# CANDIDATE CONSERVATION AGREEMENT WITH ASSURANCES FOR ARCTIC GRAYLING IN THE CENTENNIAL VALLEY, MONTANA

2021 Annual Report

Montana Fish, Wildlife & Parks

**The Candidate Conservation Agreement with Assurances for Arctic Grayling in the Centennial Valley, Montana State and Federal Agency Partnership includes:**

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## I. Introduction

A Candidate Conservation Agreement with Assurances (CCAA) is an agreement between the U.S. Fish and Wildlife Service (USFWS) and any non-Federal entity whereby property owners who voluntarily agree to manage their lands or waters to remove threats to species at risk of becoming threatened or endangered receive assurances against additional regulatory requirements should that species be subsequently listed under the Endangered Species Act (ESA). Since 2000 there have been 50 CCAA's approved in 24 different states that have more than 25.2 million acres enrolled by 717 landowners that cover 84 species. CCAA project areas range in size from one-acre aiming to protect the Greater and Lesser Adam Cave Beetles in Kentucky to 7,214,287-acres to protect Lesser Prairie Chicken in Colorado, Kansas, Oklahoma, New Mexico, and Texas (USFWS 2018).

The conservation goal of the Centennial Valley Arctic Grayling CCAA is to secure and enhance Arctic Grayling (Thymallus arcticus) populations and habitat in 52 stream miles on non-federal lands in the Centennial Valley. Montana Fish, Wildlife & Parks (FWP) holds a USFWS ESA section 10(a)(1)(A) Enhancement of Survival Permit and issues Certificates of Inclusion to non-Federal property owners within the Project Area who agree to comply with all stipulations of the Program and develop a Site-Specific Conservation Plan (SSP; Figure 1). SSPs are collaboratively developed by each landowner and an interdisciplinary FWP technical team and approved by USFWS. The conservation goal of the Centennial Valley Arctic Grayling CCAA will be met by implementing measures that:

**1)** Improve Streamflows

**2)** Improve and protect the function of riparian habitats

**3)** Identify and reduce or eliminate entrainment threats for Arctic Grayling

**4)** Remove barriers to Arctic Grayling migration

The Centennial Valley Arctic Grayling CCAA is a collaborative effort among private landowners, state and federal agencies, and non-government organizations. These stakeholders have agreed to work together for the common goals of conserving Arctic Grayling, improving Centennial Valley fish populations, addressing private property concerns, and enhancing the overall health of the Centennial Valley watershed.

The 2021 Centennial Valley Arctic Grayling CCAA report summarizes current enrollment, approved SSPs, implemented conservation measures, and completed projects.

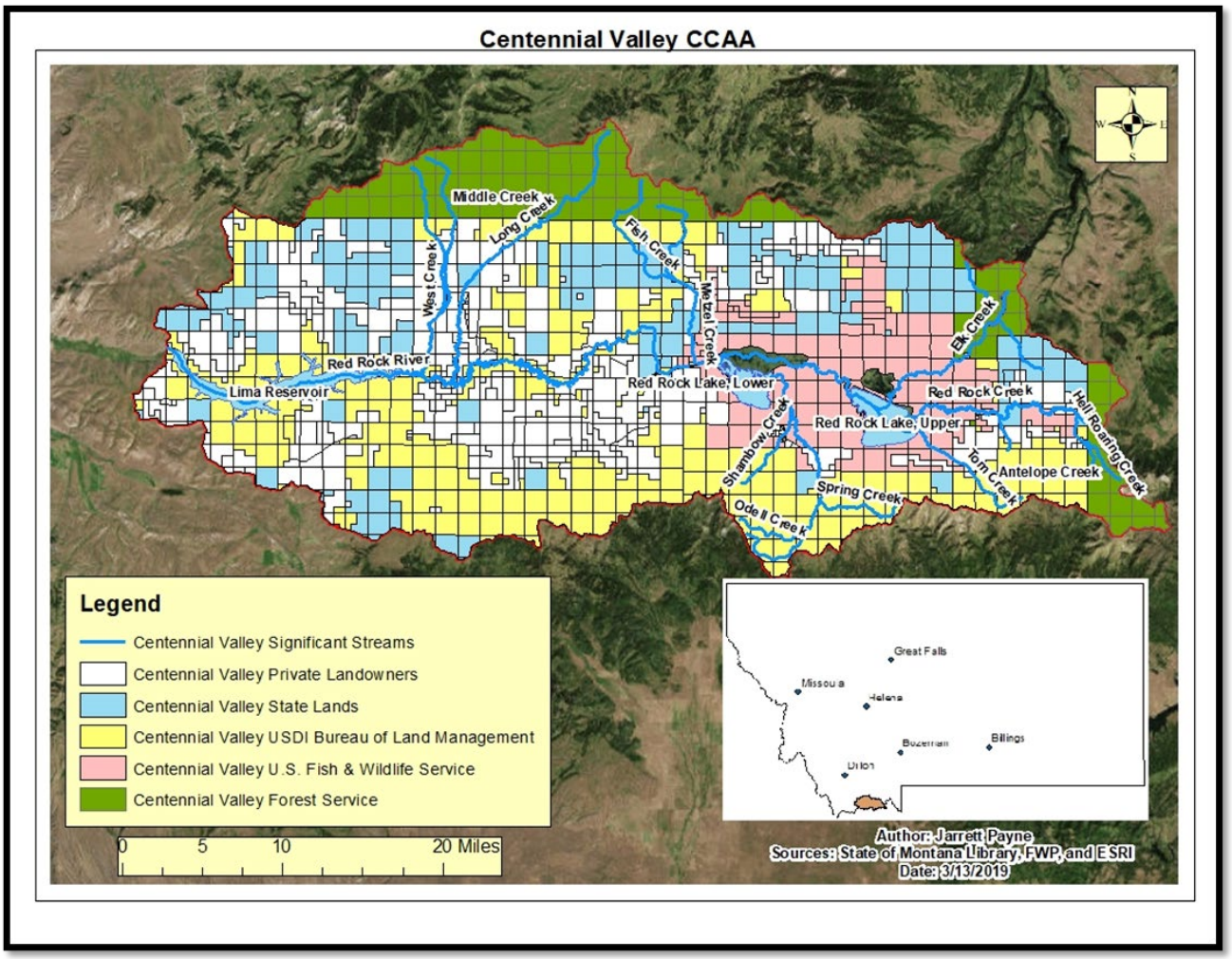


**Figure 1.** The Centennial Valley Arctic Grayling CCAA Project Area.

## II. Legal Status of Montana Arctic Grayling

On July 23rd, 2020, the USFWS announced that the Upper Missouri River Distinct Population Segment (DPS) of the Arctic Grayling did not warrant protection under the Endangered Species Act (ESA). This decision was determined using the best available science and in part based on advances by the Big Hole Arctic Grayling CCAA and critical conservation work completed by private landowners (Federal Register 2020). For complete legal review prior to 2020 please review the USFWS 2020 listing determination (Federal Register 2020).

## III. Landowner Enrollment

On September 19th, 2018, the USFWS issued FWP ESA section 10(a) (1) (A) Enhancement of Survival Permit # TE-06690D-0, authorizing the Centennial Valley Arctic Grayling CCAA. This permit allows official enrollment of any non-federal landowner within the Centennial Valley Arctic Grayling CCAA Project Area. Enrolled non-federal landowners are provided incidental

take coverage and regulatory assurances once the non-federal landowner, FWP, and the USFWS counter-sign the Certificate of Inclusion and the approved SSP for the enrolled property, if Arctic grayling become listed under the ESA. Currently, there are 5 landowners (Participating Landowners) that have enrolled 9,076 acres of private land into the Centennial Valley Arctic Grayling CCAA (Figure 2). Enrollment for the Centennial Valley Arctic Grayling CCAA will remain open until 90 days prior to any final listing rule published by the USFWS in the Federal Register.

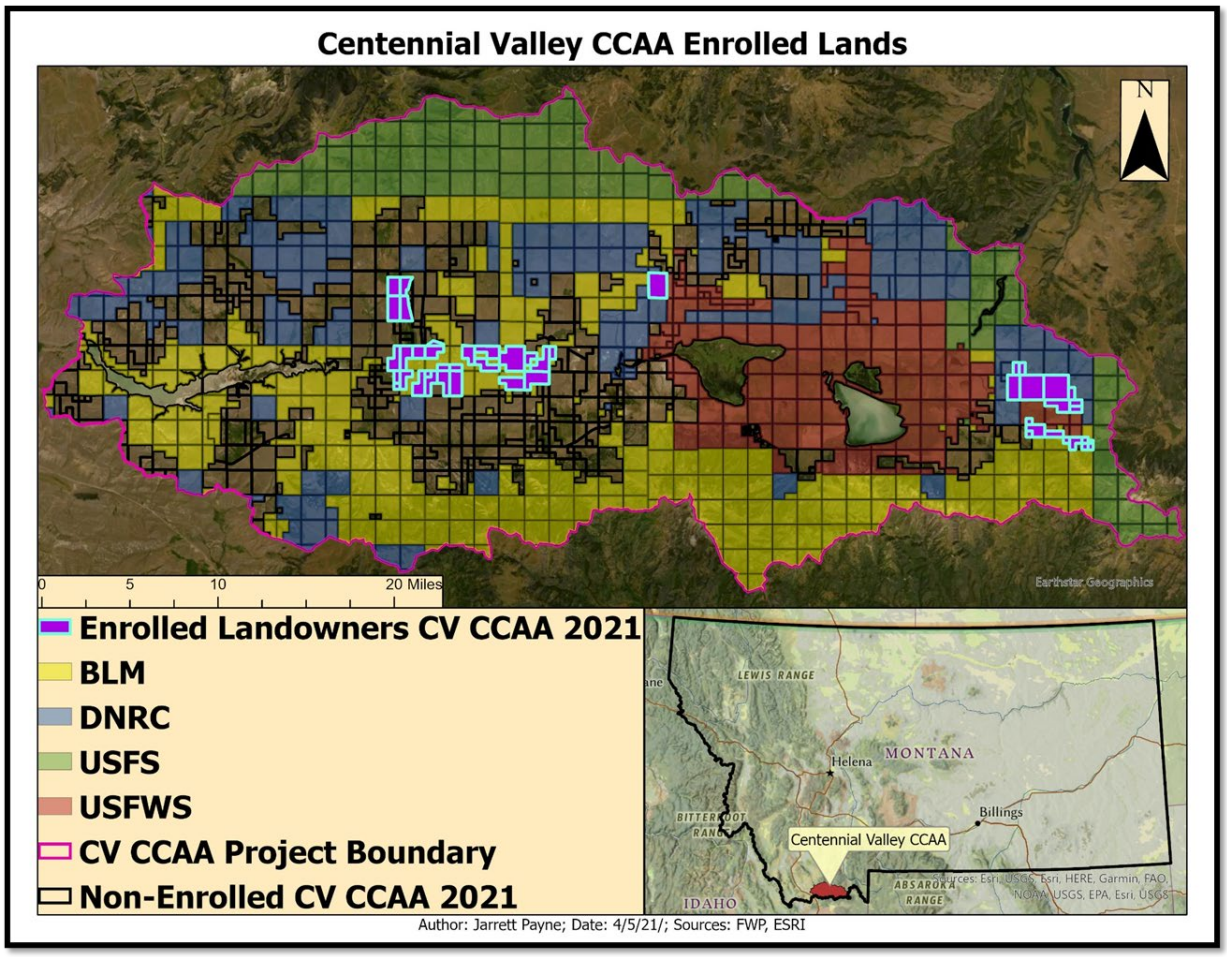


**Figure 2.** December 31st, 2021 Centennial Valley Arctic Grayling CCAA Program of private land enrolled (five landowners with a total of 9,076 acres).

## IV. Centennial Valley Arctic Grayling CCAA Rapid Assessments and Compliance Monitoring

The Participating Landowners in the Centennial Valley Arctic Grayling CCAA allow the Agencies to complete a "rapid assessment" of the enrolled property within 90 days of enrolling. The rapid assessment focuses on identifying immediate threats to Arctic Grayling and validating water rights compliance. Immediate threats to Arctic Grayling may include structures, mechanical devices or pollutants that pose a threat of immediate mortality. Examples include unscreened pumping from or toxic effluent entering a stream. Additional information may be

gathered during rapid assessments that assist with the development of the SSP with the Participating Landowner (Petersen and Lamothe 2006).

### *A. Surveys for Immediate Threats to Arctic Grayling*

During the summer of 2021, FWP and USFWS did not complete rapid assessments as there was no new enrollment. Site visits to enrolled properties did not find any immediate threats to Arctic Grayling on all five enrolled properties. Monitoring of enrolled properties for immediate threats will continue as SSPs are developed by FWP.

### *B. Flow and Water Right Compliance Monitoring*

FWP completed flow and water right compliance monitoring for all Centennial Valley CCAA streams (FWP and USFWS, 2018). Flow monitoring was completed on Corral Creek, Antelope Creek, Red Rock Creek, Tom Creek, Odell Creek, Metzel Creek, Long Creek, Red Rock River, West Creek, and Middle Creek. Four enrolled landowners have associated water rights that were monitored for irrigation compliance on Corral Creek, Red Rock Creek, Long Creek, Red Rock River, and Middle Creek. All landowners generally followed flow agreements, reducing diversions when requested. Flow and compliance monitoring of all Centennial Valley CCAA streams are summarized in Table 1 and described in more detail in Appendix 1.

## V. Site-Specific Plans

SSPs are developed for each Participating Landowner by FWP and the landowner. The SSPs identify conservation measures that will lead to improved streamflow, enhanced riparian and stream channel condition, improved fish passage and reduced levels of entrainment.

### *A. Completed and Approved*

Two SSPs have been completed for the Centennial Valley CCAA program (Table 1). At a minimum, two SSPs will be developed in 2022, with the remaining SSP being developed during the Summer and Fall of 2023. All SSPs are 10-year agreements between the Participating Landowners, FWP, and the USFWS. Updates on the implementation of these SSPs, including compliance and monitoring results, will be included in future reports.

### *B. Extension Requests Approved by the USFWS*

FWP did not submit approval for extensions to complete SSPs in 2020. Extensions provide additional time to complete SSPs and document past and ongoing conservation actions for Arctic Grayling on the property receiving the extension.

**Table 1.** Property numbers of enrolled landowners and their associated enrolled acres and enrollment status.

| Property Number | Private Land Enrolled (Acres) | State Land Enrolled (Acres) | Enrollment Status | 10 Year SSP Update |
|---|---|---|---|---|
| 1 | 696.21 | 0 | SSP completed | 2031 |
| 2 | 2227.7 | 0 | SSP in draft - Fall 2022 | NA |
| 3 | 4713.67 | 0 | SSP in draft – Summer 2023 | NA |
| 4 | 466.2 | 0 | SSP in draft - Summer 2022 | NA |
| 5 | 972.32 | 0 | SSP completed, waiting for signatures | 2032 |

## VI. Conservation Measures

Through the process of developing SSPs for Participating Landowners, projects that reduce or eliminate entrainment of Arctic Grayling, eliminate barriers to fish passage, maintain adequate streamflow and protect and/or improve riparian and stream habitat quality are identified. Projects and related conservation measures completed in 2021 are reported below.

### *A. Entrainment Surveys*

Baseline electrofishing surveys to identify potential grayling entrainment locations were conducted in 2021 on Corral, Hell Roaring, and Cole creeks. Surveys occurred in June during peak irrigation. A total of 2.82 miles of irrigation ditches were surveyed and no entrained grayling were found. Future entrainment surveys will occur as SSPs are created.

### *B. Projects to Minimize or Eliminate Entrainment of Arctic Grayling*

Currently no grayling entrainment has been observed and is not believed to be a threat on any of the monitored CCAA specific streams.

### *C. Projects to Enhance Fish Passage*

No fish passage projects were completed in 2021.

### *D. Projects to Enhance Riparian and Stream Channel Habitat*

During 2021 two stream restoration projects were completed. Riparian restoration projects occurred on two enrolled properties (Table 2).

**Table 2.** Centennial Valley CCAA streamflow and irrigation management projects completed in 2020. Projects include installing headgates, PODs, and ditch maintenance.

| **2021** | | |
|---|---|---|
| **Associated Waterbody** | **Landowner #** | **Project Component** |
| Long Creek | 5 | Activated and improved 3,600' of new riparian channel on Long Creek |
| Corral Creek | 1 | Restored 300' of channel |

### *E. Projects to Improve Streamflow and Irrigation Water Management*

No streamflow or irrigation projects were completed in 2021.

### *F. Projects to Expand Arctic Grayling Distribution into Historically Occupied Waters*

An appropriate brood population for reintroduction efforts into the Centennial Valley does not exist. However, an opportunity to re-stock Handkerchief Lake in the South Fork Flathead River drainage with an acceptable brood source is currently available. Initial attempts used Red Rock Creek grayling, but numbers thus far have not been sufficient to establish a genetically appropriate population. In 2020, FWP employees collected genetic samples from 20 mountain lakes with grayling populations established primarily using Centennial Valley and/or Madison River grayling. The objective was to identify genetic origin of each population and determine if any matched the Centennial Valley population. Initial results indicate that all non-indigenous populations contain a mix of Centennial and Madison genetics; however, at least four populations provide close genetic matches (Elizabeth Lake- Glacier National Park, Odell and Schwinegar lakes- Pioneer Mountains, Park Lake- Boulder Mountains) to the Centennial Valley population. Re-population and brood management plans for Handkerchief Lake were developed and integration of fish from appropriate lakes will occur in 2022. Once the Centennial Valley brood is established, several options in the Centennial Valley are available for grayling repopulation efforts.

## VII. Monitoring

### *A. Population Monitoring*

*Effective Number of Breeding Individuals (Nb):*

The Centennial Valley Arctic Grayling CCAA requires specific monitoring associated with the conversation measures implemented under this agreement and resulting biological responses of Arctic Grayling populations. FWP, under the guidance of geneticists and with the approval of USFWS, began systematically using genetic monitoring for Centennial Valley Arctic Grayling in 2010 (Table 3), but estimates of genetic variation are also available from historical sampling in the 1990s and 2000s (Figure 3). Justification for genetic monitoring is listed below:

> Determining trends in population abundance of rare or highly migratory fish species can be difficult. Genetic analysis is an effective alternative or supplemental method to determine the health and long-term persistence of fish populations (Schwartz et al. 2007). Using non-lethal sampling techniques geneticists can analyze the structure of an Arctic Grayling population and determine its long-term viability by estimating genetic diversity in a population (Allelic richness and average expected heterozygosity), effective number of breeding individuals that produced a given cohort (Nb), and ultimately the overall genetic effective population size (Ne). These estimates provide important population information on potential rate of loss of genetic variability and inbreeding depression, population dynamics, and the efficacy of management actions. Moreover, genetic data ensure that conservation efforts maintain the historic diversity found within and among Arctic Grayling populations, and thus, the continued evolutionary legacy of the species [Upper Missouri River Arctic Grayling Conservation Strategy, in preparation].

**Table 3.** Estimates of the number of effective breeders (Nb) for Arctic grayling from upper Red Rock Creek. N is number of individuals genotyped, LCI and UCI are the lower and upper (respectively) 95% confidence intervals for the Nb estimate from each year.

| Year | N | $N_b$ | LCI | UCI |
|---|---|---|---|---|
| 2010 | 34 | 273.1 | 86.1 | ∞ |
| 2011 | 63 | 207.1 | 106.4 | 544.1 |
| 2012 | 51 | 406.3 | 131.0 | ∞ |
| 2013 | 88 | 356.7 | 167.1 | 1714.4 |
| 2014 | 95 | 453.7 | 229.5 | 3914.3 |
| 2015 | 34 | 47.6 | 36.5 | 66 |
| 2016 | 29 | 35.8 | 26.3 | 53.2 |
| 2017 | 15 | 25.7 | 14.4 | 78 |

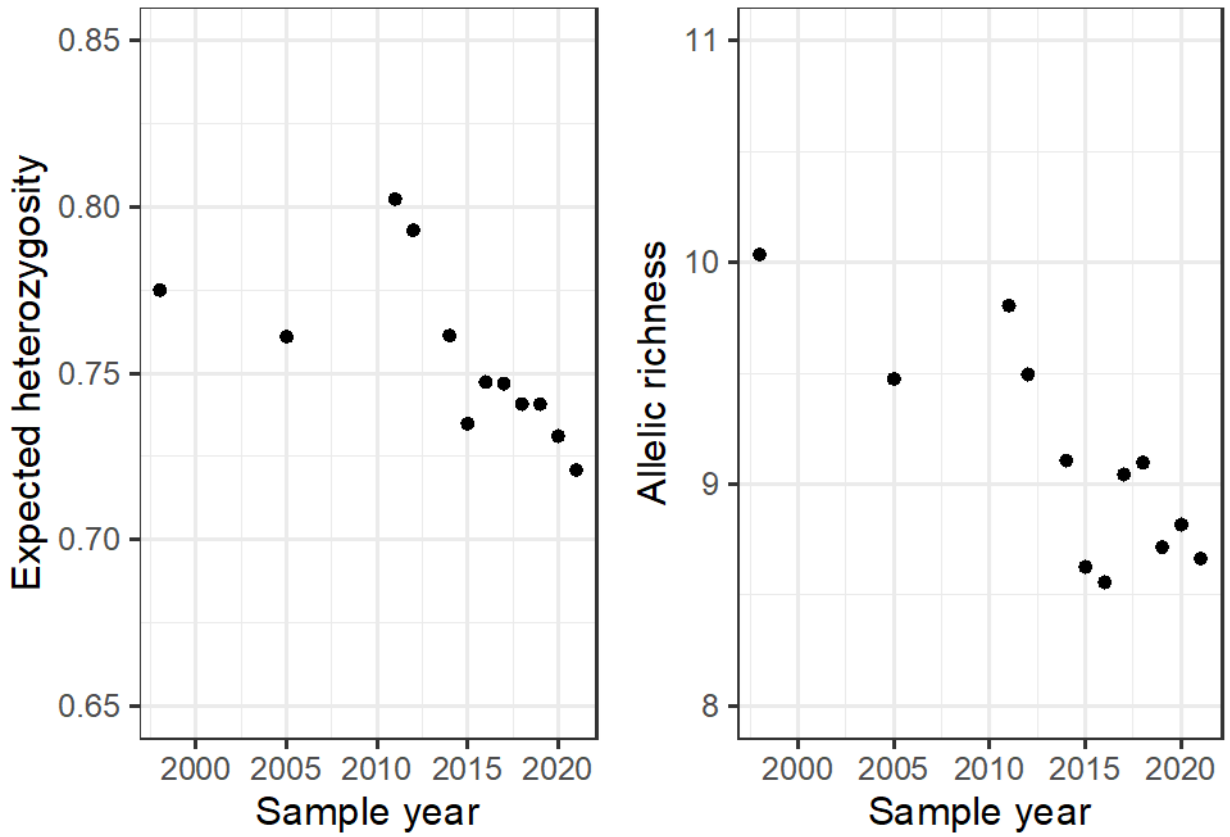


**Figure 3.** Temporal trends in measures of genetic variation in upper Red Rock Creek.

*Abundance Estimation:*

Artic grayling were collected from Red Rock Creek during two electrofishing surveys 7 days apart, uniquely marked with a visual implant (VI) tag, and sex, length (mm) and weight (g) was recorded. Abundance estimates were obtained using Chapman method (Guy and Brown 2007). It is estimated that grayling primarily spawn in approximately 3 miles of Red Rock Creek. The estimate is conducted over a 1.5-mile subset of that spawning area; therefore, the abundance estimates was doubled to obtain an estimate of spawning adults (Warren et al. 2022).

In 2021 the Arctic Grayling spawning population was estimated at 88 fish. A total of 17 Grayling were caught during two sampling events, 5 were marked, 12 were captured on a second event and of those 1 had been previously marked (recaptures). Of the 17 Grayling caught, 15 were males, and 2 were females. The average length was about 15.5 inches and the average weight was 1.3 lbs. All expected age classes were present (Figure 4).

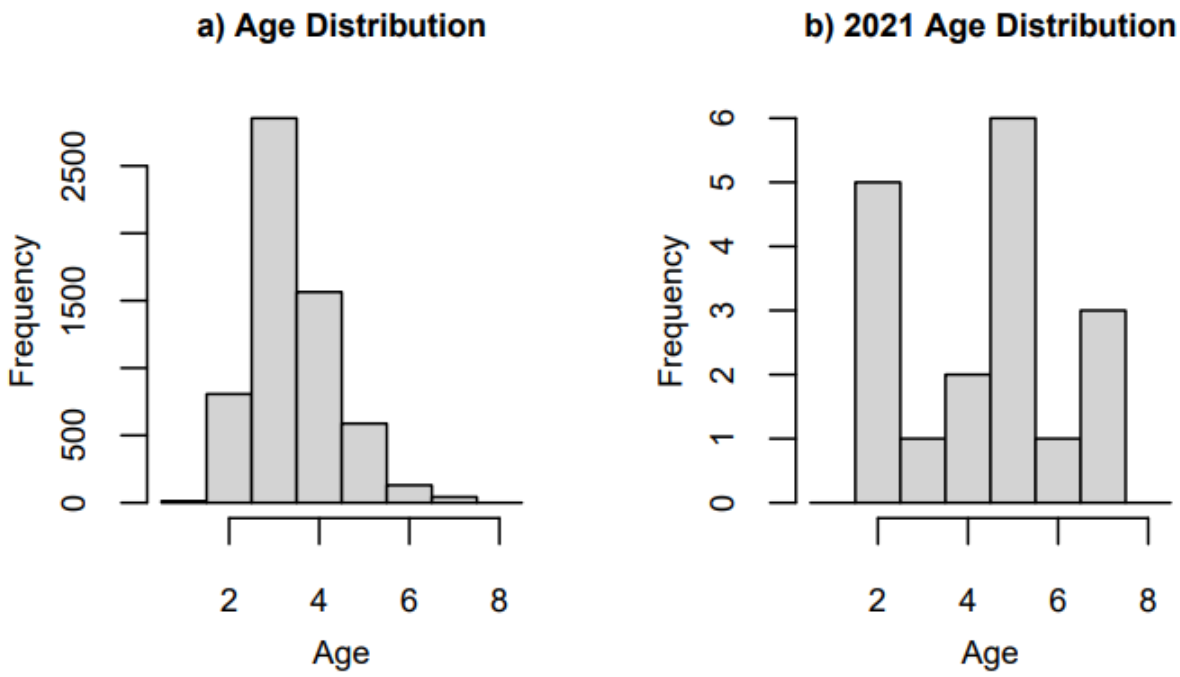


**Figure 4.** Age distributions of spawning grayling in Red Rock Creek in a) 1950-2020, and b) 2021.

All grayling that had not been sampled during previous years were genotyped by collecting a fin clip and aged using scales. Each fish was assigned to cohort for Nb estimation.

*Centennial Valley Arctic Grayling Adaptive Management Plan:*

A workgroup comprised of agencies with land and population management responsibility and authority developed the following objectives to meet the conservation goal for Arctic grayling within the CV:

1) Conserve existing Centennial Valley Arctic grayling genetic diversity.
2) Establish or maintain Arctic grayling spawning and/or refugia in at least two tributaries up and downstream of Upper Red Rock Lake and connectivity among tributaries.
3) Maintain at least 1000 spawning fish in the Upper Red Rock Lake Arctic grayling population.

The Centennial Valley CCAA was developed to improve spawning conditions and migratory access to tributaries on private land and was specifically designed to address Objective 2, which will establish and maintain additional spawning and rearing tributaries for grayling above and below Upper Lake.

To elucidate how to best address Objective 3, FWP and the USFWS implemented an Adaptive Management Plan (AMP) for the Centennial Valley in 2013 to evaluate the hypothetical drivers that govern the grayling population and inform future management actions (Warren and Jaeger

2017). The AMP evaluated the following three hypothesized drivers of the grayling spawning population:

1) Quality and quantity of tributary spawning habitat.
2) Predation by, and competition with, adult non-native hybrid Yellowstone cutthroat trout.
3) Quality and quantity of overwinter habitat in Upper Red Rock Lake.

On an annual basis, a series of management actions (e.g., non-native fish removal, restoration, beaver dam removal) and data collection (e.g., population estimates, Upper Lake dissolved oxygen measurements, spawning habitat availability) are used to inform hypothesis-specific models in the AMP and best identify limiting factors for the population.

Through 2021, AMP modeling indicates overwinter habitat in Upper Red Rock Lake is the primary population drive for Arctic grayling in the Centennial Valley (Warren et al. 2022). The Spawning Habitat model is somewhat well supported and likely describes a secondary population driver. As such, the Centennial Valley CCAA addresses a potential limiting factor by improving quality and quantity of tributary spawning habitat and is expected to ultimately contribute to maintaining genetic diversity.

### *B. Stream Temperature Monitoring*

In 2021, FWP collected stream temperature data throughout the upper Red Rock Watershed. Stream temperature data were collected in Antelope Creek, Corral Creek, Long Creek, Middle Creek, Metzel Creek, Odell Creek, Tom Creek, and West Creek. Stream temperature data were recorded at 60-minute intervals from May 20th through October 1st. The thermograph at Long Creek – Red Rock confluence was lost due to livestock. The 2021 data summarized maximum and mean temperature for the monitoring period and hours and days exceeding 21.1º C (70º F) and 25º C (77º F; Table 13). The thermal stress threshold for salmonid species is 21.1º C (70 º F; Behnke 1992), and 25º C (77º F) represents the upper incipient lethal temperature for Arctic Grayling (Lohr et al. 1996). Stream temperature monitoring summary and locations are described in Table 4 and Figure 5.

**Table 4.** Stream temperature monitoring results for 2021.

| Monitoring Site Big Hole Arctic Grayling CCAA Management Section | Mean Seasonal Temperature °C (°F) | Maximal Seasonal Temperature °C (°F) | Cumulative Hours Exceeding 21.1° C (70° F) | Cumulative Hours Exceeding 25° C (77° F) |
|---|---|---|---|---|
| Antelope Creek | 10.5 (50.9) | 23.1 (73.58) | 49 | 0 |
| Corral Creek | 9.1 (48.5) | 23.9 (75.0) | 22 | 0 |
| Long Creek – BLM | 12.5 (54.5) | 23.3 (73.9) | 98 | 0 |
| Long Creek – N. Valley Rd | 12.2 (54.0) | 24.2 (75.6) | 199 | 0 |
| Long Creek – Ruby Divide Rd | 11.8 (53.2) | 22.3 (72.1) | 31 | 0 |
| Long Creek – State Land | 12.9 (55.3) | 25.0 (77.1) | 47 | 1 |
| Long Creek – TNC | 13.8 (56.9) | 24.0 (75.2) | 84 | 0 |
| Metzel Creek | 18.5 (65.2) | 29.5 (85.0) | 975 | 296 |
| Middle Creek – BLM | 7.5 (45.6) | 16.3 (61.4) | 0 | 0 |
| Middle Creek – confluence | 11.1 (52.0) | 21.8 (71.3) | 11 | 0 |
| Odell Creek | 8.4 (47.1) | 18.3 (65.0) | 0 | 0 |
| Red Rock (USGS) | 12.1 (53.7) | 20.1 (68.2) | 0 | 0 |
| Tom Creek | 10.7 (51.2) | 25.3 (77.6) | 264 | 3 |
| West Creek – BLM | 7.5 (45.5) | 15.7 (60.2) | 0 | 0 |
| West Creek – above confluence | 10.8 (51.4) | 23.8 (74.8) | 43 | 0 |
| West Creek – below confluence | 9.7 (49.5) | 22.9 (73.2) | 62 | 0 |

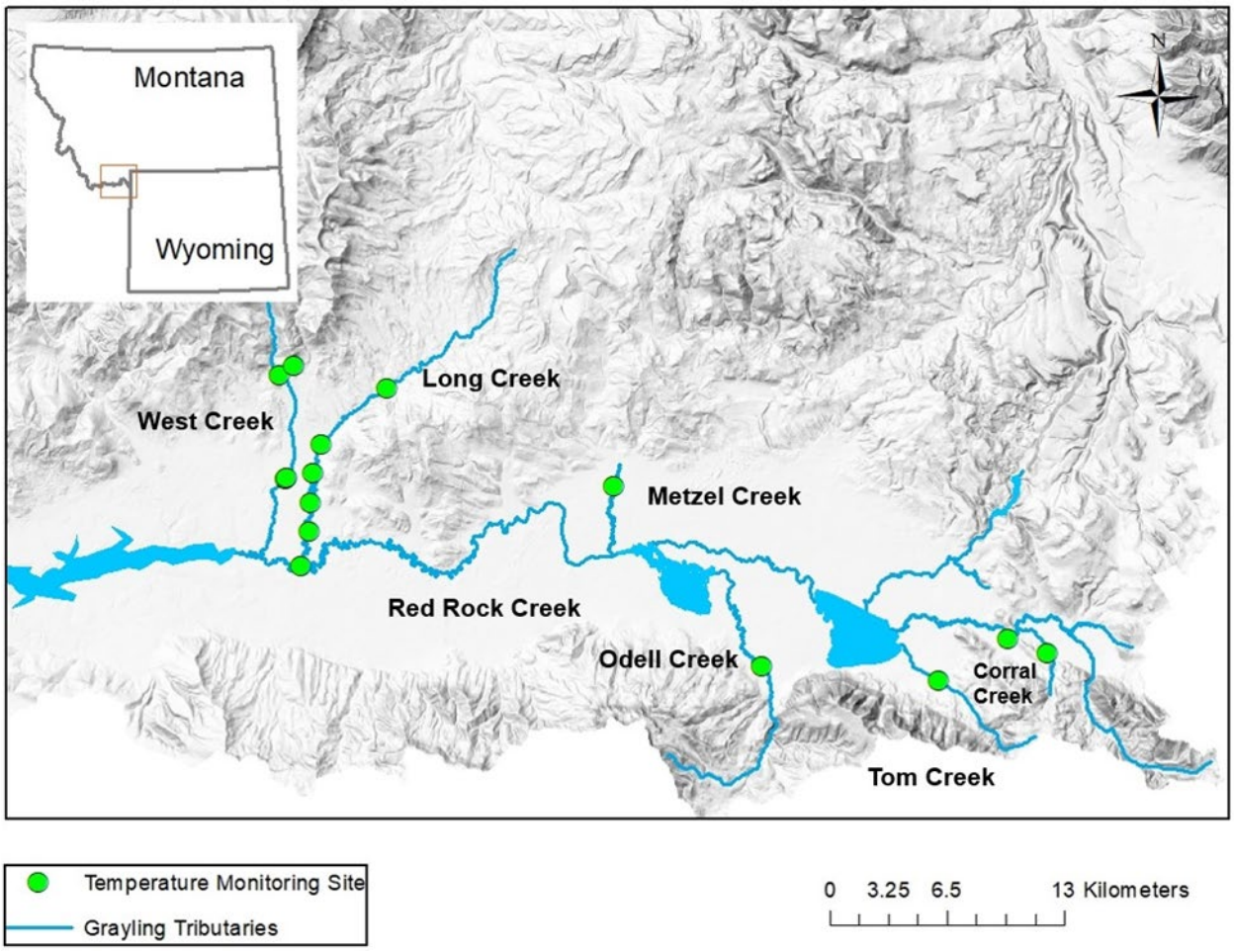


**Figure 5.** Stream temperature (green circle) monitoring sites in the Centennial Valley Arctic Grayling CCAA Project Area.

*C. Compliance Monitoring of Approved Site-Specific Plans*

One enrolled landowner had an approved SSP and monitoring indicated they were in general compliance with their plan. CCAA staff monitored the amount of water being diverted and enrolled landowners with SSPs in development generally followed their interim flow conservation plans in 2021.

FWP established a new measuring site on Corral Creek following the disturbance of the existing site by road construction in the fall of 2020. A rating for this site was not developed in 2021 and therefore not available to the enrollee, making streamflow compliance more challenging. With a gage rating now in place, streamflow management can be more precise at this site. Installation of measuring devices at diversions that do not currently have them will greatly enhance compliance with water rights.

**VIII. Summary of Estimated Take Associated with the Centennial Valley Arctic Grayling CCAA**

In 2020, the USFWS determined that listing the upper Missouri River Basin Distinct Population Segment of Arctic Grayling as threatened or endangered under the Endangered Species Act was not warranted. Due to the current legal status of Arctic Grayling, ESA-defined take (harm, harass or kill) did not apply to the implementation or monitoring of Centennial Valley Arctic Grayling in 2021.

**IX. Literature Cited**

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**APPENDIX 1:**

Streamflow targets were developed for the spawning period (mid-April thru late June) and the base flow period (remainder of year) measured below active diversions from the respective streams. For each period a normal and dry condition target was established for both periods except for Red Rock, Tom and Odell Creeks where only a normal base flow target was established, matching the minimum flow requirement of the Red Rock Lakes Compact. The dry targets apply when available streamflow not including diversions drops below the estimated 80th percentile exceedance flow for the stream (trigger flows). This is the flow that would be expected to be met or exceeded in 8 out of 10 years.

Targets for both periods were established based on riffle wetted perimeter data for streams where data was available. Where wetted perimeter data was not available, targets from streams with data were translated to those without data using the ratio of the estimated mean annual flow between the streams. The normal spawning target was based on the flow necessary to provide an 0.5 ft. average depth of passage for the most restrictive riffle transect while the dry target is based on the average flow of all riffle transects. The base flow normal target was based on the higher inflection point of the streamflow-wetted perimeter curve above which increases in flow result in very little increase in riffle coverage. The base flow period dry target was based on the lower inflection point of the streamflow-wetted perimeter curve below which decreases in flow result in large losses in riffle coverage. Subsequently the spawning period targets for West and Middle Creeks were adjusted based an additional study of the depth of passage measured in several transects to better refine the needed flow to allow for 0.5 ft. depth of passage. Also, trigger flows were adjusted for Red Rock, Antelope and Tom Creeks based on actual long-term measurement data for Red Rock Creek.

Table 1 shows the percentage of time that the applicable spawning or base flow target was attained during 2021 based on average daily streamflow. Percentage attainment is given for both the full target as well as 80% of the full target to provide an indicator of the relative extent stream flow was below target. If for example the full attainment percentage is low while the 80% attainment is high, it means that the flow generally was close to the target level most of the time even though it fell short. Low values in both categories indicates streamflow was quite low with respect to the target.

For a given stream if there is a value in both the “Normal” and “Dry” category it means that the trigger flow was initially met during the period but then streamflow fell below the trigger level causing a shift from a normal to dry target. For example, Long Creek was initially above the trigger level for a few days, so the normal spawning target initially applied for a very short time and was met at all times. Then streamflow fell below the trigger level, so the dry spawning target applied for the remainder of the spawning period. Once a dry year target is established it

remains in effect for the remainder of the period regardless of whether available flow increases above the trigger level.

Table 1 also indicates the number of enrolled and non-enrolled water users along with the number in each category diverting water in 2021. These values provide an indicator of the influence of water users enrolled and not enrolled.

| | | Spawning Period Target Attainment | | Base Flow Period Target Attainment | | CCAA Enrollees | | Other Water Users | |
|---|---|---|---|---|---|---|---|---|---|
| **Stream** | | **Full** | **80%** | **Full** | **80%** | **#** | **# Diverting** | **#** | **# Diverting** |
| Corral Creek | Normal | N/A | N/A | N/A | N/A | 1 | 1 | 0 | 0 |
| | Dry | 0% | 0% | 0% | 2% | | | | |
| Antelope Creek | Normal | N/A | N/A | N/A | N/A | 0 | 0 | 1 | unkown |
| | Dry | 0% | 0% | 0% | 0% | | | | |
| Red Rock Creek | Normal | N/A | N/A | 100% | 100% | 2 | 1 | 0 | 0 |
| | Dry | 76% | 93% | | | | | | |
| Tom Creek | Normal | N/A | N/A | 0% | 0% | 0 | 0 | 1 | 0 |
| | Dry | 0% | 0% | | | | | | |
| Odell Creek | Normal | N/A | N/A | 11% | 32% | 0 | 0 | 1 | unkown |
| | Dry | 62% | 94% | | | | | | |
| Long Creek | Normal | 100% | 100% | N/A | N/A | 2 | 1 | 2 | 2 |
| | Dry | 34% | 40% | 20% | 32% | | | | |
| Red Rock River | Normal | N/A | N/A | N/A | N/A | 1 | 0 | 0 | 0 |
| | Dry | 73% | 81% | 21% | 23% | | | | |
| Middle Creek | Normal | N/A | N/A | N/A | N/A | 0 | 0 | 1 | 1 |
| | Dry | 0% | 6% | 0% | 0% | | | | |
| West Creek | Normal | N/A | N/A | N/A | N/A | 1 | 0 | 1 | 1 |
| | Dry | 0% | 2% | 0% | 0% | | | | |

**Table 1.** Flow and Water Right Compliance Monitoring General Summary for Centennial Valley CCAA.

If the cell indicates “N/A” or “not applicable” it means that the dry or normal target was not in use during the period. In other words, the target did not shift during the period. For example, during the base flow period, only the dry target was applicable as the inflow was below the trigger level at the beginning of the period. Red Rock, Tom and Odell Creeks do not have dry target values for the baseflow period as indicated by the darkened cells. This is because the Red Rocks Lake Water Compact established minimum flow levels that correspond to the normal base flow targets. A lower dry target would be contrary to the terms of the Compact.

Failure to meet the prescribed target may result from a lack of available flow in the stream as opposed to being caused by diversion of water. Both Tom and Antelope Creek provide an example of this situation as no known diversion occurred during the spawning and base flow periods, but the targets were not being met.