COOPERATING AGENCIES
United States Geological Survey
Cooperative Research Units
Byron K. Williams, Chief
Bernard Shanks, Unit Supervisor

California Department of Fish and Game
Donald Koch, Director
Neil Manji, Chief, Fisheries Programs Branch

Humboldt State University
College of Natural Resources and Sciences
James H. Howard, Dean
David G. Hankin, Chair, Fisheries Biology

UNIT STAFF
Walter G. Duffy, Unit Leader
Adjunct Professor, Fisheries Biology

Peggy A. Wilzbach, Assistant Unit Leader
Adjunct Professor, Fisheries Biology

Kenneth W. Cummins, Senior Advisory Scientist
Adjunct Professor, Fisheries Biology

Kay Brisby, Administrative Support Coordinator

RESEARCH STAFF
Dr. Sharon Kahara, Post-Doctoral Research Assoc. (CCV Assessment Project)
David Malakaukas, Biologist (Caspar Creek Project)

GRADUATE STUDENTS

Name	Major Prof.	Graduation
Mark Ashenfelter	Wilzbach	
Caleb Balas	George	June 2008
Philip Colombano	Duffy	
Stephen Gough	Duffy	
Luke Groff	Marks	
Brian Hodge	Duffy/Wilzbach	
Barbara McCoy	Wilzbach	Dec. 2008
Kimberly McFarland	Mesler	
Katherine McLaughlin	Duffy	May 2009
Marlene Meaders	Hendrickson	Dec. 2008
Seth Naman	Wilzbach	Dec. 2008
Roman Pittman	Wilzbach	
Brian Poxon	Duffy	
Michele Wheeler	Duffy	May 2009
Katrina Wright	Duffy	

UNIVERSITY COOPERATING FACULTY
Department of Fisheries Biology
Eric Bjorkstedt, Adjunct Professor
Kristine Brenneman, Associate Professor
David Hankin, Professor and Chair
Bret C. Harvey, Adjunct Professor
Gary L. Hendrickson, Professor
Andrew Kinziger, Assistant Professor
Eric Loudenslager, Fish Hatchery Manager & Adjunct Professor
Helen Mulligan, Lecturer
Timothy Mulligan, Professor
Terry Roelofs, Emeritus Professor

Department of Wildlife Management
Jeff Black, Professor and Chair
Richard G. Botzler, Professor
Rick N. Brown, Lecturer
Mark A. Colwell, Professor
Ned H. Euliss, Adjunct Professor
T. Luke George, Professor
Richard Golightly, Professor
Matthew Johnson, Professor
David W. Kitchen, Professor
Micaela Szykman Gunther, Asst. Professor

Other Departments
Erik Jules, Associate Professor, Biology
Tom Lisle, Adjunct Professor, Geology
Mary Ann Madej, Adjunct Professor, Geology
Sharyn B. Marks, Associate Professor, Biology
Michael Mesler, Professor, Biology

RESEARCH TECHNICIANS
David Arwood, Bryan Atkinson, Shannon Chapin, Alexandra Goodell, Elliot Johnson, Matthew Metheny, Oliver Miano, Kelly Miller, Marisa Parish, Christopher Reed, Elizabeth Werner, William Youmans, Jason Zito.

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California Cooperative Research Unit

2008 ANNUAL REPORT OF ACTIVITIES

The California Cooperative Research Unit is a cooperative effort among the United States Department of the Interior, Geological Survey, Humboldt State University, and the California Department of Fish and Game. The unit was established in 1966 and is located at Humboldt State University in Arcata, California. By agreement, the U. S. Geological Survey provides two scientists and annual base funding; Humboldt State University provides facilities and administrative support services; and the California Department of Fish and Game contributes operating funds and student support.

Research projects focus on topics ranging from salmon disease and steelhead life history in the Klamath River, the response of salmon to watershed restoration, the biology of sensitive species to wetland ecology. During the past year, the Unit has conducted or facilitated twenty research projects—sixteen by Unit scientists and four by cooperating Humboldt State University faculty.

MISSION STATEMENT

The goal of the California Cooperative Research Unit and our Cooperators is to pool our resources in order to accomplish our stated mission:

1) Conduct scientific research that benefits fish, wildlife, their habitats, and ecosystems upon which they depend;

2) Train graduate fisheries and wildlife management students, through mentoring and teaching graduate level courses, to become competent fisheries and wildlife scientists; and

3) Provide technical assistance to the fisheries and wildlife profession by sponsoring training workshops, reviewing and writing manuscripts for publication, and coordinating research activities.

COMPLETED RESEARCH PROJECTS

Validation Monitoring: Testing Protocols in Prairie Creek.

Dr. Walter Duffy, CACFRU
Katrina Wright, MS Student,
Katherine McLaughlin, MS Student
Brian Poxon, MS Student
Completed in May 2008
Funding: California Department of Fish and Game ($211,167)

This research assessed protocols for validation monitoring of watershed restoration. Assessment included evaluating the sensitivity of protocols to natural variation. Sampling was conducted in Prairie Creek, tributary to Redwood Creek, Humboldt County and included the following objectives:

1. Estimate the population size of juvenile coho salmon, cutthroat trout and steelhead in upper Prairie Creek was estimated during late summer 2005, 2006, and 2007.
2. Measure the condition of juvenile coho salmon and steelhead captured during juvenile population monitoring each year.
3. Estimate the number of salmon and steelhead migrating from Prairie Creek toward the ocean during 2005, 2006, and 2007.
4. Estimating the number of adult salmon and steelhead returning to Prairie Creek to spawn during 2005, 2006 and 2007.

The final project report is available on the Coop Unit's web page at http://www.humboldt.edu/~cuca/documents/reports/Validation-FinalReport.pdf

Growth and movement of resident rainbow trout transplanted below barriers to anadromy.

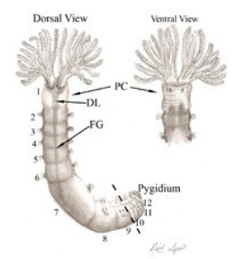
Dr. Peggy Wilzbach, CACFRU
Mark Ashenfelter, MS Student
Completed in June 2008
Funding: California Department of Fish and Game ($64,088)

Research was conducted to determine if resident rainbow trout (*O. mykiss*) isolated above an upstream barrier to anadromous migration would exhibit migratory behavior when relocated to a stream reach below the barrier. Age 1+ trout above a 5 m high waterfall in Freshwater Creek, California were captured during 2005 - 2006 and individually marked with passive integrated transponder tags. Analysis of otolith microchemistry indicated that above-barrier trout had resident rather than anadromous parents, and genetic analysis indicated that the trout showed some degree of introgression with cutthroat trout. Tagged individuals in above- and below- barrier reaches were relocated and/or recaptured to track their movement. Most transplanted individuals displayed little movement or moved in an upstream direction only, while four were last detected in the tidally influenced lower river. Five tagged, above-barrier individuals were found in below-barrier reaches, presumably washing over the falls. Of seven tagged trout captured in downstream migrant traps, two had smolted and one was a pre-smolt. The smoltification of at least some transplanted individuals, coupled with above-barrier 'leakage' of fish downstream, demonstrates the potential for resident trout to exhibit migratory behavior and to enter breeding populations of steelhead.

Manayunkia speciosa: Life history, rearing, and associated development of *Ceratomyxa shasta*.

Dr. Gary Hendrickson, HSU
Dr. Kenneth Cummins, HSU
Dr. Peggy Wilzbach, CACFRU
Marlene Meaders, MS Student
Completed in June 2008
Funding: US Fish and Wildlife Service ($55,000)

Ceratomyxa shasta is a serious pathogen of anadromous salmonids in the Klamath River Basin. It has a complicated life history using salmonids as the vertebrate host and the freshwater polychaete *Manayunkia speciosa* as the invertebrate (definitive) host. The objectives of this study were to: (1) rear *Manayunkia speciosa* in the laboratory so that its life history could be described, (2) examine uninfected and infected polychaetes histologically so that histopathology of infection could be described, and (3) describe the sequential development of *C. shasta* in the polychaete. The final report is broken into three parts which correspond both to these objectives and to three papers submitted or to be submitted to peer-reviewed journals. Part 1 includes rearing and life history of the polychaete. Part 2 includes internal anatomy and histology of the polychaete. Part 3 includes sequential development of *C. shasta* in *M. speciosa* with notes on the histopathology.



PUBLICATIONS AND PRESENTATIONS

Scientific Publications

Cummins, K. W. and M. A. Wilzbach. Rivers and Streams: Ecosystem Dynamics and Integrating Paradigms. In Sven Erik Jørgensen and Brian D. Fath (Editor-in-Chief), Ecosystems. Vol. [4] of Encyclopedia of Ecology, 5 vols. pp. [3084-3095] Oxford: Elsevier.

Duffy, W.G., and E.P. Bjorkstedt. Demographics of coastal cutthroat trout, Oncorhynchus clarki clarki, in Prairie Creek, California. 2008. Pages 100 - 106 In: P.J. Connolly, T.H. Williams and R.E. Greswell editors. Coastal cutthroat trout symposium: biology, status, management and conservation. Proceedings of a symposium, Fort Worden State Park, Washington, 29 September – 1 October 2005.

Duffy, W.G. and S. N. Kahara. Response of freshwater wetland ecosystems to USDA farm conservation practices in California's Central Valley. Ecological Applications, In Review.

Euliss, N.H., Jr., L.M. Smith, S. Liu, W.G. Duffy, S.P. Faulkner, R.A. Gleason and S.D. Eckles. Integrating estimates of ecosystem services from conservation programs and practices into models for decision makers: The vision for CEAP Wetlands. Ecological Applications, In Review.

Williams, T. H., B. C. Spence, W.G. Duffy, D. Hillemeier, G. Kautsky, T. Lisle, M. McCain, T. Nickelson, G. Garman, E. Mora, and T. Pearson. 2008. Framework for assessing viability of threatened coho salmon in the Southern Oregon/Northern California Coast Evolutionarily Significant Unit. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC.

Wilzbach, M. A. and K. W. Cummins. Rivers and Streams: Physical Setting and Adapted Biota. In Sven Erik Jørgensen and Brian D. Fath (Editor-in-Chief), Ecosystems. Vol. [4] of Encyclopedia of Ecology, 5 vols. pp. [3095-3106] Oxford: Elsevier.

Papers Presented

Duffy, W. G. 2008. Mortality of juvenile salmon associated with downstream migrant traps: a concern for monitoring. Annual Meeting, California/Nevada Chapter, American Fisheries Society, Lake Tahoe, CA, April 2008. [PRESENTED]

Duffy, W. G. 2008. Influence of freshwater habitat quality on coho salmon populations: evidence from nine years of investigations in Redwood National Park. Aquatic Resources in Redwood Creek. Redwood National Park, Orick, CA, April 2008. [INVITED]

Duffy, W.G. 2008. Response of wetlands in California's Central Valley to global change. Annual Meeting Society of Wetland Scientists, Washington, D.C., May 2008. [INVITED]

Kahara, S. K. and W. G. Duffy. 2008. Ecosystem services influence of USDA farm conservation practices on wetlands in California's Central Valley. Annual Meeting Society of Wetland Scientists, Washington, D.C., May 2008. [INVITED]

Theses

Balas, C. J. 2008. The effects of conservation programs on amphibians of the Prairie Pothole Region's glaciated plain. M.S. Thesis, Humboldt State Univ., Arcata, CA. 153 pp.

McCoy, B. L. 2008. Effect of rearing location on escapement of coho salmon (*Oncorhynchus kisutch*) at Freshwater Creek, California. M.S. Thesis, Humboldt State Univ., Arcata, CA . 41 pp.

Naman, S. W. 2008. Predation by hatchery steelhead on natural salmon fry in the upper-Trinity River, California. M.S. Thesis, Humboldt State Univ., Arcata, CA 66 pp.

CURRENT RESEARCH PROJECTS

Prairie Creek sub-basin life cycle monitoring.

Dr. Walter Duffy, CACFRU, Brian Poxon, MS Student
June 2008—June 2011
Funding: CA DFG ($259,286)

The Prairie Creek sub-basin of Redwood Creek supports self-sustaining populations of coho salmon, Chinook salmon, steelhead and coastal cutthroat trout in addition to occasional chum salmon. It was recognized as an excellent "field laboratory" for the study of anadromous salmonids in California by the Coastal Watershed Planning and Assessment Program. Studies of fisheries in the Prairie Creek sub-basin began in the late 1940's and extend to the present. Nearly continuous estimates of adult salmon returning to Prairie Creek have been made since 1990, while estimates of juvenile abundance and smolt production have been made each year since 1998.

This project will monitor a 12 km reach of Prairie Creek and a 12 KM reach of Lost Man Creek. We will monitor the abundance of salmonids at adult, juvenile and smolt life stages. A comprehensive report will analyze trends in salmonid population abundance, survival of salmonids between juvenile and smolt life stages, ocean survival of adults and efficiency of methods used to monitor salmonids in streams.

UNIVERSITY SERVICE AND TEACHING

Courses Taught

Restoration Ecology of Riverine Fish (3 units)
Duffy Fall 2007

Ecology of Running Waters (3 units)
Wilzbach Fall 2007, Fall 2008

Graduate Committee Service (unit scientists serve as members, not major advisors)

Duffy
Caleb Balas – MS Wildlife, HSU
Brooke DeVault – MS Fisheries, HSU
Luke Groff - MS Biology, HSU
Stephanie Souza – MS Mathematics, HSU

Cummins
Michael Brady – MS Biology, HSU
Oswaldo Hernandez – PhD Entomology, Michigan St. Univ.
Marlene Meaders – MS Fisheries, HSU
John Walsh – MS Biology, HSU

Wilzbach
Dawn Alvarez – MS Fisheries, HSU
Colin Anderson – MS Fisheries, HSU
Brooke DeVault – MS Fisheries, HSU
Jon Goin – MS Fisheries, HSU
Josh Fuller – MS Fisheries, HSU
Erin Hannelly – MS Biology, HSU
Oswaldo Hernandez – PhD Entomology, Michigan St. Univ.
Katherine McLaughlin – MS Fisheries, HSU
Marlene Meaders – MS Fisheries, HSU
Susan Corum - MS Fisheries, HSU
Heidi Vogel – MS Fisheries, HSU
Katrina Wright – MS Fisheries, HSU

TECHNICAL ASSISTANCE

Duffy provided a review of the Department of Defense, Naval Training Plan to Congressman Mike Thompson's office. For the Department of Fish and Game, he continues to serve as Chair of the Fishery Restoration Grants Program, Peer Review Committee and as a member of the California Advisory Committee on Salmon and Steelhead. Duffy also provided technical assistance to the Karuk Tribe regarding gold mining in streams.

Wilzbach continued to provide guidance to Plum Creek Timber Company, OR, in developing an aquatic monitoring program. Provided assistance to USFS in predicting impacts of Iron Gate Dam removal on habitat for polychaetes (intermediate hosts for salmon pathogens). She provided guidance to Idaho Fish and Game on transplantation of a cutthroat trout project.

COMPLETED RESEARCH PROJECTS

Effects of conservation programs on amphibian communities in seasonal wetlands of the Prairie Pothole Region's glaciated plains. (RWO 78)

Dr. T. Luke George, HSU Wildlife
Dr. Walter Duffy, CACFRU
Caleb Balas, MS Student
Completed in June 2008
Funding: USGS, Northern Prairie Wildlife Research Center ($102,666)

In response to USDA reporting requirements and the conservation community's concern for amphibian declines in the Great Plains of North America, this study was conducted to assess the effect of land-use change on amphibian species richness and occupancy of seasonal wetlands in the Prairie Pothole Region's Glaciated Plain. Three survey techniques (automated call surveys, trapping with aquatic funnel traps, and visual encounter surveys) were used to detect eight amphibian species at 40 seasonal wetlands. Amphibian species richness varied by study site location and wetland land-use. The probability of occupancy of amphibian species varied by study site location and (or) wetland land-use. In general, farmed wetlands negatively impacted amphibians in seasonal wetlands. This study indicates that restored and natural seasonal wetlands provide comparable habitat for most amphibian species inhabiting seasonal wetlands. Results suggest that the restoration efforts of federally funded conservation programs have largely been successful in providing suitable habitat for most amphibian species utilizing seasonal wetlands. Hence, the Conservation Reserve Program and the Wetlands Reserve Program are important in the conservation of amphibians in the Prairie Pothole Region's Glaciated Plain.

Evaluation and monitoring of burrow-nesting seabirds at Castle Rock National Wildlife Refuge. (RWO 74)

Dr. Richard T. Golightly, HSU
Richard Young, MS Student
Completed in July 2008
Funding: USGS – SSP Appropriated Funds ($46,875)

This study evaluated the seabird use of Castle Rock, located in Del Norte County, California. The first objective was to develop a non-invasive mechanism to establish long and short term monitoring of the seabirds on Castle Rock. We have successfully installed a remotely operated video camera system that allows researchers to observe seabirds on Castle Rock without disturbance. The second objective was to establish a long-term, forward looking monitoring program and the third objective was to make available to the public information about seabirds and their specific activities on Castle Rock.

Response of steelhead populations to fire disturbance in the Kings Range National Conservation Area.

Dr. Walter Duffy, CACFRU
Philip Colombano, MS Student
Completed in December 2008
Funding: US BLM ($30,189)
NOAA Fisheries ($40,000)

This research assessed steelhead populations, other aquatic biota, aquatic habitat, and water quality in streams along the west slope of the King Range following a wildfire in 2003. Preliminary analyses suggest that fire had little effect on steelhead population size or density. Composition of habitat did, however, appear to respond to fire as did recruitment of large woody debris. The thesis is in preparation.

Development of a research plan for quantifying the abundance of the invertebrate host of salmonid parasites in the Lower Klamath River. (RWO 77)

Dr. Peggy Wilzbach, CACFRU
Dr. Kenneth Cummins, HSU
Mark Yost, Biologist
Sarah Willson, Technician
Completed in December 2008
Funding: US Fish and Wildlife Service ($91,916)

Objectives of this project were to develop a research plan for quantifying the abundance and distribution of the freshwater polychaete *Manayunkia speciosa*, which is the intermediate host of myxosporean parasites that are infecting juvenile salmon in the lower Klamath River. We presented a draft report to the USFWS describing our recommendations for a polychaete monitoring program that was founded upon preliminary field sampling of its occurrence and habitat associations, as well as upon information obtained from culture of the animal in the laboratory. We found that the polychaete exhibits a patchy distribution within the river; that prevalence and density were higher below Iron Gate Dam than in the lower river; and suggested that high polychaete densities below Iron Gate Dam likely reflect high quality planktonic food resources from the reservoir as these are released over the dam. Fine sediments at the base of beds of vascular plants and mats of filamentous algae represented the primary habitat of the polychaete. We developed the ability to culture the polychaete within the lab, and described culture conditions and information about life cycle details of the polychaete through laboratory rearing in a manuscript that is presently undergoing review.

Conservation genetics of the federally endangered tidewater goby (Eucyclobius newberryi) in northern California. (RWO 79)

Dr. Andrew Kinziger, HSU Fisheries
William T. McCraney, MS Student
September 2006—December 2010
Funding: US Fish & Wildlife Service ($126,299)

The tidewater goby (*Eucyclogobius newberryi*) is a federally endangered fish species that inhabits brackish/freshwater lagoons and estuaries in California. Tidewater goby habitats are geographic isolated from one another by long stretches of unsuitable habitat and/or physical barriers such as sand bars. An understanding of how the fragmented distribution of tidewater goby influences population structure is critical for proper management. The objective of this project is to use microsatellite data to evaluate migration rates, genetic structure and levels of genetic diversity among northern California populations of tidewater goby.

Assessing the effects of USDA conservation practices on wetland ecosystem services in California's Central Valley. (RWO 80)

Dr. Walter Duffy, CACFRU
Dr. Sharon Kahara, HSU-SPF
September 2006—June 2010
Funding: USDA, Natural Resources Conservation Service ($597,332)

California's Central Valley (CCV) encompasses an area of 55,100 km2, extending a distance of almost 7,000 km from Red Bluff in the north to around Bakersfield in the south. The CCV was historically an ecosystem consisting of grassland, prairie, and oak-grass savanna habitats. Interspersed within these primary habitats were riparian woodland, freshwater marsh, and vernal pool wetlands. These wetlands were integral in supporting the diverse flora and fauna of the historic CCV.

This research will assess the effects of conservation practices on wetland ecosystem services in the CCV. This assessment will produce estimates of wetland ecosystem services, quantify the effects of agriculture on wetlands, with and without implementation of USDA conservation practices, and develop predictive wetland functional condition indicator models.

Objectives of the research are to:

1. Conduct a regional workshop to identify ecosystem functions and services most important in CCV wetlands.
2. Evaluate ecosystem services provided by USDA-NRCS restoration of palustrine emergent wetlands in the CCV.
3. Evaluate ecosystem services provided by USDA-NRCS restoration of different types of wetlands.

Age structure of steelhead in the Klamath River Basin and the effect of the half-pounder life history on populations.

Dr. Walter Duffy, CACFRU
Dr. Peggy Wilzbach, CACFRU
Brian Hodge, MS Student
March 2007—August 2009
Funding: California Department of Fish and Game/AFRAMP ($52,972)

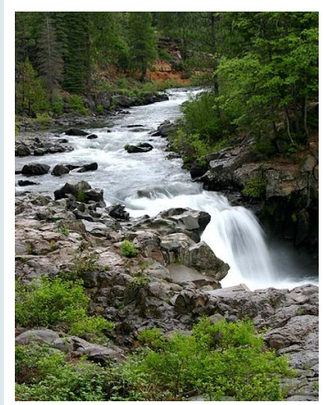
The Klamath River is the most productive steelhead fishery in the state of California, and one of only several rivers in the world in which steelhead exhibit the unique half-pounder life history. Half-pounders return to overwinter in freshwater less than a year after initial ocean entry, despite that fact that few fish have attained sexual maturity. Although existence of the half-pounder life history is well documented, no consensus exists as to what ecological conditions promote this life history, nor does a consensus exist as to what selective pressures favor the continued expression of this life history.

The primary objectives of this study are 1) to determine the population structure of steelhead in the Klamath River Basin with respect to age, growth, size, fecundity, incidence of repeat spawning, and incidence of the half-pounder life history; and 2) to estimate fitness consequences of the half-pounder migration by comparing the relative size of fish that do and do not make the migration, while also considering the effect of size on fecundity in females.

Sample, identify, and enumerate macroinvertebrates of Caspar Creek watershed.

Dr. Ken Cummins, HSU Fisheries
September 2007—September 2009
Funding: USDA Forest Service ($40,000)

The objective of the study is to compare the present day macroinvertebrate fauna of the Caspar Creek watershed with an earlier inventory, and to provide baseline data for future assessments of the watershed under new harvest operations. Benthic macroinvertebrates were surveyed in the spring and fall of 2008. Semi-quantitative (30 second timed) samples were taken in three habitats (cobble riffles, fine sediment pools, and litter accumulations) using a D-frame 250 µm mesh dip net. Three samples were taken from each habitat type at each site. Two sites on the North Fork, two on the South Fork, and two on the mainstem of Caspar Creek were sampled. Functional feeding group (FFG) analysis was performed on each live sample in the field, and the material was then preserved in 70% ETOH for return to the lab for microscope sorting and further identification of the invertebrates.



The role of barriers in the conservation of McCloud redband trout.

Dr. Peggy Wilzbach, CACFRU
Roman Pittman, MS Student
September 2007—September 2010
Funding: USDI Fish & Wildlife Service ($80,000)

In 1994, the U.S. Fish and Wildlife Service determined that potential threats to the McCloud River redband trout (*Oncorhynchus mykiss* spp.) and its habitat were sufficient to warrant classification as a Candidate species under the federal Endangered Species Act of 1973, as amended. This status reflected concern over threats imposed by land use activities and introductions of exotic salmonids, as well as threats to its genetic integrity from genetic introgression with stocking of hatchery strains of rainbow trout. In 1998, a conservation agreement was established to ensure that steps are taken to reduce or remove threats that could cause it to be listed as threatened or endangered. To assist in conservation efforts, this proposal seeks to explore the feasibility of adopting an isolation management strategy for redband trout by identifying potential stream barriers and evaluating MRT population parameters in two tributaries of the upper McCloud River to determine the capacity of these streams to sustain deliberately isolated stocks. Specific objectives are: 1) to identify existing and potential barriers in Tate and Trout creeks and to establish the range of flows within which these barriers are operational; and 2) describe and compare population structure of MRT in isolated and connected reaches of 2 creeks, and 3) estimate minimum stream length for population viability of MRT based on density and survivorship estimates.

Redwood Creek Juvenile Salmonid Abundance Projects.

Dr. Walter Duffy, CACFRU
Michael Sparkman, CDFG
May 2007—June 2009
Funding: CA Department of Fish and Game/FRGP (Upper RC $87,009) (Lower RC $98,401)

Redwood Creek is one of the major rivers in Humboldt County, CA and supports salmon and steelhead trout that are federally listed as threatened under the Endangered Species Act. Redwood Creek is currently listed as sediment and temperature impaired (USEPA), and various restoration efforts (and plans) in the basin are on-going. These juvenile smolt abundance studies are a cooperative effort with CDFG, Redwood Creek Landowners Association (RCLA), and the private landowner where the upper trap is located. Redwood National Park (RNP) also assists via their estuary sampling.

Data is collected to determine the current population size, status, and trends of salmon (Coho, Chinook), cutthroat trout, and steelhead trout in Redwood Creek. Peer reviewed mark/recapture techniques are used to determine population estimates. The study is designed to be long term and also encourages research/monitoring of adult populations because such studies, when combined with the current smolt study, would help establish relationships between adults and juveniles.

The Fisheries Restoration Grant Program will continue the Lower Redwood Creek project funding through 2011, with 2009 being the 6th year of the study. Continuance of the Upper Redwood Creek project is contingent upon review and available funds.