
PART II - NARRATIVE

Section 7. Abstract

The goal of the resident fish mitigation program is to emphasize the long-term sustainability of viable native fish populations, conserve the natural genetic diversity, and ensure that stocking is not interfering with existing native, wild resident fish (1994 FWP secs. 10.1, 10.1A, 10.2A). The study is authorized under measures 10.3C.4, 10.3C.5, and 10.3C.7. Resident fish mitigation in Dworshak Reservoir stocks 20,000 to 100,000 lbs of rainbow trout annually, as required in the Corps of Engineer's resident fish mitigation plan. These hatchery rainbow trout move considerable distances upstream into the free-flowing portions of the drainage, and can potentially interbreed with the native westslope cutthroat trout populations upstream of the reservoir. We are using nuclear DNA analysis to determine the extent of introgression that has occurred in westslope cutthroat trout populations in the North Fork Clearwater basin. Tissue samples (collected as fin clips) from 20 cutthroat, rainbow, and hybrid trout will be sampled from 70-80 sites in the basin. Sites vary in stream size, channel type, and distance from the Reservoir. Fish are collected from each site with an electroshocker using a multiple pass removal estimate. Three types of data are collected: morphometric characteristics, population estimates, and habitat characteristics. Morphometric characteristics will be analyzed using logistic regression to identify visual characteristics (such as spot pattern or slash intensity) associated with the genetic identity of the trout. Population estimates and habitat characteristics will be analyzed using multivariate statistics to identify any trends in cutthroat, rainbow, or hybrid distribution or density. These results will be compiled and interpreted in a comprehensive report written during FY2000, including recommendations for resident fish mitigation activities in Dworshak Reservoir that will be consistent with the persistence of pure westslope cutthroat trout in the basin.

Section 8. Project description

a. Technical and/or scientific background

Hybridization with exotic trout is considered the greatest threat to the conservation of the native westslope cutthroat trout in northern Idaho and western Montana (Allendorf and Leary 1988). Westslope cutthroat trout is reduced substantially in its historic range (Allendorf and Leary 1988; Rieman and Apperson 1989). In Idaho, strong and genetically pure populations are thought to exist in less than 4% of its native range (Rieman and Apperson 1989). Although several studies have determined that genetically pure populations of westslope cutthroat trout remain in less than 2.5% of the historic range in Montana, little genetic sampling has been done in Idaho (Allendorf and Leary 1988; Rieman and Apperson 1989; Weigel 1997). Introduced rainbow trout, Yellowstone cutthroat, and golden trout will freely hybridize with westslope cutthroat trout producing fertile offspring. This extensive hybridization will infuse exotic genes into the native population, creating a hybrid swarm (Gyllensten et al. 1985; Allendorf and Leary 1988, Leary et al. 1995). The hybrid swarm alters the genetic composition of the native trout, losing the local adaptations and reducing survival and fertility (Allendorf and Leary 1988; Leary et al. 1995). Due to the extensive interbreeding among these species, genetics has been the only reliable method to detect introgression (Gyllensten et al. 1985; Satchell and Alexander 1991).

The North Fork Clearwater basin is thought to have relatively strong populations of westslope cutthroat trout. However, rainbow and Yellowstone cutthroat trout have been widely introduced in the drainage (Weigel 1997). The completion of Dworshak Dam near the mouth of the North Fork Clearwater River has caused a large loss of riverine habitat and blocked anadromous runs of salmon and steelhead. The stocking of rainbow trout into Dworshak Reservoir is used to mitigate the losses caused by the dam. Resident fish mitigation in Dworshak Reservoir stocks 20,000 to 100,000 lbs of rainbow trout annually, as required in the Corps of Engineers' resident fish mitigation plan. Rainbow trout stocked into Dworshak Reservoir have been detected 88 km upstream in Kelly Creek (Ball and Pettit 1974). This extensive movement of hatchery rainbow trout threatens the native, wild westslope cutthroat trout in more than 75% of the drainage. Several studies have identified a conflict with the conservation of native westslope cutthroat trout, calling for a genetic inventory in the North Fork Clearwater basin with subsequent modifications to resident fish mitigation stocking activities (Maiolie et al. 1993; Fickeisen and Geist 1993; Bennett 1997). Using the results of the genetic inventory, we will make management recommendations for resident fish mitigation in Dworshak Reservoir based on the persistence and wise management of wild, native trout populations in the drainage. These recommendations will be brought to the NPPC for review of current resident fish mitigation management in Dworshak Reservoir. **Because monitoring is not authorized under this project, we have not included monitoring in this proposal.** However, if mitigation strategies are altered in the Reservoir, we will propose monitoring and evaluation of this implementation phase. Outyear costs are unknown at this time, because we do not have sufficient data to project possible

management recommendations. Continuation of this project will rely on the upcoming milestone in FY2000.

b. Rationale and significance to Regional Programs

The genetic inventory of westslope cutthroat trout meets the goals and objectives of the 1994 FWP by investigating the impacts of resident fish mitigation on native, wild westslope cutthroat trout in the North Fork Clearwater basin, and using the results to make recommendations for resident fish mitigation in Dworshak Reservoir. The overall goal of the FWP is to support and rebuild populations of native species in native habitats, while protecting and enhancing habitat that is irrevocably changed (Sections 2, 2.1, 2.2). Stocking of rainbow trout has been used as mitigation to enhance the fishery in Dworshak Reservoir since 1972, without investigating the impacts on wild populations of cutthroat trout. The FWP identifies westslope cutthroat trout as a species of concern, and stresses the goal of preserving natural genetic diversity within native, wild populations of resident fish (Section 10). Furthermore, the FWP requests the evaluation of detrimental effects of artificial propagation on the long-term sustainability of native species, and calls for a thorough comprehensive approach to conserving genetic diversity in native species when stocking is proposed. Interbreeding is specifically identified as a concern, and the plan stresses minimizing the impacts of hatchery fish on wild fish (Section 10.2.A). Our study meets the following high priority criteria listed in Section 10.1B: 1) westslope cutthroat trout in the North Fork Clearwater basin supports an important fishery; 2) the genetic inventory is gathering data that will be used to protect the health of an existing, wild resident fish population; and 3) the project works to achieve measurable biological objectives that are not inconsistent with the conservation of genetic and biological diversity of native populations. Measure number 10.3C.4 authorizes the genetic inventory of westslope cutthroat trout in the North Fork Clearwater basin, 10.3C.5 authorizes BPA to fund the NPT to implement the study, and 10.3C.7 establishes cost sharing with the Corps of Engineers to stock and monitor resident fish introduced into Dworshak Reservoir.

Our project also contributes information toward achieving the goals identified in the proposed draft MYIP. The CBFWA DAIWP (MYIP section 6.6.5.3A) addresses two resident fish objectives: 1) To maintain and restore population productivity reduced by hydropower development and operations to healthy levels which provide opportunities for consumptive and nonconsumptive native fisheries; and 2) To ensure population levels of native fish above minimum viable population sizes which maintain adaptability and genetic diversity, and maximize probability of survival. The results of the genetic inventory will be used to support the goal of providing a consumptive fishery in the North Fork Clearwater basin, while minimizing the impacts on existing native, wild populations of westslope cutthroat trout, maintaining pure genetic composition, and viable populations of pure westslope cutthroat trout. Furthermore, this project is an important component of the Corps of Engineers' current reevaluation of resident fish mitigation in Dworshak Reservoir. The potential impacts, and benefits of a native westslope cutthroat trout broodstock derived from pure westslope from the North Fork basin was discussed by Bennett (1997).

c. Relationships to other projects

This project is related to other Dworshak Reservoir mitigation projects (project numbers 8740700 and 8709900) to implement resident fish mitigation that will provide a consumptive fishery (>0.5 fish/hr), that will not conflict with the preservation of other native wild fish, and minimizes the impacts of hatchery trout on wild trout. Maiolie et al. (1993) identified the need to investigate the effects of stocking rainbow trout, as Dworshak resident fish mitigation, on native westslope cutthroat trout populations in the North Fork Clearwater basin. These projects are involved in the Dworshak resident fish mitigation review, and the System Operation Review, and coordinate with other agencies (CoE, USFWS, IDFG) on the management of fisheries mitigation in the basin. Coordination and cost sharing are established under measure number 10.3C.7 in the authorization of the project activities under the FWP.

The status of westslope cutthroat trout is currently being reviewed for listing under the ESA (petition accepted June 1998). Genetic data on the extent of introgression in westslope cutthroat trout populations is lacking in Idaho (Rieman and Apperson 1989). The information gained from this project will provide important genetic status and density data for westslope cutthroat trout within its native range.

d. Project history (for ongoing projects)

This genetic inventory of westslope cutthroat trout project has completed its third year of funding at a total cost of \$549,754. We have completed a background study and evaluation of current fish distribution in the North Fork Clearwater basin (Weigel 1997), and the genetic reference sample under subcontract with the University of Montana (submitted as an annual report to the NPT in April 1997). Currently, we have completed the second year of collection and analysis of tissue samples. Preliminary results were summarized in the 1997 Annual Report (submitted to BPA in May 1998). The analysis of the tissue samples collected during 1997 was submitted as an annual report to the NPT in July 1998 under the subcontract. We have detected hybridization among cutthroat and rainbow trout, however, we are still building our sample size to make basinwide conclusions about introgression and the distribution of cutthroat, rainbow, and hybrid trout at this time.

Using the results of the genetic inventory, we will make management recommendations for resident fish mitigation in Dworshak Reservoir based on the persistence and wise management of wild, native trout populations in the drainage. These recommendations will be brought to the NPPC for review of current resident fish mitigation management in Dworshak Reservoir. **Because monitoring is not authorized under this project, we have not included monitoring in this proposal.** However, if mitigation strategies are altered in the Reservoir, we will propose monitoring and evaluation of this implementation phase. Outyear costs are unknown at this time, because we do not have sufficient data to project possible management recommendations. Continuation of this project will rely on the upcoming milestone in FY2000.

The FWP defines adaptive management as “learning by doing” or “learning from implementation.” Therefore, the adaptive management generated from the results of the project will relate to the evaluation of stocking programs that conserve the native

westslope cutthroat trout, a species recognized as a sensitive species by the State of Idaho and currently under consideration for listing under the ESA. The study will document the effects of resident fish stocking activities, and will recommend mitigation activities that will not interfere with native trout.

e. Proposal objectives

Objective 1. Determine the extent of introgression in the native, wild westslope cutthroat trout in the North Fork Clearwater basin.

Measureable Objective: Maintain viable populations of pure westslope cutthroat trout in the North Fork Clearwater basin, as measured as 150-300 pure breeding individuals and 0 hybrids.

Null Hypothesis: The stocking of rainbow trout in Dworshak Reservoir has not resulted in introgression in the native, wild westslope cutthroat trout in the North Fork Clearwater basin.

Assumption: The habitat in the North Fork Clearwater basin is suitable to support viable populations of native, wild westslope cutthroat trout.

Relation to FWP: Mitigation that does not negatively impact native fish populations, and conserves genetic integrity of native populations.

f. Methods

Objective 1

The North Fork Clearwater basin is 2,440 square miles, and has 3 major tributaries and numerous smaller tributaries. Most of the basin is characterized by inaccessible backcountry. We plan to sample 70-80 sites in the basin by 2000. Sites vary in stream size, channel type, and distance from the Reservoir. Most sites are sampled with a backpack electroshocker. However, several sites collect fish for genetic tissue samples by angling in large mainstem rivers or high mountain lakes. Population estimates and habitat characteristics are not collected at these sites where electroshocking is inefficient or dangerous.

We collect four types of data for the project: genetic tissue samples, morphometric characteristics, population estimates, and habitat characteristics. The genetic tissue samples characterize the trout sampled at each site, and all other data will be analyzed with the genetic identities. Morphometric characteristics are tested to identify if any visual characteristics are consistent in determining the genetic identity of a fish that could be useful for monitoring programs or other fisheries managers. The sites will be divided into groups based on the genetic status, and will be tested with density estimates and habitat characteristics to determine any trends in the distribution of cutthroat, rainbow, or hybrid trout, and the relationship to habitat variables.

Genetic Analysis and Morphometric Characteristics

Background information was compiled throughout the basin relating stocking histories to current fish distribution (Weigel 1997). Three fish genetics labs submitted proposals and costs to genetically detect hybridization. Traits of nuclear DNA analysis were determined to be most suited to our goals, such as non-intrusive sampling and equal inheritance from the parents. We selected the University of Montana Fish Genetics lab

(F. Allendorf) using non-coding sequences of nuclear DNA Paired Interspersed Nuclear Elements (PINEs) to determine the extent of introgression in the basin. This method has been shown to detect hybridization in trout (P. Spruell pers. comm.), and was the most cost effective and direct method to test introgression. Preliminary research indicates that this method is useful in detecting cutthroat X rainbow trout hybrids (P. Spruell pers. comm.). A reference sample including all fish in the North Fork Clearwater basin that could hybridize with westslope cutthroat trout was developed to identify markers. The reference sample identified 16 markers to differentiate between westslope and rainbow trout (Spruell et al. 1997). The larger number of species specific markers detected using the PINE analysis provides greater power in identifying introgression between cutthroat and rainbow trout at sites in the basin (Spruell et al. 1997).

Tissue samples are collected from 20 cutthroat, rainbow, or hybrid trout at sites in the basin. Although the sample size is small for genetics work, we are working with a 95% confidence of detecting hybridization exceeding 1% in the population. The reduced sample size also allows us to test more sites in the basin with the available funds. This was necessary to adequately assess the status of cutthroat trout in the large basin. Tissue samples are collected as a small fin clip from the pelvic or caudal fin and preserved in 95% ethanol.

Morphometric characteristics are recorded for each trout from which tissue is collected, and include both continuous and categorical variables. These characteristics include: head and body measurements, spot pattern, spot shape, slash intensity, fin spotting, and presence/absence of hyoid teeth.

Population Estimates and Habitat Characteristics

Fish are collected with a Smith-Root 15-D backpack electroshocker using a three pass removal method. A 50m site is block netted at the top and bottom to prevent fish movement into and out of the site during sampling. Fish collected on each pass are held separately in buckets until the sampling is complete. Density estimates are calculated for all salmonids captured at each site using the Capture program.

The location of each site is benchmarked with a metal tag, and marked on a topographic map. Five transects are measured at 10m intervals. Width, depth, sediment size, and cobble embeddedness are measured at each transect. Gradient, map elevation, Rosgen channel type, and proportion of cover are measured over the site.

Data Analysis

The genetic results will be mapped over the basin in order to determine the extent of introgression. Morphometric characteristics will be modeled with the genetic identification of the trout using categorical and continuous variables. The data will be analyzed using ANOVAs, MANOVAs, logistic regression, and/or discriminant function analysis. Habitat data will be modeled by fish species and density using principal components analysis, factor analysis, and/or discriminant function analysis. The different statistical analyses will be evaluated for the data meeting the necessary assumptions.

Expected Results

These analyses will describe the relative abundance of genetically pure westslope cutthroat trout, morphometric characteristics that differentiate between cutthroat, rainbow, and hybrid trout, and the habitat that is correlated with the distribution of trout. The genetic status of westslope cutthroat trout will be evaluated in a final report completed in FY2000. This report will include an evaluation on the effects of resident

fish mitigation stocking practices on westslope cutthroat trout, recommendations for future resident fish mitigation in Dworshak Reservoir, and identify potential sources for genetically pure westslope cutthroat trout broodstock, if recommended. These recommendations will be brought to the NPPC for review of current resident fish mitigation management in Dworshak Reservoir. **Because monitoring is not authorized under this project, we have not included monitoring in this proposal.** However, if mitigation strategies are altered in the Reservoir, we will propose monitoring and evaluation of this implementation phase. Outyear costs are unknown at this time, because we do not have sufficient data to project possible management recommendations. Continuation of this project will rely on the upcoming milestone in FY2000.

g. Facilities and equipment

The NPT will provide office space, storage, and shared office equipment (fax, photocopier, internet access, etc) for the project in the Orofino Field Office. The location of the Orofino Field Office reduces travel time to the field sites. The project has purchased a 4-wheeler, trailer, backpack electroshocker, and two computers for full-time personnel. The project also has a 4X4 truck rented through GSA. The truck and 4-wheeler are used for remote access.

h. Budget

Ninety-one percent of the proposed budget is salaries, benefits, indirect, and operational costs (rent, utilities, etc). The project has two full-time biologists: a project leader and a fisheries biologist. Part-time support personnel include a secretary and supervisory biologist whose salaries are shared among several projects. Other costs include vehicle rental for transportation to the field, travel and per diem to meetings (BPA annual presentations, cooperative meetings, Columbia Basin issues, etc), and subcontracts/professional services. The subcontract pays for the genetic analysis of trout collected during the study (approx. 200 samples at \$30 per sample). Professional services include outfitter fees used to access a limited number of backcountry sites (10 days at \$100/day), and statistical consultation (50 hours at \$25/hr).

Section 9. Key personnel

The project supports two full time personnel. Currently, the fisheries biologist position is vacant, and in the process of being filled. The project leader resume follows.

Dana Weigel, Project Leader, Nez Perce Tribe Fisheries, Orofino Field Office, 3404 Hwy 12, Orofino, ID 83544

EDUCATION

M.S. Fisheries, University of Minnesota 1994

B.S. Aquatic Environments, Allegheny College 1991

RESEARCH EXPERIENCE AND PUBLICATIONS

Project Leader, Nez Perce Tribe, Orofino, ID, Sept 1996 – present.

Project: Genetic inventory of westslope cutthroat trout in the North Fork Clearwater basin.

Reports: Weigel, D.E. 1997. The genetic inventory of westslope cutthroat trout in the NF Clearwater basin, Idaho. Annual Report prepared for the Bonneville Power Administration. Contract No. 95BI61768, Project No. 9501600. 13pp.

Weigel, D.E. and S. Cross. 1998. The genetic inventory of westslope cutthroat trout in the NF Clearwater basin, Idaho. Annual report prepared for the Bonneville Power Administration. Contract No. 97AM30423, Project No. 9501600.

Research Assistant, University of Minnesota, Department of Fisheries and Wildlife, St. Paul MN, Sept 1991 – March 1994

Thesis Title: Longitudinal distribution of brook, brown, and rainbow trout in a midwestern stream cannot be explained by habitat variables, submitted Transactions of American Fisheries Society 1997

Co-Author: Sorensen, P.W., T.E. Essington, J. Cardwell, and D.E. Weigel. 1995.

Hybridization and spawning behavior of brook and brown trout in a small stream.

Canadian Journal of Fisheries and Aquatic Sciences. 52:1958-1965.

TECHNICAL EXPERIENCE

Fisheries Biologist, Clearwater Biostudies Inc., Canby, OR, June –Sept 1996.

Project: Steam surveys under contract with the USFS Clearwater and Nez Perce National Forests

Fisheries Biologist, University of Idaho, Cooperative Fisheries Research Unit, Moscow, ID, April – June 1996.

Project: Radiotelemetry of adult chinook salmon at Ice Harbor Dam

Fisheries Biologist, M&M Environmental Enterprises, Boise, ID, June-Dec 1995.

Project: Stream surveys under contract with the USFS Payette National Forest

Fisheries Consultant, Vermont Natural Resource Council, Montpelier, VT, April – June 1995

Project: Prepare expert testimony evaluating FERC dam relicensing regulation, and evaluate the flow regulation studies and proposed fish passage facilities

Fisheries Biologist, USFS Intermountain Research Station, Boise, ID, Aug –Oct 1994.

Project: Monitoring the movements and genetic exchange of resident and migratory bull trout

Fisheries Biologist, National Biological Survey, Cook WA, April – July 1994

Project: Monitoring the movement of chinook and steelhead smolts through reservoirs and dams on the Snake and Columbia Rivers using radiotelemetry and hydroacoustics.

Research Assistant, Rocky Mountain Biological Lab, Gothic, CO, June-Sept 1991.

Project: Evaluating the costs and benefits of paedomorphosis versus metamorphosis in tiger salamanders and identifying the species composition of invertebrates in high elevation ponds.

TRAINING

University of Idaho, Applications of Multivariate Statistical Methods 1997.

USFWS, Fish Genetics, 1997.

JOB DUTIES

Literature reviews, report writing, experimental design, data analysis, computer modeling, speaking to peer and local interest groups, budget planning and management, writing proposals, administer contract and subcontract, personnel management, planning logistics, provide scientific advice to the agency, coordinate activities with other agencies and projects

Section 10. Information/technology transfer

Information from the project is distributed by Annual Reports submitted to BPA under the terms of our contract. Additionally, we plan to incorporate citizen education meetings, professional society meetings (such as the Idaho Chapter of AFS), and inter-agency information sharing. Furthermore, the information gained from this project will be used by the Army Corps of Engineers for resident fish mitigation planning in Dworshak Reservoir, and by the USFWS in their current status review of westslope cutthroat trout under the ESA.

Congratulations!