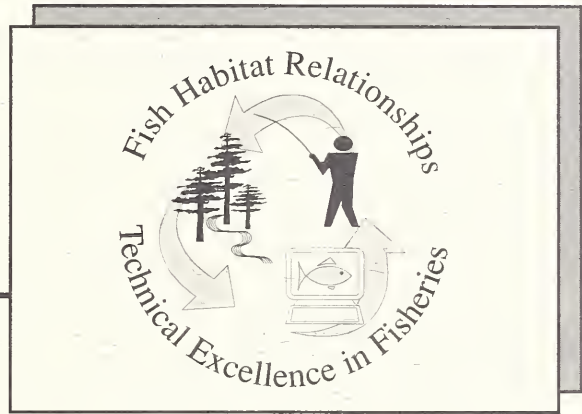


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FHR Currents...

Fish Habitat Relationships Technical Bulletin
Number 16 September 1994



Annual Accomplishment Report -- 1993 Fish Habitat Relationships Program

Purpose

Effective management of the diverse and complex aquatic resources on National Forest system lands requires biologists to have the best possible understanding of aquatic ecosystems and the processes that influence aquatic resources. The Fish Habitat Relationships (FHR) Program provides a broad framework for the development and dissemination of this technology to biologists. The following is the annual report of the USDA Forest Service, Fish Habitat Relationships Program. This is a summary of the accomplishments from the national FHR program, as well as Regions 1,2, 4, 5 and 6, for Fiscal Year 1993.

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FHR Currents Purpose

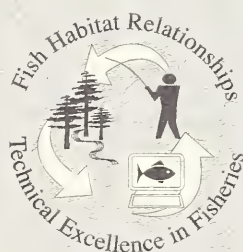
The USDA Forest Service Fish Habitat Relationships Program was established to further the development of fisheries technology and transfer this technology to field biologists. With ever increasing demands for natural resources, protection and management of aquatic communities requires biologists to be knowledgeable of current research findings and state-of-the-art techniques. The purpose of *FHR Currents* is to provide a vehicle to quickly disseminate information important to field-level biologists in the USDA Forest Service.

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This was a year of transition for FHR professionals, both regionally and nationally. The National Aquatic Ecosystem Management Lab became fully operational during 1993 with offices in Logan and Provo, Utah. Glenn Chen was added to the staff in Logan during the year. We welcomed Bryce Rickel (Region 3) and Ron Dunlap (Region 10) back to regional FHR positions. We look forward to expanded efforts from both of these programs. Rich Torquemada (Region 1 - FHR) moved to the Bitterroot National Forest and was replaced by Brian Sanborn and Kathy Moynan on a temporary basis. Dave Fuller, the technical editor of the FHR Currents, accepted a job with the BLM in Arcata, California. He will be sorely missed.

This was also a year where FHR personnel and information played a significant role in major resource issues. FHR personnel were highly involved in the President's plan for the northwest (Federal Ecosystem Management Assessment - FEMA), the Pacific Fish Strategy (PACFISH), and the creation and implementation of "Watershed Analysis" as part of the FEMA effort. In addition, FHR personnel were heavily involved in the Habitat Conservation Assessments for bull trout and inland cutthroat trout, as well as efforts in the Columbia River Basin. As you will see, the program has expanded its efforts in every area. We've developed more technical applications and expanded our technology transfer efforts in an attempt to meet the needs of biologists in all regions. We look forward to 1994 as a year where our programs will continue to provide high quality technical products and aggressive technology transfer. We hope you enjoy this report. For information regarding national products and programs, please contact us here in Logan. For regional products please contact the regional representative listed on the inside cover of this bulletin.

Background

In 1981, a national steering committee was established to develop a program to provide systematic methods for evaluating fish and wildlife habitats and applying that information in land management planning and project decisions that affect fish and wildlife habitat. In 1982, at the recommendation of the steering committee, a Wildlife and Fish Ecology Group was established to develop a framework for what was to become the Wildlife/Fish Habitat Relationships Program.

The primary goal of the Fish Habitat Relationships Program is to promote, "Technical Excellence in the Forest Service Fisheries Program." There are two primary elements identified in the program:

1. The development of technology to assess fish habitat condition and understand fish habitat relationships.
2. The transfer of technology to fisheries biologists in the field.

The National Fish Habitat Relationships (FHR) program is currently based at Utah State University in cooperation with the Fisheries and Wildlife Department, College of Natural Resources. Regional programs are located in six of the nine Forest Service regions. In addition, Regions 1 and 4 of the Forest Service, in cooperation with the Intermountain Forest and Range Experiment Station, have a technology development/transfer specialist operating within the FHR program.

In addition, research scientists from Forest Service Research played a key role in technology development and technology transfer within the FHR program. We would like to acknowledge Danny Lee, Jack McIntyre, Bruce Rieman, and Russ Thurow from the Intermountain Research Station, Mike Young from the Rocky Mountain Station, Tom Lisle and Kathleen Matthews from the Pacific Southwest Station, Gordon Reeves, Jim Sedell, and

Kelly Burnett from the Pacific Northwest Station, Andy Dolloff and Pat Flebbe from the Southeast Station, and Clay Edwards from the North Central Station as important contributors to the FHR program.

Technology Development

In 1993 there were 68 technology development projects initiated or ongoing in the FHR program. These projects were cooperatively carried out with 25 national forests, five research stations and seven universities. The following are the summaries for technology development in the national and regional FHR programs.

National FHR Program

1. Hawkins, C.P. and D.W. Carlisle. Classification and management strategies for high mountain lakes in the Uinta Mountains.

The objectives of the project are to develop cost effective inventory strategies and management prescriptions for high mountain lakes. One year of survey data has been collected and is being analyzed. Expected products are a cost-effective inventory procedure and analysis technique for high mountain lakes. This project is jointly sponsored by the Wasatch-Cache National Forest and the FHR unit. Project completion is expected in summer 1994.

2. Crowl, T. A. and J. L. Kershner. A hierarchical approach to understanding variables that limit fisheries in watersheds.

The objective of the project is to develop a system to analyze among stream and within stream standardized variables that will allow resource managers to identify factors that potentially limit fish abundances and distribution. Analyses can be

conducted on many different scales of data. There is currently an operational model being tested. This model and documentation are available. This project is jointly sponsored by the Intermountain Region and the FHR unit.

4. Kershner, J. L. and D.P. Horan. Developing silvicultural prescriptions for fish habitat objectives in the north slope Uinta Mountains.

The objective of the project is to develop silvicultural prescriptions to maintain long-term inputs of debris into stream systems. This project is currently finishing the first year and is jointly sponsored by the Wasatch-Cache National Forest, Intermountain Region and the FHR unit. Expected completion of this project is December 1994.

5. Black, R. W., J.L. Kershner and T. A. Crowl. A habitat restoration and recovery template for the Colorado River cutthroat trout in the Uinta Mountains.

The objectives of the project are to determine what habitat factors are important to maintain viable populations of Colorado River cutthroat trout and how historic log drives have influenced stream habitat condition. This information will be used to develop a restoration template for habitat in streams. Currently we have two phases under way. The first is looking at the influence of woody debris on the distribution and abundance of cutthroat trout; and the second is developing landscape level prescriptions to manage riparian habitats and recruit woody debris into streams. This project is jointly sponsored by the Intermountain Region and the FHR unit. This is year two of the three year project. Presentations from this work have been given at regional AFS meetings, the North American Benthological Society national meeting, and the annual Desert Fishes

Council meeting. We have incorporated this work into our continuing education courses. A two year summary report is available. Expected completion of this project is December 1994.

6. Bartz, K. L. and J. L. Kershner. The applicability of using aerial videography in classifying riparian habitats.

The objective of this project, sponsored by the FHR unit, is to assess the viability of aerial videography to classify riparian habitat. Aerial videography has been used as a low cost method to classify vegetation and has been shown to be a valuable long term monitoring tool in agriculture. We used aerial videography to classify riparian complexes and as the initial input mapping to Geographic Information Systems (GIS). The second phase of our project is to determine the applicability of the method to classify stream habitats. The Master's thesis for the project is complete. The presentation of the work was given at a national Remote Sensing workshop in May 1992 and a conference on the application of aerial videography in 1993. There are two publications available from the FHR unit.

National Aquatic Ecosystem Monitoring Center

1. Vinson, M. Development of a dBase program to analyze aquatic macro-invertebrate biomonitoring samples.

The objective of this project was to develop a PC-based program to analyze aquatic macro-invertebrate samples collected as part of water quality biomonitoring protocols. This program was written in dBase and uses macroinvertebrate taxa lists obtained from laboratory analysis of collected samples. It will generate most all of the indices currently being used in state and federal agencies, including a variety of community

richness, diversity, and abundance measures (taxa richness, abundance, family level measures, Shannons H', Margalef's Index, Menhinicks Index, dBar, Simpson's D, Lidwig/Reynolds Evenness); the EPT (Ephemeroptera/Plecoptera/Trichoptera) index; the Forest Service BCI (Biotic Condition Index); the modified Hilsenhoff Biotic Index; the Forest Service CTQ (Community Tolerance Quotient); functional feeding group classification; indices in the EPA Rapid Bioassessment Level III protocols; relative taxon pollution tolerance; and voltinism. The program also generates the report that presents the results of macroinvertebrate samples sent to the Logan analysis laboratory, which includes all of the metrics, a generalized discussed of their interpretation, taxa lists, and an extensive literature list.

2. Chen, G., F. Mangum, J. Kershner, R. Brassfield, L. Lefferts, D. Scully, and M. Johnson. A strategy for monitoring the effectiveness of the Elk Valley (Montpelier Ranger District) grazing allotment plan.

The objective of this project is to develop a plan for monitoring the effectiveness of a revised allotment plan to protect the stream habitat of sensitive Bonneville cutthroat trout stocks in the Bear River basin (southeastern Idaho). The allotment plan was recently modified by Montpelier District Ranger Mark Johnson (Caribou National Forest, R-4 Idaho), based upon information collected by the Montpelier Ranger District which showed that livestock grazing had negatively affected trout habitat in adjacent streams. These tributaries are the only areas where Bonneville cutthroat exist in the Bear River drainage. The monitoring plan focuses on physical habitat features (width:depth, pool frequency, bank stability/undercut banks, percent fines) and water quality (stream temperature and biomonitoring). The plan is scheduled for completion in spring of 1994 and will be implemented in

summer of 1994. This is a cooperative project between the AEMC, the Caribou National Forest, and the Idaho Department of Fish and Game.

3. Chen, G., L. Bizios, M. Ross, T. Willard, J. Cooper, Tonto National Forest, and Arizona Game and Fish. **A plan for monitoring the implementation and effectiveness of the Saguario and Bartlett lakes warmwater fisheries habitat rehabilitation project.**

The objective of this project is to develop and implement a plan to monitor the Saguario and Bartlett lakes fisheries habitat work on the Tonto National Forest, Region 3 (Arizona). The Saguario/Bartlett project is a large-scale effort to increase habitat diversity and recruitment of largemouth bass, crappie, bluegill, and catfish in these popular reservoirs, located near the Phoenix metropolitan area. Thousands of habitat structures have been placed in both lakes through a cooperative effort by Arizona Game and Fish, angler groups, and the forest. The plan focuses on implementation and effectiveness monitoring of physical and biological changes brought about by the rehabilitation. Along with the habitat work, recreational enhancement has also been conducted and will be monitored under a joint study by the Tonto National Forest and Arizona State University. A draft of the plan was completed in September of 1993 and the monitoring will begin in 1994.

4. Novak, M., G. Chen, and K. Nelson. **A monitoring strategy for the Greys River grazing allotment plan.**

The objective of the project is to develop and refine a strategy for monitoring the effects of grazing allotments in the riparian corridor along the Greys River, located in southwestern Wyoming on the Bridger-Teton National Forest (Region 4, Wyoming). The Greys River basin has experienced a variety of land uses, including

livestock grazing, timber harvest, roading, and recreational use. It is being proposed as a candidate for Wild and Scenic River designation and supports a population of Snake River fine-spotted cutthroat trout. We spent field and office time developing objectives, designing a study plan, identifying study sites, and specifying data collection methods, sampling strategies, and data analysis/interpretation. A draft proposal was completed in July of 1993 and tested that summer, focusing on grazing BMP/S&G effectiveness monitoring. The Wyoming Game and Fish Department is a cooperator with the Bridger-Teton and AEMC.

5. Chen, G., D. Konnoff, G. Haugen, G. Reeves, B. House, R. Wiley, and A. Thomas. **A strategy for monitoring the effectiveness of Section 7 (Endangered Species Act) salmonid habitat protection measures in the upper Columbia River basin.**

The objective of this project is to develop a specific protocol for monitoring the implementation and effectiveness of measures designed to protect the habitat of sensitive/threatened anadromous salmonid stocks in the upper Columbia River basin. This came about as a result of mandates by the National Marine Fisheries Service (NMFS) during Section 7/ESA consultation. The protocol focuses on the six Desired Future Condition (DFC) elements outlined in the FEMAT/PACFISH strategy (frequency of large woody debris, pool frequency, width:depth, stream temperature, bank stability, and undercut stream banks) as objectives. It will focus on describing specific methods to deal with spatial and temporal variability in monitoring these parameters, their use in monitoring direct or cumulative effects, and data analysis procedures. A draft plan is available and will be final in April 1994. This project is a cooperative effort between the USFS Region 6, AEMC, Oregon and western BLM offices.

6. Mangum, F., P. Skaabelund, and G. Chen. Monitoring the recovery of stream macroinvertebrates in the Strawberry Lake basin following rotenone treatment.

The objective of this project is to monitor the effects of a watershed-wide rotenone treatment project in the Strawberry Reservoir basin on the Uinta National Forest, Utah. The Utah Division of Wildlife Resources conducted the largest chemical treatment project in history to remove all fish from Strawberry Reservoir and tributaries. This was intended to restore the renowned rainbow and cutthroat trout fishery. The Provo Aquatic Ecosystem Analysis Lab and the Uinta National Forest have been annually monitoring the recovery of macroinvertebrates in a number of tributary streams to Strawberry Reservoir.

Results indicate that recovery among taxa such as dipterans, some ephemeroptera, and simuliids have been rapid; however, plecoptera and trichoptera have only begun to return to the stream. The Strawberry basin has also been subjected to much grazing, and a watershed restoration project has been implemented. This monitoring project will be long-term and will assess the effects on water quality of both the restoration and rotenone treatment efforts.

7. Vinson, M. Evaluating the effects of a high sustained discharge release from Flaming Gorge Dam.

This is a three year study which began in fall 1993 to assess the effects of large flow releases out of Flaming Gorge Dam. To enhance recovery of threatened and endangered fish in the lower Green River, a proposal has been made to release water from Flaming Gorge Reservoir to mimic pre-Flaming Gorge Dam spring runoff flows. Currently, the Green River below Flaming Gorge Dam is one of the most productive and popular trout fisheries in the United States. A large discharge release from Flaming Gorge Dam has

the potential to have a detrimental effect on this fishery by altering trout food resources. Major products derived from this study will include an estimate of primary and secondary productivity in the tailwater reach and an assessment of the relative vulnerability of the aquatic ecosystem to high sustained discharge. Information gained from this study will be useful in developing flow schedules which would mitigate lower trophic level impacts and benefit the overall Green River ecosystem.

Region 1

1. McMahon, T.E., J.D. McIntyre and R. Thurow. Spawning and overwintering habitat for cutthroat trout in areas of western Montana dominated by sedimentary geologic types.

This project's objectives are determination of:

- (a) The spawning and overwintering requirements of cutthroat trout in western Montana (sedimentary geology).
- (b) Their sensitivity to land use activities.

The project is being conducted on the Taylor Fork of the Gallatin River and tributaries, and is a cooperative effort of the Intermountain Station Fisheries Research and Montana State University. Data collection is completed. Thesis is in draft and defenses to be completed by December, 1993.

2. White, R.G., J.D. McIntyre and B. Shepard. Population and habitat assessment methods.

The purpose of this project is to develop methods needed for assessment of the risk to stream salmonids associated with small population size and degraded habitat in isolated watersheds throughout western Montana. This project is a cooperative effort of the Intermountain Station Fisheries Research and Montana State University.

First year sampling was completed in fall 1993. Data summary and analysis is underway.

3. McMahon, T., M. Jakober, C. Clancy, and J.D. McIntyre. Bitterroot bull trout dynamics and habitat use.

The purpose of this project is to assess the needs and status of bull trout populations in the Bitterroot River basin. Project streams include Daly and Meadow creeks, upper tributaries of the Bitterroot River. The project is a cooperative effort of the Intermountain Station Fisheries Research, Montana State University, and the Bitterroot National Forest. Data collected in 1992 and 1993 on the movement patterns, habitat utilization, and microhabitat characteristics exhibited by resident bull trout and west slope cutthroat trout. Thesis in preparation.

4. McMahon, T., A. Hansen, J. D. McIntyre, and B. Rieman. Effects of habitat fragmentation and exotic species invasion on persistence of bull trout and other native fishes of the Bitterroot River system, Montana.

This study is intended to provide information basic to the understanding of the effect of habitat fragmentation and presence of brook trout on the ability of resident salmonids to persist in the Bitterroot and similar systems.

The specific objectives are:

- (a) Conduct necessary field studies to determine the current distribution of bull trout and west slope cutthroat in streams of varying size, habitat quality, and invasion by brook trout.
- (b) Develop and test hypotheses regarding the factors that determine the probability of presence and persistence of bull trout and westslope cutthroat trout, including the effects of habitat size, distance to

neighboring populations, habitat quality, and invasion by brook trout.

The project is a cooperative effort of the Intermountain Station Fisheries Research, Montana State University, and the Bitterroot National Forest. Preliminary sampling was initiated in summer 1993. A graduate student has been selected and the workplan/experimental design are in preparation.

5. McIntyre, J. D., B. Rieman, and D. Bennett. Spatial distribution of trout and char in the Spokane River basin.

The purpose of this project is to determine the relative importance of habitat quality, local patch size, and dispersal processes in explaining the distribution and persistence of local populations of cutthroat and bull trouts.

Specific objectives:

- (a) Describe the relative abundance of cutthroat trout and bull trout among streams with a variety of watershed and habitat characteristics throughout portions of the Spokane River basin.
- (b) From existing data and for each sampled stream, summarize habitat characteristics including channel stability, substrate condition, gradient, habitat unit complexity and quality, watershed size, and distance to other populations.
- (c) Develop hypotheses and conduct statistical analyses to determine whether the presence or abundance of fish among streams is explained by habitat condition, habitat size, or proximity to other populations.

Preliminary sampling was initiated in summer 1993 under a cooperative agreement with the Panhandle National Forests. A graduate student is being considered and the workplan/experimental design is in preparation.

6. Jakober, M. J. and T. McMahon. Influence of stream size and morphology on the seasonal distribution and habitat use of resident bull trout and westslope cutthroat trout in western Montana.

This is a cooperative project to study autumn and winter habitat patterns of resident bull trout and westslope cutthroat trout in two headwater tributaries of the Bitterroot River in western Montana. Project objectives are to compare and contrast microhabitat characteristics, spawning movements, and critical overwintering habitat for each species. A progress report for the 1992-1993 field seasons was prepared in December 1993.

7. Rich, C. F., B. Rieman, and T. McMahon. Bull trout and westslope cutthroat trout spatial diversity and habitat characteristics in the Bitterroot River system.

The Bitterroot National Forest, Intermountain Station Fisheries Research, and Montana State University cooperated in a pilot project to address several of the factors influencing the distribution and persistence of bull trout and cutthroat trout within the Bitterroot River drainage. This project will combine existing habitat and population information with an expanded sampling and monitoring effort and analysis to look at population fragmentation, habitat conditions, exotic species interactions, and species viability at the basin and sub-basin scales. A progress report summarizing objectives, existing data, initial 1993 data collection, and future objectives was completed in October 1993.

8. Torquemada, R. and G. Decker. Comparison of CRBAPIG Basinwide Stream Inventory protocol and hydrologic monitoring and evaluation techniques.

The Columbia River Basin Anadromous Policy & Implementation Guide (CRBAPIG) set several

objectives and tasks to support and participate in the achievement of anadromous fish restoration goals. One objective, developing a standardized habitat inventory, has resulted in a draft inventory protocol for basinwide stream surveys. Using these protocols, baseline aquatic habitat conditions were assessed within the upper Selway drainage. In 1993, 75 miles of stream were surveyed in the White Cap Creek and Indian Creek drainages. Intensive hydrologic evaluation (Bitterroot Watershed Analysis technique) was conducted within the survey drainages. These two methods will be compared to evaluate the relationships and applicability of extensive and intensive survey techniques across the forest.

9. May, B.E. Substrate-sediment evaluation for southwestern Montana streams.

The objectives of this evaluation are to:

- (a) Re-evaluate the relationship between the R-1/R-4 sediment model predictions and "fine sediment" by depth within drainage basins in southwestern Montana.
- (b) Compare hollow core sampling depth information (four inch sampling depths compared to six inch sampling depths).
- (c) Compare "fine sediment" information taken with a six inch diameter hollow core from various spawning site locations (egg pocket vs. tail spill vs. undisturbed areas).

The information gained is intended to improve the predictive tools currently being used in environmental analyses associated with timber management and road construction. The bulk of the field work has been completed and data analysis is continuing. It is anticipated that the findings will be presented in three reports due for completion in April or May 1994.

10. Shuler, S., W. McClure, N. Hetrick and B.E. May. **Habitat and Fish population enhancement evaluations, Gallatin National Forest.**

There is an ongoing effort to monitor and evaluate aquatic ecosystem restoration and enhancement efforts that are being implemented on the forest.

The objectives for the project are:

- (a) Determining the extent that pool habitat development influences fish population abundance and structure.
- (b) Evaluating the restoration of large woody debris and the influences to channel morphology and improved fish habitat.
- (c) Evaluating spawning habitat enhancement.
- (d) Determining the effects of wetlands enlargement and creation of pond environments.
- (e) Evaluating angler preference associated with stream enhancement.
- (f) Evaluating native fish species restoration efforts for Yellowstone and westslope cutthroat and arctic grayling.

Several progress reports are due for completion during 1994.

11. Cross, D., and L. Everest. **Fish habitat attributes of managed and unmanaged watersheds and the distribution of bull char (*Salvelinus confluentus*) spawning sites in the upper Spokane River ecosystem, northern Idaho.**

The Idaho Panhandle National Forests began habitat typing managed and unmanaged watersheds in the upper Spokane River ecosystem in 1991. A physical habitat typing protocol developed in Region 5 of the Forest Service and modified for the waters of northern Idaho was used to monitor any changes in fish habitat which may have occurred due to land management prescription. Of the attributes described by the methodol-

ogy, mean residual pool volume and residual pool depth from managed and unmanaged watersheds have been emphasized in analysis because of the value of pools in the stream ecology of bull char and westslope cutthroat trout for rearing and overwintering habitat. Changes in the quality (volume and depth) and quantity of pool habitat as a result of channel destabilization has a negative influence on carrying capacity as demonstrated by distribution and abundance of the two species in the Coeur d'Alene and St. Joe rivers, and appears to influence the distribution of spawning bull char. Fish habitat attribute data from stream reaches of unentered watersheds in the upper St. Joe basin provide a reasonable standard by which to judge deviations seen in stream reaches of basins of similar geology, channel type, elevation, and forest type where management activities have occurred. These data have been fundamental to facilitating the development of a strategy to maintain ecosystems capable of supporting viable assemblages of bull char and other native fishes.

Region 2

1. Richmond, A. D. and K. Fausch. **Characteristics and function of large woody debris (LWD) in mountain streams of northern Colorado.**

The purpose of the study is to measure the characteristics and functions of LWD in undisturbed streams draining old-growth forests in the mountains of northern Colorado. Another objective is to provide fishery biologists and hydrologists with information that is useful for managing these systems to maintain or enhance trout populations.

The objectives of the study are to:

- (a) Determine how much LWD is present in undisturbed streams.
- (b) Measure relevant characteristics such as size and orientation.

- (c) Assess function of LWD in the shaping of channels and forming fish habitat.
- (d) Suggest rates of LWD recruitment to, and disappearance from, stream systems.

The overall project is in cooperation with the Arapaho-Roosevelt National Forest, Rocky Mountain Forest and Range Experiment Station, FHR and Colorado State University. Completion is expected in spring of 1994.

2. Leonard, S. and T. Wesche. Evaluation of the effects of reservoir storage on spawning gravel quantity and quality in Douglas Creek.

Objectives of this study are to determine if differences exist in the quantity of stored spawning gravel within five different stream reaches above and below Rob Roy Reservoir. In addition to reach evaluation, another objective will be to assess differences in the quality of stored spawning gravel within specific geomorphic channel units. Finally, an attempt will be made to develop a multiple regression model for predicting stored gravel quantity and quality based on important watershed, land use and channel characteristics. The project is funded by the FHR Program in cooperation with the Wyoming Game & Fish Department, Wyoming Water Resources Center, and the Department of Rangeland Ecology and Watershed Management at the University of Wyoming. The project is located on the Medicine Bow National Forest. Project completion is expected in May 1994.

3. Goyn, L., T. Wesche and Q. Skinner. Responses of hydraulic geometry and channel morphology in Battle Creek, Wyoming.

This second phase of a four-year riparian demonstration project has continued goals that

will develop, implement and evaluate environmentally sound and cost-effective stream and riparian habitat management measures.

Specific objectives will be to:

- (a) Continue to investigate the hydrologic, morphologic and aquatic habitat response of Battle Creek to Phase I management plan implemented by the Medicine Bow National Forest in 1990.
- (b) Initiate studies to design, implement and evaluate innovative structural and non-structural methods for streambank stabilization under Phase II of the management plan.
- (c) Continue to carry out an information/education program to disseminate study results.

Cooperators include Department of Rangeland Ecology and Watershed Management, University of Wyoming, Cooperative Extension Service, Trout Unlimited, Medicine Bow National Forest and FHR. Completion for Phase II (which began in 1992) is expected in May, 1994. A progress report was made available for review September 30, 1993.

4. Herger, L. Assessment of basin-wide habitat inventory technique relative to Colorado River cutthroat trout.

The "basin-wide inventory" is a method for cataloging fish habitat (channel units) in streams and has been widely adopted by the USDA-Forest Service. Streams were studied in the Medicine Bow National Forest to examine the distinction among habitat unit types, relation of fish to unit types, and effects of flows on habitat features that were used by Colorado River cutthroat trout. Cooperators were Rocky Mountain Forest and Range Experiment Station and Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming. The project was completed in July 1993. (Indirectly supported by FHR.)

5. Schmal, N., J. Maxwell and V. G. Leonard. Tie Camp Project: Geographic Information System (GIS) and Integrated Resource Inventories (IRI).

The overall goals of this project were to develop and test hierarchical relations for process-function and population-community based ecosystem theory for incorporation into a GIS and IRI test site on the Hayden Ranger District, Medicine Bow National Forest. Specific objectives were to develop integrated water related attributes for the Common Water Unit Handbook. Forest specialists will use the science-based framework for aquatic ecosystem management, including environmental analysis. Cooperators included the Regional Office IRI Work Group, Hayden Ranger District, Cooperative Extension Service, Department of Rangeland Ecology and Watershed Management, University of Wyoming and the FHR Program.

Region 4

1. Intermountain Region, Rocky Mountain Research Station, Intermountain Research Station, National FHR Program Leader, and Regions 1, 2, 3 and 6. Cutthroat Habitat Conservation Assessments.

The Intermountain Region and the Rocky Mountain Research Station took the lead in the development of habitat conservation assessments for inland cutthroat trout listed as "sensitive." The overall goal of this project is to develop conservation strategies for site specific management of the habitat of these fish. Published and unpublished data were used to summarize life history, habitat needs, historic and current distribution and abundance of six cutthroat subspecies. A final product is due by early summer 1994 as a general technical report.

2. Sawtooth National Recreation Area. Range Allotment Monitoring.

The objectives of the project are to:

- (a) Assess the efficacy of the Forest Plan standards and guidelines for riparian grazing.
- (b) Assess whether correlations exist between utilization and stream channel responses to use utilization as a management tool.

Twenty-two 100m stream reaches corresponding with utilization cage locations on various riparian grazing pastures thought the Sawtooth National Recreation Area were each monitored before, during, and after livestock grazing. This project is ongoing.

3. Sawtooth National Recreation Area. Developed Recreation Monitoring.

The objectives of this project are:

- (a) Reassessment of Forest Plan standards and guidelines.
- (b) Input to cumulative effects analyses for consultation with NMFS.
- (c) Future site closures, relocations or management/rehabilitation in anadromous drainages.

A new protocol was developed and tested for measuring vegetation loss between campsites in campgrounds. Fifteen campgrounds along lake shores or river corridors were assessed. Over 300 individual sites were analyzed. This project is ongoing.

4. Sawtooth National Recreation Area. Floatboating Studies.

The objectives of this project were to assess:

- (a) Displacement of spawning chinook salmon from floatboating activity on the Salmon River.
- (b) The extent to which salmon spawning in commonly "floated" reaches was localized (to determine if mitigation was appropriate).

- (c) Whether salmon spawn throughout both the day and the night (outside of the common floating hours).

Data collected are being used in significant management decisions regarding floatboat management on the upper Salmon River.

5. Sidle, R. C., Intermountain Research Station, Logan, Utah Fuel Company; and the Manti-La Sal National Forest. Skyline Mine study: hydrology and channel morphology changes related to surface subsidence.

The objective of the study is to address the issue of progressive longwall coal mining and related subsidence on changes in stream channel morphology, riparian habitat, and baseflow. One of the major concerns regarding longwall mining is the effect on hydrologic conditions. Surface and subsurface cracking could alter flow paths and interconnectivity of surface and groundwater. Changes in channel and basin morphology could affect sediment delivery and routing, as well as riparian habitat. While speculation exists concerning hydrologic and morphologic changes associated with subsidence, these impacts have not been substantiated in controlled studies. Documented channel cross-sections and longitudinal profiles have been established on the main drainage (Burnout Canyon) and on a second nearby canyon that will serve as an uncalibrated control. As the mining progresses down the drainage the cross-sections and profiles will be reread. Channel characteristics (i.e., pools, riffles, etc.) and riparian vegetation compositions were surveyed in both drainages. A landslide inventory was also conducted in Burnout Canyon. These surveys will be repeated throughout the mining and post mining periods. Long-term research findings will have application to future longwall coal mining in the Wasatch Plateau. The project is ongoing.

6. Utah Division of Wildlife Resources, Wyoming Department of Fish and Game, Utah State University, and Ashley National Forest. Limnological study on Flaming Gorge Reservoir.

The objective of this study is to examine how the availability of different size fractions of zooplankton influence the abundance of planktivorous fish such as kokanee. This project is in its fourth season.

Region 5

1. Freel, M., and C. Carpanzo. Status and restoration of Southern California steelhead (*Oncorhynchus mykiss*).

Watersheds in Southern California historically supported substantial runs of steelhead (*Oncorhynchus mykiss*). A significant number of these runs have disappeared due to land use changes and the construction of dams. This four phase project is an effort to define the historic and current steelhead distribution in Southern California streams and look for opportunities for reintroduction. In FY93, the first two phases of this study were completed. Historical steelhead and rainbow trout distribution has been defined and, as expected, much of the extinction of these runs was due to human influence. Stream habitat and population surveys were conducted on 24 streams. Tissue samples from captured fish were sent to UC Berkeley for genetic analysis. Data analysis is currently in progress. Phases three and four of this project are expected to be completed in FY94.

2. Robinson, R. and S. Dougherty. Life history, habitat requirements, and effects of current land use practices on the populations of the Santa Ana speckled dace.

The Santa Ana speckled dace (*Rhinichthys osculus* ssp.) is a Category 2 species for listing under the federal Endangered Species Act and is a California State Species of Special Concern. Little is known of the habitat requirements of this species.

The objectives of this study were to:

- (a) Determine the habitat requirements for all life stages.
- (b) Analyze risks to known populations from current land use on the San Bernadino National Forest.

Basin-level habitat and population data were collected for 6.3 miles of City Creek, 2.4 miles of East Twin Creek, and 1.3 miles of Strawberry Creek. These data are currently under analysis. Land use activities in each drainage have been identified and documented. Further analysis and recommendations will be made in FY94.

3. Matthews, K., E. Ballard, and S. Chubb. Radiotracking study of habitat use by golden trout inside and outside cattle enclosure on the Inyo National Forest.

This study addressed three questions:

- (a) Is there a difference in the water temperature used by golden trout inside and outside of cattle enclosure at Ramshaw Meadows?
- (b) Is there a difference in the home range size and habitat association of golden trout inside and outside of cattle enclosure at Ramshaw Meadows?
- (c) Is there a difference in the day and night home ranges of golden trout at Ramshaw Meadows?

In FY93, 23 fish were tagged and tracked during September on Ramshaw Meadows in the Inyo National Forest. Four study locations included

areas inside and outside of both cattle enclosure in upper and lower Ramshaw Meadows. Golden trout were restricted in the diurnal movements and were typically relocated at the same locations throughout the ten days of tracking. Fish were more active at night and were often found out in the open actively feeding. Temperature data and differential home range and habitat data inside and outside cattle enclosure are currently being analyzed.

4. Lechner, M., H. Eddinger, J. Barnes, W. Sinnen. Pyramid Lake warmwater fisheries investigations.

The objectives of this study were to determine the fish community structure in Pyramid Lake and to determine angler success and satisfaction. Work in FY93 was a continuation of work started in FY92. This project is a joint effort between the California Department of Fish and Game and the US Forest Service, Pacific Southwest Region. Electrofishing and seining surveys were conducted in FY93, adult bass were tagged and recaptured and caught by anglers. A food, habit and age-growth study was conducted for striped bass, and a spawning survey was conducted for largemouth bass. In addition, creel surveys were conducted throughout the year. Results of these data are currently being analyzed and data collection is planned for FY94. A final report is due in FY95.

5. Fuller, D.D. Multi-year assessment of anadromous salmonid populations.

Techniques to estimate the total abundance of fish in streams using snorkel observation techniques have recently been developed and are widely used. However, assessment of year to year variation of anadromous salmonid populations in the Klamath Province of California have been rare. This ongoing study has made summer population estimates for juvenile chinook salmon, coho salmon, and steelhead in Horse Linto Creek (a

large tributary to the Trinity River) for the past four years. Horse Linto Creek has been the site of extensive watershed restoration work and instream habitat improvement for the past 15 years. The results show large year to year variation in all anadromous salmonid populations, with coho salmon being the most variable. Data analysis has also examined the distribution of these fishes among stream reaches and habitat types. The results of this study compliment other studies of migration and streamflow that are currently underway in this basin. A FY93 progress report is complete and may be obtained by contacting the author. The project is expected to continue in FY94, with the final report written in FY95.

6. **Carlson, A., N. Berg, and D. Azuma. The role of small woody debris in six central Sierra streams.**

Although much has been published on the role of Large Woody Debris (LWD) in stream ecosystems, the role of Small (less than 30 cm diameter) Woody Debris (SWD) in small, low-order streams has not been studied.

This study's objectives were:

- (a) Determine the present distribution and abundance of small wood in six Sierra Nevada streams.
- (b) Assess the change in distribution of SWD over time.
- (c) Understand how small wood debris contributes to habitat complexity and sediment storage.
- (d) Understand the role of small wood in fish habitat quality and development.

Six small (less than 4 m low flow wetted channel width) streams were selected on the Tahoe National Forest. Ten 100 m stream segments were selected on each of the six streams; five segments in the lower portion of the watershed and five

segments in the upper portion of the watershed. All pieces of SWD (0.08 to 0.30 m in diameter and 1.0 or greater in length) were counted and their diameters and lengths were measured. Each piece of SWD was tagged with a metal plate and a unique identifying number. All pieces of SWD were evaluated to determine their contribution to percent cover, complexity, and structure for fish habitat. In addition, snorkel surveys of a subset of habitat types within each study reach were made to evaluate fish use. Data analysis is ongoing.

7. **Olson, A. Large woody debris in the Klamath Basin.**

The objective of this study is to determine the size and distribution of Large Woody Debris (LWD) present in second to fifth order streams within the Mid Klamath Sub-Basin. Large wood was inventoried during the summer of 1992 along 20 miles of wilderness streams. Information from these inventories was used in development of the regional integrated riparian inventory. During the summer of 1993, another 70 miles of streams were inventoried using an updated protocol that stratifies LWD by size and density. Data analysis is ongoing and a report will be completed in FY94.

8. **Roby, K., and A. Carleton. Sierra Nevada meadow stream condition inventory.**

This project continued work that was started in FY92 to survey the condition of meadow stream systems on National Forest System and National Park lands in the Sierra Nevada Mountains. Using a protocol developed by an interdisciplinary team of scientists and resource specialists, field crews surveyed meadow streams that had been grazed by livestock and meadow streams that had not been grazed by livestock for fifty years or more. Parameters studied include pool frequency, woody debris, stream substrate, bank condition, and riparian vegetation. Seven streams were surveyed during the summer of 1993 using this

protocol. Information gained from this study will be used to help define Desired Condition for Sierran meadows in National Forests. This study will continue in FY94 as more meadow streams are added. A progress report of FY93 findings will be available in early 1994, to obtain a copy contact the authors. A technical report with recommendations will be published as a future issue of FHR Currents.

9. Roby, K. and several others. Developing an Integrated Riparian Inventory.

The objective of this effort is to supplement the existing Pacific Southwest Region stream habitat database with a set of "core" attributes measured using a standardized protocol. This "core" set of attributes will then be used to develop Desired Conditions for similar streams and the protocol will become a standard monitoring system for stream conditions. The list of "core" attributes was developed by a team of fishery biologists and hydrologists from throughout the Pacific Southwest Region and the Pacific Southwest Experiment Station. In addition, statisticians, ecologists, and botanists were involved in the development of sampling strategies, field methods, and survey design. Selected attributes include measures of the stream channel, stream banks, and riparian vegetation. Once the protocol was developed it was tested on the Cleveland National Forest, the Tahoe National Forest, and the Six Rivers National Forest during the summer of 1993. Analysis of this data is currently underway. A report summarizing the objectives, development, and analysis of these surveys will be prepared and undergo internal and external peer review to further refine the set of attributes, sampling design, and methods. A refined version of this effort will be tested during the summer of 1994 and will be integrated with a watershed condition assessment.

10. Roby, K. Pacific Southwest Region stream habitat database.

The goal of this project is to gather all the stream habitat data collected using the standardized regional protocol into a central database. The database is now operational, allowing resource specialists to use these data as a supplement to on-forest data when describing ranges of attributes within similar stream types. This database is located at the Pacific Southwest Research Station in Albany, California. In 1993 the database was queried to help answer questions on stream habitat for the Forest Ecosystems Management Assessment Team (FEMAT) during the development of the Northern Spotted Owl Supplemental Environmental Impact Statement. Future uses may include Forest Service and university stream research projects. Remaining to be completed for this database are entry of some watershed classification data and writing standard queries.

11. Janemark, F. Collection, compilation, and reporting of Elk Creek outmigration data.

The objective of this project is to describe the findings of three years of anadromous salmonid outmigrant trapping conducted on Elk Creek, a tributary to the Klamath River. The outmigrant trapping data has been collected from spring through fall for 1991, 1992, and 1993. Data analysis on the timing and abundance for salmon and steelhead migration has been completed for 1991 and 1992, and will soon be completed for 1993. A final report will be completed in FY94.

12. Yasuda, D. Update of FISHHAB dBase IV analysis software.

The FISHHAB program was developed to simplify the input, storage, and analysis of stream habitat data collected using the standardized Pacific Southwest Region stream habitat evaluation procedure. FISHHAB runs within the dBase IV

relational database to automate the functions needed to process the standard data and output standard reports. This program has been in use for the past five years and has gone through previous updates. The objective of the FY93 work was to fix the known "bugs" in the program and to update the user's manual. The current program update includes improvements to data entry, data backup, and unit conversions. This project will be completed in early 1994.

13. Bumpas, D., L. Mink, and D.Martin.
Distribution and abundance of red-legged frogs and western pond turtles on the Plumas National Forest.

This study had three objectives:

- (a) Determine the location and status of red-legged frog (*Rana aroura*) and western pond turtle (*Clemmys marmorata*) populations on the Plumas National Forest.
- (b) Establish a checklist of other herpetofauna found on the Plumas National Forest.
- (c) To contribute to information on California herpetofauna using a standard protocol.

A standardized frog survey protocol was used to survey eight randomly selected townships on the Plumas National Forest from May through July 1993 at elevations ranging from 3,600 to 6,460 feet. These standard surveys were time used a time constraint to standardize sampling effort. In addition, other more extensive surveys (not of standard protocol) were conducted in other areas of the Forest. These surveys found no red-legged frogs. Western pond turtle were surveyed in July and August of 1993, which was late in the year to survey for this species. A total of five adult and two juvenile turtles were found during these surveys. The data collected during these surveys are useful for riparian management decisions on the Plumas National Forest.

14. Buck, M.K., M. Lechner, and D.Martin.
Anuran population surveys on the Sierra and Sequoia national forests.

The objective of this study was to document the presence or absence and relative abundance of anuran populations on the Sierra and Sequoia national forests. Data were collected during the summer of 1993 using a standardized time constrained protocol. Eight townships were selected for surveys; four low elevation townships were surveyed first and four high elevation townships were surveyed later. Approximately 93,000 meters of stream were surveyed on the two forests. Data analysis is in progress and a final report is due in FY94. This data will be used to monitor the relative abundance of anurans over time.

15. Welsh, H.H. Jr., D. Reese, and P. Crumpton.
Habitat use, nesting ecology and demographics of western pond turtles.

The western pond turtle (*Clemmys marmorata*) is listed as a Forest Service sensitive species in the Pacific Southwest Region. The objective of this study is to study habitat use, nesting ecology, and demography for Mainstem Trinity River (a dammed system) populations and compare this information with data collected on South Fork Trinity River (an undammed system) populations. Aquatic habitats in the mainstem Trinity River have changed markedly since the construction of Lewiston Dam in 1969 and these changes could have direct impacts to western pond turtle populations. The Trinity River is the largest tributary to the Klamath River in northern California. During the summer of 1993, mark-recapture surveys were conducted twice along three 2-mile reaches of the Mainstem Trinity River and similarly along three 2-mile reaches of the South Fork Trinity River. Habitat attributes were measured and radio telemetry was used to collect behavioral information. A "nesting bench" was discovered during 1993 which will provide opportunities for further

exploration of the nesting habits of this species. Data analysis is ongoing using a GIS to record known turtle locations. Data collection will continue in 1994 and the project is expected to be complete June 1995.

16. Fuller, D.D. and A.J. Lind. Reducing negative impacts to foothill yellow-legged frogs when implementing fish habitat improvement.

Foothill yellow-legged frogs (*Rana boylei*) inhabit many of the same permanent streams in California that have been modified by the Forest Service to improve habitat for fish. A recent study showed that fish habitat improvement structures may have had direct negative impacts to breeding habitat required by foothill yellow-legged frogs. A greater understanding of breeding habitat requirements for this species will allow stream habitat managers to avoid negative alteration of this habitat. The study conducted in 1993 was a follow-up study work completed in 1992.

The 1993 study had three objectives:

- (a) Determine if solar radiation influenced breeding site selection.
- (b) Determine if bankfull width to depth ratios influenced breeding site selection.
- (c) Determine if breeding sites used in 1992 were used again in 1993.

Data were collected during June 1993. Results show that these frogs selected breeding sites with a high level (mean of 78 percent) of solar radiation compared to sites that were otherwise suitable (based on microhabitat variables). This species selected breeding sites with significantly higher width-to-depth ratios compared to availability. Approximately 58 percent of the breeding sites used in 1992 were used again in 1993. Unusually high streamflows in June may have affected breeding site availability in 1993 and this question should be looked at again in the future. A final

report for this study, which includes recommendations to reduce impacts to this species, is completed and may be obtained by contacting the authors.

17. Reichart, M. Analysis of stream temperature data on the Klamath National Forest.

The objective of this study is to determine the relationship of stream temperature to various factors that can influence stream temperature. Stream temperatures, collected by recording thermographs, have been processed and summarized into daily averages. The information from this study will be used to set Desired Conditions for the streams studied. The possibilities and pitfalls of using air temperatures and water temperatures in control streams to detect management-cause changes will be discussed in the final report due out in FY94.

18. Baldwin, K. Indian Creek cross sections.

The objective of this project is to establish permanent cross sections along Indian Creek, a tributary to the Klamath River that was effected by large floods in 1955 and 1964 and has been the site of previous research. These cross sections will be resurveyed in subsequent years to detect changes in coarse sediment storage in the stream channel. Twenty-two stream channel profiles were completed in 1992 with permanent anchors set in concrete. Currently, a cadastral survey team is establishing the precise locations and elevations of these permanent anchors. When this survey is completed a final report will be written.

Region 6

1. Stein, K., K. Burnett, J. Kershner, A. Olsen, K. Overton, and R. Wiley. The aquatic biology and aquatic habitat Analysis procedures for watershed analysis.

The objective of this project was to provide aquatic biologists with a protocol to evaluate biological and habitat conditions within watersheds. The procedure uses an ecosystem health approach to the assessment and is available as part of the Draft "Watershed Analysis" procedures. Operational testing will continue in 1994.

Intermountain Station Technology Transfer Unit

1. Minshall, G. W. and K. Overton. Response of stream biotic and physical conditions to watershed management.

The general objective is to compare and contrast the stream survey information obtained from the Rapid River/Boulder Creek study in relation to differences in watershed management.

The approach is to:

- (a) Conduct the ecological surveys at four sites and with ten samples per site in Rapid River and Boulder Creek to include benthic macroinvertebrates, organic matter, periphyton, water chemistry, and physical factors.
- (b) Compare data obtained from Rapid River and Boulder Creek with data previously obtained from Big and Chamberlain Basin creeks.

Data collection was completed in 1992. Results of study to be completed by the end of FY93. A final report has been received (May, 1993). An additional study was initiated in June, 1993, including two other watersheds. A final report is planned due for July, 1994.

2. Radko, M. and K. Overton. FY93 fish habitat inventory of the Little Weiser drainage, Payette National Forest.

Project objectives are to:

- (a) Inventory the Little Weiser drainage using the R-2/R-4 inventory parameters and procedures.
- (b) Work with NFS biologists to develop data needs to assist in meeting forest management objectives.

Fish habitat inventories were completed. Data has been entered and transferred to the forest. Training on using the database has been completed.

3. Chandler, G., Thurow, R., and D. Newberry. Analysis of 18 years of McNeil core samples from six sites in the South Fork Salmon River drainage.

Project objectives are to:

- (a) Describe trends in substrate composition at five sites in South Fork Salmon River and one site in Johnson Creek.
- (b) Determine any spatial changes between sites in the South Fork Salmon River.

The initial contract has been satisfied. Additional analysis completed in 1993. Report in progress.

4. Young, M., McIntyre, J.D., Rieman, B. and R. Jones. Cutthroat trout conservation assessments.

The objectives for this project are to determine the current status and considerations for the development of a conservation strategy for recovery of inland trout. A draft report has been submitted for comment.

5. McIntyre, J.D., Rieman, B. and R. Stowell.
Bull trout habitat conservation assessments.

The project objectives are to:

- (a) Determine the current status of bull trout versus their historical range.
- (b) Develop a conservation strategy to aid in the species recovery.

A GTR (INT-302) has been published. Comments on the cooperative conservation assessment are anticipated in November, 1993 with completion of the project shortly thereafter. A FHR Currents titled "Consideration of Extinction Risks for Salmonids" is in progress.

6. Rieman, B. , Lee, D.C. and K. Overton.
Foothills fire effects: Dispersal and recovery of local salmonid populations in managed and unmanaged watersheds.

The objectives for this project are to:

- (a) Describe fish habitat changes related to the burn and anticipated watershed disruption.
- (b) Compare fish population structures and life history characteristics among streams.
- (c) Describe responses related to population disruption and habitat simplification.
- (d) Describe dispersal and recovery rates and mechanisms and the relative stability of populations over an extended 5+ year period.

Habitat classification was completed in the burned watersheds immediately following the fire and again in 1993 (1 year later). Fish population estimates and distributions described throughout each watershed at the same time. Preliminary data suggest that adult salmonids rapidly invaded the vacant habitats in Sheep Creek but not in Rattlesnake Creek. Data analysis will proceed over the next year and sampling will continue as long as funding is available.

7. Overton, K., Pisano, J., Duncan, K., Whitwell, S., Chandler, G. and J. Schmidt.
Evaluation of monitoring procedures to assess the effects of cattle grazing on channel morphology and fish habitat.

The objectives of this project are to:

- (a) Compare data collected by the proposed R-2/R-4 Inventory Procedures and DFC templates.
- (b) Evaluate the use of photo points (videography) to display and monitor riparian and channel morphology conditions.

Data collected in 1991 on Silver King Creek has been summarized and analyzed and an INT General Technical Report is in press. Data collected in 1993 on Marsh Creek have been summarized and a technical report is in preparation, planned to be available in January, 1994.

8. Overton , K. **Development and evaluation of standard fish habitat inventory parameters and procedures for R-2/R-4 forests.**

The project objectives are to:

- (a) Develop and evaluate physical habitat parameters and sampling procedures to characterize R-2/R-4 streams.
- (b) Edentify and evaluate a standard core set of inventory parameters that could be used to link with DFC parameters, Fish Habitat Relationship (FHR) research, and forest monitoring procedures.

Inventory parameters, procedures, and sampling frequencies have been recommended to R-2/R-4 forests in annual draft procedures. A final habitat inventory handbook is in preparation with a completion date of May, 1994.

9. Overton, K., Armstrong, R. and K. Duncan. Development of Desired Future Condition (DFC) numeric variables for the Intermountain West anadromous fish streams.

The project objectives are:

- (a) Development and evaluation of inventory and monitoring protocols to describe Desired Future Conditions for R-2/R-4 anadromous fish streams.
- (b) Develop and refine DFC numeric values for providing reference for describing natural potential.

Data on 98 streams have been summarized. The interim DFC stream summaries (December 1992) are being updated with inclusion of 1993 stream data and analyses. A GTR is in preparation to describe stream channels and fish habitat within minimally human-impacted watersheds. Final report planned for May 1994. Analysis has begun on isolating habitat variables that will detect differences between disturbed and non-disturbed streams.

10. Nelson, R., Visnovsky, K. and K. Overton. Development of a computerized fish habitat database management system for inventory data.

The objectives for this project are:

- (a) Development of a user-friendly fish habitat inventory database management system for storing, retrieving, analyzing, and displaying inventory data collected using the proposed R-2/R-4 Inventory Procedures.
- (b) Development of an interface with DG Oracle for future links with the Forest Service corporate database.

The basic structure of the PC-based database management system has been developed. Format and templates for data entry, data summary, and reports are currently being used and evaluated by Forests in R-1 and R-4. The system will continue

to develop and be updated as inventory parameters and procedures are refined, and as NFS biologists data needs are identified and incorporated into standard data reports. A user manual is currently being written with a planned release in March, 1994. The interim system is available to all R-2/R-4 forests.

11. Radko, M., Overton, K., Nelson, R. and D. Burns. Development and evaluation of fisheries technical tools for R-2/R-4 NFS fishery biologists - demonstration watershed project, Rapid River (unmanaged watershed) and Boulder Creek (managed watershed), Payette National Forest.

The objectives of this project are to:

- (a) Evaluate fish habitat and biological inventory procedures for developing a watershed fishery resource database.
- (b) Identify and compare inventory parameters to determine if differences exist between the two watersheds.
- (c) Develop and test predictive tools for describing the relationship between watershed activities, fish habitat, and fish production.
- (d) Develop the data format and procedures for completing a risk analysis.
- (e) Evaluate aerial videography for displaying channel conditions.
- (f) Develop a fishery resource GIS using inventory data, GPS, and videography.
- (g) determine the steps for integrating the fishery resource GIS with other GIS data layers (soils, roads, harvest units, etc.).

Two years of data collection have been completed. A GTR (INT-300) describing habitat differences and sampling frequencies has been published. A second manuscript describing fish distribution and GIS utility is in preparation.

**12. Roberts, B., Armstrong, R. and K. Overton.
R-4 fish habitat inventory coordination.**

The objectives are to:

- (a) Coordinate with district and forest fisheries biologists, crew leaders, and seasonal crews to ensure everyone is kept current on the inventory procedures and any changes that might occur in the interim in order to improve data consistency between the Region 4 anadromous forests.
- (b) Schedule and provide the seasonal crews from the R-4 anadromous forests training in techniques, procedures, etc. needed to complete the required R-2/R-4 Fish Habitat and Snorkeling Inventories as required by the Columbia River Basin Anadromous Fish Habitat Management Policy and Implementation Guide.
- (c) Assist the district and forest fisheries biologists and crew leaders to insure quality and consistent data collected by seasonal crews and contractors.
- (d) Assist the forests as needed with recruitment and hiring of seasonal crews.
- (e) Assist the forests with data entry and proofing upon request.
- (f) Produce a training slide show for both the R-2/R-4 Fish Habitat and Snorkeling Inventories this upcoming winter.

Currently processing 1993 data. Summarized data is being tabulated on a PC decision support system and being transferred to the forests. Preparation for the 1994 inventory coordination is underway.

**13. Hawkins, C., Bartz, K. and K. Overton.
Evaluation of videography as a habitat monitoring tool.**

Project objectives are to:

- (a) Develop field sampling procedures for the use of videography for monitoring a variety of channel reach types, habitat types, and management activities.

- (b) Assist in training of field technicians in collecting and handling video footage.
- (c) Develop and evaluate videography processing procedures and efforts to convert video footage into GIS cross-sectional maps.
- (d) Evaluate the management utility of videography from field video footage collected from June 15 to September 30, 1992 by INT field technicians from a variety of channel reaches in the Forest Service Intermountain and Northern Regions.

All of the above listed streams have been sampled. The procedures for imaging the videos into a GIS format have been identified and digitized streams have been delivered to INT. A final report and possible GTR are in preparation by the principal investigators and INT.

14. Roberts, B. and K. Overton. Assessment of smolt density model for monitoring forest smolt production capability objectives.

The objectives for the project are to:

- (a) Identify the assumptions and limitations of existing smolt density models.
- (b) Identify ties to the R-2/R-4 Inventory Procedures and make recommendations to improve the accuracy of the model Outputs of the existing model using local and Columbia Basin data are being compared.

A report describing the methodology has been forwarded to the forests. INT scientists developed a list of assumptions and limitations for calculating smolt numbers. An R-4 biologist workshop was hosted to calculate habitat conditions and smolt capabilities.

Technology Transfer

Technology transfer is a key activity in the FHR program. In 1993 both national and regional FHR units participated in 23 formal technology transfer activities. These included continuing education short courses, newsletters, and a variety of other activities. The following are the summaries for technology transfer in the national and regional FHR programs.

Continuing Education Courses

National FHR Program

The FHR program has demonstrated a commitment to continuing education by sponsoring not only the original core set of classes, but expanding the curriculum to include technical courses that are relevant to fisheries biologists. The following are the courses offered by the Unit in 1993, a brief description of content, and numbers and types of participants.

Basin Surveys and Applications

This course is designed to provide biologists and hydrologists with a statistically reliable survey method for aquatic inventories. The course covers general theory of the method, hands on field demonstrations, computer application of the database, and application of the information to management activities. We hosted one course in 1993, with a total participation of 22 people from two federal agencies and one state agency.

Program Management

This course is designed to provide biologists/botanists with the skills to conduct successful fish, wildlife and botany programs. The course covers a variety of topics including budget training,

personnel development, program marketing and the use of forest plan information to develop a successful program of work. Participants included 28 biologists from all regions of the Forest Service. In addition, regional courses in program management were offered to fish and wildlife biologists and botanists.

Fish Habitat Management

This course is designed to provide mid-career biologists with new ideas and concepts in fish habitat management. The course covers ideas such as landscape ecology, evaluating cumulative effects, limiting factors analyses and other relevant topics. Two sections of the course were offered, one at Virginia Polytechnic Institute and the other at Utah State University. A total of 50 participants from the Forest Service, two state agencies, the BLM, and one tribal group attended.

Lake, Reservoir and Pond Management

This course is designed to present ideas and concepts related to lake ecosystems and lake management. This course was offered at Auburn University during the spring of 1993. Twenty four participants from the Forest Service, BLM, Fish and Wildlife Service and state agencies. Course participants included a deputy regional forester who remarked, "It was some of the best training I've received."

National Aquatic Ecosystem Monitoring Lab

Two new continuing education courses were developed by the AEMC in 1993 and will be offered in 1994. These include Aquatic Monitoring for Natural Resource Specialists (September 12-16 at Utah State University) and Inventory and Management of Lakes and Reservoirs (October 1994 at Utah State/ Bear Lake).

Members of the AEMC gave 14 presentations at three shortcourses which include Basin Surveys and Applications (May 1993) and Fish Habitat Management (April 1993, Virginia Tech., and October 1993, Utah State). Other presentations were given at program manager's and director's meetings and regional biologist workshops (5).

Region 1

The R-2 FHR Program sponsored a three day basinwide habitat inventory training session for biologists and field crews on May 11-13 1993. The training session was conducted by personnel from the Intermountain Station Fisheries Research. The R-2 FHR program also provided a PC Tools and Applications Workshop at the annual R-2 Fish and Wildlife Congress in February.

Region 2

The Rocky Mountain FHR Program Leader Nick Schmal instructed at the October 1992 Fish Habitat Short Course in Logan, Utah. Topic of presentation was the R-2 Integrated Resource Inventories (IRI); specifically, the Common Water Unit (CWU). In addition, Nick instructed at the Fish Habitat Short Course in Blacksburg, Virginia and Basin-wide Stream Surveys: Methods and Applications Short Course in Logan, Utah.

Nick also developed a Challenge Cost Share (CCS) agreement between the Regional Office and University of Wyoming to hold a 2-3 day GIS Workshop and Training for R-2 fishery biologists and hydrologists. Tuition will be paid by the FHR Unit. The course will be held in the Digital Earth Sciences Laboratory in the Geography Department and is planned for June of 1994.

Region 5

In June, the seventh annual Northern California Stream Habitat Assessment Training was held on Six Rivers National Forest. This training session was sponsored by the Anadromous FHR Program. Biologists, technicians, and hydrologists from four national forests, the California Department of Fish and Game and the California Conservation Corps attended this two-day session. Training included lectures and field instruction on the use of standard US Forest Service, Pacific Southwest Region stream habitat evaluation procedures. Sessions on habitat classification, channel classification, and fish enumeration were conducted.

Jerry Boberg, anadromous FHR coordinator, was an instructor for the Basin Survey Shortcourse. This course is part of the Fish and Wildlife Continuing Education Program. Jerry taught a module of computerization of stream inventory data by using an example of the stream inventory database he developed for the Pacific Southwest Region.

David Fuller of the anadromous FHR program was an instructor for the Fish Habitat Shortcourse (also part of the Continuing Education Program). David taught a module on long term monitoring of instream fish habitat improvement structures. He shared results of his monitoring work and cooperative studies.

Region 6

The Pacific Northwest Region has instituted a series of workshops which are designed to supplement and strengthen the technical skills of the fisheries and hydrology workforce. The intent is to provide standardization and consistency in the approach to aquatic ecosystem management. The following four workshops (one through four) were held:

1. Stream Survey (Level II)
2. Stream Survey Data Interpretation
3. Fluvial Processes
4. Design and Implementation for Stream Restoration & Enhancement
5. Monitoring & Evaluation (currently under development)

Publications

The National FHR unit publishes a computer newsletter, "THE FISHWORKS" four times per year. The purpose of the newsletter is to share information between biologists, hydrologists, and researchers. We also provide information on request for various products and literature. The services provided by the unit are detailed in an annual information brochure available from the FHR group in Logan. In 1992, the FHR unit responded to over 400 requests for information.

FHR Currents

FHR Currents is now the national FHR Technical Bulletin. Each issue consists of a scientific article on a topic of interest to US Forest Service fishery biologists and other aquatic specialists. Topics include techniques, research findings, economic analysis, literature reviews, and other related subjects. During FY93, FHR Currents made the transition from being the Pacific Southwest Region's technical bulletin to becoming the national bulletin. FHR Currents is still published by the FHR staff located on Six Rivers National Forest. In FY93, four issues were published:

Direct Observations of Largemouth and Smallmouth Bass in Response to Various Brush Structure Designs in Ruth Reservoir, California (by Gregory Bryant).

This paper is a summary of a two-year research project evaluating the effectiveness of three brush structure designs as spawning and rearing cover

for bass. Recommendations for future bass structure work are made. FHR Currents, Number 10, October 1992. 13pp.

A Technique for Moving Existing Fish Habitat Data Sets Into The Spatial Environment of a Vector Geographic Information System (by Mike Martischang of Six Rivers National Forest). This article provides a general overview of techniques that were used to prepare existing fish habitat data sets so they could be moved into a Geographic Information System (GIS). The use of "address matching" is explained and examples of the uses of these analysis tools are provided. FHR Currents, Number 11, February 1993. 17pp.

Fishing Economics on the Tule River Ranger District (by Matt Lechner and Teresa Pustejosky of Sequoia National Forest).

This paper explains the use of three cooperative surveys of anglers and angling on the Tule River Ranger District, Sequoia National Forest, located near the urban centers of Southern California. The results show over 50,000 angler days were spent annually on the district which equated to two to three million dollars spent on fishing. FHR Currents, Number 12, September 1993, 9pp.

Annual Accomplishment Report — 1992, Fish Habitat Relationships Program (by Jeffrey L. Kershner, National Fish Habitat Relationships Program Leader.)

This report provides brief summaries of the FHR Technology Development and Technology Transfer efforts that occurred during FY92. This was the first issue of FHR Currents as a national publication. FHR Currents, Number 13, November 1993, 13 pp.

**National Aquatic Ecosystem
Monitoring Center**

1. Chen, G., M. Vinson, and F. Mangum. An equipment list for field collection of aquatic macroinvertebrate samples. AEMC Technical Bulletin Number 1/1a.

These publications provide a recommended list of the most commonly-used equipment for collecting stream macroinvertebrate samples. Specifications and suppliers are also described. An equipment ordering service is available through the AEMC Logan office. An order form and payment instructions are in the Technical Bulletin. This publication was completed in July of 1993.

2. Chen, G. A procedure for biological monitoring of lakes and reservoirs. AEMC Technical Bulletin Number 2.

This publication is intended to provide a simple and efficient protocol for monitoring biological surrogates of chemical/physical/ecological factors and processes in ponds, lakes and reservoirs. Such biomonitoring is useful for assessing water quality, aquatic productivity, fish predation effects, etc. The bulletin describes sampling methods, equipment, their specifications and potential suppliers, field data form(s), sample analysis through the AEMC Limnology Lab, and offers purchasing/distribution services (through a form in the bulletin). A revised draft was completed in December 1993; the final version is scheduled for completion in May 1994.

3. Vinson, M. A procedure for stream temperature monitoring. AEMC Technical Bulletin Number 3.

This publication provides suggested protocols for stream temperature monitoring. It focuses on sampling equipment, data collection strategies,

and analysis procedures. A revised draft was completed in November of 1993 and it is scheduled for completion in April of 1994.

Computer program: As a companion to this document there is a computer program available to store and analyze water temperature data collected with Hobo Temp (On-Set, Inc.) thermographs. The computer program takes a Hobo temp output file and converts it to a dbase file, summarizes the data into daily average, maximum, and minimum temperatures, and writes a report indicating the number of days a user specified temperature was exceeded.

4. Chen, G., F. Mangum, and J. Kershner. Draft program document for the AEMC.

This document describes the goals and objectives, organization, and structure of the AEMC

5. Mangum, F. A. and M. Vinson. Macroinvertebrate Sample Processing Reports.

The AEMC operates two macroinvertebrate processing laboratories. These were established to facilitate water quality assessments conducted in national forests and BLM resource areas by providing an inexpensive means for identification and analysis of macroinvertebrate samples collected as part of biomonitoring procedures. The Forest Service/BLM Macroinvertebrate Analysis Laboratory in Logan, Utah, was officially placed under BLM operation in October 1993. Dr. Liz Bergey, an aquatic ecologist from UC Berkeley, supervises the Utah State University students who sort, pick, and identify the samples. Liz provides quality-control/quality assurance of taxa ID results. Mark Vinson is the lab director. This lab processed over 350 samples in 1993 for two national forests and 20 BLM units. The average turnaround time for sample processing was less than six months.

The Forest Service Aquatic Ecosystem Analysis Laboratory in Provo, Utah is directed by Fred Mangum and is supervised by Nicole Cox. This lab processed 1,719 samples for 32 national forests, eight BLM units, and seven other state and federal agencies.

Both labs now operate under a maximum turn-around time of no more than six months from receipt of the samples to mailing of analysis reports. Sample processing prices reflect only actual costs; during a survey conducted in August, processing costs were 20-80 percent less than other private and agency facilities.

Region 6

Aqua-Talk is the Fish Habitat Relationships Program technical bulletin for the Pacific Northwest Region. It was established to provide aquatic specialists (biologists, hydrologist, etc.) with new information, technology, and training being developed in the region and elsewhere. Aqua-Talk is distributed to Forest Service fishery biologists, hydrologists, and fishery agencies in Oregon and Washington. In addition, fishery biologists from the above states have been officially invited to publish a brief technical paper focusing on their research findings or new techniques. In 1993 two issues of Aqua-Talk were published:

Biological Assessment of Fish Populations on the Oregon Dunes National Recreation Area, Siuslaw National Forest, by Thomas Merrit, Fisheries Biologist, Oregon Dunes National Recreation Area, Reedsport, Oregon, William Davies, Fisheries Biologist Auburn University, Dept. of Fisheries and Allied Aquacultures in Auburn, Alabama, and Todd Confer, Fisheries Biologist from ODFW, Charleston, Oregon. Issue Number 3, February 1993.

Trapping of Juvenile Steelhead Outmigrants from Calf Creek -- A Tributary of the North Umpqua River, by Glen R. Harkleroad, Fisheries Biologist, North Umpqua Ranger District, and Timothy J. LaMarr, District Fisheries Biologist, North Umpqua Ranger District. Issue Number 4, June 1993.

Additional Activities

FHR program leaders are involved in a variety of other activities and provide expertise to all levels of the Forest Service from district office to Washington office. In the Pacific Northwest, FHR specialists Dave Fuller, Debbie Konhoff, Kerry Overton, and Karl Stein helped to develop watershed analysis procedures for the Forest Ecosystem Management Analysis. In addition, many of these same specialists are involved in developing numeric standards and analysis procedures for the Pacific Anadromous Fish Strategy (PACFISH). In the Rocky Mountain Region, FHR specialist Nick Schmal was instrumental in developing the Habitat Conservation Assessment for Colorado River cutthroat trout. Nick Schmal in Region 2 and Debbie Konhoff in Region 6 have developed a literature clearinghouse for biologists in their regions. Glenn Chen, Fred Mangum and Mark Vinson of the Monitoring Center assisted biologists throughout the Forest Service and BLM in developing monitoring programs and conducting analyses. Monitoring services became available to all regions in 1993 and are expected to expand in 1994. In all, FHR program leaders participated in over 100 activities designed to assist all levels of the Forest Service achieve "Technical Excellence in Fisheries."



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