

Whiskeytown Environmental School
Clear Creek Field Lab Experience – Fourth Grade
Salmon Life Cycle

Revised Fall 2008

Unit Overview:

In this unit, students will be introduced to the concept of food chains and webs in the context of the Clear Creek watershed. After discussing the implications of losing salmon from the ecosystem, they will learn about the efforts to restore salmon to Clear Creek. They will test biotic and abiotic factors at Clear Creek to assess its suitability for salmon.

Classroom Lesson 1: *Food Chain Simulation*

After a simulation activity, students explain the eating patterns of members of a simple food chain.

Classroom Lesson 2: *Creating a Salmon Food Web*

Using the information provided, the students will create a salmon food web and then discuss the consequences if salmon are removed from the aquatic ecosystem.

Classroom Lesson 3: *Hooks and Ladders*

Hooks and Ladders is a game that deals with the life cycle of Pacific salmon.

Field Lab Lesson 4: (Taught by WES Staff at Clear Creek)

Activity One: Stream Chemical Assessment

The students will perform a variety of tests at Clear Creek to determine its suitability as salmon habitat.

Activity Two: *Stream exploration*

The students will explore the stream by catching bugs and placing them in buckets. The students will assess which bugs they have and using a stream sheet will determine if the bugs present indicate healthy or unhealthy water.

Classroom Lesson 5: Assessment/ Follow Up

Using the data collected during the field lab, the students will discuss the suitability of Clear Creek as salmon habitat.

Science Content Standards - Fourth Grade

State of California, State Board of Education

Life Sciences

1. All organisms need energy and matter to live and grow. As a basis for understanding this concept, students know:
 - a. plants are the primary source of matter and energy entering most food chains.
 - b. producers and consumers (herbivores, carnivores, omnivores, and decomposers) are related in food chains and food webs, and may compete with each other for resources in an ecosystem.
3. Living organisms depend on one another and on their environment for survival. As a basis for understanding this concept, students know:
 - a. ecosystems can be characterized in terms of their living and nonliving components.
 - b. for any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.

Investigation and Experimentation

6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content of the other three strands, students should develop their own questions and perform investigations. Students will:
 - a. differentiate observation from inference (interpretation), and know that scientists' explanations come partly from what they observe and partly how they interpret their observations.
 - c. formulate predictions and justify predictions based on cause and effect relationships.
 - d. conduct multiple trials to test a prediction and draw conclusions about the relationships between results and predictions.
 - e. construct and interpret graphs from measurements.

Classroom Lesson 1: *Food Chain Simulation*

Objective

After a simulation activity, students explain the eating patterns of members of a simple food chain.

CA Science Standards – 1a, 1b

Time/Setting

45 to 60 minutes; Outdoor area with about 15 meters (50 feet) on a side

Materials

Nametags or armbands
Four to five liters (four to five quarts) of popped popcorn (or beans or acorns)
Marking pen
Timer
Masking tape
Graph paper
One sandwich bag stomach for each student

Subjects

Science, physical education, math

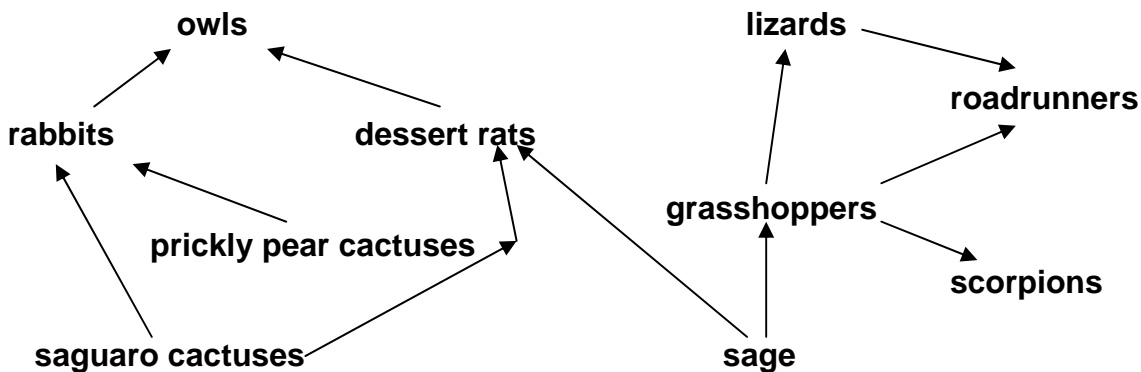
Vocabulary

Biotic community, food chain, predators, prey

Background Information

A human community meets all the needs of its members, including food needs. In a biotic community, all the needs of plants and animals living there are met by the various elements of the community. For example, the animals in a particular biotic community must have their food needs met by other members of the community. This means that plant-eating animals depend on suitable plants for food, and animal-eaters, or predators, depend on prey for survival.

A food chain is a simplified way of showing food relationships between plants and animals in a community. The food chain grass → mouse → hawk shows that grass is eaten by a mouse and the mouse in turn is eaten by a hawk. (The arrow points in the direction that the food energy is flowing; in this example, food energy in the grass goes to the mouse and the food energy in the mouse passes on to the hawk). Placing animals into a visible food chain like this can help us understand what happens to members of a community.



Food web of a desert community

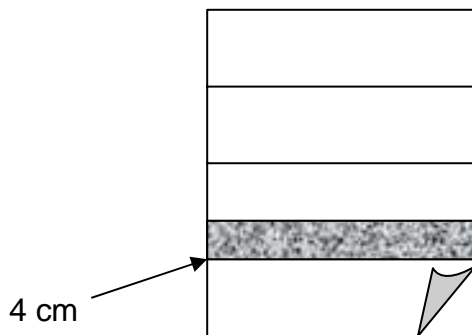
Rarely does an animal eat only one type of food, however, as a food chain might imply. To get a clearer picture of how animals in a community are related to one another, it is often helpful to look at food webs rather than food chains. A food web is the interconnection of the food chains in a community. It shows how members of the community are connected to other members by what they eat.

This activity introduces students to the concept that members of a biotic community depend on one another for survival. Feeding relationships of community members are often difficult to observe, but by assuming roles of animals and simulating feeding relationships, students can begin to understand that plants and animals in a community are closely tied to each other.

In nature, populations are usually large enough to ensure continuation of a species even though some of the individuals die. In this simulation, populations are so small that survival of even one or two of each kind indicates a balanced, ongoing community.

Advanced Preparation

Prepare one sandwich bag stomach for each student by placing a piece of masking tape on a sandwich bag so that the bottom of the tape is four centimeters (one and a half inches) from the bottom of the bag.



Make nametags out of index cards and yarn, writing one animal name on each, or make armbands in three colors from strips of cloth about 50 centimeters long and 10 centimeters wide (20 inches long by 4 inches wide). Make enough nametags so that up to three-fourths of the class can be grasshoppers while one third can be frogs and one-third hawks. (The extra grasshopper nametags or armbands allow students to change population numbers during the simulation.)

Select a site and mark its boundaries. In the simulation, popcorn kernels represent the food source for a plant eater. Distribute popcorn around the site, saving some so that students can eat it after the activity.

Write the rules (See step three in the procedure) on graph paper or on the chalkboard. On another piece of graph paper, prepare the chart below.

Round	# of Grasshoppers	# of Frogs	# of Hawks	Action Taken

Procedure

1. Discuss with students how members of a human community must have their needs met by the community. Explain that in a biotic community all the plants and animals living there must have their needs met by the community too. Ask, "How do people in a human community get the food they need? Where does the food come from? Where do animals in a biotic community get their food?"
Discuss with students how plants and animals get their food needs met by other plants and animals. Introduce the concept of food chains and explain that a food chain shows us the relationship between plants and animals and what they eat. As a class, draw a food chain for the ants in the ant farm (seed → ant). Draw a food chain ending with a student in the class (For example, grass → cow → student). Tell students that they will be acting out a food chain to see how food chains work.
 2. Write on the board the food chain plants → grasshopper → frog → hawk. Explain that for this activity each student will be either a grasshopper, a frog, or a hawk. To distinguish one animal from another, students will have nametags or colored armbands. The kernels of popcorn represent plants that the grasshopper eats. When the simulation starts, frogs will try to capture (tag) grasshoppers, and hawks will pursue frogs.
 3. Explain the rules:
 - Grasshoppers eat only plants. (Be sure students understand that they don't really eat the plants, but put them in their stomach bags).
 - Frogs eat (tag gently) only grasshoppers. (They cannot eat popcorn from the ground.)
 - Hawks eat (tag gently) only frogs. (They cannot eat grasshoppers or popcorn from the ground.)
 - If eaten, the student must give up the contents of his or her stomach (bag) to the predator and leave the simulation. (The predator puts the stomach contents into his or her stomach.)
 - Animals that have been eaten wait on the sideline for the next round of the simulation.
 - A round lasts two minutes or until all of one kind of animal is eaten.
 - You must tag *gently*; no shoving, pushing or hitting.
- For the first round, divide the class equally into three groups and assign each group a part so that there are equal numbers of grasshoppers, frogs, and hawks. Distribute the nametags or armbands and the stomachs.
4. Show students the simulation site and boundaries. Explain that only grasshoppers will eat the plants (popcorn) that have been distributed throughout the site. You might have a mock round to be sure that students understand the rules.

5. Play a round of the simulation. (The first round often lasts only a few seconds.) Count the number of survivors and record them on your chart. To survive, a grasshopper's stomach must be filled to the bottom of the tape on the sandwich bag; a frog's stomach must be filled to the top of the tape; and a hawk's stomach must be completely filled. Animals with less than the required amount "starve."
6. Explain that in order for there to be a balanced food chain, two grasshoppers, two frogs, and one hawk need to be alive at the end of the simulation. Ask for suggestions from students on how they might produce a balanced food chain on the next round. (Students may suggest things like adding more plants, changing the number of frogs, adding "safety" zones, or giving frogs and grasshoppers a head start.)
7. Conduct the simulation again, incorporating one of the students' suggestions. (Return popcorn to the activity area after each round.) Count and record the number of survivors again and indicate the action taken on the chart.
8. Allow students to continue changing components of the simulation until they produce a balanced food chain.
9. Explain to students that tomorrow they will be learning more about ways that animals and plants in a biotic community depend on each other.

Discussion Questions

What numbers of each type of animal created a balanced food chain?

What would happen if there were only one-half the number of available plants?

If there were no frogs, what would happen to the plants? To the grasshoppers? To the hawks?

Plants, grasshoppers, frogs, and hawks are all members of a community. How are they important to each other?

How might hawks help the frogs survive?

Evaluation

Students write about or discuss how a food chain helps them understand the connections between plants and animals living in a community.

Source of Activity

The California State Environmental Education Guide

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Hayward, CA 94544-01198

Adapted from Outdoor Biology Instructional Strategies (OBIS),
"Food Chain Game." Developed by Lawrence Hall of Science, University of California.
Nashua, NH: Delta Education, 1982.

Classroom Lesson 2: *Creating a Salmon Food Web*

Objective

Using the information provided, the students will create a salmon food web and then discuss the consequences if salmon are removed from the aquatic ecosystem.

CA Science Standards – 1a, 1b

Time/Setting

45 to 60 minutes; Classroom and outside (for food web)

Materials

The Pacific Salmon and Steelhead Coloring Book - one copy per group of students

Paper or tagboard for animal, sun, and plant cards

Half sheets of paper with arrows drawn on them

Tape

Large ball of heavy string, twine, or yarn

Subjects

Science, language arts

Vocabulary

Egg, fry, smolt, adult, life cycle, food web

Background Information

All the background information is in *The Pacific Salmon and Steelhead Coloring Book*.

Advanced Preparation

Gather the materials together.

Procedure

1. As the students read the salmon booklet, have them write down a list of all the plants and animals that are mentioned. Next to each animal, they should record how it gets its food and what uses it for food.

List of Animals Mentioned

Trout, birds (eagles, gulls, etc.), insects, frogs, mammals (bears, sea lions, killer whales, humans), fish (striped bass, pike minnows, herring, small ocean fish), squid and shrimp. Since a salmon's place in the food chain depends on its size, it is helpful to list egg, fry, smolt, and adult separately.

2. Ask the students what is missing from their lists (sun, plants). Discuss why salmon are sometimes a predator and sometimes prey of other fish.
3. Write down each of the animals on a piece of paper. Make another paper for plants and another for the sun. Using the floor, an empty wall, or some other large space, piece them together into a large food web. They can use pieces of paper with arrows drawn on them to indicate the flow of energy. Remind the students that many fish and insects use plants for food.
4. Each student tapes one of the animal/ plant/ sun papers from the food web to their front and the class stands in a circle. One student starts with a ball of yarn or string and holds firmly on to the end. He/she passes the ball of string to another student that is connected to them in the food web. They need to state the connection and the direction of the energy transfer. That student then repeats the process. This

continues until all students have gotten the string and the entire circle is connected. If you get to a dead end, you can go back to the sun as an energy source. It can go to the same student more than once.

"I am an eagle and I eat adult salmon. I take energy from you"

"I am an adult salmon. I eat fish and get energy from them."

"I am a fish and I eat fry. I get energy from you."

"I am a fry and I get eaten by birds. I give energy to you"

5. When a web is formed, discuss what might happen if one member of this web is removed from the ecosystem. Have the adult salmon drop their string(s). Discuss the consequences. Next, explain that if the adults don't return, there will be no eggs, no fry, and no smolts. Have these students drop their strings one at a time. Discuss what might occur in that watershed when the salmon are removed.
6. Explain to the students that salmon have been removed from many aquatic ecosystems, but many people are trying to bring them back and restore the natural balance. They will be visiting a part of Clear Creek that used to be blocked to salmon because of a small dam. The dam has recently been removed, and they will be testing the water upstream to see if it is suitable for salmon.

Classroom Lesson 3: *Hooks and Ladders*

Objective

Students simulate Pacific salmon and the hazards faced by salmon in an activity portraying the life cycle of these aquatic creatures. Students will: 1) recognize that some fish migrate as part of their life cycle; 2) identify the stages of the life cycle of one kind of fish; 3) describe limiting factors affecting Pacific salmon as they complete their life cycle; and 4) generalize that limiting factors affect all populations of animals.

CA Science Standards – 1b, 3b

Time/Setting

30-60 minutes; outside or large room

Materials

Large playing area (100 ft. x 50 ft.)

500 ft. of rope, string, or cones for marking boundaries (masking tape may be used if you are playing indoors)

100 tokens (3 x 5 cards, poker chips, etc.)

Jump rope

Subjects

Science, social studies, geography

Vocabulary

Life cycle, limiting factors, population, migration

Background Information

Many fish live part of their lives in one habitat and then migrate to another habitat. Some make their migratory journeys to mature and reproduce. Both Atlantic and Pacific salmon are spectacular examples of migrating fish.

Pacific salmon are destined to spawn only once in their lifetime. Within their genetic fiber is an encoded instinct that drives them from the time of hatching along a monumental journey from their freshwater spawning beds downstream into the sea. Once in the sea, they spend several years reaching the maturity needed for their single return journey to their original hatching ground. Once there, the salmon spawn and die.

Salmon must face a myriad of hazards that serve as limiting factors in the completion of their life cycle. Limiting factors are factors that reduce the populations of living organisms. Sometimes the limiting factors are natural and sometimes they result from human intervention with natural systems.

The female Pacific salmon deposits 1,500 to 7,000 eggs in her freshwater spawn. The eggs are deposited in a shallow gravel depression scooped out by the female. Once deposited, the male fertilizes the eggs and then both fish nudge the gravel back over the eggs to offer as much protection as possible. Within a few days both the male and female salmon have completed their reproduction and soon die.

The eggs, before and after hatching, are susceptible to many limiting factors. Smothering silt can be washed in suddenly from watersheds damaged by a variety of land-use practices and events – including erosion following some road building, logging and fires. Predators can eat some of the eggs and damage hatching populations. Dropping water levels can isolate salmon offspring in streamside depressions to remain isolated and die. After hatching, the small fish – called “alevins” – spend their first two weeks hiding in the gravel. Gradually, they absorb their yolk sac and become known as “fry”. If they survive the first two weeks, they then begin their journeys. Some head directly to the sea.

Depending on the species, young salmon may spend several months to as much as a year or more in the river before migrating to the estuary and then to the open ocean.

The small ocean-bound salmon, now called “smolts”, are at once confronted by hazards on their downstream journey. Dams slow salmon migration. Because salmon cannot find the current behind dams they become disoriented in reservoirs. When disoriented, salmon are extremely vulnerable to predators. Low water in streams, predatory birds, mammals, and larger fish pose additional hazards. Up to 90% of the salmon that hatch never reach the sea. When in the ocean, salmon grow rapidly by feeding on the ocean’s rich food supply. Predators such as sharks, killer whales and other marine mammals take their toll. In addition, humans fish for salmon commercially and for personal reasons, such as food and recreation.

In two to five years, the Pacific salmon start the journey that will guide them back to the rivers and streams leading to their own hatching site. The upstream migration from the ocean is also a series of hazards. For example, dams hinder their journey and would block it completely if fish ladders were not installed. Fish ladders are water-filled staircases that allow the migrating fish to swim upstream around the dam. Humans who fish, eagles, bears, and other predatory mammals also reduce the numbers along the way to the spawning ground. Sometimes landslides and logjams provide unexpected new barriers. So too do the natural waterfalls and rapids that the now weighty salmon must overcome. Once back at the spawning ground, the life cycle of the Pacific salmon begins anew. To maintain the Pacific salmon population, some biologists believe that only one pair of fish from each spawn must return to deposit and fertilize eggs. All

possible conditions are not covered by the design of this activity. However, the activity does serve simply and effectively to illustrate three important concepts – life cycle, migration, and limiting factors.

Procedure

1. Begin by asking the students what they know about the life cycle of fish that live in their area. If yes, which ones? (Mullet, shad, lake trout, striped bass, suckers, carp and salmon are examples of fish that migrate to spawn.) In this activity, students will learn about some of the characteristics of one species of fish that migrates as a part of its life cycle – the Pacific salmon.
2. This is a physically involving activity! Set up a playing field as shown in the diagram, including spawning grounds, reservoir, downstream, upstream, and ocean. The area must be about 100 feet by 50 feet. Assign roles to each of the students. Some will be salmon; others will be potential hazards to the salmon. Assign the students roles as follows:
 - Choose two students to be the turbine team. These are the ones who operate the jump rope, which represents the turbine in hydroelectric dams. Later in the simulation, when all the salmon have passed the turbine going downstream, these students move to the upstream side to become the waterfall-broad jump monitor. (See diagram.)
 - Choose two students to be predatory wildlife. At the start of the simulation, the predators will be stationed in the reservoir above the turbines to catch the salmon fry as they try to find their way out of the reservoir and downstream. Then, they will move to below the turbines where they catch salmon headed downstream. Later in the activity when all the salmon are in the sea, these same two predators will patrol the area above the “broad jump” waterfalls. There they will feed on salmon just before they enter the spawning ground.
 - Choose two students to be humans in fishing boats catching salmon in the open ocean. These students in the fishing boats must keep one foot in a cardboard box to reduce their speed and maneuverability.
 - All remaining students are salmon.
3. Begin the activity with all the salmon in the spawning ground. The salmon first move into the reservoir above the dam. They must stay in the reservoir while they count to 30. This simulates the disorientation that salmon face due to a lack of current in the lake to direct them on their journey. During this time, the predators may catch the salmon and escort them one at a time to become part of the fish ladder. The salmon then start their journey downstream. A major hazard is the turbines at the dam. At most dams there are escape weirs to guide migrating salmon past the turbines. The student salmon **cannot go around** the jump rope swingers, but they **can slip under** the swingers’ arms if they do not get touched while doing so. A salmon dies if the turbine (jump rope) hits it. The turbine operators may change the speed at which they swing the jump rope. NOTE: Any salmon that “dies” at any time in this activity must immediately become part of the fish ladder. The student is no longer a fish, but becomes part of the physical structure of the human-made ladders now used by migrating salmon to get past barriers such as dams. The students who are the fish

ladder kneel on the ground as shown in the diagram, a body-wide space between them.

4. Once past the turbines, the salmon must get past some predatory wildlife. The predators, who have moved from the reservoir area to the area below the turbine, must catch the salmon **with both hands** – tagging isn't enough. Dead salmon are escorted by the predator to become part of the fish ladder. Later, the salmon that survive life in the open ocean will use the structure of the fish ladder – by passing through it – to return to the spawning ground. NOTE: Both the predatory wildlife in the last downstream area and people fishing in the open ocean must take dead salmon to the fish ladder site. This gets the predators and fishing boats off the playing field regularly, helping to provide a more realistic survival ratio.
5. Once in the open ocean, fishing boats can catch the salmon. The salmon must move back and forth across the ocean area in order to gather four tokens. Each token represents one year of growth. Once each fish has four tokens (four years' growth), that fish can begin migration upstream. The year tokens can only be picked up one token at a time on each crossing. Remember that the salmon must cross the entire open ocean area to get a token. The "four years" these trips take make the salmon more vulnerable and thus they are more readily caught by the fishing boats. For purposes of this simulation, the impact of this limiting factor creates a more realistic survival ratio in the population before the salmon begin the return migration upstream.
6. Once four of the year tokens are gathered, the salmon can begin the journey upstream. The salmon must walk through the entire pattern of the fish ladder this enforced trip through the fish ladder gives the students a hint of how restricting and tedious the upstream journey can be. **In the fish ladder, predators may not harm the salmon.**
7. Once through the ladder, the salmon faces the broad jump waterfall. The waterfall represents one of the natural barriers the salmon must face going upstream. Be sure the jumping distance is challenging but realistic. The two former turbine students will monitor the jump. The salmon must jump the entire breadth of the waterfall to be able to continue. If the salmon fails to make the jump, then it must return to the **bottom of the fish ladder** and come through again. NOTE: When playing indoors, the broad jump waterfall may be changed into a stepping stone jump defined by masking tape squares for safety on hard floors.
8. Above the falls, the two predators (who started the simulation as the predators below the turbines) are now the last set of limiting factors faced by the salmon. They represent bears – one example of predatory wildlife. Again, remember that the predators must catch the salmon with both hands. If they do catch a salmon, they must then take the students they caught to become part of the structure of the fish ladder.
9. The activity ends when all the salmon are gone before the spawning ground is reached – or when all surviving salmon reach the spawning ground.

10. Next engage the students in a discussion. Explore topics such as:

- The apparent survival-mortality ratio of salmon
- The students' feelings throughout the activity
- The role of the barriers
- The role of the predatory wildlife and the people fishing
- Where the losses were greatest
- Where the losses were least
- What the consequences would be if all the eggs deposited made the journey successfully
- What seemed realistic about this simulation and what did not

11. Ask the students to summarize what they have learned about the life cycle of salmon, the salmon's migration and limiting factors that affect salmon. Make sure the students have a clear working definition of limiting factors. Encourage the students to make the generalization that all animals – not just Pacific salmon – are affected by limiting factors. Ask the students to give examples. They might mention availability of suitable food, water, shelter and space; disease; weather; predation; and changes in land use as well as other human activities.

Source of Activity

Adapted from:

Project WILD Aquatic Education Activity Guide. 1992.

Council for Environmental Education

Field Lab Lesson 4: (taught by WES staff at Clear Creek) *Water Canaries and The Nose Knows*

CA Science Standards – 3a, 3b, 6a, 6c, 6d

Activity One: *Stream Chemical Assessment*

Objective

Students will assess the relative environmental quality of Clear Creek based on indicators of pH, water temperature and chemical species.

Materials

Test strips for pH
Buffers for pH meter
Digital pH meter
Thermometers
ID books or sheets
Hand lenses on strings
Two way viewers
White tubs
Large kick nets
Ice cube trays for sorting
Tweezers

Background Information

In streams the presence or absence of certain organisms called indicator species reveals much about the quality of the water. These creatures comprise a **biotic index**. That is, their absence or presence tells us something about water quality.

Water with a rich and varied range of aquatic creatures is usually a healthy environment, whereas water with just a few different species usually indicates conditions that are less healthy. Healthy is used here to indicate an environment supportive of life. Pollution generally reduces the quality of the environment and in turn the diversity of life forms. In some cases the actual biomass or amount of living materials will increase due to pollution, but the diversity inevitably goes down.

Procedure

1. Select a sampling site where student impact will be minimal. Be sensitive to the impact students may have on stream banks and beds, spawning and nesting sites and vegetation.
2. Brief the students on habitat courtesies and have them establish ethical guidelines for their sampling activities. Alert them to ways to minimize the potential for damaging the habitat and encourage care in their collecting techniques. Emphasize that all the wildlife is to be returned to its habitat unharmed.
3. Start by observing the water. Look for organisms on the surface and in the depths. Using the sampling equipment, have the students collect as many different forms of animal life as possible. Ask them to be alert to differing microhabitats near rocks, in riffles, and in eddies. Place the animals to be observed in the white trays for viewing and observing. Keep an adequate amount of water in the trays and place them in a cool shady spot. Change the water as often as needed to keep the animals cool.
4. Have the students identify and draw the animals on the worksheet labeled *Clear Creek Organisms* – those observed in the creek and those temporarily remove for observation. Ask them to fill in the number of each kind found and describe the actual location where the animal was found. Have each student draw and count at least 3 different types of organisms. Once these observations are completed, carefully return the animals to their natural habitat.
5. Discuss their observations before going on to the next activity. Were a lot of different aquatic organisms found? Introduce the concept of **diversity** of life – that is, a variety of different kinds of plants and animals is usually an indication of a healthy ecosystem.
6. Test the water at the site for other indicators of quality. Have the students determine the pH and the temperature of the water, as well as the air temperature. This data should be recorded on worksheet II.
7. Help the students to understand that the values for pH, water and air temperature affect the diversity of life forms found in aquatic environments. Ask whether they would expect the same variety of life in other locations. Help them realize that predictions of animal diversity can be made from measurements of pH and water

temperature. Likewise, certain indicator species can tell you about pH and water temperature.

Source of Activity

Adapted from:

Project WILD Aquatic Education Activity Guide. 1992.

Council for Environmental Education

Stream Exploration

Objective

Students will determine the health of the stream based on the organisms found.

Time/Setting

50 minutes, with added time should the students want to play again.

Materials

Numerous white buckets

Background Information

The health of a stream can be assessed with both physical factors and biological.

Students will be able to determine how polluted the stream is based on how many 'pollution sensitive' insects are found.

Advanced Preparation

1. Gather all needed materials.
2. Explain the 'dos' and 'don'ts' about working in the stream and how to use the equipment.
3. Students will work together to collect as many insects as possible.
4. Students will work in their groups to calculate how many of each insect they found and determine if the stream is healthy.

Evaluation

1. Ask students to explain why we tested the water using both physical and biological monitoring.
2. Ask them how else they could test the water.
3. Have the students write in their journals about their conclusions and discuss why they were or were not the same as their predictions.

Classroom Lesson 5: Follow Up

Objective

Using the data collected on the field trip, discuss the suitability of Clear Creek as salmon habitat. Now that they can make it past the dam, will they be able to live in this section of stream?

CA Science Standards – 3a, 3b, 6a, 6c, 6d, 6e

Time/Setting

30 to 60 minutes; inside

Materials

Depends on how you choose to debrief class

Subjects

Science, math

Vocabulary

Abiotic, biotic

Procedure

There are several ways to use the data collected during the field lab. They are listed below by standard.

6a – As the students look at their data, discuss what it means for the salmon. An example would be listing the average temperature and then determining whether or not it is suitable for salmon. Do the insects that were found indicate suitable salmon habitat?

6d –As the class analyzes the data, discuss what might be different if one group did the measurement 6 times instead of 6 groups measuring once.

6e – Graph the number of insect found in each category (biologists frequently use this technique to determine biodiversity); graph the temperature and pH data and compare the median to the mathematical average. The same techniques and data sheets can be used to collect data at another site for comparison.

Ideas for Journal Pages

1. Record food chain from lesson 1.
2. Record salmon food web from lesson 2. They could also write down thoughts about the impact on an aquatic ecosystem when a species is lost.
3. After playing *Hooks and Ladders*, they could record the results of their game.
4. At the creek, they could record their hypotheses before they collect the data. After the tests, they can write down their conclusions and explain why their hypothesis was correct or incorrect.
5. Any graphing could be included in the journal.

Clear Creek Data Sheet

Part 1

Name of Organism _____

in tub 1 / 7 _____

in tub 2 / 8 _____

in tub 3 / 9 _____

in tub 4 / 10 _____

in tub 5 / 11 _____

in tub 6 / 12 _____

Total number of _____ = _____

Part 2

Indicated pH _____

Water temperature _____ Celsius / Fahrenheit

Part 3

Dissolved Oxygen

	Temp	Prediction	Actual
Creek	_____		_____
Tub	_____	_____	_____