FISH AND AQUATIC ECOLOGY UNIT
ANNUAL REPORT FY 2004

Fish and Aquatic Ecology Unit
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INTRODUCTION

The U.S. Department of Agriculture, Forest Service, Fish and Aquatic Ecology Unit, is a detached, Washington office group located in Logan, UT. In support of the conservation and restoration of aquatic communities on Forest Service land, the unit works with federal and state research organizations and universities to identify emerging aquatic resource issues and to develop scientifically sound, cost-effective technology to help address these issues. Once this technology is developed, we distribute it to field biologists through continuing education workshops, presentations, publications, and on-site visits.

The Fish and Aquatic Ecology Unit, headed by Dr. Jeffrey Kershner, is divided into subsections (Fig. 1). The continuing education subunit is not included in this report. We hope you enjoy the annual report. If you would like more information on any of the projects, or copies of reports or manuscripts, please feel free to contact us.

Web site:
http://www.fs.fed.us/biology/fishecology/index.html

Fish and Aquatic Ecology Unit Structure

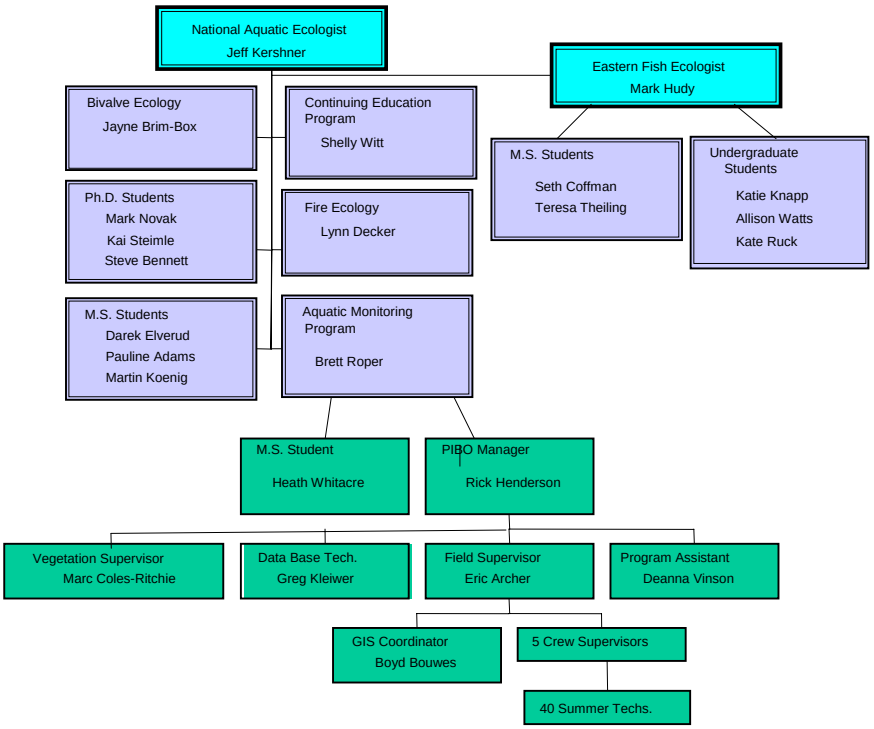
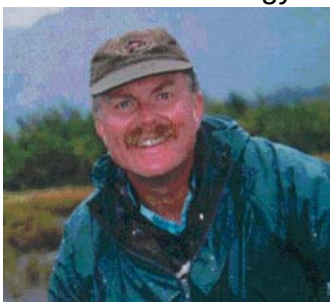


Figure 1. Organizational structure of the National Fish and Aquatic Ecology Unit of the U.S.D.A., Forest Service.

PERSONNEL

Jeff Kershner, Ph.D., is a Washington Office Aquatic Ecologist with the U.S.D.A., Forest Service, Fish and Aquatic Ecology Unit, in Logan UT. He is also an associate research professor within the Aquatic, Watershed, and Earth Resources Department in the College of Natural Resources at Utah State University, Logan. Jeff oversees technology development and transfer for the fisheries and aquatic resources program of the Forest Service. He earned a B.S. in fisheries in 1976 from Humboldt State University, Arcata, CA; and an M.S. in natural resources from Humboldt State University in 1981. Jeff earned his Ph.D. in ecology from the University of California, Davis, in 1991. Dissertation title: The role of physical factors in the distribution and abundance of rainbow and brown trout in the Little Truckee River. His interests include the conservation biology of native salmonids, restoration ecology, and the effects of land management activities on aquatic and riparian resources.



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Mark Hudy is a Fish Ecologist for the U.S.D.A., Forest Service Eastern Regions (8 and 9). He is stationed at James Madison University in Harrisonburg, VA. Mark earned his B.S. in fisheries and wildlife from Virginia Polytechnic Institute and State University, Blacksburg, in 1978 and his M.S. in fisheries from Utah State University, Logan, in 1980. Thesis title: Evaluation of six strains of rainbow trout stocked as fingerlings in Porcupine Reservoir, UT.

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Brett Roper, Ph.D., joined the Forest Service Fish and Aquatic Ecology Unit in 2000 as an Aquatic Ecologist and serves as the Program Leader for the Aquatic Monitoring Project. Brett is also an adjunct professor with Utah State University, Logan. He earned his B.S. degree in environmental studies from Utah State University, Logan, in 1986, and his M.S. in forest resource management from Utah State University, Logan, in 1989. Brett completed his Ph.D. in fisheries management at the University of Idaho, Moscow, in 1995. Dissertation title: Ecology of anadromous salmonids within the Upper South Umpqua River Basin, Oregon.

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Lynn M. Decker was an Aquatic Ecologist from January 2001 to fall 2004. She earned her B.S. in wildlife and fisheries biology, from the University of California, Davis, in 1979, and her M.S. in wild land resource science, from the University of California, Berkeley, in 1984. Thesis title: Distribution, abundance, and coexistence of two species of sucker

(*Catostomus*) in Sagehen Creek, California and their status in the Western Lahontan Basin. In FY 04, Lynn accepted a position with the The Nature Conservancy as director of the Fire Learning Network.

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Jayne Brim-Box, Ph.D., is a Bivalve Ecologist for the unit. She earned her B.A. in journalism with a minor in zoology from Ohio State University, Columbus, in 1983, and her M.S. in biology from the University of South Carolina, Columbia, in 1991. Jayne received her Ph.D. in 1999 from the School of Forest Resources and Conservation, University of Florida, Gainesville. Dissertation title: Community structure of freshwater mussels (Bivalvia: *Unionidae*) in coastal plain streams of the southeastern United States.

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Kai Steimle is currently a Ph.D. student under Dr. Kershner, in the Aquatic, Watershed, and Earth Resources Department at Utah State University, Logan. Kai received a B.S. in ecology, evolution, and conservation biology from the University of Washington, Seattle, in 2000. She is currently working on an investigation of brook trout invasion ecology in the Lost Rivers of southeast Idaho and plans to graduate in 2006.

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Steve Bennett is a fisheries Ph.D. student in the Aquatic, Watershed, and Earth Resources Department at Utah State University, Logan. His proposed dissertation title is: The impact of invading rainbow trout on native westslope cutthroat trout in the upper Kootenay River: influencing factors and conservation priorities. Steve graduated from the University of Montana, Missoula, in 1990 with a B.S. degree in wildlife biology. He earned his M.S. degree in resource and environmental management from Simon Fraser University, Burnaby, British Columbia, Canada, in 1994.

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Mark Novak is a Ph.D. candidate under Dr. Kershner, in the Aquatic, Watershed, and Earth Resources Department at Utah State University, Logan. He is also a fisheries biologist with the U.S.D.A., Forest Service, Bridger-Teton National Forest, in Jackson, Wyoming, since 1991. Mark earned a B.S. in biology and geography from

Western Michigan University, Kalamazoo, in 1983, and an M.S. in fish and wildlife management from Montana State University, Bozeman, in 1988. His research involves morphological, ecological, and genetic characteristics of cutthroat trout populations in the Snake River headwaters of Wyoming. Mark plans to graduate in 2005.

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Darek Elverud is a M.S. graduate student in fisheries biology under Dr. Roper and Dr. Kershner, at Utah State University, Logan. He earned his B.S. in wildlife biology at the University of Montana, Missoula, in 2000. Darek's thesis title will be: Developing protocols for evaluating management indicator species. He will graduate in the summer of 2005.

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Pauline M. Adams is currently a M.S. graduate student in aquatic ecology under Dr. Kershner, at Utah State University, Logan. Her thesis will explore the range of stream conditions of reference and managed watersheds in Colorado. She plans to graduate in 2006. Pauline is also a Student Career Experience Program (SCEP) fisheries biologist with the Grand Mesa, Uncompahgre, and Gunnison National Forests in Colorado. Pauline earned her B.S. degree in biology from James Madison University, VA, in 2003, where her senior project used aerial and ground based photography for aquatic monitoring using an integrated Global Positioning System (GPS) system.

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Martin Koenig joins us from San Carlos, California where he earned a B.S. degree in wildlife, fish, and conservation biology from the University of California, Davis in 2002. He recently participated in the Feather River project under the California Department of Water Resources, gathering information on the Chinook salmon and steelhead fisheries of the Feather River. Martin is an M.S. student researching factor limiting recruitment of Yellowstone cutthroat trout in the Idaho's Teton Valley.

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Seth Coffman is a M.S. student under Mark Hudy, at James Madison University, VA. His research involves fish passage issues in the eastern U.S. He plans to graduate in 2005. Seth earned a B.S. degree in fisheries from Virginia Technical College in 2002. This year he was awarded the Best Paper Award at the annual meeting of the Virginia Chapter of the American Fisheries Society, Lexington, VA March 18-19, 2004.

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Teresa Theiling is a M.S. student at James Madison University, Harrisonburg, VA researching a subwatershed risk assessment and predictive model for brook trout populations. She expects to graduate in the summer of 2006. Teresa earned her B.S. degree in forestry from Michigan Technical College in 2002.

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Kate Ruck is an undergraduate, biology major (sophomore), at James Madison University, Harrisonburg, VA. She is working on photo monitoring of riparian habitat. Email: ruckke@jmu.edu

Allison Watts is an undergraduate biology major (junior) at James Madison University, Harrisonburg, VA. Her project involves the movement of mottled sculpin in agricultural and forested watersheds.

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CURRENT PROJECTS

1. Kershner, J. L.; Roper, B. B.; Bouwes, N.; Henderson, R. C.; Archer, E. K. *An analysis of stream habitat conditions in reference and managed watersheds on some federal lands within the Columbia River basin.* The loss of both habitat quality and quantity for anadromous fish in the Columbia River basin has been identified as a major factor in the decline of many species and has been linked to a variety of land management activities. In this study, we compared stream reaches in watersheds representing both managed and reference conditions to determine if we could detect differences in physical habitat variables. We randomly sampled perennial stream reaches in Idaho, Montana, Oregon, and Washington. Watersheds containing reference stream reaches had a slightly higher percentage of federal lands, were larger, tended to occur at higher mean elevations, and received more annual precipitation than managed watersheds. Stream banks were more stable and more undercut in reference streams. Reference streams also had slightly more pools and those pools were deeper than pools in managed streams. We observed less fine sediment

in pool tails in reference streams. We believe that the comparison of reference conditions to managed conditions provides a credible way to report on the condition of these systems in lieu of trend information at individual sites. This project was completed in 2004 and published in the North American Journal of Fisheries Management.

2. Kershner, J. L.; Roper, B. R.; Reeves, G. *A review of stream habitat objectives and their use in setting standards for land management.* Managers have often had difficulty in describing the effects of land use on stream habitat potential in meaningful ways. While there have been numerous studies that described changes in stream habitat variables as a result of land use activities, these studies are generally short-term, small-scale, and lack study controls that show changes in watersheds with little land management. In addition, stream habitat potential is often described as the "dream stream" or streams that exist in late successional forests with little active land management. While this concept may be useful for describing the context of management, there is an emerging body of literature suggesting that stream habitat may be much more dynamic, making rigid standards impractical. This project reviews the current use of stream habitat management objectives, examines their usefulness in guiding land management practices, and suggests ways to make this concept more useful in light of new information on watershed disturbance and recovery.

3. Kershner, J. L. *A guide to integrating viability analysis into forest planning: an interactive learning tool.* The objective is to develop an interactive learning transfer website and CD-ROM based learning modules for delivery to Forest and Regional-level biological professionals in the Forest Service to aid in viability planning analysis and management. This course may also be of interest to planners and line officers who wish to learn more about the concepts, science, and principles of viability analysis as it relates to forest planning.

4. Whitacre, H.; Kershner, J. L.; Deibel, R. *Literature review on the factors contributing to the downstream displacement of fish as a result of hydro peaking operations*. Many of the negative downstream impacts of dams are caused by the altered flow patterns typical of hydroelectric power generation. Hydropeaking or pulse power generation refers to reservoir operations, usually on 'run of the river' hydroelectric plants, where water is stored to generate electricity during times of peak demand (Scruton et al. 2003). Rapid releases of water during peaking operations results in diurnally or annually variable water pulses in the river section below the power station, leading to alterations of flow magnitude, duration, sequence and frequency. These rapid increases and decreases in flow patterns typically last less than a day with shorter intervals creating multiple peaks per day. Short term flow fluctuations related to hydropeaking are a serious disturbance of the lotic ecosystem. Physical impacts of hydropeaking include alterations to stream bank and channel morphology, chemical conditions below the outlet, water temperature, depth, volume, and velocity distribution, wetted area, stream substrate composition, amount and composition of suspended matter, stream structure and heterogeneity and patterns and dynamics of ice formation (Moog 1993; Liebig et al. 1999). Direct effects on fish can include

mortality due to stranding, asphyxiation, or desiccation. Indirect effects can include flushing of fish downstream or volitional movement (in any direction) from unfavorable habitats, physiological and behavioral changes, reductions and impairment of habitat, and food depletion (Moog 1993).

5. Hudy, M. *Aerial and ground based photography for aquatic monitoring utilizing an integrated global positioning system (GPS)*. The purpose of this project is to investigate the utility and potential applications of geo-spatial photography for aquatic monitoring and inventory on national forest lands. On the Huron-Manistee National Forest we are monitoring a large wood addition project on the Au Sable River (http://csmres.jmu.edu/forestservice/ Ausable_paired/).

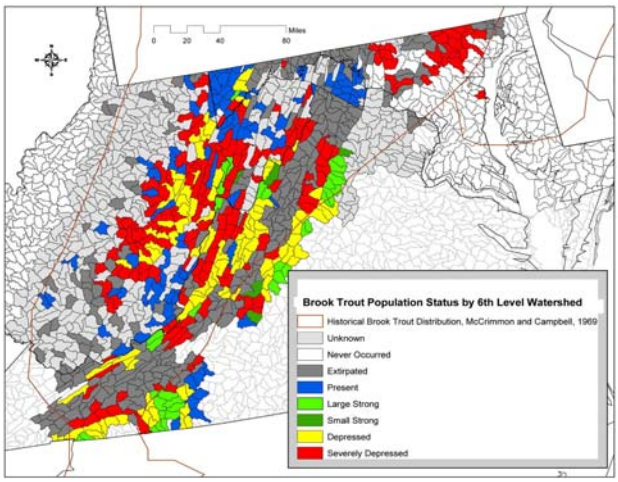
An undergraduate research study comparing video and still photography surveys to basin wide survey estimates are taking place on the George Washington, Jefferson, and Monongahela National Forests. Geo-referenced photographs of culverts are being investigated on the Monongahela, Green Mountain, White Mountain, and Mark Twain National Forests, and the National Forests of North Carolina, (http://csmres.jmu.edu/forest service/Passage/).

Habitat improvement on Okissa Lake is being monitored on the National Forest of Mississippi.

6. Hudy, M.; Whalen, K. *Crayfish distribution on U.S.D.A., National Forest lands in Regions 8 and 9, 5th order hydrological unit codes (HUC's)*. The purpose of this project is to obtain knowledge of crayfish distribution and fill in data gaps to prevent future conflicts with the Endangered Species Act (ESA), Forest Land Management Plans (FLMP), and invasive species issues. The project has been completed and is available online at http://csmres.jmu.edu/forest service.

7. Hudy, M. *Characteristics of 5th and 6th order watersheds on Eastern National Forest Lands.* The purpose is to develop watershed and riparian corridor metrics for use in watershed risk and viability assessments in the east. In 2004, we completed data for all 5th order watersheds. The 6th order watersheds will be completed in 2005.

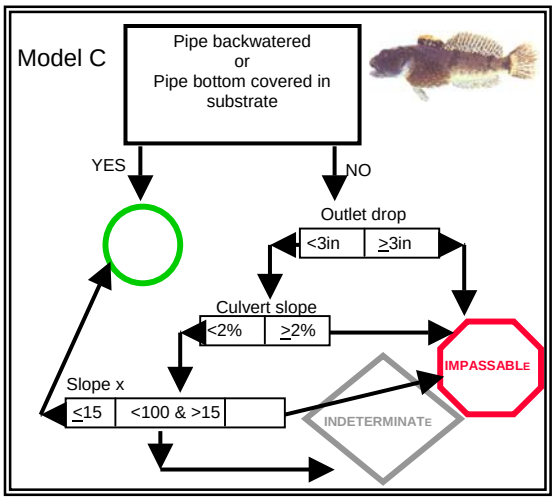
8. Hudy, M.; Theiling, T. *Multimetric subwatershed risk assessment and predictive model for brook trout (Salvenius fontinalis) populations.* The objective of this project is to develop indices to rank watersheds for a brook trout risk assessment. The model will help predict brook trout status where data is missing and specify population thresholds for anthropogenic and landscape factors. The study area covers 35 eastern states and includes all 6th level HUC's within 48 km of the historic range of brook trout.



9. Hudy, M.; Gibson-Reinemer, D.; Coffman, S.; Knapp, K. *Fish passage/ stream connectivity issues in the east*.

The purpose of this project is to develop and validate coarse filters for families of fishes in the eastern United States. We are testing the national monitoring template for fish passage to evaluate its utility to the eastern United States (Monongahela, Mark Twain, Green Mountain, George Washington, and Jefferson National Forests), and identifying fish passage problems at a project and landscape scales.

Field data collection was completed in November 2004. The thesis will be completed in spring 2005 and a journal article will be submitted in fall 2005.



10. Hudy, M. *Effects of hemlock wooly adelgid on riparian ecosystems*. This is a long term, project where we are monitoring large wood recruitment, water temperature, and fish response to hemlock wooly adelgid in the George Washington National Forest.

11. Hudy, M.; Whalen, K. *A Comparison of two methods of macroinvertebrate index's of biotic integrity (IBI's) among Forest Service and Environmental Protection Agency protocols*. A journal article with several EPA co-authors will be submitted in 2005.

12. Roper, B. B. *The effects of land management on physical stream attributes.* We are currently determining effects of management on many commonly evaluated stream attributes. Because managed and unmanaged watersheds differ in characteristics such as size, location, gradient, and precipitation, these comparisons must first use analysis of covariance to ensure appropriate comparisons. The objective of this project is to determine the most efficient suite of stream attributes to measure after minimizing the effects of landscape differences. A manuscript has been submitted for publication in the North American Journal of Fisheries Management. We hope to use this effort to begin a discussion/analysis on the use of aquatic standards in land management.

13. Roper, B. B. *A comparison of methods using macroinvertebrates to evaluate watershed status*. I collaborated with Mark Vinson (BLM Bug Lab, Logan, UT) and Chuck Hawkins (Western Center for Monitoring and Assessment of Freshwater Ecosystems, Utah State University, Logan) to compare a variety of multimetric and multivariate approaches commonly used to evaluate stream health. The primary goal of these comparisons is to provide models for Forests within the Columbia River basin to use GIS information and macroinvertebrate collections as part of stream health evaluations. We are currently comparing RIVPACS (a multivariate approach) with multimetric evaluation which includes model based and ANCOVA approaches.

14. Roper, B. B. *Using Geographical Information Systems to evaluate the relationship between disturbance and stream condition within the Frank Church Wilderness Area.* In cooperation with the

Remote Sensing Applications Center in Salt Lake City, we plan to use GIS coverages to correlate landscape disturbance over the past 30 years with stream conditions evaluated at a site. We expect this study to reinforce the need for actual on site data collection.

15. Roper, B. B. *Aquatic Ecological Technical Manual*. The goal of our National Team is to standardize stream evaluation methods. In 2003 we finalized the core aquatic attributes and sampling designs for use in the evaluation of status and trends of aquatic resources on lands managed by the Forest Service. We are currently editing this manual based on the review effort which started last year. We plan to finalize the manual in 2005. In addition to the national efforts I have been working with regions 1 and 6 to facilitate the rapid adoption of this manual, and with a graduate student to determine the best way to evaluate species presence on a Forest.

16. Roper, B. B. *Migration of fluvial cutthroat within the Coeur d'Alene basin.* In cooperation with the Panhandle National Forest and the Idaho Department of Fish and Game, we are working to better understand the movement patterns of fluvial cutthroat trout within the Coeur d'Alene National Forest. We are currently analyzing movement patterns of cutthroat trout within separate watersheds in the basin and relating movement to habitat conditions.

17. Roper, B. B. *State and Federal standardization of stream survey protocols*. Over the last year I have worked with the Federal (PACFISH/INFISH Effectiveness Monitoring Team, Aquatic Effectiveness Monitoring Program, Environmental Protection Agency, and the Bonneville Power Administration) and State agencies (Washington, Oregon, and California) to find common criteria so that data from varying stream sampling protocols can be analyzed together. In 2004 this process was formalized into the Pacific Northwest Aquatic Monitoring Partnership (PNAMP). We plan to compare aquatic survey methods within the John Day Basin during the summer of 2005. Funds for the project have been provided by the National Marine Fisheries Service, Bureau of Land Management, Forest Service, and Bonneville Power Administration.

18. Roper, B. B. *Bull trout population evaluation on the Mount Hood National Forest.* I worked with Darcy Morgan to design a statistically defensible sampling program for determining bull trout populations on the Forest.

19. Roper, B. B. *Using stream characteristics in order to better understand sediment in streams*. Currently sediment is a measured stream attribute which is often difficult to interpret. The goal of this project is to provide site specific predictions of sediment size in the absence of disturbance by explaining attributes which may better predict sediment sizes in streams. This analysis should help the Forest Service better utilized their sediment data.

20. Roper, B. B. *Use of stream survey data for Forest planning efforts*. I worked with fish biologists, hydrologists, and geologists from several National Forests in both Oregon and Washington on a design using stream survey data to evaluate the current condition of streams. This effort expands previous work from the Wenatchee, Okanogan, and Colville National Forests to the Blue Mountain

region. Together we have formulated a method that uses geological subsections as strata for analysis.

21. Roper, B. B. *Instruction and teaching helpful to the professional development of fisheries biologists and hydrologists*.

Vegetation Monitoring - I team taught a Forest Service continuing education class on methods used to monitor vegetation. My portion of the class focused on statistical aspects.

Analysis with Excel - I taught several two day courses on using Excel to analyze fisheries data. My goal was to help participants analyze their own data in the simplest form. Class size averaged 20 students.

22. Roper, B. B. *Recommend reading lists*. I review numerous relevant publications related to fire and aquatic ecosystems, and then produce a recommended reading list. This list is available upon request but will soon be retrievable on our web site.

23. Decker, L. M. *Fire and aquatics learning portal: fire management planning tools for integrating watershed and aquatic ecosystem science*. This project involves the development of a rapidly updateable, interactive learning transfer website and CD-ROM based learning modules for delivery to field level fishery, aquatic, hydrology, geology, and watershed professionals. This course may also be of interest to fire professionals, who wish to obtain greater understanding of watershed, aquatic, and fisheries issues. First year funding was secured in 2002. Funding is needed to finish work and put the portal into operation this FY. Assistance was provided by Mike Furniss, Pacific Northwest Research Station (PNW), Corvallis, OR.

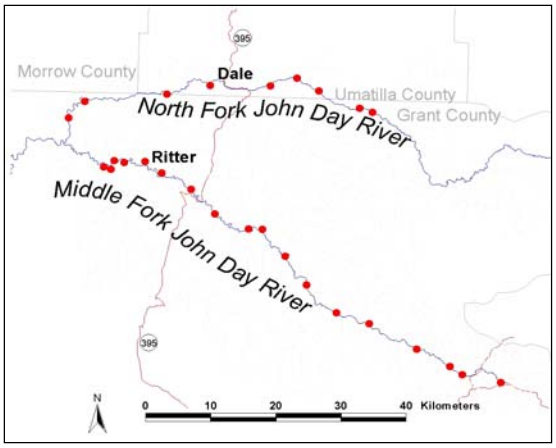
24. Brim-Box, J. *The distribution and habitat of freshwater mussels in the Umatilla and Middle Fork John Day Rivers in eastern Oregon.* Freshwater mussels are considered the most highly endangered fauna in North America, yet little is known about their basic biology, ecological interactions, or habitat requirements. The purpose of this study was to provide critical information on the status of freshwater mussels. This information is essential for the restoration of freshwater mussels and their associated traditional and cultural uses.

Surveying for freshwater mussels in the Middle Fork John Day River, Oregon.

Freshwater mussels are vital components of intact salmonid ecosystems that have been affected directly and indirectly by dams, habitat deterioration, and declines in salmon populations.

Freshwater mussel glochdium on fin of speckled dace (glochidium is approximately 250-microns in length), from the Middle Fork John Day River, OR.

In 2004 we quantitatively assessed mussel densities and macro- and microhabitat variables in selective mussel beds in the Umatilla and Middle Fork John Day Rivers, assessed the geomorphic change in channel morphology of these rivers, and determined the historical distribution of freshwater mussels in the Umatilla River drainage.



Sites where *Margaritifera* were found in the Middle and North Fork John Day Rivers during freshwater mussel surveys.

Cooperators included David Close and David Wolf from the Confederated Tribes of the Umatilla Indian Reservation.

25. Brim-Box, J. *Patterns of genetic diversity among populations of freshwater mussels in the Bonneville basin, UT*. Populations of freshwater mussels (genus *Anodonta)* appear to be in a state of rapid decline in the western U.S. In 2005 we plan to: a) continue investigating the anthropogenic factors that may be contributing to the decline of western *Anodonta*, b) conduct a habitat-based assessment of potential adaptive divergence among *Anodonta* populations, and c) conduct a broad-scale analysis and synthesis of genetic and morphological variation among *Anodonta* in the western U.S.

Type specimens of *Anodonta wahlametensis* (USNM 86363, length = 63.2mm) (top) and *Anodonta nuttalliana* (USNM 86391, length = 60 mm) (bottom). *Anodonta wahlametensis* was placed in the synonymy of *A. nuttalliana* by Turgeon et al. (1998).

Collaborators include Karen Mock and Mark Miller, Department of Forest, Range, and Wildlife Sciences, Utah State University, Logan.

26. Brim-Box, J.; Bennett, S. *Historical distribution and taxonomy of freshwater mollusks of the western United States*. The objective of this study is to produce a distributional database for GIS coverage of western freshwater mollusk species and their historical distributions (and type localities where applicable). This database will allow managers and researchers to anticipate local mollusk occurrences, identify areas for further inventory and long-term monitoring, and help to unravel the complex nomenclature of mollusk species. We conducted an extensive literature review and visited major national history museums (e.g., Smithsonian Institution) to obtain pertinent freshwater mussel records, and to photograph type specimens and representative morphologies. To date, approximately 3,500 records of freshwater mollusks have been compiled from publications and museum records.

In 2005, distributional data will be georeferenced to produce maps of historical occurrences for target species (e.g., Forest Service sensitive) and other

mollusk species. Our goal is to make these data available through our website.

27. Brim-Box, J. *Reproductive behavior of the western pearlshell, Margaritifera falcata.* The objective of this study was to record the simultaneous release of conglutinates (and possible predation of conglutinates by fishes) of *Margaritifera falcata* populations in Soldier Creek on the Lassen National Forest, and in the Eel River on the Angelo Coast Range Reserve. We recorded relevant habitat and population variables to gain a better understanding of factors influencing the reproductive cycle of *M. falcate*. In May, 2004 we used underwater photography to record the release of conglutinates and potential host fishes. This could provide valuable information on the ecology of freshwater mussels and their host fish, and allow managers to target conservation efforts appropriately.

Western pearlshell (*Margaritifera falcata*) in the Middle Fork John Day River, OR.

28. Novak, M. *Yellowstone and Snake River cutthroat trout distribution in the Snake River headwaters of Wyoming.* The goal is to document the geographic distributions of Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*, YSC) and Snake River cutthroat trout (*O. c.* subsp., SRC) in the Snake River headwaters of Wyoming.

Annual inventory accomplishments have averaged approximately 425 km in 75 streams totaling approximately 2,600 km (1,500 mi) in 450 fish bearing streams between Palisades Reservoir and Jackson Lake Dam since 1998. In 2004 sampling was completed upstream of Jackson Lake Dam within Grand Teton National Park, the John D Rockefeller Memorial Parkway, Yellowstone National Park, and the Bridger-Teton National Forest.

Surveys were made possible by availability of National Park Service inventory funds, and grants from the Greater Yellowstone Coordinating Committee and the Jackson Hole One Fly Foundation-National Fish and Wildlife Foundation Conservation Partnership. Surveys in the Salt River drainage were made possible by availability of inventory and monitoring funds from the USDA Forest Service Intermountain Region.

29. Novak, M. *Seasonal movement patterns of stream-resident cutthroat trout in the Snake River headwaters of Wyoming*. Radio telemetry was used to assess cutthroat trout mobility and post-spawning movements of 38 fish from the summer of 2003 through early winter 2004, in the Greys and Little Greys River drainages on the Bridger-Teton National Forest in northwest Wyoming. Since few YSC were captured, no distinction is made between SRC and YSC movements. Overall, cutthroat trout in the Greys and Little Greys River drainages exhibited similar weekly, seasonal, and annual patterns of movement. Ranging movements were <500 m for the majority of fish, with many remaining in the same habitat unit throughout the duration of the transmitters' life. Eighteen of the 38 fish were mortalities, never found after

release, or had their transmitters surgically removed to assess difficulties with transmitters. Most fish were relocated for several months and exhibited resident life histories. Four fish exhibited fluvial life histories, with movements of 16-21 km among 2-4 separate streams. Larger movements occurred as either post-spawning or fall migrations.

An additional 40 post-spawning fish in the Hoback River drainage were implanted with radio transmitters and relocated bi-weekly June-September 2004. Results are pending completion of fall-winter relocations in 2005.

30. Novak, M. *Subbasin Assessments*. The completion of subbasin assessments will proactively prepare the Forest for conservation efforts and updating fisheries prescriptions, standards, and guidelines during the Forest Plan revision (scheduled to begin in 2006). Drafts are completed on two subbasins (Greys-Hoback and Gros Ventre) within the Snake River headwaters basin on the Bridger-Teton National Forest and the remaining three assessments will be completed in 2005.

31. Novak, M. *Dissertation research: morphological, ecological, and genetic characteristics of cutthroat trout populations in the Snake River headwaters of Wyoming*. Data entry and analysis for ecological and morphological investigations is continuing. I began optimization of DNA to assess divergence between Yellowstone cutthroat and finespotted Snake River cutthroat trout and optimization of microsatellite primers for analysis of geographic subdivision in the Snake River headwaters. Project completion is planned for 2005.

32. Novak, M. *The ecosystem effects of introduced salmonids on high elevation lakes in the central Oregon Cascade Mountains*. This is an ongoing project to where I provide assistance and coordination support for field activities.

33. Steimle, Kai; Kershner, J. L. *Brook trout invasion ecology.* FY 2004 was the third year investigating brook trout invasion ecology in the Lost Rivers of southeast Idaho. Work in 2004 included a large sampling effort to document brook trout patterns of occurrence in relation to summer stream temperatures. We were also able to evaluate local survival patterns by recapturing the fish tagged in 2002 and 2003. We tagged additional fish

to continue monitoring local survival rates.
Brook trout from the Big Lost River in Idaho.

Our data indicate that survival rates are much higher for the allopatric brook trout in the Right Fork of Iron Bog Creek than they are for brook trout sympatric with bull trout in Mill Creek (Fig 2). This apparently reduced local survival at the invasion front for brook trout in Mill Creek may explain the apparent upstream limit of brook trout distribution in Mill Creek.

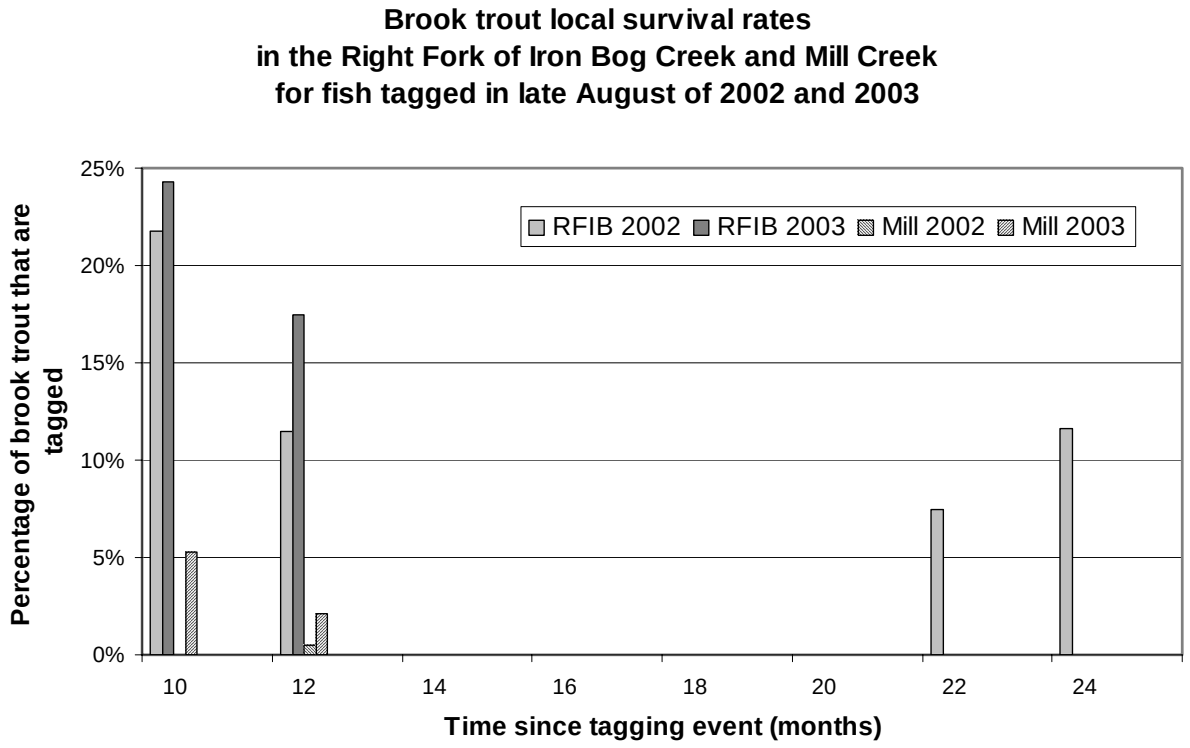


Figure 2. The local survival rates of brook trout are much higher for the allopatric brook trout in the Right Fork of Iron Bog Creek than in Mill Creek, a similar stream where brook trout are sympatric with bull trout.

Associates include: Thad Brewer Ralph Mitchell, Ciara Cusack, Jonathan Wagner, Adam Sepulveda, the Lost River Ranger District of the Forest Service and the Rocky Mountain Research Station in Boise, ID.

34. Elverud, D; Roper, B. B. *Understanding of management indicator species.* The primary objective of this study is to determine the number of stream reaches that must be sampled to establish whether a species is present in a particular stream. The goal of the project is to develop a sample design that clearly indicates whether a species is increasing or decreasing at the Forest level. In 2004 species abundance and stream habitat data were collected in seven sub-basins within Regions 1, 4, and 6. Data collection is now complete. Analysis of data from 2003 and 2004 will be completed in 2005.

35. Koenig, M.; Roper, B. B. *Evaluating cutthroat trout population status within the Teton Valley.* We worked with the Bridger/Teton National Forest, the Idaho Department of Fish and Game, and Friends of the Teton River, to evaluate populations of cutthroat trout in the upper Teton Basin. Our goal in this second and final year of this study is to identify which of a variety of threats are reducing populations. Those threats include competition with introduced species, whirling disease, degraded habitat, diversion, and lack of connectivity.

FUTURE PROJECTS

1. Kershner, J. L. *Fuels and fisheries integration.* Tools for fuels planners to integrate species conservation concerns into fuels planning will be developed in collaboration with Dave Thomas (Fuels Program Manager), and Gina Lampman, (Regional Aquatic Ecologist) from the U.S. Forest Service Intermountain Regions; Linda Wadleigh, (Fire Ecologist), U.S. Forest Service Southwest Region; Deb Bumpus, (Ecosystem Staff Officer), Apache Sitgreaves National Forest; Amy Unthank, (Regional Fisheries Program Manager), U.S. Forest Service Southwest Region; and other State, Federal, Tribal, and non-government partners.

2. Roper, B. *Integrating remote sensing applications into broad-scale aquatic/ riparian resource monitoring in the Columbia basin.* There is a critical need to understand the trajectory of aquatic and riparian resource conditions in the Columbia basin where listed threatened and endangered species occur. Currently, Regions 1, 4, and 6 of the Forest Service and the BLM state offices in Idaho and Oregon are conducting field-level monitoring to determine habitat condition. This sampling is conducted at the site level (200m) in HUC 6 watersheds. While comparisons are possible, it is often difficult to detect a change within watersheds because of the limited sampling unit. By using remotely sensed images to characterize some aspects of the riparian/aquatic condition and use field information to ground truth the imaging, we may be able to develop models to characterize “within” watershed condition. These models could assist field units with the identification of problem watersheds or watersheds that are a high priority for restoration. The use of remote sensing could provide a cost-effective means to characterize watershed condition.

3. Novak, M. *Inventory of Yellowstone cutthroat trout in the Snake headwaters basin of Yellowstone and Grand Teton National Parks.* This planned inter-agency effort is a projected one-year continuation of our ongoing inventory on the Bridger-Teton National Forest and has been identified by the National Park Service (NPS) as a part of the Greater Yellowstone Network Inventory Study Plan. This will likely be a coordinated effort with the Wyoming Game and Fish Department, and the Bridger-Teton National Forest to complete the inventory within the Snake River and Yellowstone River headwaters upstream of Yellowstone Lake.

4. Novak, M. *Conservation Strategy for cutthroat trout.* I plant to initiate a conservation strategy for Yellowstone and Snake River cutthroat trout in the Snake River headwaters of Wyoming

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Bragg, D. C.; Kershner J. L. 2004. Sensitivity of a large woody debris recruitment model to the number of contributing banks and tree fall pattern. Western Journal of Applied Forestry. 19:117-122.

Hilderbrand, R. H; Kershner, J. L. 2004. Diets of brook trout and cutthroat trout, invertebrate drift, food selection, and diet overlap between Bonneville cutthroat trout and nonnative brook trout in Beaver Creek, Idaho. North American Journal of Fisheries Management. 24: 33-40.

Kershner, J. L.; Roper, B. B.; Bouwes, N.; Henderson, R. C.; Archer, E. A. 2004. An analysis of stream habitat conditions in reference and managed watershed on some federal lands within the Columbia River basin. North American Journal of Fisheries Management. 24: 1363-1375.

Mock, K. E.; Brim-Box, J. C.; Miller, M. P.; Downing, M. E.; Hoeh, W. R. 2004. Genetic diversity and divergence among freshwater mussel (*Anodonta*) populations in the Bonneville basin of Utah. Molecular Ecology. 13: 1085-1098.

Roper, B. B.; Kershner, J. L.; Henderson, R. C. 2003. The value of using permanent sites when evaluating steam attributes at the reach scale. Journal of Freshwater Ecology. 18: 585-592.

Schmidt, J. C.; Brim-Box, J. C. 2004. Application of a dynamic model to assess controls on age-0 Colorado pike minnow in the middle Green River, Colorado and Utah. Annals of the Association of American Geographers. 94: 458-476.

Whalen, J. K. 2004. A risk assessment for crayfish conservation on National Forest lands in the eastern United States. Harrisonburg, VA: James Madison University. 126 p. Thesis.

MANUSCRIPTS SUBMITTED

Brim Box, J. C.; Wolf, D.; Howard, J.; O'Brien, C.; Nez, D.; Close, D. Submitted. Freshwater mussels (Bivalvia: Unionoida) of the Umatilla and Middle Fork John Day Rivers in eastern Oregon. Northwest Science.

Brim Box, J. C.; Chappell, S.; McFarland, M.; Furnish, J. Submitted. The aquatic mollusk fauna of the Lassen National Forest in northeastern California. Gen. Tech. Rep. U.S. Department of Agriculture, Forest Service.

Colyer, W. T.; Kershner, J. L.; Hilderbrand, R. H. Accepted. Movements of fluvial Bonneville cutthroat trout in the Thomas Fork of the Bear River, Idaho-Wyoming. North American Journal of Fisheries Management.

Hilderbrand, R. H.; Kershner, J. L. Accepted. Are there differences in growth and condition between mobile and resident cutthroat trout? Transactions of the American Fisheries Society.

Hilderbrand, R. H.; Kershner, J. L. Submitted. Interferences and condition-specific competition between Bonneville cutthroat trout and non-native brook trout. Canadian Journal of Fish and Aquatic Sciences.

Hudy, M.; Whalen, J. K.; Theiling, T. In Press. A large-scale risk assessment of the biotic integrity of native brook trout watersheds. September 20-22, Proceedings of Wild Trout 8, Yellowstone National Park.

Hudy, M.; Whalen, J. K.; Coffman, J. S.; Gibson-Reinemer, D. K.; Smith, E. P. Submitted. Impacts of culverts on resident fish assemblages in forested watersheds. North American Journal of Fisheries Management.

Scarnecchia, D. L.; Roper, B. B. In Press. Patterns of vertebrate diversity, density, and biomass among ten small streams in the South Umpqua River basin, Oregon. Northwest Science.

Thode, A.; Kershner, J. L.; Roby, K. R.; Decker, L. M.; Beyers, J. In Review. Watershed Resources and Aquatic Systems. In: Sugihara, Neil; Fites-Kaufman, JoAnn; Shaffer, Kevin; Thode, Andrea; Van Wagtendonk, Jan, eds. Fire in California ecosystems. Berkeley, CA: University of California Press.

POSTERS AND PRESENTATIONS

Brim Box, J. 2004. Tying it all together: where east meets west. Second Annual Workshop of the Freshwater Mussels of the Pacific Northwest, April 20, Vancouver, WA.

Brim Box, J.; Wolf, D.; Howard, J.; O'Brien, C. 2004. Freshwater mussels of the Umatilla and Middle Fork John Day Rivers: a tale of two drainages. Oregon Chapter American Fisheries Society 40th Annual Meeting, February 18-20, Bend, OR.

Coffman, J. S.; Hudy, M. 2004. Evaluation of a predictive model for upstream fish passage through culverts. Annual Meeting of the Virginia Chapter of the American Fisheries Society, March 18-19, Lexington, VA.

Coffman, J. S.; Hudy, M. 2004. Evaluation of a predictive model for upstream fish passage through culverts. Annual Meeting of the American Fisheries Society, August 12, Madison, WI.

Hudy, M.; Whalen, J. K.; Theiling, T. 2004. A large-scale risk assessment of the biotic integrity of native brook trout watersheds. Wild Trout 8, Yellowstone National Park, September 23, Yellowstone, WY.

Hudy M.; Downey, D. M.; Whalen, J. K. 2004. Successful restoration of an acidified native brook trout stream through mitigation with limestone sand: ten years later. Annual meeting of the Virginia Chapter of the American Fisheries Society, March 18-19, Lexington, VA.

Hudy M.; Whalen, J. K. 2004. A large-scale risk assessment of the biotic integrity of native brook trout watersheds. Annual meeting of the Virginia Chapter of the American Fisheries Society, March 18-19, Lexington, VA.

Hudy, M. 2004. Aquatic organism passage. Annual meeting of the West Virginia Chapter of the American Fisheries Society, February 4-6, Clarksburg, WV.

Kershner, J. L.; Roper, B. B.; Henderson, R. C.; Archer, E. 2004. Developing a broad-scale, effectiveness monitoring program to evaluate land use effects on aquatic and riparian resources in the Columbia River basin: an integrated approach to plan development and implementation. Monitoring Science and Technology Symposium, September 22-23, Denver, CO.

Kershner, J. L. 2004. Invasives in riparian ecosystems: non-native trout. Society of Range Management annual meeting, January 29, Salt Lake City, UT.

Kershner, J. L.; Decker, L. M.; Winters, D. 2004. An evaluation of the short-term effects of the Hayman fire on aquatic ecosystems. Oregon chapter of the American Fisheries Society 40th annual meeting, February 18-20, Bend, OR.

Landes, C. R.; Hudy, M.; Downey, D. M. 2004. Water chemistry and response of fish to liming of Mountain Run. Annual meeting of the Virginia Chapter of the American Fisheries Society, March 18-19, Lexington, VA.

Shiflet J.; Johnson, N.; Hallerman, E.; Hudy, M. 2004. Inference of parentage for young-of-year brook trout *(Salvelinus fontinalis*) in an isolated population. Annual meeting of the Virginia Chapter of the American Fisheries Society, March 18-19, Lexington, VA.

Whalen, J. K.; Hudy, M. 2004. Use of a rarity-weighted richness index for large-scale assessments: crayfish in USDA Forest Service watersheds in the eastern U.S. Annual meeting of the Virginia Chapter of the American Fisheries Society, March 18-19, Lexington, VA.

REPORTS FILED

Brim Box, J.; Wolf, D.; Howard, J.; O'Brien, C.; Nez, D.; Close, D. 2004. Distribution and status of freshwater mussels in the Umatilla River system. 2002-2003 Annual Report, Project No. 200203700, (PPA Report DOE/BP-00011402-1). 74 electronic p.

Novak, M. 2004. Yellowstone cutthroat trout and Snake River cutthroat trout distribution in the Snake River headwaters of Wyoming. Annual reports to Wyoming Game and Fish Department, Bridger-Teton National Forest, National Elk Refuge, Grand Teton National Park, Greater Yellowstone Coordinating Committee (State and Federal Inter-Agency), and the U.S. Forest Service Inland Cutthroat Trout Coordinator.

EFFECTIVENESS MONITORING PROJECT FOR PACFISH AND INFISH (PIBO)

DESCRIPTION

An interagency team of specialists was designated to develop a plan that will monitor the effects of land use activities on aquatic and riparian resources. There are three components of the plan; implementation monitoring, effectiveness monitoring, and validation monitoring. Our group is responsible for developing the "effectiveness" monitoring component of the PACFISH/INFISH/ bull trout/steelhead monitoring plan.

The primary goal of the effectiveness monitoring component is to assess whether management (as directed by aquatic conservation strategies), are effective in maintaining or improving aquatic and riparian conditions on federal lands. The program began in 1998 as a pilot study and has expanded to comprise most Forest Service and Bureau of Land Management lands, containing listed species, within the interior Columbia River basin. This area includes 20 National Forests within Regions 1, 4, and 6; and three State offices of the BLM.

In 2002 the program received partial funding and we collected data in 142 watersheds for a total of 194 sites.

Beginning in 2003 the Effectiveness Monitoring project received full funding and collected data in 309 sub-watersheds for a total of 395 separate sites. In 2004 the program sampled 385 sites in 304 sub-watersheds. The total number of sites includes Integrator reaches (Fig. 3) established at the bottom of the sub-watershed, grazing designated monitoring areas (DMA's) (Fig. 4), and quality assurance sites. Site locations are broken down by BLM State Offices, Forest Service Regions, BLM Districts, and Forests (Tab. 1).

At each site, a three-person crew collects information on a suite of physical stream habitat parameters, riparian vegetation composition, and macroinvertebrates. In addition, hourly water temperature is recorded for the mid-summer period between July 15 and September 1. For a complete list and description of methods used see our web site.

In 2004 we completed our yearly Quality Assurance/Quality Control (QAQC) component of the study, where 22 sites are double sampled by two different crews. All information with the exception of macroinvertebrates was collected at these sites. These sites were randomly chosen from our sentinel sites.

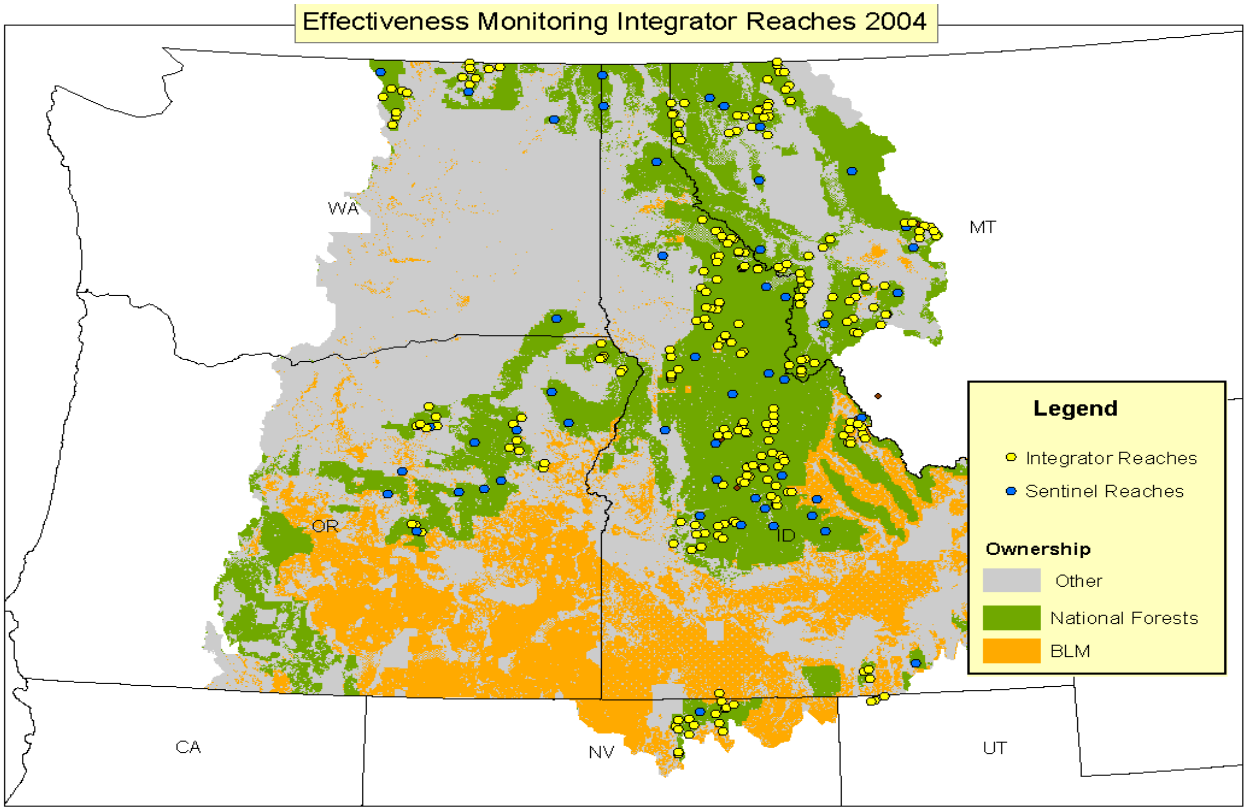

Figure 3. Integrator reaches sampled by Effectiveness Monitoring project during 2004.

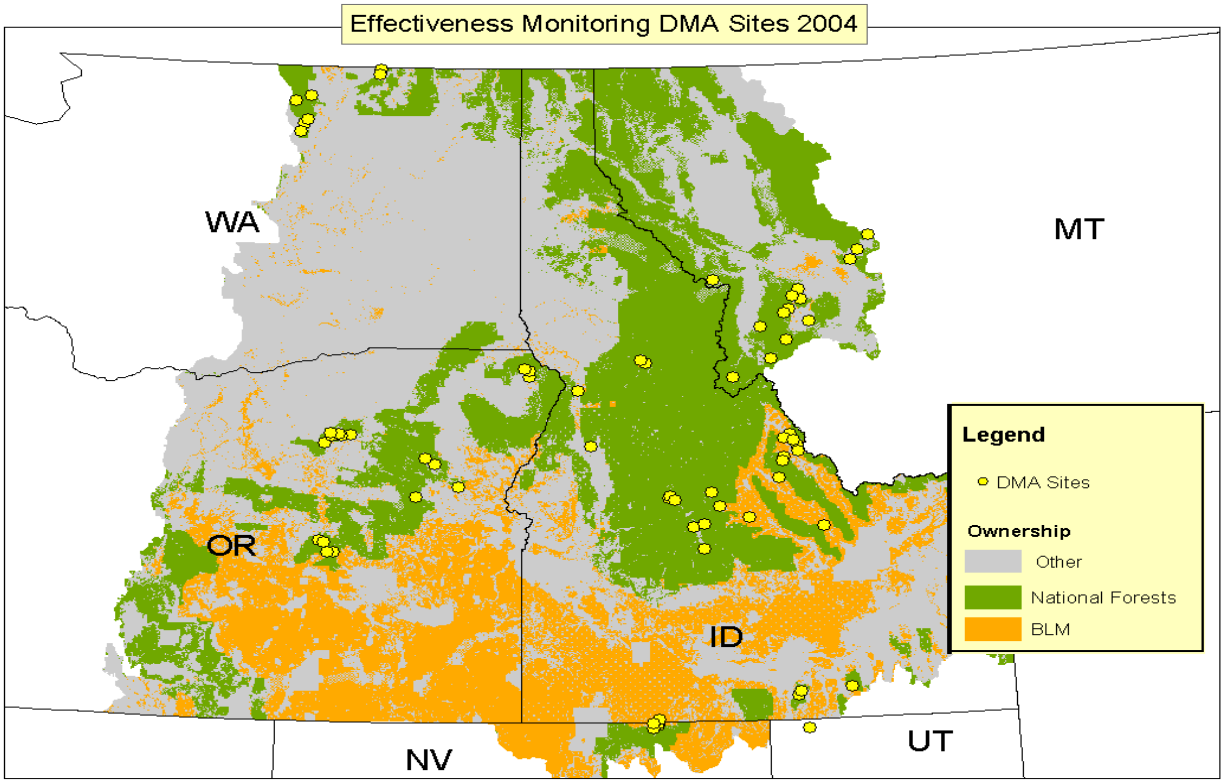

Figure 4. Designated Monitoring Area (DMA) sites sampled by Effectiveness Monitoring project during 2004.

Table 1. Total number of managed integrator sites, reference integrator sites, and designated monitoring areas (DMA's) sampled in 2004, by BLM District and by Forest Service Regions.

State Office/ FS Region	Forest / BLM District	Integrator Managed	Integrator Reference	DMA
NV BLM	Mountain City	1	0	3
ID BLM	Idaho Falls	10	0	9
	Coeur d'Alene	1	0	4
	Twin Falls	1	0	1
	Total ID & NV BLM	**13**	**0**	**17**
OR-WA BLM	Burns	0	0	0
	Lake View	0	0	0
	Prineville	4	0	0
	Vale	0	0	0
	Total OR BLM	**4**	**0**	**0**
Region 1	Bitterroot	9	8	3
	Clearwater	14	11	0
	Deerlodge	11	5	7
	Flathead	16	3	0
	Helena	5	5	3
	Kootenia	12	2	0
	Lolo	5	4	0
	Nez Perce	12	3	0
	Panhandle	8	3	0
	Total Region 1	**92**	**44**	**13**
Region 4	Boise	16	2	0
	Humboldt-Toiyabe	14	1	0
	Payette	4	5	1
	Salmon-Challis	10	21	6
	Sawtooth	13	3	7
	Total Region 4	**57**	**32**	**14**
Region 6	Colville	4	0	0
	Malheur	7	1	4
	Ochoco	1	0	0
	Okanogan	12	2	7
	Umatilla	5	2	7
	Wallowa-Whitman	16	2	7
	Total Region 6	**45**	**7**	**25**
QAQC	**Quality Assurance (repeat sites)**	**13**	**9**	**0**
	Grand Total 2004	**224**	**92**	**69**

Web site: a complete description of who we are, sampling methods, annual reports, publications, and employment opportunities can be found on our website at http://www.fs.fed.us/biology/fishecology/emp/index.html.

SPECIAL PROJECTS

1. *Weeds.* In 2003, we began reporting the presence of weeds along the greenline and within the riparian area. However,

because only a sub-sample of the stream reach is sampled, and because early weed species can be patchy, we were interested in defining the accuracy of the weeds data we report. In 2004, at 34 of our normal sample sites we collected additional information to help understand the relevance of the weed information we were reporting. This information will help determine how well our existing riparian monitoring detects the presence or absence and abundance of weed species. This study will also allow us to look at observer variability associated with our approach and compute a confidence interval for the weed data presented.

2. *Region 1 Bank Disturbance Methods*. In 2003, we conducted an assessment of several methods used to measure current year streambank alteration by livestock (Heitke et al., submitted). The results were used by a Forest Service team in Region 1 to develop a standardized sampling method for the region. In 2004 we conducted an assessment of this method along with several other approaches. This year's assessment examined three bank alteration methods to estimate the three sources of variability: a) among observer variability using the same method, b) variability between methods, and c) within observer variability at a site. For this study 10 sites where sampled on the Beaverhead-Deerlodge and Lewis and Clark National Forests. We expect to complete the report by April 1, 2005. Funding was provided by the Fish and Aquatic Ecology Unit.

3. *Additional DMA Sites.* Idaho BLM provided funding to sample 15 of their high priority DMA's each year. Sites are selected by the field units and re-sampled every three years. The information collected at these sites will be summarized and included in the project annual report, but will not be included in analyses of randomly chosen PIBO sites. This effort will help Idaho BLM meet regulatory obligations and provide useful information on the condition of these sites.

4. *Plant identification accuracy.* We continue to evaluate the accuracy of plant identification by the field technicians. In 2004 we collected specimens of two of the dominant species at each site. Those specimens, as well as specimens collected from random quadrats, are evaluated in the laboratory to determine if the technician recorded the correct genus and species. A subset of the specimens has also been sent to experts for verification. Preliminary results suggest that plant identification accuracy increased through the field season. Verification of plant specimens collected in the field adds to our information about the site vegetation, pinpoints challenging species to address in future training, and indicates species for which field identification is impractical.

5. *Weed Survey*. A detailed weed survey was conducted at a subset of our sites during the 2004 field season to determine how often weeds are undetected with our current methods. Two weed identification experts completed the weed surveys, which included repeat visits to the same sites by the two different botanists. This will allow comparisons between the two experts as well as the comparison of the survey to our normal methods.

6. Whitacre, H.; Roper, B. B. *Comparison of observer precision and protocol methodologies for physical habitat on Oregon and Idaho streams*. The objective of this study was to compare results of several stream survey methods to determine which methods provide the highest degree of repeatability among crew members. Our goal is to development a core set of physical attributes and measurement techniques that most consistently describe physical stream habitat.

Compared protocols included: Aquatic and Riparian Effectiveness Monitoring Program (AREMP) for the Northwest Forest Plan; PACKFISH/INFISH Biological Opinion (PIBO) in the Columbia River basin; and the Environmental Monitoring and Assessment Program (EMAP), developed by EPA and used by Idaho and Oregon state Departments of Environmental Quality (DEQ), and Forest Service Regions 6, 10, and 4. In 2002, six streams were surveyed by crews from the PIBO monitoring team; AREMP; Regions 1, 4, 6, and 10 stream survey crews; Oregon DEQ crews; and Idaho DEQ crews. Analysis in 2003 indicated that protocols for measuring percent pools, width to depth ratio, and percent undercut bank were imprecise, suggesting new techniques may be necessary or inclusion of these attributes in a monitoring program may not be useful. This project was completed in 2004 and is available as a thesis (Whitacre 2004).

FUTURE PROJECTS

1. In FY 2005, the Effectiveness Monitoring project will select sites and sample in an additional 250 6th level sub-watersheds. In early spring we will meet with field office personnel to discuss 2005 sampling locations. In addition we will re-sample the 50 sentinel sites that are repeated each year and complete our standard 25 quality assurance/ quality control sites (double sampling by two separate crews).

2. Coles-Ritchie, M. *Bank stability rating for riparian plant species*. There is a need for a rating of streamside vegetation in terms of its ability to stabilize streambanks. We are seeking to address this need by identifying relationships between vegetation and bank characteristics at our study sites where these data were collected at the same points. We will use this empirical data to develop a bank stability rating for the dominant species found along streams.

3. Coles-Ritchie, M. *Repeatability tests.* We continue to evaluate the repeatability of our riparian vegetation sampling methods by sending two different technicians to the same site to collect data. This was done for 22 sites, and the data for the two technicians at the same site is now being compared. This is a follow-up to our study on riparian vegetation sampling, which evaluated earlier methods of riparian sampling (Coles-Ritchie et al. 2004). Preliminary analyses indicate that the modifications in the protocol have improved the repeatability of the vegetation data.

PERSONNEL

Richard C. Henderson has worked for the U.S.D.A., Forest Service, Fish and Aquatic Ecology Unit in Logan, UT since 1998. He is currently the project manager for the Effectiveness Monitoring Project. Rick earned his B.S. degree in fisheries biology from Colorado State University Fort Collins, in 1992. In 1998 he received his M.S. degree in fisheries biology from Utah State University, Logan. Thesis title: Spawning strategies and hybridization potential of cutthroat, rainbow, and hybrid trout in a large river.

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Eric K. Archer joined the Forest Service as a fisheries biologist in 1999. He is the supervisor of field operations and data analyst for the Effectiveness Monitoring project in Logan, UT. Eric received a B.S. degree in fisheries management in 1996 and a M.S. degree in aquatic ecology in 1999 from Utah State University, Logan. Thesis title: Effects of food availability and competition on age-0 Colorado pike minnow growth and lipid stores in the San Juan River.

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Boyd A. Bouwes joined the Forest Service in 1999 as field crew supervisor and GIS specialist for the Effectiveness Monitoring Project. He is stationed at the Forest Service office in McCall, ID. Boyd received a B.S. degree in geography from the University of Wisconsin, Madison, and a M.S. in biogeography from Portland State University, OR. Thesis title: Role of riparian vegetation in stabilizing stream banks.

Email: babouwes@fs.fed.us

Marc Coles-Ritchie is a Ph.D. candidate under Dr. Kershner, in vegetation ecology at Utah State University, in Logan, and has been funded by the Effectiveness Monitoring Project since 1999. He is currently managing the riparian vegetation sampling portion of the project. Marc's dissertation title will be: Evaluating the influence of livestock grazing on riparian vegetation in the Upper Columbia River basin. He received a B.A. in comparative literature from the University of Massachusetts, Amherst,

and an M.S. in environmental studies from Bard College, Annandale-on-Hudson, NY. Thesis title: Analysis of non-timber extractive products from tropical forests: the Tagua example in Ecuador.

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Greg Kliewer has been a computer technician for the Effectiveness Monitoring Project since 2001. He manages the project database and computer systems. Greg earned a B.A. degree in philosophy from Calvin College, Grand Rapids, MI, and a Ph.D. in philosophy from the University of Southern California, Los Angeles. Dissertation title: Role of neutral concepts in our thinking about color. Greg is currently working on a M.S. in computer science from Utah State University, Logan.

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Jeremiah Heitke joined the Effectiveness Monitoring program as a field crew member in 2003. Jeremiahs dedication, attention to detail and hard work has elevated him to head field supervisor for the project. He is presently responsible for many aspects of report preparation, crew training, crew logistics, and overall data quality. Jeremiah graduated from the University of Wisconsin, Stevens Point with a B.S. in fisheries biology in 1998. He also completed a M.S. in 2002 from Iowa State University. Thesis title: In-stream and riparian habitat relationships in Iowa streams.

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Dax Dugaw joined the Effectiveness Monitoring program as a field team member in 2000. Since that time Dax's enthusiasm, people skills, and attention to detail has allowed him to fulfill many roles on the project including: crew member, scout, and scout supervisor. Dax also leads our QA assessment of the field data during the fall and winter. Dax graduated in 1999 with a B.S. from Utah State University, Logan, in watershed ecology.

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Heath Whitacre was a M.S. graduate student under Dr. Kershner and Dr. Roper, in watershed science at Utah State University, Logan. He earned a B.S. in environmental biology from Fort Lewis College, Durango, CO in 1995. His thesis title is: Comparison of U.S. Forest Service and EPA stream protocol methodologies and observer precision for Oregon and Idaho streams. Heath completed his thesis and defended in 2004. Heath is now working for the U.S. Forest Service, Region 10 in Alaska.

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Deanna K. Vinson has been the program assistant for the Effectiveness Monitoring Project since 2001. She manages the project budget and provides editorial review of unit documents. Deanna earned a B.S. degree in both resource management and wildlife from the University of Wisconsin, Stevens Point in 1979, and a M.S. in aquatic ecology from Idaho State University, Pocatello in 1988. Thesis title: Diatom species composition along a thermal gradient in the Portneuf River, USA.

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Summer field crews. The project employed 45 seasonal crew members during the summer of 2004 to collect physical habitat measurements and assess riparian vegetation. Most are college students or recent graduates in natural resources from throughout the U.S.

Effectiveness Monitoring field sampling crew 2004. Eric K. Archer, Tony Burrows, Andy Hill, Heath Whitacre, Boyd Bouwes, Allie Kelly, Ryan Colyer, Ralph Mitchell, Luca Adelfio, Paul Schwartz, Erik J. Archer, Ryan Leary, Ryan Salem, Missy Barnes, Sarah Kingsporn, Dax Dugaw, Jeremiah Heitke, Jacob Riley, Nicholas Weber, Sarah Quistberg, Sabrina Rust, Tyler Ramaker, Benjamin Wright, Holly Truemper, Richard Wathen, Keyna Bugner, Kipp Marzullo, Jade Alicandro, Allison Berry, Annie Birnie, Ariel Muldoon, Diane Menuz, Greg Kliewer, Greg Huchko, Jeff Lebrun, Jonathan Wagner, Julie Vincigue, Kirk Lambrecht, Kyle Steele, Marina Whitacre, Matthew Peters, Olivia Carter, Sarah Brandy, Sheherezade Adams, Stewart Wechsel, Tyler Logan, Zacchaeus Compson, Brett Connell, Jacob Schaub, Ralph Mitchell, Kate Metzger, Jamie McEvoy, Abigail Jensen, and Marc Coles-Ritchie.

MANUSCRIPTS PUBLISHED

The program, associated scientists, and graduate students have produced publications to help distribute program results to land management and regulatory agency personnel, other monitoring programs, and the scientific community. Six articles have been published and five others have been submitted. The PIBO monitoring plan (Kershner et al. 2004) outlines the foundation and design of the program. Other articles focus on our efforts to assess observer variability in sampling methods (Archer et al. 2004; Coles-Ritchie et al. 2004; Roper et al. 2002), sources of variability associated with particle counts (Olsen et al., submitted), evaluations of riparian vegetation data (Coles-Ritchie, dissertation; Coles-Ritchie, submitted), comparisons of different sampling methods (Whitacre 2004; Heitke et al., submitted), the benefits of sampling permanent sites (Roper et al. 2003), and a comparison of managed and reference sites for physical habitat attributes (Kershner et al. 2004). Finally, we have produced a "6 Year Status Report" that provides an overview of the program and summarizes accomplishments from 1998 through 2003. All publications can be found on our website at: http://www.fs.fed.us/biology/fishecology/emp.

Archer, E. K.; Roper, B. B.; Henderson, R. C.; Bouwes, N.; Mellison, S. C.; Kershner, J. L. 2004. Testing common stream sampling methods for broad-scale, long-term monitoring. Gen. Tech. Rep. RMRS-GTR-122. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 15 p.

Coles-Ritchie, M.; Henderson, R. C.; Archer, E. K.; Roper, B. B.; Kennedy, C.; Kershner, J. L. 2004. The repeatability of riparian vegetation sampling methods: how useful are these techniques for broad-scale, long-term monitoring? Gen. Tech. Rep. RMRS-GTR-138. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 15 p.

Kershner, J. L.; Coles-Ritchie, M.; Cowley, E.; Henderson, R. C.; Kratz, K.; Quimby, C.; Ulmer, L. C.; Vinson, M. R. 2004. Guide to effective monitoring of aquatic and riparian resources. Gen. Tech. Rep. RMRS-GTR-121. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 57 p.

Whitacre, H. 2004. Comparison of USFS and EPA stream protocol methodologies and observer precision for physical habitat on Oregon and Idaho streams. Logan, UT: Utah State University. 72 p. Thesis.

MANUSCRIPTS SUBMITTED

Coles-Ritchie, M. C. Submitted. Evaluation of riparian vegetation data and associated sampling techniques. Logan, UT: Utah State University. 204 p. Dissertation.

Coles-Ritchie, M. C.; Roberts, D. W.; Kershner, J. L.; Henderson, R. C. Submitted. A wetland rating system for evaluating riparian vegetation. Journal of the American Water Resources Association.

Heitke, J. D.; Henderson, R. C.; Roper, B. B.; Archer, E. K. Submitted. Comparison of three streambank alteration assessment methods. Journal of Rangeland Ecology and Management.

Henderson, R. C. Submitted. PIBO effectiveness monitoring program: 6 year status report 1998 – 2003. Gen. Tech. Rep. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Olsen, D. S.; Roper, B. B.; Kershner, J. L.; Henderson, R. C. Archer, E. K. Accepted. Sources of variability in pebble counts: why differences among observers may not matter. Journal of the American Water Resources Association.

POSTERS AND PRESENTATIONS

Archer, E. K.; Bouwes, B. B; Henderson, R. C. 2004. Over 30 presentations were given to individual National Forests and BLM Resource areas. Presentations provided an overview of the Effectiveness Monitoring Project, answered field unit questions, and facilitated distribution of annual reports.

Coles-Ritchie, M. C. 2004. Monitoring the effects of management on riparian vegetation in the upper Columbia River basin. Riparian Buffers Conference American Water Resources Association, June 30, Squaw Valley, CA.

Coles-Ritchie, M. C. 2004. Testing the repeatability of a modified riparian monitoring protocol. Society for Range Management, January 27, Salt Lake City, UT.

Coles-Ritchie, M. C. 2004. Monitoring the effects of management on riparian vegetation in the upper Columbia River basin. Western Division American Fisheries Society, March 4, Salt Lake City, UT.

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The Effectiveness Monitoring Project produces annual reports for each of the 20 National Forests, three Forest Service Regions, and three BLM State Offices.

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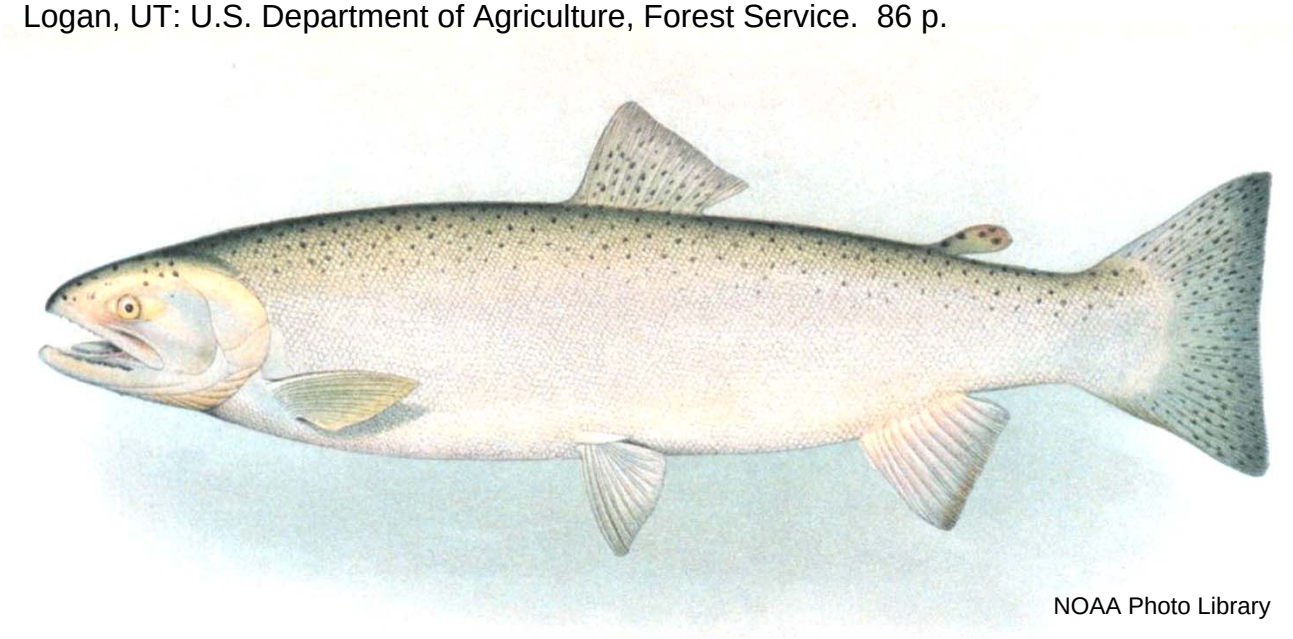

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