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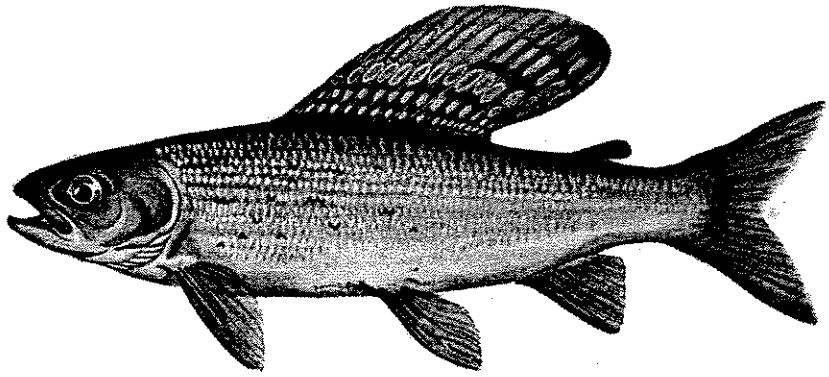

UPPER RUBY RIVER FLUVIAL ARCTIC GRAYLING REINTRODUCTION

ENVIRONMENTAL ASSESSMENT AND REINTRODUCTION PLAN

JANUARY 1997

Montana Fish, Wildlife & Parks

MONTANA FISH, WILDLIFE, AND PARKS
FISHERIES DIVISION

ENVIRONMENTAL ASSESSMENT

UPPER RUBY RIVER FLUVIAL ARCTIC GRAYLING REINTRODUCTION

Part I. Proposed Action Description

General Purpose: Arctic grayling (Thymallus arcticus) were once widespread in the Missouri River drainage upstream of Great Falls. During the 20th century, the range of fluvial, or river-dwelling, grayling became restricted to the Big Hole River, about 4% of its native range. The Big Hole River grayling population declined in abundance through the mid-1980's to low levels. Concern for the population resulted in formation of the interagency Fluvial Arctic Grayling Workgroup (FGW) to coordinate restoration of fluvial grayling in the Big Hole River and throughout native range in Montana. The Montana Fluvial Arctic Grayling Restoration Plan was developed to recover Arctic grayling with a goal of "at least five stable, viable populations distributed among at least three of the major river drainages...within the historic range of Montana grayling..." A reintroduction plan, as required by the Montana Fluvial Arctic Grayling Restoration Plan, is attached as an Appendix.

Background: The upper Ruby River, above Ruby Reservoir, was identified as a candidate site for reintroducing grayling (Figure 1). The upper Ruby River is of particular interest because it provides a relatively long unimpeded river reach, a basic requirement of fluvial grayling habitat. Over 41 miles of the Ruby River upstream of the reservoir may encompass suitable habitat for fluvial grayling with respect to pool habitats, adequate flow, temperature, and geomorphology. The goal of the project is to establish a self-sustaining population of fluvial Arctic grayling by 2005.

Location of Project: The proposed reintroduction area is the Ruby River, from its inlet at Ruby Reservoir upstream to its headwaters, in Madison County. Actual planting sites will be in the vicinity of the confluence of the three forks of the Ruby River, near the mouth of Cottonwood Creek, and below Warm Springs Creek (Figure 1).

Need for the Project: Conservation of fluvial Arctic grayling in Montana (the last stronghold in the lower 48 United States) will necessitate reintroductions throughout its native range. Due to uncertainties regarding potential listing of grayling as endangered, controversy has developed over reintroductions. The Ruby reintroduction will provide a critical initial action that will demonstrate the feasibility of re-establishing grayling. Citizens of the Ruby Valley, while concerned over the political implications of a reintroduction, have shown support for the reintroduction as a means of conserving fluvial grayling. This reintroduction will not only provide empirical data on survival of planted grayling and potential success of establishing a population, but also serve as a template to demonstrate that conservation of native species is not necessarily a threat to the economic well-being of communities.

Scope of the Project: The proposed reintroduction will begin in July, 1997. Young grayling will be stocked annually into the upper Ruby River at least through the year 2000. Yearling and young-of-the-year (YOY) grayling will be supplied by U. S. Fish and Wildlife Service Fish Technology Center in Bozeman and Washoe State Fish Hatchery in Anaconda with fish descended from wild fluvial Big Hole River stock. Stocking rates will depend on availability of fish. Recommended stocking rates are at densities of 350 per mile or 15,000 yearlings based on predicted mortality of 50 to 75%. Stocking rates of YOY grayling should be equal to or greater than those of yearling plants. Grayling will be divided into 3 equal, differentially marked lots. Each lot will be transported in aerated tanks to each of three upper Ruby River sites, tempered to river temperatures, and held in live cars for acclimation for 3 to 7 days. After acclimation, grayling will be released either at the location of acclimation or distributed throughout the reach. Yearling grayling should be released immediately after runoff in late June or early July. YOY should be stocked in late August to allow sufficient acclimation before winter.

Thorough monitoring of reintroductions is necessary to maximize the probability of success and to document factors that may hinder or help future reintroductions. Monitoring will continue through 2002 unless data dictate that successful establishment of a self-sustaining population is unlikely. Electrofishing will be employed as a primary monitoring tool to document survival, dispersal, population density, and fish community composition. Additional sampling may include food habits

of grayling and sympatric species using gastric lavage techniques. Other monitoring tools may include creel census, drift netting, snorkeling surveys, and tagging with VI tags. Additional research and monitoring projects will be adapted as need arises.

List of Agencies Consulted During Preparation of EA

Beaverhead-Deerlodge National Forest, Ruby Valley Conservation District, Lewis and Clark Trout Unlimited, Fluvial Arctic Grayling Workgroup.

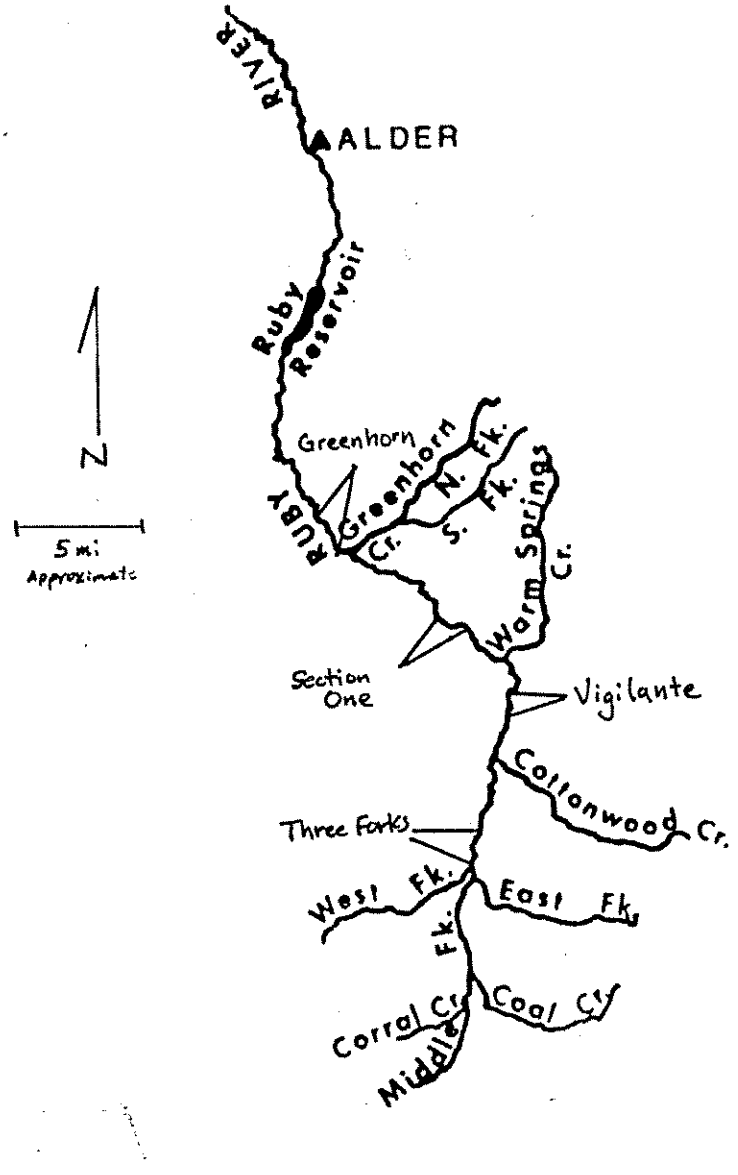

Figure 1. Map of the upper Ruby River showing reintroduction sites and sampling sections, modified from Kaya (1992).

PART II. Environmental Review

1. Environmental Impact Checklist:

Potential Impact on Physical Environment

	Major	Moderate	Minor	None	Unknown	See Comment
1. Terrestrial & aquatic life and habitats			XX			XX
2. Water quality, quantity, and distribution				XX		
3. Geology, soil quality, stability, and moisture				XX		
4. Vegetation cover, quantity, and quality				XX		
5. Aesthetics		XX				XX
6. Air quality				XX		
7. Unique, endangered, fragile, or limited environmental resources		XX				XX
8. Demands on environmental resources of land, water, air and energy				XX		
9. Historical and archeological sites				XX		

Explanation of Impacts to Physical Environment:

1. Terrestrial & aquatic life and habitats.

The introduction of hatchery-reared fish may affect resident fish populations through interruption of social structure, especially of rainbow trout. However, low densities of non-native rainbow trout and rainbow-cutthroat hybrids exist in most of the upper Ruby River and are unlikely to decline due to presence of Arctic grayling. Grayling are a native species and have a higher management priority than rainbow trout in the upper Ruby. Other native fish species, such as mottled sculpins, longnose dace, longnose and white suckers, and mountain whitefish, may be temporarily affected by an introduction of Arctic grayling. However, these species co-evolved with grayling and have developed separate niches that will prevent long-term disturbance from occurring. The aquatic invertebrate community may be disturbed by the addition of Arctic grayling. Likely impacts are changes in density of certain species, but grayling are not likely to change species diversity or community structure. No unique or endangered invertebrates are resident to the upper Ruby.

5. Aesthetics.

Presence of grayling in the upper Ruby River will have a moderate positive influence by providing an additional opportunity to view native species in their natural habitats.

7. Unique, endangered, fragile, or limited resources.

The reintroduction of grayling into the upper Ruby River will moderately enhance the status of fluvial grayling in Montana. Conservation of this potentially endangered species requires establishment of new populations.

Potential Impacts on Human Environment

	Major	Moderate	Minor	None	Unknown	See Comment
1. Social structures & mores				XX		
2. Cultural uniqueness and diversity				XX		
3. Local, state tax base & revenue				XX		
4. Agricultural or industrial production			XX			XX
5. Human health				XX		
6. Quantity and distribution of community and personal income				XX		
7. Access to & quality of recreational and wilderness activities		XX				XX
8. Quantity and distribution of employment				XX		
9. Distribution and density of housing				XX		
10. Demands for government services				XX		
11. Industrial & commercial activity			XX			XX
12. Energy demands				XX		
13. Locally adopted environmental plans and goals				XX		

14.	Transportation networks and traffic flows				XX		
15.	Site specific modification system wide				XX		

Explanation of Impacts to Human Environment:

4. Agricultural or Industrial Production.

The reintroduction of a candidate species for endangered status may affect grazing practices on public lands in the upper Ruby. However, current practices are resulting in positive trends in habitat quality so no alteration of grazing practices is likely. No additional regulation of activities on private lands will occur with the addition of Arctic grayling. Existing regulations protecting stream bed and banks and appropriating water for irrigation will remain in effect and unchanged.

7. Access to & quality of recreational and wilderness experiences.

A moderate positive effect on recreational experiences is likely due to the availability of a native species to wildlife watchers and anglers. A thriving Arctic grayling population would add to the diversity of angling opportunity.

11. Industrial and Commercial Activity.

Other than agriculture, recreation is the major commercial activity in the upper Ruby River basin. The presence of Arctic grayling would enhance the recreational industry by providing added value to outfitting and guiding of anglers.

2. Description and Analysis of Reasonable Alternatives:

A. No Action - No reintroduction. Failure to initiate a reintroduction will maintain the current restricted range of fluvial Arctic grayling. A single population in the Big Hole River will be more susceptible to extinction due to catastrophic events. No progress toward ensuring conservation of the species will be

made, increasing the likelihood and necessity of listing as an endangered species under the Endangered Species Act. No progress will be made toward reaching goals of the Montana Fluvial Arctic Grayling Restoration Plan or a Conservation Agreement with the U.S. Fish and Wildlife Service.

B. Conduct Reintroduction as Planned. Will have beneficial effects of progressing towards conservation of fluvial Arctic grayling.

3. Recommendation concerning preparation of EIS:

No EIS required due to lack of significant environmental impacts and potential benefits to the environment

4. Level of Public Involvement

Public involvement appropriate for this project has included three public meetings held in Sheridan, MT to assess public concerns. A comment period extending forty-five days, beginning February 1, 1997 to March 17, 1997, publication of proposed action in Montana Standard and , and public meetings held in Ennis, MT on March 12 and in Sheridan, MT March 13, 1997. This EA and Reintroduction Plan will be mailed to MFWP's MEPA mailing list and to 82 citizens and groups previously expressing interest.

5. Person Responsible for preparing EA:

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Date: February 1, 1997

UPPER RUBY RIVER FLUVIAL ARCTIC GRAYLING

REINTRODUCTION PLAN

Prepared By

Patrick A. Byorth

For

Montana Fish, Wildlife, and Parks

and

Fluvial Arctic Grayling Workgroup

JANUARY 1997

INTRODUCTION

Arctic grayling (Thymallus arcticus) were once widespread in the Missouri River drainage upstream of Great Falls. Grayling were endemic to the Missouri River and its tributaries: the Smith, Sun, Teton, Madison, Gallatin, Jefferson, Beaverhead, and Big Hole rivers. During the 20th century, the range of fluvial, or river-dwelling, grayling became restricted to the Big Hole River, about 4% of its native range (Kaya 1992a). The impacts of climatic change, introductions of non-native fishes, habitat alteration, and over-harvest by anglers are considered primary reasons for the decline of fluvial grayling (Vincent 1962, Kaya 1992a).

The Big Hole River grayling population declined in abundance through the mid-1980's to low levels. Concern for the population resulted in formation of the interagency Fluvial Arctic Grayling Workgroup (FGW) to coordinate restoration of fluvial grayling in the Big Hole River and throughout native range in Montana. A plan was developed to recover Arctic grayling with a goal of "at least five stable, viable populations distributed among at least three of the major river drainages...within the historic range of Montana grayling... (FGW 1995)."

The upper Ruby River, above Ruby Reservoir, was identified by Kaya (1992b) as a candidate site for reintroducing grayling. The

upper Ruby River is of particular interest because it provides a relatively long unimpeded river reach, a basic requirement of fluvial grayling habitat. Over 41 miles of the Ruby River upstream of the reservoir may encompass suitable habitat for fluvial grayling with respect to pool habitats, adequate flow, temperature, and geomorphology. This document is the Reintroduction Plan required for grayling reintroductions by the FGW in the Montana Fluvial Arctic Grayling Restoration Plan (FGW 1995).

Restoration Goals, Objectives, and Scope

The restoration goal is to re-introduce fluvial Arctic grayling into the upper Ruby River, beginning in 1997, to establish a stable, naturally reproducing population above Ruby Reservoir by 2005. Objectives of the reintroduction are to:

1) Monitor survival, movements and densities of introduced grayling to determine factors affecting success of reintroduction, and
2) Through monitoring, document natural reproduction by 2002,
3) Attain stable to increasing population densities in sampling sections where natural reproduction equals or exceeds annual mortality for three consecutive years.

It is recognized that the success of any reintroduction will hinge upon a complex set of environmental variables beyond the

control of resource management. Thus, it is important to define the scope of time that will be dedicated to the effort. If limiting factors are identified that will realistically preclude founding of a self-sustaining population, the project will cease. Therefore, if natural reproduction is not documented by October, 2005 and data do not demonstrate a likelihood of correcting limiting factors, the project will be discontinued and resources will be diverted to alternative reintroduction sites.

IDENTIFICATION OF ISSUES AND SUITABILITY FOR GRAYLING

A number of issues must be addressed to successfully plan and implement the reintroduction program. Issues were identified by representatives of the FGW, U. S. Forest Service Beaverhead-Deerlodge National Forest (USFS), Montana Fish, Wildlife, and Parks (MFWP), and interested publics at three open meetings held in Sheridan, MT in 1995.

Endangered Species Act

The U. S. Fish and Wildlife Service (USFWS) formerly classified fluvial Arctic grayling in Montana as "Category 1" under the Endangered Species Act; that is, enough substantial information exists to support a proposal to list it as threatened or endangered (USFWS 1991). This category was renamed "Candidate" in February 1996 (USFWS 1996). A petition to list fluvial Arctic grayling as

endangered was submitted in October, 1991 (USFWS 1993). A recent finding on the petition recommended that listing fluvial Arctic grayling was "warranted, but precluded" by higher priority listing actions (USFWS 1994).

The potential for listing fluvial Arctic grayling as endangered was a primary concern of the residents of the Ruby Valley voiced at public meetings. Reintroduction of candidate species to the upper Ruby River was perceived to potentially affect land management on public and private lands. However, a recent agreement between USFWS and MFWP may alleviate many of the concerns as to the affects of a potential listing.

A Memorandum of Agreement was developed to maintain efforts to protect and restore fluvial grayling in the Big Hole River while expanding a program to reestablish additional populations. This agreement, signed in February 1996, includes a provision that, "By the year 2000, a minimum of five ...reintroductions will be in progress...within the historic range (MFWP Files)." The upper Ruby reintroduction would be included to fulfill this requirement along with other proposed reintroductions. The goal of the Agreement is to restore fluvial grayling to a level such that listing under the Endangered Species Act is unnecessary. Progress toward establishment of a viable population of fluvial grayling in the

Ruby River would be an important step toward fulfilling the terms of the agreement, achieving grayling restoration, and precluding the need to list. In the event that terms of the agreement are not met, a status review would be initiated to re-determine the necessity of listing in 2003. By this time, the success or failure of the upper Ruby reintroduction will be known and therefore render listing as immaterial to land management in the upper Ruby Valley.

Private Property

Approximately 32 miles of the upper Ruby River flows through private land. These lands are primarily used for pasture, hay production, and recreation. Approximately 3,000 acres of private lands are irrigated via diversions from the river (USGS 1991). Concerns were voiced that reintroducing grayling may impact private lands management. The primary concerns, relating to the Endangered Species Act, are addressed above. No additional legal protection would be provided to grayling, other than angling regulations. Statutes protecting grayling and their habitat in the upper Ruby River would include laws already in effect, regardless of presence or absence of grayling. For instance, the Montana Stream Protection Act (124) and Montana Natural Streambed and Land Preservation Acts (310) require permits to alter stream bed and banks. Water rights granted under the Montana Water Use Act would

be unaffected by an introduction of grayling. Entrainment of grayling into legally permitted irrigation canals could only be prevented via voluntary corrective measures. If corrective measures are necessary, financing would be provided by outside sources to avoid imposing financial burdens on landowners. Thus, private land management rights would remain unchanged with respect to a grayling reintroduction.

Public Lands Management

The USFS manages over 88,000 acres of land in the upper Ruby Valley. Primary uses are cattle and sheep grazing on over 43,000 acres, recreation, and wildlife habitat (USFS 1992). The potential affects of reintroducing grayling into the basin may include altering the management of these lands. However, management practices currently in effect are resulting in positive trends in stream habitat, which in turn improves the probability of a successful reintroduction of grayling.

The predominant land use that would relate to a reintroduction is livestock grazing. Historic grazing practices impacted riparian vegetation, stream channels, and uplands throughout the upper Ruby Drainage. Damage to resources in the drainage were recognized and grazing practices were modified in the 1970's (Page 1978). However, restoration of stream channels was not adequately

progressing under those management practices. Grazing management underwent a further, controversial change beginning in 1992, when the Upper Ruby Cattle and Horse Allotment Management Plan was revised (USFS 1992). Since the implementation of the new grazing strategies, stream conditions have improved. The upper Ruby was identified as suitable habitat for reintroduction (Kaya 1992b). Thus, under improving stream conditions, fish habitat improves, and the likelihood of successful reintroductions increase. Therefore, adjusting grazing management would be unnecessary due to presence of grayling in the basin under current management strategies.

Other land management activities that may be impacted would include road maintenance. As stated in the section above on private lands, existing statutes protecting stream beds and banks would remain unchanged in the presence of Arctic grayling.

Fisheries Management

The upper Ruby River supports wild, resident game fish populations of rainbow trout and rainbow-cutthroat hybrids, brown trout, and mountain whitefish. Resident non-game species include mottled sculpin, longnose dace, and longnose and white suckers. The fishery in Ruby Reservoir is supplemented by annual plants of hatchery-reared rainbow trout. An estimated 564 angler-days were exerted in the upper Ruby River and 1869 angler-days on Ruby

Reservoir in 1995 (MFWP 1996). For comparison, the upper Big Hole River near Wisdom sustained 1513 angler-days in 1995 (MFWP 1996).

Game fish populations are monitored by electrofishing regularly in the upper Ruby River. Electrofishing sections have been distributed throughout the upper basin from the three forks to the reservoir since the mid-1970's (Figure 1). Low densities of rainbow trout and rainbow\cutthroat hybrid trout predominate above Warm Springs Creek (Table 1). Densities of 4 inch and longer rainbow/cutthroat trout in the Three Forks Section have ranged from 127 per mile to 258 per mile between 1990 and 1995 (Oswald and Brammer 1993, MFWP Files). In 1995, estimates were 194 per mile in the Three Forks Section. The Vigilante Section was established upstream of Warm Springs Creek in 1995 and sampled again in 1996. Densities of rainbow/cutthroat trout were very similar between the Three Forks and Vigilante sections at under 200/mile. Low numbers of brown trout were also sampled in both sections. Densities of rainbow/cutthroat trout increase substantially below the confluence with Warm Springs Creek. A 1976 survey estimated nearly 3000 rainbow/cutthroat per mile in Section One. Brown trout densities were estimated at 85 per mile over 4.0 inches (Peterson 1979). In contrast, 1996 surveys in Section One indicated a decline in rainbow trout densities of 55% and brown trout declined nearly 75%.

Rainbow/cutthroat trout decreases, while brown trout densities increase nearer to Ruby Reservoir. In the Greenhorn Section, approximately 17 mi above the reservoir, rainbow/cutthroat trout were estimated at under 150/mi in 1990 and 1995. Brown trout densities were approximately 300 in 1990 and 1995 (Oswald and Brammer 1993, MFWP Files).

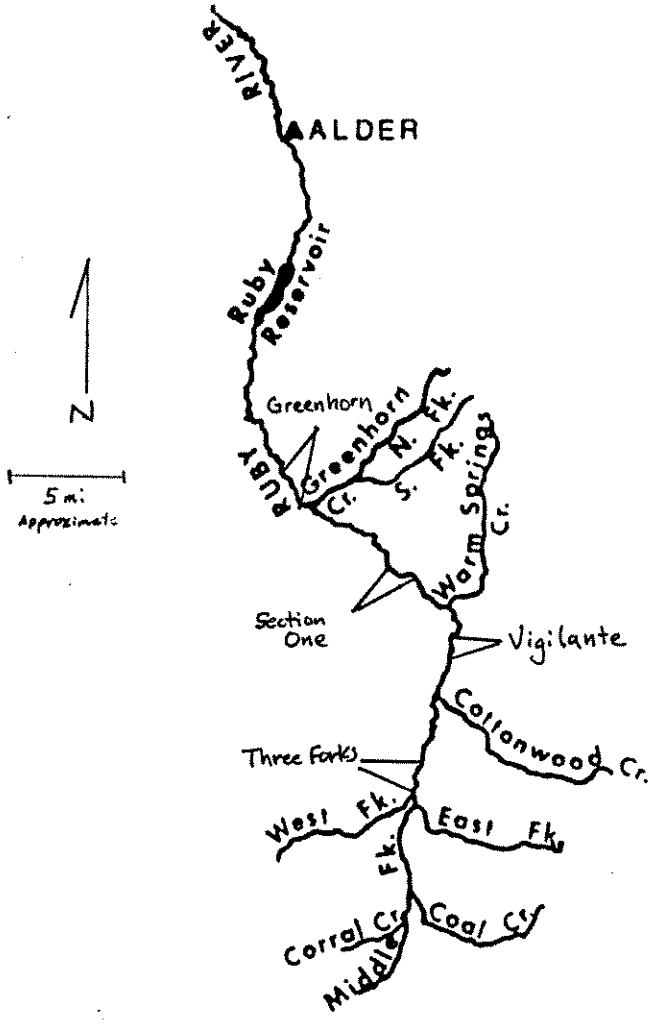

Figure 1. Map of upper Ruby River showing electrofishing sections, modified from Kaya 1992b.

Table 1. Rainbow (RB), rainbow-cutthroat hybrid (RB x CT), and brown trout population densities in electrofishing sampling sections of the upper Ruby River, Montana.

Sampling Section	River Mile	Year	Abundance (#/mi)	Species
Three Forks	92.0	1990	200	RB x CT
		1992	258	RB x CT
		1995	186	RB x CT
Vigilante	84.0	1995	186	RB x CT
		1996	189	RB x CT
Section One	78.0	1976	2899	RB, RB x CT
		1976	85	Brown
		1996	1606	RB, RB x CT
		1996	24	Brown
Greenhorn	65.0	1990	118	Rainbow
		1990	307	Brown
		1995	139	Rainbow
		1995	294	Brown
Ruby Reservoir	48.0	-	-	-

Kaya (1992b) expressed concern that the presence of non-native fishes in the upper Ruby River may hinder success of the reintroduction. In the Big Hole River, densities of grayling are lowest where brown and rainbow trout are highest. However, it appears that grayling can co-exist with rainbow and brown trout when they are low in densities. Grayling are aggressive fish and have been observed to successfully defend territories against

similar-sized rainbow and brown trout in low densities (MFWP Files). In Deep Creek, a tributary of the Big Hole River, grayling spawn and rear, and age 1+ grayling coexist successfully in rainbow trout densities exceeding 200 per mile. Established resident species may influence survival of stocked grayling through predation and competition for food and space. However, stocking of hatchery-reared fish is known to negatively impact wild populations (Vincent 1987, Bachman 1982). The affects of resident populations and stocked grayling on each other will be monitored.

Angling regulations in the upper Ruby River will not be significantly adjusted to protect grayling. Currently, grayling are managed under catch-and-release-only regulations in Montana streams. Current regulations on rainbow/cutthroat and brown trout in the Ruby River (limited to 5 fish daily and in possession) will remain unchanged after reintroduction commences, unless the populations undergo significant declines. Similarly, fishing regulations in the reservoir will not be adjusted with respect to rainbow and brown trout.

The goal of the introduction is specifically to establish a fluvial grayling population above Ruby Reservoir. The presence of Ruby Reservoir may encourage introduced grayling to adapt to lacustrine environment with an adfluvial spawning behavior (Kaya

1992b). That is, that grayling may assume residence in the reservoir and enter the river only to spawn. Ruby Reservoir will not be managed for grayling. If monitoring indicates that an adfluvial population is developing, preventative measures may be necessary such as liberalizing creel limits or constructing a migration barrier.

Similarly, grayling may spill over Ruby Dam into the lower Ruby River. The lower Ruby River is outside of the designated reintroduction area. While grayling will be protected under catch-and-release regulations, no further management for grayling will be exerted in the lower Ruby River.

Whirling Disease

Presence of the myxosporean parasite Myxobolus cerebralis and symptoms consistent with whirling disease have been documented in the lower Ruby River. Brown and rainbow trout collected in several reaches of the Ruby River were confirmed to be infected with the parasite. A sample of rainbow trout from Ruby Reservoir tested positive for the disease in 1995 (MFWP Files). However, a subsequent sample of 60 rainbow trout taken from the reservoir tested negative in 1996. Samples from the Three Forks Section in 1995 also tested negative.

Although the susceptibility of grayling to whirling disease is

not adequately documented, the presence of the parasite in the basin may hinder reintroduction efforts. Densities of the intermediate host, Tubifex spp. worms, are extremely low above Warm Springs Creek but extremely high above the confluence (D. Gustafson, Montana State University, Personal Communication). Hence, the potential for proliferation of the parasite is high in the lower 30 miles of the study reach. Testing for whirling disease will continue in the basin and bioassays are underway to test the susceptibility of grayling to whirling disease.

Habitat and Biological Suitability

The upper Ruby basin is characterized by unstable geology that results in high rates of sedimentation and erosion (Page 1978). The channel of the upper Ruby River is highly unstable, causing lateral channel migration and high suspended sediment loads. Grayling commonly spawn on freshly eroded and deposited gravels, generally after lowland runoff in early spring. The unstable character of the upper Ruby River should provide ample suitable spawning habitat. However, gradient of the upper Ruby River is greater than typical spawning reaches of the Big Hole River: ranging between 0.7 and 1.3% versus 0.26 to 0.56% in the upper Big Hole River (USFS Files, MFWP Files).

The hydrograph of the upper Ruby River reflects suitability

for grayling spawning. Review of flow records from a U.S. Geological Survey (USGS) gaging station 6 mi upstream from Ruby Reservoir indicates a spring hydrograph similar to the upper Big Hole River. Winter base flows in the Ruby River between 1988 and 1995 averaged approximately 106 cfs (USGS 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996). Lowland runoff typically increased flows to over 300 cfs into mid-April and returned to around 200 cfs by mid-May. Grayling typically spawn, incubate, and emerge in the Big Hole River during this period, prior to highland runoff. Highland runoff generally begins in the Big Hole and upper Ruby rivers in mid-May and persists until mid-June. This similarity in flow patterns suggests that the upper Ruby River will provide suitable flow conditions for spawning grayling.

While the upper Big Hole River was plagued by severe drought conditions between 1987 and 1994, the upper Ruby River maintained suitable flows. The "absolute minimum" flow recommended by MFWP for the upper Ruby River was 50 cfs (MFWP 1989). During the period 1988 to 1995, the Ruby flowed below 50 cfs on 1 day in 1988 and 11 days in 1994 (USGS 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996). Irrigation of over 3,000 acres above the gaging station has not caused substantial dewatering of the river channel even during drought. In the Big Hole River between 1988 and 1995 mean monthly

flows ranged from 58.7 to 85.8% of long-term (50-year) average. In contrast, mean monthly flows of the upper Ruby River ranged from 83.7 to 91.8% of long-term norms during the same period. Impacts of severe dewatering on grayling observed in the Big Hole River is not likely to be an issue in the upper Ruby River.

Water quality parameters vary between the upper Ruby River and the Big Hole River. Page (1978) reported specific conductances averaged 340 μmhos/cm, mean pH of 8.7, and alkalinity of 172.8 mg/l in the upper Ruby in August 1976. Surveys in the upper Big Hole River in August 1993 indicated mean specific conductances of 85.3 μmhos/cm, mean pH of 7.6, and alkalinity of 785 mg/l (MFWP Files). Water chemistry and consequently the biological productivity in the upper Ruby River may affect survival of stocked grayling. Forage availability may limit grayling densities. Invertebrate densities measured with Surber samplers in August 1976 in the upper Ruby River were up to two orders of magnitude lower than similar samples taken in the Big Hole River in August of 1993 (Greene et al. 1977, MFWP Files). Although the samples were taken nearly twenty years apart, it suggests that invertebrate production in the upper Ruby River is much lower than the Big Hole River and equal densities of grayling are unlikely to be achieved.

Water temperatures of the upper Ruby River were measured at

six thermograph stations in 1996. While technical problems rendered data unreliable, trends are apparent. Water temperatures remained within suitable ranges from Three Forks to Warm Springs Creek. Temperatures increased substantially at the confluence with Warm Springs Creek, reaching levels potentially lethal for grayling. Page (1978) also recorded temperatures into the 70°F range with a maximum temperature of 80°F near the confluence. Thermal tolerances of grayling are exceeded above 77°F (Lohr et al. 1996). Water temperatures cool below Warm Springs Creek and remain well within suitable limits for grayling to Sweetwater Creek, within 3 mi of the reservoir, where temperatures approached but did not surpass lethal limits.

High water temperatures occurred locally in the upper Ruby River for short periods of time. However, miles of river with more moderate temperatures will provide sufficient refuge from high temperatures. We will continue to monitor water temperatures.

REINTRODUCTION AND MONITORING PROTOCOL

Grayling will be stocked into the upper Ruby River beginning July 1997 through the year 2000. Yearling and young-of-the-year (YOY) grayling will be supplied by USFWS Fish Technology Center in Bozeman and MFWP Washoe State Fish Hatchery in Anaconda with fish descended from wild fluvial Big Hole River stock. Stocking rates

will depend on availability of fish. Recommended stocking rates are at densities of 350 per mile or 15,000 yearlings based on predicted mortality of 50 to 75%. Stocking rates of YOY grayling should be equal to or greater than those of yearling plants. Grayling will be divided into 3 equal, differentially marked lots. Each lot will be transported in aerated tanks to each of three upper Ruby River sites, tempered to river temperatures, and held in live cars for acclimation for 3 to 7 days. Kaya and Jeannes (1995) observed that the tendency for young grayling to remain within a stream section increased substantially when acclimated on site for up to 7 d. Release sites will be located at Three Forks, near Cottonwood Camp, and below Warm Springs Creek. After acclimation, grayling will be released either at the location of acclimation or distributed throughout the reach. Yearling grayling should be released immediately after runoff in late June or early July. YOY should be stocked in late August to allow sufficient acclimation before winter.

Monitoring

Thorough monitoring of reintroductions is necessary to maximize the probability of success and to document factors that may hinder or help future reintroductions. Monitoring will continue through 2002 unless data dictate that successful

establishment of a self-sustaining population is unlikely.

Electrofishing will be employed as a primary monitoring tool to document survival, dispersal, population density, and fish community composition. Electrofishing sections will include: Three Forks, Vigilante, Section One (Canyon Camp), and Greenhorn (Figure 1). Each section will be electrofished in spring to investigate over-winter survival and maturity and in fall to document post-plant survival and dispersal.

Sampling may include food habits of grayling and sympatric species using gastric lavage techniques. Other monitoring tools may include creel census, drift netting, snorkeling surveys, and tagging with VI tags. Additional research and monitoring projects will be adapted as need arises.

Annual spring gill-netting will continue on Ruby Reservoir to detect presence and relative abundance of grayling and monitor reservoir rainbow and brown trout populations.

CONCLUSIONS

Analysis of social and biological issues indicates that a reintroduction of grayling into the Ruby River is feasible and should be pursued. The assistance of the Ruby Valley community in identifying issues and their support for the reintroduction will be a key in the success of the program. The primary social concern

included the impacts of the Endangered Species Act on public and private land management. Concerns regarding this issue should be allayed by a recent cooperative agreement between USFWS and MFWP, which will allow the reintroduction program to continue without the likelihood of classification as endangered. Much about the biological suitability of the upper Ruby River for grayling is unknown. While cursory analysis of habitat, temperature, and flow data indicate a similarity to the Big Hole River, the potential for establishment of a self-sustaining population will best be answered by a well-planned reintroduction followed by thorough monitoring.

The key to conserving Montana's unique stock of fluvial Arctic grayling is maintaining the Big Hole River population at maximum stable levels while re-establishing populations throughout its native range. Our goal of establishing a self-sustaining population in the upper Ruby River will be an important step in preserving Montana's fluvial Arctic grayling.

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