TECHNICAL WORKPLAN

WILD FISH HABITAT INITIATIVE PHASE III

October 1, 2004 – December 31, 2005

submitted by:
Montana Water Center
Montana State University - Bozeman

submitted to:
Division of Fish and Wildlife Management Assistance
US Fish and Wildlife Service

Submitted: June 30, 2004

WILD FISH HABITAT INITIATIVE

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INTRODUCTION

Wild Fish Habitat Initiative Background and Purpose

Degradation of fish habitat is one of the principal reasons for the listing of wild fish under the Endangered Species Act. In addition, the detrimental effects of exotic competitors and diseases such as whirling disease are exacerbated by habitat degradation. Land values are diminished by habitat degradation and the subsequent loss of wild fish populations. Private landowners forego economic opportunities when land uses are restricted and resources are directed toward fish restoration. In recent years, many techniques of fish habitat enhancement have been implemented, but their long-term efficacy is not well understood because little or no evaluation and monitoring have been conducted.

The Partners for Fish and Wildlife Program, administered by the US Fish and Wildlife Service (USFWS), is a critical national effort to restore important fish and wildlife habitat. This is a voluntary program that works with private landowners to restore habitat on their lands. The purpose of the Wild Fish Habitat Initiative (hereafter referred to as the Initiative or WFHI) is to enhance the success of restoration projects conducted through the Partners for Fish and Wildlife Program. The Initiative seeks to augment the success of the Partners Program and other habitat restoration programs through the following two activities: conducting targeted research related to habitat restoration techniques, and by implementing a technology transfer program to provide technical information to landowners and project managers.

Phase III of the WFHI will build on the successes of previous program phases by continuing to pursue relevant research investigations and by continuing to refine our ongoing information-transfer project. One research project is continuing, one project will be modified and geographically expanded, and two new research projects will be initiated. Activities for each of the Phase III actions and projects are outlined in the subsequent sections of this report.

PROGRAM ADMINISTRATION

Wild Fish Habitat Initiative Program Administration

Principal Investigators

Dr. Alexander Zale, Montana Cooperative Fishery Research Unit Leader; Professor, Department of Ecology, Montana State University

Liz Galli-Noble, Assistant Director for Research, Montana Water Center

Goal and Objectives

The overall goal of WFHI program administration is to meet the needs of the USFWS Project Officer regarding the Initiative, and to support the research teams in carrying out the four research projects described below. Specific objectives are:

- To assure that fiscal transfers are timely, clear, and appropriate,
- To keep the USFWS well-informed about the progress and results of the program,
- To identify and enter into formal relationships with additional project partners, as appropriate, and
- To conduct outreach activities and publicize Initiative projects, research results, and program deliverables to interested parties.

Activities

During the period of October 1, 2004 to December 31, 2005, Montana Water Center administrative personnel will manage the annual USFWS contract and all research subcontracts; process invoices and track the fiscal status of each project; periodically invoice the USFWS; submit progress reports to USFWS; submit a single compiled final project report to USFWS; respond to USFWS requests for information or assistance; and support the research teams in acquiring information, supplies and facilities, in contractual or hiring matters, and in other ways as needed.

Milestones

Administrative milestones are shown in *Table 1*. All administrative duties are the responsibility of Montana Water Center staff—namely, the Assistant Director for Research—in consultation with the Principal Investigator, Dr. Alexander Zale. Major duties involve developing an annual Initiative contract and budget, maintaining communication with the USFWS, and submitting detailed reports on outreach activities, research investigations, and financial actions of the Initiative.

Deliverables

Deliverables for program administration as a whole are regular communication and updates to Division Chief Bolton, two program progress reports per year, regular invoices and financial reports to the USFWS, and a compiled final project report.

TECHNOLOGY TRANSFER / TECHNICAL SUPPORT / OUTREACH

Technology Transfer Project

Project Team Members

Molly Boucher, Web site Specialist, Montana Water Center

Cal Fraser, Program Biologist, Montana Water Center

Liz Galli-Noble, Program Director, Montana Water Center

Alicia Paz-Solis, Undergraduate Student, Montana State University

Introduction and Scope

In recent years, many techniques regarding fish habitat enhancement and restoration have been implemented, but project results generally have not been shared or exist only in "gray literature" where they are difficult to access. To address this problem, the technology transfer project—a continuing effort of the Initiative—is collating information on methods and results of various fish habitat restoration projects within the Intermountain West (Colorado, Idaho, Montana, Nevada, Utah, Wyoming, and inland areas of California, Oregon, and Washington). Information is organized in a searchable bibliography and case history database, which is accessible through the Initiative web site at: http//:wildfish.montana.edu. Web site products are being continuously updated and revised as new restoration project information is made available, and/or as monitoring data are collected and shared with project staff.

Goal and Objectives

The overall project goal of the technology transfer project is to provide useful bibliographic and case history data to those responsible for fish habitat projects within the Partners Program, and other interested parties. Specific objectives for Phase III of the project are:

(1) To strengthen the Montana Water Center/MSU collaboration with Partners Program administrative and field staff;

(2) To evaluate our newly-established, online fish habitat literature bibliography and continue to update the bibliography with timely, pertinent literature;

(3) To evaluate, update, and maintain our online habitat restoration manuals clearinghouse;

(4) To evaluate, update, and revise our online case history database of fish habitat restoration projects with projects particularly pertinent to land managers in the Intermountain region of the United States; and

(5) To actively publicize web site features and products, and enhance information exchange among Partners Program personnel, tribes, land managers, fishery professionals, and other interested parties.

Activities

Four general types of activities will be carried out in Phase III of the project. First, Montana Water Center staff will bolster our outreach efforts. We will broaden our communication base with Partners Program personnel, regional fisheries biologists, landowners, tribes, and habitat specialists; solicit feedback on our accomplishments to date; explore more effective ways in which the Initiative web site can address our partners' and audience's needs; and vigorously

publicize the web site and its products. Second, we will continue to collect new and innovative restoration project information. Initially, the team will focus on filling current information data gaps and providing follow-up monitoring data collected for projects already showcased on the web site. When warranted, we will also tap new information or follow-up data through remote access or site visits. Third, team members will expand resource information availability on the Initiative web site. Several target actions for this project phase include: establishing an expertise directory, adding an option in the bibliography to export and add selected references, making online interfaces to streamline research team data collection, and developing a section within the case histories database documenting common problems in restoration project development/application. Finally, we plan to critically evaluate our web site and project products. Resource and case history information will be presented to an expert panel (including our project partners) for formal review, and their suggested revisions will be implemented in Phase III of the project.

Milestones

Existing Web Site Products— Most technology transfer project products are ongoing efforts that will continue to be updated and refined for years to come.

In response to both an internal and external web site review, the bibliography and selection of habitat manuals will be refined and revised in late 2004 and early 2005. During the same time period, all completed case histories from California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming will be evaluated and refined by an advisory panel and current project team members. Further, in October 2004, Water Center staff will hire a part-time professional researcher/technical writer to assist the technology transfer team with particularly hard-to-find habitat restoration case histories. The new team member's six-month goal is to fill in the case history data gaps by providing new/additional projects for each of the restoration categories outlined on the web site. In the long term, projects from each focal state will be added, edited, or removed as new projects are revealed and as follow-up data are made available.

New Project Needs/Opportunities—Montana Water Center staff strive to be responsive to newly identified needs of our research and resource partners. Although a rather sensitive topic for many landowners and resource managers, by showcasing unsuccessful restoration projects we hope to provide vital information on what **not** to do in the future. Therefore, it is the project team's intent to add a new unsuccessful projects component to our case histories database in 2005. We will also add an expertise directory to the web site in 2005, which has been identified by project partners as useful information for landowners. In addition, the technology team web site specialist will continue to assist WFHI field researchers with data management and exchange; one innovative product being developed and implemented in 2004/2005 is an online data collection method for the Eradication and Exclusion research team.

Outreach and Program Publicity—The new program director of the WFHI will actively publicize the Initiative web site through media contact, partner correspondence, and outreach presentations. She plans on attending USFWS Partners Program meetings, whenever possible, to foster better communication between the partners, and to present program updates and research deliverables. The technology team web site specialist will continue to publicize the site

through online means, including linking and search engine ranking. Several 2004-2005 events targeted for outreach presentations include, but are not limited to: 21st Annual Meeting of the American Water Resources Association - Montana Chapter, October 2004; local Trout Unlimited chapter meetings; American Fisheries Society Western Division Conference, spring 2005; and the FFF annual conclave, summer 2005.

Deliverables

Deliverables for this project include: a continuously updated web-based bibliography of fish habitat literature for the Intermountain West region; a continuously updated compilation of habitat restoration manuals (in PDF-format) applicable to the Intermountain West region; and continuously refined web-based case studies of completed habitat restoration projects. Case histories of various types of fish habitat restoration projects include narrative descriptions, data tables, photographs, engineering diagrams, and project cost information, insofar as this information can be collected for each case.

Potential Partners

Project information will be collected from a number of sources, including university researchers, state fish and wildlife biologists in the focal Intermountain West states, Federal agency personnel, tribes, private landowners, and fishery biologists employed by private and non-profit organizations in the region.

Technical Research Assistance & Support

Laboratory Staff

Cal Fraser, Wild Trout Laboratory Director, Montana Water Center

Since the inception of the Initiative in 2002, Montana Water Center Wild Trout Research Laboratory staff has provided technical support and research assistance to many WFHI research teams, as well as Montana state and federal fisheries agencies. This collaboration will continue into Phase III of the Initiative with the laboratory director assisting WFHI researchers with the following tasks:

1. Experimental apparatus design, development, maintenance, and use.
2. Graduate student husbandry assistance.
3. Disease identification assistance.
4. Disease treatment support.
5. Graduate student data collection assistance.
6. Emergency on-call support.
7. Graduate student technician support.

The lab director also works closely with USFWS Fish Technology Center staff on a wide range of activities. This collaboration will also continue into Phase III of the project, with Cal Fraser providing the Center with technical support and performing the following tasks: facility maintenance support, fish husbandry support, disease identification assistance, community outreach support, and graduate student research assistance.

Given the ever-growing need for fisheries-based laboratory research in the Intermountain West, it is the Montana Water Center's intent that the Wild Trout Research Laboratory, and its staff, will continue to play a prominent research role in the years to come.

RESEARCH PROJECTS

Project 1.

Evaluation of Entrainment Losses of Westslope Cutthroat Trout at Private Irrigation Diversions on Skalkaho Creek, Montana

Principal Investigator: Alexander V. Zale, Montana Cooperative Fishery Research Unit

Partner: Christopher G. Clancy, Montana Department of Fish, Wildlife and Parks

Graduate Research Assistant: TBA

Introduction and Scope

Seven lowhead irrigation dams on lower Skalkaho Creek, a tributary to the Bitterroot River in Western Montana, divert significant numbers of downstream migrant westslope cutthroat trout into eight irrigation canals. Both post-spawn adults migrating back to the Bitterroot River and juveniles emigrating downstream from nursery areas in upper Skalkaho Creek become trapped and die in the irrigation canal system, thereby resulting in a net loss to the population. Private landowners and irrigators in the drainage expressed concern over the number of fish killed annually in the irrigation system and worked with Montana Fish, Wildlife and Parks to successfully request funds from the Fish Restoration and Irrigation Mitigation Act program to install fish screens and siphons at some of the diversions to preclude such losses. The screens were installed in 2003 and became operational in April 2004. Installation of the siphons is projected for late 2004. The first phase of our study involved estimation of fish losses during 2003, prior to installation of the screens. It thereby provided baseline "before" data for evaluating the efficacy of the screens and siphons. We saw significant entrainment, particularly of age-0 juveniles, at the unscreened diversions. The second phase of this study, currently being conducted, provides initial post-screen-installation data for comparison. Under Phase III, we will continue to evaluate the efficacy of the screens (as bugs in their operation are worked out), evaluate the efficacy of the siphons, and estimate the increased recruitment contribution of trout to the Bitterroot River that these structures facilitate. No such evaluations have been conducted and published in the peer-reviewed literature to date, thereby inhibiting private landowners and agencies throughout the Northern Rockies Ecoregion from investing in fish screens and siphons as part of their fish habitat management and restoration efforts.

Goal and Objectives

Our goal is to evaluate the efficacy of irrigation diversion fish-screen and siphon structures in western Montana. Our specific objectives in Phase III are: 1) to quantify the proportions and numbers of downstream migrating juvenile trout entrained or bypassed at irrigation diversions on Skalkaho Creek, Montana, after fish-screen and siphon installation, and 2) to estimate the recruitment contribution of Skalkaho Creek to the Bitterroot River.

Activities

An existing screw trap owned by Montana Fish, Wildlife and Parks will be deployed above all of the diversions in Skalkaho Creek to estimate abundance of the emigrating juvenile trout cohort. Trap nets will be deployed in all of the irrigation canals to estimate entrainment. A new screw trap will be deployed below the irrigation diversions above the mouth of Skalkaho Creek to estimate the system's recruitment contribution to the Bitterroot River.

Downstream-migrant age-1 juvenile cutthroat trout captured in the upper screw trap will be fitted with radio-telemetry transmitters. Their locations and movements will be monitored several times per week to determine their success in bypassing the irrigation diversions during their downstream migrations to the Bitterroot River. The final fate of each individual will be determined (i.e., in-river mortality, canal entrainment and mortality, in-river residence, or successful emigration).

During 2004, the efficiency of the fish-screen structures in returning entrained fish to the river is being evaluated. Age-0 juveniles are implanted with passive integrated transponder (PIT) tags and released into the upstream sections of irrigation canals between the head gates and the screens. PIT-tag readers affixed to screen bypass pipes record return of each individual to the river and thereby allow estimation of screen-induced migration delays. Depending on the conclusiveness of findings of this component in 2004, it may or may not be repeated in 2005.

Milestones
Field work will begin in April 2005 and continue through the irrigation season until autumn. Analyses and a final report will be completed by December 31, 2005.

Deliverables
A detailed final report describing the methods, findings, and management implications of the study will be produced. A manuscript will be submitted for publication in a peer-reviewed journal. Results will also be presented at scientific meetings.

Partners
The study is being conducted in close cooperation with Montana Fish, Wildlife and Parks, local ditch/irrigation companies, and local landowners.

Project 2.
Thermal Requirements of Yellowstone Cutthroat Trout

Principal Investigators: Thomas E. McMahon, Montana State University, and Alexander V. Zale, Montana Cooperative Fishery Research Unit

Partner: Cal Fraser, Director, Wild Trout Laboratory, Montana Water Center, MSU

Graduate Research Assistant: TBA

Introduction and Scope
Yellowstone cutthroat trout *Oncorhynchus clarki bouvieri* are in decline throughout their native range in the Northern Rockies, are listed as a Species of Special Concern in Montana, and have been petitioned for listing under the Endangered Species Act. Habitat degradation and

competition and predation by non-native trout are the primary causes of their decline. Water temperature is widely regarded as playing a key role in determining persistence of native salmonids, yet specific thermal requirements and optima of this and other cutthroat trout subspecies are largely unknown. Water temperature also plays an important role in tipping the balance in favor of non-native over native trout, yet how temperature influences competitive interactions of Yellowstone cutthroat with their non-native competitors has not been investigated. This lack of information precludes effective reintroduction and restoration programs, development of land management policies, and hatchery propagation protocols. Summer maximum water temperatures are likely a major limiting factor for this and other native trout; however, no studies have been conducted to determine the upper incipient lethal temperature of Yellowstone cutthroat trout or the temperatures at which growth is optimized during summer rearing in the presence and absence of non-native competitors. Such data are critical to further develop and evaluate temperature criteria for native cutthroat habitats and better understand the factors responsible for the decline of this unique subspecies.

Arctic grayling, bull trout, westslope cutthroat trout, and Yellowstone cutthroat trout are the primary native trout species in Montana, and all are listed as Species of Special Concern. The Yellowstone cutthroat trout is the last remaining of this group for which temperature data are unavailable. Thermal information for westslope cutthroat trout has been gathered under Phases I and II of the Wild Fish Habitat Initiative, and prior to that, bull trout thermal requirements were evaluated by our research team (Selong, J.H., T.E. McMahon, A.V. Zale, and F.T. Barrows. 2001. Effect of temperature on growth and survival of bull trout, with application of an improved method for determining thermal tolerance in fishes. Transactions of the American Fisheries Society 130:1026-1037). The Yellowstone cutthroat trout studies proposed here will build upon this thermal information and provide some of the most extensive thermal information available for a group of native and non-native salmonid species.

Results of this study are critical to the development and evaluation of temperature criteria for Yellowstone cutthroat trout waters. This information will promote effective habitat protection, restoration, and species reintroduction programs, and assessment of land management policies in watersheds inhabited by this cutthroat subspecies with the desired outcome of minimizing risk of further decline and increasing their current range. Recent controversy over bull trout temperature tolerances as land management policy clearly illustrates that having well-defined temperature criteria for now-rare fishes are required for effective protection and management, and our study will provide that information. Intended users include state and federal land management agencies, USFWS Ecological Services and hatcheries, state and federal natural resource agencies, and the timber and grazing industries. The information will be especially helpful in implementing conservation plans for this native cutthroat trout in Montana, Idaho, and Wyoming.

Goals and Objectives

Our project goals are (1) to renovate the existing MSU Wild Trout Laboratory in order to conduct our thermal research investigation; and (2) to characterize the thermal biology of Yellowstone cutthroat trout.

Our research objectives are to define the maximum growth temperature, upper incipient lethal temperature (i.e., the highest temperature that can be survived indefinitely), and preferred temperature of Yellowstone cutthroat trout.

Activities

The thermal studies team was recently informed that we will no longer be able to conduct future investigations at the USFWS Fish Technology Center. There is simply too great a need for internal USFWS research at that facility to accommodate us in the future. Fortunately, we have the MSU Wild Trout Laboratory as an alternative location to conduct our work. From October 2004 to July 2005, we will assist the Montana Water Center in renovating a portion of their existing laboratory, thereby enabling our research team to conduct our thermal experiments in that facility starting in mid-2005.

Laboratory trials will be conducted in the thermal testing facility housed at the Montana Water Center Wild Trout Lab. The thermal testing facility will consist of 36 treatment tanks supplied with water from multiple recirculating process systems to provide a wide range of test temperatures. A three-year study of bull trout thermal requirements using similar apparatus was completed in 2000 (Selong et al. 2001), and the westslope cutthroat thermal studies are scheduled for completion in spring 2005.

Eyed eggs of Yellowstone cutthroat trout will be obtained from the wild broodstock maintained at the Yellowstone River State Fish Hatchery in Big Timber, Montana. Juveniles will be reared at the Montana Water Center Wild Trout Lab until they reach about 8 to 10 centimeters. Growth and survival will be examined at 12 constant temperatures over the range of 8 to 28^{o} Celsius to span the entire range of temperatures potentially encountered by Yellowstone cutthroat trout during summer. Optimal growth temperature and upper incipient lethal temperature will be determined in a series of long-term (60 days) temperature trials following the protocol established by Selong et al. (2001).

Milestones

Lab renovations will be completed from October 2004 to July 2005. Experiments will be conducted in 2005 following completion of the lab renovation.

Deliverables

A written scientific report detailing the thermal requirements of Yellowstone cutthroat trout will be produced and a manuscript describing this research will be submitted for publication in a peer-reviewed journal. Results of the study will also be presented at scientific meetings. For example, results of our bull trout and westslope cutthroat trout thermal studies have been presented at seven national or regional conferences.

Partners

The study is being conducted in close cooperation with the Montana Department of Fish, Wildlife and Parks, which will provide Yellowstone cutthroat trout eggs for our experiments, and the Montana Water Center Wild Trout Laboratory, which will house the thermal testing and fish rearing facilities.

Project 3.
Evaluation of the Efficiency and Efficacy of Non-Native Fish Eradication and Exclusion Techniques for Native Fish Restoration

Note: This project is a continuation, modification, and geographic expansion of the Phase II Fan Creek project.

Principal Investigator: Alexander V. Zale, Montana Cooperative Fishery Research Unit

Graduate Research Assistant: Peter J. Brown, PhD student, Montana State University

Introduction and Scope

Native fish conservation has become a pressing issue for resource managers, often because of threats posed by non-native fish species. Predation and competition for resources can drive native populations to extinction and hybridization reduces the overall genetic integrity of native populations. Fishery restoration projects have been undertaken therefore throughout the United States to conserve threatened and endangered species as well as to rid water bodies of non-native species. These projects use a combination of techniques to eradicate non-native fish species, usually including fish toxicants, and prevent their reinvasion, usually with physical barriers. Despite their widespread use as a management tool, little standardization of techniques exists and evaluations of successes or failures are rarely conducted. Furthermore, the techniques used and the results of evaluations are rarely published in peer-reviewed literature. For example, the effective concentrations of frequently-used fish toxicants in different water chemistries have only anecdotally been noted to vary. Also, no comprehensive barrier-design guidelines exist, as barriers tend to be designed on a case-by-case basis. Understanding the dynamics of fish toxicants and effective barrier design are critical to making restoration projects an effective tool in managing native fish.

Goal and Objectives

The goal of this project is to increase the success rate of native fish restoration projects through improved non-native eradication and exclusion techniques. To achieve this goal, we will conduct a thorough investigation of past and present techniques used to eradicate and exclude non-native fish. Interviews with project leaders and site visits to ongoing and past restoration projects will be used to identify state-of-the-art methods of fish removal and barrier design. In addition, this process will identify projects that have not been evaluated or have not been evaluated adequately. For example, in the rare case that evaluations are made, they usually take place soon after initial fish removal (i.e., less than 5 years), and may not reflect eventual steady-state conditions. We will evaluate selected restoration projects more than 5 years after fish removal and exclusion. Study of restoration projects will identify the qualities of successful and unsuccessful projects. Identifying causes of failure will help managers implement ongoing and future restoration projects. Our specific short-term objectives are to: 1) identify the methods currently used in fish eradication and exclusion projects, and 2) identify the qualities of both successful and unsuccessful native fish restoration projects. Subsequent field and laboratory research will focus on increasing the efficiency of eradication and exclusion protocols

through direct experimentation. Understanding the inefficiencies of fish eradication and exclusion will increase the overall effectiveness of native fish management.

Activities

As described in our previous Phase II workplan, an evaluation of the techniques used to eradicate and exclude non-native fish was to be carried out in Fan Creek, Yellowstone National Park. However, recent findings have made the planned restoration there unfeasible. Cutthroat trout in the North Fork of Fan Creek were previously thought to be genetically pure (i.e., containing no genetic material from rainbow trout) and the National Park Service had planned to protect this “pure” population by removing the rainbow trout from Fan Creek and excluding rainbow trout from elsewhere in the drainage from immigration to it. Our plan was to use the Fan Creek restoration as a model case-history to study non-native eradication and exclusion techniques. However, protection of the cutthroat trout population in Fan Creek became a low priority for the National Park Service because subsequent genetic testing showed that the cutthroat trout in Fan Creek did contain a small amount of rainbow trout genetic material and were therefore slightly introgressed and not "pure." The planned restoration of Fan Creek was therefore canceled. We are replacing Fan Creek with several restoration projects that are being carried out elsewhere and are available for research. These include Vermejo Creek, New Mexico; Labarge Creek, Wyoming; and Cherry Creek, Montana.

Our initial work during 2004 is focusing on identifying agencies and personnel who are conducting native fish restoration projects and identifying the methods they are using to eradicate and exclude non-native fishes. We are interviewing native-fish managers and assisting with their ongoing fish-removal efforts to better understand the techniques being used so that we can design competent evaluation protocols for these techniques. The results of this survey will be compiled into a manual for barrier design. These interactions and interviews will identify the research questions that will be addressed during subsequent phases of this project.

We will conduct electrofishing surveys in 2005 to evaluate the success of native fish restoration in streams that used a variety of removal and exclusion techniques. Multiple-pass electrofishing will be used in areas accessible to non-natives (i.e., downstream of barriers) and areas ostensibly inaccessible to non-natives (i.e., upstream of barriers) to compare species composition and population abundances. Design of the barrier will be analyzed along with potential hydrographs of the region to determine if the barrier is of sufficient design to exclude non-native species. Records of the eradication efforts will also be examined to determine if the effort and techniques used were sufficient to eradicate all non-native fish. This sampling will provide direction to further manipulative, experimental studies on fish eradication and barrier function.

Milestones

The Barrier Design manual will be completed in January 2005. The graduate student's study proposal will be completed in February 2005. Study sites will be identified by May 2005. Field sampling will be carried out from May 2005 through August 2005.

Deliverables

A report detailing the successes and failures of native fish restoration projects will be developed. These results will also be presented to native fish managers through presentations at professional meetings and in publication.

Partners

Critical to this study will be relationships with native-fish managers from several agencies. Relationships with Brad Shepard (Montana Fish Wildlife and Parks), Carter Kruse (Turner Enterprises), Hilda Sexauer (Wyoming Game and Fish Department), Chad Mellison (United States Fish and Wildlife Service), Jim Olsen (Montana Fish Wildlife and Parks), and Todd Koel (Yellowstone National Park) are being developed.

Project 4.
Evaluation of Habitat Restoration for the Conservation of Cutthroat Trout

Principal Investigator: Alexander V. Zale, Montana Cooperative Fishery Research Unit

Graduate Research Assistant: Brad Shepard, PhD student, Montana State University

Faculty Consultant: Mark Taper, Montana State University

Introduction and Scope

The distributions and abundances of native westslope *Oncorhynchus clarki lewisi* and Yellowstone cutthroat trout O. c. *bouvieri* have declined from historical levels and both are considered at risk for listing under the Endangered Species Act. Efforts are currently underway to conserve these subspecies throughout the Northern Rocky Mountain region. One important conservation strategy is that of habitat restoration and enhancement, but few studies have quantitatively assessed the response of cutthroat trout populations following habitat restoration. In fact, few studies have described what constitute ideal habitats for the conservation of these subspecies. In addition, another major threat to the conservation of these subspecies is competition and predation by non-native trout species, particularly brook trout *Salvelinus fontinalis* that occur in sympatry with both subspecies over much of their range. Interactions between brook and cutthroat trout are likely regulated by habitat condition, but little is known about these relationships. Our study will evaluate past and ongoing habitat restoration and enhancement projects that specifically targeted conservation of cutthroat trout to assess whether these projects resulted in increased densities or distributions of cutthroat trout. In the future, we will describe what constitutes quality habitat for westslope and Yellowstone cutthroat trout and determine how habitat condition and the presence of brook trout interact to affect densities of cutthroat trout.

Goal and Objectives

The distributions and abundances of native westslope *Oncorhynchus clarki lewisi* and Yellowstone cutthroat trout O. c. *bouvieri* have declined from historical levels and both are considered at risk for listing under the Endangered Species Act. Efforts are currently underway to conserve these subspecies throughout the Northern Rocky Mountain region. One important conservation strategy is that of habitat restoration and enhancement, but few studies have

quantitatively assessed the response of cutthroat trout populations following habitat restoration. In fact, few studies have described what constitute ideal habitats for the conservation of these subspecies. In addition, another major threat to the conservation of these subspecies is competition and predation by non-native trout species, particularly brook trout *Salvelinus fontinalis* that occur in sympatry with both subspecies over much of their range. Interactions between brook and cutthroat trout are likely regulated by habitat condition, but little is known about these relationships. Our study will evaluate past and ongoing habitat restoration and enhancement projects that specifically targeted conservation of cutthroat trout to assess whether these projects resulted in increased densities or distributions of cutthroat trout. In the future, we will describe what constitutes quality habitat for westslope and Yellowstone cutthroat trout and determine how habitat condition and the presence of brook trout interact to affect densities of cutthroat trout.

Activities

During 2005 we will evaluate the effectiveness of habitat restoration projects on the conservation of cutthroat trout. We will locate habitat restoration projects that targeted cutthroat trout populations where pre-project population estimates had been made and make post-treatment estimates at those sites. In addition, we will collect pre-treatment estimates at sites where habitat restoration is proposed. Pre- and post-restoration estimates will be compared to habitat parameters that were changed by each habitat restoration project. Previous work we have done suggests that increasing frequencies of woody debris might favor brook trout over westslope cutthroat trout and we will further test these preliminary observations.

Milestones

We will locate habitat restoration projects suitable for this study in 2004 and sample these projects during the summer of 2005. We plan to continue sampling habitat and fish populations at habitat restoration project sites through 2007.

Deliverables

A detailed final report describing the methods, findings, and management implications of the study will be produced. At least one manuscript based on this study will be submitted for publication in a peer-reviewed journal. Results will also be presented at scientific meetings.

Partners

The study is being conducted in close cooperation with Montana Fish, Wildlife and Parks, the US Forest Service, the US Bureau of Land Management, and will involve local landowners.

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Project Personnel

Dr. Alexander Zale will serve as Wild Fish Habitat Initiative principal investigator. Dr. Zale is the Cooperative Fishery Research Unit Leader for Montana and an Affiliate Professor in the Department of Ecology at Montana State University. In addition to exercising overall program leadership, he will be the principal investigator of the Irrigation Diversions project, Eradication and Exclusion project, and Habitat Restoration project, and co-principal investigator of the Yellowstone Cutthroat Thermal Requirements project. Dr. Zale's research interests center on applied aquatic ecology and fisheries management. A brief curriculum vita for Dr. Zale accompanies this proposal.

Dr. Thomas McMahon will serve as Project Biologist. Dr. McMahon is a Professor in the Ecology Department at Montana State University whose principal research interests are wild trout management, fish-habitat relationships, winter ecology, and conservation biology of salmonids. He will be the co-principal investigator of the Yellowstone Cutthroat Thermal Requirements project.

Liz Galli-Noble is the Assistant Director for Research at the Montana Water Center, and serves as the Wild Fish Habitat Initiative program director. She has a Bachelors degree from the University of Montana and a Masters degree from Yale University. Her chief professional interests are landscape ecology and watershed management, and she has 20 years of experience in the natural resource management field—nationally and internationally.

William C. Fraser is a member of the Technology Transfer project. Mr. Fraser is a fishery biologist who serves as Manager of the Wild Trout Research Laboratory at the Montana Water Center. His chief professional interests are fisheries ecology and culture.

Molly Boucher is a Program Specialist with the Montana Water Center. She has a degree in environmental studies and develops web sites and databases for the Center. She is the web site developer for the Wild Fish Habitat Initiative and works with William Fraser and Liz Galli-Noble on the Technology Transfer project.

Peter Brown is a PhD student at Montana State University. He is working with Dr. Alexander Zale on the Eradication and Exclusion project.

Brad Shepard is a PhD student at Montana State University and a fisheries biologist with the Montana Department of Fish Wildlife and Parks. He is working with Dr. Alexander Zale and Dr. Mark Taper on the Habitat Restoration project.

Table 1. Phase III Milestones—October 1, 2004 to December 31, 2005.

Project / Task	Deliverables / Outputs	2004	2005			
		4	1	2	3	4
Program Administration						
Task 1A. Provide administrative & management services	USFWS-MSU Contract—Work plan & budget	X				
	Communication w/USFWS	On going	X	X	X	X
	Managing subcontracts	On going	X	X	X	X
	Maintain financial records	On going	X	X	X	X
	Reporting:					
	Semi-annual report		X		X	
	Final report					X
	Manage WFHI staff & maintain office	On going	X	X	X	X
Task 1B. Research project management & technical oversight	Meetings with PIs	On going	X	X	X	X
	Communication w/research teams	On going	X	X	X	X
	Reporting:					
	Web site project updates	On going	X	X	X	X
	Briefings	On going	X	X	X	X
Technology Transfer Project						
Task 2A. Update & maintain web site	Web site maintenance	On going	X	X	X	X
	TAC review/critique	X				
Task 2A. Update & maintain bibliography	Bibliography updates	On going	X	X	X	X
	Export/add references	X				
	Establish expertise dictionary	X				
Task 2B. Showcase habitat manuals	Manual updates	On going	X	X	X	X
Task 2C. Research & showcase case histories	Hire staff	X				
	Make project contacts	On going	X	X	X	X
	Case history updates	On going	X	X	X	X
	Site visits	X		X	X	
Task 2D. Outreach / project promotion	Presentations	2	1	1	1	2
	Publicity, media contact	On going	X	X	X	X
	Correspondence	On going	X	X	X	X
Technical Research Assistance						
Task 3A. Assistance to WFHI research teams	Student research assistance	On going	X	X	X	X
	Student technical support	On going	X	X	X	X
	Disease id & treatment	On going	X	X	X	X
Task 3B. Assistance to USFWS Fish Technology Center	Facility maintenance	On going	X	X	X	X
	Technical support	On going	X	X	X	X
	Community outreach	X			X	X
	Student research assistance	On going	X	X	X	X

Table 1 continued

Project / Task	Deliverables / Outputs	2004	2005			
		4	1	2	3	4
RESEARCH PROJECTS						
Irrigation Diversions Project						
Objective 4A. Quantify entrainment and recruitment of migrating juvenile trout				X	X	X
Objective 4B. Data analyses and reporting	Final report					X
Wild Trout Lab Renovation & Thermal Requirements of Yellowstone Cutthroat Trout Project						
Task 5A. Engineering work		X				
Task 5B. System and facility design		X	X			
Task 5C. Acquisition and installation thermal equipment		X	X	X		
Task 5D. Obtain eggs from hatchery					X	X
Task 5E. Thermal trials					X	X
Task 5F. Data analyses and reporting	Final report					X
Non-Native Fish Eradication and Exclusion Project						
Task 6A. Investigate E & E techniques used	Site visits Interview managers Assist on current projects	X X X				
Task 6B. Evaluate techniques	Evaluation protocols Barrier design manual	X	X			
Task 6C. Conduct follow-up electrofishing surveys				X	X	
Task 6D. Data analyses and reporting	Final report					X
Habitat Restoration Project						
Task 7A. Locate suitable projects		X				
Task 7B. Sample project sites				X	X	
Task 7C. Data analyses and reporting	Final report		X			X

ATTACHMENTS

Attachment A. **Program Budget**

Attachment B. **Budget Justification**

Attachment C. **Dr. Alexander V. Zale's Curriculum Vita**

Attachment D. **Task Budget: Program Administration, Technology Transfer Project, and Wild Trout Lab Renovation**

Attachment E. **Task Budget: Irrigation Diversions Project**

Attachment F. **Task Budget: Eradication and Exclusion Project**

Attachment G. **Task Budget: Habitat Restoration Project**