Whiskeytown Environmental School
Clear Creek Field Lab Experience - Third Grade
Insect Adaptations

Revised Fall 2008

Unit Overview:
In this unit, students will be introduced to the concept of adaptations, focusing on aquatic insects. The first three lessons will prepare the students for the field experience and the last lesson will serve as an assessment for the unit.

Classroom Lesson 1: ***Human Adaptations***
As an introduction to the concept of adaptations, students identify human adaptations and conduct an experiment demonstrating the importance of the opposable thumb.

Classroom Lesson 2: ***Dream a Stream / Puppet Show***
In the *Dream a Stream* activity, the students create a mural as they explore how varied a stream can be. The puppet show introduces some common stream insects and their adaptations to stream life.

Classroom Lesson 3: ***Aquatic Insects – Stream Sam and Sally***
Students think about some adaptations that aquatic insects need for living in fast water.

Field Lab Lesson 4: (taught by WES teacher or naturalist at Clear Creek)

Activity One: Stream Study

The students will compare the populations of aquatic insects in two different water habitats. They will collect data on physical factors, such as the streambed, temperature, water velocity, and depth, and other biotic elements.

Activity Two: Pond Study

They will collect data on physical factors, such as the streambed, temperature, water velocity, and depth, and other biotic elements. They will then compare the physical and biological similarities and differences between the two habitats.

Classroom Lesson 5: ***Assessment***
Students will place drawings of the insects that they observed on their field lab in the appropriate section of the stream mural.

Science Content Standards – Third Grade

State of California, State Board of Education

Life Sciences

3. Adaptation in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept, the student knows:

a. plants and animals have structures that serve different functions in growth, survival, and reproduction.
d. when the environment changes, some plants and animals survive and reproduce, and others die or move to new locations.

Investigation and Experimentation

5. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content in the three strands, students should develop their own questions and perform investigations. Students will:

a. repeat observations to improve accuracy, and know that the results of similar scientific investigations seldom turn out exactly the same because of differences in the things being investigated, methods being used, or uncertainty in the observation.

b. differentiate evidence from opinion, and know that scientists do not rely on claims or conclusions unless they are backed by observations that can be confirmed.

c. use numerical data in describing and comparing objects, events and measurements.

d. predict the outcome of a simple investigation, and compare the results to the prediction.

My Science Journal

Name_________________

Classroom Lesson 1: *Human Adaptations*

Objective

Students identify human adaptations and conduct and experiment demonstrating the importance of the opposable thumb.

Time/Setting
30 to 45 minutes; Classroom

Materials
Masking tape
Unshelled peanuts

Subjects
Science, language arts

Vocabulary
Adaptation, opposable thumb

Background Information

Throughout this unit students have looked at ways that animals and plants are adapted to the place they live and to their lifestyles. In this activity students are given the opportunity to think about adaptations that humans have that enable us to survive.
The most profound adaptation that we possess is our well-developed brain, which enables us to manipulate the environment around us and make it livable. We are able to live in extremely diverse habitats because of our ability to invent solutions to survival problems. We no longer depend solely on our bodies for obtaining and storing food and water, moving about, protecting ourselves, or adapting to various temperatures. Instead, we depend greatly on the complex systems we have developed to satisfy these needs. Listed below are some of the systems we have developed to meet our needs.

Category	**Adaptation**
Obtaining and storing food	Agriculture, food processing, freezers, refrigerators, silos
Obtaining and storing water	Water pipelines and systems, reservoirs
Moving about	Cars, bicycles, trains, trucks, buses, transportation
.	systems, airplanes, boats, space shuttles, shoes
Protection	Police, firefighters, armies, knives, guns, homes, pesticides
.	and other chemicals
Temperature	Clothing, shelter, fire, heaters, air conditioners

While these methods for satisfying our survival needs are ways that we have actively adapted to our environment, they are not evolutionary adaptations. Evolutionary adaptations are genetic rather than characteristics we consciously affect. Our advanced brain is an example of an evolutionary adaptation.
Another example is our opposable thumb. Because our thumbs oppose the rest of our fingers, we are able to manipulate objects with our hands—an adaptation that has enabled us to develop tools and technologies to enhance survival. In this activity students experiment with their thumbs to learn how this adaptation greatly affects their lives.

Advanced Preparation

Gather the materials.

Procedure

1. Ask the students how we meet our needs for obtaining and storing food and water, moving about, protecting ourselves and adjusting to temperatures. Ask, “Which of these are adaptations? How do these human adaptations vary from animals’ adaptations? How are they alike?

2. Introduce students to an adaptation that humans have to help them survive—the opposable thumb. Ask, “How important do you think your thumb is to you? How do you think your life would be different if you didn’t have a thumb? What experiment might we try to find out?”

3. Using masking tape, tape students’ thumbs to their index fingers (students can help tape each other). Make sure when taping that the top of the thumb is taped securely so that students cannot “cheat” by using their thumbs a little. Have students attempt to button or unbutton a shirt, hold and write with a pencil, or fold a piece of paper. Give each student a peanut, and with their thumbs still taped, ask students to shell and eat the nut.

Discussion Questions

Could you do all the things?
Which was hardest?
How do we use our opposable thumb?
How does your thumb help you survive?
Can you think of other animals that have this adaptation?
What other ways are people adapted for survival?

Evaluation

The discussion can help evaluate students’ understanding.

Source of Activity

The California State Environmental Education Guide
Carolie Sly, Coordinator
Alameda County Office of Education
313 West Winton Avenue
Hayward, CA 94544-01198

Classroom Lesson 2: *Dream a Stream* and *Puppet Show*

Objective

The students will find that a single stream can contain amazingly different habitats that host a variety of plants and animals. They will also be introduced to some common stream insects and their adaptations to stream life.

Time/Setting

40 minutes - Dream a Stream; Classroom
20 minutes - Puppet show; Classroom

Materials
Paper
Pencils
Roll of paper
Crayons, marking pens, or paints for mural
Script for puppet show - 4 copies if students are reading parts
Puppets - Willy Water Bug, Gregor Grasshopper, Mable Mayfly Nymph, Lucy Black Fly Larva
Coat Hangar (Prop for Puppet Show)
Toilet Plunger (Prop for Puppet Show)
"Magnifying Glass" - a 12" circle of cardboard with 11" circle cut out of center, attached to a handle (Prop for Puppet Show)

Subjects
Science, performing arts, art

Vocabulary
Adaptations, habitat

Background Information

See section labeled "Background Information - The Challenge of a Moving, Watery World" at the end of this lesson.

Advanced Preparation

Gather all the materials.

Procedure - *Dream a Stream*

1. All children should sit in a circle, close their eyes, and imagine themselves at a stream. What does it look like? Sound like? Each child should tell or write down an adjective to describe the imagined stream.
2. Sort the children into groups according to types of stream adjectives, such as fast-flowing, slow-moving, etc.
3. Review the different types of streams represented.
4. Roll out a long sheet of paper and have each group illustrate its stream on a section of it, forming one long stream with varying sections.
5. Save the stream mural for a field lab follow-up activity. During the field lab, they will be collecting and drawing pictures of animals and aquatic insects they find. When they return, they will cut them out and place them on the appropriate part of the stream. Animals collected in the pond can still be put in a "slow moving" section.

Procedure - *Puppet Show*

1. Give the puppet show.
2. Discuss the adaptations mentioned in the show and why, living in a stream habitat, these adaptations were necessary.
3. Show pictures of other stream animals and point out their special adaptations (salmon, river otter, beaver, etc.).

STREAMS PUPPET SHOW

Characters: Willy Water Bug
Gregor Gasshopper,
Mable Mayfly Nymph
Lucy Black Fly Larva

Props: coat hanger
toilet plunger
"magnifying glass"—a 12" circle of cardboard with 11" circle cut out center, attached to a handle.

Willy Water Bug: Oh, the start of another day swimming about in this little pond. Life is so boring in this pond, no excitement at all.
Gregor Grasshopper: Hi, Willy Water Bug.
Willy: Hello, Gregor Grasshopper.
Gregor: I heard you complaining. Why don't you come out and hop in the fields with me? Then you won't be bored.
Willy: I can't be hopping in the fields. I'm a water bug. I have to live in the water.
Gregor: Well, you could still live other places besides this boring little pond. Why don't you go live in a stream? That would be exciting, with all that rushing, bubbling water. Don't you think so audience?
Willy: Hey, that's a great idea. Do you know where there's a stream around here?
Gregor: I sure do. In fact, if you crawl on my back I'll hop you over to one. (Willy gets on and they cross the stage.)
Gregor: Here's the stream. Jump right in.
Willy: Thanks for the ride, Gregor (Jumps off Gregor's back and Gregor leaves.) Yikes! This water is moving pretty fast. I can't swim in here. Help! Help! (Mable Mayfly Nymph appears)
Mable Mayfly Nymph: Oh my, it looks like he's in trouble. I better save him. (Pulls Willy out of stream.)
Willy: Thanks for saving me. Who are you?
Mable: I'm a mayfly nymph. My name is Mable.
Willy: Boy, Mable, I don't know how you stay in the water. It moves so fast.
Mable: That doesn't bother me. I have something very special on my feet that helps me hold on to rocks and other things in the stream.
Willy: I don't see anything so special on your feet. Do you audience?
Mable: Oh, you have to look very closely. You need a magnifying glass or hand lens.
Willy: Does anyone here have a magnifying glass or lens? (Someone from audience with the magnifying glass comes up.) Hold it right in front of Mable's feet so we can all see. (Mable goes down hooked end of coat hanger appears behind 'glass'.) Boy, you do have special feet. You've got hooks on your feet to hold onto the rocks. That's why Mable's feet are so special. Thanks for the use of the magnifying glass. (Person with glass sits down again.)
Mable: Well, back to the stream for me. Bye, bye.
Lucy Black Fly Larva: We go in the stream and we don't have hooks.

Willy: Who said that? I heard you, but I don't see you.
Lucy: I'm on this rock in the stream. Pull me out if you'd like to talk.
Willy: (Reaches down for Lucy.) My, you are on a rock. (Lucy appears.)If you don't have hooks, how do you stay on that rock?
Lucy: I have something else very special at the end of my body.
Willy: Oh yeah? What?
Lucy: Well, get that magnifying glass and take a look.
Willy: (To person in audience with glass.) Could you come up here again? Thank you. (When glass gets to stage, Lucy goes down and toilet plunger comes up.) Wow, that is different from a hook! If I had that at the end of my body, I bet I'd stick to rocks too. Don't you think so audience? Thanks for the magnifying glass. (Glass and plunger exit.) Well, what do you think audience? I don't have anything special to help me hold on to things. Do you think I can live in a stream? Should I go back to the pond? Could you help me call Gregor? I can't walk back from here, and I'm too tired to fly.
Willy: (With audience.) Gregor. Gregor. (Gregor comes back.)
Gregor: What's wrong, Willy? Don't you like living in a stream?
Willy: Well, the audience and I decided that I'm not really equipped to live in a stream, right audience?
Gregor: O.K. Climb on my back and I'll hop you home.
Willy: Thanks, Gregor. And thanks for your advice audience. I'm sure I'll be happier and safer in the pond. Bye, bye.

Background Information

The Challenge of a Moving, Watery World

Streams are among the oldest bodies of water on earth. They form when volumes of water, unabsorbed by the soil, are pulled by gravity across the surface of the earth. As the water moves, it carves a course for itself, following the path of least resistance. Streams that continue to flow during dry periods are sustained by ground water surfacing through springs. Other streams are dependent on heavy rains and run-off and dry up in periods of low rainfall. Sometimes streams change course, sometimes they are empty, but they rarely disappear entirely.

Plants and animals that inhabit streams must overcome potentially difficult situations. Algae (the chief producer, or plant food source, of the stream) and moss can grow in the current, but most rooted plants must become established in the breakwaters. For animals, moving around in the current is difficult at best. With one wrong step, a fragile insect may get dislodged and battered against rocks and sticks. The normal functions of life - eating, breathing, moving or holding fast, laying and hatching eggs - are all more difficult in the stream.

The current is, however, an advantage. As water flows over a rough bottom it becomes a giant mixer, saturating the water with air. It also picks up soil run-off and nutrients from decomposing plant and animal matter along the way. Being an efficient solvent, moving water can thus create a dilute soup of vital, dissolved nutrients. Some have called stream water "liquid soil."

Heavily shaded banks and cold springs help to keep the stream water cool. This is crucial since the amount of oxygen and other gases that water can hold is inversely related to its temperature. A cooler stream can hold more dissolved oxygen, which is often the limiting element in aquatic life. Trout are normally stream-dwelling fish because they need highly oxygenated water.

Animal life is abundant in the stream. From crayfish to fish, salamander to snail, there are a great variety of creatures, each living in the part of the stream best suited to its needs and abilities. But of all the stream creatures, the insects are probably the easiest to find and observe, marvelous examples of diversity within a habitat.

Stream insects possess amazing survival adaptations for their flowing, wet world. In the still pools at the water's edge, an insect is often found flitting along the surface, its shadow frequently more noticeable than the creature itself. This is the water strider, whose hair-fringed legs skate along on the surface as it prowls for unlucky insects that have fallen in.

Not all stream insects, however, can be seen from the banks. Truly aquatic insects spend entire periods of their lives submerged and must be sought amid the rocks, gravel, and plants found under the water. Since most of these creatures are nocturnal, they remain well hidden during the day.

As you lift your first rock, some tiny (one-quarter inch) black **larvae** may be seen swaying in the current. Black fly or buffalo gnat larvae are unmistakable with their rumps anchored firmly in place. Sieve-like hairs project from the side of their heads to strain algae, tiny animals and plant debris from the water. If dislodged, these larvae will creep spider-like back up the current on a silken thread.

Under the rocks you are likely to find common stonefly and mayfly **nymphs**. Flattened and with strong hooks on their feet, they dwell within the narrow space between the bottom of the rock and the stream bed where the current is weak. Mayflies have gills on their abdomens and usually three feathery-looking tail-like appendages. Stoneflies have gills that look like fuzzy tufts at the base of each leg and only two tail-like appendages. Most mayflies and some stoneflies are **herbivorous**, although some of the larger stoneflies prey on insects.

The gravels of the streambed provide yet another type of habitat, where crane fly larvae may be found in abundance. Cream-colored and maggot-like in appearance, a crane fly larva is one and one-half to two inches long and bears some appendages on its head that look like the fleshy feelers on a star-nosed mole. Adult crane flies resemble giant mosquitoes, but they do not bite.

As you continue to turn over rocks, sift gravel, and explore the stream, you may discover a tube-shaped caddis home of sand grains or leaf pieces. Caddis larvae construct their homes by weaving an intricate tube of silk threads that is closed at one end. Depending on the species, the silk tube is covered with either sand grains, leaf pieces, or small sticks, often in a neat, spiral pattern. These elaborate cases supply protection and ballast. Caddis larvae are mostly herbivorous, eating moss, algae, and dead leaves.

A stream is a constantly changing and sometimes perilous habitat. It is also a complete habitat for many, concentrating the essentials for life within its waters.

Source of Activity
Hands-On Nature: Information and Activties for Exploring the Environment with Children. 1986.
Jenepher Lingelbach, Editor
Vermont Institutes of Natural Science
Woodstock, VT 05091
1-(802)-457-2779

Classroom Lesson 3: *Aquatic Insects - Stream Sam and Sally*

Objective

Students think about some adaptations that aquatic insects need for living in fast moving water.

Time/Setting
40 minutes; Classroom

Materials
Colored paper
Scissors
Tape
Yarn or string
Pipe cleaners
Balloons
Straws
Crayons
Egg cartons
Cardboard tubes from toilet paper or paper towels
Any other materials that might be useful for creating adaptations

Subjects
Science, art

Vocabulary
Adaptations

Background Information

See the section labeled "*Background Information - The Challenge of a Moving, Watery World"* preceding this lesson.

Advanced Preparations

Gather the materials for creating "Stream Sam and Sally." List the adaptations on the board for reference.

Procedure

1. Divide the children into small groups. Tell them they will be turning one of their group members into a stream critter. Using the materials supplied, they will make and attach body parts to that person so the newly created critter can do all of the following while submerged on the stream bottom:

- Catch food and eat it
- Breathe
- Move around on the bottom
- Lay eggs (if appropriate for the class)

- Keep from getting washed away
- See

2. Have them name their critter. A spokesperson from each group will then explain how their critter can perform each of the appointed tasks while living on the stream bottom.
3. Explain that they will be looking at aquatic insects and their adaptations in different stream habitats on their field trips. This would be a good time to discuss field trip behavior.
4. Have the students draw a picture of their classmate with their adaptations for their science journal. They should label as many of the adaptations as possible.

OUR STREAM CRITTER

Draw a picture of your classmate with his/her adaptations. Explain how they use their special attachments.

Field Lab Experience Lesson 4: (taught by WES staff at Clear Creek)

Objective

The students will explore two different aquatic habitats and compare biotic and abiotic elements. Afterwards, they can test predictions with *Fast Floaters*.

****Salmon****

As you discuss insect adaptations, talk about the adaptations of salmon. Explain why this stream is a good habitat for salmon.

Time

15 minutes - show students two study sites and fill in *My Predictions*
45 minutes – Stream study
45 minutes - Pond study
15 minutes- fill in *Conclusions* and discuss results

Materials

Copies of *Stream Studies* sheet (one green and one blue per pair/group of students) Copy *Field Lab Insect* on back
Copies of *My Predictions* (one for each student) Copy *Conclusions* on the back
Pencils (one per student for *My Predictions*, then one per group)
Clipboards (one per student for *My Predictions*, then one per group)
White tubs
Large kick net
Small nets
Pieces of rope measuring 10ft long
Two way viewers
Thermometers – C and F
Meter Sticks
Watch or stopwatch
ID keys
Microscope if available
Bag of floatable objects - optional

Advanced Preparation

Gather all the equipment together and locate the two study sites.

Activity One: Stream Study

Procedure

1. Have the students record their hypotheses on the sheet labeled “My Predictions.” Have the adult leader assist the students to fill in their predictions. To support the "Investigation and Experimentation" strand of the science standards, discuss the following questions:

- Why do we have to measure the temperature, water velocity and depth so many times?
- Do you think the temperature/water velocity/depth will be the same in the fast and the slow part?
- Do you think there will be a difference in the rocks on the bottom in the two different sections?

2. Conduct the physical observations such as velocity, temperature and surface under water.

3. Students will then listen to instructions on the ‘dos’ and ‘don’ts’ of using the equipment and being in the water.

4. Students will then collect specimens from the water to observe.

5. Demonstrate proper release of the animals back in the part of the stream where they were found.

6. When both *Stream Study* sheets are complete, compare results:

- What is the bottom like where the water is moving fast? Slow?
- Where were the most animals found?
- How are animals different in fast and slow sections of the stream?

7. Fill in *Conclusions* (on the back of the *My Predictions* sheet). Discuss the results.

Activity Two – *Pond Study*
Procedure

8. Have the students record their hypotheses on the sheet labeled “My Predictions.” Have the adult leader assist the students to fill in their predictions. To support the "Investigation and Experimentation" strand of the science standards, discuss the following questions:

- Why do we have to measure the temperature, water velocity and depth so many times?
- Do you think the temperature/water velocity/depth will be the same in the fast and the slow part?
- Do you think there will be a difference in the rocks on the bottom in the two different sections?

9. Conduct the physical observations such as velocity, temperature and surface under water.

10. Students will then listen to instructions on the ‘dos’ and ‘don’ts’ of using the equipment and being in the water.

11. Students will then collect specimens from the water to observe.

12. Demonstrate proper release of the animals back in the part of the stream where they were found.

13. When both *Stream Study* sheets are complete, compare results:

- What is the bottom like where the water is moving fast? Slow?
- Where were the most animals found?
- How are animals different in fast and slow sections of the stream?

Fill in *Conclusions* (on the back of the *My Predictions* sheet). Discuss the results.

Lesson Five: Assessment and Follow-up

Objective

Students place drawings of the insects they observed on the field trip in the appropriate part of the stream mural.

Time/Setting
20-40 minutes; Classroom

Materials
Science journal page *Field Lab Insect*
Stream mural
Paper for copying or tracing - optional
Pencils, crayons

Subjects
Science, art

Vocabulary
Adaptations

Procedure

1. Have the students cut out the pictures of the insects they drew and label the picture with the name of the animal and its adaptation. If you choose to keep the original drawing in their science journals, have the students trace the insect they drew on *Field Lab Insect*. Make sure they label where it was found (fast or slow water).
2. When everyone is done, place their work in the appropriate part of the stream mural. As each picture is added to the mural, discuss the adaptations of that particular organism. If you would like to turn this into an individual assessment, ask the students to draw the animals in their journals and write about their adaptations.

3. Data Analysis

- If the students did not get a chance to calculate velocity at the creek, they can do that in class. Once you have all the velocities, the numbers can be averaged or graphed on a simple bar graph. If the velocity data seems too complicated for your class, try averaging and/or graphing the time it took for the orange to travel 10 ft. Since several groups took measurements using the same procedure, this can be tied into the science standard 5a (*repeat observations to improve accuracy, and know that the results of similar scientific investigations seldom turn out exactly the same because of differences in the things being investigated, methods being used, or uncertainty in the observation*). The same procedure can be used for the temperature and depth data.
- Have the students look at their predictions carefully. After they have read through them, have them look at their data sheets. Next, turn over the “My Predictions” page to the “Conclusions” side. Take the class through the worksheet one question at a time to avoid confusion. This supports the science standard 5d (*predict the outcome of a simple investigation, and compare the result to the prediction. [Draw] conclusions [based on the results].*
- Discuss adaptations that were observed at the creek (hooks on feet, attached to rocks, casing for protection, etc.) Compare them to adaptations that might have been observed at the pond (staying on surface of still water, can tolerate low O2 and high temperatures, etc.)