TECHNICAL WORKPLAN

WILD FISH HABITAT INITIATIVE

July 1, 2002 - December 31, 2003

submitted by:
Montana Water Center
Montana State University - Bozeman

submitted to:
Division of Fish and Wildlife Management Assistance
U.S. Fish and Wildlife Service

March 29, 2002

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 U.S. Fish and Wildlife Service, 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 is to enhance the success of riparian projects conducted through the Partners for Fish and Wildlife Program***. The Initiative involves two activities: conducting targeted research to assist Partners fish habitat restoration projects, and implementing a vigorous information-transfer program to provide technical results to those who plan and carry out Partners projects. The four projects are described below.

Irrigation Diversions Project

Introduction

Five major lowhead irrigation dams on lower Skalkaho Creek, tributary to the Bitterroot River in western Montana, are believed to divert downstream migrant westslope cutthroat trout into irrigation canals. Both post-spawn adults migrating back to the Bitterroot River and juveniles emigrating downstream from nurseries in 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 have expressed concern over the number of fish killed in irrigation canals and would like to install fish screens at the diversions to preclude such losses. Montana Fish, Wildlife and Parks is requesting funds from the Fish Restoration and Irrigation Mitigation Act to install fish screens at these diversions in autumn of 2003 and to monitor their performance. However, studies to estimate fish loss prior to the installation of fish screens are not within the scope of FRIMA. Our study will evaluate current effects of entrainment by the five diversions on the westslope cutthroat population of Skalkaho Creek. We will assess the need for fish screens and provide baseline data for evaluating the efficacy of screen devices. No such evaluations have been conducted in Montana to date, thereby inhibiting private landowners from investing in fish screens as part of their fish habitat management efforts.

Goal and Objective

Our goal is to assess the need for fish screen structures at irrigation diversions in western Montana and to provide preliminary data to evaluate the success of such structures when they are subsequently built. Our specific objectives are to quantify the proportions and numbers of downstream migrating juvenile and adult westslope cutthroat trout currently entrained at each of five irrigation diversions on Skalkaho Creek, Montana.

Activities
Thirty-five juvenile and 50 adult westslope cutthroat trout will be fitted with radio-telemetry tags in spawning and nursery areas of upper Skalkaho Creek prior to their respective emigration periods. Their locations and movements will be monitored several times per week to determine their success in bypassing the five irrigation diversions during their downstream migration to the Bitterroot River. The final fate of each individual will be determined (i.e., in-river mortality, canal mortality, in-river residence, or successful emigration).

Abundances of downmigrating juvenile westslope cutthroat trout will be estimated by trapping fish above and below the diversions and electrofishing within the diversion canals to quantify the proportion of juveniles lost to each canal. These data will corroborate and supplement findings of the telemetry component.

Absolute abundances of westslope cutthroat trout will be estimated in specific benchmark sections of the Bitterroot River where downmigrant fish emigrate to after leaving Skalkaho Creek. These abundances will be compared to abundances after the diversions are screened to determine if screening has a discernable effect on the population.

Milestones/Schedule
Project activities are laid out on the attached milestone table. The study will commence July 1, 2002. Abundance estimates at benchmark sites in the Bitterroot River will be conducted in autumn 2002 and 2003. Telemetry and downstream migrant trapping will be conducted in spring and summer of 2003 when post-spawn adults and juveniles migrate downstream. The project, including all field work, analyses, and the final report will be completed by December 31, 2003.

Deliverables
A detailed final report describing the methods and findings of the study will be produced. The report will go into sufficient detail to allow all methods and protocols to be reproduced exactly in the follow-up study.

Partners and Nature of Contribution
Montana Fish, Wildlife and Parks personnel will assist with field work coordination and with contacting landowners and irrigators.

Cutthroat Thermal Testing Project

Introduction
Westslope cutthroat trout are in decline throughout the native range in the Northern Rockies and are considered at risk for listing under the Endangered Species Act. Habitat degradation and displacement by non-native trout species are the primary causes of decline. Although increased water temperature contributes to habitat degradation and is widely regarded as a determining factor in the persistence of native salmonids, specific thermal requirements of cutthroat trout subspecies are largely unknown. It has been hypothesized that summer maximum water temperatures are a limiting factor for native trouts; however, the upper incipient lethal temperature of westslope cutthroat trout has not been determined. In addition, water temperature

may play an important role in the balance of non-native and native trouts, yet the influence of temperature on interactions of westslope cutthroat with their non-native competitors has not been investigated. This lack of information precludes effective fish reintroduction and habitat restoration programs, development of land management policies, and hatchery propagation protocols.

Recent studies of temperature tolerances of bull trout have illustrated the need for well-defined and scientifically-defensible temperature criteria for effective protection and management. The desired outcome of the current project is to provide temperature tolerance information for westslope cutthroat trout to minimize the risk of further decline and increase the current range of these fish. Information obtained from this study will enhance habitat protection and restoration efforts, species reintroduction programs, and land management policies in watersheds inhabited by native cutthroat trout. This information also will be helpful in implementing recently developed conservation plans for native cutthroat trout in Montana and Idaho. Intended users of this information include: USFWS Partners for Fish and Wildlife personnel, Ecological Services and hatcheries; state and federal natural resource agencies; and the timber and grazing industries.

Goals and Objectives

Our goal is to characterize the thermal biology of westslope cutthroat trout, specifically with respect to the lethal and optimal temperatures for this subspecies, and to compare its performance against a non-native competitor in sympatry and allopatry.

The objectives of this study are to define the temperature for maximum growth, ultimate incipient upper lethal temperature (i.e., the highest temperature that can be survived indefinitely), and the influence of temperature on competitive interactions with a non-native competitor of westslope cutthroat trout. Laboratory trials will be conducted in a state-of-the-art thermal testing facility housed at the USFWS Bozeman Fish Technology Center. The thermal testing facility consists of 36 flow-through tanks and a series of cold and warm water springs from which water is combined to allow precise and accurate temperature control over a wide range of test temperatures. A three-year study of bull trout thermal requirements using this apparatus was recently completed (Selong et al. 2001).

Activities

Eyed eggs of westslope cutthroat trout will be obtained from the wild broodstock maintained at the Washoe Park State Fish Hatchery in Anaconda, Montana. Eggs will be reared to the juvenile stage at the Fish Technology Center until they reach about 8-10 cm. Growth and survival will be examined at 12 constant temperatures over the range of 8-30 ^{o}C to span the entire range of temperatures potentially encountered by westslope cutthroat trout during summer.

Optimum growth temperature and ultimate incipient upper lethal temperature will be determined in a series of long term (60 d) temperature trials using the acclimated chronic exposure protocol (Selong et al. 2001). Additional trials will be conducted to determine relative growth and survival of westslope cutthroat trout compared to rainbow trout, a major non-native competitor. Because differing growth rates between co-occurring species can be a result of differing physiological optima as well as behavioral interactions, we will conduct our test using westslope cutthroat alone, rainbow trout alone, and cutthroat and rainbow trout together at temperatures of

8, 12, 16 and 20^{o}C with three replicates for each treatment. Fish density and size will be matched to preclude confounding influences. The experimental protocol and measurements of growth and growth efficiency will duplicate that used in the initial experiment.

Milestones/Schedule
Eyed eggs of westslope cutthroat trout will be obtained from the Washoe Park State Fish Hatchery in Spring 2002. Optimum temperature and thermal limit trials will commence in Summer 2002 as soon as the fish reach appropriate size. Competition experiments will be conducted in Fall 2002 and Winter 2002-2003. Analytical treatment of fish tissues (proximate analysis), data analyses, and report preparation will follow, with project completion in December 2003.

Deliverables
A written scientific report detailing the thermal requirements of westslope cutthroat trout will be produced. A manuscript will submitted for publication in a peer-reviewed journal. Results of the study will also be presented at scientific meetings.

Partners and Nature of Contribution
The Montana Fish, Wildlife and Parks Washoe Park State Fish Hatchery in Anaconda will provide eyed eggs of westslope cutthroat trout for our experiments. Fish rearing facilities, feed, water, utilities, and the thermal testing apparatus will be provided by the Bozeman Fish Technology Center.

Control of Coldwater Disease

Introduction
Flavobacterium psychrophilum, the causative agent of bacterial coldwater disease (BCD), has become an increasing source of concern for fish aquaculture in the last decade, as it has spread worldwide from its apparent original source in the northwestern U.S. The bacterium is now considered one of the most significant pathogens of salmonids worldwide. It causes death if untreated, and requires continuous antimicrobial drug administration to be controlled. Although this fish pathogen is a major problem in salmonid hatcheries, few studies have been conducted on its pathogenicity or epidemiology. *F. psychrophilum* apparently can be transmitted both horizontally (among fish) and vertically (from adults to their progeny) within salmonid hatcheries, making it especially difficult to control.

Currently, BCD is the only disease found in State fish hatcheries in Montana, which have long had the unique and enviable reputation of being disease-free. The Washoe Park State Fish Hatchery in Anaconda, MT currently is the only State facility capable of producing westslope cutthroat trout suitable for restoration. Because of the severity of the BCD problem at the Washoe Park State Fish Hatchery, however, the State is unable to restore native westslope cutthroat trout to rivers and streams in Montana. Westslope cutthroat trout produced at Washoe Park were to be used in westslope cutthroat trout recovery plans throughout western Montana, but these recovery plans have been hindered due to the presence of BCD at the hatchery. Successful control of BCD in the hatchery will allow restoration of native westslope cutthroat trout to proceed in Montana.

The source of BCD at Washoe Park is unknown, as is the epidemiology of the bacterium. To control the bacterium in hatcheries, oxytetracycline (OTC) has been incorporated in fish feed in North America and Europe. Additionally, cutthroat trout at Washoe Park are treated prophylactically with OTC to suppress the disease. Although no resistance to OTC has been documented in North America, resistance of *F. psychrophilum* to OTC has been documented recently in Europe. Therefore, the effectiveness of OTC as a control measure for BCD appears to be limited. Furthermore, the bacterium may not be eliminated by OTC. After treatment with OCT, the bacterium may remain dormant in the brain of infected fish, proliferating when the fish are no longer fed the medicated feed, or when the fish are under stress, as upon stocking. New control measures must be developed and tested expeditiously to ensure the success of fish restoration projects.

Goals and Objectives

The goal of this research is to better understand the ecology of *F. psychrophilum* in hatcheries so that control measures can be developed and tested. Specific objectives are:

-To identify the source of *F. psychrophilum* at Washoe Park State Fish Hatchery;

-To determine where in the hatchery production process *F. psychrophilum* is most prevalent and at what life stages cutthroat trout are susceptible; and

-To identify and evaluate measures at Washoe Park to eradicate or control the bacterium such that production, and consequently native species restoration efforts, are no longer hindered by BCD.

Activities

The Montana Fish, Wildlife and Parks Washoe Park State Fish Hatchery will be used as a model to study BCD. Montana FWP will provide access, laboratory space, personnel, and fish for the project. The source of *F. psychrophilum* will be identified as well as its location and intensity throughout the hatchery. After the source has been identified, and the conditions in which it exists and thrives become known, potential control measures will be investigated. These control measures include water quality factors, changes in management procedures, UV irradiation, and chemotherapy. Although Washoe Park will be the primary site of this research, the results and findings of this work will be applicable throughout Montana and the Pacific Northwest.

Traditional bacteriology culture procedures as well as molecular techniques will be employed in this work. Traditional culture procedures will be used for verification, whereas molecular techniques such as PCR will be used for more precise evaluations of the bacterium in a shorter period of time. A PCR-based method for detecting *F. psychrophilum* has already been identified. This assay is a rapid and sensitive alternative to conventional plate-culture methods for identification and detection of the bacterium. The entire process of tissue preparation, DNA extraction, amplification, and gel electrophoresis of PCR products can be performed in about 24 hours, versus several days for the plate-culture techniques.

Project Milestones

In spring 2002 preliminary work will begin to refine techniques and to become familiar with the Washoe Park facility and its operations. Data collection will take place from July 2002 through-

July 2003. August 2003 - Dec 2003 will be occupied with data analysis and preparation of the final report.

Deliverables
A final report will be produced detailing the major findings and recommendations from the project. The final report will be submitted by 31 December 2003. At least one manuscript describing the findings will be submitted to a peer-reviewed journal.

Partners
Montana Fish, Wildlife and Parks will provide the use of the Washoe Park State Fish Hatchery, including laboratory facilities, technical assistance, and westslope cutthroat trout.

Technology Transfer

Introduction and Scope
Partners projects can benefit from the lessons learned in previous habitat-restoration work. However, a great deal of useful design and monitoring information is never shared by restoration workers, or exists only in "gray literature" where it is very difficult to access. Therefore, the Initiative will include a technology transfer project to collate information on methods and results of various fish habitat restoration projects. This project will deal only with habitat projects within the intermountain west (Idaho, Montana, Nevada, Wyoming, Utah, Colorado, Eastern Washington, Eastern Oregon, and Eastern California).

Goals and Objectives
The overall project goal is to provide useful bibliographic and case-history data to those responsible for fish-habitat projects in the Partners Program. Specific objectives are to: alert Partners biologists to the project and solicit their information needs; provide a web-accessible bibliography of pertinent fish habitat literature; provide a web-accessible clearinghouse for literature on fish habitat topics; and provide a web-accessible case history database of fish habitat projects pertinent to Partners activities in the northwestern U.S.

Activities
Three general types of activities will be carried out. First, we will sound out Partners Program personnel and other fisheries biologists to learn what kinds of information would be beneficial, to which they now have unsatisfactory access. Next, we will collect information either through remote access or site visits. Finally, draft and final information products will be developed and presented to Partners Program personnel and fishery biologists, and the final website will be publicized vigorously. The specific anticipated activities are to:
-Post a searchable bibliography on the web;
-Post acquired literature on the web in PDF format;
- Contact University researchers, state wildlife and fish experts, Federal agency researchers and private and non-profit organizations to find information on fish habitat projects;
-Acquire needed photographs and documentation for featured case studies;
-Collate all project information into a visually appealing web-based case study format; and,
-Finalize the case history database after external review.

Milestones
Literature review will be conducted from July 1 – September 30, 2002. The bibliography and PDF articles will be posted on the web by October 1, 2002. Contacts with fisheries researchers and site visits will occur November 1, 2002 – June 1, 2003. Development and implementation of the case study web page will take place from December 1, 2002 – July 1, 2003. Preliminary results will be presented at the national Partners meeting in February 2003.

Deliverables
There are three deliverables for this project: a web-based bibliography of fish habitat literature in the selected region; a PDF-format literature compilation concerning fish habitat in the selected region; and web-based case studies of completed habitat projects. Case histories of various types of projects, from around the Northwest, will 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 selected states, Federal agency personnel, and fishery biologists employed by private and non-profit organizations in the region.

Program Administration

Goals and Objectives
The overall goal of program administration activities will be to support the investigators in carrying out the four projects described above, and meet the needs of the USFWS Project Officer regarding the Initiative. Specific objectives are to:
-Assure fiscal transfers are timely, clear and appropriate;
-Identify and enter into formal relationships with additional project partners, as appropriate;
-Keep the USFWS well-informed about the progress and results of the program; and,
-Publicize the projects and results to interested parties.

Activities
Administrative personnel will manage the USFWS contract and any subcontracts, process invoices and track the fiscal status of each project, invoice the USFWS periodically, 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 researchers in acquiring information, supplies and facilities, in contractual or hiring matters, and in other ways as needed.

Milestones
The administrative milestones are shown on the milestone chart. They chiefly consist in reporting to the Fish & Wildlife Service and consummating contractual matters.

Deliverables
The deliverables for the project as a whole are two interim progress reports, regular invoices to the Fish & Wildlife Service, the compiled final project report and the final financial report.

Project Personnel

Dr. Alexander Zale will serve as Principal Investigator. Dr. Zale is the Cooperative Fishery Research Unit Leader for Montana and an Affiliate Associate Professor in the Department of Ecology at Montana State University. Besides exercising overall leadership, he will be the co-leader for the Bacterial Coldwater Disease 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 an Associate 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 lead the Westslope Cutthroat Thermal Testing project and the Irrigation Diversions project.

Eileen Ryce, Post-Doctoral Associate in the Ecology Department at Montana State University, will co-lead the Bacterial Coldwater Disease project. Dr. Ryce specializes in fish health issues.

William C. Fraser will direct 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 salmonid ecology and culture.

Michelle White is a Water Quality Specialist with the Montana Water Center. She has degrees in general biology and marine science, and manages water quality projects for the Center. She will serve as project administrator for the Wild Fish Habitat Initiative.

Reference

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.