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

2020 Annual Report

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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 non Federal 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). According to the USFWS, 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. The project areas associated with these CCAA's range from a one-acre area aiming to protect the Greater and Lesser Adam Cave Beetles in Kentucky to 7,214,287-acre area to protect Lesser Prairie Chicken in Colorado, Kansas, Oklahoma, New Mexico, and Texas (USFWS 2018). The Arctic Grayling in the Centennial Valley, Montana CCAA Program (Centennial Valley Arctic Grayling CCAA) began September 5th, 2018.

The conservation goal of the Centennial Valley Arctic Grayling CCAA is to secure and enhance the populations of Arctic Grayling (Thymallus arcticus) and habitat on 52 stream miles on non-federal lands in the Centennial Valley. Under the Centennial Valley Arctic Grayling CCAA, Montana Fish, Wildlife & Parks (FWP) holds an ESA section 10(a)(1)(A) Enhancement of Survival Permit issued to it by USFWS on September 19th, 2018 and will issue Certificates of Inclusion to non Federal property owners within the Project Area who agree to comply with all stipulations of the Program and develop an approved site specific conservation plan (Figure 1). Site specific conservation plans will be developed with each landowner by an interdisciplinary technical team made up of individuals representing FWP. The conservation guidelines of the Centennial Valley Arctic Grayling CCAA will be met by implementing conservation 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

This planning effort will help alleviate private property concerns, as well as generate support from private landowners to improve habitat conditions for Arctic Grayling throughout the Centennial Valley. The goal for the Arctic Grayling population inhabiting the Centennial Valley is to ensure the long-term, self-sustaining persistence of Arctic Grayling by maintaining the geographic distribution, abundance and genetic diversity of existing populations, and where feasible, reestablishing populations in suitable habitats (FWP and USFWS 2018).

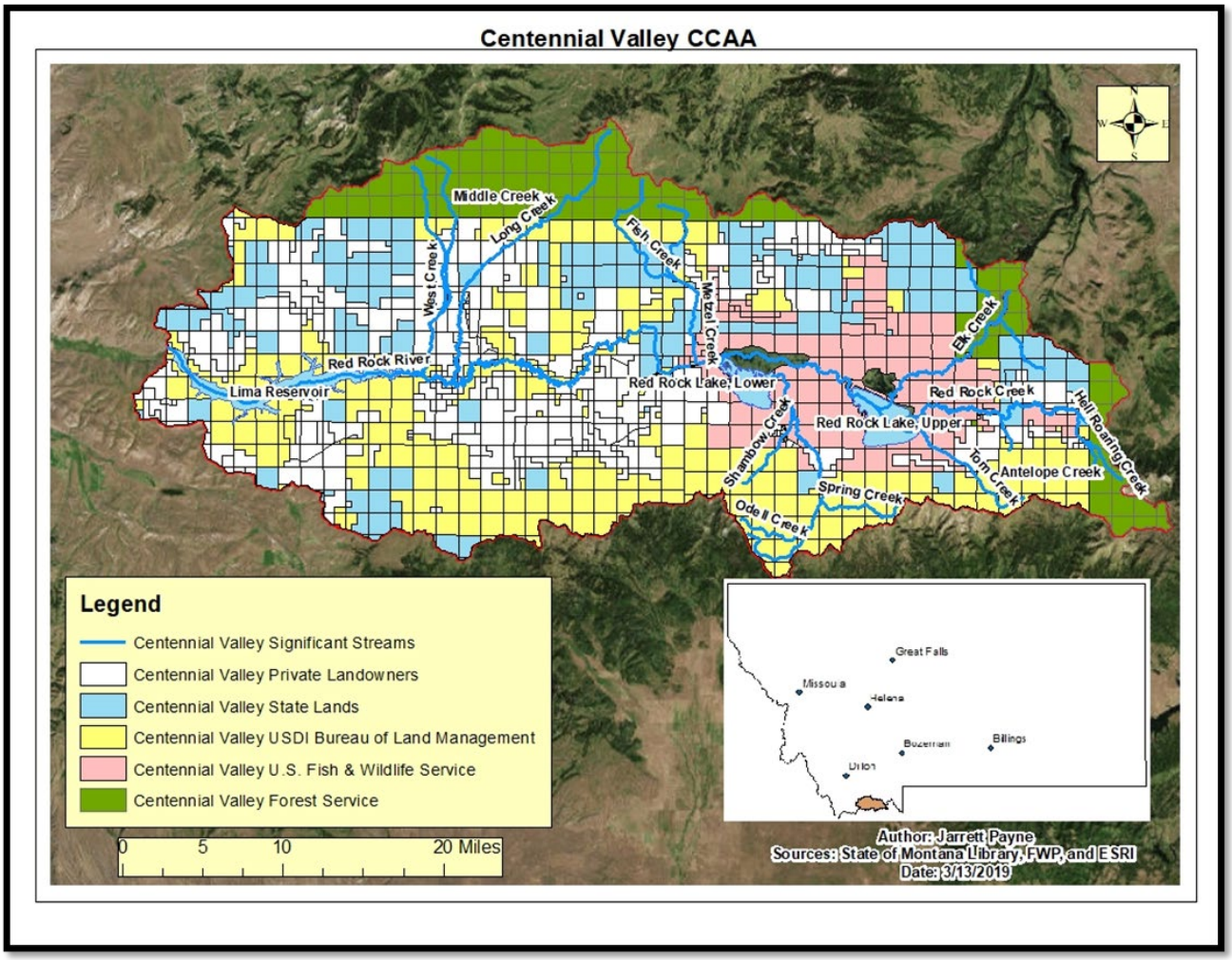

Figure 1. The Centennial Valley Arctic Grayling CCAA Project Area.

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 the Centennial Valley watershed fish populations, addressing private property concerns, and enhancing the overall health of the Centennial Valley watershed.

The 2020 report includes a summary of current enrollment, signed site-specific plans, conservation actions implemented, and FWP project funding as part of the Centennial Valley Arctic Grayling CCAA.

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 from the best available science, advances in 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 an ESA section 10(a) (1) (A) Enhancement of Survival Permit # TE-06690D-0, authorizing the Centennial Valley Arctic Grayling CCAA. The issuance of this permit allowed for the 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 site-specific conservation plan 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.

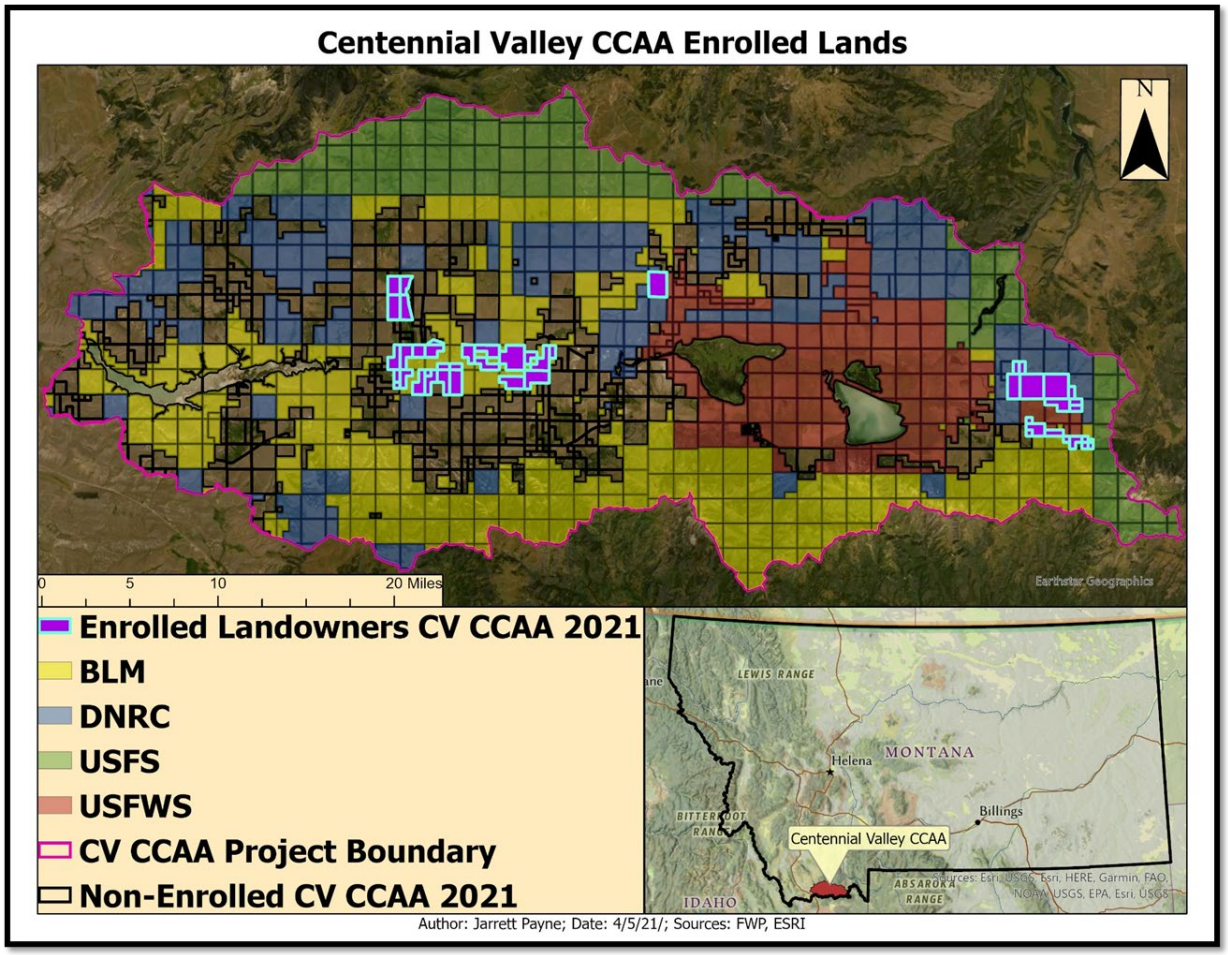

Figure 2. December 31st, 2020 Centennial Valley Arctic Grayling CCAA Program of private land enrolled (five landowners with a total of 9,076 acres).

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 site-specific conservation plan with the Participating Landowner (Petersen and Lamothe 2006).

A. Surveys for Immediate Threats to Arctic Grayling

During the summer of 2020, FWP and USFWS completed rapid assessments on all five landowners for immediate threats to Arctic Grayling. No immediate threats to Arctic Grayling were identified during the surveys. Monitoring of enrolled properties for immediate threats will continue as site-specific conservation plans are developed by FWP.

B. Flow and Water Right Compliance Monitoring

FWP completed flow and water right compliance monitoring for all Centennial Valley CCAA specific streams (FWP and USFWS, 2018). Flow monitoring was completed on the following streams: Corral Creek, Antelope Creek, Red Rock Creek, Tom Creek, Odell Creek, Metzel Creek, Long Creek, Red Rock River, West Creek, and Middle Creek. Of the streams with flow monitoring completed, four of the 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 followed flow agreements, reducing diversions when notified that streamflow targets were not being met. For a general summary of flow and compliance monitoring of all Centennial Valley CCAA streams please see Table 1, or for a more detailed review please see Appendix 1.

V. Site-Specific Conservation Plans

Site-specific conservation plans (SSP) are developed for each Participating Landowner by FWP and the landowner. The SSPs identify conservation actions that will lead to improved streamflow, enhanced riparian and stream channel condition, improved fish passage and reduced levels of entrainment.

A. Completed and Approved

No SSPs are currently implemented in the Centennial Valley CCAA program (Table 1). At a minimum, two SSPs will be developed in the spring of 2021, with the remaining SSPs being developed during the Summer and Fall of 2021. All SSPs are 10-year agreements between the Participating Landowners, FWP, and the USFWS. Updates on the implementation of these site-specific plans, including compliance monitoring results, will be included annually in future reports.

B. Extension Requests Approved by the USFWS

FWP did not submit approval for extensions to complete site-specific plans in 2020. Extensions provided additional time to complete the SSP and document past and ongoing conservation actions for Arctic Grayling on the property receiving the extension.

Property Number	Private Land Enrolled (Acres)	State Land Enrolled (Acres)	Enrollment Status	10 Year SSP Update
1	696.21	0	SSP Plan in draft - Spring 2021	NA
2	2227.7	0	SSP Plan in draft - Fall 2021	NA
3	4713.67	0	SSP Plan in draft - Fall 2021	NA
4	466.2	0	SSP Plan in draft - Summer 2021	NA
5	972.32	0	SSP Plan in draft - Spring 2021	NA

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

VI. Conservation Measures

Through the process of developing site-specific conservation plans for Participating Landowners, the Agencies identify 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. Projects and related conservation efforts completed in 2020 are reported below.

A. Entrainment Surveys

Baseline electrofishing surveys to identify potential grayling entrainment locations were conducted in 2018 and 2019. Surveys occurred once in June during peak irrigation and immediately after ditches were turned off in August. During these entrainment surveys, every active ditch originating from West, Middle, and Long creeks were electrofished from the lowermost point of water to the headgate. A total of 16.53 and 11.73 miles of ditch were surveyed in 2017 and 2018, respectively. 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 an issue on any of the monitored CCAA specific streams.

C. Projects to Enhance Fish Passage

No fish passage projects were completed in 2020 by FWP.

D. Projects to Enhance Riparian and Stream Channel Habitat

During 2020 no riparian habitat projects were completed. Two riparian restoration projects are scheduled for construction in 2021 on Elk Springs and Long Creek.

E. Projects to Improve Streamflow and Irrigation Water Management

During 2020, FWP partnered with three participating and one non-enrolled landowner to implement three streamflow and irrigation water management projects on Long Creek, Corral Creek, Cole Creek, and Hell Roaring Creek. These projects are intended to enhance the ability to control and measure irrigation withdrawals and reduce the need to divert water for livestock or irrigation purposes during baseflow conditions (Table 2).

2020		
Associated Waterbody	**Landowner #**	**Project Component**
Long Creek	5 and two non-enrolled landowners	Two Headgates, Three Measuring Devices, 100' of Ditch Maintenance
Corral Creek	1	Measuring device
Cole Creek	1	Removed Two Headgates
Hell Roaring Creek	2	Two Headgates

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

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 utilized Red Rock Creek grayling, but numbers thus far have not been sufficient to establish a detectable 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 three populations provide close genetic matches (Elizabeth Lake- Glacier National Park, Odell and Schwinegar lakes- Pioneer Mountains) to the Centennial Valley population. Re-population and brood management plans for Handkerchief Lake will be developed based on discussions between FWP Regions 1 and 3.

VII. Monitoring

A. Population Monitoring

Nb:

The Centennial Valley Arctic Grayling CCAA requires specific monitoring associated with the conversation measures implemented under this agreement and the resulting biological responses of the Arctic Grayling populations. FWP, under the guidance of the geneticists and with the approval of USFWS, began systematically using genetic monitoring for Centennial 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	∞
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	30.5	21.5	47.7

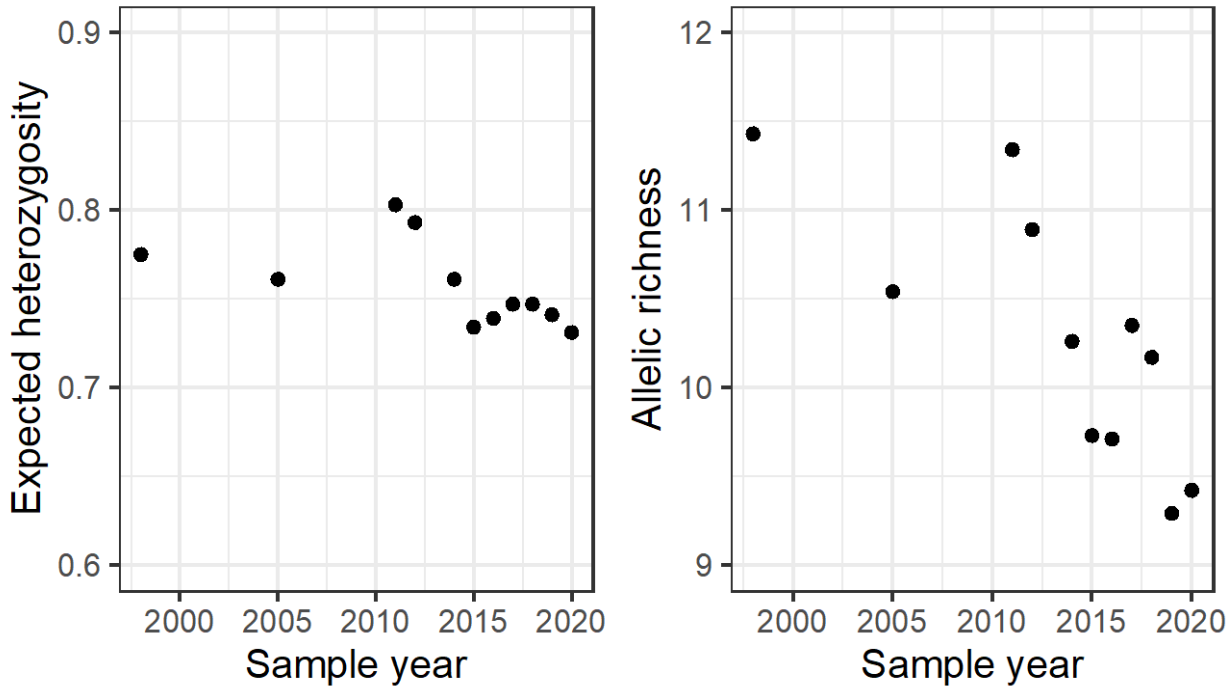

Figure 3. Temporal trends in measures of genetic variation in upper Red Rock Creek.

Mark Recapture:

The Chapman Method or closed Mark Recapture (MR) is used to estimate the population of spawning Arctic Grayling within Red Rock Creek. The spawning population size is estimated by capturing and marking adult individuals from the sampled fish population. Approximately 7 to 10 days later a recapture sampling event is completed in the same location. The fraction of individuals in the recapture sample that are marked from the first sample event is compared to the number of new fish captured from the second event to estimate the population abundance. 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 MR calculation is doubled to obtain an estimate of total spawning adults.

In 2020 the adult spawning Arctic Grayling population was estimated at 138 fish. A total of 36 Grayling were caught during two sampling events, 23 were marked, 13 were captured on a second event and of those 4 had been previously marked (recaptures). Of the 36 Grayling caught 22 were males and 14 were females. The average length was about 15.5 inches and the average weight was 1.4 lbs. Of note was an absence of age-2 grayling (Figure 4.) Historically, age-2 fish have constituted about 12.5% of the spawning run in Red Rock Creek, but they were absent in 2020. This was likely due to poor over-winter habitat in recent years.

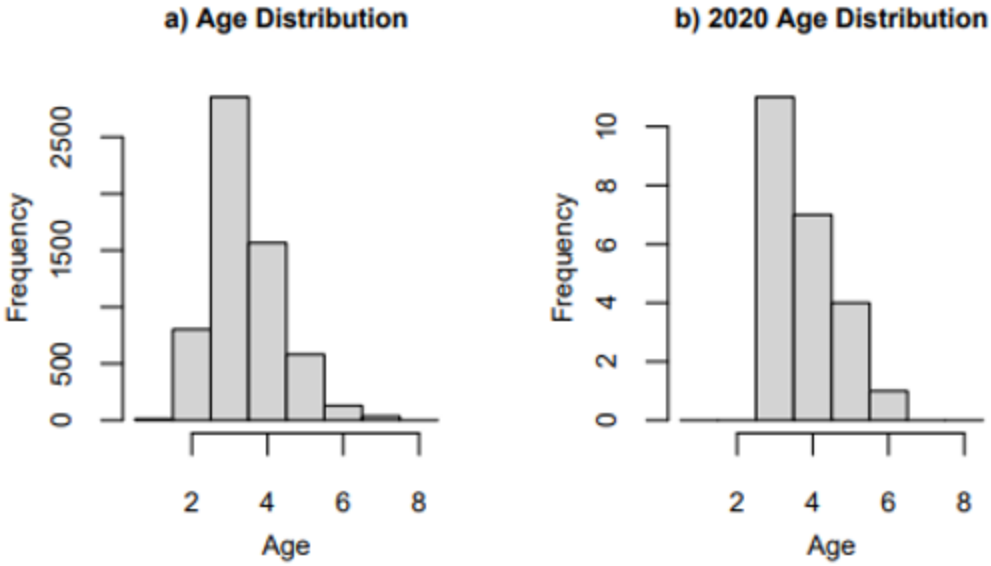

Figure 4. Age distributions of spawning grayling in Red Rock Creek in a) 1950-2019, and b) 2020. Note the absence of age-2 grayling in 2020.

All new grayling that have not been sampled or VI tagged in previous assessments are genetically sampled by fin clip and aged following scale collection. Each scale sample is used to assign a specific age-cohort for that grayling, this information is then used to calculate Nb.

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 2020, the Winter Habitat Model has separated itself as the primary driver of the population in the Centennial Valley, although the Spawning Habitat Model is also somewhat well supported and likely describes a secondary population driver. As such, the CV CCAA will also address the first Limiting Factor hypothesis by improving quality and quantity of tributary spawning habitat and is expected to ultimately contribute to all three CV grayling conservation objectives.

B. Stream Temperature Monitoring

In 2020, 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 2020 data were 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 considered 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). Please see Table 4 for stream temperature monitoring summaries and Figure 5 for stream temperature monitoring locations.

Table 4. Stream temperature monitoring results for 2020.

Monitoring Site (Big Hole Arctic Grayling CCAA Management Section	Mean Seasonal Temperature ^{o}C (^{o}F)	Maximal Seasonal Temperature ^{o}C (^{o}F)	Cumulative Hours Exceeding 21.1^{o} C (70^{o} F)	Cumulative Hours Exceeding 25^{o} C (77^{o} F)
Antelope Creek	8.9 (48.1)	19.5 (67.0)	0	0
Corral Creek	6.7 (44.1)	15.7 (60.2)	0	0
Long Creek - BLM	11.8 (53.3)	21.8 (71.2)	10	0
Long Creek – Red Rock Confluence	14.2 (57.6)	23.6 (74.4)	97	0
Long Creek – State Land	12.6 (54.7)	20.9 (69.6)	0	0
Long Creek – TNC	13.3 (55.9)	21.2 (70.2)	1	0
Long Creek – J-L	12.4 (54.3)	21.1 (70.0)	1	0
Metzel Creek	16.3 (61.3)	28.3 (82.9)	597	131
Middle Creek – BLM	6.3 (43.4)	13.6 (56.4)	0	0
Odell Creek	6.7 (44.1)	14.8 (58.6)	0	0
Red Rock (USGS)	10.1 (50.2)	18.6 (65.3)	0	0
Tom Creek	8.9 (47.9)	22.5 (72.5)	28	0
West Creek – BLM	5.9 (42.7)	12.0 (53.6)	0	0
West Creek – above confluence	9.3 (48.7)	17.7 (63.9)	0	0
West Creek – below confluence	10.2 (50.4)	18.5 (65.3)	0	0

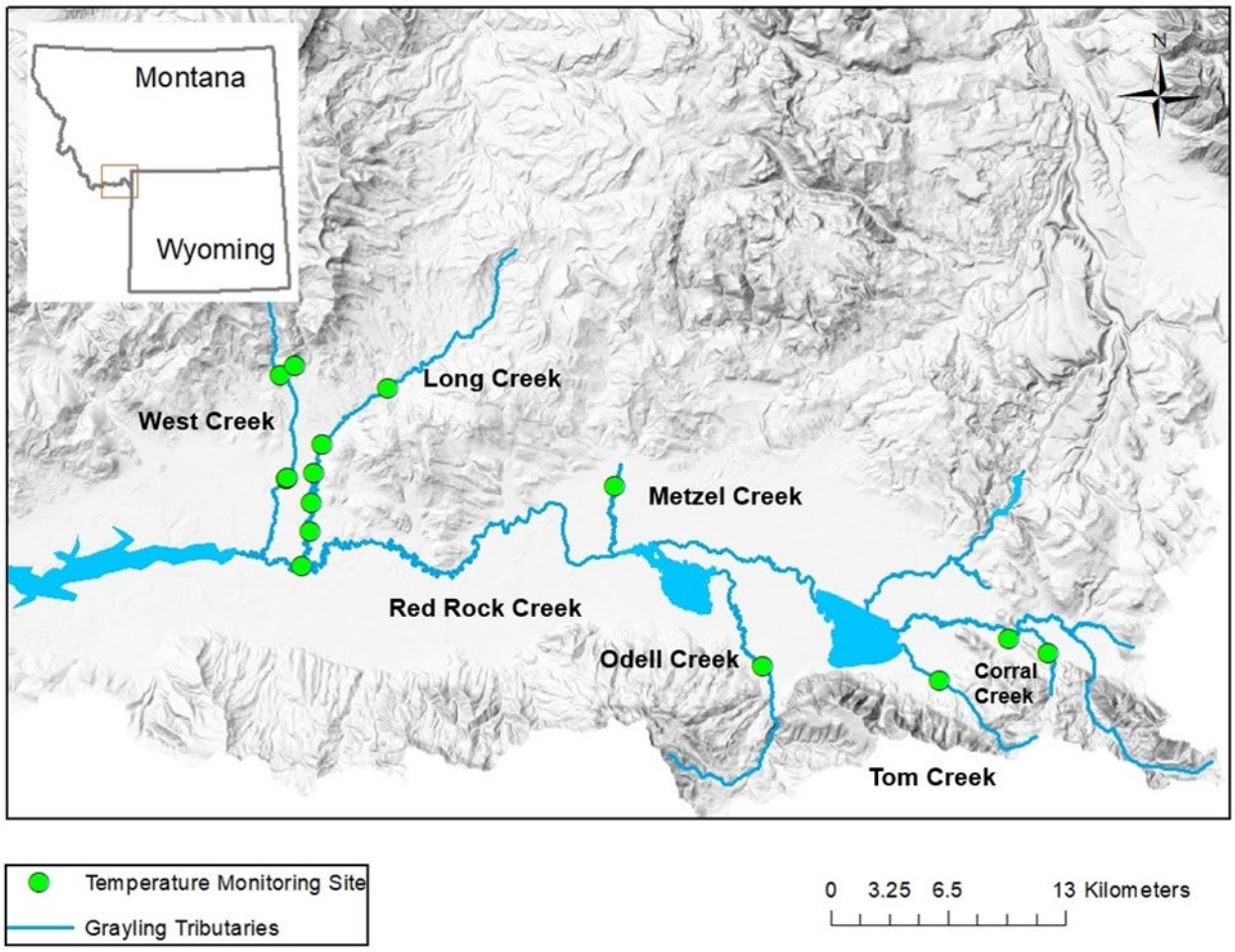

Figure 5. Stream temperature (green circle) monitoring sites in the Centennial Valley Arctic Grayling CCAA Project Area.

C. FWP Monitoring of Compliance with Approved Site-Specific Plans

The monitoring of compliance with approved site-specific plans will begin annually starting in 2021 following SSP development. All enrolled landowners followed their interim flow conservation plans in 2020. FWP field personnel checked the amount of water being diverted by enrolled landowners, the condition of riparian areas, the ability of fish to access fish passage structures, and for any evidence of immediate threats of harm or mortality to on the enrolled properties. The initial compliance meetings focus on expectations for monitoring the riparian management and irrigation diversion agreements in the SSPs being developed.

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 2020.

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 2020 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. 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, Corral Creek was initially above the trigger level, so the normal spawning target initially applied for a very short time. 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.

		Spawning Period Target Attainment		Base Flow Period Target Attainment	
Stream		**Full**	**80%**	**Full**	**80%**
Corral Creek	Normal	0%	100%	N/A	N/A
	Dry	100%	100%	55%	77%
Antelope Creek	Normal	0%	0%	7%	43%
	Dry	N/A	N/A	100%	100%
Red Rock Creek	Normal	96%	100%	100%	100%
	Dry	N/A	N/A		
Tom Creek	Normal	6%	22%	82%	92%
	Dry	0%	0%		
Odell Creek	Normal	100%	100%	100%	100%
	Dry	N/A	N/A		
Long Creek	Normal	100%	100%	100%	100%
	Dry	N/A	N/A	54%	79%
Red Rock River	Normal	100%	100%	100%	100%
	Dry	100%	100%	64%	71%
Middle Creek	Normal	N/A	N/A	35%	41%
	Dry	68%	69%	N/A	N/A
West Creek	Normal	N/A	N/A	76%	95%
	Dry	25%	39%	N/A	N/A

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 diversion was known to be occurring during the base flow period, but the targets were not being met. During the spawning period for these two streams, the target was not met but this is an indicator that spawning targets need to be further investigated in the field.