ARCTIC GRAYLING RECOVERY PROGRAM

MONTANA ARCTIC GRAYLING

MONITORING REPORT

2009

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Montana Fish, Wildlife & Parks
Dillon, Montana

Submitted To:
Fluvial Arctic Grayling Workgroup
And
Beaverhead National Forest
Bureau of Land Management
Montana Chapter, American Fisheries Society
Montana Council, Trout Unlimited
U. S. Fish and Wildlife Service

July 15, 2011

Acknowledgments

The following individuals and organizations contributed valuable assistance to the project in 2009. Peter Lamothe, Emily Cayer, Bryn Erb, Scott Lula and Lucas Bateman of Montana Fish, Wildlife, & Parks (FWP) provided field assistance. Ken Staigmiller and Marc Terrazas (FWP) analyzed samples for fish health assessment of brood populations. Travis Horton (FWP/ Native Species Coordinator) provided administrative support, chaired the Fluvial Arctic Grayling Workgroup, reviewed progress reports and assisted funding efforts. Dick Oswald and Jim Olsen (FWP/Area Management Biologist) and Bruce Rich (FWP/ Regional Fisheries Supervisor) provided program and technical support. Chris Hunter (FWP) provided direction and support as Fisheries Bureau Administrator, and Karen Zackheim (FWP)(Operations Bureau Chief/Acting Fisheries Bureau Administrator) assisted with budget and funding efforts. Nancy Podolinsky (FWP) edited and formatted the annual report. Jay Pravecek (FWP) and Josh Culver (FWP) assisted with egg takes at the brood lakes, as well as raised and managed grayling brood stock at Yellowstone River Trout Hatchery. Bob McFarland (FWP) and Reed Simonson (FWP) provided technical support for mark/recapture analysis and data entry. Wayne Black (FWP) prepared scales for age determination. Mike McClane (FWP) and Andy Brummond (FWP) assisted with water rights and instream flow conservation efforts. Jeff Everett (USFWS Partners for Fish and Wildlife Program) provided technical assistance in water conservation efforts, habitat improvement, financing efforts and field assistance. Doug Peterson (USFWS Ecological Services) provided technical assistance for ESA and CCAA issues. Mike Roberts and Travis Zangri of the Department of Natural Resources (DNRC) provided technical expertise to monitor and develop instream flow conservation plans in the Big Hole drainage. Kyle Tackett, Jim Olsen, Justin Morris and staff of the U.S. Department of Agriculture Natural Resource and Conservation Service (NRCS) assisted conservation efforts by allocating funding and implementing an Environmental Quality Incentive Program with landowners in the upper Big Hole Valley. Paul Hutchinson of the Bureau of Land Management (BLM) and the Dillon Field staff assisted with funding efforts. Jim Brammer and Chris Riley of the U.S. Forest Service (USFS) assisted with funding efforts and Ruby restoration efforts. Jim Boetticher (water commissioner) assisted with instream flow conservation efforts. Carter Kruse and crew of Turner Enterprises' assisted in egg takes and monitoring at Green Hollow II brood lake and maintained a barrier and trap on Green Hollow Creek. Linda Lennon (The Nature Conservancy/Arctic Grayling Recovery Program) assisted with willow restoration, riparian assessments, and habitat monitoring. Rebecca Ramsey and members of Ruby Watershed Council assisted with planning, funding and monitoring habitat projects in the upper Ruby Watershed. Technical Advisors of the Arctic Grayling Workgroup provided advice and direction. We appreciate the efforts of the Big Hole Valley landowners to implement conservation efforts to benefit instream flows and riparian health on the Big Hole River, and the Big Hole Watershed Committee (BHWC), Big Hole River Foundation (BHRF), The Nature Conservancy (TNC), Avian Science Center (ASC) and Trout Unlimited (TU) for promoting conservation actions. The Arctic Grayling Recovery Program is chaired by FWP. We would like to thank all funding sources for support and contributions in 2009. Program funding was provided by FWP, TU, Pennsylvania Power and Light – Montana (PPL-MT), the BLM, the Landowner Incentive Program (LIP) and USFWS Partners for Fish and Wildlife Program and State Wildlife Grants (SWG).

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Montana Arctic Grayling

I. Introduction

Montana Arctic grayling (*Thymallus arcticus)* exist at the southern extent of the historic Arctic grayling distribution, and are distinct genetically and geographically; (Kaya 1990, Petersen and Ardren 2009) from other grayling populations within their circumpolar range. Montana Arctic grayling populations exhibit both fluvial (stream dwelling) and adfluvial (lake dwelling) life history forms. Fluvial Arctic grayling populations in Montana historically occupied waters in the Missouri River drainage upstream from Great Falls, MT (Figure 1). Adfluvial Arctic grayling populations historically were present in the Red Rock drainage and in mountain lakes of the Big Hole drainage (Figure 1). Declines in native fluvial and adfluvial Arctic grayling populations in Montana have spurred numerous management, conservation and research actions. Montana Arctic grayling conservation efforts for fluvial Arctic grayling in 2009 are summarized in this report.

II. Montana Arctic Grayling Legal Status

Montana fluvial Arctic grayling historically occupied the Missouri River and its' major tributaries upstream of Great Falls, MT (Figure 1). Currently, fluvial Arctic grayling distribution is limited to the Big Hole drainage which represents four percent of its' native, historic range. Fluvial Arctic grayling in Montana are designated as a "Species of Special Concern" by Montana Fish, Wildlife and Parks (FWP), the Montana Chapter of the American Fisheries Society (MCAFS) and the Montana Natural Heritage Program (MNHP; Holten 1980, MNHP 2004). The United States Forest Service (USFS) and the Bureau of Land Management (BLM) classify fluvial Arctic grayling in Montana as a "Sensitive Species."

In October 1991, the United States Fish and Wildlife Service (USFWS) received a petition to list fluvial Arctic grayling in the upper Missouri River basin throughout its' historic range in the coterminous United States for protection under the Endangered Species Act (ESA). In 1994, the USFWS finding classified fluvial Arctic grayling in Montana as a Category One - warranted but precluded species, indicating enough information is available to support listing as threatened or endangered, but the listing action was precluded by species with greater need (USFWS 1994). In March 2004, the USFWS elevated the fluvial Arctic grayling Distinct Population Segment (DPS) listing priority from a level nine to a level three (USFWS 2004). The elevation in priority level was based on: 1) the distribution of Montana fluvial Arctic grayling represents only four percent of its' historic range, and 2) a decline in abundance of the Big Hole River population. In May 2004, the USFWS received a petition for an emergency listing of fluvial Arctic grayling due to ongoing drought conditions and decreased population abundance. The USFWS announced their finding on April 24, 2007, which removed the upper Missouri Arctic grayling from the candidate species list. The finding concluded that Arctic grayling were distinct, but not significant and therefore not a listable entity (DPS) as defined by the ESA (USFWS 2007). This ruling was challenged in November of 2007. As part of a settlement agreement, in May 2009, with the plaintiff, the USFWS agreed to conduct a status review for Arctic grayling in the upper Missouri River system. This status review will determine whether or not all life history ecotypes (fluvial and adfluvial) satisfied policy requirements to qualify as a DPS, then evaluated the status of the grayling

populations within the area (USFWS 2009).
The status review will be published in the Federal Register in September of 2010.

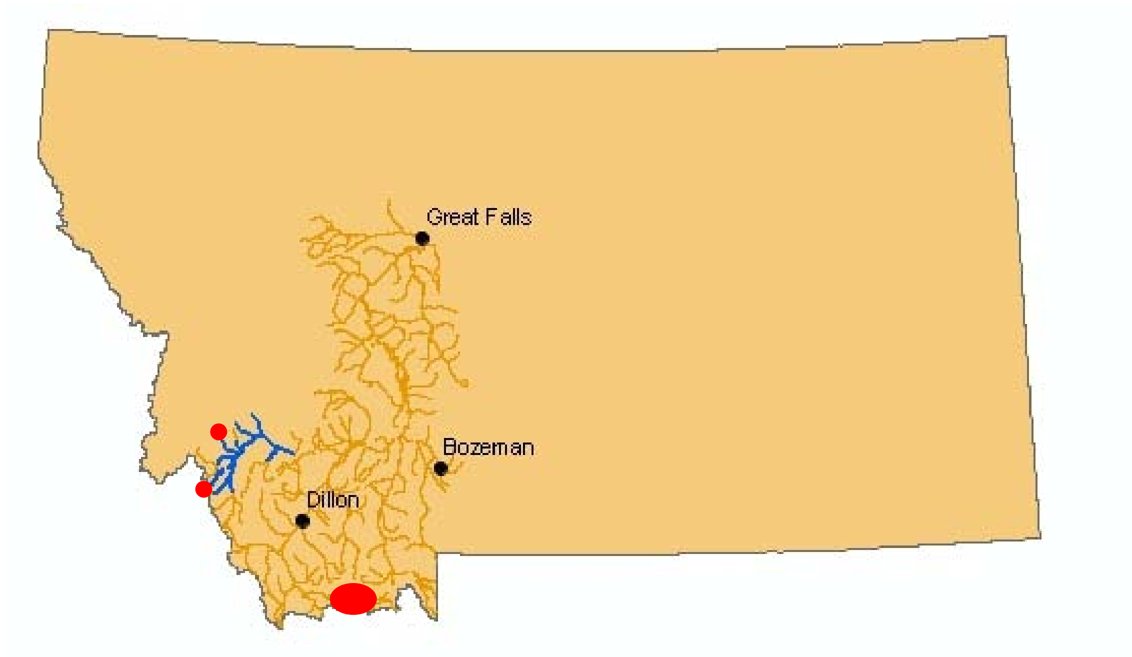

Figure 1. Historic and current distribution of Arctic grayling in Montana. Yellow lines represent historic fluvial populations; blue lines represent the current fluvial distribution in the Big Hole River. Red areas represent native adfluvial lake populations currently found in the Big Hole and Red Rock drainages.

III. Big Hole River Population

A. Introduction

The fluvial Arctic grayling population of the Big Hole watershed represents the last strictly fluvial, native grayling population in the contiguous United States (Figure 2). The population abundance and distribution declined in the 1980's, resulting in an increase in efforts to understand population demographics, identify critical habitats and implement conservation projects to address limiting factors. These efforts have been directed primarily through the Arctic Grayling Recovery Program (AGRP) and the Candidate Conservation Agreement with Assurances Program for fluvial Arctic Grayling in the Upper Big Hole River (Big Hole CCAA).

B. Arctic Grayling Recovery Program

The AGRP was formed in 1989 after declines in the Big Hole grayling population created concerns among fisheries managers and conservationists. The program's goals 1) address ecological factors limiting the Big Hole grayling population, 2) improve critical habitats, 3) monitor abundance, distribution and population demographics, 4) restore other fluvial grayling populations within the native range, 5) develop relationships that promote conservation actions, and 6) inform the public of Montana grayling status and conservation efforts. The AGRP includes representatives from FWP, BLM, USFS, USFWS, MNHP, MCAFS, Montana State University (MSU), University of Montana (UM), Montana Trout Unlimited (TU), PPL-MT, the National Park Service (NPS), Turner Enterprises and the Nature Conservancy (TNC).

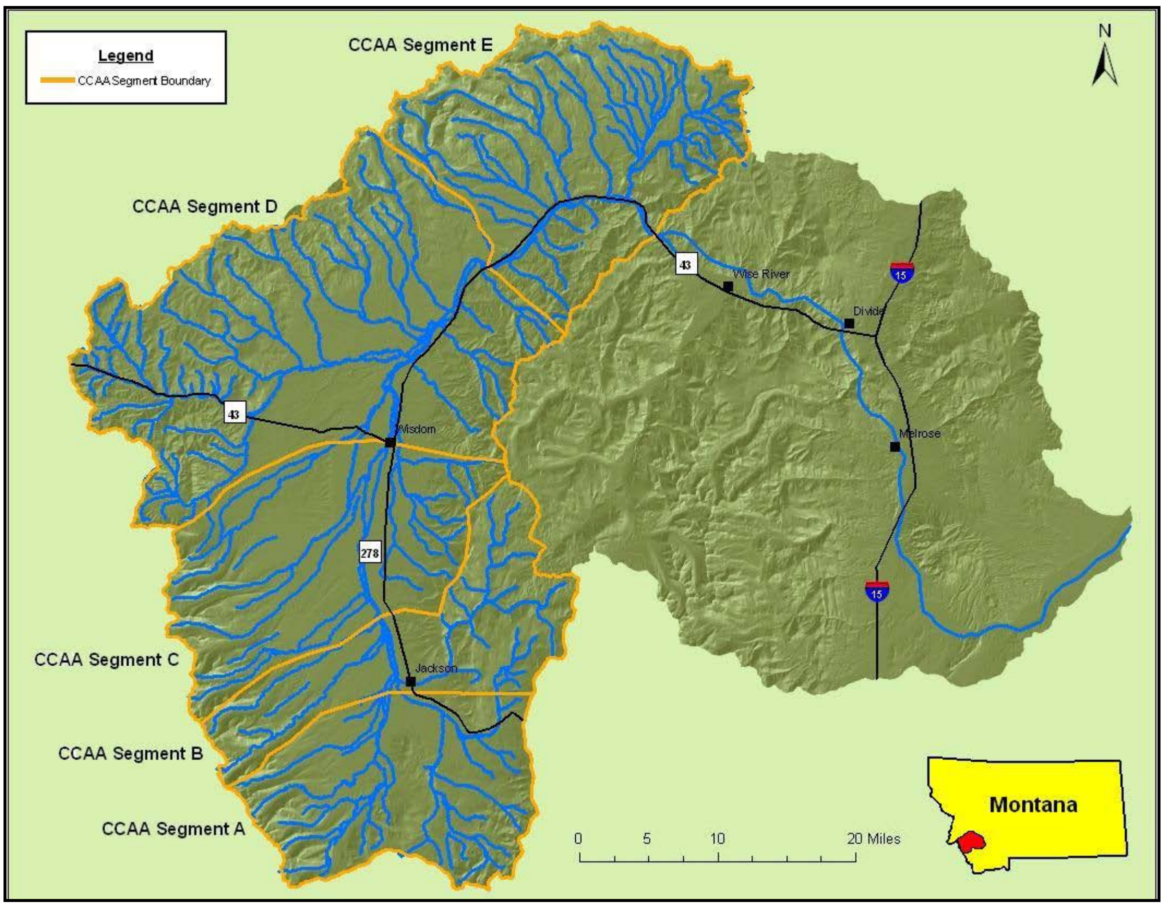

Figure 2. The Big Hole River watershed including the Big Hole CCAA project area and segment boundaries (A - E).

C. Big Hole CCAA Program

The Big Hole CCAA program was developed in the upper Big Hole River drainage as a program to implement conservation actions for Arctic grayling on private lands. Under this agreement the USFWS issued FWP an ESA section 10(a) (1)(A) Enhancement of Survival Permit. The agreement was executed on August 1, 2006, which gave FWP the authority to enroll non-federal landowners within the Big Hole CCAA Project Area (hereafter referred to as the Project Area) into the Big Hole CCAA program (Figure 2). 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 a site-specific conservation plan for the enrolled property (Lamothe et. al 2007). Currently, thirty-two private landowners have enrolled 153,436 acres of private land and 6,370 acres of state land into the Big Hole CCAA program. The Big Hole CCAA includes partnering agencies that assist with the implementation and monitoring of the conservation actions and include the DNRC, NRCS, and USFWS.

A site-specific conservation plan (SSP) will be developed with each participating landowner by an interdisciplinary technical team made up of individuals representing FWP, USFWS, NRCS and DNRC (hereafter referred to as the Agencies). The conservation guidelines of the Big Hole 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 to Arctic grayling
4) Remove barriers to Arctic grayling migration

The Big Hole CCAA Program will help alleviate private property concerns, as well as generate support from private landowners which will improve habitat conditions for Arctic grayling throughout the Project Area (Lamothe et. al 2007). The goal for the population of Arctic grayling inhabiting the Project Area is to increase the abundance and distribution of Arctic grayling within the Project Area (FWP and USFWS 2006).

The Agencies will monitor biological and habitat response to conservation efforts, and Big Hole CCAA enrollee compliance throughout the life of the Big Hole CCAA agreement. Biological monitoring consists of annually monitoring ten stream reaches to determine Arctic grayling population demographics and abundance. Monitoring reaches will include one mainstem and one tributary reach within each Big Hole CCAA management segment (Figure 2). Surveys are also conducted in irrigation ditches on enrolled properties to assess the impacts of entrainment on the Big Hole grayling population. Habitat variables monitored include a vegetative/riparian function component outlined by the NRCS Riparian Assessment Method, channel morphology, instream water temperatures and streamflow discharge. Permanent stream channel cross section and substrate monitoring at a mainstem and tributary site have been established within each Big Hole CCAA management segment to document changes in channel morphology. Instream water temperatures and streamflow discharge are recorded at mainstem and tributary sites in each CCAA segment between April 1 and October 31. FWP will use seasonal streamflow data, channel morphology parameters and stream temperature in each management segment to help explain Arctic grayling population trends. The data collected from these monitoring reaches will help the Agencies implement adaptive management plans and respond to changing conditions (FWP and USFWS 2006).

Arctic grayling conservation objectives initiated through the AGRP and the CCAA program within the Big Hole watershed from January 1 through December 31, 2009 were to:

1. Develop and implement site-specific conservation plans on properties enrolled in the Big Hole CCAA program.

2. Promote and initiate habitat projects that will improve riparian and channel function, fish passage, and instream flow conditions while reducing entrainment into irrigation systems in the Big Hole River basin on private land enrolled in the Big Hole CCAA program.

3. Develop and promote landowner relationships and continually educate the public and interest groups of Arctic grayling conservation needs and status.

4. Monitor water temperatures, instream flow and habitat conditions in the Big Hole River and tributaries.

5. Monitor abundance and distribution of Arctic grayling, sympatric native and sport fish species in the upper Big Hole basin.

D. Big Hole River Watershed Habitat Monitoring Methods

Stream Water Temperature

Stream water temperatures were monitored in the upper Big Hole River watershed at 10 mainstem and 15 tributary sites (Figure 3). Sites were selected to characterize mainstem and tributary temperatures within the Big Hole CCAA project area, and to monitor stream temperature response to habitat enhancement projects. Temperature loggers recorded data at 60-minute intervals and data were summarized as daily minimum, maximum and mean, and hours and days exceeding 70 and 77 degrees Fahrenheit. Seventy degrees Fahrenheit serves as a threshold for salmonid thermal stress (Behkne 1991), and 77 degrees Fahrenheit represents the upper incipient lethal temperature for Arctic grayling (Lohr et. al. 1996).

Stream Flow Discharge

Stream flow conditions in the Big Hole River watershed are heavily influenced by accumulative snowpack and precipitation events. The Natural Resource Conservation Service monitors Big Hole River basin snowpack and cumulative precipitation at seven Snotel sites and collects snowpack data at an additional twelve Snow Course sites. Results are reported online at www.nrcs.usda.gov.

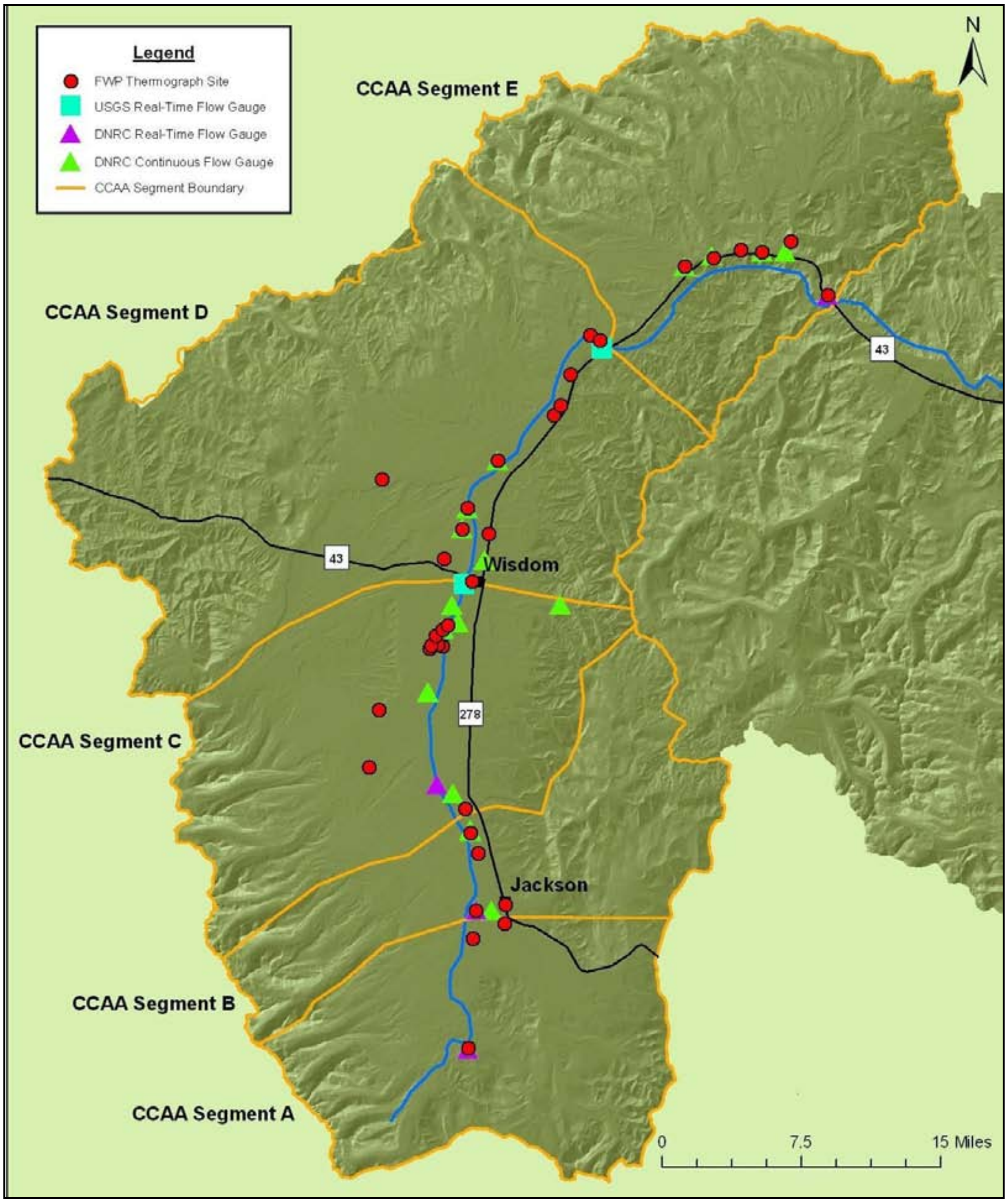

Figure 3. FWP stream temperature monitoring sites, USGS real-time flow gauge sites, and DNRC real-time flow gauge and continuous flow monitoring sites.

In 2009, the DNRC maintained a network of continuous flow gauges in the Big Hole River watershed to assist the Agencies and private landowners to monitor instream flows and implement conservation actions when low-flow triggers were reached. The DNRC worked with USGS to establish four new real-time flow gauging sites at Saginaw Bridge, Miner Lakes Road, below the Big Hole River's confluence with Miner Creek, and Dickie Bridge. These gauges and the two existing USGS sites at Wisdom and Mudd Creek Bridge are shown in Figure 3. The upper Big Hole River gauge sites can be viewed online at (www.usgs.gov). In addition to the real-time gauges, the DNRC used continuous stage recording instruments (AquaRod© or Trutrack©) at four mainstem Big Hole River sites, 13 tributary sites and in four irrigation diversions to assist with instream flow management and conservation efforts. Collectively, data were used to:

1. Track baseline flows
2. Provide daily flows to track and evaluate instream flow conservation actions,
3. Monitor flow targets outlined in the CCAA, and
4. Develop flow agreements within the CCAA site-specific plans.

E. Big Hole River Watershed Habitat Monitoring Results

Stream Water Temperature

In 2009, FWP monitored upper Big Hole River watershed stream temperatures at 25 locations (10 mainstem, 15 tributary; Figure 3). Seven mainstem and 12 tributary sites (Figures 4 & 5, respectively) exceeded the thermal stress threshold (70°F) for salmonid species (Behkne 1991). The upper incipient lethal temperature for Arctic grayling (77° F; Lohr et. al. 1996) was exceeded at two mainstem and two tributary sites (Figures 4 & 5, respectively). The Mudd Creek Bridge site on the mainstem Big Hole River and Swamp Creek near State Highway 43 were the warmest sites.

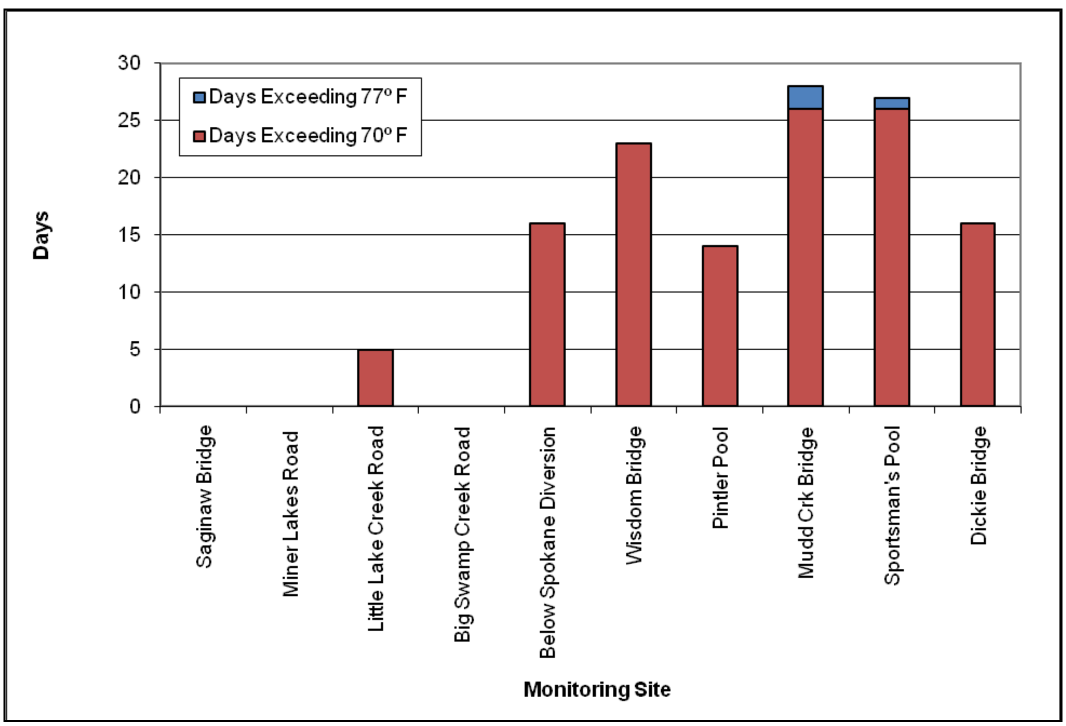

Figure 4. Number of days that water temperatures exceeded 70° F and 77° F at FWP instream temperature monitoring sites in the upper Big Hole River.

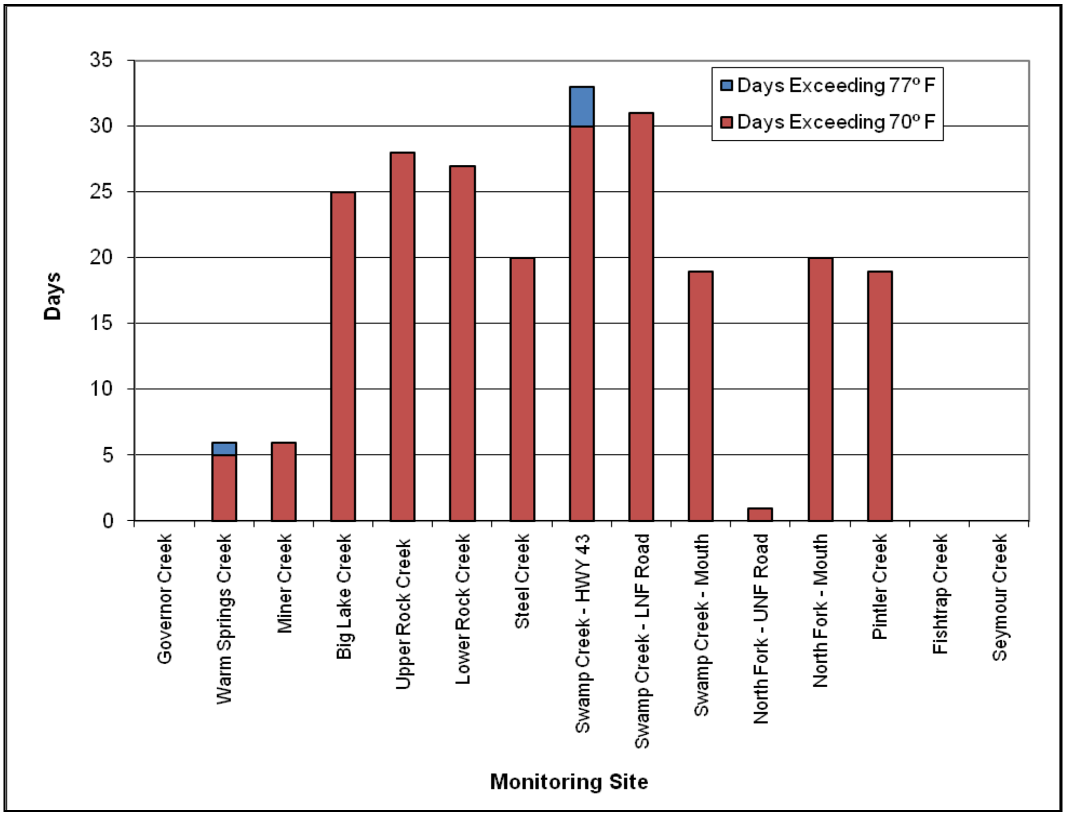

Figure 5. Number of days that water temperature exceeded 70° F and 77° F at FWP instream temperature monitoring sites in the upper Big Hole River tributaries.

Stream Flow Discharge

The 2009 Big Hole River basin snowpack was 110% of the average for the period of record (POR; 1971 – 2009), and cumulative precipitation for the water year (October – September) was 105% of the average for the POR (1971 – 2009). Above average snowpack and cumulative precipitation resulted in relatively good streamflows in the Big Hole River compared to recent years. Peak run-off measured at the USGS real-time flow gauges near Wisdom, MT, occurred on June 22 (2,230 cfs; Figure 6), and occurred at Mudd Creek Bridge on May 26 (4,480 cfs; Figure 7).

Below average September precipitation in the Big Hole valley (77% of the POR) contributed to a decrease in stream flows to a mean daily discharge of 28 cfs in late September at the Wisdom gauge. Eleven participating landowners enrolled in the Big Hole CCAA program voluntarily reduced irrigation water withdrawals by 101 cfs to enhance instream flows. These contributions assisted to maintain stream flows above the angling closure triggers in the Big Hole River in 2009 (Big Hole Drought Management Plan 2008).

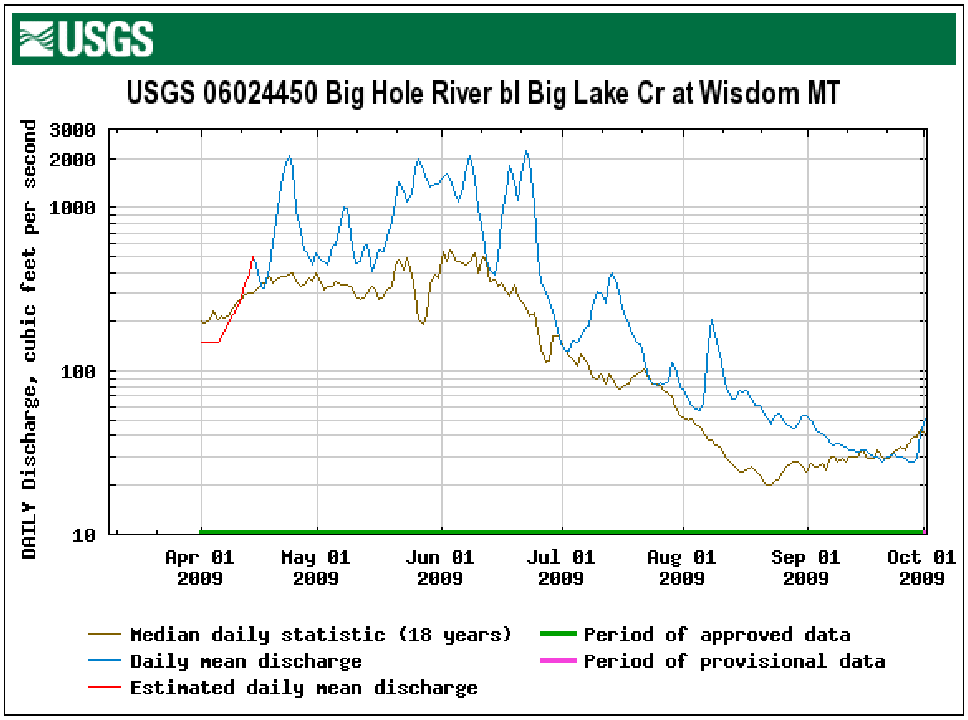

Figure 6. USGS real-time flow gauge data from the Big Hole River below Big Lake Creek at Wisdom, MT in 2009.

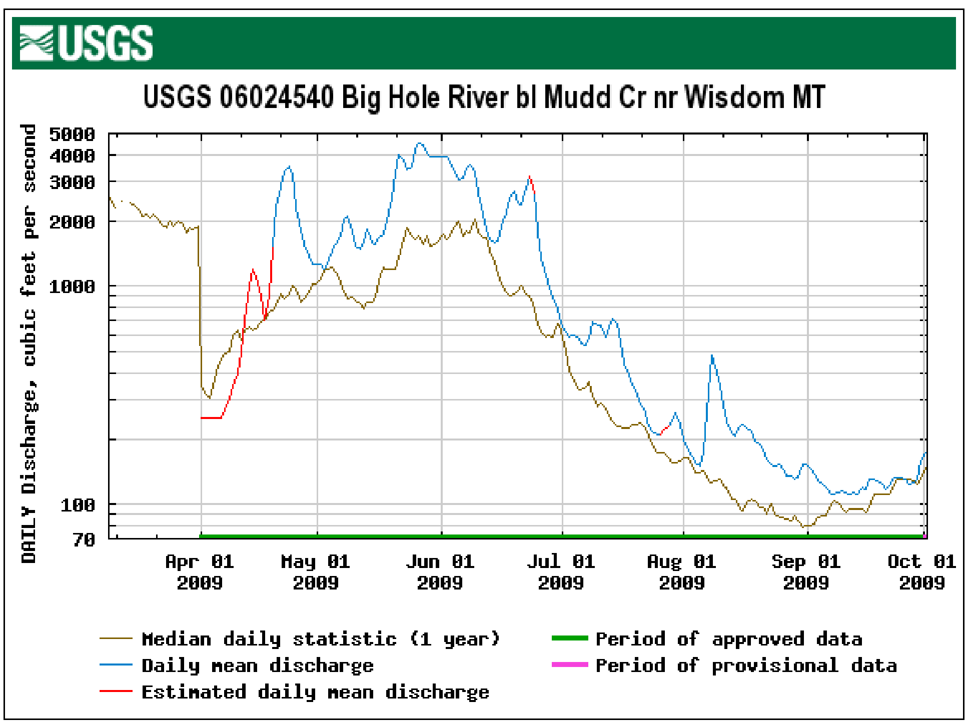

Figure 7. USGS real-time flow gauge data from the Big Hole River below Mudd Creek near Wisdom, MT in 2009.

F. Big Hole River Watershed Population Monitoring Methods

FWP monitors the upper Big Hole River watershed Arctic grayling population to assess abundance, distribution, recruitment and age-class structure. Surveys also document pre-project species composition and relative abundance within habitat restoration reaches, and post-project fish community response. Drift boat or crawdad boat mounted mobile-anode equipment and backpack electrofishing units are used to conduct species composition and relative abundance surveys. Native and sportfish species including rainbow trout *Oncorhynchus mykiss*, brown trout *Salmo trutta*, brook trout *Salvelinus fontinalis* and burbot *Lota lota* are also captured to document distribution and relative abundance. Captured fish are anesthetized using Tricaine™ Methanesulfonate-222 (MS-222) and measured for total length (± 0.1 in.) and weight (± 0.01 lb.). Arctic grayling greater than six inches in length receive a visible-implant (VI) tag in the transparent adipose tissue immediately posterior to the left eye. A fin clip is taken from the pelvic fin for genetic analysis, and scale samples are used to determine the individual's age.

In 2009, FWP conducted electrofishing surveys on 26 reaches in the Big Hole watershed which include eight mainstem (43.9 miles) and 18 tributary reaches (25.5 miles; Figure 8). The 26 total survey reaches include ten CCAA monitoring reaches, 6 long-term monitoring reaches and 10 tributary reaches surveyed to investigate presence/absence of Arctic grayling and to evaluate habitat restoration projects. As part of the Big Hole CCAA monitoring requirements, one mainstem and one tributary reach in each Big Hole CCAA management segment A-E (Figure 8) was surveyed. Big Hole CCAA tributary reaches include Governor Creek (A), Miner Creek (B), Rock Creek (C), Steel Creek (D) and Deep Creek (E). Long-term monitoring reaches include Little Lake Creek, Wisdom West, the "Pools" (Sawlog pool, Fishtrap pool and Sportsman's pool), Jerry Creek, Melrose and Hogsback sections of the Big Hole River. Additional tributary sections sampled include; upper Steel Creek, Swamp Creek, upper Swamp Creek, Plimpton Creek, Pintler Creek, York Gulch, Mudd Creek, Fishtrap Creek, East Fork Fishtrap Creek, LaMarche Creek and Seymour Creek.

Data collected during electrofishing surveys were summarized with Fisheries Analysis 1.2.7 (Montana Fish, Wildlife & Parks 2007). Catch per unit effort (fish/mile) was completed for one-pass sampling reaches, or for the first pass, if multiple electrofishing passes were completed. Catch-per-unit-effort is used to show trends in population relative abundance and spatial distribution. Arctic grayling length data are summarized using a length-frequency histogram to describe the population age structure (Figure 9). Additionally, young-of-the-year (YOY; < 6.0 inches) and Age 1+ (> 6.0 inches) Arctic grayling are summarized as the number of fish captured per mile by reach (Figure 10 & 11).

Electrofishing surveys were also conducted within irrigation ditches connected to the Big Hole River or its tributaries to assess entrainment of Arctic grayling. Captured Arctic grayling are weighed, measured, VI tagged and transported to the nearest Big Hole River or tributary location. In 2009, FWP electrofished 6.4 miles of irrigation ditch associated with 14 points of diversion (Figure 8).

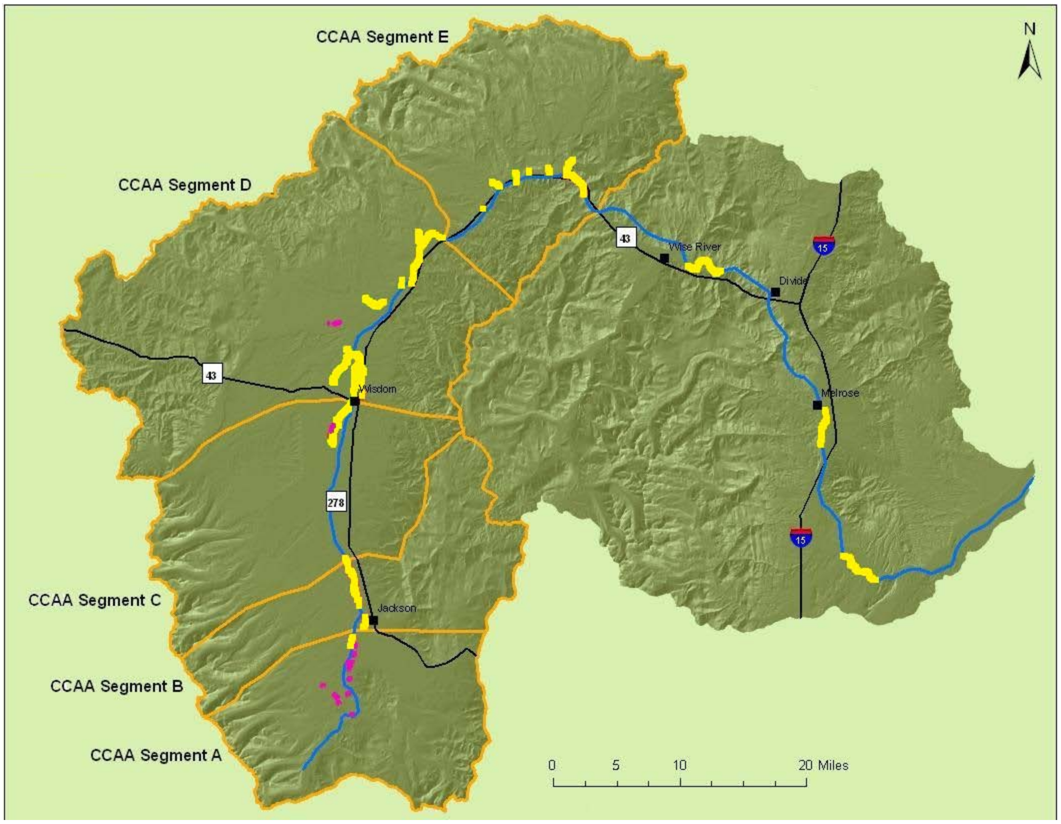

Figure 8. FWP Arctic grayling monitoring and entrainment monitoring surveys in the Big Hole River watershed in 2009. Arctic grayling monitoring surveys are shown in yellow and entrainment surveys shown in red.

G. Big Hole River Watershed Population Monitoring Results

In 2009, over 6,069 fish were captured during electrofishing surveys including 4,818 brook trout, 374 rainbow trout, 331 burbot, 327 Arctic grayling, and 219 brown trout. We captured 202 YOY Arctic grayling (62% of total) and 125 Age- 1 and older Arctic grayling (38% of total; Figure 9 & 10). We captured 85 % of Arctic grayling in tributaries (n= 277) and 15% in the mainstem Big Hole River (n= 50; Figures 11 & 12). Distribution of Arctic grayling extended approximately 98 river miles between CCAA Reach C, near Wisdom, MT, downstream to the Hogback reach, near Glen, MT. Arctic grayling relative abundance for age 1 and older fish was highest in the Reach D and E tributaries (LaMarche, Fishtrap, and Deep creeks) and in the Reach C and D tributaries (Steel, Swamp, Plimpton and Pintlar creeks) for YOY. No Arctic grayling were captured during entrainment surveys in 2009.

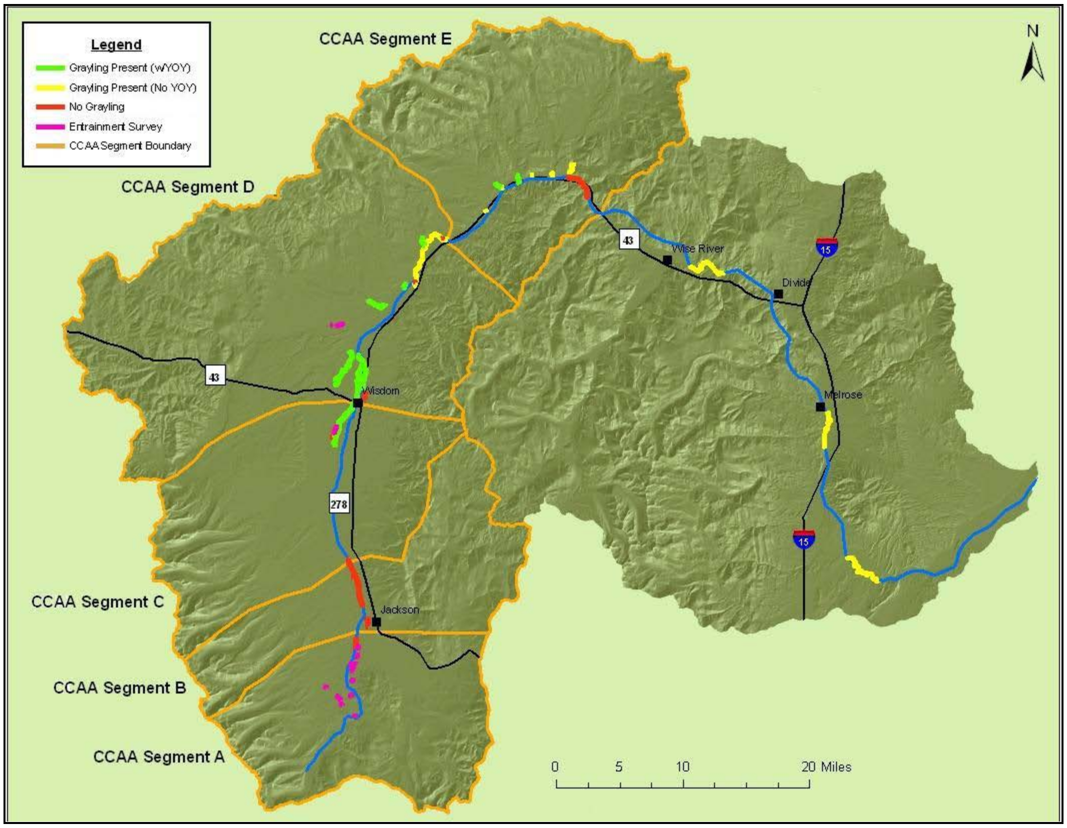

Figure 9.Arctic grayling distribution from FWP elcetrofishing surveys in 2009.

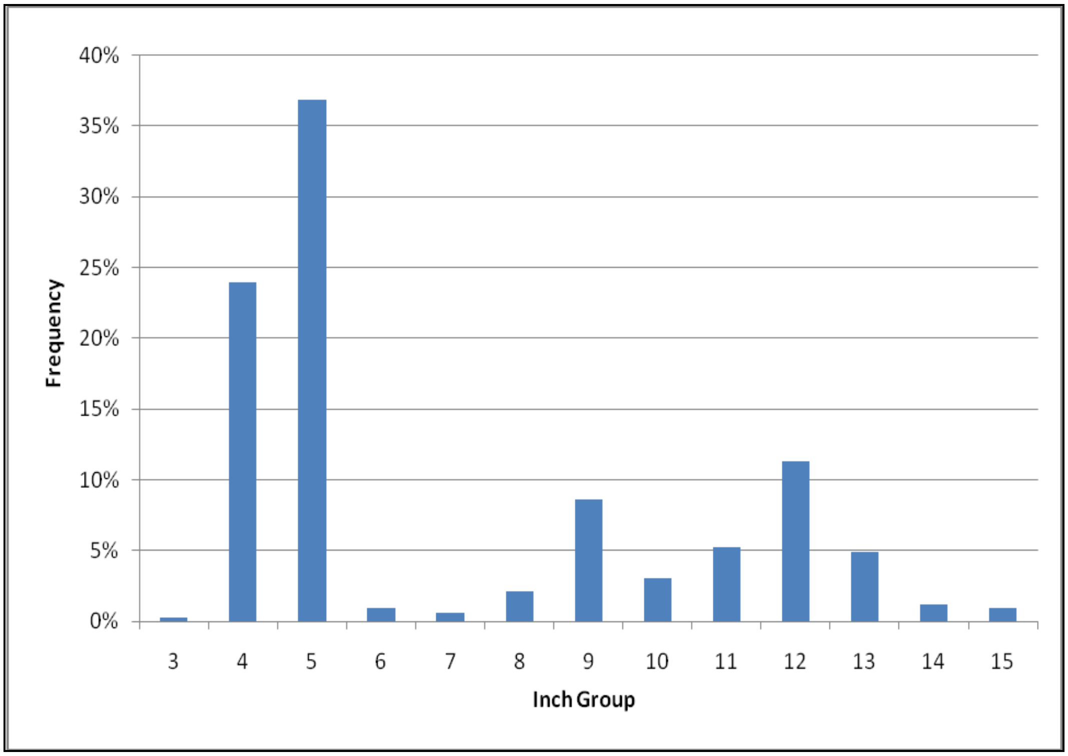

Figure 10. Length-frequency histogram for Arctic grayling captured during 2009 FWP electrofishing surveys in the Big Hole River watershed (n = 327).

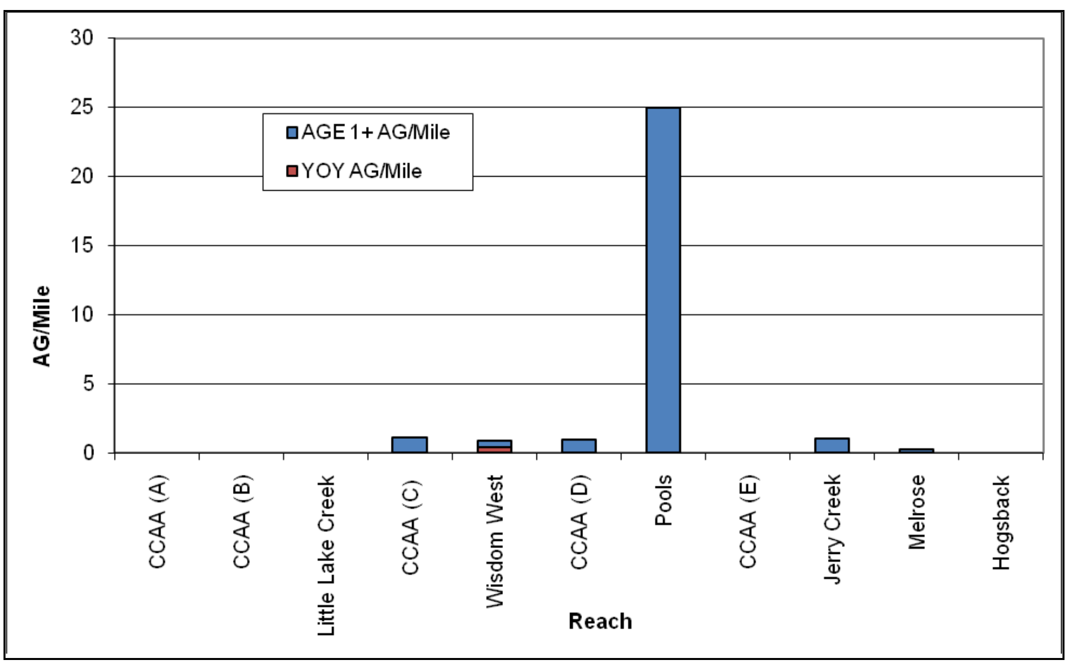

Figure 11. Catch per unit effort of age 1+ and young-of-the-year (YOY) Arctic grayling captured per mile for each survey reach during 2009 FWP electrofishing surveys in the Big Hole River.

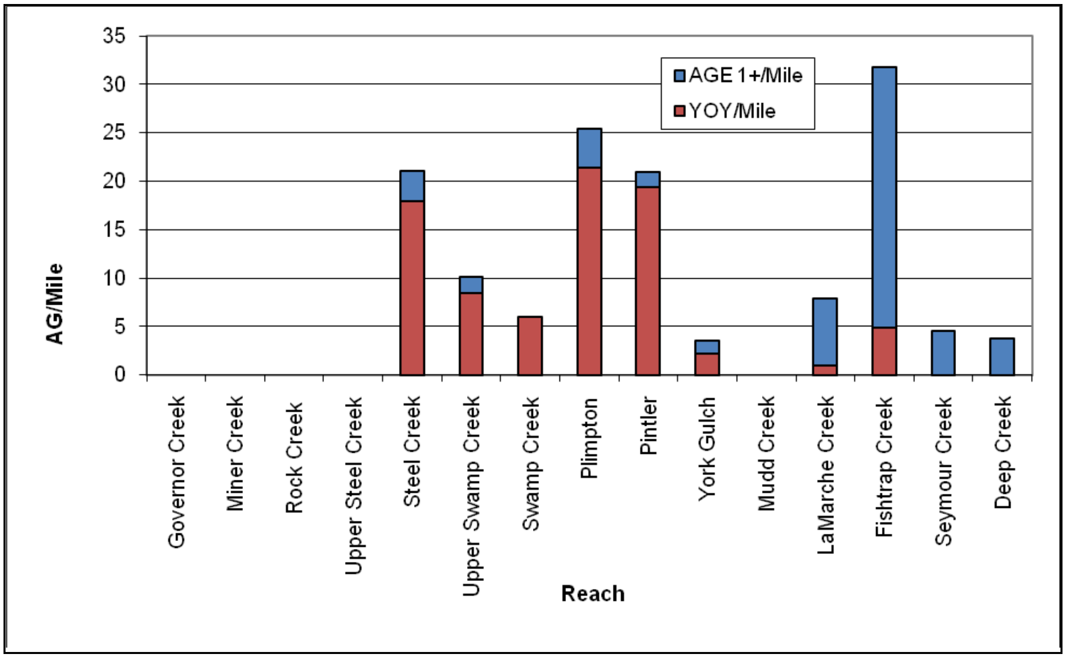

Figure 12. Catch per unit effort of age-1+ and young-of-the-year (YOY) Arctic grayling captured per mile for each survey reach during 2009 FWP electrofishing surveys in Big Hole River tributaries.

IV. Ruby River Population

A. Introduction

A goal of the Arctic Grayling Recovery Program is to establish additional fluvial Arctic grayling populations within the native historic range (Fluvial Arctic Grayling Recovery Plan 1993). The upper Ruby River was historically occupied by Arctic grayling and is considered suitable for fluvial Arctic grayling in terms of appropriate habitat, biological productivity, stream size, gradient and abundance of non-native salmonids (Kaya 1992). Reintroduction efforts in the upper Ruby River began in 1997 from Ruby River Reservoir upstream to the headwaters; approximately fifty-five river miles (Figure 13). Age 0, 1 and 2 hatchery-reared Arctic grayling originating from fluvial grayling brood stock were stocked from 1997 to 2005. In 2003, FWP began to use remote stream incubators (RSIs) to introduce fertilized Arctic grayling eggs into the upper Ruby River. Arctic grayling produced from RSIs imprint and acclimate to the natural stream environment.

Arctic grayling reintroduction efforts are ultimately gauged by establishing self-sustaining populations. By 2009, multiple age-classes of Arctic grayling had been successfully introduced into the upper Ruby River through stocking and RSI efforts. The population included mature age-3 and 4 Arctic grayling capable of spawning. In 2009, no supplementation occurred and FWP completed fall monitoring surveys to determine if Arctic grayling in the Ruby River were able to successfully reproduce.

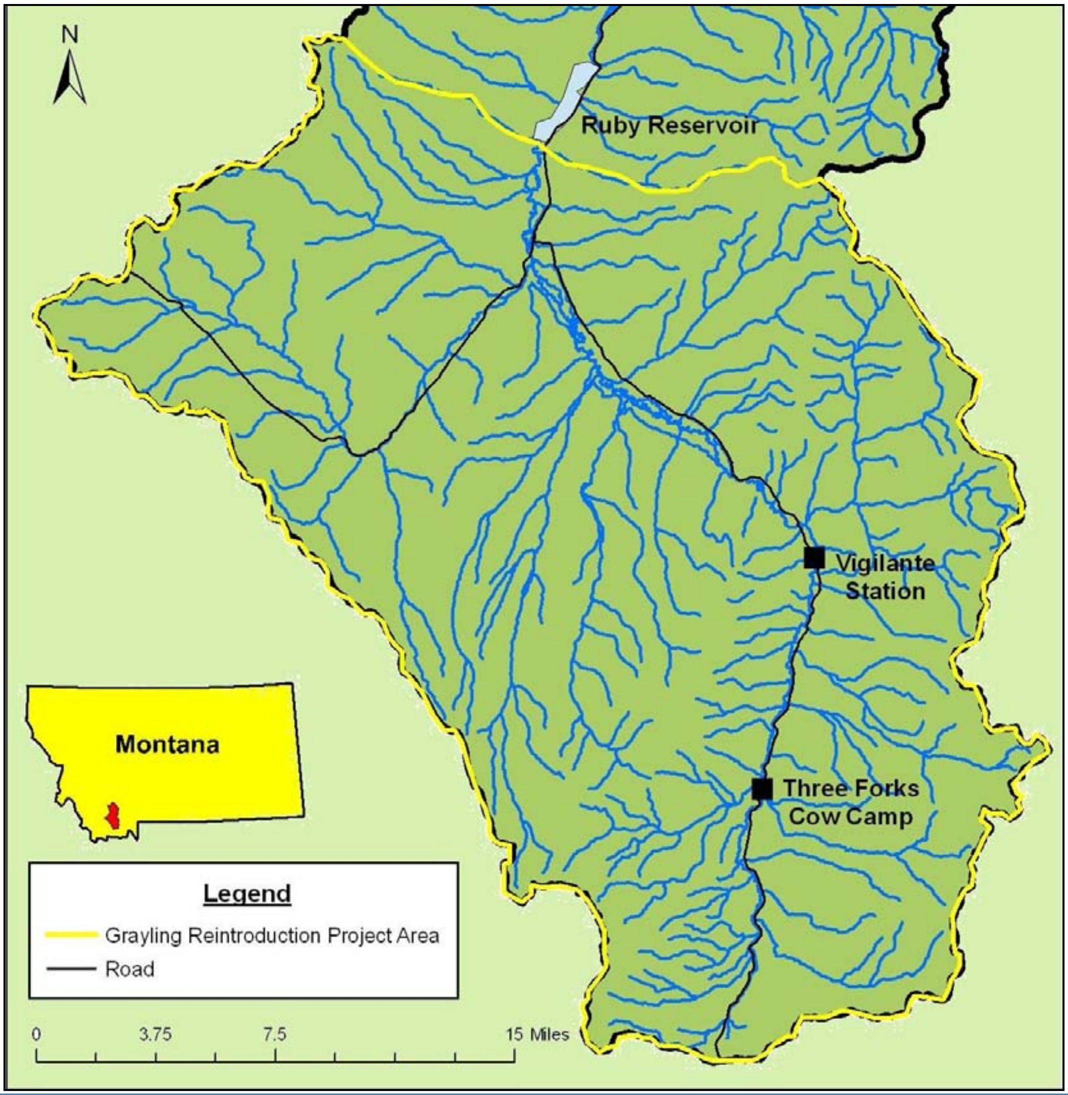

Figure 13. Upper Ruby River Arctic grayling reintroduction project area.

B. Ruby River Watershed Habitat Monitoring Methods

Stream Water Temperature

Stream water temperatures were monitored in the upper Ruby River watershed at seven mainstem and three tributary sites (Figure 14). Sites were selected to characterize mainstem and tributary temperature regimes, and to monitor stream temperature response to habitat enhancement projects. Temperature loggers recorded data at 60-minute intervals and data were summarized as daily minimum, maximum, mean, and hours and days exceeding 70 ° F and 77°F. We used 70°F as a threshold for salmonid thermal stress (Behkne 1991), and 77°F represents the upper incipient lethal temperature for Arctic grayling (Lohr et. al. 1996).

Stream Flow Discharge

Stream flow conditions in the Ruby River watershed are primarily influenced by cumulative snowpack and precipitation events. The NRCS monitors the Ruby River basin snowpack and cumulative precipitation at five Snotel sites, and collects snowpack data at an additional six Snow Course sites. Results are reported online at www.nrcs.usda.gov.

The USGS monitors the upper Ruby River watershed discharge using a real-time gauging station located directly upstream of the Ruby River Reservoir (Figure 14). Measurements are recorded at 15-minute intervals and reported online at www.usgs.gov.

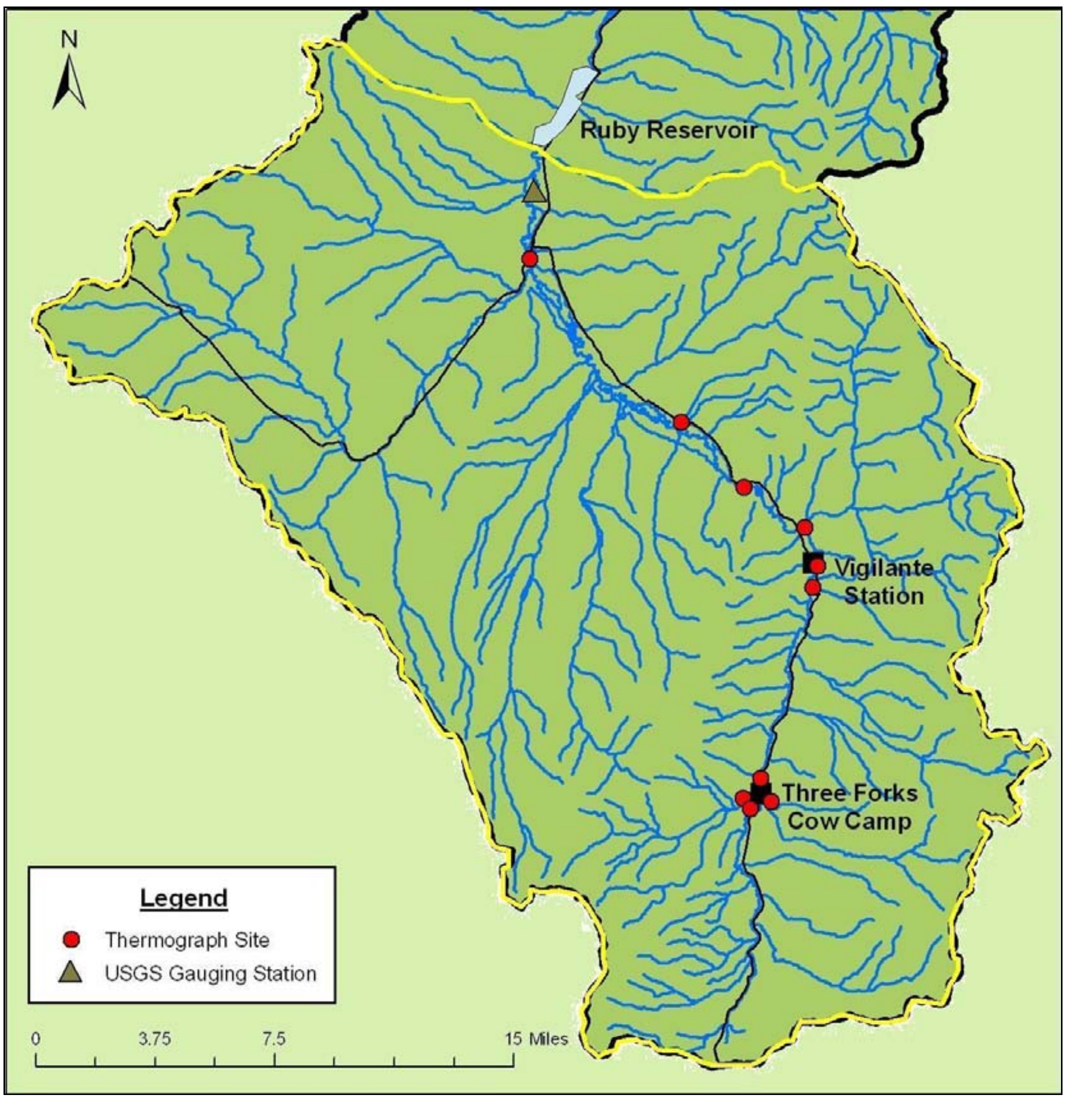

Figure 14. USGS real-time flow gauging station and FWP stream temperature monitoring locations in the upper Ruby River watershed in 2009.

C. Ruby River Watershed Habitat Monitoring Results

Stream Water Temperature

No stream temperatures exceeded the upper incipient lethal temperature for Arctic grayling (77°F) in 2009. Four mainstem and one tributary site exceeded the 70°F threshold, including two of the sites, Warm Springs Creek and the Canyon site which are influenced by thermal upwelling in Warm Springs Creek. Temperatures at the remaining three sites only exceeded thermal stress levels for short periods of time (Figure 15).

Stream Flow Discharge

Snowpack in the Ruby River drainage was 100% of the average for the POR (1971 – 2009), and cumulative precipitation was 106% of average for the POR (1971 – 2009). Stream discharge measured at the USGS real-time gauging station immediately above Ruby Reservoir peaked on May 20 at 839 cfs (Figure 16); low flow occurred on August 28 at 98 cfs (Figure 16).

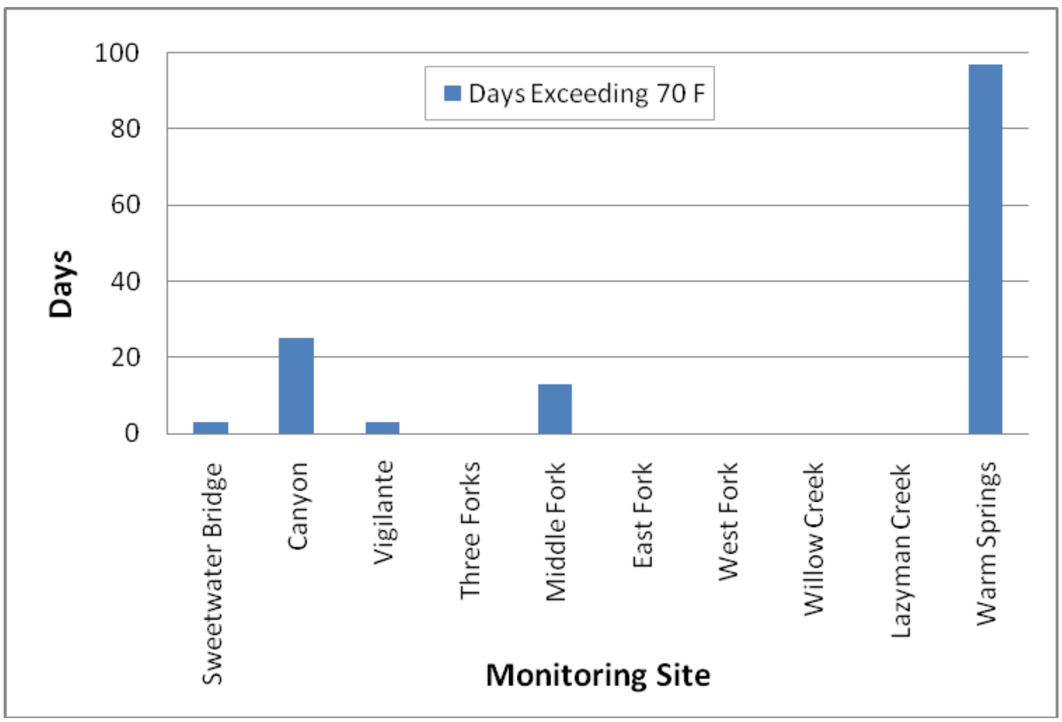

Figure 15. Days exceeding 70° F at FWP water temperature monitoring sites in the upper Ruby River watershed.

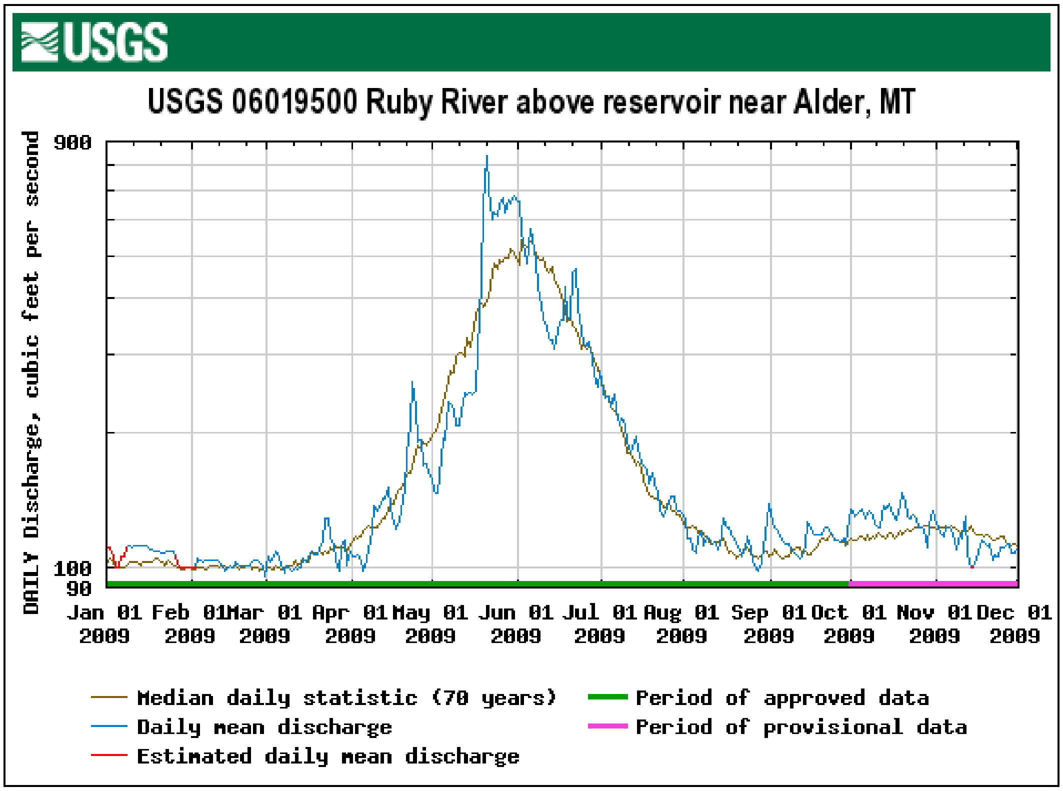

Figure 16. USGS real-time flow gauge data from the Ruby River above reservoir near Alder Montana in 2009.

D. Ruby Watershed Population Monitoring Methods

FWP monitors Arctic grayling in the upper Ruby River to estimate relative abundance, distribution and age-class structure. Electrofishing surveys were conducted when flow and temperature conditions (<65º F) were optimal for efficiency and less stressful for fish. Rainbow/cutthroat trout hybrids, brown trout, and brook trout were also captured to monitor their distribution and relative abundance. Captured fish were anesthetized using Tricaine™ Methanesulfonate-222 and measured for total length (± 0.1 in.) and weight (± 0.01 lb.) Pelvic fin tissue samples were collected from Arctic grayling and preserved for genetic analysis. Arctic grayling greater than six inches in length received a VI tag in the transparent adipose tissue immediately posterior to the left eye.

One-pass electrofishing surveys were completed in ten reaches in September and October (Figure 17). Mainstem reaches included Greenhorn, Canyon, Vigilante, Burnt Creek and Three Forks. Tributary reaches included Lazyman Creek, the Middle Fork of the Ruby River, Shovel Creek, Corral Creek, Pete's Creek and Bucket Creek. Data collected during electrofishing surveys were summarized with Fisheries Analysis 1.2.7 (Montana Fish, Wildlife & Parks 2007) and catch-per-unit-effort (fish/mile) were calculated for each sampling reach. These data are used to as an index to population abundance, spatial distribution and age-class structure, and to monitor fish community response associated with habitat enhancement projects. Arctic grayling length data are summarized using length-frequency histograms to characterize population age structure

(Figure 18), and catch-per-unit-effort (fish/mile) of young-of-the-year (YOY, < 6.0 inches) and Age 1+ (> 6.0 inches) for each reach (Figure 18).

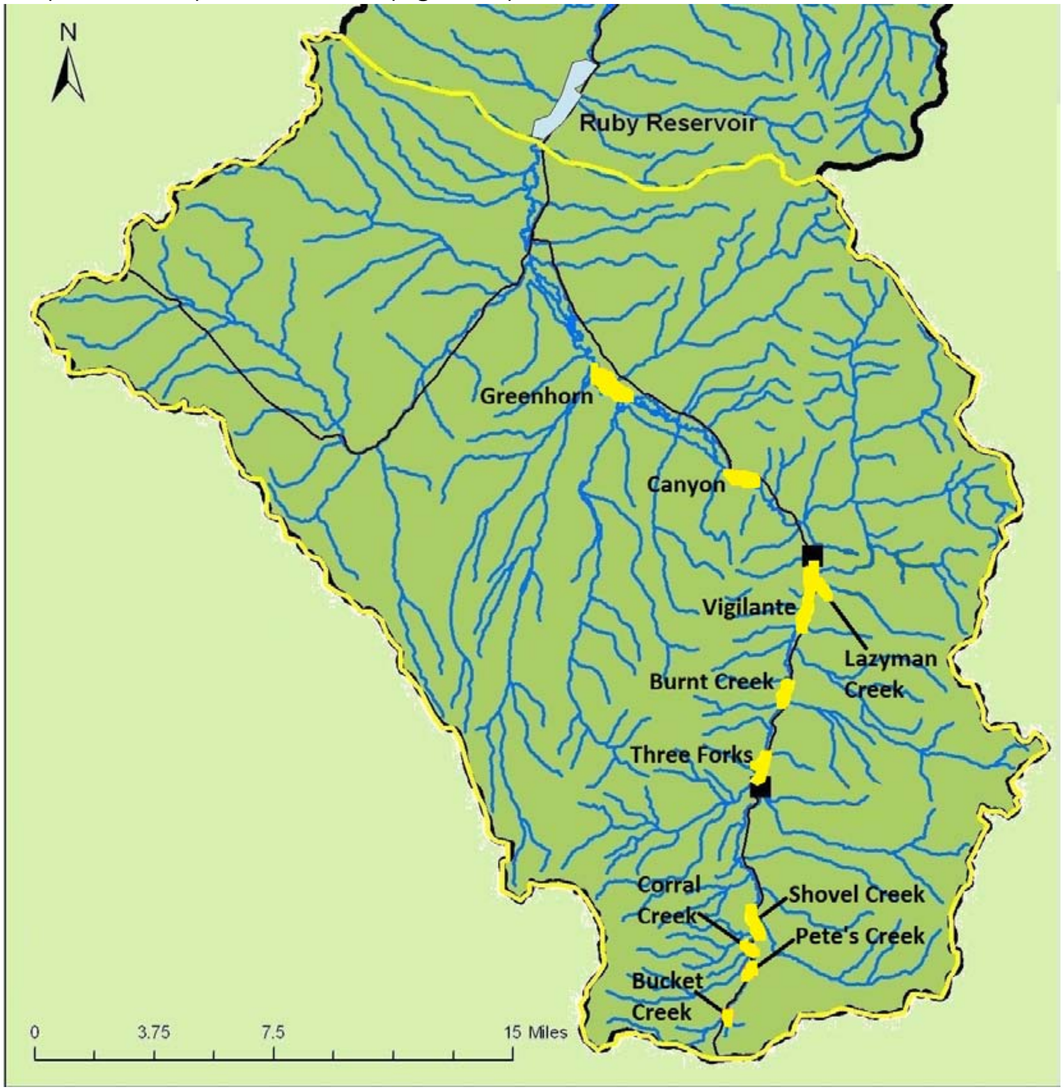

Figure 17. FWP electrofishing reaches in the upper Ruby River in fall 2009.

E. Ruby River Watershed Population Monitoring Results

Arctic grayling were captured in seven of the 10 reaches sampled (Figure 18), and were distributed throughout a 35 mile reach from the Greenhorn Section to the Corral Creek Section. We captured 231 Arctic grayling, representing multiple year classes including 62 YOY (Figure 19). Young-of-the-year Arctic grayling captured in 2009 indicate successful reproduction occurred from Arctic grayling previously reintroduced into the Ruby River drainage from RSIs or stocking programs. Young-of-the-year Arctic grayling were distributed between the Vigilante Section and Corral Creek Section, approximately 19 river miles (Figure 20). The highest Arctic grayling abundance occurred in the Burnt Creek Section (122 grayling/mile; Figure 18).

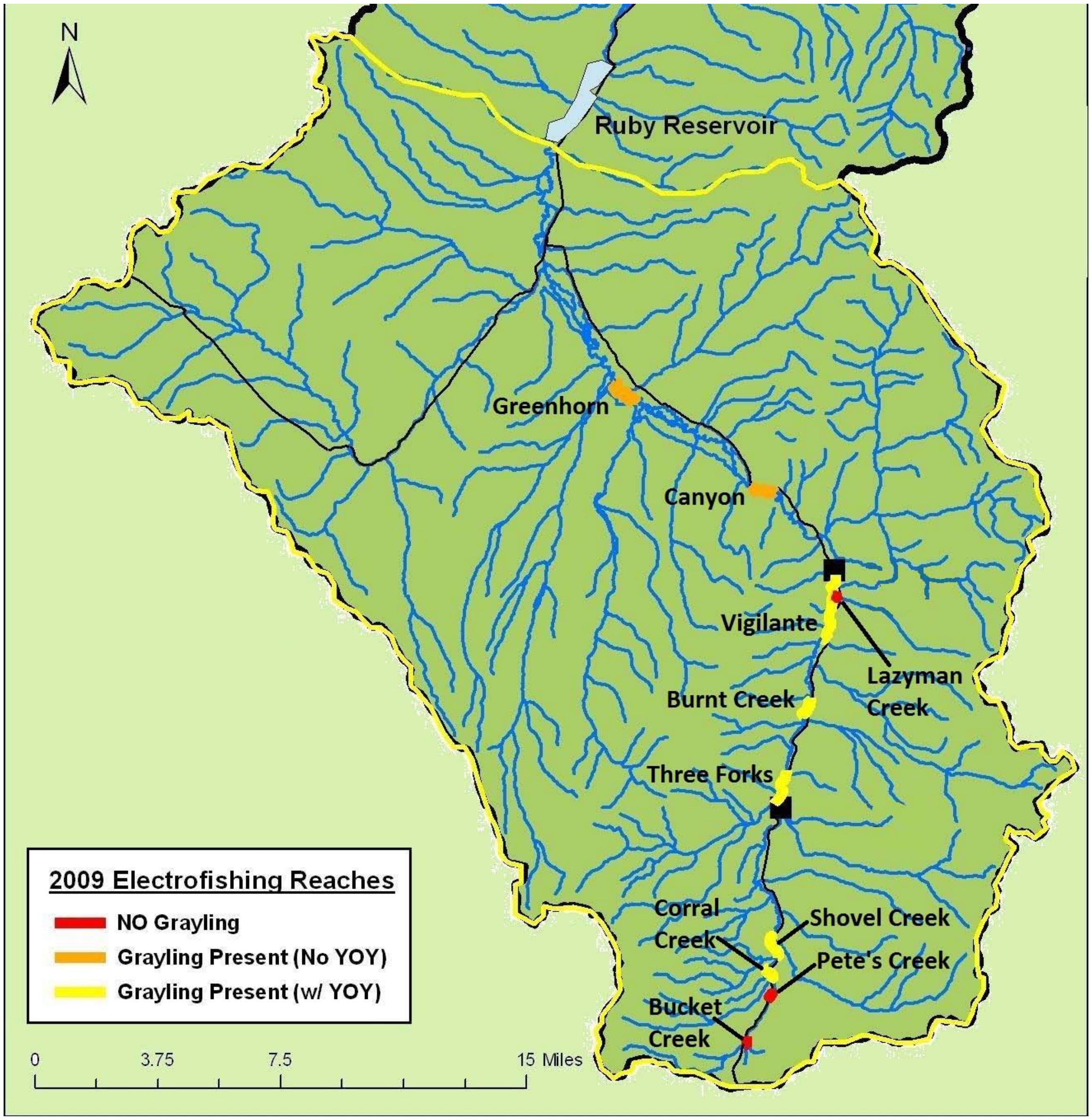

Figure 18. Arctic grayling distribution from FWP electrofishing reaches in the upper Ruby River watershed in 2009.

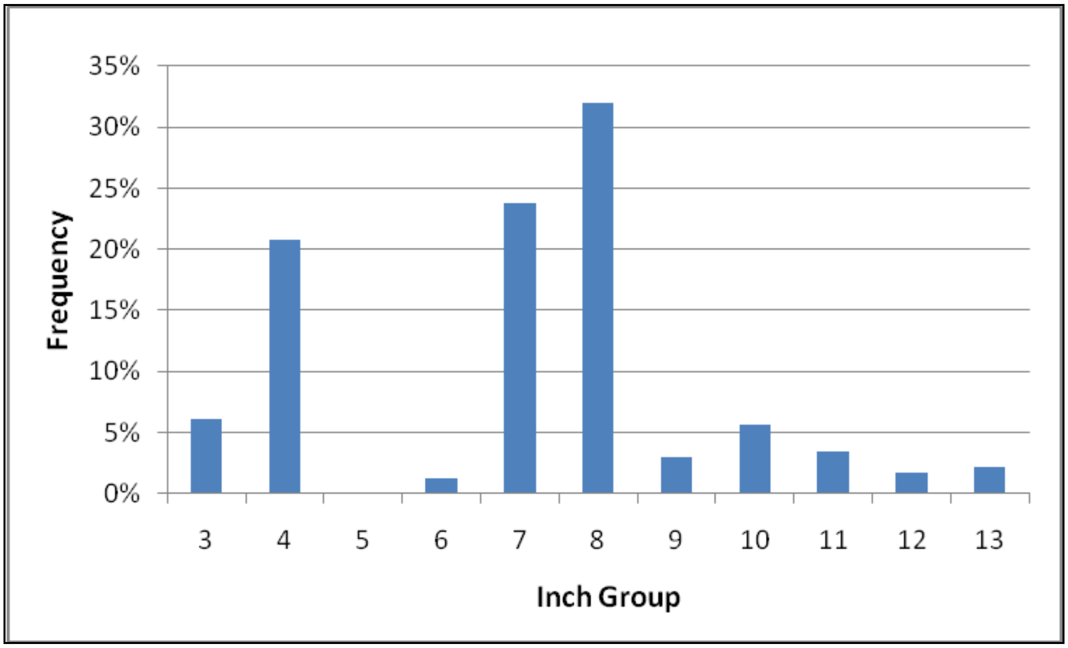

Figure 19. Length-frequency histogram for Arctic grayling captured during 2009 FWP electrofishing surveys in the upper Ruby River watershed (n = 231).

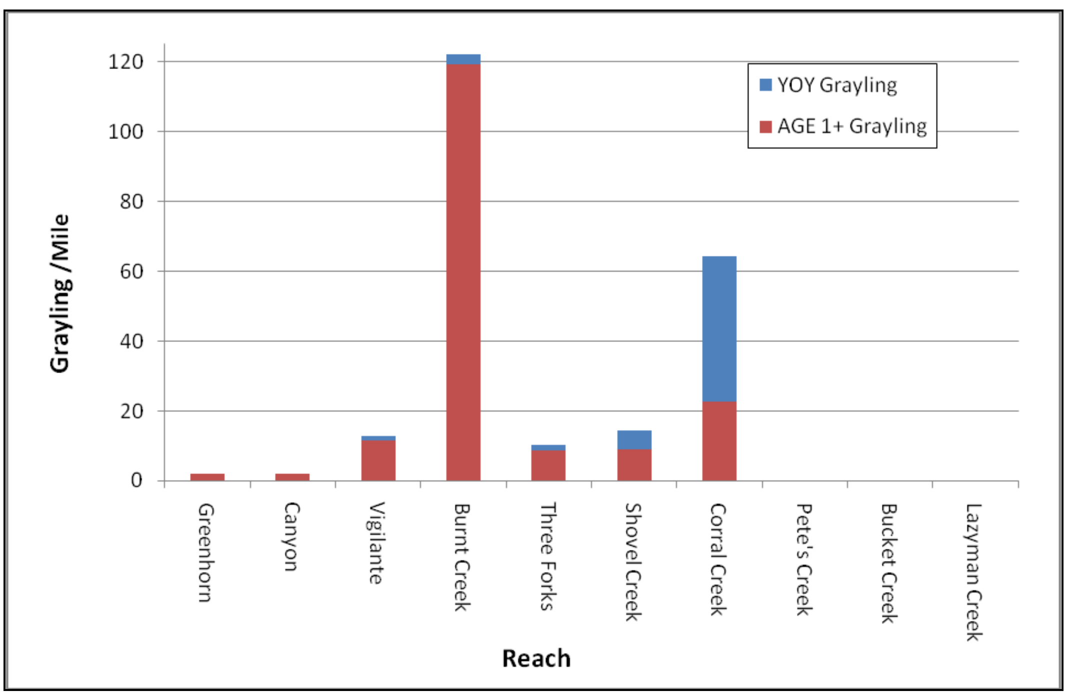

Figure 20. Catch per unit effort (number per mile) of age-1+ and young-of-the-year (YOY) Arctic grayling captured for each survey reach during 2009 FWP electrofishing surveys in the upper Ruby River watershed.

V. Arctic Grayling Brood Program

A. Introduction

The fluvial Arctic grayling brood stock developed from the Big Hole Arctic grayling population has been as a source of fluvial Arctic grayling for reintroduction and enhancement efforts (Fluvial Arctic Grayling Recovery Plan 1993). Currently, there are two fluvial brood stock populations located in Twin Lakes II at the Axolotl chain of lakes (hereafter referred to Axolotl Lake) and Green Hollow II Reservoir. The fluvial Arctic grayling brood populations in Green Hollow II Reservoir and Axolotl Lake provide gametes that are developed to eyed-eggs, fingerlings or yearlings for reintroduction efforts in streams or rivers within the historic range of fluvial Arctic grayling. Beginning in 1997, the brood populations have supported Arctic grayling reintroduction efforts in the upper Ruby River, North and South Fork of the Sun River, the lower Beaverhead River and the Missouri River headwaters near Three Forks, MT.

The Arctic grayling brood stock populations were not used to support reintroduction efforts in 2009 (no supplementation occurred). In 2009, the Axolotl and Green Hollow II brood stocks were each supplemented with 1,000 age-1 Arctic grayling raised at the Yellowstone River Trout Hatchery from the 2008 gamete collection at Axolotl Lakes.

B. Brood Program Monitoring Methods

Green Hollow II

On May 20, 2009 fyke traps and angling were used in Green Hollow II Reservoir to capture Arctic grayling and eastern brook trout for pathogen testing. Tissue samples were taken from sixty grayling and two brook trout and sent to the FWP fish health lab for analysis. All captured fish were measured for total length (±0.1 in.) and weight (±0.01 lbs.). Additional Arctic grayling captured were released back into the reservoir.

In September 2009, 1,000 age-1 Arctic grayling from the 2008 Axolotl spawning efforts were used to supplement the Green Hollow II population to maintain multiple age-classes in the brood population.

Axolotl Lake

On May 27 and 28, 2009 fyke traps and angling were used to capture Arctic grayling from the Axolotl Lake brood population for fish health screening and spawning purposes. Tissue samples were taken from sixty grayling and sent to the FWP fish health lab for analysis. Captured Arctic grayling were measured for total length (±0.1 in.) and weight (±0.01 lb) and sorted by sex into separate live-cars. On May 28, YRT Hatchery personnel spawned 200 grayling (100 males and 100 females). Fertilized eggs were cleansed in a NaCl solution, rinsed and stored in distilled water for transportation to the hatchery.

In September 2009, 1,000 age-1 Arctic grayling from the 2008 Axolotl spawning efforts were used to supplement the Axolotl Lake population and maintain multiple age-classes in the brood population.

C. Brood Program Monitoring Results

Green Hollow II

FWP captured 116 Arctic grayling and two brook trout for pathogen testing. The tissue samples from 60 Arctic grayling and two brook trout analyzed at the FWP fish health lab were negative for pathogens. The average length of captured grayling was 10.99 inches.

Axolotl Lake

FWP captured 507 Arctic grayling for gamete collection and fish health testing. All tissue samples from 60 Arctic grayling analyzed at the FWP fish health lab were negative for pathogens. On May 28, 2009, 137,200 eggs were collected from 100 females and fertilized with milt from 100 males. Average fecundity of spawned females was 1,372 eggs, and the average length for captured grayling was 11.29 inches. Progeny will be used to supplement the Green Hollow II and Axolotl Lakes brood populations in 2010.

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Appendix A

Table 1. Total fish captured by species for each reach during 2009 FWP monitoring surveys on the Big Hole River.

Big Hole River Reach	Reach Length (Miles)	Grayling	Brook Trout	Rainbow Trout	Brown Trout	Burbot
CCAA (A)	1.59	0	693	15	1	12
CCAA (B)	2.51	0	252	11	39	2
Little Lake Creek	3.79	0	164	2	13	12
CCAA (C)	6.32	7	138	9	4	10
Wisdom West	6.54	6	144	4	1	9
CCAA (D)	6.98	7	33	24	9	0
"The Pools"	0.60	15	15	38	17	0
CCAA (E)	4.34	0	1	87	79	2
Jerry Creek (4)	3.68	11	4	1,457	150	0
Melrose (5)	3.32	3	2	678	161	0
Hogback (5)	4.22	1	2	564	152	0
Total	**43.89**	**50**	**1448**	**2,889**	**163**	**47**

Table 2. Total fish captured by species for each reach during 2009 FWP population monitoring surveys on tributaries to the Big Hole River.

Big Hole Tributary Reach	Reach Length (Miles)	Grayling	Brook Trout	Rainbow Trout	Brown Trout	Burbot
Governor Creek (A)	1.55	0	285	8	15	2
Miner Creek (B)	0.79	0	56	0	1	1
Rock Creek (C)	0.74	0	0	0	0	0
Steel Creek (D)	3.47	73	698	2	1	70
Upper Steel Creek	1.12	0	201	0	0	1
Upper Swamp Creek	4.15	42	655	0	0	148
Swamp Creek	2.69	16	287	2	1	19
Plimpton Creek	2.95	75	300	6	4	15
Pintler Creek	0.67	14	*	*	*	*
York Gulch	1.41	5	*	*	*	*
Mudd Creek	0.10	0	*	*	*	*
LaMarche Creek	1.02	8	255	52	2	9
Fishtrap Creek	1.04	33	466	17	1	9
Seymour Creek	0.67	3	111	23	0	6
Deep Creek (E)	1.89	7	64	74	31	4
Total	**24.26**	**276**	**3378**	**184**	**56**	**284**

* Arctic grayling were the only species that were netted in these reaches. Other species were present but not captured.

Table 3. Total fish captured by species for each reach during 2009 FWP population monitoring surveys in the upper Ruby River watershed.

Ruby River Reach	Reach Length (miles)	Grayling	Cutthroat/Rainbow Hybrids	Brown Trout
Greenhorn	3.23	7	26	119
Canyon	1.03	2	362	54
Vigilante	2.57	33	303	2
Burnt Creek	0.68	83	159	0
Three Forks	1.25	13	169	0
Shovel Creek	1.33	20	105	0
Corral Creek	1.15	74	42	0
Pete's Creek	0.14	0	1	0
Bucket Creek	0.3	0	5	0
Lazyman Creek (Tributary)	0.40	0	59	0
Total	**11.68**	**232**	**1172**	**175**