STREAM ECOLOGY LESSON

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MODIFIED FROM 4-H ENVIRONMENTAL APPRECIATION DAYS

OCTOBER 2001

KEY POINTS

A. Invertebrates are adapted to their water environment.

B. Participants will discover that there is a high diversity of aquatic insects in Enfield Creek

C. Invertebrates are sensitive to the conditions in their aquatic environment. They are, therefore, one indicator of water quality.

Pre-activity planning—indicate in program description that water shoes or sandals are recommended

I. Introduce yourself and mention other similar naturalist programs that are scheduled for the upcoming week

II. Describe the plan for the session

A. What is a safari? Describe what we'll be doing over the next hour, and what's the plan before we head out on our actual safari.

III. Setting the stage

A. Observing aquatic environments

1. Ask what they know about this creek? Where does it start? Where does it wind up?
2. If the group has some slightly older kids ask: How does anything upstream affect the health of the creek? How does what's here affect downstream?
3. Ask the group to name some creatures that might be found in the creek that we might see on our safari. Fish, salamanders, ducks, bugs probably will be mentioned

IV. Basics of aquatic entomology

A. what are these bugs doing in the stream?

1. part of their life cycle. These are larvae and nymphs, that started off as eggs, and will grow up to be adults, who will then mate and lay eggs.
2. The life cycle of many of these bugs we find in streams has been happening this way for over 250 million years. They must be doing something right!

V. What makes stream bugs special and allows them to live in the water?

What to do:

1. Select a youth with a good sense of humor. Call him or her Ernie or Irene, and have this youth stand beside you.

2. Tell the group that at the moment, Ernie/Irene is well adapted to live on land. S/he can move around, breathe, eat, etc. Then ask the youth "What would happen

if Ernie/Irene had to live in a stream for the rest of his/her life?" "Would s/he survive very long?" "How can we adapt Ernie/Irene be an all-purpose stream invertebrate?"

3. As youth give suggestions ("Ernie needs a way to hang on against the stream current," "Irene needs to get air to breathe," "Ernie needs to capture food"), outfit Ernie/Irene with the item that will accomplish this purpose. Using the chart given above, or your own experience, explain how each of these "adaptations" will equip Ernie/Irene for life in the stream. Be sure to make reference to the "real-life" aquatic organism analog of the fun adaptation the group has given him/her. If youth give broad suggestions, try to prompt them for more specifics. For example "If Ernie needs to get oxygen, describe a way he might do this. OK, if he needs dissolved oxygen, what can we give him that will let him take in this dissolved oxygen? Gills might be a good idea!" If he needs to get food, ask how he might do this. If the youth decide he might be a filter feeder, then give him a mesh strainer to filter out the little stuff that is floating downstream. You could also ask leading questions such as "how do fish get their oxygen?"

4. When/if kids run out of ideas, pull out items still in the kit and explain what adaptation they represent.

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Ernie/Irene the Invertebrate

All organisms are adapted to the environment or environments in which they live. Aquatic creatures have many similar needs as terrestrial organisms, such as requirements for food, oxygen, protection against predators, and an ability to move about. But aquatic organisms also have many special adaptations that permit them to live in their watery habitats.

What you'll need:
A variety of props that represent Ernie or Irene's adaptations

Role of Adaptation	**How to Represent it on Ernie/Irene**	**Actual Adaptation**	**Invertebrate That Has This Adaptation**
Gathering food	wire strainer, or mesh bag	filter feeding	caddisfly or blackfly larva
	goggles	visual predator	dragonfly nymph
	vise grips/pliers	jaw/claws	dobsonfly nymph
	syringe (without the needle!)	piercing mouth parts	giant water bug
	tongs	grasping front legs	water scorpion
Locomotion/stability	scuba flippers	swimming	water boatman, mayfly nymph
	toilet plunger	suction cup	leech, water penny
	rope	anchor silk	blackfly larva

Oxygen acquisition	snorkel, straw	breathing tube	mosquito larva
	packing bubbles	physical "lung"/attached air bubble	beetle, backswimmer
	leafy tree branches*, feather duster	gills	mayfly nymph
Predator protection	spray bottle	chemical defense	whirligig beetle
	camo hat or vest	natural camouflage	nearly all
	hard hat	tough exoskeleton	sowbug, crayfish
	pipe cleaners	antennae (for smelling)	almost all

* tie these together into 2 small bunches, each with a loop of twine. Slip a hand through each bunch, and slide up to shoulder like an epaulet.

By the time you are finished decking out your volunteer, Ernie/Irene will look pretty funny. Wrap up the lesson by revisiting the key points:
• Ernie/Irene is a conglomeration or representation of adaptations of many different organisms. S/he may look strange but each adaptation fulfills a specific function.
• One reason animal species look different from each other is that they are each adapted to a particular niche within an environment.
• Although they are different in many ways from terrestrial organisms (and us!), aquatic animals have many of the same needs we have.

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V. What are some of the more common bugs in the stream?

A. mayflies
1. 2 or 3 tails
2. ALWAYS have gills along side of abdomen
3. swim like the "man from Atlantis" or like doing the "wave"
4. demonstrate this motion - “the May Fly Dance”

B. caddisflies
1. look like inchworms
2. many species build protective cases
   a. keep them from getting swept downstream
   b. provide camouflage from predators like fish, but if you have gone fishing and examined a fish's stomach contents, you may find caddisfly cases anyway
   c. cases may be made of stones, sand grains, vegetation
   d. cases may be attached to larger stones in the stream, or be carried around by the caddisfly like a snail carries its shell around. Caddisfly larvae mostly walk along the substrate, not swimming.
   e. silk spun by caddisfly is very strong, like spider web silk. If you roll a sand case around in your fingers, it is relatively tough to crush. *Only do*

this if there is no animal in the case. If you hold the case up to the light, you can see if it is empty.

e. net-spinning caddis build retreats out of this silk. Sometimes, if you handle a rock very gently, you can pull the small net away from the stone and see its grid pattern. These nets are about 1/2 inch square.

C. stoneflies

1. 2 stiff tails
2. may or may not have gills

a. if gills, located in "armpits"

3. the MOST sensitive to DO levels—they need the most DO of these three taxa; therefore, if you find stoneflies in a stream, you will likely find mayflies and caddisflies, but not necessarily vice versa; not as strong swimmers as mayflies
4. swim with "sinusoidal" movement, like the way a snake slithers through the grass
5. demonstrate this motion - "the Stonefly Dance"

VI. Why do these bugs matter?

A. they are *food* for larger animals like fish and crayfish (many of the kids know these as "crabs")

B. they are the *"clean-up crew"* that helps to break down or decompose leaves and other organic things that fall into the stream

C. they *keep the algae from growing* out of control in the stream

D. What conditions might be different in the different areas?

- dissolved oxygen in riffles
- temperature warmer in shallow or unshaded areas
- larger predators in deeper water

VII. (optional) How can a BUG tell you about water quality?

A. The quality of the environment affects those who live in it

1. where do you live? how does this affect your quality of life compared to if you lived in a town that had lots of factories that pumped bad-smelling smoke into the air? What if you lived right next to a busy 8-lane highway?
2. bugs—especially aquatic ones— are also affected by their environment
3. what in a stream do YOU think bugs are sensitive to?

a. light
b. pH
c. pesticides and other chemicals
d. amount of water
e. **dissolved oxygen!!!** gets reincorporated from the air as water flows over rocks
f. temperature will influence dissolved oxygen (DO)

VIII. Review

A. How do you know you have a mayfly larva? A stonefly larva? A caddisfly larva.

B. Everyone do the mayfly dance! Do the stonefly dance!

IX. Sampling procedures (demonstrate this stream side)

A. Divide group into sets of 3-5
   1. each team gets one bug box, 1 ID sheet, 1 plastic tub, 1 net or strainer, 1 white plastic spoon or soft forceps
   2. each team is responsible to return these items at the end of the lesson

B. Explain the procedure for the activity.

They will be looking for invertebrates in a variety of microhabitats. In shallow water, turn over the rocks and carefully look through leaves. In deeper water, use the net. Sample in the different microhabitats, e.g., shallows, riffles, pools, backwaters if you want them to be really thorough. In reality, they'll probably just go where they want, which is fine, too!

   1. wade into about 1 foot of water in a riffle area
   2. fill the basin with about 2" of unclouded water, and set this on the banks of the stream.
   3. face downstream
   4. place flat end of net about 18" in front of you, and do the "twist" or bug dance for about 20 seconds. You can also dig your toe into the cobbles in front of you if you are wearing close-toed shoes or boots. The object is to dislodge creatures living on the undersides of rocks—not to squash them!
   5. remove the net from the water, and invert into the pan of water. Allow the turbulence to settle for a minute or two before you start searching for your bugs.
      a. if the water is exceptionally muddy, "clear" the net by holding the frame of the net above the surface of the water after you have sampled, with the "bag" of net in the water. Swirl the net around in a circle, gently, so that the fine particles that cloud the water in the sample will rinse out of the net.
   6. Encourage them to carefully move critters into bug boxes for closer examination.

D. Call the groups back together
   1. Demonstrate how to carefully return the invertebrates to the water
   3. Have them empty and rinse all equipment, then return it. Parents can help with collecting all items.

X. Wrap-up

A. Get group together after they have returned their equipment

B. Ask the group members to raise their hands and call out the names of the insects they found in the stream

C. Take a vote about the quality of the water in the stream
   1. ask for reasons why this is so

D. Ask the group what would happen if the stream flow was reduced, or the water got very muddy
   1. what would the effect be on the bugs living there? The fish? Birds? How might this affect people?

E. End with a message about taking care of streams. Kids can make a difference by monitoring water quality and having fun at the same time.

F. Congratulate the group on a job well done.