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KLAMATH RIVER EDUCATIONAL PROGRAM

Grades 7&8
Fiscal Year 1990

U.S. FISH AND WILDLIFE SERVICE
CONTRACT #14-16-0001-90130

FINAL REPORT

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TABLE OF CONTENTS

Abstract

The Klamath River Educational Program (KREP) is being developed for public schools as part of the Klamath River Basin Fisheries Restoration Program. The goals of the program are to increase awareness of and knowledge about salmon habitat requirements, habitat restoration, and harvest management. The KREP is providing curriculum materials and equipment, establishing fieldtrip sites and training teachers in order to facilitate inclusion of these topics into schools curriculums. The program will eventually encompass grades K-12, and is being implemented in Del Norte, Humboldt, Trinity and Siskiyou Counties in California; and in the upper Klamath River Basin, in Oregon. The fourth through sixth grade portion of the program was developed during 1990-91 with FY 1989 funds. This reports covers development of seventh and eighth portion of the program, which was developed during the 1991-92 school year, with FY1990 funds.

The curriculum consists of lessons plans on topics of anadromous fish runs, habitats of the river and how fish use those habitats, river ecology, problems that impact fish runs, restoration efforts, conservation and best management practices, economic and cultural values of salmon and steelhead, and salmon harvest management. Adopt-a-stream activities are also presented, including aquatic insect keys that use insects collected in the river basin as examples.

Teacher training has been a major emphasis of the program. The KREP has sponsored two week long summer institutes for teachers. Participants travel along the Klamath River and major tributaries. They visit watershed and river restoration sites, observe fish and their habitats by snorkeling, and talk to resource managers and people whose livelihoods depend on the fish. The Summer Institute increases teachers' knowledge and concern for the Klamath River and enhances their desire and ability to address relevant topics in their classrooms.

In addition to curriculum materials, field equipment, technical support and trainings, the KREP has created other products. A summary description of all curriculums about salmon and steelhead and/or stream habitats that exist in the Pacific Northwest was prepared. It was found that no other curriculum included information about restoration and best management practices, or about the fish runs and problems found in the Klamath River Basin. Teachers who used the 4-6th grade KREP curriculum were surveyed and an evaluation was prepared. Results of the evaluation will guide future development and revisions of the curriculum. The extent of use was also gauged by this evaluation. It is estimated that approximately 2,500 4-6th grade students have used portions of that curriculum during the past two school years. The 7-8th grade curriculum implementation will begin in the 1992-93 school year.

INTRODUCTION

In 1986, the U.S.Congress enacted the Klamath River Basin Fishery Resources Restoration Act (PL 99-552), setting in action a twenty year program for restoring the anadromous fish populations within the Klamath River Basin. The Act established the Klamath River Basin Fisheries Task Force (Task Force) to assist the Secretary of the Interior in formulating, coordinating and implementing the program. Recognizing the fundamental role education can play in bringing about change, the Task Force made education one of the Restoration Program goals. Funding has been provided for public information and education, and for education in public schools. Public information and education is being coordinated by the U.S. Fish and Wildlife Service staff in the Klamath River Fishery Resource Office. Education in public schools is being addressed through the Klamath River Educational Program (KREP), which is being developed under contract with the U.S.Fish and Wildlife Service.

The ultimate goal the of the KREP is to have citizens within the Klamath River Basin who appreciate the value of the fishery, who know what constitutes healthy habitat and who understand that human activities are closely linked to the state of the fishery resource. To achieve this goal, the program is developing curriculum materials about the life history and habitat needs of the Klamath River anadromous fish, and is establishing field trip sites for viewing healthy habitat, degraded habitat and restoration projects. Curriculum about harvest of these fish and harvest management, along with field trips to fish processing facilities is also a component of the KREP.

The lessons are designed to encourage independent, critical thinking by students. Although the curriculum focuses on fish and what we must do to increase their abundance, the other resources in the river basin are not overlooked. The lessons present a balanced view of resource use.

Simply giving new educational materials and fieldtrip manuals to teachers will not ensure their use. To facilitate inclusion of the KREP materials into curriculums on a regular basis, teachers must be educated and motivated to embrace these topics. Providing teacher trainings that increase knowledge and skills is a crucial step towards implementing new curriculum, and is the most important objective of the KREP.

Eventually, this program will encompass grades K-12. In fiscal year 1990, the portion for grades 7 and 8 was developed. The curriculum materials are intended for use in the four counties that are within the Klamath River Basin: Siskiyou, Trinity, Humboldt and Del Norte. Some of these schools are close to the Klamath River or a tributary, others are entirely outside the Klamath River Basin. The school facilities vary widely, from urban to remote.

METHODS AND MATERIALS

Selection of Consulting Teachers

Announcements about the consulting teacher positions were sent to all seventh and eighth grade teachers in Humboldt, Del Norte, Trinity and Siskiyou Counties. Copies of the announcement, cover letter, and consulting teacher job description are included in Appendix A. School directories were used to identify the teachers, and an announcement was sent to each teacher through the school couriers. Criteria for selecting mentor teachers are given in Appendix B. Nine teachers were originally selected, but one had to drop out because of a death in the family. Eight teachers worked with the program. Their names and schools are listed in Appendix C.

Curriculum Development and Field Testing

Prior to writing lessons, teachers attended a one day workshop at Humboldt State University. They were introduced to some of the topics they would be addressing with their lessons. Pat Higgins, consulting fisheries biologist, gave a slide presentation which introduced teachers to the problems that exist in the Klamath River system and some of the restoration projects. Mary Kay Buck, U.S.Forest.Service fisheries biologist, gave a slide talk about the restoration work that has been done by the Forest Service on the lower Trinity River. Joe Polos, U.S.F.W.S. biologist, talked to teachers about the Klamath Fisheries Management Council, the Pacific Fisheries Management Council, and how harvest management decisions are made. Dr. David Lauck, an entomologist from Humboldt State, talked about using aquatic insects as indicators of habitat quality.

Teachers were given an overview of the Klamath River Educational Program, and were told about their responsibilities as consulting teachers. They were given a reader, which consisted mostly of relevant newspaper articles, and a few short, readable reports. Teachers received copies of *California's Salmon and Steelhead* and *Klamath River Studies For Grades 4-6* as background material. They also received an outline of goals, subgoals, and possible topics to be addressed by the 7-8th grade curriculum. The outline was prepared by the contractor, Diane Higgins. It is included as Appendix D.

The contractor and two teachers wrote thirteen draft lessons. These were given to Summer Institute participants, which included all the consulting teachers. These materials were reviewed and edited by U.S. Fish and Wildlife Service personnel and were pilot tested during the fall and winter of 1991 and 1992. The rest of the teachers wrote new lessons and tried them in their classrooms during the 1991-92 school year. Some teachers also tested the *Restoration Game*, which was printed in the 4-6th grade curriculum. The lessons were compiled and illustrations were made. Each

A slide show was prepared to address the concepts of harvest management. Since so much of harvest management is technical and confusing, the slide show will make it easier for teachers to address these topics. The script for the show is included as Appendix F.

Teacher Trainings

The first training was described in the Curriculum Development section, since it was intended to help teachers get acquainted with the issues so they could write effective lessons.

In July 1991, a one week Summer Institute was held for seventeen teachers of grades seven through twelve. Participants had the option of receiving three units of credit from Humboldt State University for attending. A list of participants is included as Appendix G , and the Summer Institute agenda is Appendix H.

The goals of the Summer Institute were to increase teachers' awareness of the problems that exist in the Klamath River Basin, the restoration work that is underway and that is needed, and the viewpoints of the various user groups. Teachers were also given an opportunity to dive in several streams so they could observe fish and their habitats. Aquatic insects were collected and identified.

Teachers also benefited from opportunities to talk with their colleagues about their teaching strategies. Most of the teachers commented that they would like to participate in a retreat where they could share their teaching experiences and ideas in more detail. This suggestion has been incorporated into the next phase of program development, and a retreat is planned for the summer of 1993.

The Summer Institute was the topic of a detailed article in the *Arcata Union*, which devoted an entire page to the story. This increased awareness of the general public about the Restoration Program and some of its activities.

Field Trip Sites

Five new field trip sites were identified and summarized. They are included as part of the curriculum, which appears as Appendix K of this report. The reason for including these sites is to promote field trips where students can view habitat in various conditions. Some sites serve as examples of healthy fisheries habitat, others point out problems and restoration work that has been done. All the descriptions were written after visiting the sites and noting points of interest. One of the sites is on the Whiskey Lake/Shasta River Preserve.A portion of this river reach has been adopted by two schools in the Shasta River Basin. The Salmon River field trip is actually a loop that includes several different stops.

Adopt-A-Stream

The KREP has helped to facilitate several adopt-a-stream programs. Pat Higgins and the contractor have both visited teachers and assisted them with field trips and setting up monitoring activities. The contractor also helped several teachers receive funding last year to buy equipment for their stream studies.

Dave VanScoyoc's class at Dorris School has planted willows and monitored aquatic insects on Shovel Creek. Dave Sanders and his students at Weitchpec School are studying Cappel Creek and plan to monitor insect populations in the Klamath and Trinity Rivers next year. Mike Savarese, from Sisson Elementary in Mt. Shasta, has his students involved in monitoring the recovery of the Upper Sacramento River from the toxic chemical spill. Alan Eddy and Kathy Koon both have their students actively involved in restoring sections of the Little Shasta River. Sally Burns has helped to start an adopt-a-watershed program that involves her whole school. Tom Clark, who teaches fourth grade at Big Springs Elementary School will begin to study Big Springs Creek with his students next year. John Mason, at Trinity Valley School, has plans to begin his adopt-a-stream program on Willow Creek next year, as well. Marianne Schmidt has continued to keep Morris Elementary School involved with their adopted stream, Widow White Creek. Both Geoff Proust and Rebecca Leuck, in Trinidad, would like to adopt Mill Creek, which is near the school. However, some local residents have objected to kids getting near the intake for the community's drinking water, so they will probably not pursue an adopt-a-stream program, but rather will just take field trips there each year. Greg Stackhouse's class at Pacific Union School has adopted Janes Creek. Pam Halstead has her Fortuna High School students very involved with Rohnert Creek. All these teachers have participated in the Klamath River Educational Program, either as consulting teachers or in the Summer Institute. This involvement has certainly encouraged them to adopt these creeks.

Evaluation of 4-6th Grade Curriculum

The 4-6th grade curriculum, which was disseminated at workshops, and by consulting teachers and the KREP coordinator during the 1991 school year, was evaluated in 1992. A one page questionnaire was prepared and mailed to many of the teachers who received the curriculum. The questionnaires were self-addressed and stamped to facilitate their return. Telephone interviews were also conducted. More than eighty percent of the 4-8th grade teachers who received the curriculum and responded to the survey reported that they had used all or parts of the curriculum. The phone interviews proved especially helpful in gathering specific suggestions for improving the curriculum in the future. These will be incorporated into any revisions that are made. A more complete description of the methods and results of the evaluation can be found in Appendix I.

Summary Description of Other Curriculums About Salmon and Restoration

Other curriculums in use throughout the Pacific Northwest were reviewed and a summary of their contents was prepared. Most of the relevant curriculums were in the contractor's collection. One was not, but an information sheet about its contents was available from the publisher. The contractor keeps a current library of curriculum materials by reviewing bibliographies and ordering any new materials on a regular basis.

The curriculums were inspected in some detail, and a list of topics addressed was made for each product. It was discovered that no other curriculums address salmon habitat restoration. Suggestions as to how the Klamath River Educational Program materials might enhance the use of these curriculums, or vise versa, were made. The summary of curriculum products is included as Appendix J.

Computer Program Development

A program was written for use with HyperCard, which runs on Macintosh computers. The program is titled *HyperKlamath*. It is divided into categories of Fisheries, Geology, Resources, Climate and People, and attempts to make conceptual links between these categories. *HyperKlamath* is still in an initial phase, and the Fisheries and Geology sections are the most complete. This program has great potential as a learning tool. However, fewer than 20% of the schools in the Klamath River Basin have Macintosh computers. Continued development will be postponed until more computers can be acquired.

HyperKlamath was demonstrated to teachers at the 1992 Siskiyou County Aquarium-Incubator Workshop. The responses were very positive. There are three schools with computers and teachers who are eager to pilot test the existing materials in the fall. Pilot testing will assure that the right approach is being taken. It was originally thought that the program should contain large amounts of information. However, it may be more effective if the students themselves do research and write portions of the program. The information they gather and present can be shared with other students in the river basin. This active approach would probably result in more learning.

Development of Funding Proposals

Pat Higgins assisted Greg Stackhouse from Pacific Union School in acquiring a $500 grant from the Humboldt Area Foundation. He has bought field equipment and his class has adopted a portion of Janes Creek, in Arcata. The contractor assisted teachers from the Klamath Trinity Joint Unified School District in preparing a proposal to the Klamath River Task Force for funding in FY93. A teacher at Gazelle School was also coached in his proposal writing for the same source of funding. At this time, decisions about funding of these proposals have not been made.

The contractor also submitted a proposal to Apple Computers for eight Macintosh computers, printers and modems. These would have gone to schools that are on the Klamath River and tributaries. The idea is to allow students to create a basin-wide data base about the river, and to share their restoration activities with each other. Although the proposal was not funded, the contractor will be pursuing funding from several other foundations during the summer of 1992. Acquisition of the computer equipment would allow more time to be spent on developing the *HyperKlamath* program and on setting up meaningful, hands-on data collection by students.

RESULTS AND DISCUSSION

The results of this phase of program development are: the 7-8th grade curriculum guide which is correlated with the California Science Framework, descriptions of field trip sites, continued support of adopt-a-stream programs, a slide show about harvest management, in-depth training for teachers, opportunities for teachers to form networks, a very useful evaluation of the 4-6th grade curriculum, a summary of other curriculum products about salmon, an initial version of a computer program and several funding proposals. Public awareness about the Restoration Program was also increased.

CONCLUSIONS

The Klamath River Educational Program is providing curriculum and support to teachers and is facilitating the inclusion of fisheries topics into curriculums in local schools. Without these materials and trainings, it is very unlikely that the issues involved with restoring the river would be addressed in schools. The KREP is effectively addressing the Restoration Program's goal to increase the public's awareness about the fisheries resource and gain their support in restoration efforts.

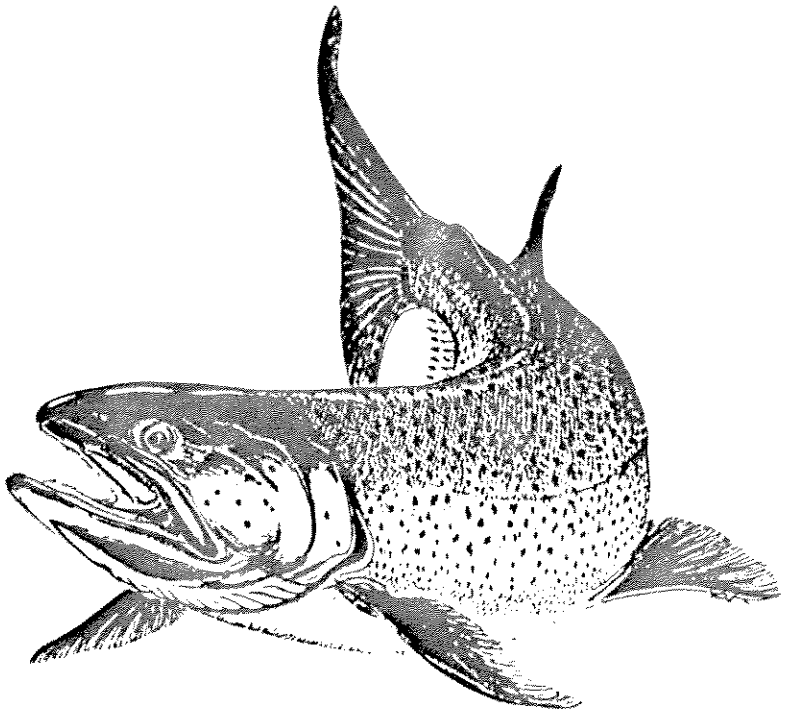
The Klamath River Educational Program is gaining recognition not only within schools, but by the general public. The aquatic insect key produced by the program is being used by some U.S. Forest Service fisheries technicians and requests from teachers in other areas for these materials have also been made. The slide shows about harvest management and restoration can be used by the general public, too. The video library and field equipment, which are kept in the KREP coordinator's office, have been used extensively this year.

The Klamath River Educational Program will also be implemented as part of the Adopt-a-Watershed Program. Many of the KREP materials are included in units for this program. The accurate and up-to-date information provided by the KREP is making young people knowledgeable and well prepared to be wise stewards of our resources.

TEACHERS!

BE ON THE LEADING EDGE OF ENVIRONMENTAL EDUCATION

HELP THE FISH



MOTIVATE YOUR STUDENTS

WOULD YOU LIKE TO:

- HELP DEVELOP A PROGRAM ABOUT THE KLAMATH RIVER AND ITS FISH?

- BE PART OF A TEAM THAT IS WORKING TO RESTORE THE RIVER ?

- ATTEND A SUMMER INSTITUTE TO LEARN MORE ABOUT STREAM ECOLOGY AND RESTORATION?

IF YES, THEN READ ON.....

Diane Higgins, Coordinator
4649 Aster Road
McKinleyville, CA 95521

January 7, 1991

Dear Teacher,

Do you ever look for new curriculum topics that will help your students understand their community, engage them in hands-on studies of their environment, and encourage them to become active, involved citizens? Often, local affairs can provide a theme for a unit of study that is interesting and relevant to young people.

Consider the current effort to restore the fish runs of the Klamath River. A task force of fourteen people, representing four counties, Indian tribes, fishing groups and agencies, must sit down together and agree on how to restore what was once a great fishery resource. They must gather and evaluate information. What makes a healthy fishery? Why have fish populations declined? How does use of one resource affect another? What actions or measures can we take to help the fish? How can we get people's cooperation so that necessary changes can be made?

These few questions alone could lead to a great variety of investigations in biology, physical science, civics, local history, resource management, and other subjects. They are issues that will face your students when they become the resource users and the decision makers.

As a teacher in or near the Klamath River system, you could play an important role in creating new educational materials about these topics. We are looking for eight to ten teachers of grades seven or eight, who will be active participants in writing, testing and implementing lessons. If you are creative and would enjoy being part of a team that is working to restore the river and to help the fish, we would like to work with you.

The enclosed material explains the program in more detail and describes the job of being a consulting teacher. If you do not wish to apply for the job of consulting teacher, but would like to use the materials we develop, or feel that you could contribute in some other way, we welcome your involvement. Just call or write to me, or contact Brain Swagerty at Siskiyou County Schools.

Sincerely,

Diane Higgins

Diane Higgins

KREP CONSULTING TEACHER
JOB DESCRIPTION

As a consulting teacher to the Klamath River Education Program, you will assist with program development by doing the following:

INCREASE YOUR OWN EXPERTISE

Attend an eight hour workshop, which will be conducted at Humboldt State University on March 2, so that you can learn more about the Klamath River and restoration of fish habitat. This workshop will be open to other interested teachers as well, and participants may choose to receive college credit of 1/2 semester unit.

At this workshop, experts and practitioners in fisheries and resource management will teach you about the salmonids and other fish in the Klamath River, the factors that have caused declines of fish runs, some methods we can employ to protect and restore habitat, the importance of healthy fish runs to local economies, and the process of harvest management. You'll also learn about how to bring some of these topics back to your classroom, particularly through adopt-a-stream activities. You will receive the KREP curriculum materials that have been developed for grades 4-6 and some draft materials for grades 7&8.

LESSON WRITING AND FIELD TESTING

During the remaining school year, you will be responsible for writing and fieldtesting at least three new lessons. Those who teach a single subject (science, social studies) will write lessons in their subject area. Teachers of multiple subjects may develop lessons for any subject area. All are encouraged to create interdisciplinary lessons. You will also be responsible for fieldtesting at least two of the draft lessons that will be given to you. These will be about salmon and other fish of the Klamath River system, river habitats and ecosystems, habitat restoration, importance of fish to people, harvest and resource management.

SUMMER TRAINING INSTITUTE

Consulting teachers will join approximately fifteen other teachers of grades 7 and 8 in a week-long summer training institute. During this week, we will travel down the Klamath River and some of its tributaries, staying at lodges along the way. Biologists, geologists, representatives from Indian tribes, commercial and sport fishermen and other experts will act as facilitators. You will see restoration projects and habitat

destruction, get a mountain top view of watersheds, visit pristine streams, collect and identify aquatic insects, and dive in to observe the fish and habitats directly (if you wish).

During the evening sessions, consulting teachers may be asked to assist in showing other teachers the materials they have helped to develop. You may also be asked to choose some other responsibility in conducting the institute (ie. help lay out and pack up lunch foods, drive one of the rented vans, help keep track of diving equipment, etc.)

ORGANIZE AND CONDUCT A WORKSHOP FOR YOUR SCHOOL OR SCHOOL DISTRICT

Your final task will be to organize and conduct an inservice training for other teachers in your school or district. There will be flexibility in the exact nature of this inservice, but it should serve to encourage and help those who want to address stream ecosystems, fisheries or resource management in their courses. The KREP materials you'll have helped develop will be given to teachers who attend. You will have assistance from the KREP coordinator or consultant in organizing this inservice.

PAYMENT

As a consulting teacher, you will be paid a total of $1,000 for the work you perform. Payments will be in four $250 installments, to be made after completion of each of the four tasks outlined above.

If you must travel more than a couple hours to attend the March 2 workshop in Arcata, KREP will reimburse you for motel expenses. .

Credit will be available from Humboldt State University for both the March 2 workshop (1/2 unit) and for the summer institute (3 units).

CRITERIA FOR SELECTING MENTOR TEACHERS

The following criteria was used to select mentor teachers for grades 7&8.

1. Number of years teaching experience in grades 7&8 and total number of years teaching at any grade level

2. Background in fisheries (ie. prior involvement with aquarium incubator program or adopt-a-stream) or in environmental education. Experience with developing curriculum was also considered.

3. Stated reasons for wanting to participate in the program. I looked for people who articulated a commitment to protecting the fisheries resources and to providing their students with relevant topics to study.

4. Teachers were also selected on the basis of a brief synopsis they wrote about how they would integrate two or more subject areas together in a lesson on fish.

CONSULTING TEACHERS GRADES 7&8

Stephanie Bennett
Big Lagoon Elementary School, 269 Big Lagoon Park Rd., Trinidad CA 95570
School Phone: (707) 677-3688
Science: 5th, 6th, 7th & 8th , Social Studies: 7th & 8th

Robert Childs
Pacific Union Elementary School, 3001 Janes Rd., Arcata CA 95521
School Phone: (707) 822-4619
Life Science 7th
Earth Science 8th

John Crechriou
Big Springs Elementary, 7405 A-12, Montague, CA 96064
School Phone: (916) 459-3189
8th Grade, self contained, 7th Grade science

Darlene Haas
Scott Valley Junior High School, P.O. Box 607, Fort Jones, CA 96032
School Phone: (916) 468-5565
Outdoor Education/ Social Studies/ Woodshop/ English, 7th & 8th

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Rebecca Leuck
Trinidad School, Box 3030, Trinidad, CA 95570
School Phone: (707) 677-3631
7th Grade, self-contained

David Sanders
Weitchpec Elementary School, P.O. Box 1308, Hoopa, CA 95546
School Phone: 444-5464 (radio phone)
4th - 8th Grades

Carol Van Sant
Miranda Junior High, P.O. Box 58, Miranda, CA 95560
School Phone: (707) 943-3168
Social Studies & Language Arts, 7th Grade

David Van Scoyoc
Dorris Elementary School, P.O. Box 748, Dorris, CA 96023
School Phone: (916) 397-4491 7th Grade, self-contained

KLAMATH RIVER EDUCATIONAL PROGRAM

CURRICULUM OUTLINE FOR GRADES 7-8

This curriculum outline is divided into three domains which provide an organizing structure for the goals. These domains are broad categories and have been identified as knowledge, values and attitudes (affective domain) and social action. Goals listed within each domain are broken into subgoals. Following each subgoal is a list of concepts or topics that could be addressed by the lessons and activities in the 7-8th grade curriculum.

DOMAIN OF KNOWLEDGE

Students should acquire factual information about anadromous fish and their habitats, which will form a body of knowledge. This information will allow them to analyze all the variables involved in a certain action and to predict the possible consequences of such actions. This should help to promote responsible decisions about the way resources are used or treated now and in the future.

GOAL 1: Students should be knowledgeable about fish biology and life histories. They should understand that characteristics exhibited by fish have evolved over many years and are finely tuned for survival in a particular environment.

Subgoal 1 Students should know about fish anatomy and physiology and should recognize similarities to other animals.

Topics/concepts:

Identifying and classifying fish of the Klamath River
- Classification through species
- Evolution of fish - Klamath River fish have evolved into differentforms and have come to utilize different but closely related niches
- Subspecies (runs of chinook, steelhead)

Fish anatomy and physiology
- Specialized cells
- Organ systems and functions
- Physical adaptations
- Similarities to other animals

Subgoal 2 Students should know about the life cycles of anadromous fish, and should appreciate the advantages and dangers of being anadromous.

Topics/concepts

Reproduction of fish how timing and choice of habitats maintain distinct populations within the same river system
Survival rates at various life stages
Ocean migrations adaptations that allow fish to live in very different environments
Mechanisms that help fish to navigate successfully during migrations

Subgoal 3 Students should recognize that all fish behavior has evolved because it provides some survival advantages. If an environment changes quickly, fish behavior may no longer be appropriate for survival.

Topics/concepts

Behaviors to reduce competition (run times, choice of spawning rearing habitats)
Behaviors that ensure genetic diversity within a breeding populationBehaviors that increase survival from predators
Behaviors that allow fish to maximize food source
Environmental cues and behavior
Hatchery environments/behaviors vs. wild environments/behaviors

GOAL 2 Students should acquire a basic understanding of stream ecosystems, and should know what constitutes good fish habitat.

Subgoal 1: Students should understand the concept of energy and nutrient flows through an aquatic ecosystem

Topics/concepts
Aquatic food webs
Oxygen and nitrogen cycles
River continuum

Subgoal 2 Students should be aware of the great variety of element that make up an ecosystem

Topics/Concepts
Living elements of ecosystem populations of organisms
Fish
Insects
Instream vegetation
Riparian trees and other plants - Relationship of watershed to streams
Birds, reptiles, amphibians, mammals

Non-living elements of ecosystems
Oxygen, nitrogen and carbon: where they come from and how they are used by organisms.
Effect of geology and soils on river ecosystems
on type and amount of vegetation
on characteristics of stream substrate
as source of minerals and nutrients
on tendency of watershed to erode
on stream morphology

Role of riparian area in keeping physical conditions healthy for fish water temperatures, bank stabilization, large organic debris and how it adds to stream diversity
Water cycle patterns of precipitation in Klamath River Basin
Biomes and Zones
Zones within the watershed
Pools and Riffles
Orders of streams and their characteristics
Basic introduction to stream habitat typing system

Subgoal 3 Students will learn that all living element of an ecosystem are interdependent.

Topics/Concepts
Niches
Adaptations of environments
Food webs
Living things are affected by change in their environments
Different species vary in ability to adapt to changes
Natural balance - equilibrium

GOAL 3 Students should understand that it is possible to restore some damaged streams and watersheds, and should know about some of the techniques that can be used. Students should be aware that conservation and wise resource management could reduce or eliminate the need for restoration.

Subgoal 1 Students should know what habitat problems exist in the Klamath River system

Topics/concepts
Effects of timber harvest - erosion and loss of large organic debris contribute to conditions of degraded streams
Agriculture competes for water

Livestock grazing impacts on streams (riparian zones, bank erosion, changes in water chemistry)
Urban development (pollution, erosion, channelization,)

Subgoal 2 Students will know that anadromous fish runs have greatly declined in recent years and will understand some reasons for those declines.

Topics/Concepts

Threatened, endangered and extinct species
Historical perspectives - how today's fish runs compare to those of the past?
Correlation between declining fish populations and habitat destruction and over harvest of fish

Subgoal 3 Students should understand that comprehensive planning for resource use can greatly reduce habitat destruction.

Topics/Concepts

What kind of planning could reduce or eliminate habitat problems?
Who are the people involved in planning and implementing the plans?
What guidelines for resource management already exist?
What kinds of guidelines must we still create and/or implement to be successful?

Subgoal 4 Students should know about some of the techniques that are used to restore habitat and enhance fish populations. They should understand that these techniques are not quick fixes to problems and may sometimes inadvertently do more harm.

Topics/Concepts

Restoration and Conservation Techniques
Techniques to create diversity in habitat
Fish access
Fencing to keep livestock out
Replanting riparian areas
Putting roads to bed
Slide stabilization
Fish rearing
Distinctions between wild runs and hatchery runs
Problems of rearing fish
Mistakes of the past - are we doing the right thing now?
Various viewpoints on value of instream structures, fish rearing, etc.

GOAL 4 Students will be aware that fish are an important economic resource in the Klamath River Basin, and that there is competition among people who harvest them. Harvest management is the process of deciding how many fish can be caught, and what percentage of the harvest will go to each user group.

Subgoal 1 Students will recognize the economic importance of the salmon and steelhead fishery.

Topics/concepts

Native American subsistance fishing and commercial fishing
Commercial fishing and related industries
Sport fishing and related industries

Subgoal 2 Students will understand the potential for over harvest of fish and will relate this to the need for harvest management

Topics/concepts

Harvest pressure - number of people making demands on resource
What happens to a fish population at various harvest level rates?
Case studies of over harvest of other fish species and the results of that over harvest

Subgoal 3 Students will have an historical perspective on the harvest of fish.

Topics/Concepts

Native American harvest of the fish and cultural mechanisms for harvest management
Harvest techniques and levels during early days of settlement by Europeans
Changes in harvest management

Subgoal 4 Students will know who establishes harvest management policies and will be aware of the harvest regulations that apply to them.

Topics/Concepts

Regulatory agencies (Pacific Fisheries Management Council, Klamath Fisheries Management Council, U.S. Fish and Wildlife Service, California Dept. of Fish and Game, Indian Tribes)
How are harvest rules made? What information and processes are used? What are the regulations for salmon and steelhead inriver fishing?

Subgoal 4 Students will know that there is much disagreement about how to manage the fishery resource.

Topics/concepts

Competition and mistrust among user groups
Imprecise nature of information used for management decisions
Questions about legitimacy of the statistical models used by managers

DOMAIN OF ATTITUDES AND VALUES

Knowledge alone will not necessarily ensure that wise use of our resources. People must have attitudes and values which will lead to concern, and hopefully, positive actions.

GOAL 1 Students will develop opinions about their environment and fisheries issues that are based on knowledge and reason.

Subgoal 1 Students will have opportunities to hear a variety of perspectives about resource uses.

Topics/Concepts

People belong to groups that hold certain positions about issues. Understanding and respecting those positions are first essential steps towards cooperation and agreement.
Sometimes people agree about what they want, but can not agree on the process of getting it.

Subgoal 2 Students will be willing to express their opinions and to accept opinions of others.

Topics/Concepts

Taking an active interest in resource management is part of responsible citizenship
There are appropriate forums for debating and sharing ideas, and accepted rules of conduct for doing so.
Critical thinking skills should be applied to evaluating information and other people's ideas.

GOAL 2 Students will develop a sense of stewardship toward their watersheds, streams and the life within them.

Subgoal 1 Students will have the desire to act in ways that will not harm the fisheries resource, and which will benefit the stream

Topics/Concepts

Raising fish in classroom
Adopt-a-stream activities - monitoring, mapping, studying animals and plants, cleaning up litter, educating others

Subgoal 2 Students will appreciate the beauty of streams and will desire to preserve that beauty.

Topics/Concepts

Stream walks with basic awareness activities
Art / music / poetry

Subgoal 3 Students will show a willingness to share their stream resources with others and will acknowledge that such a resource belongs to and is the responsibility of all.

Topics/Concepts

Community education projects
Developing nature trails

GOAL 3

Students will appreciate the value of salmon and steelhead and will have a commitment to change the trend of declining fish runs.

Subgoal 1 Students will appreciate the importance of preserving fish for their natural role within the ecosystem See Goal 2, Knowledge

Subgoal 2 Students will develop an empathy for the fish as a beautiful living creature that is struggling for its existence. See Goal 1, Knowledge

Subgoal 3 Students will come to appreciate how important streams and salmon are to Native American and non Native American cultures and will come to regard them as an important element of our society.

Topics/Concepts

Aesthetic and spiritual values related to these resource
Myths, symbols, ceremonies, and other forms of expressing relationship people have with streams and fish
Appreciation of salmon and streams is expressed in art, photography, literature, drama, etc.
Ecological and scientific values
Commercial and economic values
Recreational values

Subgoal 4 Students will develop a desire to help the fish survive.

Topics/Concepts

Fish rearing
Adopt-a-stream activities
Development of appreciation and empathy in above subgoals

DOMAIN OF SOCIAL ACTION

If changes are to occur, people must act. It is not enough to know about a problem and to desire change. Only people in action can make a difference. Many people who would like to see improvements in the environment do little about it because they do not think they have the power to bring about changes, or they are not sure what actions to take. It is necessary to instill in children the skills, competence and confidence to become actively involved in decision making processes.

GOAL 1 Students will become actively involved with their stream or watershed.

Activities/Concepts

Adopt-a-Stream activities

GOAL 2 Students will have opportunities to plan resource use and to share their plans with others.

Activities/Concepts

Simulations
Research
Surveys
Attending community meetings

GOAL 3 Students should know what information sources are available to them and how to participate in resource planning.

Subgoal 1 Students should know what sources of data are available to them so they may stay informed about the state of the resource and about management options that are available.

Subgoal 2 Students should learn how to analyze data, and how to critically evaluate information.

Subgoal 3 Students should understand the procedures available to them to take an active role in resource planning and should develop the skills to take on such roles.

CORRELATION OF THE *KLAMATH RIVER STUDIES FOR GRADES 7-8* TO THE CALIFORNIA SCIENCE FRAMEWORKS

OVERVIEW

The California Science Frameworks has articulated guidelines for the creation of science programs, teaching methods and production of curriculum materials. The most relevant of these guidelines have been excerpted and are included here. The lessons contained in the KREP 7-8th grade curriculum are listed and are matched to the various contents, themes and processes outlined in the Frameworks.

The *References to Essential Program Elements* calls for a thematic approach to teaching science. The idea of themes is discussed on **pages E2-3**, and the six themes suggested by the *Framework* are listed on **page E3**. The KREP lessons each fit within at least one of those themes.

The *References to Essential Teaching Elements,* **page E4**, calls for a strong emphasis on hands-on teaching techniques and the use of topics that are relevant to students' lives. Many of the KREP activities take this approach, involving students in the study of a resource that is important to their communities and to their own futures. The processes of science are listed on **page E5**. **Pages E6 and E7** summarize some of expectations educators should have of middle school students and provisions they should make to enhance the learning of science. The KREP curriculum strives to make connections between the disciplines of science by showing how geology and land use practices impact habitats and populations of specific species. Water quality (physical science) is tied in with biology. Links are also made between the natural sciences and social sciences (economics and politics). Getting students focused on their local environment and a resource that is inherently interesting will hopefully motivate them to become more involved in science. Long-term stream monitoring projects will demonstrate the relevance of scientific principals to the real world, and will provide opportunities for students to apply more sophisticated thinking processes. As schools become involved in the activities from the KREP curriculum, they will make use of community resources, as suggested in the *Frameworks*.

The Content of Science section beginning on **page E8** contains excerpts of those concepts which are relevant to the lessons in the KREP curriculum. The curriculum also addresses many other concepts that are not specifically stated in the *Frameworks*, but are important and valid.

Finally, pages **E13-14** contain a matrix that shows which themes, processes and contents are addressed by each of the lessons.

References to Essential Program Elements

(From the California Science Framework)

Introduction

In recent years, tremendous progress has been made . . . by making science instruction more experiential and engaging for students. Yet the *general* trend has been to reduce and compartmentalize science content to focus on isolated facts and concepts. This fragmentation is especially detrimental in the elementary grades. Rather than being encouraged to attain a global and integrated understanding of the natural world, which the disciplines and the nature of science describe and define so beautifully, students are encouraged to memorize isolated facts and concepts.

This *Framework* emphasizes a thematic approach to science. Its approach is derived from . . . a report issued by Project 2061. That report shows a need for a thematic approach to science instruction, in order to demonstrate the connections that exist among the various disciplines of science, and to enable students to understand the rapidly changing world.

The three basic scientific fields of study--physical, earth, and life--are addressed, ideally each year, and the connections among them are developed.

Some Major Themes of Science

The themes of science are ideas that integrate the concepts of different scientific disciplines in ways that are useful to the presentation and teaching of scientific content. As opposed to theories, which unify and make sense of facts and hypotheses related to a particular natural phenomenon, themes are pedagogical tools that cut across disciplines. The incorporation of themes into science curricula is a major goal of this framework. They are meant to integrate concepts and facts, to provide a context through which to present content matter, and to encourage better writing in science instructional materials.

What are themes? they could also be called big ideas, overarching concepts, unifying constructs, or underlying assumptions. They are distinct from facts and concepts. A fact is a statement based on confirmed observation and inference, such as the number of electrons in an atom of iron, the date of the discovery of helium, or the descent of birds from dinosaurs. A concept often involves several facts; for example, the concept of continental drift, the need for repeatable observations in constructing science, or how magnets work. Themes are larger ideas: they link the theoretical structures of the various scientific disciplines and show how they are logically parallel and cohesive. Scientific literacy lies not only in knowing facts and concepts but also in understanding the connections that make such information manageable and useful.

What are the major themes of science? Science can be organized in many ways; those presented here should be regarded as only one way to integrate the overarching concepts of science into a curriculum that spans scientific disciplines. The suggested arrangement of themes is designed to encompass and connect a great deal of the basic data and evidence of science. No doubt there are alternative arrangements that would work equally well. The important point is that at least some thematic structure will improve the recitations of disunited scientific facts and examples that has come to pass for science in many current curricula and instructional materials.

Six themes are developed in this framework. They are:

1. **Energy**
2. **Evolution**
3. **Patterns of change**
4. **Scale and structure**
5. **Stability**
6. **Systems & Interactions**

References to Essential Teaching Elements

(From California Science Framework)

The Role of Direct Experience in Science Learning

Much has been written about the need for students to conduct hands-on investigations in learning science. . . . "Learning by Doing" is the most effective instructional paradigm. Our best science teachers know, however, that experiential lessons must be planned more carefully than passive modes of instruction.

Engage students in science activities by placing them in a position of responsibility for the learning task.

Many teachers describe their best hands-on activities as "minds-on." Minds-on lessons grip students in a way that makes them truly engaged in the action. Students actively process the information revealed to them in direct experiences; and they demonstrate their new understandings in discussions with other students. The most directly observable clue that students are engaged in the task is that they control the learning episode. Whether the minds-on activity is hands-on or a simulation presented through electronic (or some other medium of) learning, the engaged student has the "power" to manipulate some aspect of what is happening. The test for an engaging hands-on experience is whether the student is controlling the situation or vice-versa.

Provide students with experimental problem solving where the result has direct meaning for them.

Along with the issue of student activity is the necessity for students to really care about the hands-on activity in which they participate. Students who are working to solve problems in which they have some investment are more likely to learn and retain important concepts. Science education has an enormous opportunity to invite students to learn about their world, so that students can come to understand what is important for them to learn and why.

Science Processes and the Teaching of Science

This chapter explains the processes of science that form the core of science pedagogy: observing, communicating, comparing, ordering, categorizing, relating, inferring, and applying. As scientists use these processes in their everyday work, so science teaching should center instruction, particularly hands-on instruction, on these fundamental processes, and expository instructional materials should show how scientists actually use these processes in their work.

The Processes:

1. **Observing**
2. **Communicating**
3. **Comparing**
4. **Ordering**
5. **Categorizing**
6. **Relating**
7. **Inferring**
8. **Applying**

The Processes in the Context of Child Development

Grades Three Through Six

In addition to the processes at which they are so adept in the earlier grades (*observing, communicating, comparing, ordering,* and *categorizing*), youngsters (in Grades 3-6) begin to develop the process of *relating*. Using this process and building upon the facts learned earlier, youngsters will derive many principles of science.

Grades Six Through Nine

As youngsters move into adolescence, they become more able to make inferences. They think more about the future and understand more about the past. They can comprehend concepts that are not represented by objects and materials. If their earlier activities have provided them with appropriate experiences, they can hypothesize, design experiments, predict, and conceptualize the laws of science.

Middle School Science

1. Introduce students to the connections among the disciplines of the physical, earth , and life sciences.

During the middle school years, students should have the cognitive ability to understand that developments in one field can have major implications for another. Nowhere is this more true than in the natural sciences. Fore example, if a local business causes a toxic spill in a nearby creek, students can examine what effects toxic chemicals will have on the soil, plants, and animals of the area.

2. Expand the role of the science processes.

As students mature during this period of adolescence, they become ready to tackle more sophisticated thinking processes that was possible earlier in their education Activities should raise students' expectations for the level of thinking of which they are capable. Students should be able to appreciate the connections among disciplines and to apply higher-level thinking processes in their study of science.

3. Motivate students to take and learn more science.

A major goal of middle school science is to maximize students' exposure to high-interest science topics so that they will be eager to enroll in a variety of science classes in high school. These students, more than those in any other age group, need to see a direct relationship between science education and their daily life. Courses designed to help students to learn about...their world (environmental/earth science) are highly motivating to these students. Science lessons should be highly experimental, manipulative, and laboratory oriented.

4. Create long-term projects with students

Middle grade science teachers can offer students the opportunity to select projects that are consistent with the curriculum for the course and involve considerable out-of-class work. Science projects increase the possibility that students will take responsibility for what the learn. As they develop this growing sense of responsibility for learning, they should be encouraged to seek assistance from peers, parents, teachers, and others in the community. Whether schools adopt a project orientation to their science program or not, at least 40 percent of the class time should be spent on activity-based lessons.

5. Make full use of community resources.

Many community agencies are open to participating in classes where adolescents care about what they learn. As students take initiative in learning science, they will learn more about their community and possible future vocations.

6. Establish the relevance of science lessons outside the school context. Middle grade students often challenge teachers about the relevance of a particular topic or concept. These challenges ought to be seen as requests for the relevancy of science to students' daily lives, and students should not be put off with an answer like, "You will need to know this in order to do well in high school."

If students are to take responsibility for their learning, they ought to be given reasonable justification for what they are learning. ...It may prove useful to entreat these students to develop the rationale themselves. In this way, they can begin to model the self-sufficiency towards learning they will use throughout their adult lives.

The Content of Science

LIFE SCIENCES

A. LIVING THINGS

A-1 What are Characteristics of Living Things?

All living things have DNA and RNA, the genetic material that determines how each organism grows and develops.

Digestion, respiration, metabolism, water regulation, and reproduction are functions common to all organisms; all but the simplest organisms have specialized tissues, organs, and organ systems to perform these functions. Cycles, such as those of carbon, nitrogen, oxygen, carbon dioxide, and other nutrients, are processes and patterns by which living things convert external materials to grow and maintain themselves.

A-2 How do the structures of living things perform their functions, interact with each other, and contribute to the maintenance and growth of the organism?

Organisms need energy to help them perform function necessary to life. They obtain energy through various means, either from sunlight or by digesting complex molecules and producing simpler ones.

The digestive, osmoregulatory, circulatory, respiratory, and reproductive systems have comparable function in different groups of organisms, even though the organ systems that perform them are often quite different.

In large groups of organisms, such as animals or plants, tissues and organs systems are homologous because they have been inherited from a common ancestor.

There is a hierarchy to the structure of biological systems. Cells are organized into tissues, tissues into organs, and organs into organ systems that perform particular functions in an individual. Individuals themselves are organized into reproductive groups (such as populations and species), that are part of larger taxonomic units (species and higher categories) changing and evolving through time.

The genetic diversity of populations of organisms is greatly increased by sexual reproduction, because new combinations of characters appear. Some combinations of characters are better suited to some environments than others.

A-3 What are the relationships of living organisms, and how are living things classified?

Groups of organisms are recognized because they share derived characteristics that appeared in their common ancestor and have been passed on. These characteristics serve as the basis for diagnosing and classifying groups of organisms. Within each of these groups are other groups that are distinguished by their own unique characteristics. By identifying these unique characteristics, we discover the evolutionary pattern, which is the basis for classification.

A-4 How do humans interact with other living things?

Humans have learned how to breed animals and plants to select desirable characteristics (artificial selection) much as natural selection has operated in evolutionary time.

B CELLS, GENETICS AND EVOLUTION

B-2 How are the characteristics of living things passed on through generations? How does heredity determine the development of individual organisms?

Genetic factors contribute to individual variation, and such variation are the raw material of evolution.

All living things follow the patterns of various cycles, and cyclical rhythms. Other patterns of change may be directional (e.G., growth, development, and maturation).

B-3 How has life changed and diversified through time? What processes and patterns characterize the evolution of life?

Natural selection and adaptation are different concepts. Natural selection refers to the process by which organisms whose biological characteristics better fit them to their environment are better represented genetically in future generations. With time, those that are more poorly fitted would normally become less well represented. Adaptation is the process by which organisms respond to the challenges of their environments, through natural selection with changes and variation in their form and behavior.

Extinction has been an inevitable biological process since life began. Over 99 percent of all the organisms that ever lived are now extinct. Extinction, therefore, is a natural process. But humans have also caused or contributed

to the extinction of many forms of life and continue to contribute to a rate that is much higher than at any previous time in human history. Extinction can stimulate further evolution by opening resource space.

C ECOSYSTEMS

C-1 What are ecosystems, and how do organisms interact in ecosystems?

Populations are groups of the same kind of organism (species) living together because they share common environmental needs. A population is also a natural reproductive unit.

Species are groups of populations of the same kind of organism, reproductively isolated from other species in their natural environments. Each species has its own niche, which is the sum of its interactions with other species and the physical environment of its ecosystem.

A community is a system of species that share an environment and interact with each other . Ecosystems vary according to the physical characteristics of their environments and also by the presence or absence of particular species. Each species has particular needs and interacts in particular ways with other species in the environment.

Predation and competition are important regulators of populations within ecosystems, and their effects have been demonstrated in living ecosystems. However, the ability to survive within the physical environment may be the most difficult task faced by most organisms and may be the prime factor underlying both adaptation and extinction.

The environment of a species consist of both physical and organic resources that can be exploited and used by it and other species. There are many kinds of adaptive zones in biomes.

Organisms have adaptations for coping with their environments and surviving to reproduce. Some animal species live in social groups, which enhance their ability to survive.

The earth supports an incredible diversity of habitats that have different kinds of physical properties and different associations of organisms. In each habitat the interaction of predation, competition, and so forth, and the flow of energy through organisms in the system can be studied and compared with those of other ecosystems.

C-2 How does energy flow within an ecosystem?

Energy and matter are transferred among organisms within each ecosystem. Matter needed to sustain life is cycled and recycled within ecosystems; however, energy is eventually lost to the ecosystem and must constantly be renewed. Because energy is either used by the consumer or lost to the environment as heat energy, its flow through a food chain can be represented as a pyramid. The efficiency of energy transfer decreases upward through the food chain and food webs.

Decomposers use organic material from producers, herbivores, and carnivores, and themselves decompose. Matter and energy are thus partly recycled in the environment.

C-3 How do ecosystems change?

The cycles of matter, such as oxygen, nitrogen, water, and minerals, are crucial to sustaining ecosystems.
Populations may stabilize over a period of time in a balanced ecosystem, where relationships among species are in a dynamic stability. Ecosystems are dynamic, and they change through time as climate and species compositions change. Speciation, extinction, immigration, and emigration are four ways in which the species composition of ecosystems can change. These changes affect the availability of sources of food and other resources and they also affect the flow of energy through ecosystems. Recently, humans have accelerated the rate of extinction of species and also the rates of emigration of species from their natural habitat, but the rates of speciation have not increased to keep up with the very high rate of destruction of species due largely to human intervention.

Natural catastrophic changes in ecosystems can wipe out many species in an area and reset natural cycles of succession.

Changes in the environment can affect the size of a population which may lead to its local or global extinction. Species must be sufficiently adaptable to absorb these changes and respond to them. Optimal population size helps to ensure variation in the organisms necessary for the population to survive.

C-4 What are the responsibilities of humans toward ecosystems?

Ecosystems often exist in a fragile balance. The extinction of a species by human contribution often affects the well-being of the ecosystem.

Pollution, which can be defined as an unnatural excess of (usually) abnormal materials in an ecosystem, is a primary human cause of local extinction. The

destruction of natural habitats, such as the tropical rain forest, and the elimination of necessary resources, such as breeding grounds turned into areas for recreation, agriculture, or housing , are the primary contributions by humans to the destruction of other species.

With careful planning , humans can manage ecosystems to preserve their diversity and natural beauty, while allowing human use.

GEOLOGY AND NATURAL RESOURCES

D-1 What is the history of the earth, and how have geomorphic processes shaped the earth's present features?

Geographic features of the earth's surface are manifestations of its geology. The topography of a region; the content and mineral resource of its rocks and soils; its economic resources, transportation routes, water sources, and potential for agriculture, fishing and support of domesticated animals all ultimately depend on geology.

D-2 What are the responsibilities of humans toward natural resources?

Humans use air, fresh water, soil, minerals, fossil fuels and other sources of energy that come from the Earth. Some of these materials are non-renewable: they cannot be replaced, or can be replaced only at such slow rates and under such rare conditions (e.g., fossil fuels) that they are for all practical purposes not renewable at all. Therefore, their use must be seen as ephemeral, and they must be conserved judiciously. (Energy, Systems & Interactions)

PHYSICAL SCIENCE

F-1 What is force? What are the characteristics of forces? What is the relationship of force to motion?

G-1 What happens when substances change? What controls how substances change?

CORRELATION OF LESSONS IN 7-8TH GRADE CURRICULUM WITH SCIENCE FRAMEWORK

Lesson	Reference to Content	Reference to Themes	Reference to Processes
Fashion A Klamath Fish	A-3, B-3	4, 6	2, 3, 5,
Comparing Lives of Salmon and Humans	- -	2, 4, 6	2, 3, 6, 7
Aquatic Food Pyramid & Energy Flow	A-1, A-2, C-2	1, 4, 6	2, 5, 6
Stream Diversity Protects Salmon	C-1, C-3, C-4, D-2	4, 6	1, 3, 6, 7
Limiting Factors	C-1, C-3, C-4, D-2	3, 5, 6	3, 4, 6, 7
Sediment Effects on Salmon Eggs	A-1, C-1, C-3, C-4, D-2	6	1, 3, 6, 7
How Salmon & Steelhead Smolts Use Klamath Estuary	A-4 C-1, C-3 C-4, D-2	3, 5, 6	3, 6, 7, 8
Memories of Days (And Fish) Gone By	C-3, C-4, D-1, D-2	3, 6	2, 3, 6, 7
Cappel Fish Dam and Yurok Fisheries Management	A-4, C-1, C-4, D-1, D-2	6	2, 4, 7
Comparing Insects in Different Streams	A-3, B-2, B-3, C-1	2, 3, 4, 6	1, 2, 3, 4, 5
Aquatic Insect Dichotomous Key	A-3	2, 4	1, 3, 5
Habitat Typing	C-1, C-3, D-1, F-1	1, 3, 4, 5, 6	1, 3, 5
Dissolved Oxygen and Temperature	G-2, C-3, C-4	3, 4, 5, 6	1, 3, 4, 5, 6, 7

Lesson	Reference to Content	Reference to Themes	Reference to Processes
Measuring and Understanding pH	G-2	3, 5, 6	1, 3, 4, 5
Measuring pH of a Stream.	G-2, A-4, D-2, C-4	3, 5, 6	1, 3, 4, 5, 6, 7
Planting Willows	C-3, C-4, D-1, D-2	3, 5, 6	3, 7
Why Fish and Game Laws?	A-4, C-1, C-3, D-2	3, 5, 6	2
Who's Who In Fisheries Management and Restoration.	A-4, D-2	6	2, 3, 7
What is Escapement?	A-4, C-1	6	
Who Is Catching Klamath Fish In The Ocean?	A-4, C-3, D-2	3, 6	2, 3, 5, 7
Salmon Population Trends in the Shasta River	B-3, C-3, C-4, D-2	3, 6	2, 3, 4, 7
Ocean Commercial Salmon Fishing and Local Economy	A-4	6	2, 5, 6, 7
Fish Runs of K-T River Systems	B-2, C-1, D-1	2, 6	3, 7

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1991 KLAMATH RIVER SUMMER INSTITUTE AGENDA

Monday, July 8: Convene at 1:30 Yreka Community Center

1:30 - 3:30 •Lunch, Introductions, Orientation and some words about safety •Mapping activities from K.R.E.P. curriculum - to get acquainted with the Klamath River Basin.
3:30 - 5:00 •Klamath National Forest fisheries program, Jack West, Forest Fisheries Biologist

5:00 - 6:00 •Break/ Dinner
6:00 - 6:30 •Slide show tour of Upper Klamath Basin, Pat Higgins, Consulting Fisheries Biologist
6:30 - 9:00 •Tour of Shasta River Valley - riparian restoration site, spawning channel Dennis Maria, Fisheries Biologist with California Dept. of Fish & Game

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Tuesday, July 9

7:30 - 9:00 •Breakfast, make lunches
9:00 - 10:00 •Travel to Scott River Valley

10:00 -12:30 •Tour upper Scott River Valley. Bob Bartholomew of the Soil Conservation Service will be with us. We'll visit the ranch of Mike Bryan to see river uses and some restoration work. We'll also visit Moore's gravel to see the devastating effects of mining from earlier times. At French Creek, we'll see decomposed granite sands that cause so many problems in the Scott River system. Take samples of aquatic insects. Cool off.

12:30 - 1:30 • Lunch

1:30 - 5:00 • Drive down the Scott River. See a fish screen in Quartz Valley. We'll stop at Kelsey Creek spawning channel where we'll be joined by Greg Des Laurier, Fisheries Biologist with Klamath National Forest. First direct observation dive - compare fish use of Kelsey Creek and Scott River. Pat Higgins, Fisheries Biologist, will help identify the fish we see.

5:00 - 6:00 •Travel to Sarah Totten campground.
6:00 - 7:30 •Break, Set up Camp and Dinner

7:30 - 9:00 •Peter Brucker - Klamath Forest Alliance - Perspective of an local environmental group

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Wednesday, July 10

7:00 - 8:30 •Breakfast, make lunch, pack up to leave
8:30 - 10:00 •Drive down Klamath River

10:00 - 12:30 •Go up to Slater Ridge to view areas burned by recent fires. Ken Baldwin, Geologist, with the U.S.F.S., will join us.

12:30 - 3:00 •Look at restoration work and fish habitat on Elk Creek and eat lunch. Alan Olson, Fisheries Biologist, U.S.F.S. We may visit with people who are dredge mining on Elk Creek.
We'll be joined by Dr. David Lauck, and John Lee aquatic entomologists, who'll help us collect and identify insects

3:00 - 5:00 •Clear Creek: Cool off, dive in the water to see juvenile salmon and steelhead in some of the most pristine habitat in the Klamath system.
5:30 - 7:30 •Arrive at Young's Ranch, Somes Bar. Get settled in, eat dinner.

8:00 - 9:00 •Green sturgeon in the Klamath River system. Pat Foley, Graduate student, U.C. Davis.

Thursday, July 11

7:30 - 8:30 •Breakfast, make lunches

8:45 - 11:00 •Visit Ishi Pishi Falls, a fishing place of the Karuk people. Leaf Hillman, representative for the Karuk Tribe, will talk about Karuk fishing and culture. We'll then drive down to Camp Creek to see the spawning and rearing facility operated by the Tribe and CDF&G . We'll also see some stream restoration work.

11:00 - 1:00 •Soyka Dobush, Fisheries Biologist, Six Rivers National Forest will explain her research on downstream migrants and how habitat typing is used by fisheries biologists. Habitat type small segment of creek. Eat lunch.

1:00 - 3:00 •Diving - direct observation of fish and habitat. Collect aquatic insects from different stream habitats. Dr. Lauck will show sampling technique and help identify insects.

3:00 - 6:30 •Go back upriver, taking in lower portion of Salmon River. See mouth of Wooley Creek and visit Butler Creek. Collect more insects. Travel back to Young's Ranch

7:00 - 9:00 •Dinner, followed by slide show on Klamath River Basin Fisheries Restoration Program. Tricia Whitehouse, Fishery Biologist, U.S.Fish and Wildlife Service.

CAN YOU KEY THIS BUG? A CONTEST FOR EMERGING ENTOMOLOGISTS.

Friday, July 12

7:30 - 8:30 •Breakfast, make lunches, pack and leave

9:15 - 10:15 •See Bluff Creek and the astounding impacts of the 1964 flood. Pat Higgins and Danny Hagans will facilitate.

10:15 - 12:00 •Drive to Hoopa, stopping to see the convergence of the Trinity and Klamath Rivers.
12:00 - 1:00 •Lunch

1:00 - 2:30 •Traditional uses of salmon by the Hupa Tribe. Jasper Hostler, Vice Chairman, Hoopa Valley Tribal Council.
• Restoration work being done on the Hoopa Square. Mike Orcutt, Fisheries Biologist

2:30 - 4:30 •Visit Mill Creek with Danny Hagans, Earth Scientists, Pacific Watershed Associates, and Mike Orcutt and discuss comprehensive watershed management as an approach to fisheries restoration. Greg Bloomstrom, Forester for the Hupa Tribe, will talk about planning timber harvest to reduce impacts to fish.

4:30 - 7:00 •Travel to H.S.U., Break, Dinner

7:00 - 9:00 •Brainstorm lessons covering topics relevant to Klamath Restoration.

Saturday, July 13

8:00 - 9:00 •Breakfast, pack up and be ready to leave.

9:00 - 10:30 •Key aquatic insects in biology lab

10:30-11:00 •Travel to Eureka

11:00 - 12:00 •The Commercial Fishermen's perspective on harvest management. Visit fishing boat.

12:00 - 1:00 •Drive to Trinidad and eat lunch

1:00 - 2:00 •Visit retail fish market (Katy's) to see how fish are bought and processed for sale. Observe sport fishing at Trinidad pier.

2:00 - 3:00 •Travel to Klamath River estuary.

3:00 - 4:00 •Talk to Mike Wallace, California Dept. of Fish & Game, to learn about seining as a tool for estimating fish populations, and studies of smolt migrations.

4:30 • Arrive at Redwood Youth Hostel, Wilson Creek

4:30 - 6:00 Enjoy the ocean (hopefully in the sun)

6:30 - 9:00 Yurok salmon barbecue and demonstration of fishing techniques at mouth of Klamath River.

Sunday, July 14

7:30 - 8:30 •Breakfast

8:30 - 10:30 • Structured share time - discuss ideas for implementing experiences from the last week our classrooms.

10:30 - 11:30 •Instructions for writing implementation plans (for H.S.U. credit) Diane Higgins Wrap-up.

Depart by 12:00.

SUMMARY OF TEACHERS' EVALUATIONS OF *KLAMATH RIVER STUDIES FOR GRADES 4-6*

Task 4.1 Monitor teacher training by consulting teachers in the curriculum and field activities plans.

Task 4.2 Monitor use of the curriculum and field activities, and prepare a quantitative estimate of the extent of use.

Task 4.3 Qualitatively evaluate the curriculum and field activities as taught during the 1990-91 school year, and provide detailed recommendations for revising and updating. Evaluation should included detailed comments of teachers using the materials.

METHOD OF GATHERING INFORMATION

An evaluation of the curriculum materials for grades 4-6 was conducted using questionnaires and telephone interviews. Inquiries about use of the curriculum by about 100 teachers were made. Forty four questionnaires were sent to teachers who had received the curriculums at the 1991 Aquarium Incubator Inservice in Siskiyou County and at the 1991 Redwood Area Science Project Workshop in Humboldt County. Forty phone interviews were conducted. Information about the remaining teachers was attained through other teachers who knew whether they had used the curriculum.

Nine of the forty four questionnaires (20%) were returned. Although this is considered a good response rate to a survey, it did not help much in determining the extent of use of the curriculum. Phone interviews proved to be the best method for gathering information.

TASK 4.2 QUANTITATIVE ESTIMATE OF EXTENT OF USE

Sixty nine percent of all teachers who responded to the survey used the curriculum. However, nine who received the curriculum were high school teachers who attended the 1991 Summer Institute. None of these teachers used the materials. This is to be expected, since the discrepancy in grade levels too great, and most of the activities were not age appropriate. When these teachers are eliminated from the calculations, the percentage of use is greater.

Eighty three percent of the **teachers of grades 4-8** who responded to the survey or were interviewed by phone used the curriculum.

All teachers (with the exception of one who is no longer teaching) who attended the 1990 and 1991 Summer Institutes were surveyed by phone. These teachers used the curriculum at a much higher rate than others. A conversation with Kim Stokely revealed that all of the eight teachers she gave the curriculums to had used them. Of the nine teachers who returned the written questionnaire (none of whom attended the institutes), 50% had used the curriculum. (One returned survey was omitted, because the teacher apparently was confused and gave responses pertaining to a different curriculum. About 50% of the teachers who received the curriculum at the inservices conducted by the 4-6th grade consulting teachers had used some of the materials.

These results indicate that those teachers with the most extensive exposure to the Klamath River issues (via the Summer Institute or the Adopt-A-Watershed Program) are the most likely to implement the materials. Although the number of responses to the questionnaire is small, the responses received indicated that teachers using aquarium incubators are more likely to use the materials than those who do not have an incubator.

Another fact became clear in talking to teachers. Teachers often keep all related materials together in a binder or file. They don't pay much attention to the source of the materials. Some teachers got the Klamath lessons confused with those from *California's Salmon and Steelhead*. This curriculum was also given to those who attended the 1990 Summer Institute. Disseminating two curriculums at once is probably not a good idea if the goal is to have teachers focus on only one of them.

Although many teachers took their students on field trips, the field trip summaries did not seem to be the inducement to do so.

TASK 4.1 DISSEMINATION OF CURRICULUMS BY CONSULTING TEACHERS

Of the ten original consulting teachers, eight worked with the program to completion. Seven of these presented the curriculum to other teachers in their schools in the spring of 1991. The other teacher, Gary Warner, does not teach at a school, but introduces many teachers to the KREP materials while they are at the Kidder Creek Outdoor School.

After talking to the consulting teachers and a few of the teachers to whom they gave the curriculums, it would seem that this is not the most effective method of disseminating the curriculum. There are several reasons for this. Consulting teachers gave short presentations at faculty meetings and then gave out the curriculum. The focus of their talks tended to be their own experiences with the Summer Institute and in their classrooms. Since they had only contributed lessons, and had not written the whole curriculum, they did not feel they were expert enough to really dive into the topics of harvest management and fisheries restoration in detail.

The smaller schools usually have only one teacher per grade level, or combined grade levels. McCloud, Big Springs and Trinidad are such schools. This meant that at most, only two other teachers taught appropriate grade levels for the 4-6th grade materials. (In fact, consulting teachers gave the curriculums to some primary and some 7-8th grade teachers as well. Primary teachers did not use it, but some of the 7th and 8th grade teachers did.) If the other teachers are not interested in environmental education or fisheries topics, they will not use the materials, regardless of how much "in-servicing" is done.

The schools where the method of having consulting teachers disseminate the curriculum was most effective were: McCloud (because they have an adopt-a-watershed program that all grades are involved with), Trinity Valley and Hoopa schools (because several teachers already had an interest in the subjects and they are close to the Trinity River). At two of the smaller schools, this method of dissemination was not as effective. At Big Springs, where the fourth grade teacher gave out the curriculum, the fifth and sixth grade teachers had no interest in the subject of fisheries. The 7th grade teacher, John Crechriou, was already working with the KREP. At Trinidad, the situation was the same. The fourth and sixth grade teachers aren't interested in teaching about the environment, and the 7th grade teacher was already working with the KREP. Eight teachers at Morris School received the curriculum at a short inservice about their adopt-a-stream project. Three of those teachers are using some of the materials.

Some possible alternatives to having consulting teachers disseminate the curriculum would be to conduct one or two day workshops targeting teachers in each county who have an interest in fisheries and river resources. Teachers could learn about some of the issues, and get hands-on training in field techniques, such as water quality analysis, aquatic insects and willow planting. Since it would be elective, only those with

an interest would be there. This would increase the probability that the curriculum gets used, and would allow those with an interest who cannot attend the Summer Institute to get some training and receive the curriculum.

When the Adopt-A-Watershed (AAW) program is developed and ready for implementation, the KREP materials will be given to participating teachers. The AAW Program is including lessons from KREP in their units about fish. Implementation of the AAW program will begin in Trinity County next year. Giving the curriculum to teachers who raise salmonids in their classrooms is also a good idea.

TASK 4.3 QUALITATIVE EVALUATION: SOME COMMENTS MADE BY TEACHERS

Many commented that the curriculum was comprehensive and offered a wide variety of topics and types of activities. Phrases used were:

- a wealth of material,
- a good resource for information,
- good representation of all the impacts (not just easy targets, like timber),
- lessons are written well in good format with understandable background, procedures and evaluations
- excellent activities
- good background information, lessons are easy to read
- more than enough to choose from - good to have choices of materials
- nice illustrations and presentation
- very complete, includes more than can be done in one year
- for 4-6 combined classes its good to have many activities because teachers avoid doing the same thing two years in a row since they have the same kids for three years
- overall it is a very well designed book
- activities are hands-on: role playing, graphing, keying insects, etc.
- gives a good feeling for what's going on in the river basin
- activities are fun - kids like doing them
- lots of variety - good for heterogeneous class
- gives opportunities to apply science in other subjects (English, Social Studies)
- shows the big picture - relates fish to habitat and watershed
- all the materials are good but insect materials are the best

Suggestions for changes or additional materials were:

•the lesson *Changes in Harvest* should have actual (estimated) numbers of fish for each year instead of the hypothetical 100,000 fish each year

•keep the hypothetical 100,000 fish as an introductory activity, then have students use the real numbers

•include information about methods scientists use to estimate fish populations

•for *Harvest Management* (simulation where students take on roles of user groups), let students question each other after all have stated positions - make them defend their positions and engage in debates

•encourage letter writing, give guidelines for writing letters to editors that are not accusatory or rude - give addresses of political representatives

•include information about the restoration program and what it is doing

•more information about hatchery vs. wild fish and their harvest

•overview of different runs - why are spring runs wiped out and not fall runs?

•have teachers write up descriptions of their own field trip sites

•put in a list of schools participating in the KREP and encourage exchange of data between schools (weather, stream conditions, restoration work done)

•need illustration or photograph of a wollman stick

•the section on restoration techniques may be a little wordy - possibly too long - problem is how to manage it - too many pages to make sets for every student - suggest that teacher make booklets they can reuse each year - possibly make illustrations smaller to get more per page

•suggest that teachers have students make models of restoration work

•what kinds of streams are easy to adopt - which are not?

•give more information about things to take on field trips

•include how long it takes to do activities, exactly how many copies of materials to make, etc.

•give some sample units

•move restoration game to 7-8th grade - too complex for 4-5th graders

•include more information about Trinity River - maps, fish runs, etc. (Kids in Humboldt County tend to be more familiar with the Trinity River than with the Klamath River. Trinity County schools will be using KREP materials as part of the AAW program and they want relevant information.)

•add more short lessons - some are too long & and complicated

•for a given concept - possibly have one lesson that is very simple to do - another that is more involved

•make information simpler for teachers with no science background

•include more cross words, word finds, vocabulary and spelling lists - dictionary of aquatic/restoration terms

•show how to integrate concepts throughout the year - infuse ideas and approach them indirectly - some kids are very biased against the environment because of family attitudes - will turn off when issues are addressed directly

•include more Native American stories

•tie lessons in with reading of books - make outlines for a few of the favorites that teachers use such as *I Heard the Owl Call My Name*

•include more prepared materials so teachers don't have to do much preparation work

•use salmon as a framework to teach other concepts - not necessarily a discrete unit on salmon but show how salmon issues could be embedded into larger themes

•make collection of slides showing what each subbasin looks like so kids can get a visual impression of what the Klamath River Basin is like, from the upper Klamath to the estuary

•include instructions about how to preserve insect specimens
•put focus on gathering data - keeping journals of data, etc.
•include information about life cycle of insects
•include more activities to do at stream sites

Some of these suggestions were made by the 7th and 8th grade teachers, and are not as appropriate for grades 4-6. Those that are appropriate will be incorporated into the final version of the curriculum.

The biggest discrepancy in comments exists in the amount of information teachers want to see. Some are put off by too much information, others really appreciate it. Perhaps the background sections for individual lessons could be written very simply, and more complete information could be included separate from the lessons.

CONCLUSIONS

The curriculum was well used by those teachers who received it. However, the challenge is to find all the teachers who may have an interest, and encourage them to use the curriculum. Since the topics of fish and river restoration are not mandatory in any school curriculum, teachers will use them at their own discretion. It is also important to design lessons and units that contain many concepts and skills that teachers are required to teach, so they won't feel they are "taking time out" to teach about salmon and the restoration of watersheds.

The suggestions for infusing fisheries concepts into bigger themes will be especially relevant when the high school level is developed. High school schedules and curriculums tend to be more rigid than elementary school, and teachers don't have time to include "extra" units.

Studies have shown that it takes at least five years of follow-up contacts with teachers to get a new program fully implemented. Although a high percentage of teachers used the *Klamath River Studies*, usage may drop off if they don't continue to get support and encouragement.

Dissemination of the curriculum by consulting teachers does not seem to be very effective. It might be better to have consulting teachers help identify others at their school who might be interested in these topics, and encourage them to attend workshops where the curriculum is given out. Direct visits with interested teachers to introduce them to the ideas and give assistance might also be useful.

A SUMMARY DESCRIPTION OF CURRICULUMS ABOUT SALMON

This report has been prepared to fulfil one of the goals set forth in the contract for development of the 7-8th grade portion of an educational program. Specifically, that goal calls for a summary description of other curriculums and field activity programs in use in the Pacific Northwest states and British Columbia having anadromous fish restoration as principal subject, and display how the curriculums and field activities developed through the Klamath Fishery Restoration Program may best be integrated to provide maximum educational benefit.

A survey of the existing curriculums found that none have restoration of salmon habitats or populations as the major subject. However, there are several curriculums and programs that deal primarily with salmonid life histories and habitats or with watershed and stream systems. These are summarized below. They are:

Clean Water Streams and Fish: A Holistic View of Watersheds
The Stream Scene
Salmonids in the Classroom
California's Salmon and Steelhead, Our Valuable Natural Heritage
Life Cycle of Salmon
The Salmon Kit
Adopt-a-Stream
F.I.S.H. (Fishermen Involved in Saving Habitat)
Adopt-a-Watershed

Portions of the Klamath River Educational Program curriculum products could be used in any Pacific Northwest school, while other parts would probably be considered too specific to the Klamath River system to be of use elsewhere. The readings about the anadromous fish species might be of some use in other regions for the general information they present. The information about aquatic insects, variations in habitat use, food webs, limiting factors, fish adaptations, water quality analysis, watershed and instream restoration and economics would be of use in other regions.

However, the materials have been designed specifically for use in the Klamath Basin, and some lessons may not be useful outside this area. The river basin maps, the simulations that are designed specifically for Klamath River issues, and information about the Native Americans are designed for schools near the Klamath River and would not transfer well to other regions.

There are several significant distinctions between the KREP products and other products. The KREP curriculum puts a major emphasis on natural runs of fish and natural spawning, as opposed to hatcheries. The KREP is also placing a major focus on restoration. None of the other products deal with restoration techniques, or the economic issues of resource use (ie. fisheries, agriculture, timber, tourism, etc.) In this respect, the KREP products could provide other regions with unique and relevant information that is not available elsewhere. Also, with the exception of *Clean Water, Steams and Fish*, none of the other curriculums cover the issues of fish habitat as thoroughly as the KREP products. And, although that curriculum is thorough and fairly in-depth, it lacks the visual appeal of the KREP materials. Since this is a major factor that determines use, the KREP materials could provide useful supplementary materials to be used by teachers in conjunction with *Clean Water Streams and Fish*. Together, these products would offer information for either urban or rural areas, and teachers could choose the student materials they found to be most appealing.
A summary of the curriculums and programs in existence is given below.

CURRICULUMS

Clean Water, Streams and Fish: A Holistic View of Watersheds
Washington State Office of Environmental Education, no date
17011 Meridian Ave., Seattle, WA 98137
Grade Levels: Elementary; Secondary

This curriculum was designed for use in Washington schools, but approximately half of the materials are general enough to be used throughout the Pacific Northwest. The main focus is watersheds and salmonids.
The secondary curriculum revisits the same topics covered in the elementary curriculum, giving more reference materials and going into more depth.

Topics covered include:
•classification of animals and fish
•identification of the species of salmonids
•basic ecological concepts such as food webs and requirements for life
•aquatic food webs and the role of salmon in those food webs
•how stream environments provide shelter and other needs of the fish
•identification and significance of various stream parameters such as

water temperature, flow rates, aquatic insects and water quality
- concepts of watersheds: water cycle, soil types & drainage, topography, erosion, the making of a stream
- threats to fish - predation and natural disasters (eruption of Mount St. Helens is the example given), human caused threats including agriculture, logging, urban development, dams and mining
- data and maps showing size of fish harvests in Washington and dams in the Columbia River Basin
- techniques to prevent some problems: designing culverts, disposing of toxic wastes and techniques to prevent flooding and erosion caused by urban development
- an essay about the need for and some problems with hatcheries
- a list of all hatcheries in Washington
- Native American legends and uses of salmonids

There is some overlap of topics covered by *Clean Water, Streams and Fish*, and the Klamath River Educational Program curriculum. However, materials from KREP are presented in more detail and with much better illustrations and worksheets. The KREP materials also give information specific to the Klamath River Basin that are not found in *Clean Water, Streams and Fish.* For example, the materials about fish in the Washington curriculum include the pink, sockeye and chum salmon, which are not found in the Klamath River system. No other anadromous fish species are discussed in the Washington curriculum.

The information about conservation and restoration in *Clean Water, Steams and Fish* has a strong emphasis on urban environments. There are several lessons about household toxic wastes and the detrimental effects of paving. There is no information given about best management practices for timber harvest, livestock grazing, crop irrigation or regulating flows through dams. There is nothing about the impacts of fertilizers and biocides that would be appropriate for the Upper Klamath Basin or the Scott and Shasta River Basins.

This curriculum contains region-specific information that would not be of much use in other states or regions. Examples of such information includes Native American legends and histories, location of Washington's dams and hatcheries, commercial fishing techniques and regulations in Washington, and native plants.

The Stream Scene
Oregon Dept. of Fish and Wildlife, 1990
P.O. Box 59, Portland, OR 97207
Grade Levels: Grades 6-12

The focus of this curriculum is watersheds and streams. There are only two lessons about salmon. The topics covered include:

- the water cycle
- definition of a watershed
- water dynamics - flows as related to climate and seasons, stream bed composition
- water quality: temperature, dissolved oxygen, pH, and sediment
- aquatic insects
- directions and data sheets for stream studies

These materials would be good supplements to the KREP curriculum. The aquatic insect section contains very good information about functional feeding groups that the KREP product does not have. Also, the data sheets for conducting stream studies would be useful to teachers and students in the Klamath River Basin. The KREP curriculum materials could be used along with *The Stream Scene* to broaden the scope of studies to include anadromous fish and restoration of watershed and stream habitats.

Salmonids in the Classroom
British Columbia Department of Fisheries and Oceans, Salmonid Enhancement Program, 1984
BCTF Lesson Aids, 105-2235 Burrand St., Vancouver, BC, Canada, V6J 3N9
Grade Levels: Primary; Elementary; Intermediate and Secondary

Salmon are are main focus of these curriculum products. Each curriculum contains unit outlines, lesson plans, transparencies and references to other materials that are available through the Salmonid Enhancement Program. The main topics covered include:

- salmon life histories
- species of salmon found in B.C.
- habitat requirements
- threats to salmon
- the fishing industry: economics, fishing techniques, nutritional value
- hatcheries
- some field activities

The primary materials could be used throughout the Pacific Northwest, since they are the most general. The materials for older students are more specific to British Columbia. For instance, salmon ocean ranges are discussed but are specific to fish from British Columbia rivers. Fishing techniques and management are also specific to Canada. The lessons on fish anatomy and habitats could be used throughout the Pacific Northwest.

This curriculum does not discuss restoration techniques. It does delve into habitat destruction to a small extent. There is no direct reference to problems caused by timber harvest, agriculture or grazing. There is a strong emphasis on artificial production as a means of fisheries restoration.

California's Salmon and Steelhead, Our Valuable Natural Heritage
Diane Higgins, et al, 1989
4649 Aster Ave., McKinleyville, CA 95521
Grade Levels: K-6

This curriculum is about the salmon and steelhead in California and covers the following topics.

- classification of animals and salmonids
- fish anatomy & physiology
- life cycle
- habitat requirements
- homing behavior
- river habitat components
- aquatic food webs
- watersheds
- people's use of fish (historic, economic and management aspects)
- threats to fish
- restoration and conservation techniques
- wild vs. hatchery fish issue
- careers in fisheries/ resource management
- raising salmonids in the classroom

The curriculum contains many reference readings for teachers that would be useful to use in conjunction with the KREP materials. The KREP products goes into much more detail about restoration, aquatic ecosystems, and includes other species of anadromous fish. The KREP lessons could be used to supplement *California's Salmon and Steelhead.*

Life Cycle of the Salmon
Pacific Science Center & Washington Sea Grant, 1988
200 Second Ave. North, Seattle, WA 98109
Grade Levels: Grades 4 & 5

This curriculum focuses entirely on salmon. Activities include:

- a story about a salmon's encounter with danger
- the salmonid life cycle
- a salmon habitat mural, showing dangers encountered by the fish
- a chart showing the 5 species of salmon
- a slide presentation about the salmon life cycle
- a physical game that takes students (salmon) through an obstacle course
- observation of a salmon to learn about physical adaptations
- tools for evaluation

All of the materials in this curriculum could be used by teachers in the Klamath River Basin to enhance their studies of salmon. The information is general and basic.

Fish and Fisheries
Alaska Sea Grant Program, 1983
University of Alaska, Fairbanks, Alaska
Grade Level: Upper Elementary

Salmon are included in this curriculum but are not the main focus. The main topic is fish, with a strong emphasis on the economic and food values of fish. Species covered are halibut, blackfish, herring and salmon. Topics are:

- classification and adaptations of fish
- the species of fish
- field activities to study stream and lake environments
- fishing: traditional and current methods
- life on the seas and rivers: navigation, boat and nautical language, boating safety, sportfishing
- fish as food: nutritional values of various fish, fish processing, and the fishing industry
- fish for the world: aquaculture and hatcheries, needs of other countries for fisheries resources

The Salmon Kit
Pacific Science Center, no date available
200 Second Ave. North, Seattle, WA 98109
Grade Level: Grades 4-6

This curriculum focuses on salmon and puts an emphasis on math and science. There are ten activities, a computer program and a slide show. The activities are:

- species identification: distinguishing between the 5 salmon species
- make a graph showing salmon populations
- film strip about life history and habitat requirements
- computer activity to teach about populations of salmon and the effect of some hazards on populations
- computer activity to show how different salmon species prefer different stream environments
- experiment to show how temperature affects breathing rate of fish
- computer activity about fish sampling
- life at a fish hatchery : a film strip
- design a fish hatchery - students build model hatcheries
- fish anatomy

The cost of this curriculum ($200) may be prohibitive to many school districts. The various elements (written materials, film strips and computer programs) may not be purchased separately. There is a strong emphasis on hatcheries. No information about protecting and restoring habitats is included.

PROGRAMS

Adopt-a-Stream Foundation
P.O. Box 5558, Everett, WA 98206

The Adopt-a-Stream Program is based in Olympia, Washington. It assists concerned citizens, including school children, in adopting streams and helping to restore them. Activities the foundation encourages include: stream clean up, rearing fish in hatch boxes and stocking local streams, and community education efforts. The foundation has published a book called *Adopting A Stream: A Northwest Handbook*. It is not a curriculum, but could serve as a useful reference for teachers.

A number of school or other community groups throughout the Pacific Northwest have adopted local streams. These are not formal programs, tend to be very local in their focus and are not officially tied to the Foundation. Typical activities include studying and monitoring streams, engaging in restoration work like replanting riparian areas and stabilizing watersheds, monitoring water quality, small scale fish rearing, and participating in public policy meetings.

Fishermen Involved in Saving Habitat (FISH)
Pacific States Marine Fisheries Commission, No date available
2501 SW First Ave., Suite 200, Portland Oregon 97201

This group has produced a poster for students to color that shows twenty-four fish and shellfish that are important in the Pacific Northwest. They have also compiled a forty-four page package of lessons from various sources, including *Project Wild, Nature Scope* and *California's Salmon and Steelhead*, among others. The lessons do not all deal with salmon, but rather are about aquatic habitats in general.

Adopt-a-Watershed Program
P.O. Box 70, Hayfork, CA 96041

This program is currently being developed by the Trinity County Office of Education. It is still being produced and pilot tested, and completed lessons or units are not yet available for review. The program will be for grades K-12 and will include units that cover these topics:

Watersheds , Wildlife, Rocks, Soils, Landforms, Fish, Trees, Animal Adaptations, Populations, Riparian Ecosystems, Indicator Species, Water, Wild flowers, Birds, Forest Ecosystems, Native Americans, Geologic History, Human Responsibility & Land Use Management, Ecosystems and the Physical Environment, Water Cycle, Aquatic Ecosystems, Agriculture, Succession, Water Quality, Watershed Physics, Vegetation Management/ Forestry, Recreation, Wildlife Management, Fisheries/Wildlife.

Portions of the KREP curriculum will be included in the Adopt-a-Watershed program. These two programs are being closely coordinated to prevent duplication of lessons and to increase the usefulness of the KREP lessons to teachers in Trinity County.