BIG HOLE ARCTIC GRAYLING RESTORATION PROJECT

WORK PLAN: 1992 - 1995

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INTRODUCTION

The Big Hole River represents the last refuge of strictly fluvial Montana Arctic grayling, once distributed throughout the headwaters of the Missouri River. The Arctic grayling of the Big Hole River (BHR) has declined in abundance in the last decade, and concern for its future has increased. Beginning in 1979 and continuing through 1990, a variety of research was conducted to characterize the BHR Arctic grayling population. These investigations indicated that the population was unique and in a state of decline, necessitating a concerted research effort to preserve and enhance the BHR grayling.

An interagency committee was formed in 1987 to coordinate a restoration program. The committee developed a restoration plan which led to the development of a memorandum of understanding to fund a 5-year research program intended to gather information necessary to preserve and enhance the BHR grayling.

The following work plan represents a framework for research and restoration designed to provide a comprehensive understanding of the distribution, life history, and factors limiting the abundance of Arctic grayling in the BHR. The work plan was developed to incorporate the recommendations of past investigators, the restoration plan by the Montana Arctic Grayling Workgroup, and recommendations of the Montana Arctic Grayling Technical Advisory Committee. Although the work plan is designed to direct efforts from January 1, 1992 through 1995, it should be considered dynamic, and will evolve as more information is gathered. The activities outlined below will be conducted by the grayling recovery team (Montana Department of Fish, Wildlife, and Parks), cooperators with the U.S. Fish and Wildlife Service, and private contractors. Research is based on:

GOAL: To increase population abundance, expand the range, and conserve the genetic integrity of fluvial Montana Arctic grayling in the Big Hole River basin to eliminate any danger of extinction.

OBJECTIVES:

I. Define ecological factors limiting the abundance of Arctic grayling in the Big Hole River drainage,

II. Monitor population trends, enhance abundance, and expand the range of fluvial Arctic grayling, and

III. Educate the general public to increase awareness and support for Big Hole River Arctic grayling recovery.

Explanation of Outline

Activities associated with each objective are classified under:

TASKS: General topics associated with each objective.

Project: Groups of related specific activities intended to provide information directly associated with Objectives and Tasks.

Components:

Individual research projects specific in nature. Accompanied with brief explanation of study design.

=Related Proj: cross-reference to related studies in which fieldwork will overlap or for which common data will be gathered.

(format of reference: IA1a
Refers to Objective, task, Proj, component, respectively.)

=Time Table: Proposed time frame in which field work and analysis will be performed. If specific month is not given assume the project is on-going throughout the year.

=Additional Cost: Approximate funds required in addition to basic equipment and operations budgets.

=Priority:

1) Projects of immediate necessity such as baseline data or activities requiring immediate attention,

2) Advance studies and procedures needed to establish management guidelines, or

3) Studies or management procedures conducted to fill in gaps in knowledge or for synthesis of results.

OUTLINE OF WORK PLAN

OBJECTIVE I. Define limiting factors.

Task A. Analyze interspecific factors contributing to the decline of BHR grayling.

Project 1. Analyze competitive and predatory influences between grayling and sympatric fishes in the BHR.

Components:

a. Laboratory Interactions
=Artificial stream study of competition and predation on grayling by brook trout. Work performed on contract with MSU to fund graduate student.
=Time Table: Aug 1992-July 1994
=Additional costs: $30,000
=Priority: 2

b. Species Distribution Mapping
=Map distribution and relative abundance of grayling and sympatric fishes in BHR, and tributaries. Data collected with electrofishing surveys, habitat studies, and MRIS.
=Related Proj: IB4a, IC1b, IIA,
=Time Table: 1992-1995
=Additional costs: $2,000 aerial photos
=Priority: 2

c. Species Interaction Observation
=Scuba or snorkel surveys of grayling habitats to document species interactions.
=Related Proj: IA1c, IIa
=Time Table: 1994-1995
=Additional costs: $750.00 gear and training
=Priority: 3

d. Food Habits Comparison
=Collect stomach contents with gastric lavage techniques from fish sampled during surveys to determine diet overlap between grayling and sympatric species, and detect predation on grayling.
=Related Proj: IA1a, IIA
=Time Table: 1994
=Additional costs: minimal
=Priority: 3

e. Brook Trout Removal
= Remove brook trout from a selected reach(es) of BHR or tributaries with sufficient barriers to prevent re-encroachment and monitor response of grayling in the reach(es).
=Related Proj: IA1a,d
=Time Table: 1993 or 1994
=Additional costs: minimal
=Priority: 3

Project 2. Assess potential effects of angling on BHR grayling.

Components:

a. Hooking Mortality
=Collect grayling by hook-and-line techniques, hold in tanks, and monitor short-term mortality due to hooking injuries. Correlate to occurrence of hook scars in population surveys and creel census.
=Related Proj: IA2b, IIA
=Time Table: July 1992
=Additional costs: minimal
=Priority: 3

b. Voluntary Creel Census
=Provide log books to outfitters and guides and post creel card stations at key access points to record grayling catch information and assess potential affects of angling on the population.
=Related Proj: IA2a
=Time Table: June-Sept 1992-1993
=Additional costs: $500.00 signs, printing
=Priority: 1

Task B. Identify and mitigate effects of water-related factors affecting BHR grayling.

Project 1. Identify irrigation practices that may be detrimental to the grayling population and work cooperatively with water users to minimize negative affects.

Components:

a. Water Leasing
=Within the authority of the Water Leasing Bill (85-2-436, MCA) continue to pursue leases of instream flows in key tributaries to augment flows in the BHR.
=Time Table: 1992->sunset of Bill
=Additional costs: Leases
=Priority: 1

b. Cooperative Water Management
=Pursue water conservation projects through easements or agreements with water users to modify and improve diversions, and conserve instream flows.
=Related Proj: IB1a,c,
=Time Table: 1992-1995
=Additional costs: unknown
=Priority: 1

c. Young-of-the-year Entrainment
=Survey irrigation ditches to determine the extent of YOY entrainment loss.
=Related Proj: IB1b
=Time Table: Jun-Aug 1992-1993
=Additional costs: minimal
=Priority: 1

Project 2. Determine water temperature patterns in BHR and correlate to thermal tolerance of grayling.

Components:

a. Thermal Monitoring
=Install 5 thermographs at various locations to document water temperature patterns.
=Related Proj: IB2b
=Time Table: Apr-Oct 1992-1995
=Additional Costs: minimal
=Priority: 1

b. Thermal Tolerance Bioassays
=Laboratory study at FCDC to determine thermal tolerance range suitable for grayling.
=Related Proj: IB2a
=Time Table: 1992 - 1993
=Additional costs: $5,000
=Priority: 1

Task C. Quantify grayling habitat and assess seasonal habitat usage.

Project 1. Quantify and map grayling distribution and habitat in BHR basin, including land uses.

Components:

a. Habitat Quantification and Mapping
=Using low level aerial photographs and on-ground surveys, quantify fish habitat and relate to spawning and population surveys, species distribution, land use, thermal patterns, and grayling abundance.
=Related Proj: IA1b, IB1b,c, IIA1e
=Time Table: BHR Twin Lk. Rd->Dickie Br. June-Aug 1992-1993,BHR tribs June-Aug 1993-1994, BHR Dickie Br-> June-Aug 1995.
=Additional costs: minimal
=Priority: 1

b. Upper BHR Grayling Distribution
=Survey BHR and tributaries above Jackson to determine grayling distribution.
=Related Proj: IA1b
=Time Table: June-Aug 1992-1993
=Additional costs: minimal
=Priority: 1

Project 2. Monitor seasonal movements of grayling in the BHR basin using tagging methods to determine seasonal habitat usage and distribution.

Components:

a. Fall-Winter Movements
=Using radiotelemetry, analyze fall-winter grayling movements to determine usage and location of winter habitat.
=Related Proj: 1991 project underway, IC2b, IIB2d
=Time Table: Aug 1992-January 1993
=Additional costs: $2800.00 transmitters
=Priority: 1

b. Effects of Transmitter Implantation
=Implant 6 transmitters in brood grayling and monitor over long-term to examine healing process and mortality due to implants.
=Relate Proj: IC2a, IIB2d
=Time Table: Feb-Aug 1992
=Additional costs: minimal
=Priority: 2

c. VI Tagging
=All "new" grayling captured during surveys will be marked with VI tags. All tag numbers and relocations are logged and provide movement information.
=Related Proj: IA1b, IC1b, IC2a, IIA1a-c
=Time Table: 1992-1995
=Additional costs: minimal
=Priority: 1

Project 3. Locate, describe, and analyze the availability of spawning habitat as a potential limiting factor.

Components:

a. Spawning Habitat Assessment
=Locate and characterize areas currently used by grayling for spawning, and locate suitable, but unused areas.
=Related Proj: IC1a, IC2c, IC3b, IIA1e, IIB1a
=Time Table: April-May 1992-1995
=Additional costs: inimal
=Priority: 1

b. Effects of Sediment on Spawning Success
=Extract core samples of spawning substrates, both current and potential, to correlate fine sediment levels with usage, hatching and rearing success.
=Related Proj: IC1a, IC3a
=Time Table: Apr-June 1992-1994
=Additional costs: $1,000 processing
=Priority: 2

Project 4. Rehabilitate and protect BHR riparian zones to improve grayling habitat and stabilize river channel.

Components:

a. Riparian Exclosures Pilot Study
=Establish fenced exclosures in several riparian locations to determine impacts of cattle grazing on riparian and grayling habitat.
=Related Proj: IB1b, IC1a
=Time Table: 1992-1995
=Additional costs: $6,000.00, fencing and willow shoot implants
=Priority: 2

b. Cooperative Riparian Management
=Pursue conservation easements and cooperative grazing/riparian management agreements to rehabilitate and protect riparian values and grayling habitat.
=Related Proj: IB1b, IC2a, IC4a
=Time Table: 1992-1995
=Additional costs: unknown
=Priority: 2

Objective II. Monitor, Enhance, and Expand Range of Grayling

Task A. Monitor grayling population abundance through population estimates and surveys.

Project 1. Monitor grayling population trends and establish baseline abundance.

Components:

a. Large-Scale Population Estimate
=Conduct a grayling population estimate encompassing BHR from McDowell section to Divide Dam by electrofishing.
=Related Proj: IA1b, IC2a, IIA1b
=Time Table: Aug-Oct 1992, 1994
=Additional costs: minimal
=Priority: 1

b. McDowell-Wisdom Section
=Electrofish the McDowell-Wisdom section to obtain grayling population estimates as a population index.
=Related Proj: IA1b, IC2a, IIA1b
=Time Table: Sept-Oct 1993, 1995
=Additional costs: minimal
=Priority: 1

c. Early Summer Population Estimates
=If feasible, electrofish McDowell-Wisdom, North Fork, and Three Pools sections for post-spawning population estimates and tagging.
=Related Proj: IC2a,c, IIA1a,b,d
=Time Table: June 1992-1995
=Additional costs: minimal
=Priority: 3

d. Spot Surveys
=Electrofish Three Pools, and other areas to monitor population, movements, and to tag fish.
=Related Proj: IC2a,c, IIA1a,c
=Time Table: Sept-Oct 1993, 1995
=Additional costs: minimal
=Priority: 2

e. Spawning Surveys
=Electrofish spawning areas to locate active spawning beds to monitor spawning population, and collect gametes.
=Related Proj: IC1a, IC2c, IC3, IIB1a
=Time Table: Apr-May 1992-1995
=Additional costs: minimal
=Priority: 1

Task B. Enhance BHR grayling population, maintain reserve stocks, and expand the range of fluvial Arctic grayling.

Project 1. Maintain reserve grayling stocks to preserve genetic integrity of fluvial Arctic grayling and to provide a source for reintroductions.

Components:

a. Collect BHR Grayling Gametes
=During spawning season, collect gametes from wild BHR grayling spawners to enhance genetic variability of reserve stocks.
=Related Proj: IC3a,b. IIA1e, IIB1,2
=Time Table: Apr-May 1992-1995
=Additional costs: minimal
=Priority: 1

b. Axolotl Reserve
=Monitor and maintain Axolotl Lake stock and obtain gametes for crosses to increase genetic variability in reserve stocks and provide a source for reintroductions.
=Related Proj: IIB1a,c, IIB2a-f
=Time Table: May 1992-1994
=Additional costs: minimal
=Priority: 1

c. Fish Cultural Development Center Brood
=Maintain reserve/brood stock composed of progeny of BHR egg takes and cross with other egg sources to increase genetic variability of reserve stocks and provide a source for reintroductions.
=Related Proj: IA1c, IIB1a,b, IIB2a-f
=Time Table: 1992-1995
=Additional costs: minimal

Project 2. Enhance BHR grayling population and expand the range of fluvial grayling in suitable habitats.

Components:

a. Small Scale BHR Plants
=Plant low numbers of YOY and yearling grayling derived from FCDC brood to examine the feasibility of future introductions and supplementations, and monitor through population surveys.
=Related Proj: IIA1, IIB1a-c, IIB2b-f
=Time Table: Yearling Plant June 1992, YOY Plant September 1993
=Additional costs: minimal
=Priority: 2

b. Cougar Cr., YNP, Introduction
=Plant yearling grayling from 1991 egg take reared at FCDC into Cougar Cr., Yellowstone National Park, to expand range of fluvial grayling and refine reintroduction procedures.
=Related Proj: IIB1a-c, IIB2
=Time Table: Plant 1992, monitor ->1995
=Additional costs: minimal
=Priority: 2

c. West Gallatin River, Mt, Introduction
=Plant yearling grayling derived from FCDC brood into West Gallatin River, MT, to expand the range of fluvial grayling and refine reintroduction procedures.
=Related Proj: IIB1, IIB2
=Time Table: Plant 1992, monitor->1995
=Additional costs: minimal
=Priority: 2

d. Mature brood BHR Re-introduction
=Plant 10 mature brood grayling from FCDC, implanted with radiotransmitters, into BHR to determine movements, adaptability, and survival as reference for future reintroductions.
=Related Proj: IC2a,b, IIB1,2
=Time Table: June 1992-Sept 1992
=Additional costs: $1600.00 tags
=Priority: 2

e. BHR Grayling Re-introductions
=Supplement BHR grayling population with brood reserve fish when genetic variability is sufficient to prevent "swamping" of wild gene pool. Based on procedures refined in previous introductions.
=Related Proj: IIA1, IIB1,2
=Time Table: 1994-1995
=Additional Costs: unknown
=Priority: 2

f. Other Fluvial Grayling Introductions
=Introduce fluvial grayling into suitable habitats to expand range.
=Related Proj: IIA,B
=Time Table: 1993->As feasible
=Additional costs: unknown
=Priority: 3

Objective III. Public Information and Education

Task A. Develop multimedia public information program to raise interest and support for Arctic grayling recovery.

Project 1. Produce documentary videos for presentation to the public to encourage support for Arctic grayling recovery.

Components:

a. Decline of BHR Grayling and Recovery Efforts
=Produce documentary describing factors contributing to the decline of fluvial grayling and outline recovery efforts.
=Time Table: 1992-1993
=Additional costs: $15,000-$40,000
=Priority: 2

Project 2. Develop publications to inform the public, cooperators, and professional groups of the decline of fluvial grayling and recovery efforts.

Components:

a. Popular Articles
=Publish articles in popular media and use news releases to inform the public and elicit support for the recovery program.
=Time Table: 1992-1995
=Additional costs: unknown
=Priority: 3

b. Professional Journals
=Publish results of grayling recovery research in professional literature.
=Time Table: 1994-1995
=Additional costs: unknown
=Priority: 3

TIME-LINE MATRIX OF WORK PLAN

Objective I

Activity	YEAR			
	1992	1993	1994	1995
Task A; Proj 1				
a. Lab Interact.	Aug	-->	-->July	
b. Spp Distrib.	-->	-->	-->	-->
c. Spp Interact.			-->	-->
d. Food Habits			-->	-->
e. EB Removal		--> or	-->	
Task A; Proj 2				
a. Angling Mort.	July			
b. Creel Census	Jun-Sep	Jun-Sep	Jun-Sep	Jun-Sep
Task B; Proj 1				
a. Water Leasing	-->	-->	-->	-->
b. Coop H20 Mgt.	-->	-->	-->	-->
c. YOY Entrainmt	Jun-Aug	Jun-Aug		
Task B; Proj 2				
a. Therm. Monit.	Apr-Oct	Apr-Oct	Apr-Oct	Apr-Oct
b. Therm. Bioasy	-->	-->		
Task C; Proj 1				
a. Habitat Quant	Jun-Aug	Jun-Aug	Jun-Aug	Jun-Aug
b. GR Distrib.	Jun-Aug	Jun-Aug	Jun-Aug	Jun-Aug
Task C; Proj 2				
a. Fall/Win Mvmt	Aug-	->Jan		
b. Implant Effct	Jan-Aug			
c. VI Tagging	-->	-->	-->	-->
Task C; Proj 3				
a. Spawning Habt	Apr-May	Apr-May	Apr-May	Apr-May
b. Sediment Stdy	Apr-Jun	Apr-Jun	Apr-Jun	

Activity	1992	1993	1994	1995
Task C; Proj 4				
a. Riparian Exc	-->	-->	-->	-->
b. Coop Rip Mgt	-->	-->	-->	-->

Objective II

Task A; Proj 1				
a. Mega-Estimate	Aug-Oct		Aug-Oct	
b. Mc-Wisdom		Sep-Oct		Sep-Oct
c. Jun Mc-Wis	Jun	Jun	Jun	Jun
d. Spot Surveys		Sep-Oct	Sep-Oct	Sep-Oct
e. Spawn Survey	Apr-May	Apr-May	Apr-May	Apr-May
Task B; Proj 1				
a. BHR Spawn	Apr-May	Apr-May	Apr-May	Apr-May
b. Axolotl Spawn	May-Jun	May-Jun	May-Jun	May-Jun
c. FCDC Brood	-->	-->	-->	-->
Task B; Proj 2				
a. Yearlng BHR	Jun-->	monitor->	-->	-->
YOY BHR	Sep-->	monitor->	-->	-->
b. Cougar Cr.	Jun-->	monitor->	-->	-->
c. W. Gallatin	Jun-->	monitor->	-->	-->
d. Radio BHR	Jun-Sep			
e. BHR Reintro			-->	-->
f. Others			-->	-->

Objective III

Task A; Proj 1				
a. GR Video	-->	-->		
Task B; Proj 1				
a. Pop Articles	-->	-->		
b. Prof Articles			-->	-->