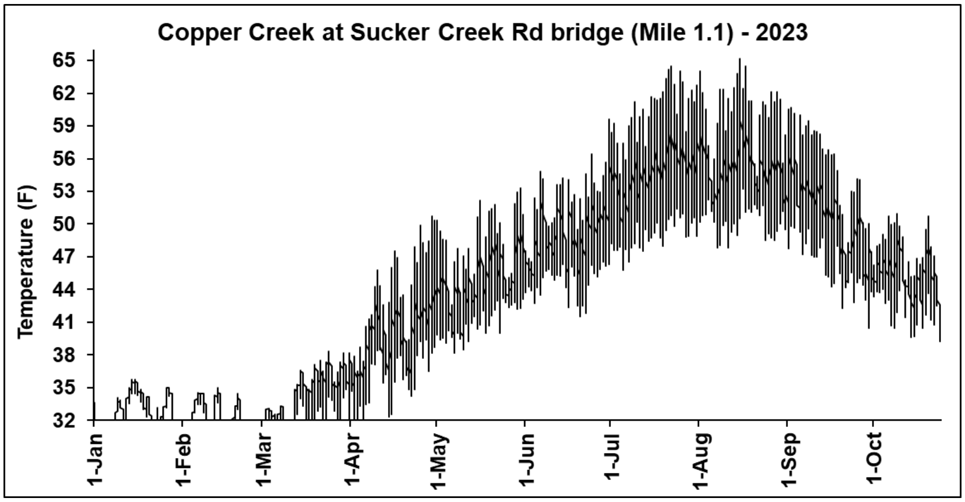
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.9	32.0	32.2	0.2	0.0
February	32.2	32.0	32.1	0.0	0.0
March	33.8	32.0	32.2	0.3	0.1
April	38.9	31.9	33.6	1.4	2.0
May	42.3	33.2	36.1	1.7	3.0
June	52.2	36.1	41.1	3.3	10.6
July	54.3	42.3	46.9	2.9	8.3
August	53.6	44.2	48.2	2.3	5.2
September					
October					
November					
December					



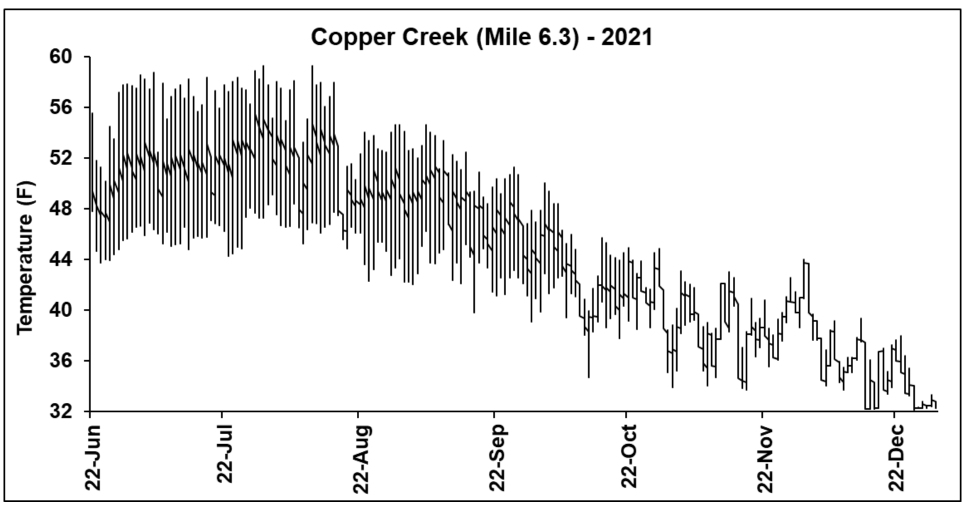
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.9	31.9	32.7	1.0	1.0
February	35.0	32.0	32.2	0.5	0.2
March	43.2	31.9	35.9	2.4	5.7
April	50.9	33.3	40.0	3.9	15.4
May	51.9	36.3	42.5	3.7	13.9
June	58.7	39.8	47.8	4.1	16.5
July	63.8	46.3	53.7	4.1	16.6
August	64.0	43.4	52.8	4.5	20.5
September	58.7	38.7	48.5	4.2	17.7
October	51.9	33.0	41.8	3.5	12.4
November	42.6	30.3	36.5	2.8	7.9
December	43.5	32.0	33.8	2.8	8.1



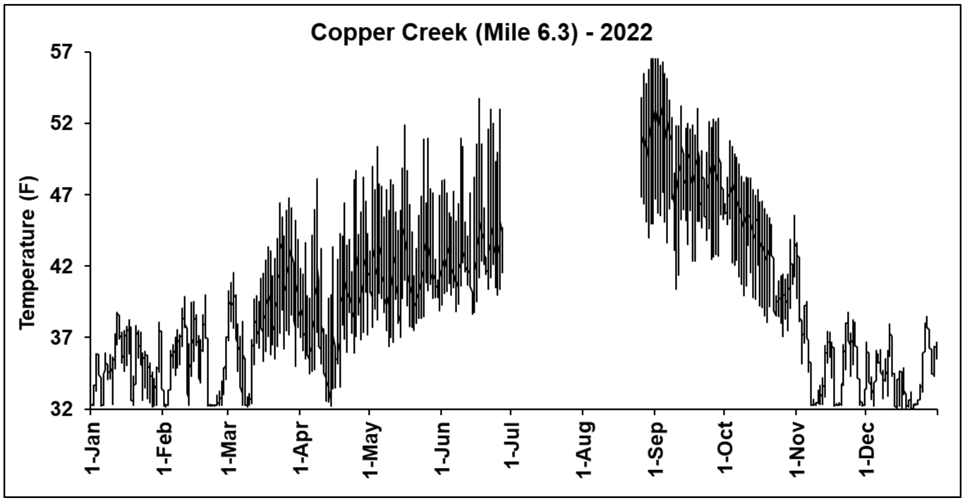
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.9	32.0	32.8	1.1	1.2
February	37.5	32.0	33.3	1.7	2.8
March	46.7	32.0	37.0	3.7	13.8
April	50.0	32.1	38.8	4.2	17.4
May	51.1	37.0	43.0	3.2	9.9
June	55.0	39.5	45.7	3.6	12.7
July	62.4	43.8	52.2	4.2	17.7
August	63.6	46.2	55.1	4.3	18.3
September	61.6	41.4	50.3	3.9	15.1
October	54.4	34.4	34.4	4.2	17.6
November	43.1	31.9	31.9	2.1	4.5
December	35.0	31.6	31.6	0.7	0.4



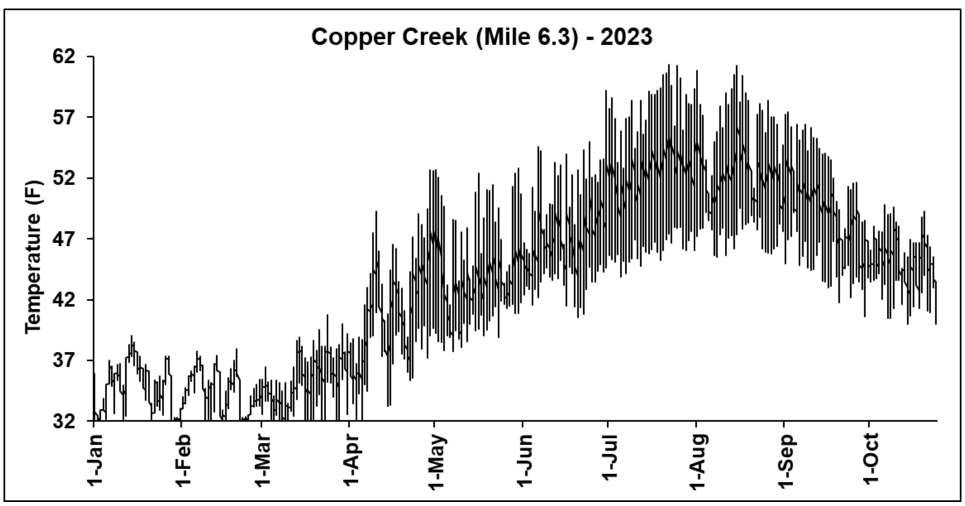
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.7	31.9	32.8	1.1	1.3
February	35.0	31.3	32.4	0.8	0.6
March	38.3	31.3	33.5	1.8	3.2
April	50.8	31.7	39.4	4.1	16.5
May	53.3	38.2	44.4	3.3	10.9
June	59.6	41.5	48.4	3.3	11.0
July	64.5	45.8	54.4	4.4	18.9
August	65.1	47.8	54.9	4.0	15.7
September	60.6	40.4	50.3	4.4	19.1
October	51.0	39.2	44.9	2.5	6.4
November					
December					



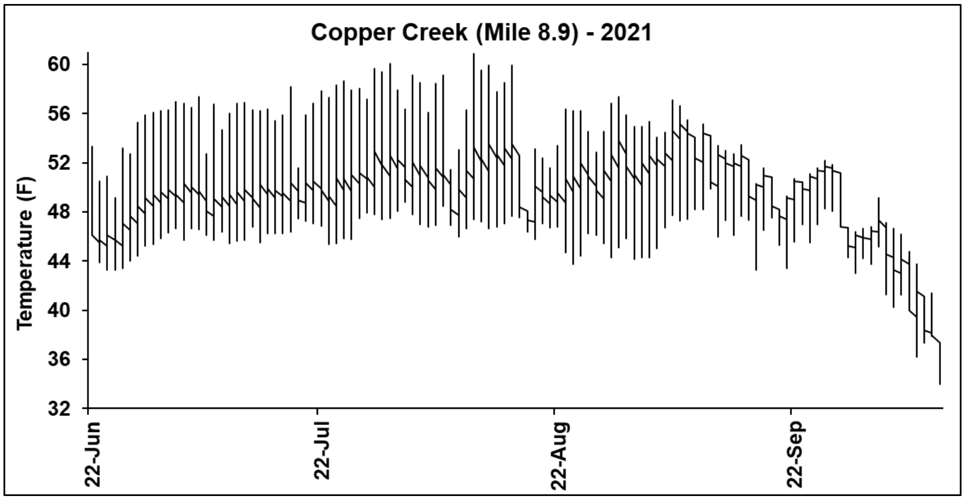
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	57.9	43.8	49.3	3.9	15.1
July	59.3	44.3	51.3	4.1	16.5
August	59.2	42.3	50.2	3.7	13.8
September	54.6	39.1	47.0	3.3	10.7
October	50.0	34.7	42.1	2.7	7.2
November	43.1	33.7	38.7	2.2	4.7
December	44.0	32.1	35.6	2.8	7.7



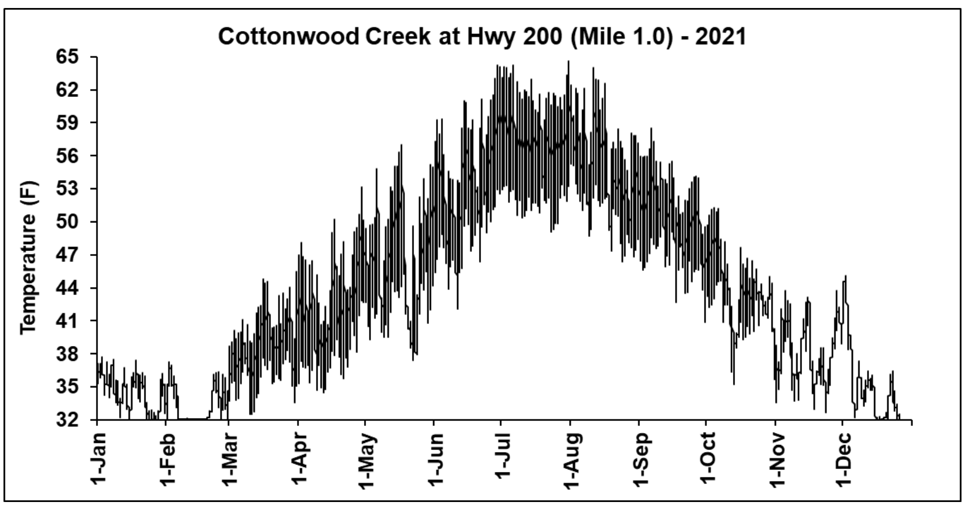
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	38.7	32.1	35.0	1.8	3.1
February	40.0	32.1	35.0	2.2	5.0
March	46.8	32.1	38.6	3.4	11.6
April	48.7	32.2	39.4	3.7	13.5
May	51.9	36.4	42.4	3.3	10.8
June	53.8	38.7	43.9	3.4	11.3
July					
August	56.6	44.0	50.5	3.7	13.8
September	56.6	40.4	48.3	3.3	11.0
October	50.8	37.1	43.3	3.1	9.9
November	43.6	32.2	35.2	2.7	7.1
December	38.5	32.0	34.4	1.7	2.8



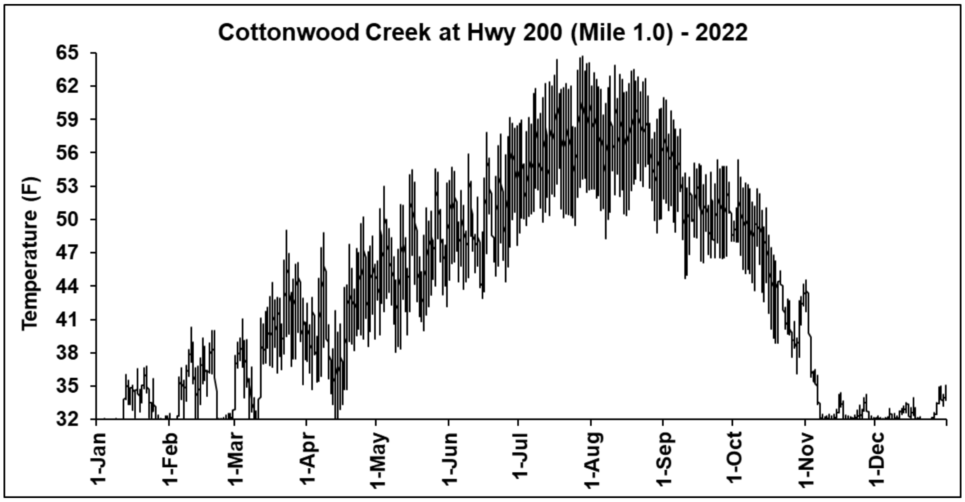
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	39.1	32.0	34.7	1.9	3.6
February	38.0	32.0	34.4	1.9	3.6
March	40.8	32.0	35.0	2.1	4.2
April	52.7	32.0	40.5	4.2	17.7
May	52.8	37.8	43.6	3.6	12.9
June	59.2	40.5	47.0	3.4	11.7
July	61.3	43.9	51.7	4.3	18.3
August	61.2	45.5	51.8	3.6	12.9
September	57.5	40.6	48.5	3.6	13.0
October	49.8	40.0	44.8	2.1	4.6
November					
December					



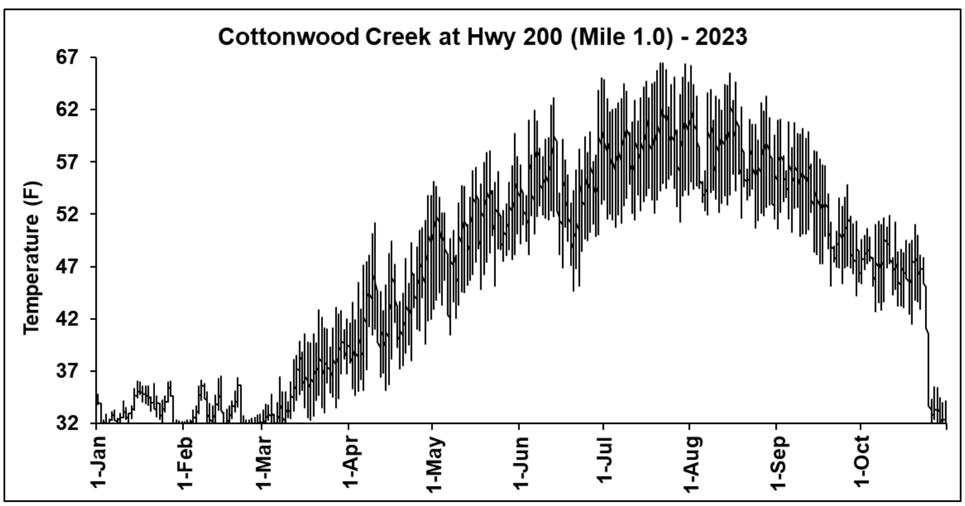
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	56.1	43.3	48.1	3.5	12.3
July	60.0	45.4	50.9	3.8	14.2
August	60.9	43.7	50.7	3.8	14.4
September	57.1	43.0	49.3	2.9	8.6
October	49.2	34.0	42.4	3.7	13.5
November					
December					



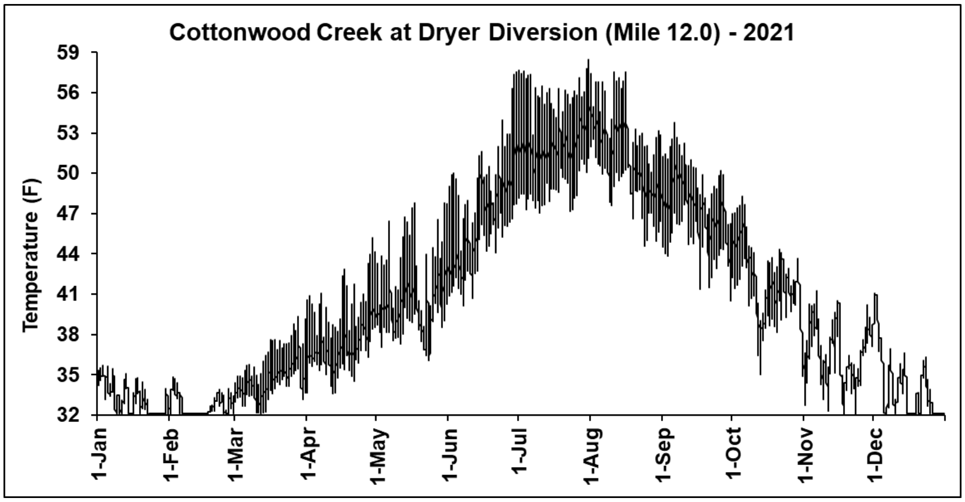
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	37.7	31.9	34.5	1.6	2.5
February	37.3	32.0	33.2	1.5	2.2
March	45.5	32.5	38.4	2.5	6.4
April	53.2	34.5	41.6	3.9	15.2
May	57.0	37.4	45.8	4.4	19.5
June	64.2	42.1	52.9	4.4	19.7
July	64.6	49.1	56.6	3.6	13.1
August	64.0	46.4	54.4	3.8	14.4
September	58.5	40.9	49.9	3.3	10.7
October	51.3	35.2	43.4	3.0	9.3
November	43.8	32.6	38.0	2.7	7.1
December	45.1	31.9	34.6	3.2	10.3



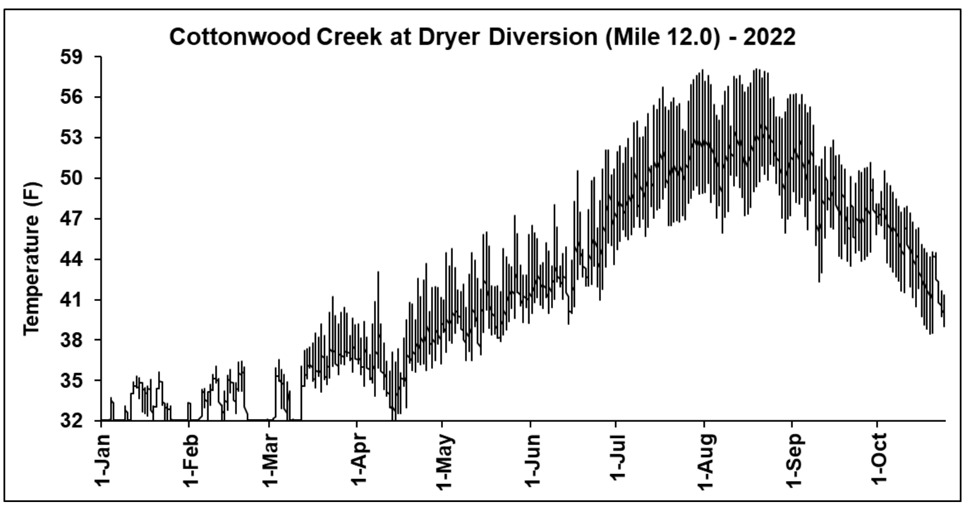
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.8	31.9	33.0	1.3	1.8
February	40.3	31.9	34.4	2.5	6.1
March	49.0	31.9	38.7	3.6	13.1
April	50.2	32.0	40.4	4.0	16.2
May	54.6	38.1	40.0	3.5	12.5
June	59.2	42.9	49.8	3.7	13.8
July	64.7	48.8	56.0	3.8	14.4
August	63.9	48.3	56.7	3.5	12.1
September	60.9	44.7	51.7	3.2	10.3
October	55.3	36.1	45.2	4.3	18.4
November	44.6	31.9	33.6	2.7	7.5
December	35.1	31.9	32.6	0.7	0.5



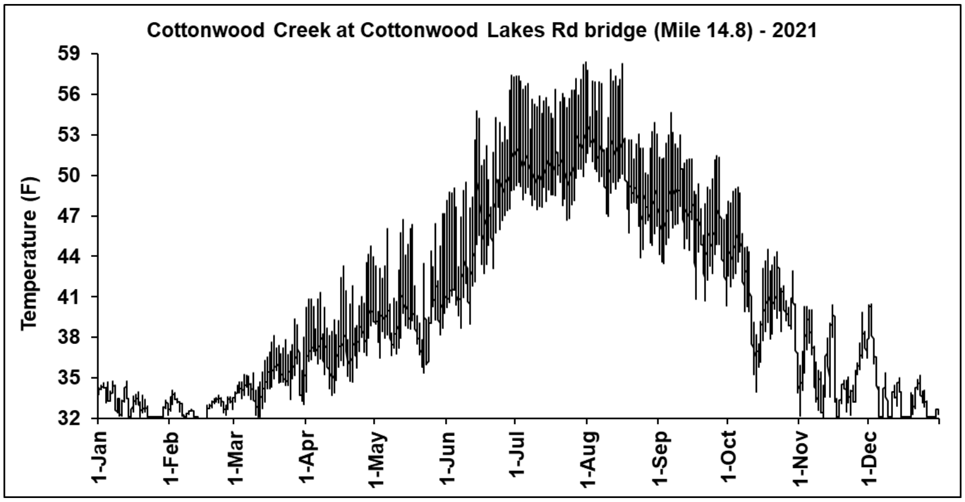
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.0	31.9	33.4	1.2	1.3
February	36.6	31.9	33.0	1.2	1.5
March	43.1	31.9	35.8	2.9	8.7
April	53.8	34.7	42.7	4.1	16.5
May	59.7	40.5	49.9	3.8	14.3
June	65.0	44.7	54.0	3.8	14.2
July	66.5	50.8	58.3	3.7	14.0
August	66.2	50.7	57.3	3.4	11.4
September	61.1	44.3	52.3	3.9	15.0
October	51.9	32.0	43.9	5.9	34.6
November					
December					



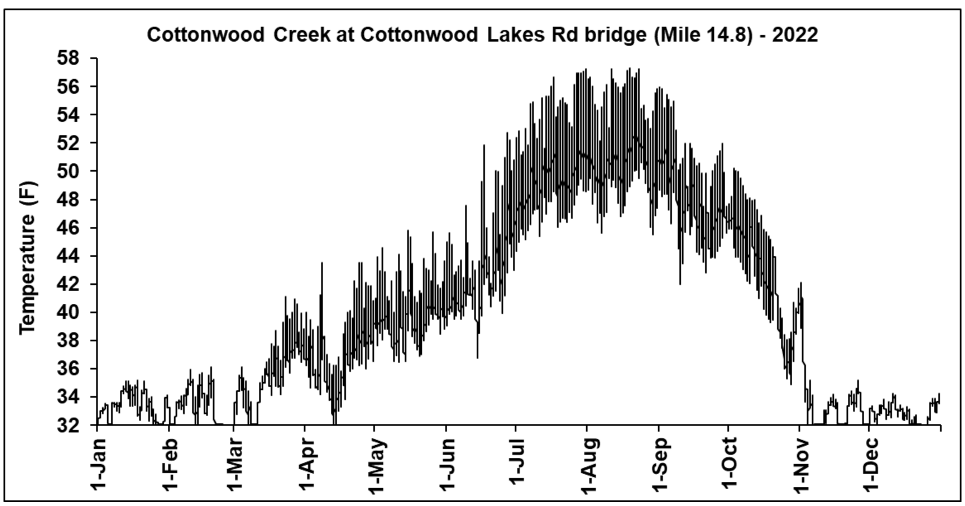
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.7	31.8	33.2	1.1	1.2
February	34.8	32.0	32.7	0.7	0.5
March	39.4	32.1	34.8	1.5	2.1
April	45.2	33.6	37.7	2.1	4.5
May	47.8	36.1	40.6	2.5	6.2
June	57.5	40.2	46.7	3.4	11.7
July	58.5	47.1	51.9	2.7	7.1
August	57.5	44.6	51.1	2.8	7.9
September	53.8	40.5	47.1	2.5	6.5
October	48.3	34.9	41.7	2.5	6.5
November	41.2	32.0	36.4	2.1	4.4
December	41.0	32.1	34.0	2.3	5.5



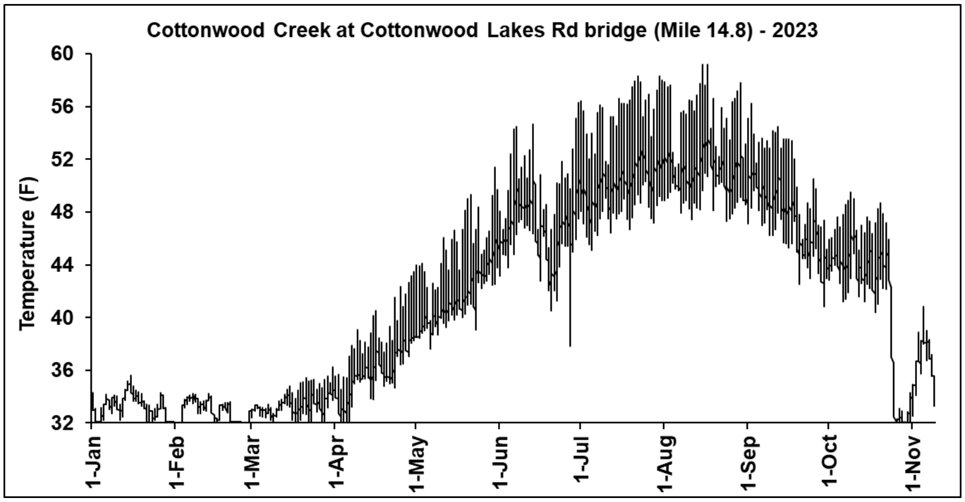
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.6	32.0	32.9	1.0	1.1
February	36.4	32.0	33.3	1.3	1.7
March	41.2	32.0	35.4	2.2	4.9
April	43.7	32.1	36.9	2.4	5.6
May	47.2	36.5	40.6	2.1	4.3
June	52.1	39.2	439.0	2.7	7.6
July	58.1	44.7	50.3	2.9	8.6
August	58.1	45.9	52.1	2.8	8.1
September	56.3	42.3	48.6	2.9	8.2
October	50.6	38.5	44.1	2.8	7.8
November					
December					



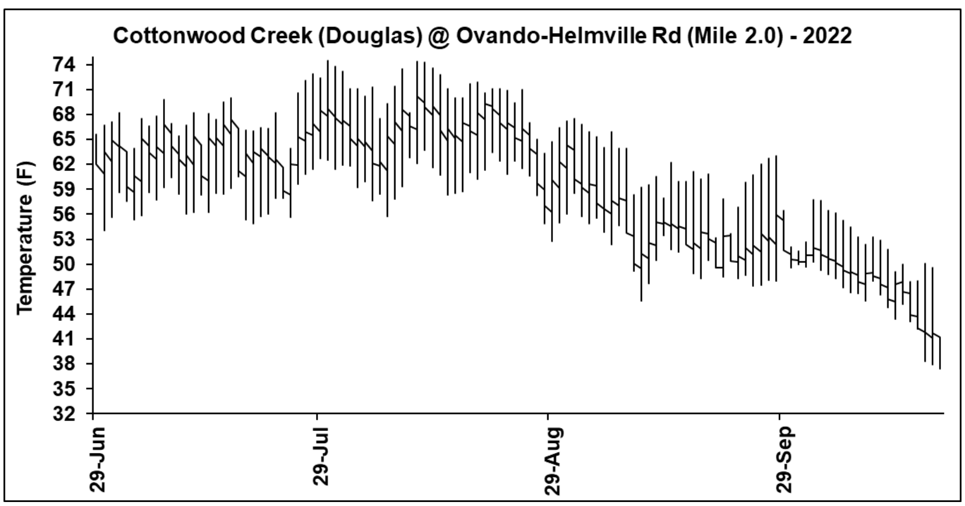
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	34.8	32.1	33.1	0.8	0.7
February	34.1	29.1	32.5	1.1	1.2
March	39.4	32.1	34.9	1.3	1.7
April	44.8	33.7	37.8	2.0	4.1
May	47.2	35.4	40.0	2.4	5.6
June	57.4	38.7	46.5	4.1	16.5
July	58.4	46.7	51.6	2.6	6.6
August	58.2	43.9	50.5	3.0	8.8
September	54.6	40.3	46.9	2.8	7.6
October	49.1	33.9	41.1	3.1	9.5
November	40.4	32.0	35.6	2.2	4.9
December	40.4	32.0	33.6	2.0	4.0



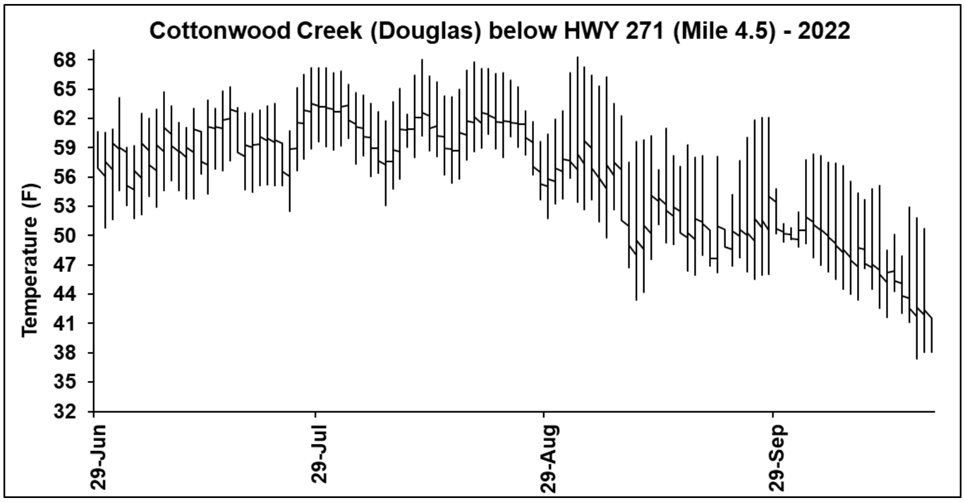
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.2	32.0	33.3	0.9	0.8
February	36.1	30.3	33.2	1.3	1.6
March	41.1	31.9	35.5	2.1	4.3
April	4.4	32.0	36.9	2.3	5.2
May	45.8	36.5	40.0	1.8	3.3
June	52.7	36.8	43.0	3.0	9.2
July	57.2	44.3	49.9	2.8	7.9
August	57.3	45.5	51.1	2.7	7.3
September	55.9	42.0	48.0	2.8	7.6
October	50.2	34.9	42.5	3.7	13.4
November	42.1	32.0	33.5	1.9	3.7
December	34.2	31.2	32.8	0.7	0.4



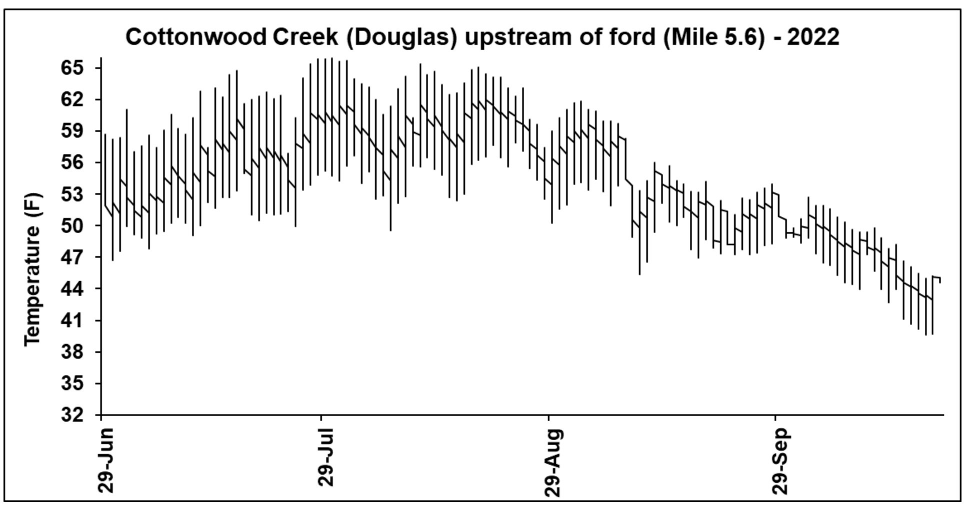
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.6	32.0	33.2	0.9	0.7
February	34.2	31.3	32.8	0.8	0.7
March	36.3	32.0	33.3	0.8	0.7
April	43.4	32.0	36.4	2.2	4.9
May	51.4	37.6	42.3	2.6	7.0
June	56.3	37.8	47.3	2.8	7.8
July	58.3	45.1	51.0	2.9	8.6
August	59.2	47.3	51.7	2.5	6.2
September	56.2	40.8	48.0	3.0	8.9
October	49.5	32.0	41.7	5.2	27.1
November	40.9	32.5	36.7	1.8	3.2
December					



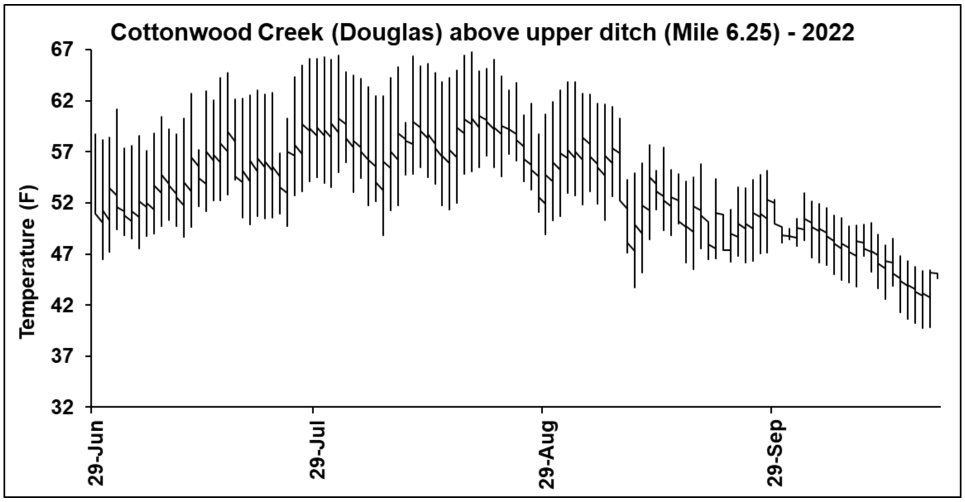
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	66.7	54.0	61.5	4.3	18.4
July	74.5	55.0	63.0	4.1	17.2
August	74.3	52.7	64.8	4.4	19.6
September	67.5	45.6	55.0	4.5	20.6
October	57.8	37.4	48.5	4.0	15.9
November					
December					



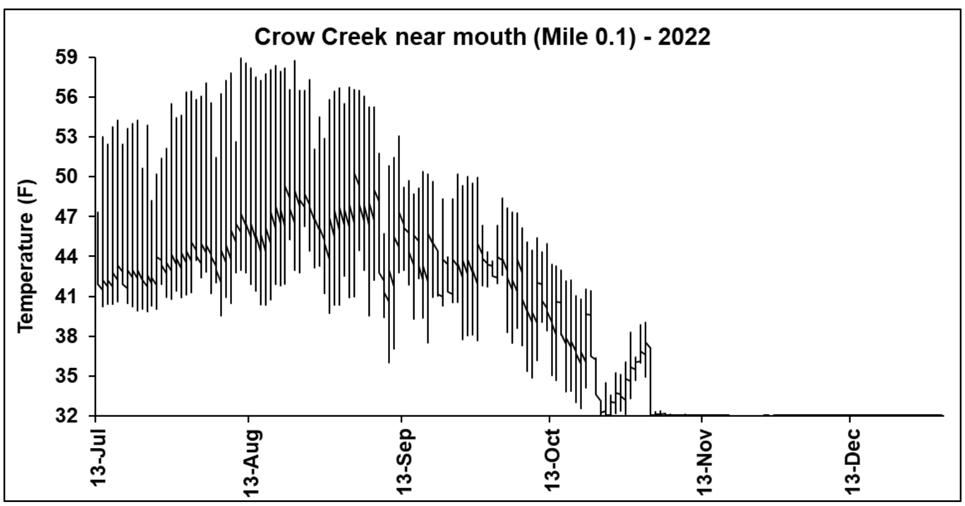
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	60.6	50.8	56.6	3.3	10.7
July	67.2	51.7	59.2	3.4	11.5
August	68.0	51.9	60.5	3.2	9.9
September	68.3	43.4	53.4	5.0	25.3
October	58.4	37.4	48.1	4.4	19.8
November					
December					



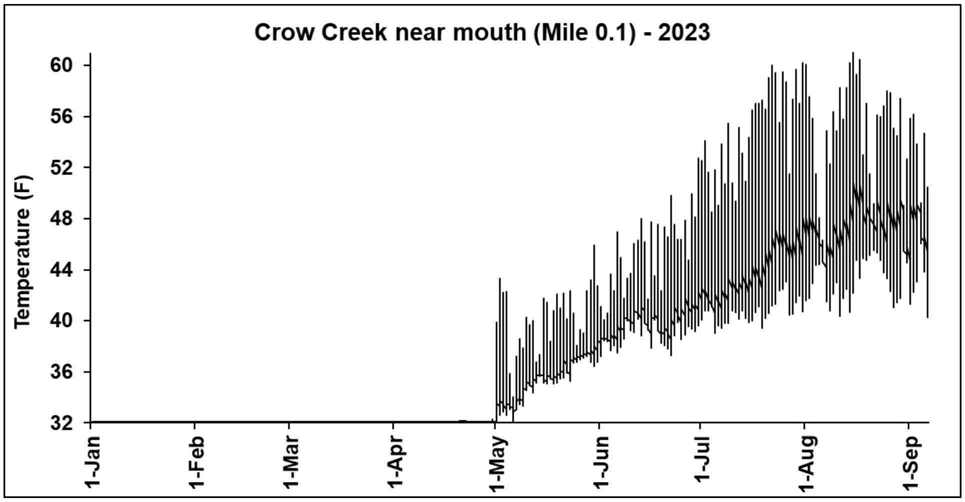
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	58.7	46.8	53.3	4.1	16.7
July	65.9	47.6	56.1	4.3	18.6
August	65.7	49.5	58.4	3.5	12.1
September	61.8	45.4	52.4	3.6	13.0
October	52.7	39.6	56.7	2.9	8.7
November					
December					



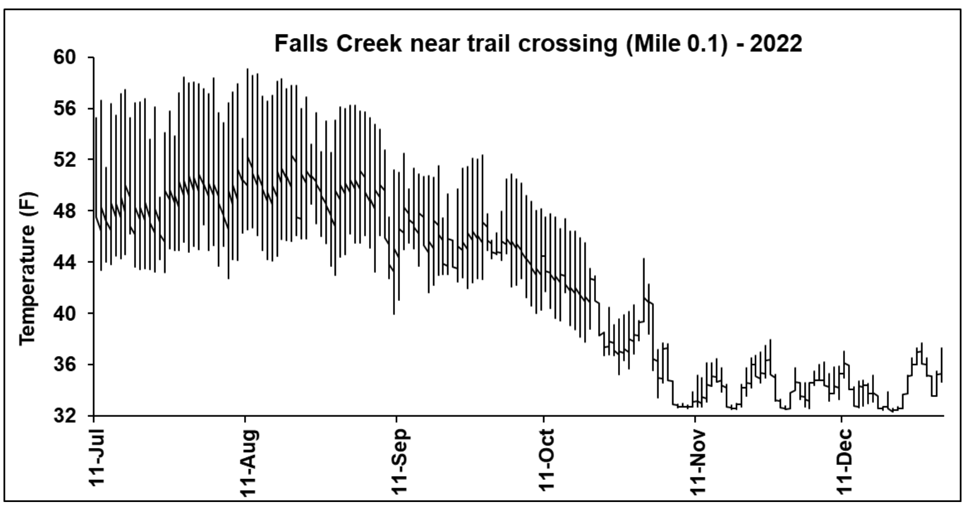
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	58.8	46.4	53.0	4.2	17.6
July	66.3	47.2	55.7	4.4	19.4
August	66.7	48.9	58.2	4.0	16.0
September	63.9	43.7	52.2	4.1	17.0
October	52.9	39.7	46.6	2.9	8.3
November					
December					



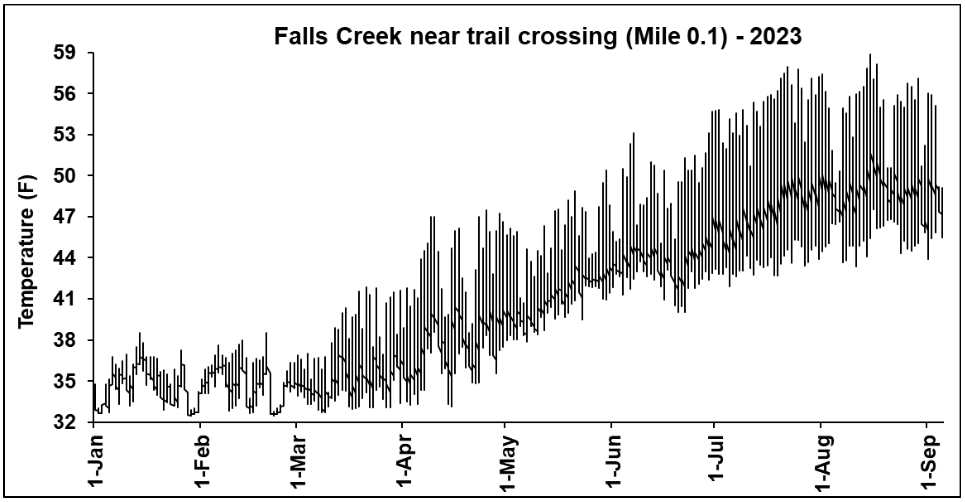
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	56.3	39.8	45.3	4.4	19.1
August	58.9	39.5	47.8	5.2	26.8
September	56.7	36.0	45.0	4.3	18.5
October	48.4	32.1	38.3	4.2	17.6
November	39.0	31.2	32.2	1.0	1.0
December	32.1	32.0	32.1	0.0	0.0



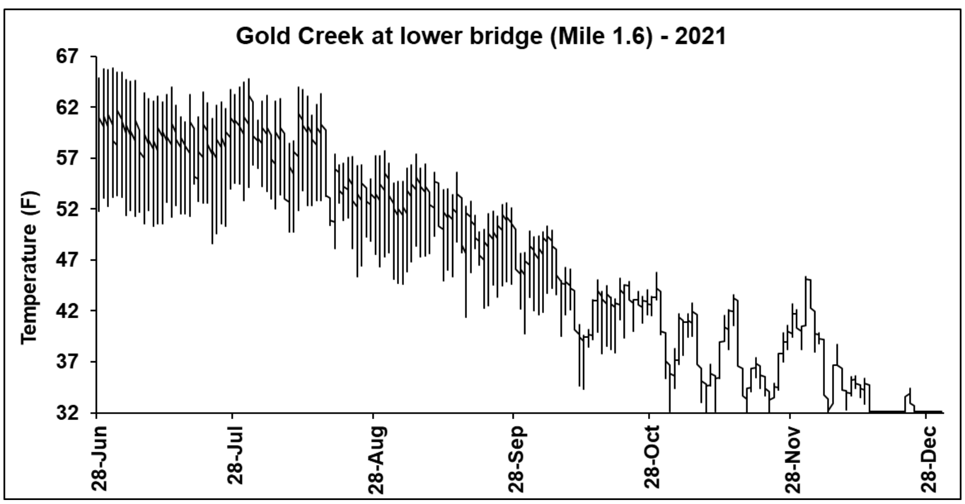
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.1	32.1	32.1	0.0	0.0
February	32.1	32.1	32.1	0.0	0.0
March	32.1	32.1	32.1	0.0	0.0
April	32.3	32.1	32.1	0.0	0.0
May	45.9	32.1	36.7	2.5	6.2
June	52.7	37.2	41.3	2.8	7.6
July	60.2	39.0	46.2	5.4	28.8
August	61.0	40.4	48.4	4.7	22.4
September	56.2	40.3	47.6	4.2	17.3
October					
November					
December					



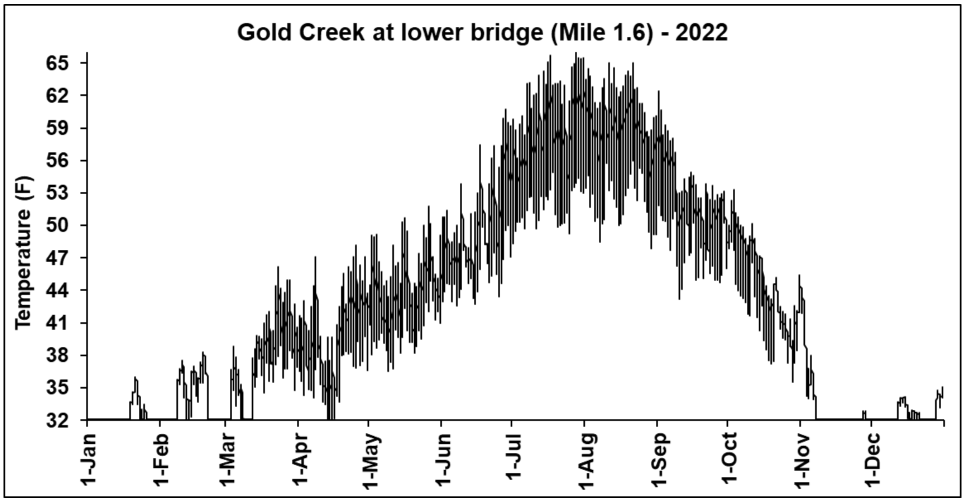
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	58.5	43.2	49.3	4.2	17.5
August	59.1	42.8	50.2	4.0	15.9
September	56.3	40.0	47.0	3.2	10.5
October	50.8	35.2	42.0	3.5	12.1
November	42.3	32.5	34.5	1.9	3.8
December	37.7	32.3	34.3	1.3	1.6



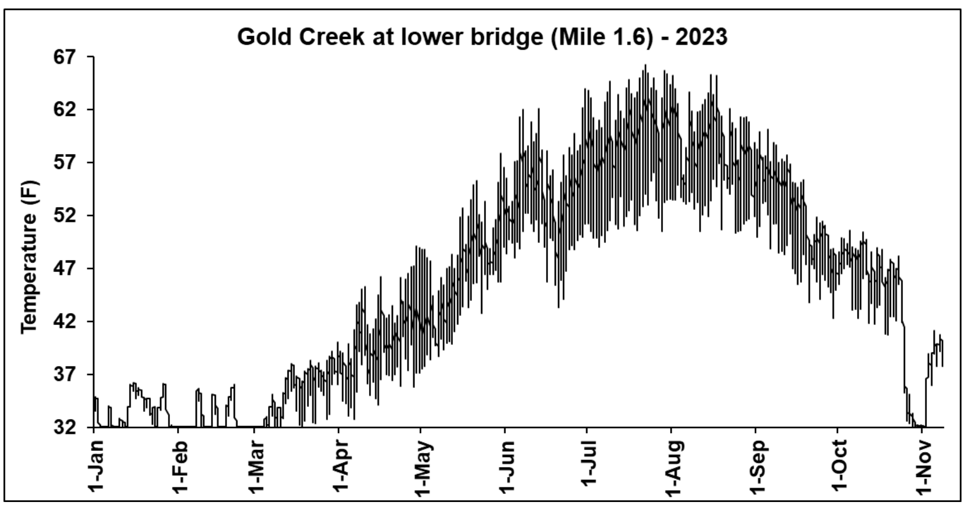
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	38.5	32.5	34.6	1.4	1.9
February	38.5	32.4	34.7	1.3	1.8
March	41.8	32.7	35.4	2.1	4.3
April	47.5	33.1	38.8	3.3	10.9
May	50.4	37.9	42.2	2.6	6.8
June	54.7	40.0	45.2	2.9	8.4
July	58.0	41.9	48.7	4.2	17.7
August	58.8	43.4	49.6	3.5	12.3
September	56.0	43.9	48.9	3.2	10.0
October					
November					
December					



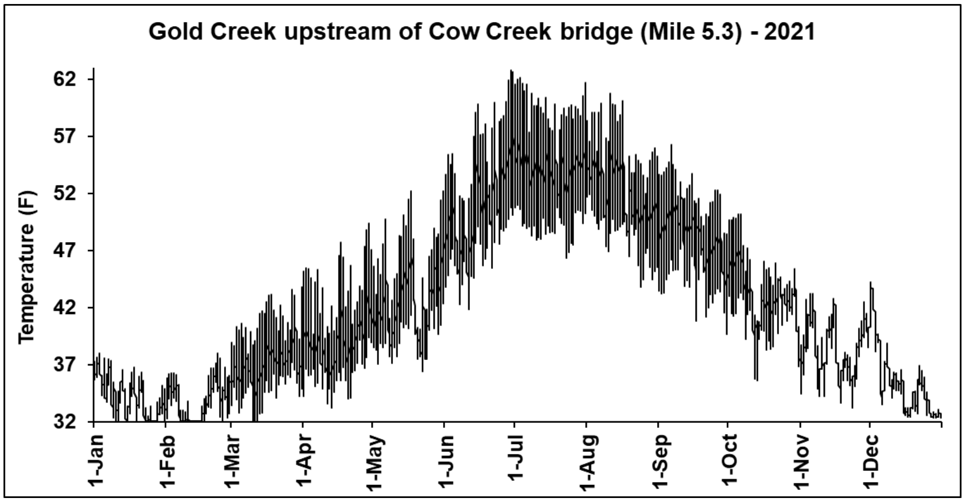
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	65.7	51.8	59.6	4.7	21.7
July	65.8	48.6	57.5	4.1	16.9
August	64.0	45.4	55.1	4.0	16.2
September	57.4	39.8	49.6	3.5	12.2
October	50.3	34.3	42.8	3.1	9.7
November	43.6	32.0	37.3	3.0	9.2
December	45.4	32.0	34.3	3.3	11.0



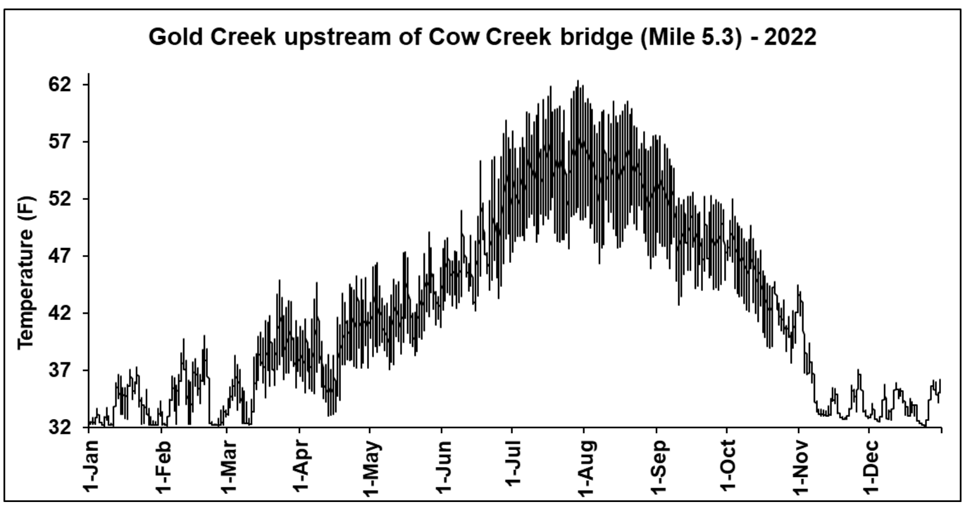
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.0	32.0	32.4	0.8	0.6
February	38.3	32.0	33.6	2.0	3.8
March	46.2	32.1	37.0	3.6	12.6
April	48.1	32.0	39.1	3.7	13.5
May	51.8	36.5	43.3	3.2	10.0
June	60.7	42.6	49.0	4.0	16.4
July	66.0	48.4	57.0	4.4	19.0
August	65.0	47.9	57.4	4.0	15.8
September	62.4	43.2	51.2	3.6	13.2
October	53.3	35.5	44.1	3.9	15.5
November	44.2	32.0	33.3	2.8	7.8
December	35.1	32.0	32.5	0.8	0.6



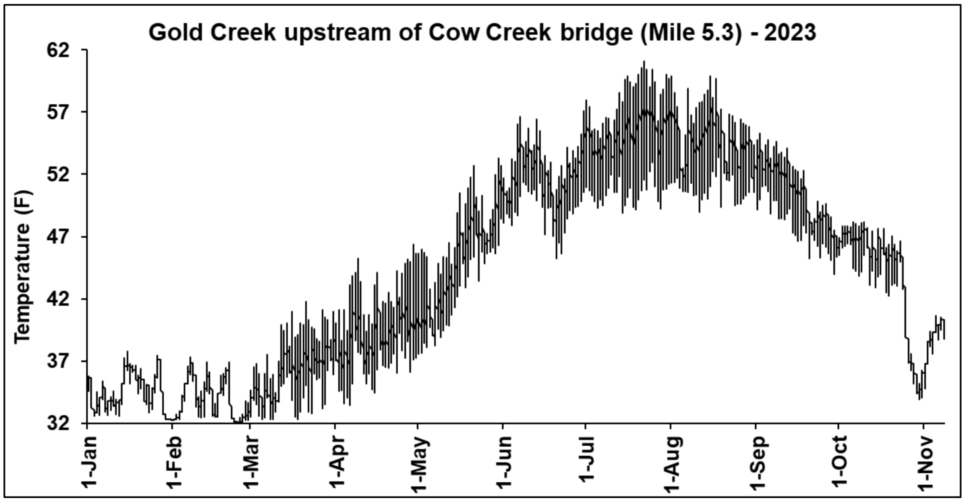
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.2	32.0	33.3	1.4	1.9
February	36.0	32.0	32.7	1.1	1.2
March	40.0	32.0	34.9	2.2	4.9
April	49.1	32.8	39.9	3.2	10.4
May	57.9	37.6	46.2	4.3	18.4
June	64.0	43.4	53.4	3.9	15.2
July	66.3	49.0	57.8	4.3	18.5
August	65.3	50.4	57.2	3.4	11.7
September	60.2	42.3	51.4	3.9	15.3
October	50.6	32.0	43.4	5.8	34.0
November	41.1	32.1	37.4	2.8	7.9
December					



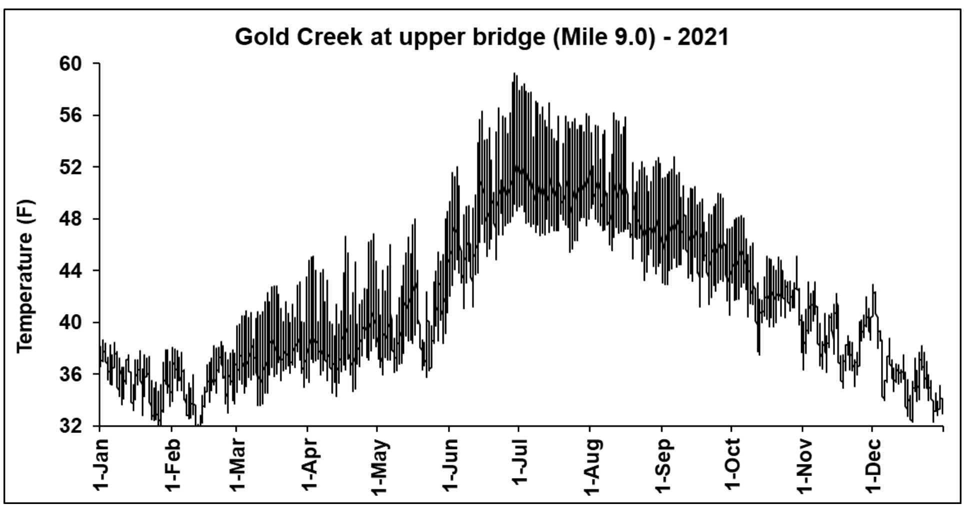
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	38.0	32.0	34.2	1.6	2.7
February	38.0	32.0	33.7	1.5	2.4
March	43.8	32.0	37.3	2.4	5.7
April	49.4	33.2	39.5	3.3	10.7
May	52.2	36.4	42.5	3.5	12.1
June	62.8	41.9	51.1	4.4	19.2
July	62.2	46.3	54.1	3.7	13.9
August	60.8	43.8	52.0	3.5	12.1
September	56.3	39.7	47.9	3.2	10.2
October	50.2	35.6	42.8	2.7	7.4
November	43.3	33.2	38.3	2.3	5.3
December	44.2	32.3	35.2	2.8	7.7



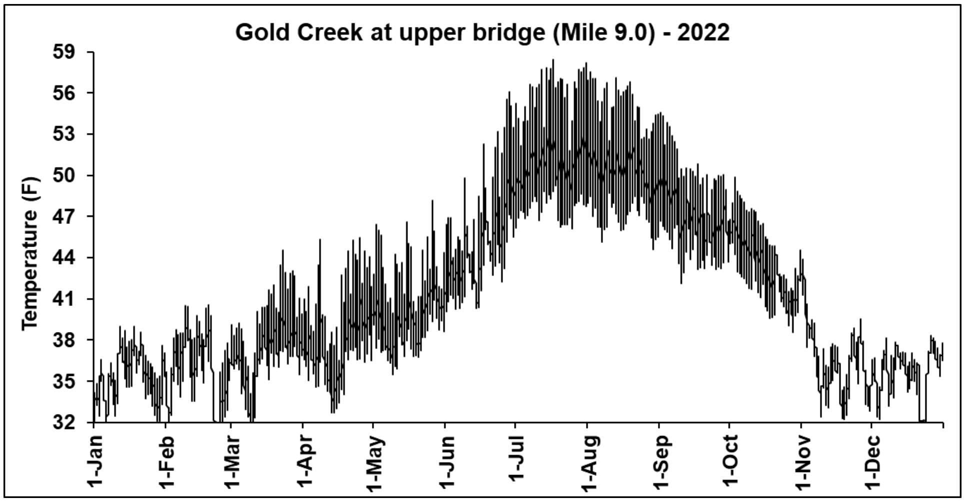
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	37.3	32.1	33.6	1.4	1.9
February	40.0	32.1	34.5	2.1	4.2
March	44.9	32.2	37.0	2.8	8.1
April	45.2	33.0	38.6	2.8	8.1
May	49.1	37.1	42.1	2.4	5.7
June	58.9	42.2	47.5	3.6	12.9
July	62.4	47.3	54.2	3.6	13.0
August	60.7	45.9	53.9	3.4	11.7
September	57.5	42.7	49.1	2.9	8.6
October	52.0	37.7	43.9	3.1	9.3
November	43.9	32.7	35.0	2.6	6.7
December	36.2	32.1	33.8	1.1	1.2



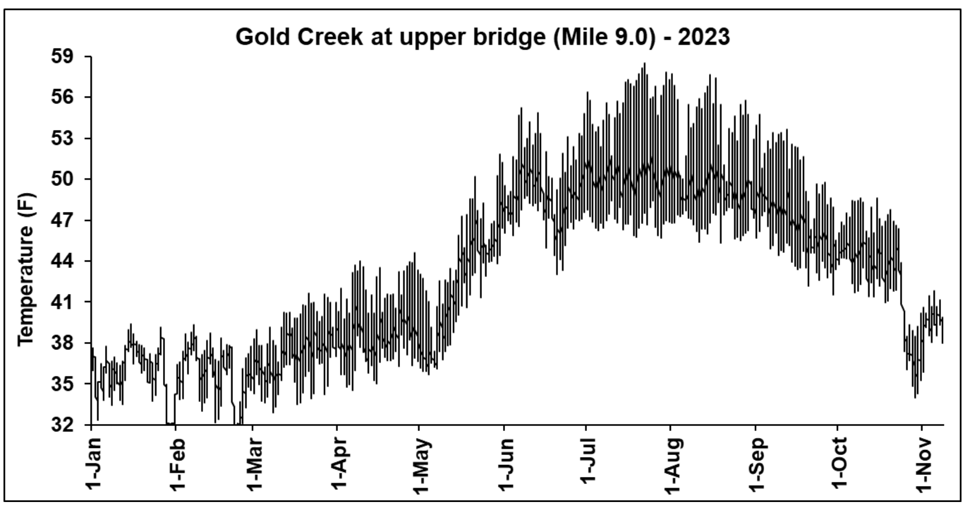
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	37.8	32.2	34.4	1.4	2.0
February	37.3	32.0	33.8	1.5	2.2
March	41.8	32.3	36.0	2.2	4.9
April	46.3	33.4	39.1	2.6	6.9
May	53.3	37.6	44.8	3.7	13.5
June	57.1	45.2	51.2.	2.3	5.1
July	61.1	48.9	54.4	2.8	7.9
August	59.9	49.0	53.7	2.4	5.6
September	55.3	43.9	49.7	2.5	6.4
October	48.2	33.9	43.6	4.2	17.4
November	40.6	34.8	38.7	1.4	1.9
December					



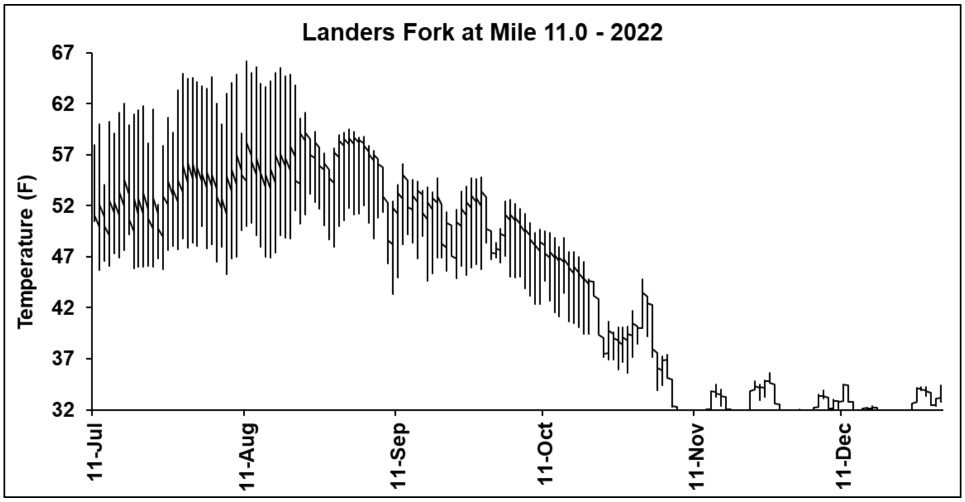
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	38.7	32.0	35.7	1.5	2.4
February	38.5	31.8	35.1	1.7	3.0
March	43.5	33.6	37.9	2.0	4.2
April	46.8	34.3	39.1	2.6	7.0
May	48.6	35.7	40.3	2.8	7.6
June	59.3	41.1	48.6	3.7	13.7
July	58.4	45.4	51.0	3.1	9.3
August	56.2	43.3	49.1	2.7	7.5
September	52.8	40.6	46.3	2.5	6.1
October	48.3	37.5	42.6	2.1	4.3
November	43.1	35.0	38.9	1.8	3.2
December	42.9	32.3	35.9	2.2	5.1



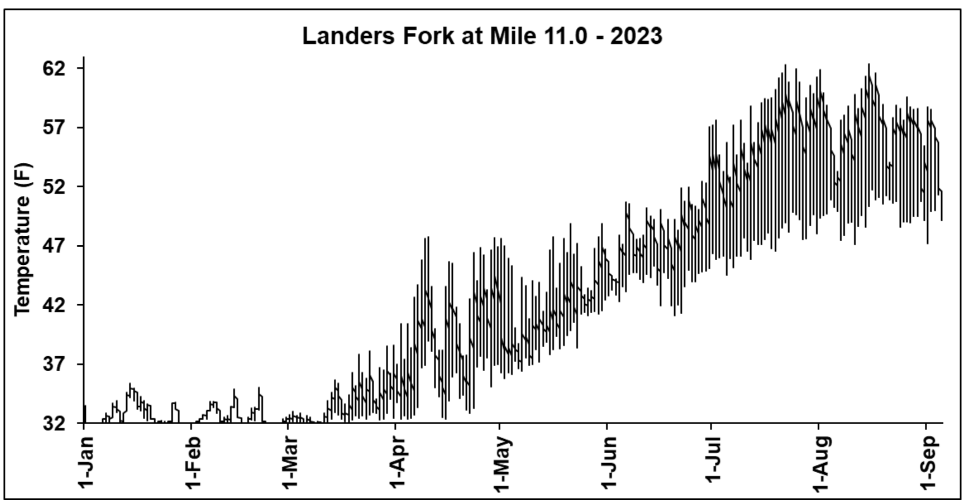
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	39.0	31.9	35.3	1.7	2.8
February	40.6	30.8	35.9	2.3	5.5
March	44.5	31.9	37.4	2.5	6.0
April	45.4	32.7	38.2	2.8	7.9
May	48.2	35.5	40.2	2.4	5.8
June	56.1	40.1	45.2	3.4	11.3
July	58.5	46.1	51.2	3.1	9.9
August	57.5	44.6	50.5	3.0	8.9
September	54.6	42.2	47.2	2.5	6.4
October	49.9	38.6	43.4	2.4	5.7
November	43.9	32.2	36.4	2.4	5.8
December	38.3	32.0	35.6	1.6	2.7



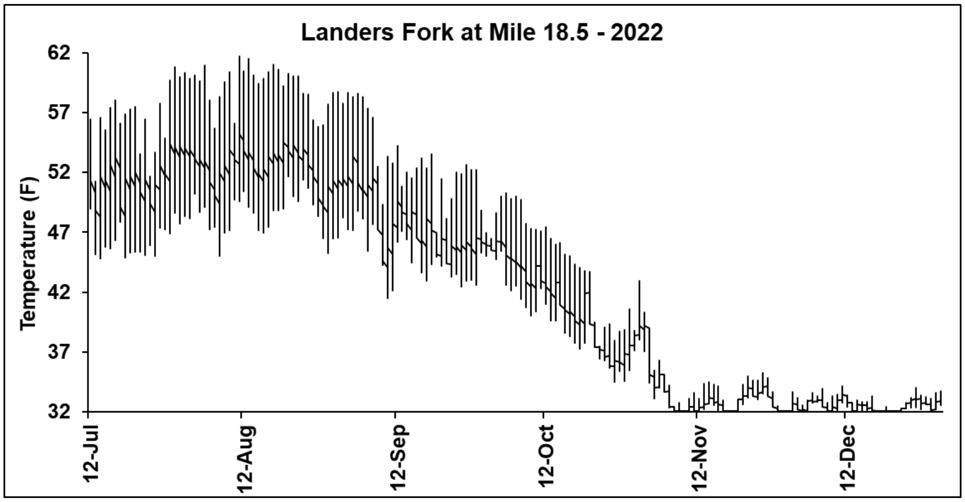
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	39.4	32.0	35.8	1.8	3.1
February	39.3	32.0	35.7	1.9	3.6
March	41.6	32.9	37.2	1.9	3.7
April	44.6	34.5	39.0	2.2	4.9
May	51.8	35.7	42.4	3.8	14.4
June	55.2	43.0	48.9	2.3	5.4
July	58.5	45.7	50.8	3.3	10.6
August	57.7	45.4	50.0	2.9	8.3
September	54.7	41.6	47.2	2.8	7.8
October	48.6	34.0	42.9	3.5	12.2
November	41.8	35.9	39.5	1.1	1.2
December					



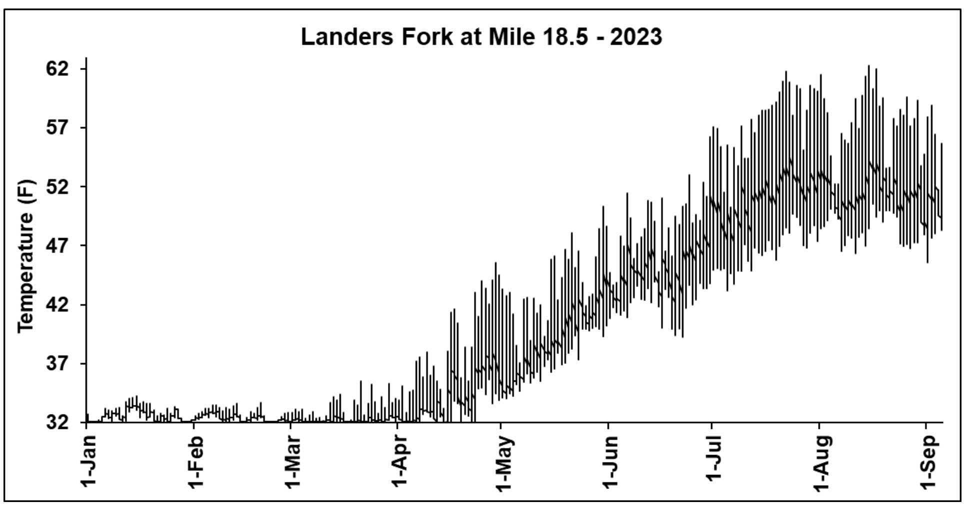
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	64.9	45.7	53.0	5.0	24.9
August	66.1	45.3	55.0	4.8	23.2
September	59.5	43.4	51.0	3.5	12.3
October	52.6	35.6	43.8	4.2	17.7
November	43.1	31.9	33.5	2.3	5.4
December	34.5	31.9	32.5	0.7	0.5



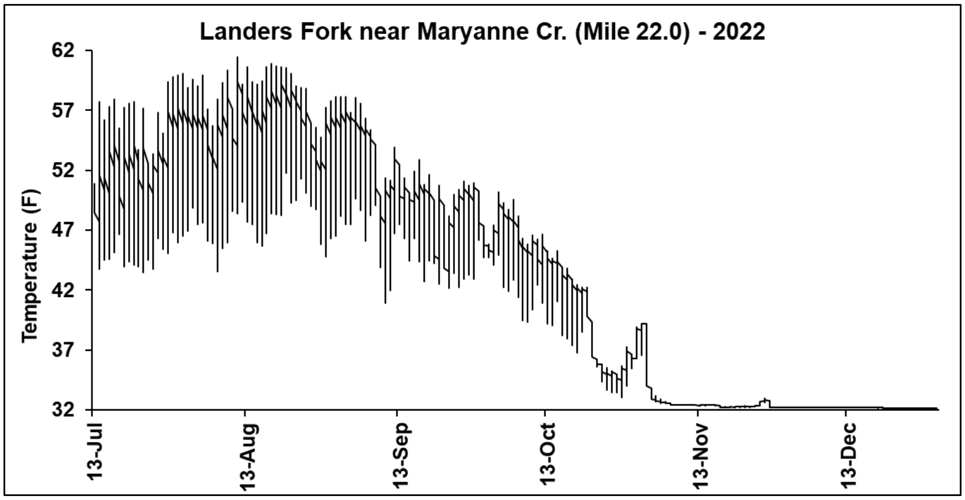
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.6	31.9	32.6	0.8	0.7
February	35.0	31.9	32.5	0.7	0.4
March	38.8	31.9	33.3	1.4	2.0
April	47.8	32.3	38.4	3.9	15.3
May	48.9	35.8	41.4	3.0	8.8
June	57.1	41.1	46.2	2.6	6.6
July	62.3	44.5	52.5	4.3	18.4
August	62.4	47.2	53.9	3.4	11.4
September	58.7	47.2	52.9	3.0	8.8
October					
November					
December					



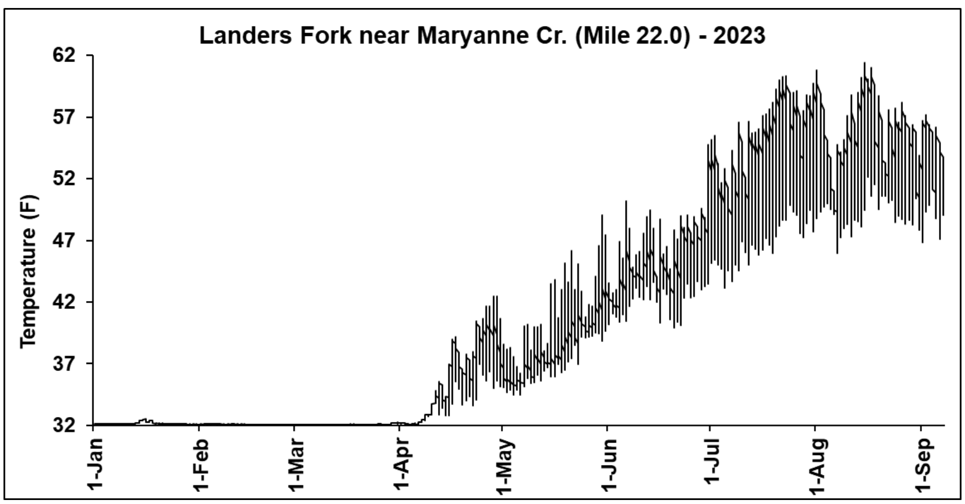
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	60.8	44.8	51.1	3.8	14.7
August	61.7	45.0	52.9	3.7	13.8
September	58.7	41.5	48.2	3.5	12.2
October	50.3	34.5	41.3	3.7	13.6
November	40.3	32.0	33.3	1.5	2.4
December	34.2	32.0	32.6	0.5	0.2



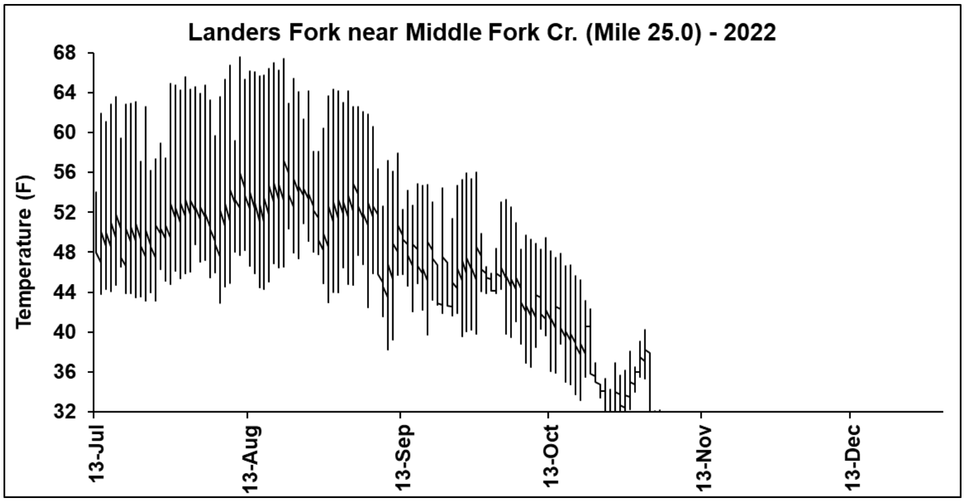
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	34.3	32.0	32.6	0.5	0.3
February	33.7	32.0	32.4	0.3	0.1
March	35.5	32.0	32.4	0.5	0.3
April	45.5	32.0	34.8	2.9	8.4
May	50.3	34.0	39.8	3.4	11.3
June	56.3	39.3	45.2	2.9	8.5
July	61.8	43.3	51.5	4.0	16.0
August	62.3	46.4	52.2	3.4	11.3
September	58.9	45.6	51.2	3.1	9.4
October					
November					
December					



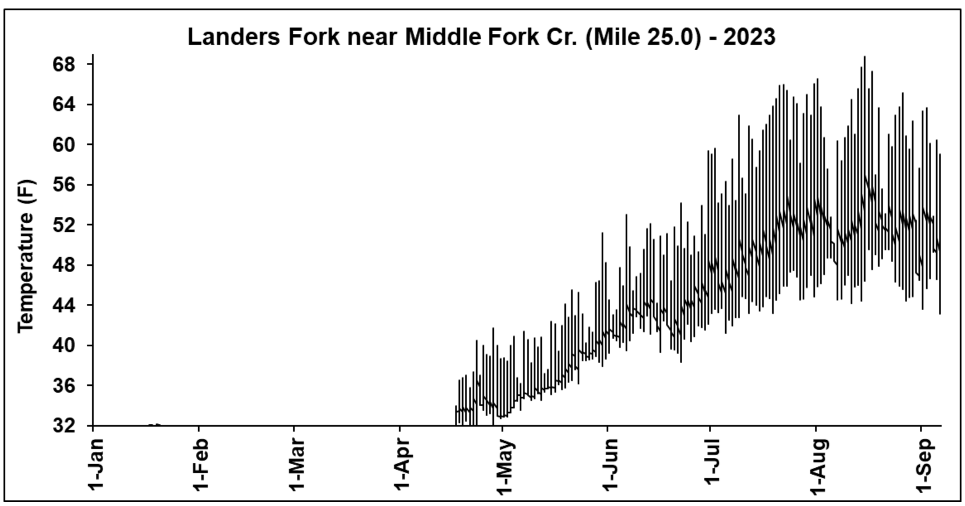
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	60.0	43.5	50.4	4.4	19.3
August	61.5	43.5	52.8	4.2	17.7
September	58.2	41.0	48.5	3.7	13.8
October	50.2	33.0	40.7	4.4	19.4
November	39.2	32.2	32.7	1.2	1.5
December	32.2	32.1	32.2	0.0	0.0



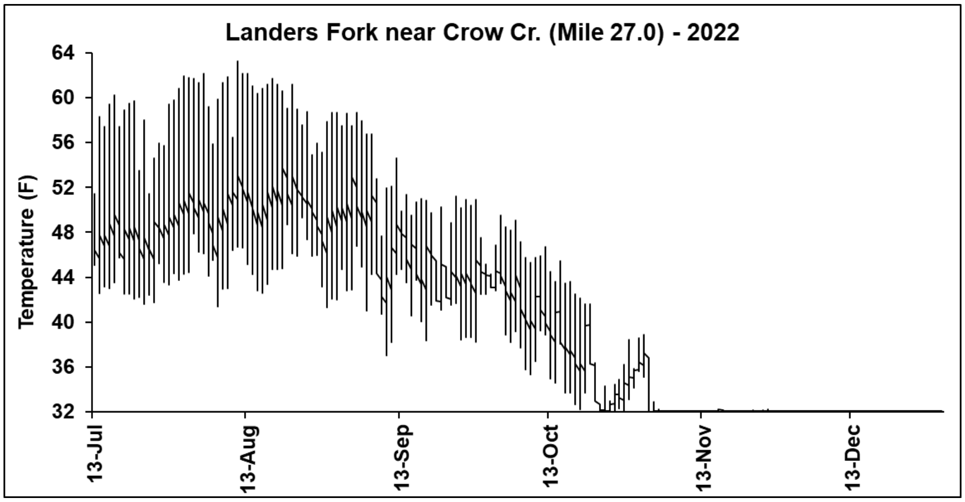
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.5	32.1	32.2	0.1	0.0
February	32.1	32.1	32.1	0.0	0.0
March	32.2	32.1	32.1	0.0	0.0
April	42.5	32.1	35.0	2.6	7.0
May	49.0	34.5	38.7	2.9	8.2
June	54.8	39.9	44.4	2.5	6.3
July	60.3	43.2	51.3	4.0	16.2
August	61.4	45.9	52.8	3.2	10.4
September	57.2	46.8	52.1	2.8	7.6
October					
November					
December					



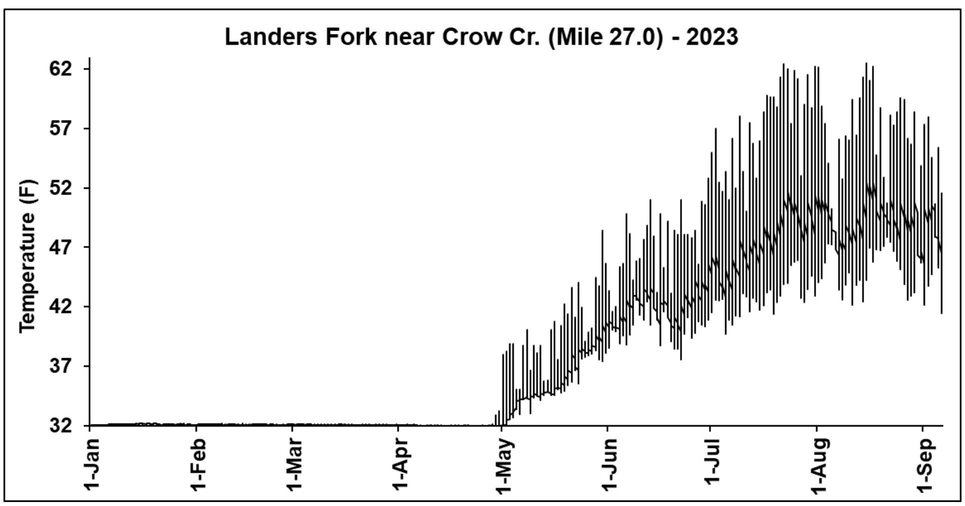
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	65.5	43.1	51.4	5.9	34.8
August	67.6	42.9	53.6	6.2	38.4
September	64.1	38.3	48.4	5.3	28.2
October	53.3	31.9	39.9	5.3	28.2
November	40.2	32.0	32.2	1.1	1.3
December	32.0	31.9	32.0	0.0	0.0



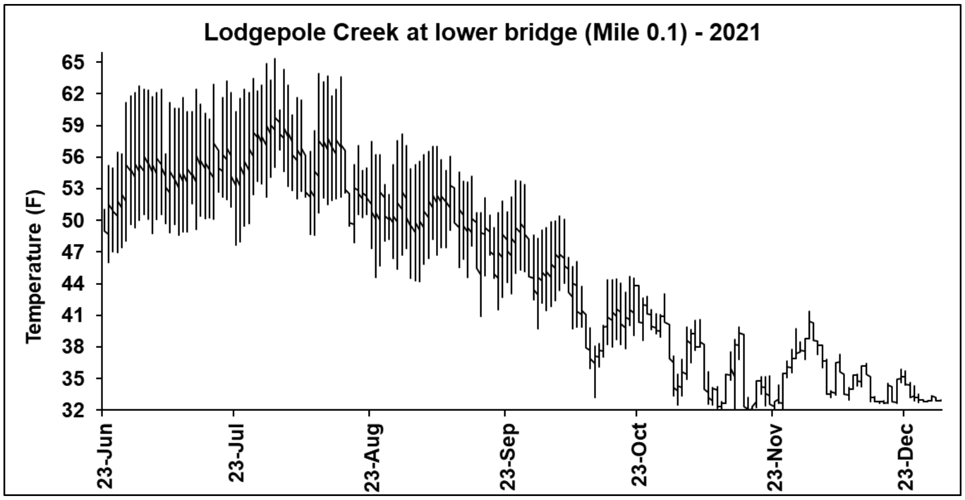
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.1	31.3	31.7	0.2	0.0
February	31.6	31.3	31.6	0.1	0.0
March	31.8	31.6	31.7	0.0	0.0
April	41.7	31.8	33.1	2.0	3.9
May	51.2	32.9	38.0	3.1	9.8
June	59.4	38.4	44.4	3.5	12.5
July	66.1	41.2	51.3	6.2	38.1
August	68.7	44.2	52.7	5.4	29.4
September	63.7	43.2	51.6	5.2	27.2
October					
November					
December					



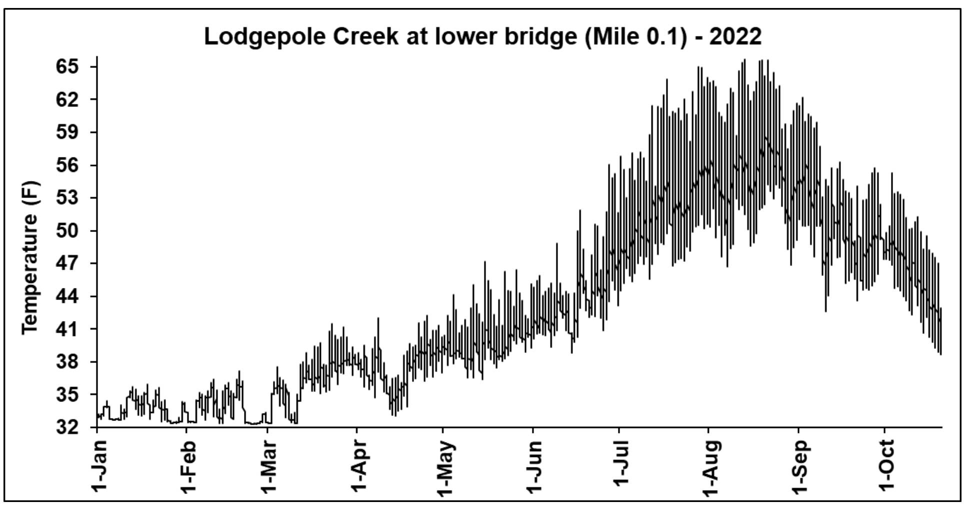
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	61.9	41.6	49.3	5.1	25.9
August	63.3	41.3	51.1	5.3	27.9
September	119.1	6.3	46.4	4.5	20.0
October	49.5	32.0	38.4	4.5	20.4
November	38.8	32.0	32.3	0.9	0.9
December	32.1	32.0	32.0	0.0	0.0



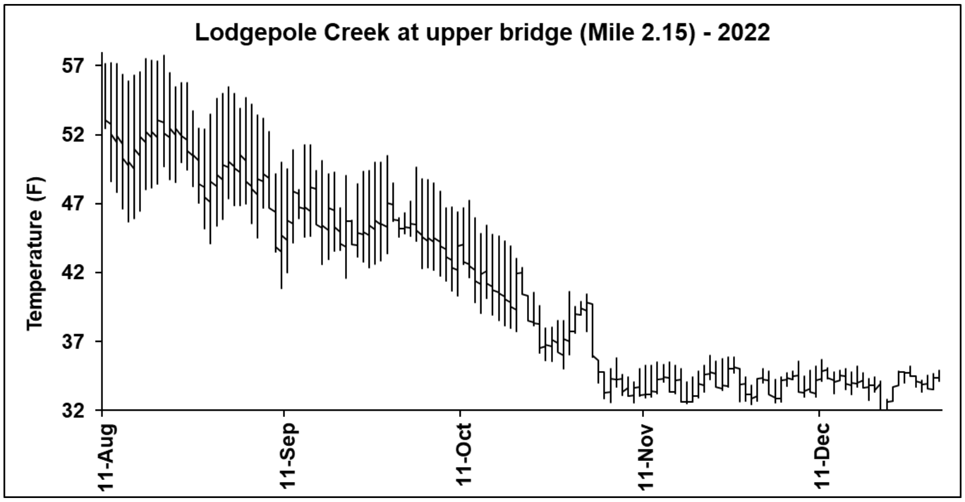
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.2	32.0	32.1	0.0	0.0
February	32.2	32.0	32.1	0.0	0.0
March	32.1	32.0	32.1	0.0	0.0
April	33.2	32.0	32.0	0.1	0.0
May	48.4	32.0	36.8	2.9	8.3
June	52.8	37.6	43.0	2.9	8.5
July	62.4	39.7	48.8	5.4	29.2
August	62.5	42.2	50.0	4.4	19.6
September	58.0	41.4	48.8	4.2	17.2
October					
November					
December					



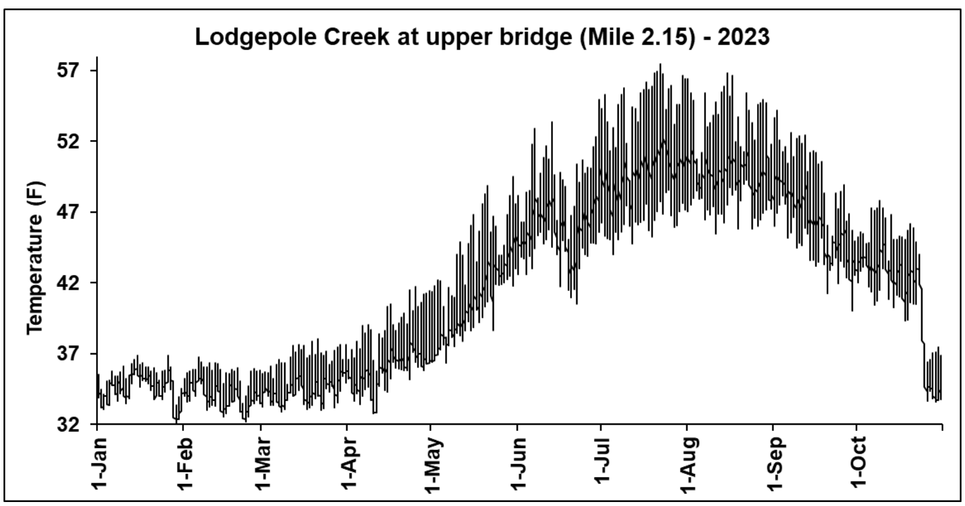
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	62.1	46.0	52.2	4.0	16.2
July	64.8	47.6	55.2	4.1	16.4
August	65.3	44.6	53.9	4.2	18.0
September	57.0	39.7	48.6	3.6	12.8
October	50.4	33.2	41.4	3.4	11.3
November	40.6	32.0	35.2	2.4	5.7
December	41.4	32.6	34.6	2.0	4.2



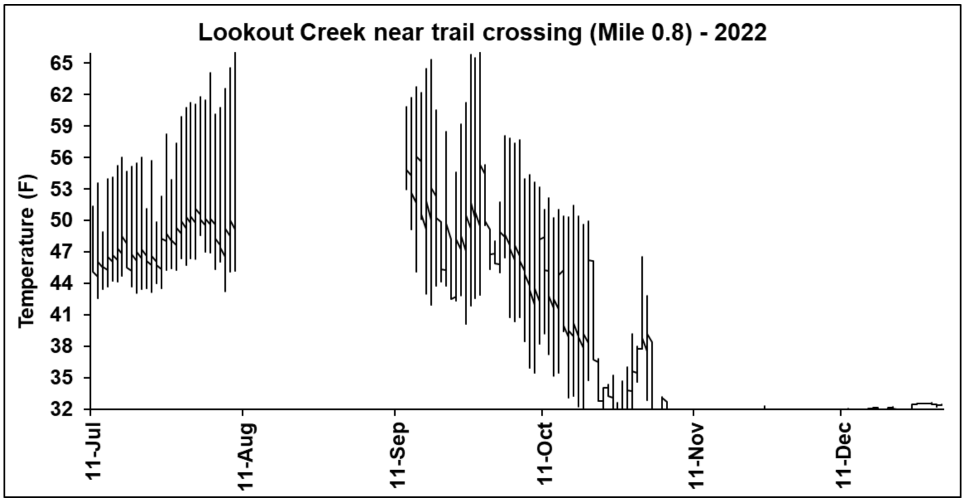
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.9	32.4	33.6	0.9	0.8
February	37.1	32.3	33.7	1.3	1.6
March	41.5	32.3	36.3	2.1	4.2
April	42.2	33.0	37.3	1.9	3.7
May	47.2	36.4	40.3	2.0	4.0
June	56.0	38.8	44.1	3.1	9.7
July	65.0	44.5	52.5	4.5	19.9
August	65.7	46.7	55.4	4.3	18.8
September	62.1	42.6	50.6	3.8	14.7
October	58.0	41.4	48.8	3.3	11.0
November					
December					



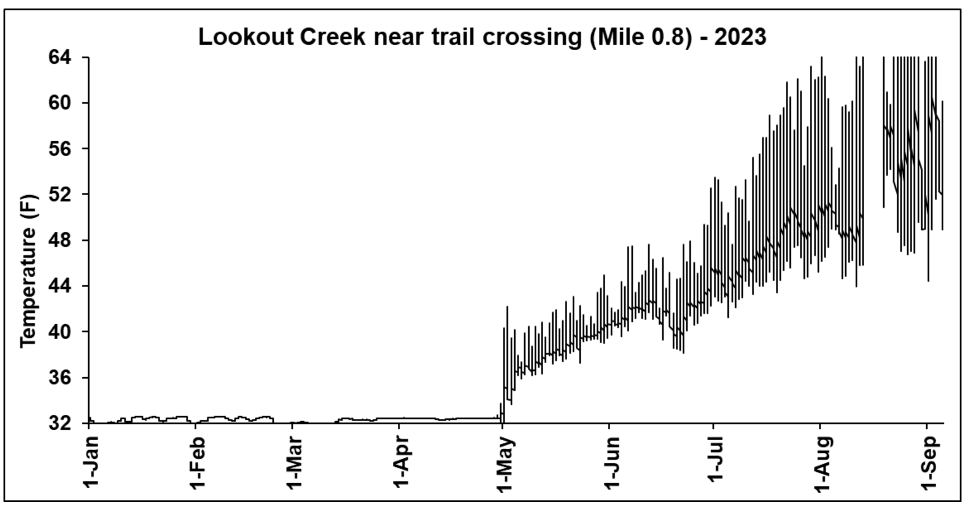
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July					
August	57.8	44.1	51.1	3.0	9.0
September	55.5	40.9	40.9	2.7	7.5
October	49.6	35.0	41.4	3.2	10.4
November	40.4	32.4	34.3	1.4	1.8
December	35.7	32.0	34.0	0.7	0.5



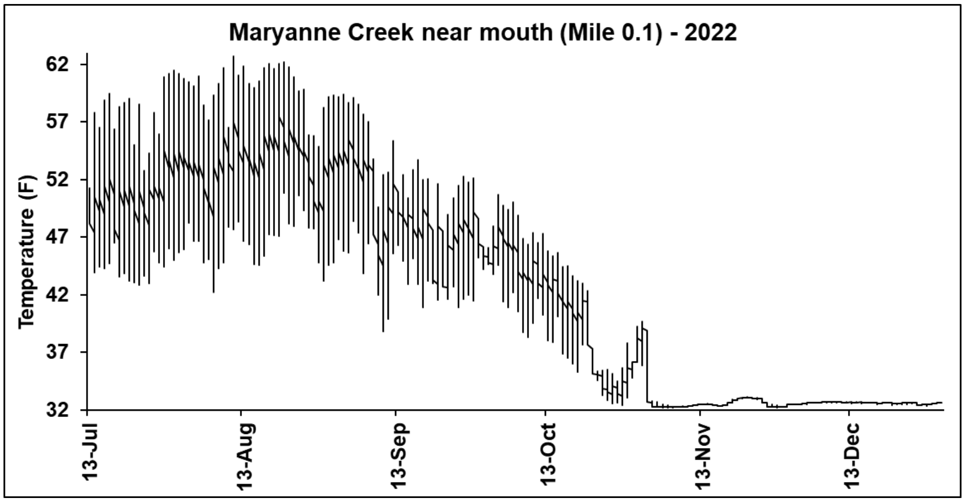
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.9	32.0	34.7	1.0	0.9
February	36.7	32.2	34.4	0.9	0.9
March	38.0	32.9	34.9	1.1	1.2
April	41.7	32.8	36.6	1.7	3.0
May	49.5	36.4	41.4	3.0	8.7
June	55.0	40.5	46.4	2.5	6.4
July	57.5	44.0	50.0	3.0	9.0
August	56.8	45.4	50.0	2.3	5.3
September	54.2	40.0	46.5	2.8	7.6
October	47.8	33.6	41.2	3.7	13.7
November					
December					



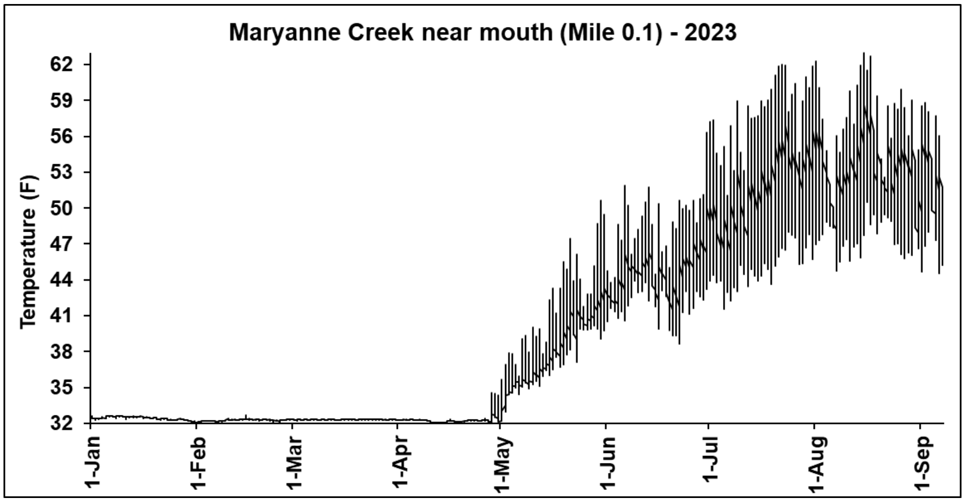
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	61.2	42.6	48.5	3.9	15.6
August	86.1	43.3	56.6	5.6	31.2
September	85.1	36.3	54.1	5.9	35.3
October	58.1	28.5	40.9	6.7	45.3
November	42.8	18.2	29.1	3.2	9.9
December	32.6	30.4	31.9	0.4	0.2



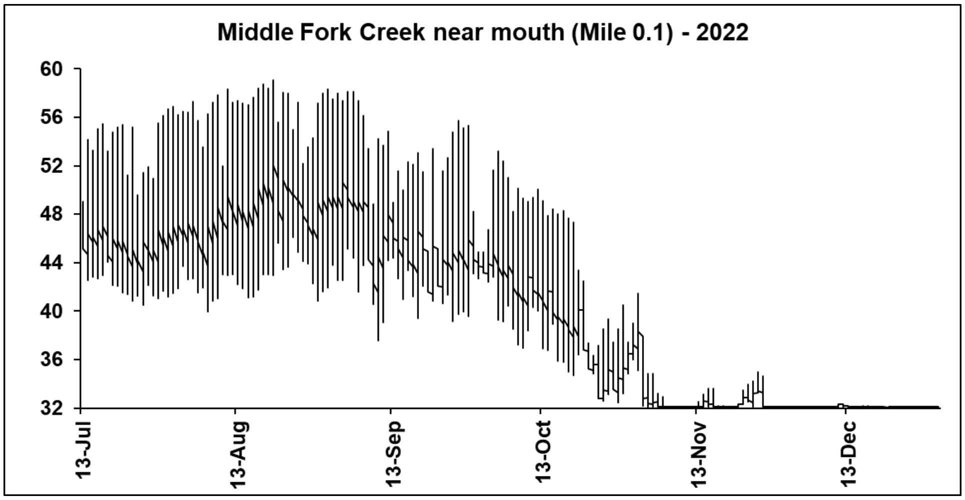
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.6	31.4	32.2	0.3	0.1
February	32.6	31.6	32.3	0.3	0.1
March	32.4	31.7	32.2	0.2	0.0
April	33.7	31.8	32.4	0.1	0.0
May	44.9	31.9	38.6	2.1	4.4
June	52.6	38.2	42.4	2.1	4.4
July	63.2	41.3	48.8	4.6	21.2
August	79.3	44.0	54.8	5.8	33.8
September					
October					
November					
December					



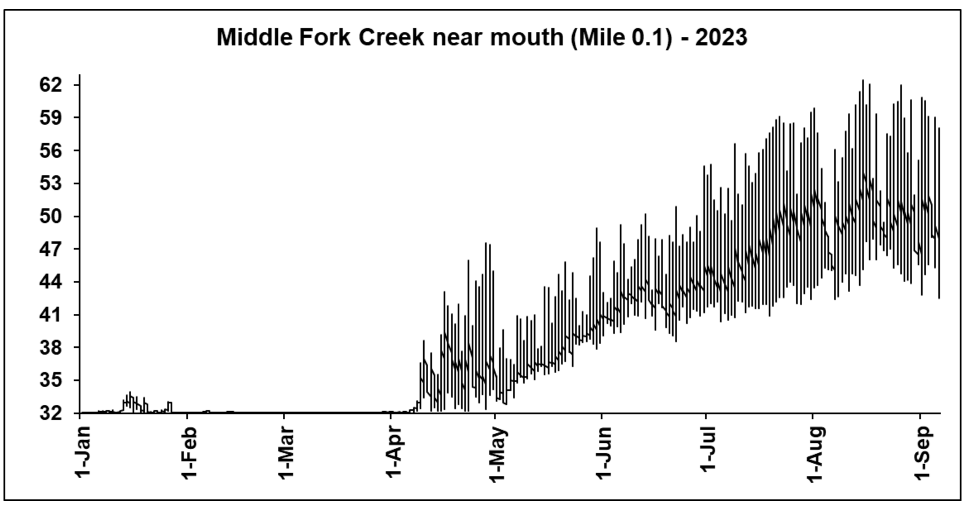
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	61.5	42.8	50.5	4.9	24.2
August	62.7	42.2	52.6	4.9	24.2
September	59.4	38.8	48.0	4.3	18.3
October	50.7	32.4	40.3	4.7	22.0
November	39.6	32.2	32.8	1.1	1.3
December	32.7	32.3	32.6	0.1	0.0



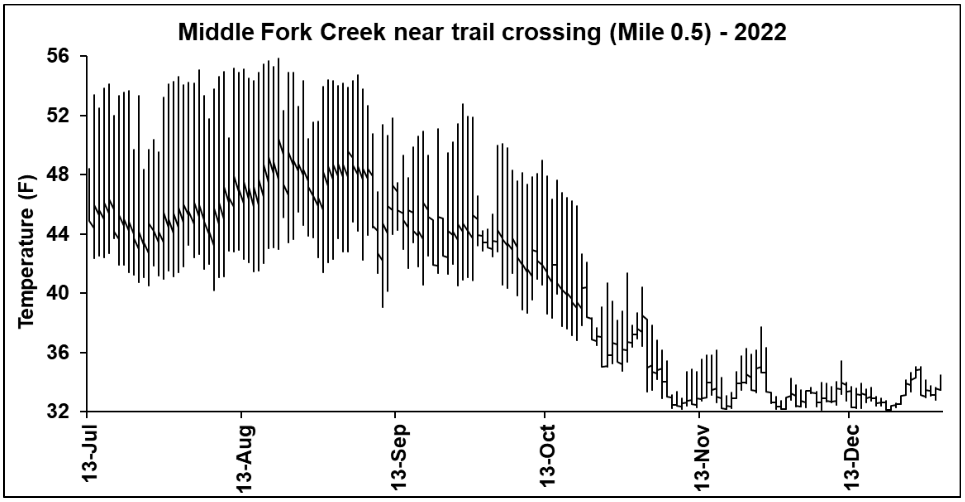
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.6	32.0	32.4	0.1	0.0
February	32.7	32.0	32.3	0.1	0.0
March	32.3	32.2	32.3	0.0	0.0
April	34.6	32.1	32.3	0.4	0.2
May	50.6	32.2	38.8	3.5	12.0
June	56.3	38.7	44.9	3.0	8.8
July	62.0	41.6	51.0	5.0	24.7
August	63.0	44.7	52.2	4.0	16.2
September	58.8	44.5	51.3	3.9	15.4
October					
November					
December					



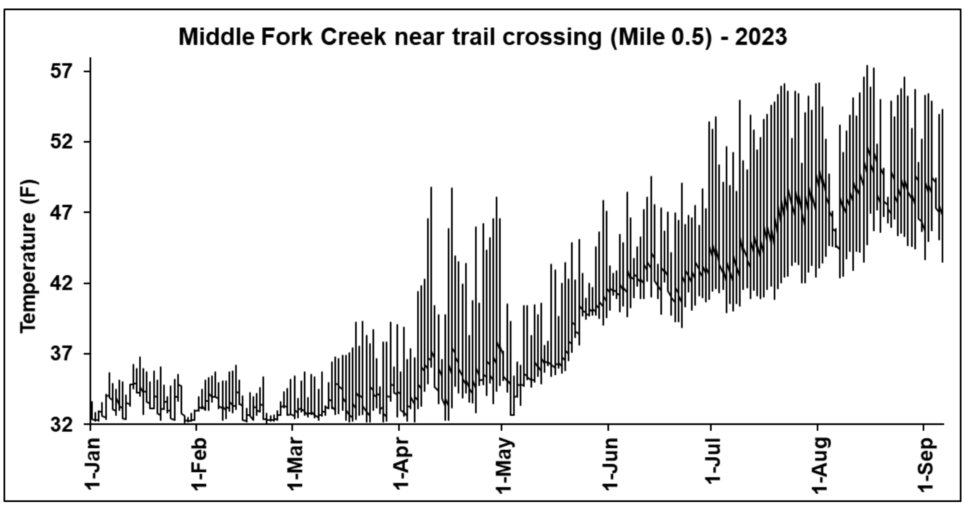
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	56.9	40.5	46.9	4.3	18.7
August	59.1	39.9	48.6	4.9	24.4
September	58.1	37.6	46.3	4.4	19.1
October	53.2	32.4	40.1	4.6	21.1
November	41.5	32.0	32.7	1.3	1.6
December	32.3	32.0	32.1	0.0	0.0



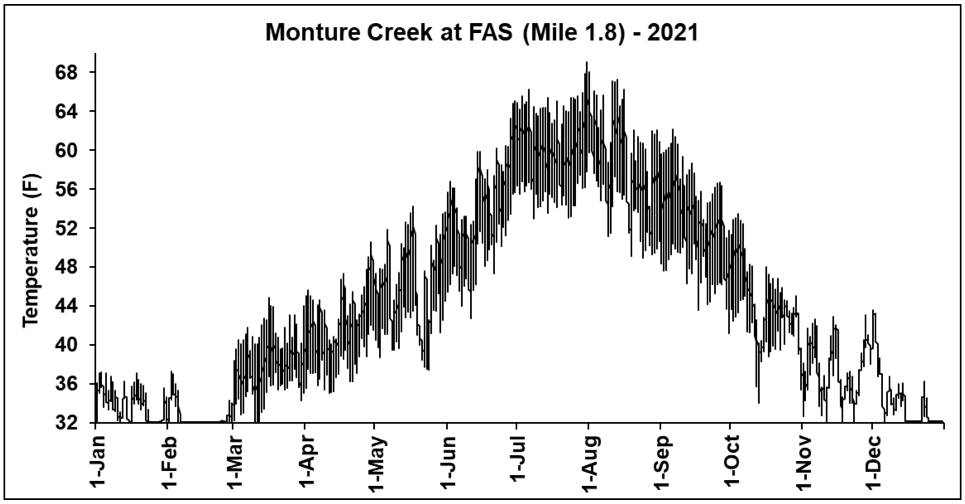
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	33.9	32.1	32.3	0.3	0.1
February	32.2	32.0	32.1	0.0	0.0
March	32.1	32.0	32.1	0.0	0.0
April	47.6	32.1	35.1	3.4	11.8
May	48.9	32.8	38.0	3.0	8.7
June	54.6	38.6	43.3	2.7	7.4
July	59.5	40.4	47.7	4.9	24.3
August	62.4	42.4	50.0	4.5	20.2
September	60.8	42.6	50.1	4.9	23.7
October					
November					
December					



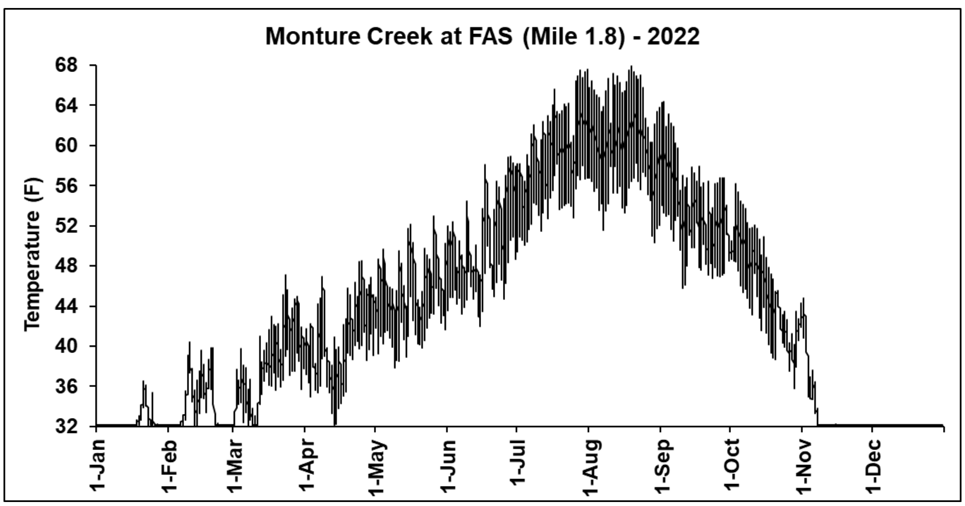
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	54.6	40.5	46.1	3.8	14.8
August	55.8	40.3	47.5	4.1	16.9
September	54.7	39.1	45.7	3.3	10.8
October	50.1	34.8	40.6	3.5	12.4
November	40.4	32.2	33.9	1.5	2.2
December	35.4	32.1	33.2	0.7	0.5



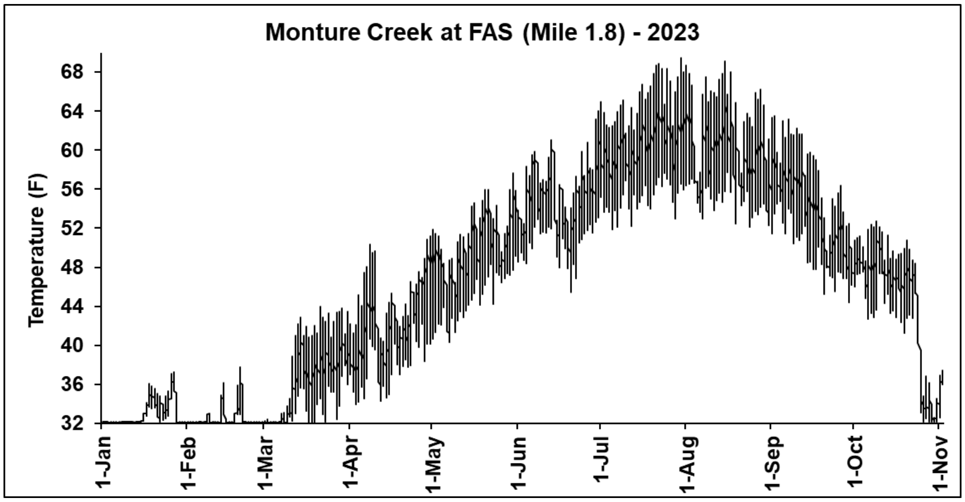
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.7	32.1	33.6	1.0	1.0
February	36.2	32.1	33.4	0.9	0.7
March	39.3	32.2	34.1	1.6	2.5
April	48.8	32.2	36.7	3.4	11.9
May	47.8	32.6	38.1	2.9	8.5
June	53.4	38.9	43.0	2.3	5.3
July	56.1	39.9	46.6	4.3	18.7
August	57.4	42.4	48.6	3.4	11.3
September	55.4	43.5	48.7	3.2	10.4
October					
November					
December					



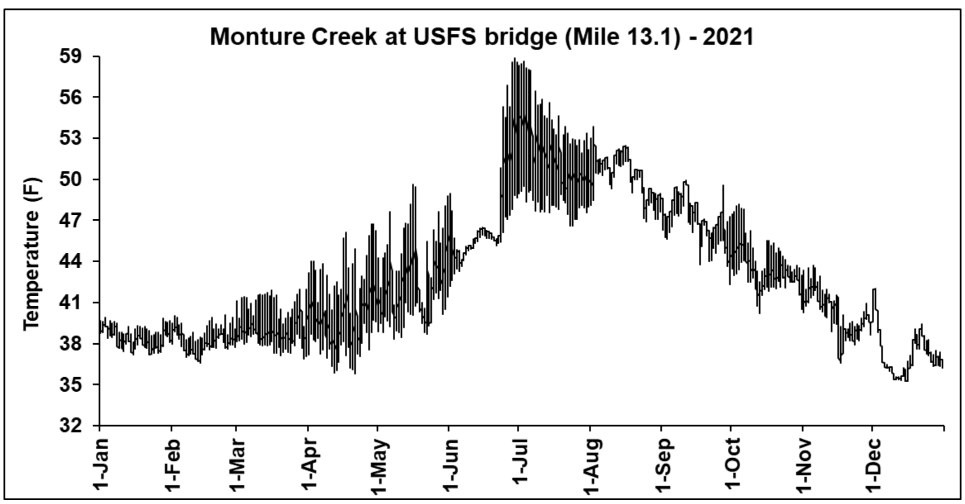
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	37.2	32.0	33.9	1.5	2.2
February	37.3	32.0	32.6	1.1	1.3
March	44.9	32.0	37.8	2.5	6.5
April	50.5	35.1	41.2	3.2	10.3
May	54.2	37.5	44.6	3.8	14.7
June	65.0	42.8	52.9	4.5	20.5
July	69.1	53.0	59.8	3.4	11.6
August	68.1	48.9	57.7	4.4	19.0
September	62.2	41.2	52.0	4.1	17.2
October	53.5	34.0	43.6	3.6	12.9
November	43.1	32.1	37.4	2.6	7.0
December	43.6	32.1	34.1	2.7	7.5



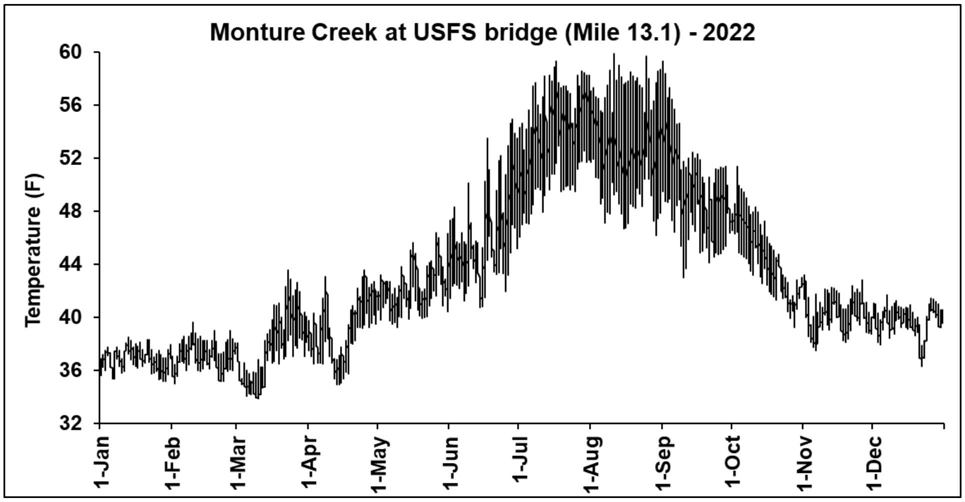
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.5	32.0	32.4	0.8	0.7
February	40.4	32.0	34.0	2.4	5.7
March	47.1	32.0	37.7	3.5	12.4
April	48.5	32.2	40.2	3.5	12.5
May	53.0	37.9	44.5	3.0	8.9
June	58.9	42.0	49.1	3.9	15.1
July	67.5	49.4	58.3	3.9	15.4
August	67.9	50.3	59.9	3.8	14.8
September	64.3	45.8	53.3	3.9	15.1
October	56.2	35.8	45.3	4.4	19.4
November	44.8	32.1	33.3	2.7	7.4
December	32.1	32.1	32.1	0.0	0.0



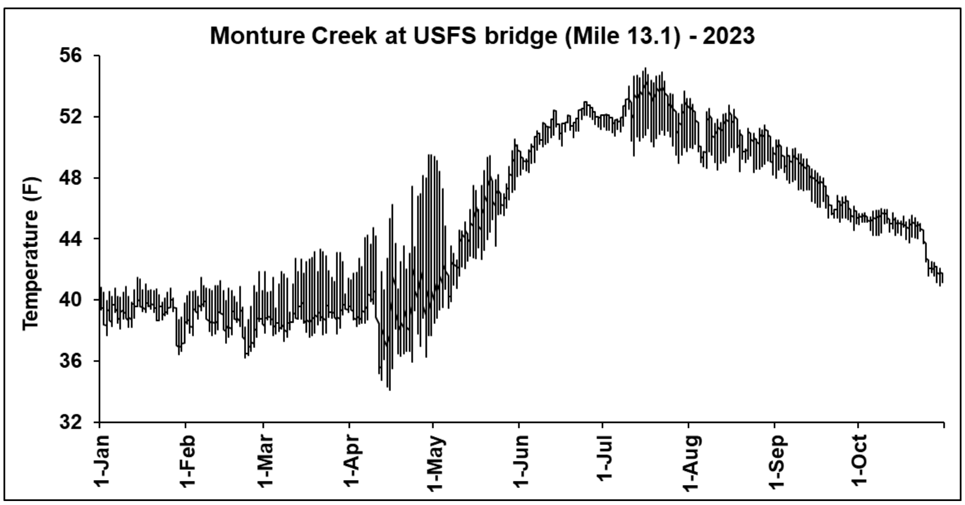
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	37.2	32.1	32.9	1.2	1.5
February	37.8	32.1	32.5	1.0	1.0
March	44.0	32.1	36.1	3.6	13.1
April	51.2	33.9	41.4	3.7	13.9
May	57.6	40.3	48.1	3.6	13.3
June	64.0	45.5	54.0	3.3	11.1
July	69.4	51.9	60.1	3.9	15.2
August	69.1	52.1	59.4	4.0	15.7
September	63.5	44.4	53.5	4.4	19.6
October	52.7	32.1	44.0	6.2	37.9
November					
December					



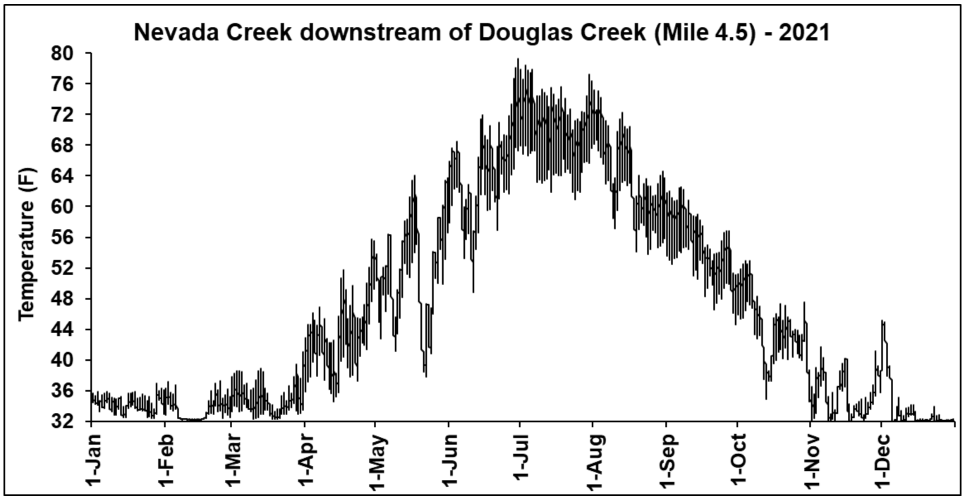
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	39.9	37.2	38.5	0.6	0.4
February	40.1	36.6	38.2	0.7	0.5
March	42.0	36.9	39.1	1.1	1.3
April	46.8	35.8	40.1	2.4	5.5
May	49.6	38.3	42.2	2.4	6.0
June	58.8	42.2	46.8	3.4	11.2
July	58.6	46.6	51.0	2.6	6.9
August	53.9	46.9	50.1	1.4	2.1
September	49.9	42.3	46.8	1.5	2.1
October	48.2	40.2	43.5	1.4	2.1
November	43.7	36.6	40.1	1.5	2.2
December	42.0	35.2	37.2	1.5	2.3



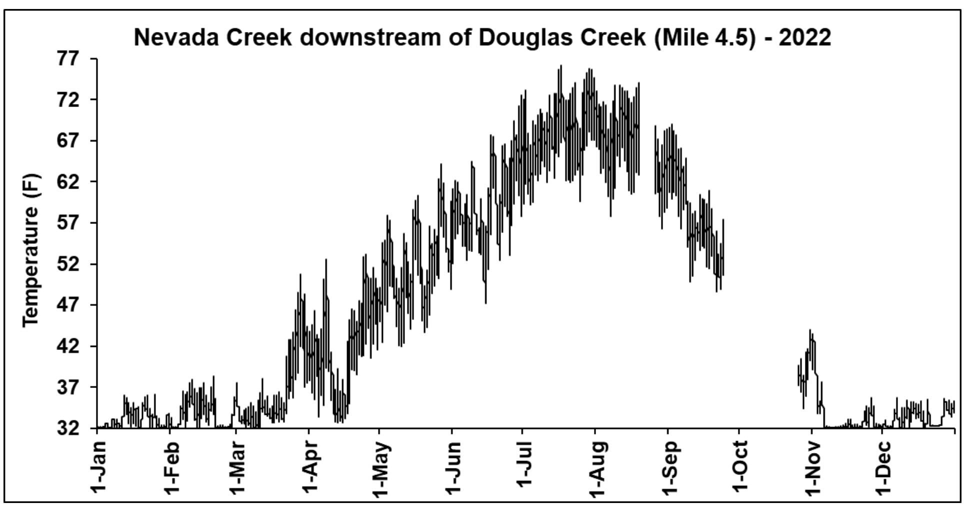
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	38.5	35.2	36.8	0.7	0.5
February	39.6	35.0	37.0	0.9	0.8
March	43.5	33.9	37.5	2.3	5.2
April	43.5	34.9	38.7	2.1	4.3
May	46.4	39.3	42.0	1.5	2.1
June	54.9	40.8	45.8	3.1	9.6
July	59.3	46.0	53.0	3.0	8.7
August	59.9	46.2	52.8	3.1	9.9
September	59.3	43.0	49.4	3.0	8.8
October	51.4	39.3	44.4	2.5	6.3
November	43.2	37.5	40.2	1.1	1.3
December	41.7	36.3	39.7	1.0	1.0



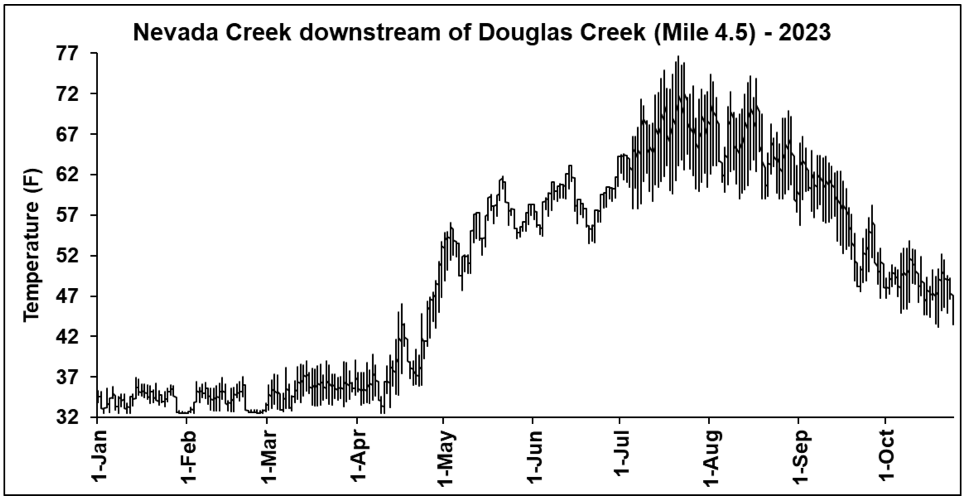
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	41.5	36.4	39.3	0.9	0.8
February	41.8	36.2	39.0	1.1	1.2
March	43.3	37.3	39.6	1.3	1.8
April	49.5	34.1	40.1	2.9	8.7
May	50.5	38.5	44.7	2.8	7.8
June	53.0	48.2	51.0	1.1	1.3
July	55.2	48.9	52.0	1.2	1.6
August	53.2	48.2	50.3	1.1	1.1
September	50.4	44.6	47.3	1.5	2.1
October	46.0	41.0	44.3	1.3	1.7
November					
December					



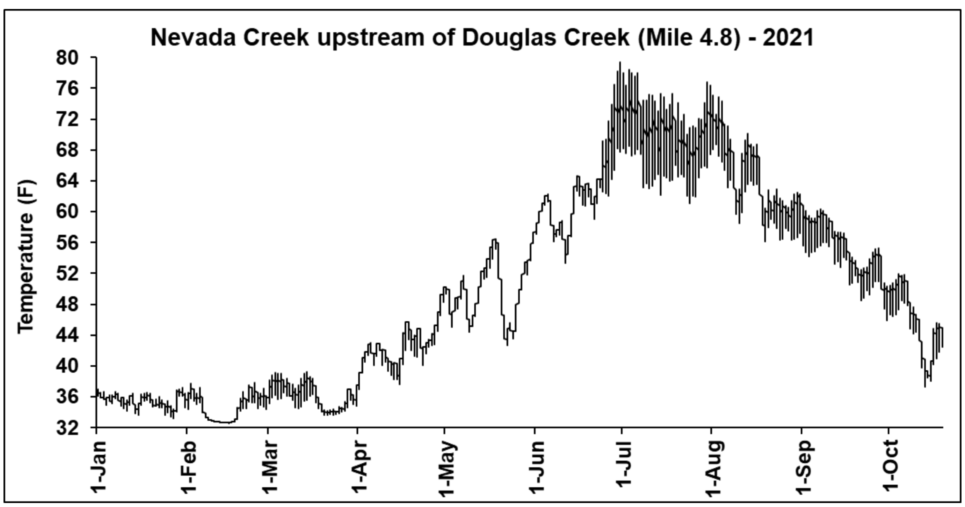
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	37.0	32.4	34.2	0.9	0.8
February	37.2	32.2	33.4	1.3	1.7
March	41.0	32.2	34.7	1.7	3.0
April	55.8	34.6	42.8	4.3	18.3
May	64.1	37.8	50.8	6.1	37.7
June	79.3	48.8	63.9	5.4	28.8
July	78.4	60.9	69.4	3.8	14.4
August	75.2	53.8	63.2	5.1	26.1
September	62.6	44.6	54.2	3.8	14.4
October	52.9	34.6	43.8	4.0	15.9
November	41.6	32.0	35.0	2.4	5.9
December	45.2	31.9	33.6	3.1	9.5



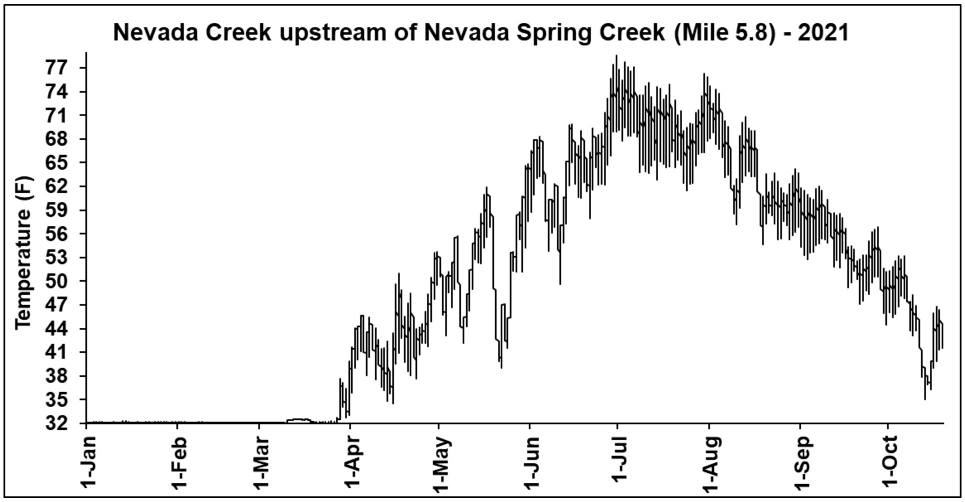
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.1	32.0	33.1	1.0	1.1
February	38.4	32.0	33.6	1.6	2.4
March	50.7	32.0	36.2	4.3	18.5
April	53.1	32.7	41.2	5.1	26.1
May	64.2	42.0	51.3	4.6	21.4
June	72.5	47.2	58.9	4.6	21.2
July	76.2	59.2	67.6	3.8	14.6
August					
September	72.6	47.5	57.2	4.8	23.1
October					
November	43.5	31.9	33.4	2.3	5.5
December	35.7	32.0	33.2	1.0	1.0



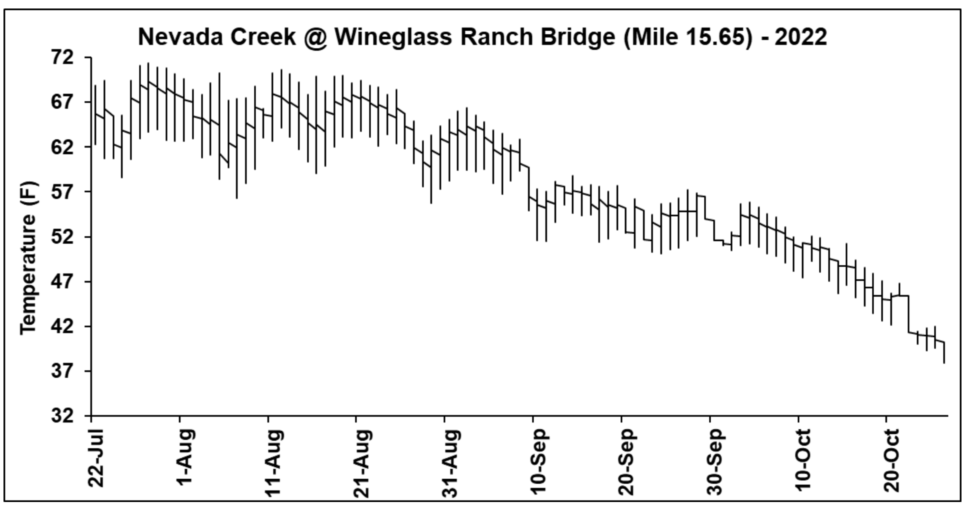
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.9	32.5	34.2	1.0	1.1
February	37.0	32.5	33.9	1.2	1.5
March	39.0	32.7	35.4	1.6	2.5
April	53.7	32.5	39.1	4.4	19.8
May	61.8	47.7	55.1	3.0	9.1
June	64.3	53.5	58.3	2.2	4.9
July	76.6	57.8	66.0	4.2	17.4
August	74.4	57.4	64.9	3.7	13.8
September	66.7	46.8	56.4	5.0	24.9
October	53.8	43.1	48.3	2.1	4.5
November					
December					



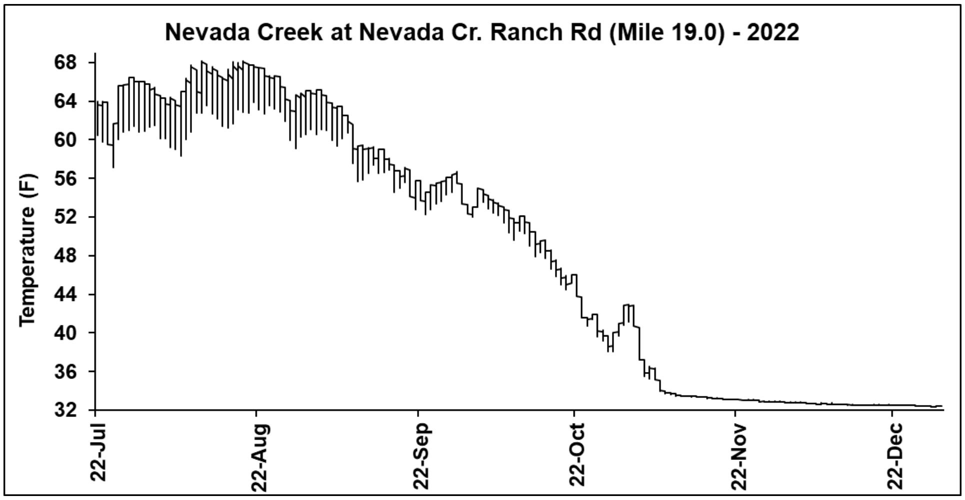
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	37.2	33.2	35.5	0.8	0.7
February	37.9	32.6	34.5	1.6	2.5
March	39.3	33.6	35.9	1.5	2.4
April	50.2	37.0	42.2	2.5	6.3
May	57.3	42.7	49.6	3.7	13.7
June	79.4	53.3	62.1	5.0	25.2
July	78.4	61.1	69.5	3.7	14.0
August	75.0	56.2	63.3	4.6	21.3
September	60.8	45.9	54.4	3.2	10.6
October	51.9	37.3	45.2	4.0	16.0
November					
December					



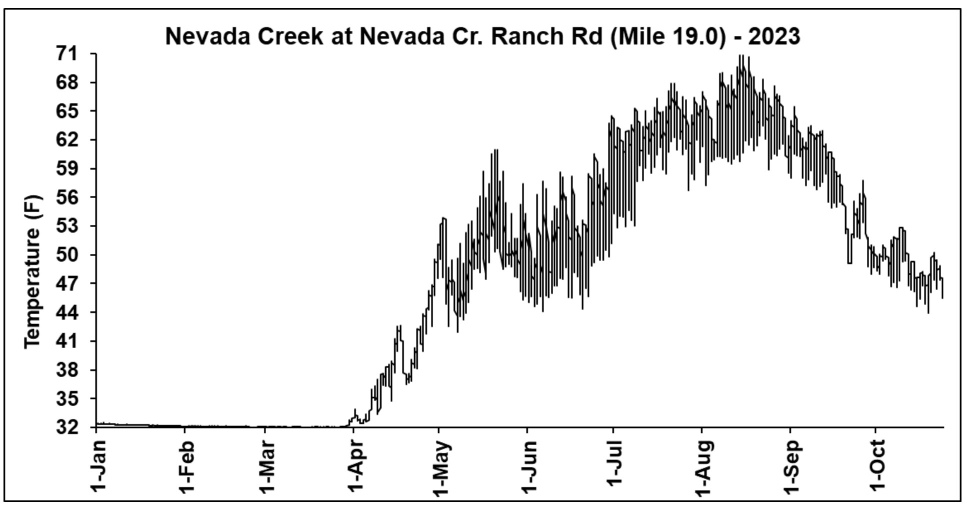
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.3	32.1	32.1	0.0	0.0
February	32.2	32.1	32.1	0.0	0.0
March	39.9	32.0	32.6	1.3	1.6
April	53.7	34.5	42.7	3.9	15.5
May	64.8	39.0	51.0	5.9	34.6
June	78.6	49.6	64.0	5.1	26.0
July	77.7	61.5	69.3	3.5	12.1
August	74.7	54.7	63.1	4.8	22.6
September	62.0	44.4	54.2	3.7	13.4
October	53.2	35.1	44.7	4.6	21.4
November					
December					



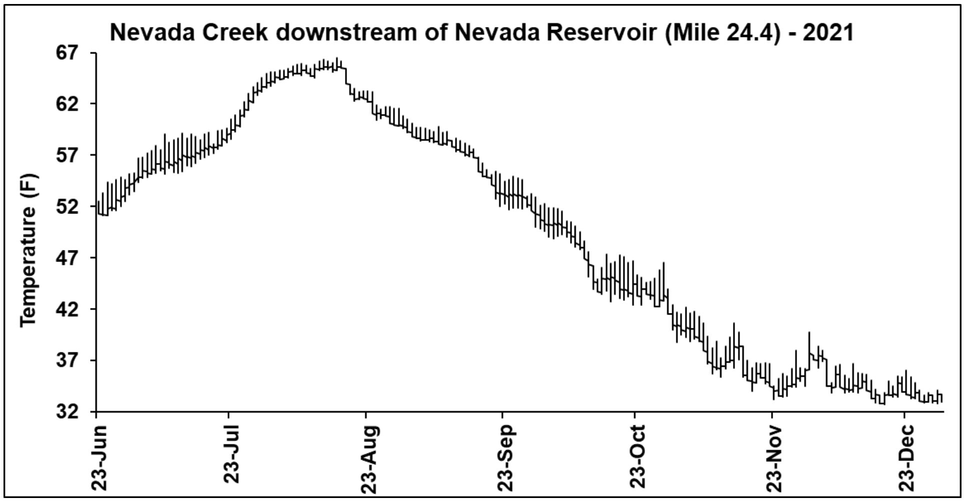
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	71.4	58.6	65.6	3.2	10.4
August	70.6	55.8	64.4	3.1	9.8
September	66.3	50.1	56.5	3.8	14.3
October	55.9	37.9	48.0	4.3	18.5
November					
December					



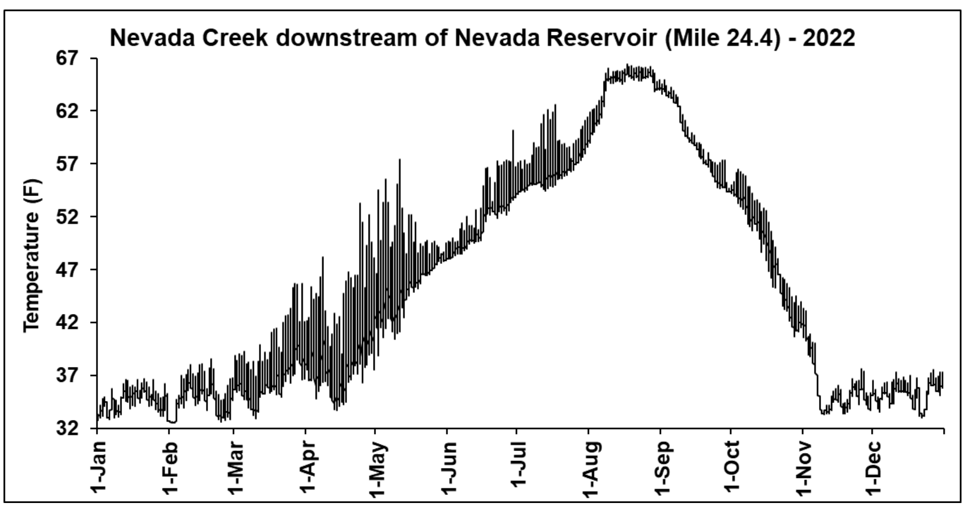
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	66.4	57.2	62.7	2.3	5.3
August	68.1	58.4	64.0	2.1	4.5
September	65.1	52.2	57.8	3.2	10.5
October	55.0	38.1	47.3	5.0	25.3
November	42.9	32.9	34.3	2.4	5.6
December	32.9	32.3	32.6	0.1	0.0



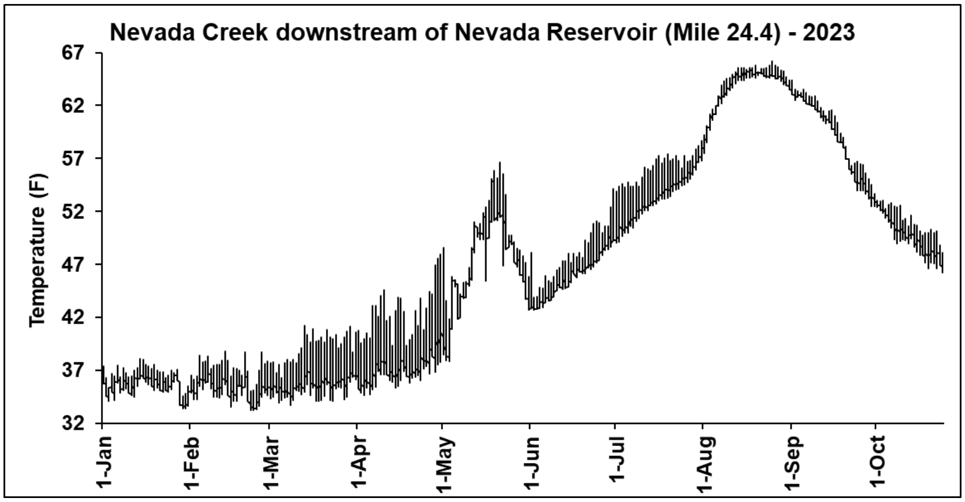
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	32.5	32.1	32.2	0.1	0.0
February	32.1	32.0	32.1	0.0	0.0
March	32.9	32.0	32.1	0.2	0.0
April	51.1	32.4	38.5	4.5	20.0
May	61.0	41.9	50.2	3.9	14.9
June	64.5	44.1	51.4	4.2	17.4
July	67.9	52.8	61.6	3.1	9.5
August	70.8	57.2	63.8	2.8	7.8
September	65.5	48.0	57.0	4.4	18.9
October	52.9	43.9	48.4	1.7	3.0
November					
December					



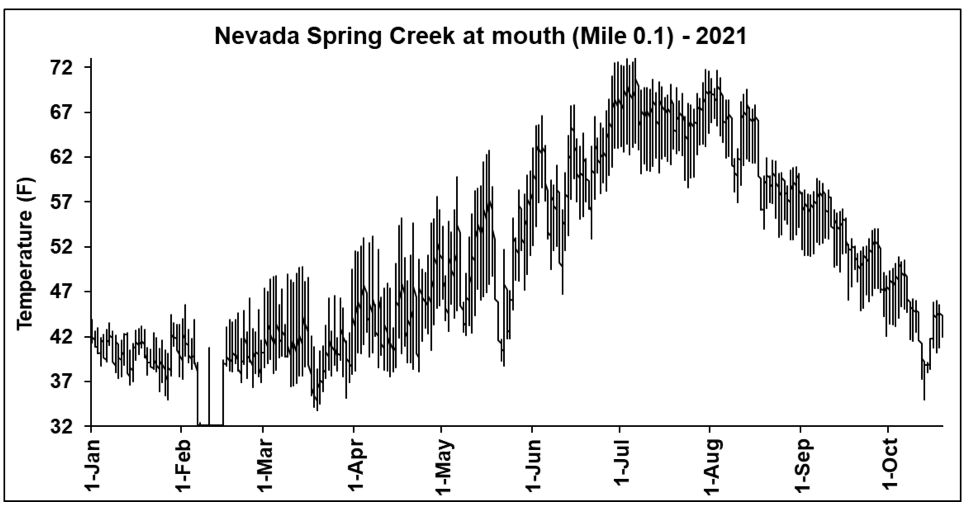
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	55.2	51.1	52.9	1.1	1.1
July	64.9	53.5	58.4	2.7	7.4
August	66.5	59.6	63.7	1.9	3.8
September	60.5	50.0	56.2	2.7	7.2
October	52.2	40.0	46.1	3.0	8.9
November	42.2	33.2	36.9	2.2	4.8
December	39.8	32.7	34.6	1.4	2.0



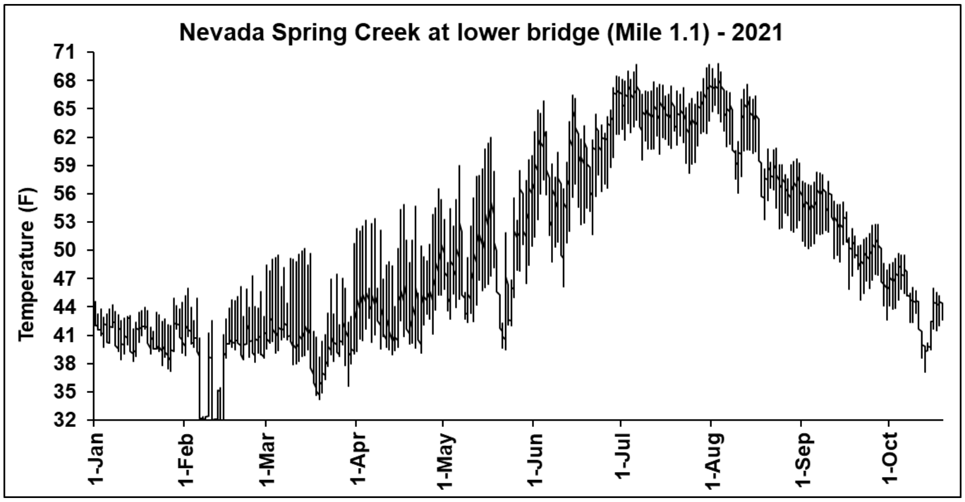
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.7	32.7	34.5	1.0	0.9
February	38.6	32.5	34.8	1.5	2.1
March	45.7	32.9	37.4	2.5	6.4
April	53.3	33.7	40.0	4.0	16.0
May	57.4	38.8	46.9	2.9	8.7
June	60.1	48.0	51.8	2.5	6.4
July	62.6	54.1	57.0	1.8	3.3
August	66.4	59.0	64.4	1.7	2.9
September	64.9	54.3	59.3	3.2	10.1
October	56.5	40.7	48.9	4.5	20.5
November	43.4	33.3	35.8	2.4	5.7
December	37.6	33.0	35.4	1.0	1.0



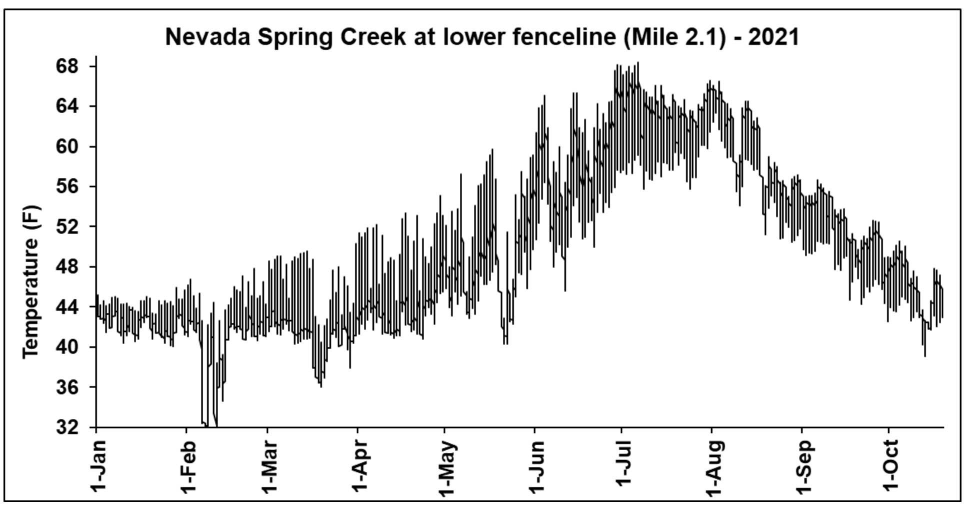
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	38.1	33.4	35.8	0.9	0.9
February	38.8	33.2	35.6	1.2	1.4
March	41.2	33.7	36.5	1.8	3.2
April	48.0	34.7	38.7	2.7	7.4
May	56.6	37.8	47.6	4.0	16.3
June	54.2	42.7	46.5	2.3	5.1
July	58.7	49.0	54.2	2.2	4.7
August	66.2	57.5	63.9	1.8	3.4
September	64.4	52.5	59.1	3.4	11.8
October	53.0	46.3	49.9	1.8	3.1
November					
December					



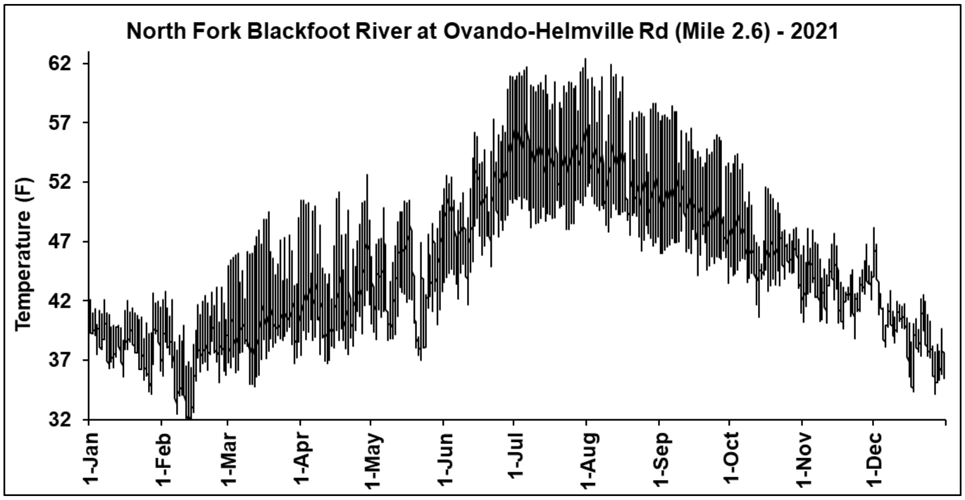
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	44.4	35.0	40.3	1.9	3.4
February	46.3	32.1	37.8	4.2	17.3
March	49.7	33.8	41.1	3.7	13.4
April	57.5	37.6	45.1	4.5	20.2
May	62.7	38.7	49.6	5.4	29.0
June	72.6	46.7	60.0	4.8	23.5
July	73.0	58.6	65.9	3.0	9.3
August	71.7	52.8	61.5	4.7	21.7
September	59.6	42.1	52.2	3.6	13.3
October	50.9	35.0	43.8	3.6	12.8
November					
December					



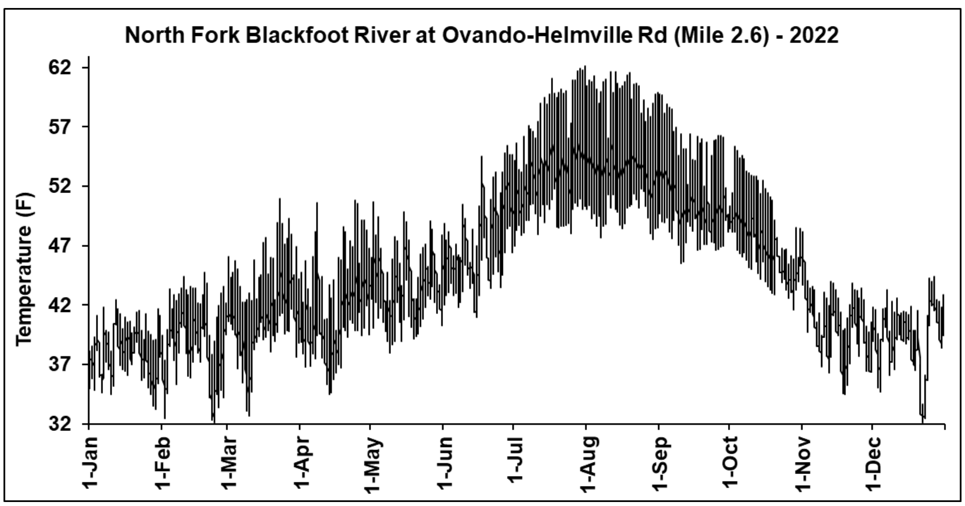
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	44.9	37.2	41.3	1.6	2.4
February	47.2	32.0	39.3	4.0	15.6
March	50.7	34.2	41.4	3.6	13.0
April	56.5	38.9	45.2	4.1	16.9
May	62.0	39.5	49.1	5.1	25.9
June	68.5	46.2	58.6	4.6	20.7
July	69.7	58.2	64.3	2.3	5.3
August	69.8	51.9	60.4	4.5	19.9
September	58.3	42.6	51.3	3.3	11.2
October	49.6	37.1	44.0	2.9	8.2
November					
December					



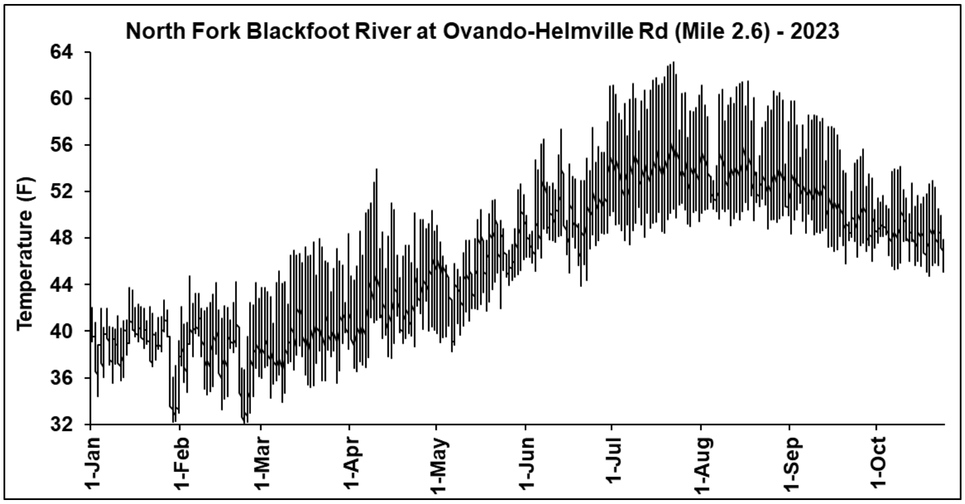
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	45.9	40.1	42.8	1.2	1.3
February	47.8	32.1	41.4	3.3	10.6
March	50.3	36.0	42.6	2.9	8.6
April	55.1	40.9	45.4	3.3	10.7
May	59.7	40.3	48.7	4.5	20.1
June	68.1	45.6	57.2	4.5	20.6
July	68.4	55.7	61.7	2.8	7.7
August	66.5	50.5	58.1	4.1	16.6
September	56.7	42.6	50.4	2.9	8.5
October	50.5	39.1	45.0	2.4	5.9
November					
December					



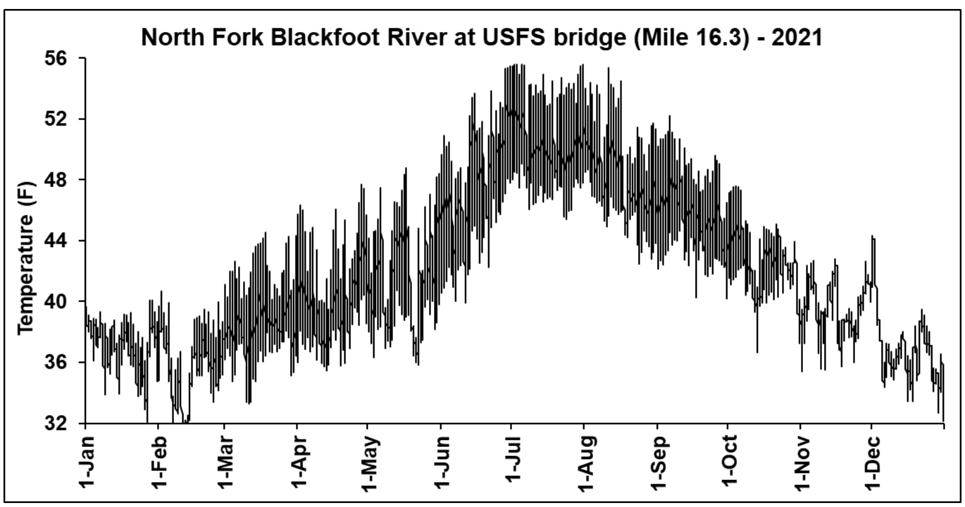
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	42.7	34.2	38.8	1.6	2.6
February	43.2	32.0	37.6	2.6	6.6
March	49.5	34.8	40.9	3.1	9.8
April	52.6	36.7	42.6	3.5	12.1
May	50.4	37.0	43.3	3.2	10.2
June	60.9	41.7	49.7	3.7	13.8
July	62.4	48.0	54.1	3.6	13.3
August	61.9	46.2	52.6	3.5	12.4
September	58.4	43.5	49.9	3.4	11.4
October	54.3	40.6	46.3	2.5	6.1
November	48.1	38.8	43.2	1.7	3.1
December	48.1	34.1	39.5	2.6	6.5



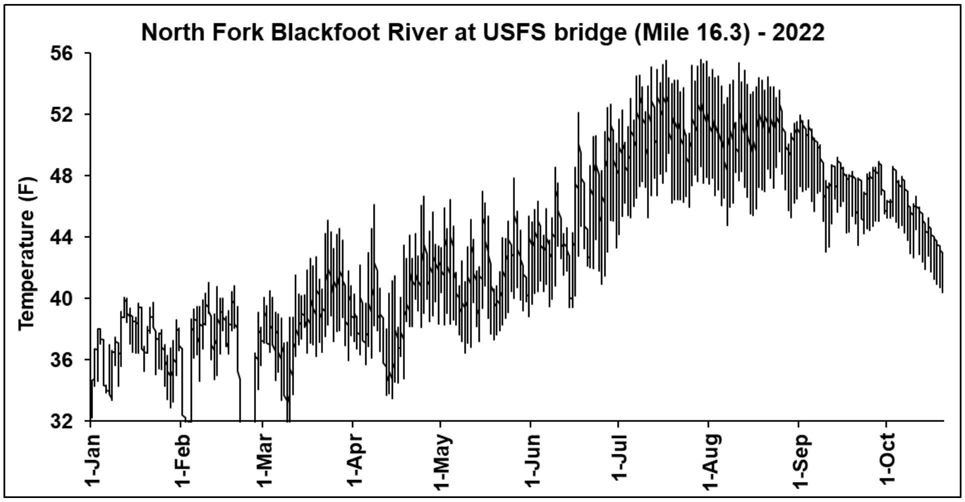
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	42.4	33.2	38.0	1.9	3.7
February	44.7	32.1	38.8	2.8	8.1
March	51.0	32.6	41.3	3.2	10.0
April	50.8	34.5	41.5	3.4	11.8
May	50.7	38.0	43.4	2.6	6.5
June	55.4	41.0	46.7	3.2	10.0
July	62.1	47.0	53.4	3.5	12.1
August	61.6	47.6	54.2	3.6	12.9
September	59.8	45.5	51.1	3.0	9.2
October	55.4	41.6	47.3	2.9	8.2
November	48.1	34.5	40.4	2.4	6.0
December	44.4	32.1	39.3	2.5	6.2



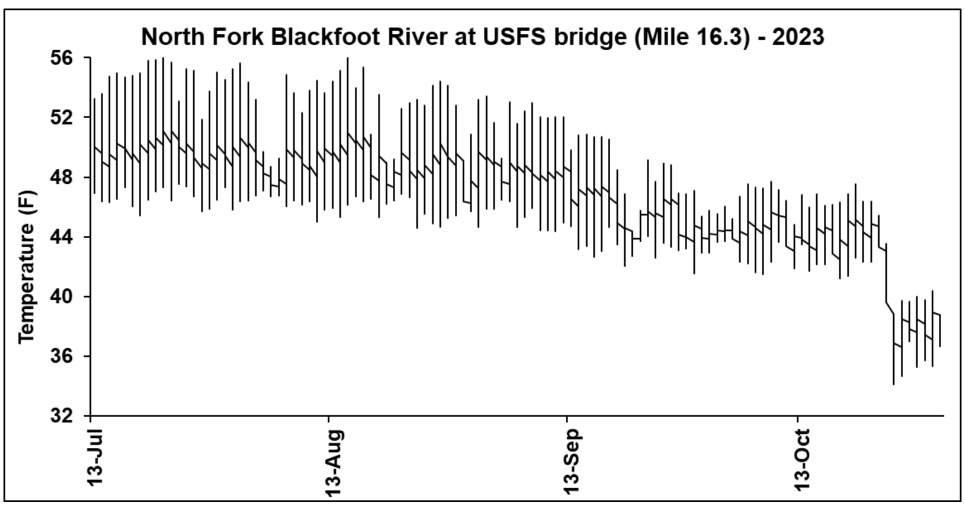
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	43.7	32.2	38.9	2.3	5.3
February	44.7	32.1	38.4	2.9	8.3
March	48.4	33.9	40.2	3.3	11.0
April	54.0	36.5	43.2	3.5	12.6
May	52.6	38.2	45.0	3.0	8.9
June	61.1	43.9	50.2	3.0	9.2
July	63.1	47.5	54.3	3.8	14.3
August	61.5	48.8	53.8	3.2	10.1
September	59.8	45.8	51.3	3.1	9.9
October	54.2	44.7	48.6	2.0	4.2
November					
December					



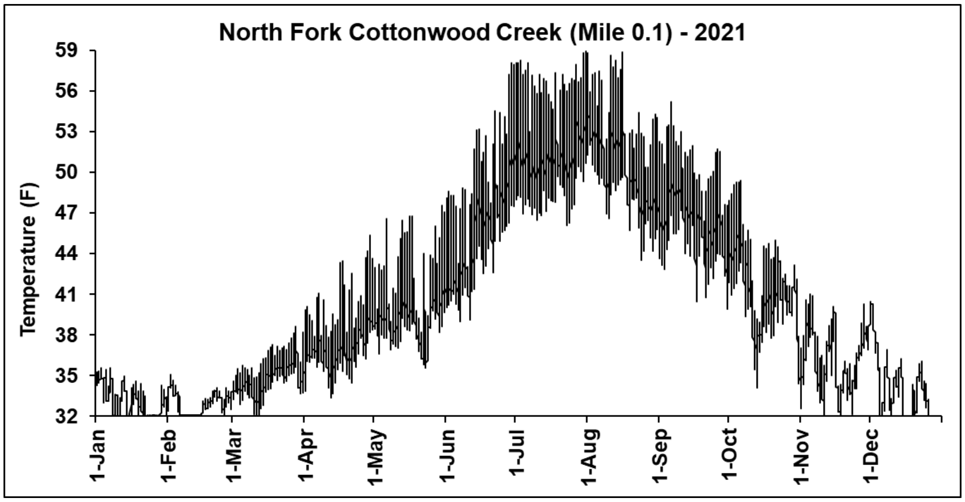
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	40.1	32.1	37.1	1.5	2.3
February	40.7	31.9	35.8	2.2	4.9
March	44.5	33.3	38.9	2.3	5.4
April	47.7	35.4	40.1	2.7	7.5
May	48.8	35.8	41.2	3.0	9.1
June	55.5	39.9	47.2	3.5	11.9
July	55.6	45.4	50.4	2.5	6.3
August	55.4	42.5	48.2	2.8	7.6
September	52.2	40.2	45.8	2.5	6.1
October	47.6	36.7	42.4	2.0	4.0
November	42.8	35.4	39.3	1.7	3.0
December	44.3	32.1	36.7	2.2	5.0



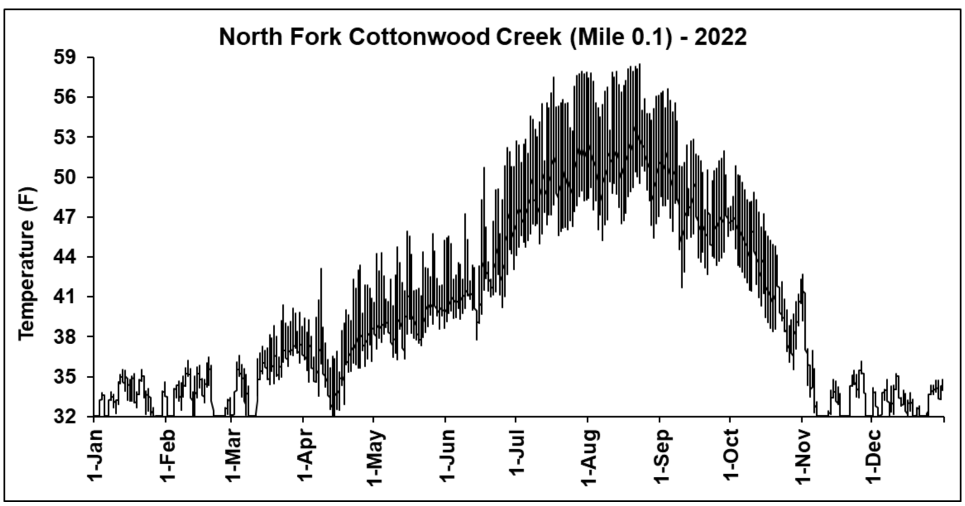
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	40.1	32.2	36.7	1.8	3.1
February	41.0	29.0	35.9	3.3	10.8
March	45.1	31.9	38.5	2.6	6.6
April	46.7	33.5	39.3	2.7	7.5
May	47.9	36.5	41.0	2.3	5.3
June	52.6	39.4	44.5	3.0	9.2
July	55.6	44.2	50.1	2.6	6.8
August	55.4	44.8	49.9	2.4	5.8
September	51.9	43.1	47.2	1.8	3.1
October					
November					
December					



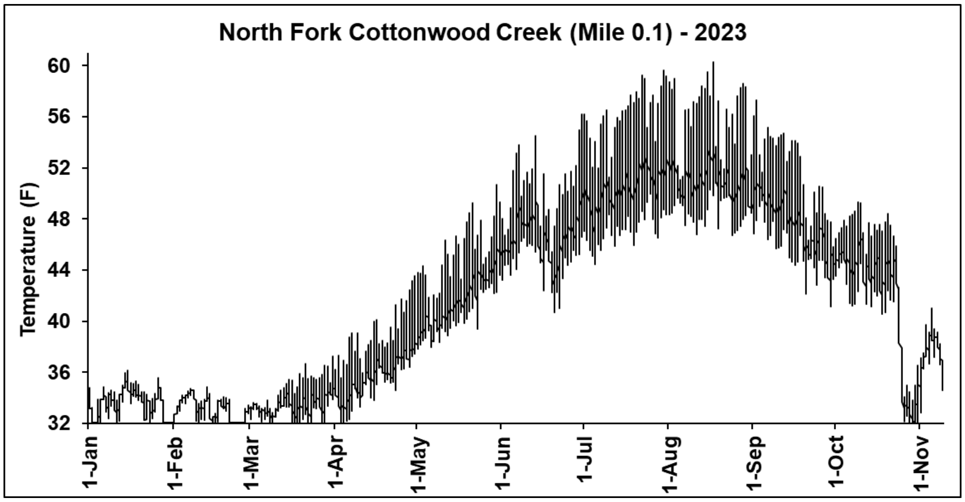
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June					
July	56.4	45.4	50.1	2.8	8.0
August	56.0	44.6	49.0	2.6	7.0
September	53.4	41.6	46.7	2.6	6.9
October	47.7	34.1	42.8	3.2	10.0
November					
December					



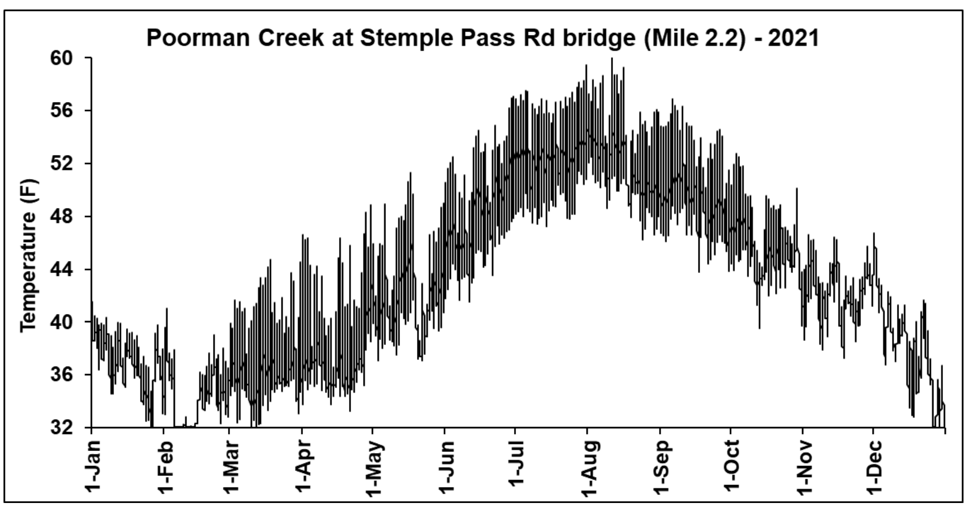
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.5	32.0	33.3	1.0	1.1
February	35.1	32.0	32.9	0.8	0.6
March	38.7	32.0	34.9	1.2	1.5
April	45.4	33.4	37.6	2.0	4.2
May	47.6	35.6	40.0	2.4	5.8
June	58.1	39.0	46.2	4.0	16.3
July	58.9	46.1	51.7	3.1	9.7
August	58.9	43.5	50.7	3.1	9.8
September	55.2	39.9	46.9	2.8	8.1
October	49.4	34.1	41.4	2.9	8.2
November	41.0	32.0	36.2	2.1	4.4
December	40.5	31.9	34.0	2.2	4.8



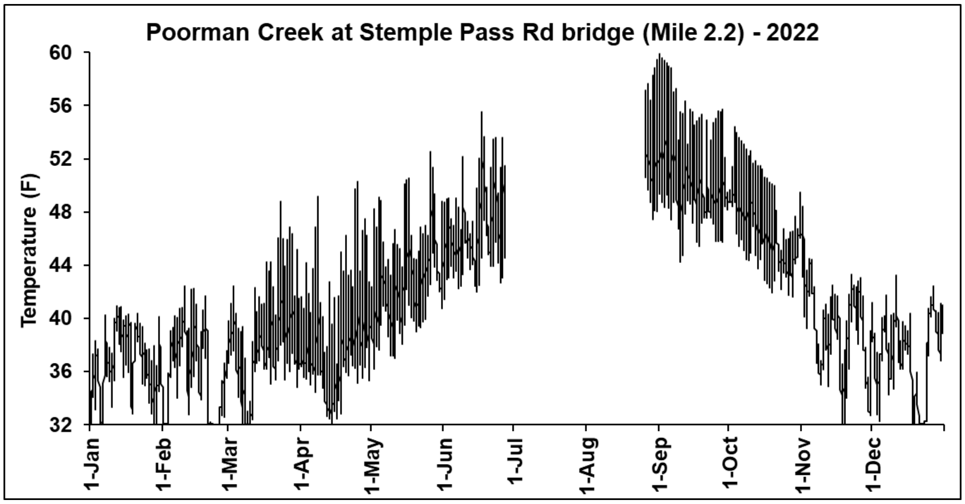
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.5	32.0	33.3	1.1	1.2
February	36.5	32.0	33.5	1.3	1.7
March	40.4	32.0	35.5	2.0	3.9
April	43.4	32.0	36.6	2.3	5.3
May	45.9	36.3	40.0	1.9	3.7
June	52.2	37.8	43.0	2.9	8.6
July	57.9	44.1	50.0	3.2	10.4
August	58.5	45.2	51.6	3.0	9.1
September	56.6	41.7	48.2	2.9	8.6
October	50.8	35.5	42.7	3.4	11.5
November	42.7	32.0	33.8	2.2	4.8
December	35.2	32.0	33.2	0.9	0.8



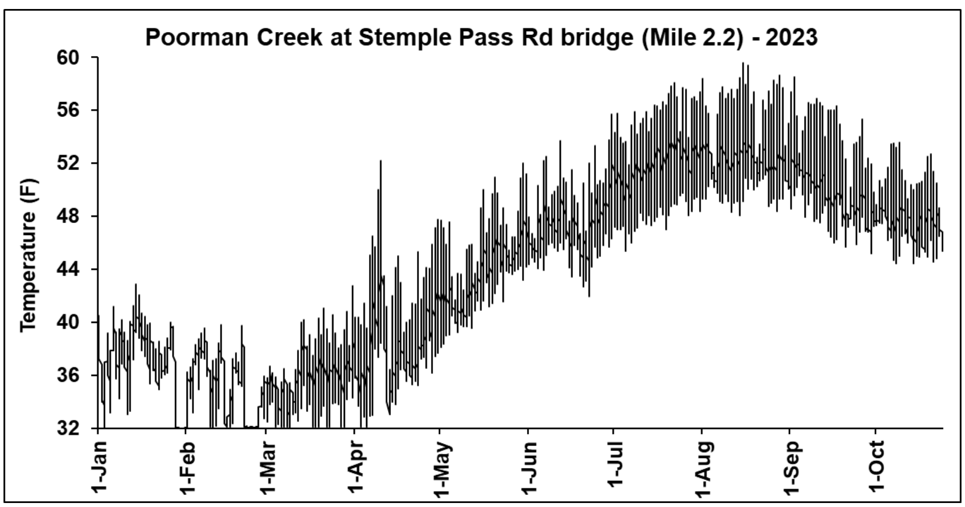
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.2	32.0	33.6	1.0	1.1
February	34.9	32.0	33.1	0.8	0.7
March	37.2	32.0	33.5	1.1	1.1
April	43.5	32.0	36.4	2.1	4.5
May	50.7	37.8	42.3	2.6	7.0
June	56.2	40.7	47.0	2.7	7.2
July	59.6	44.4	51.0	3.3	10.7
August	60.3	46.8	51.6	2.7	7.5
September	57.3	41.1	48.1	2.9	8.5
October	49.3	32.0	42.0	5.0	24.6
November					
December					



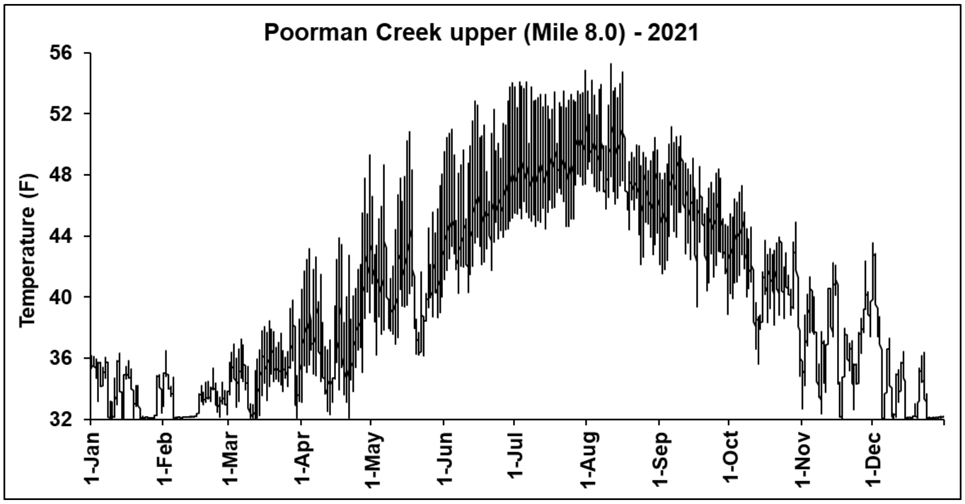
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	41.6	32.0	37.0	2.0	4.2
February	41.0	32.1	34.3	2.1	4.2
March	44.7	32.0	36.8	2.7	7.1
April	48.9	33.2	38.2	3.2	10.3
May	51.3	37.1	42.0	3.1	9.3
June	57.1	41.5	48.2	3.4	11.3
July	59.4	47.2	52.5	2.7	7.3
August	60.0	46.3	52.2	2.7	7.3
September	56.9	43.8	49.7	2.8	7.8
October	52.7	39.5	45.7	2.4	5.6
November	46.6	37.3	42.1	1.9	3.5
December	46.8	32.0	38.0	3.5	12.1



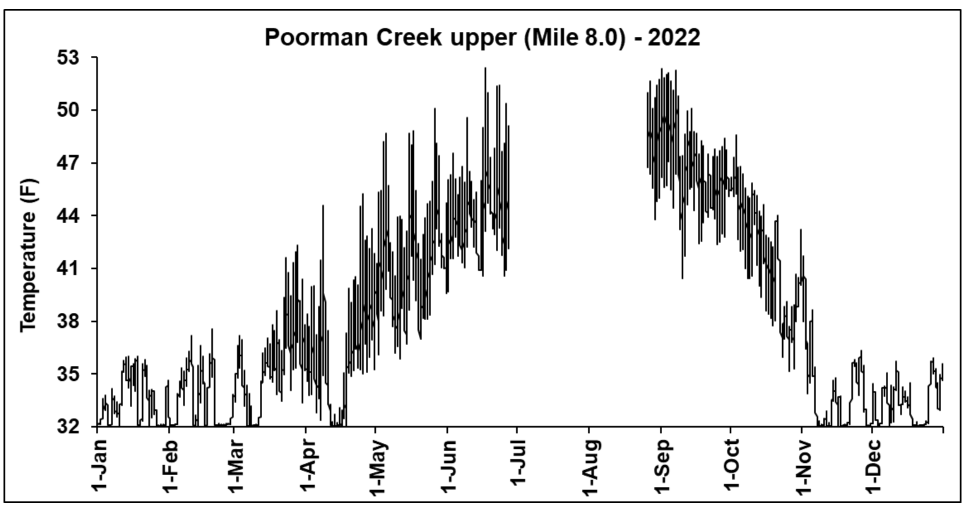
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	40.9	32.0	36.6	2.4	5.6
February	42.4	29.0	35.9	3.1	9.7
March	48.8	32.0	38.1	3.2	10.5
April	50.3	32.0	38.3	3.6	12.9
May	52.6	36.2	43.0	3.2	10.3
June	55.6	41.5	46.6	2.9	8.2
July					
August	59.4	47.5	52.5	3.2	10.1
September	59.9	44.2	50.6	3.2	10.0
October	54.4	41.6	46.8	2.8	7.7
November	48.4	32.1	39.3	3.2	10.3
December	43.3	32.0	37.3	3.0	8.7



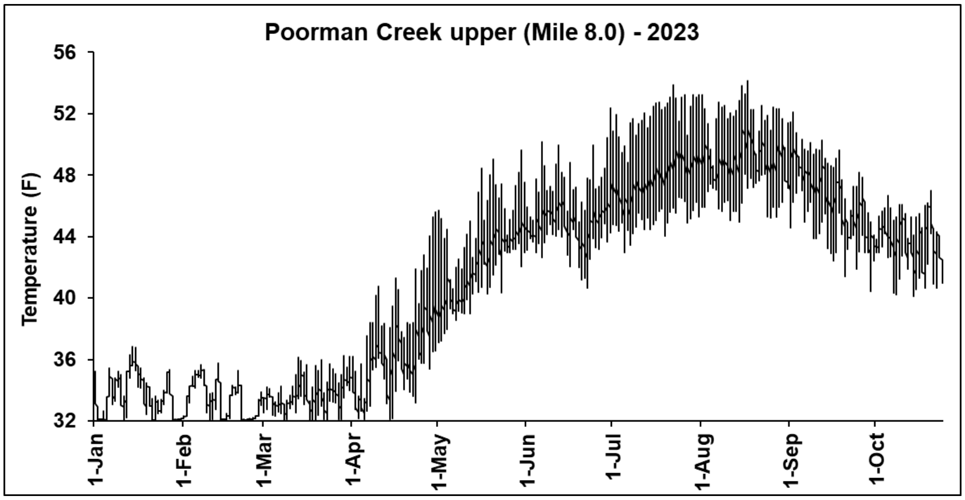
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	42.8	28.9	36.9	2.7	7.6
February	39.8	32.0	34.9	2.3	5.2
March	42.8	32.0	35.1	2.3	5.4
April	52.2	32.1	38.7	3.6	13.2
May	52.0	38.1	43.9	2.8	8.0
June	55.7	42.0	47.7	2.4	5.6
July	58.1	45.4	51.6	2.9	8.2
August	59.6	48.0	52.6	2.5	6.1
September	58.5	45.2	50.3	2.7	7.1
October					
November					
December					



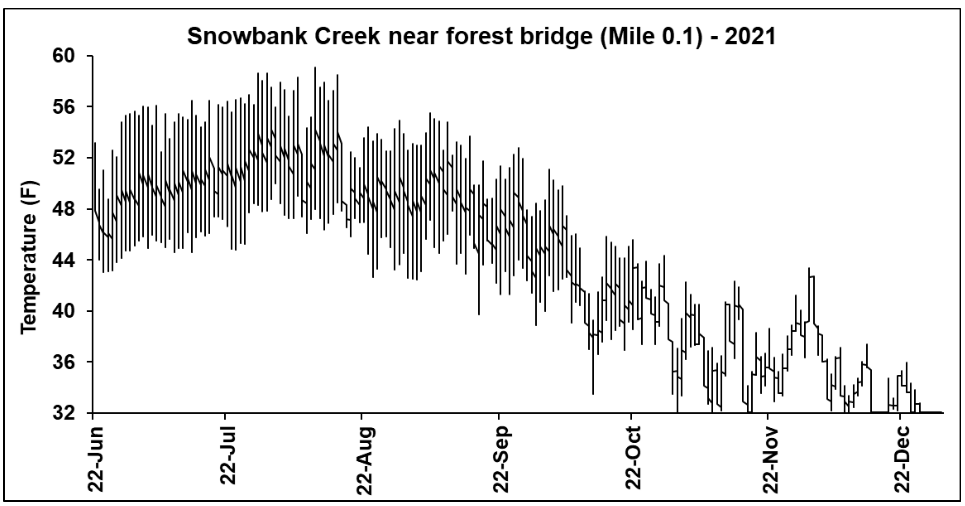
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.3	32.0	33.7	1.4	1.9
February	36.5	32.1	33.1	1.0	0.9
March	39.8	32.0	35.0	1.6	2.5
April	49.3	32.1	37.7	3.1	9.9
May	50.8	36.2	41.1	3.0	8.8
June	54.0	40.3	45.9	2.9	8.4
July	54.9	44.4	49.0	2.5	6.4
August	55.3	42.1	48.4	2.6	6.6
September	51.1	38.9	45.5	2.4	5.9
October	47.3	34.9	41.4	2.3	5.5
November	42.3	32.0	37.1	2.4	5.8
December	43.5	32.0	34.1	2.8	7.7



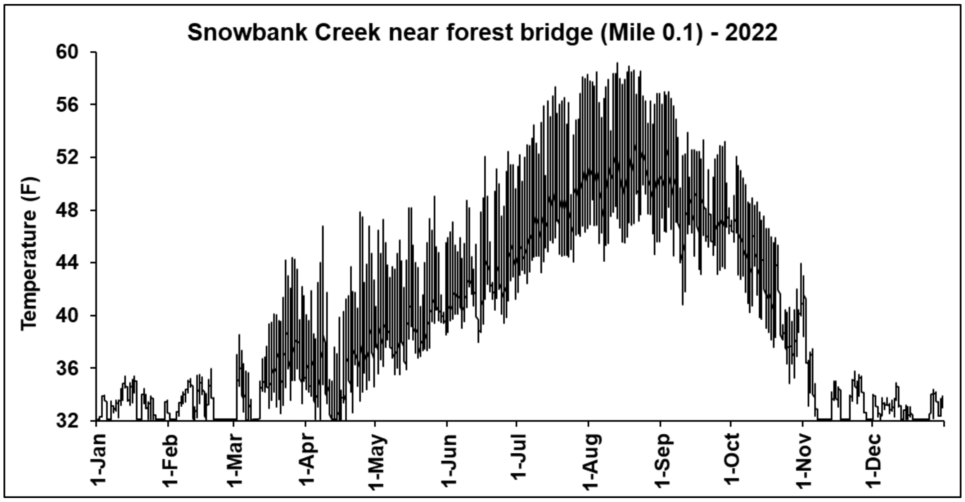
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.0	32.0	33.5	1.3	1.6
February	37.6	32.0	33.6	1.5	2.3
March	42.3	32.0	35.5	2.3	5.2
April	45.3	32.0	36.2	3.2	9.9
May	50.1	35.9	41.7	2.9	8.3
June	52.4	39.7	44.5	2.4	5.8
July					
August	51.8	43.8	48.2	2.1	4.6
September	52.4	40.4	46.6	2.3	5.3
October	48.6	35.2	41.6	3.1	9.3
November	41.7	32.0	33.9	2.1	4.4
December	35.9	32.0	33.4	1.1	1.3



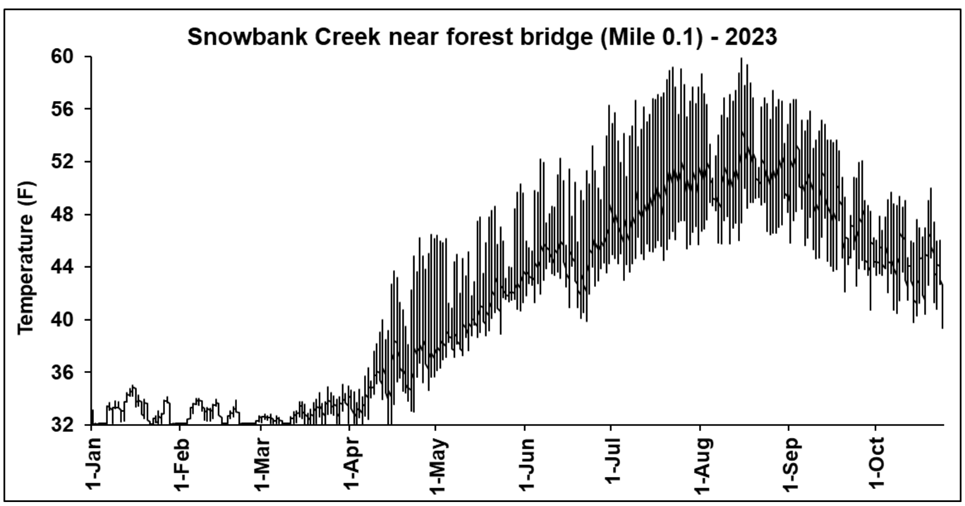
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.8	32.0	33.6	1.3	1.6
February	35.8	32.0	33.3	1.1	1.2
March	36.2	32.0	33.6	1.0	1.0
April	45.6	32.1	36.4	2.7	7.4
May	49.6	37.1	42.6	2.6	6.5
June	52.4	40.7	45.3	1.8	3.4
July	53.9	43.0	48.1	2.5	6.4
August	54.1	44.9	49.0	2.0	4.1
September	52.1	40.4	46.3	2.3	5.3
October					
November					
December					



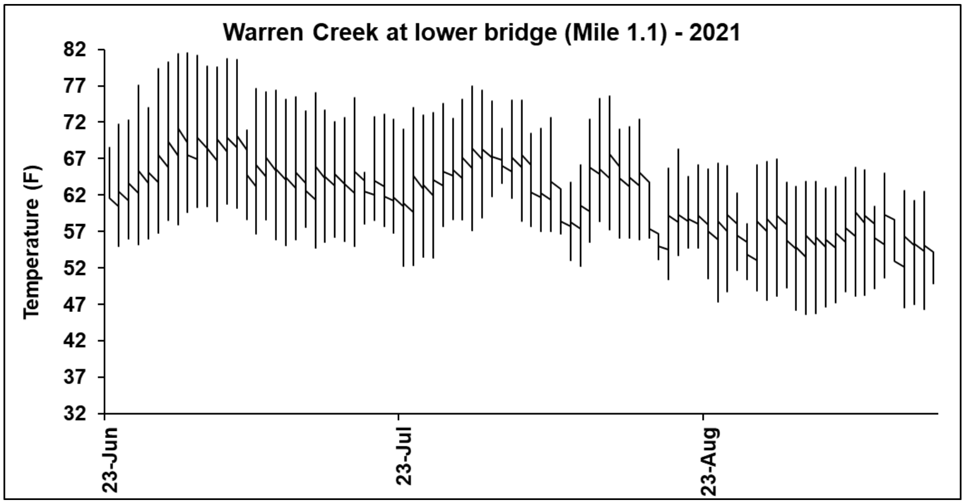
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	55.4	43.0	47.9	3.4	11.6
July	58.6	44.6	50.3	3.5	12.1
August	59.1	42.7	50.3	3.4	11.6
September	55.5	38.9	47.4	3.4	11.4
October	51.1	33.5	41.6	3.1	9.9
November	42.3	32.0	36.6	2.6	6.5
December	43.4	32.0	34.2	2.6	6.7



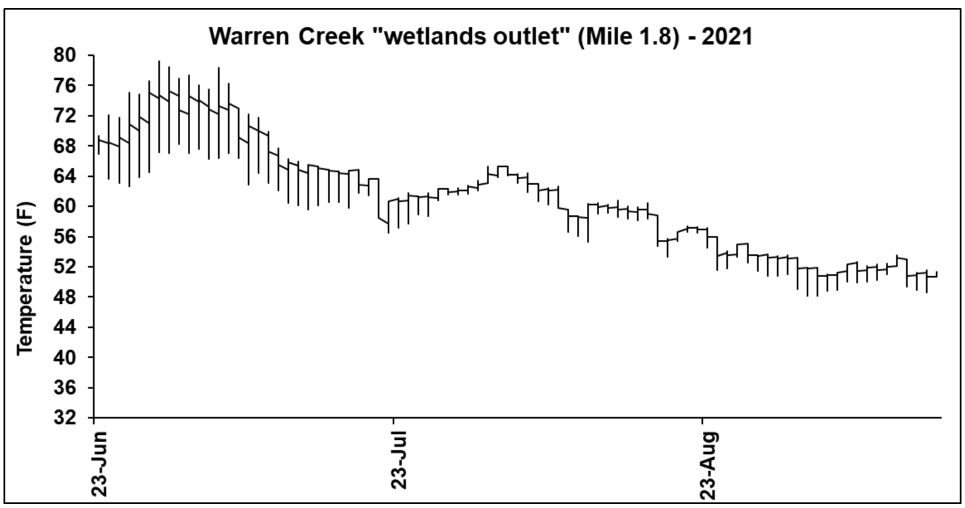
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.4	32.0	33.1	0.9	0.9
February	35.9	32.0	33.0	1.1	1.2
March	44.4	32.0	35.6	2.9	8.3
April	47.9	32.0	36.8	3.5	12.4
May	49.0	35.5	40.4	2.8	7.8
June	52.5	37.9	43.5	3.1	9.6
July	58.3	41.8	49.1	3.8	14.2
August	59.1	44.1	51.6	3.6	13.2
September	56.9	40.9	48.6	3.1	9.7
October	52.1	34.9	42.7	3.8	14.3
November	43.0	32.0	33.8	2.1	4.6
December	34.9	32.0	32.8	0.7	0.5



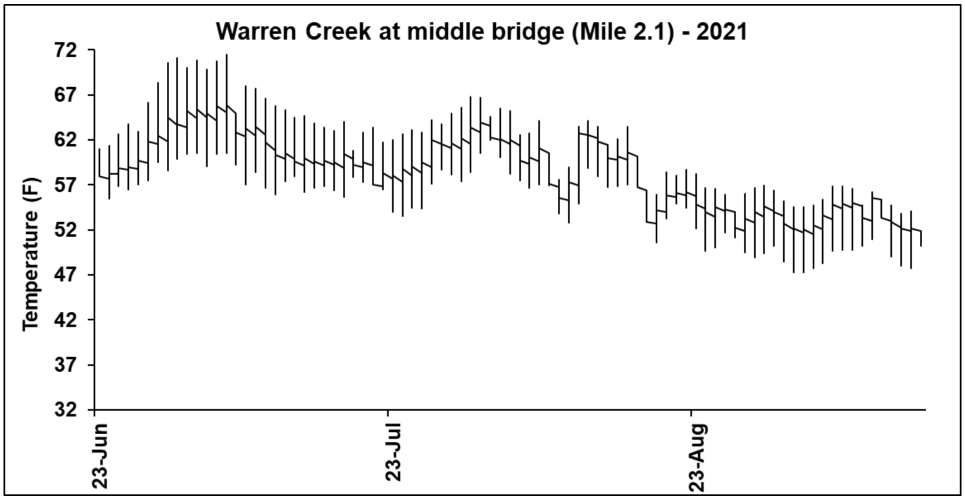
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	35.0	32.0	32.9	0.8	0.7
February	34.0	32.0	32.7	0.6	0.4
March	35.1	32.0	32.8	0.7	0.5
April	46.5	32.0	36.6	3.3	10.6
May	50.3	36.2	41.7	2.9	8.6
June	56.3	39.9	45.8	2.9	8.3
July	59.2	43.0	50.3	3.9	15.0
August	59.8	45.8	51.6	3.1	9.8
September	56.7	40.7	48.6	3.4	11.3
October					
November					
December					



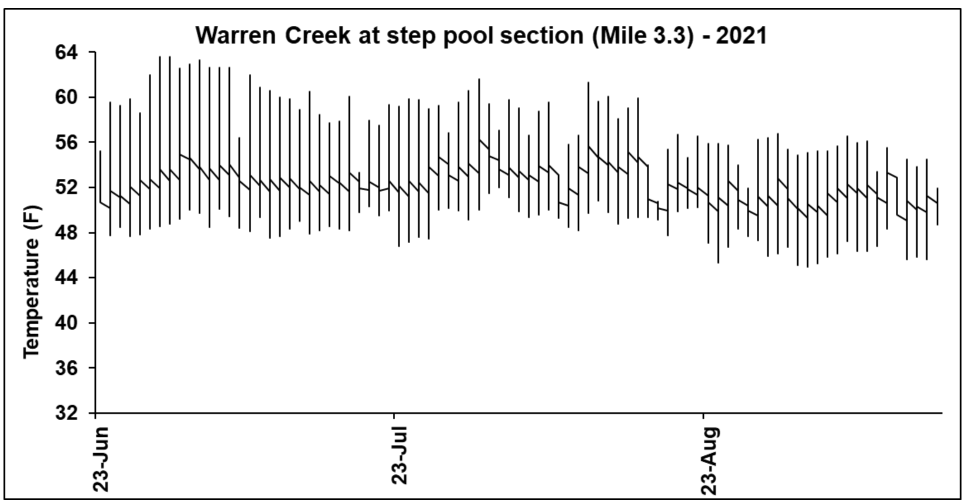
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	81.3	55.0	65.8	7.3	53.9
July	81.5	52.2	65.2	6.7	45.4
August	75.6	47.4	60.4	6.4	40.4
September	65.8	45.6	54.7	5.4	29.3
October					
November					
December					



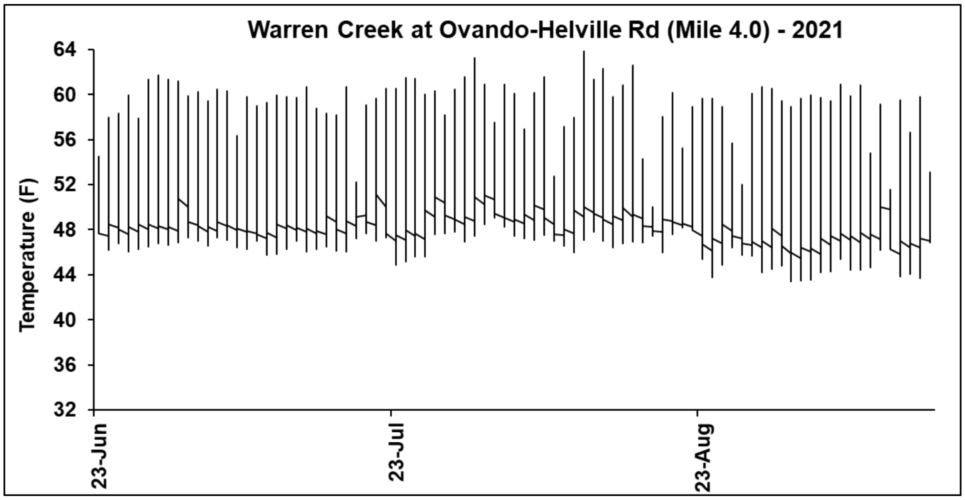
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	79.3	62.6	70.0	4.3	18.8
July	78.4	56.5	64.7	4.8	23.3
August	65.3	50.8	57.8	3.9	15.1
September	53.5	48.2	50.9	1.1	1.3
October					
November					
December					



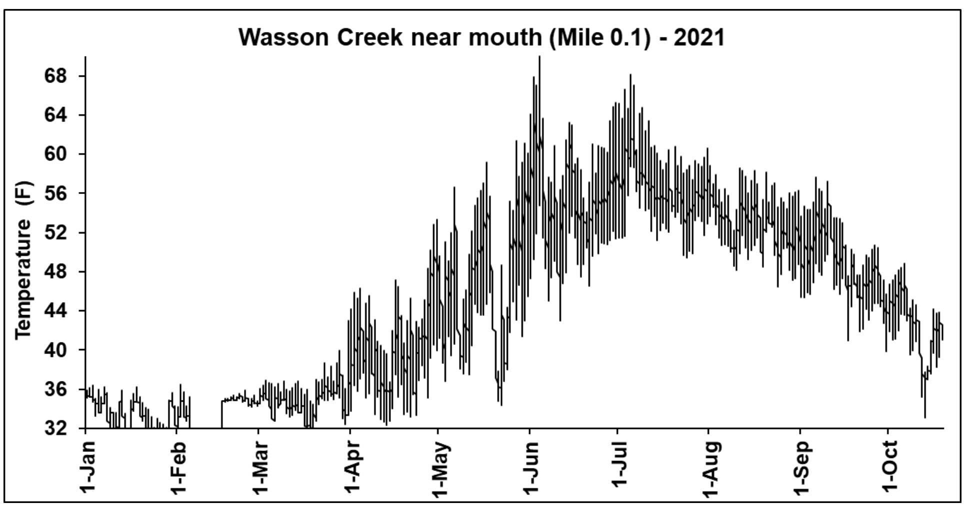
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	70.5	55.5	60.7	3.3	11.1
July	71.4	53.6	61.1	3.7	13.4
August	66.7	48.9	57.2	4.0	16.0
September	56.9	47.2	52.2	2.4	5.9
October					
November					
December					



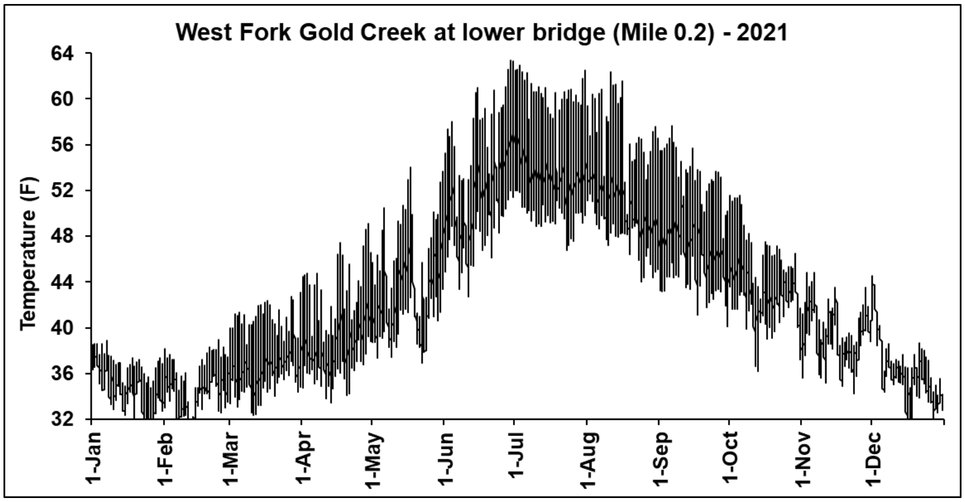
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	63.6	47.6	53.5	4.4	19.5
July	63.3	46.8	53.5	4.0	15.9
August	61.3	45.4	52.4	3.3	10.8
September	56.6	45.0	50.4	3.1	9.6
October					
November					
December					



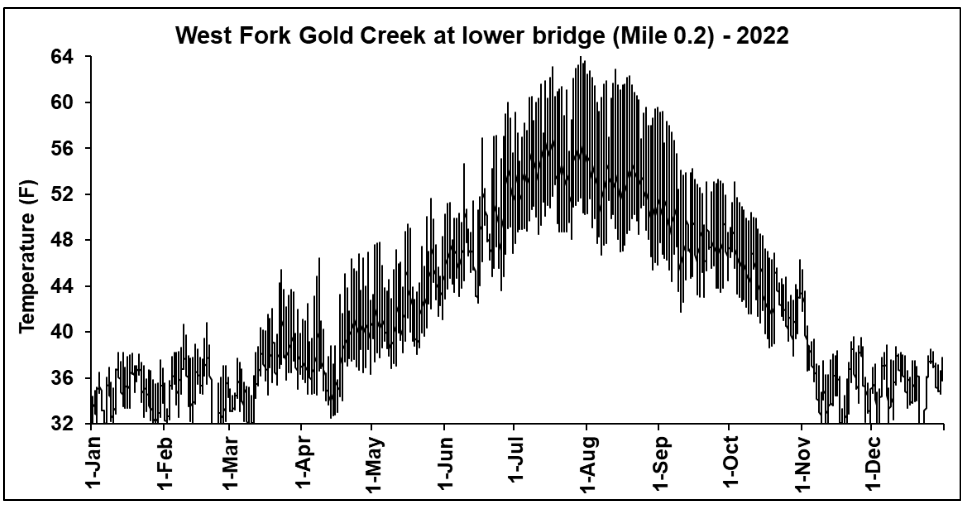
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January					
February					
March					
April					
May					
June	61.7	46.1	51.5	4.6	21.2
July	63.3	44.9	51.6	4.7	22.0
August	63.8	43.8	51.2	4.6	20.9
September	60.9	43.4	49.9	5.0	24.9
October					
November					
December					



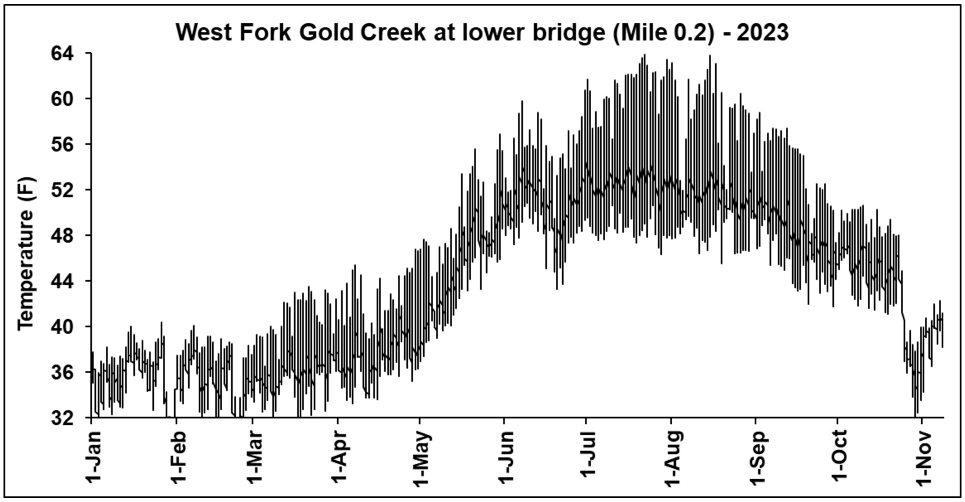
Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	36.4	31.6	33.6	1.4	2.1
February	36.5	31.7	33.5	1.5	2.2
March	43.0	32.0	35.2	1.5	2.1
April	53.3	32.3	39.8	4.1	17.0
May	61.4	34.4	46.1	6.1	37.8
June	70.0	43.0	54.9	4.8	23.2
July	68.1	49.5	56.6	3.4	11.8
August	58.8	46.4	52.7	2.6	6.7
September	57.7	39.9	48.4	3.5	12.1
October	48.9	33.1	42.0	3.2	10.6
November					
December					



Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	38.9	31.9	35.1	1.7	2.9
February	38.9	31.9	34.7	1.7	2.7
March	43.1	32.3	37.2	2.3	5.2
April	49.1	33.4	39.3	3.2	10.0
May	54.0	36.9	43.3	3.7	13.7
June	63.4	42.8	52.2	4.3	18.6
July	62.9	46.8	54.5	3.8	14.6
August	62.4	44.0	51.9	3.8	14.8
September	57.6	40.1	48.0	3.7	13.6
October	51.5	36.2	43.5	2.8	7.8
November	44.9	34.2	39.3	2.1	4.4
December	44.5	31.9	36.1	2.6	6.5



Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	38.2	31.9	34.7	1.7	2.8
February	40.8	31.9	35.1	2.2	4.7
March	45.4	31.9	36.9	2.9	8.4
April	46.9	32.5	38.6	3.3	10.8
May	51.6	36.8	42.6	3.0	9.2
June	60.0	42.5	48.7	3.6	12.9
July	64.1	47.7	54.7	3.8	14.8
August	62.8	45.4	53.9	4.2	17.7
September	59.2	41.7	48.9	3.5	12.2
October	53.0	37.9	44.3	3.2	9.9
November	45.4	32.0	36.1	2.8	7.8
December	38.8	31.6	35.5	1.9	3.5



Month	Max Temp	Min Temp	Avg Temp	StDev	Variance
January	40.4	31.9	35.7	2.0	4.0
February	40.1	31.8	35.4	2.2	4.6
March	43.5	32.0	36.9	2.6	7.0
April	46.8	33.2	38.5	2.9	8.5
May	56.9	36.9	45.8	4.2	17.5
June	60.8	43.3	51.4	3.2	10.0
July	63.9	46.3	54.0	4.3	18.7
August	63.8	45.5	52.7	4.0	16.3
September	58.8	41.8	49.1	3.8	14.2
October	50.6	32.1	43.7	4.4	19.5
November					
December					