

Monitoring Macroinvertebrates



Life Skill: Communication

Project Skill: Identifying stream macroinvertebrates (animals without a backbone that are visible without magnification)

Objective: Collect and identify stream insects and other tiny invertebrates in a group outing

Success Indicator: Participants coordinate a sampling expedition and predict the health of a stream based on its macroinvertebrate diversity

Provisions Needed

- Maps of local streams and creeks
- Kick seine; make one with:
 - 3½' x 4' nylon screening or netting (1/16" mesh)
 - 2 broom handles (5-6' long) for handles
 - heavy tacks and hammer or staples and staple gun
- White plastic bag or sheet
- White pans or ice cube trays for sorting critters by type
- Tweezers
- Vegetable brush for sweeping rocks
- Sneakers or boots
- Rubber gloves (for areas with polluted water)
- Magnifying lenses
- Notebooks
- Pencils or pens

Trailhead

Oftentimes, people plan their outdoor outings to avoid bugs. But many biologists and other people who study nature relish the insect creatures they encounter. Insects play an important role in ecosystems—most obviously as food for other animals. But they also offer humans clues about the health of the environment.

Aquatic insects, in particular, are such important indicators of water

quality that scientists count them to determine whether a body of water is clean or polluted. They regularly survey populations of aquatic macroinvertebrates such as caddisflies, mayflies, and stoneflies. Unlike fish, these tiny animals are fairly stationary. When pollution occurs, they can't move to cleaner water. So their presence or absence often points to trouble in aquatic environments.

Trailblazing

Aquatic insects can be fascinating to observe, and they can tell you a lot about the condition of your local streams. All you need are simple tools and a few enthusiastic partners. It's safer to work with others around water. Also, you can more precisely and easily sample areas if you work in pairs or teams.

Put together your sampling team. Choose people you know are interested in biology and the outdoors. You will need people to hold nets; to disturb the bottom sediments; to identify and sort animals; and to take notes. Your communication skills will be important as you assemble your team and conduct your investigation in the stream. Be sure to make all participants aware of safety precautions outlined in the Field Guide section.



what kinds of aquatic critters will you find?



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☞ **To learn what kinds of aquatic critters you may find, check the Field Guide section.** Suggested Reading and Internet Resources also will provide valuable information.

☞ **Assemble your sampling tools.** The most important one will be the net used to retrieve the animals from the stream. You can order a kick seine from the Izaak Walton League of America's

Save Our Streams program or use the materials listed in this activity to construct your own. For a sample design and building instructions, visit the following Web site: <http://www.people.virginia.edu/~sosiwla/Stream-Study/Methods/KickSeine.HTML>

☞ **Find a small creek or stream for sampling aquatic macroinvertebrates.** There may be an "adopt a stream" group in your community that can recommend places. Or check with your county Cooperative Extension Service or state wildlife or water quality agency. Shallow, fast-moving waters are ideal.

☞ **On sampling day, make sure you have all the necessary equipment and that team members know their roles.** If possible, sample at least three sites along the stream. Look for a riffle, a shallow place where water rushes swiftly over cobbles, or a partially submerged log or branch. The water depth should be between 3 and 12 inches. Select a 3-by-3-foot "grid" in the water. One person should hold one end of the kick seine flush with the bottom in the downstream portion of the grid; the other end should be held above the water. Another person should use the vegetable brush to remove any critters from stones or debris in the sample area. That person then should stir the sediment with his or her hands to dislodge any burrowing critters. Last, the person should kick the stream bottom with a sideways shuffling motion for at least a minute. Using a forward-scooping motion, the net-tender can then lift the kick seine and take it to shore to investigate the contents. Remove critters with fingers, tweezers, or forceps and place them in holding containers that have been filled with stream water. Be sure to release any fish or other large animals you may capture inadvertently.

Carefully count and record the number and types of creatures you find. Discuss and evaluate your findings as a team. Assess the water quality based on the diversity of macroinvertebrates. A sample assessment form can be found with this activity or at: <http://www.people.virginia.edu/~sosiwla/Stream-Study/Methods/Form.HTML>.



the diversity of organisms... gives a more complete picture of overall water quality.

Internet Resources

- <http://www.iwla.org/SOS/>
- <http://www.people.virginia.edu/~sosiwla/Stream-Study/Key/MacroKeyIntro.HTML>
- <http://www.dec.state.ny.us/website/dow/stream/orderpageone.htm>
- http://www.ncwater.org/stream_watch

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Stream Study: Sample Record and Assessment

Stream _____ Site Number _____

County or city _____ State _____

Collection date _____ Collectors _____

Weather conditions (last 3 days) _____

Average depth at site _____ Average width at site _____

Stream-water temperature F° _____ C° _____

Stream-flow rate High Normal Low

Stream appears Clear Cloudy Muddy

MACROINVERTEBRATE COUNT

Sensitive	Somewhat Sensitive	Tolerant
<input type="checkbox"/> _____ caddisfly larvae	<input type="checkbox"/> _____ beetle larvae	<input type="checkbox"/> _____ aquatic worms
<input type="checkbox"/> _____ hellgramite	<input type="checkbox"/> _____ clams	<input type="checkbox"/> _____ blackfly larvae
<input type="checkbox"/> _____ mayfly larvae	<input type="checkbox"/> _____ crane fly larvae	<input type="checkbox"/> _____ leeches
<input type="checkbox"/> _____ gilled snails	<input type="checkbox"/> _____ crayfish	<input type="checkbox"/> _____ midge larvae
<input type="checkbox"/> _____ riffle beetle adult	<input type="checkbox"/> _____ damselfly larvae	<input type="checkbox"/> _____ lunged snails
<input type="checkbox"/> _____ stonefly larvae	<input type="checkbox"/> _____ dragonfly larvae	
<input type="checkbox"/> _____ water penny larvae	<input type="checkbox"/> _____ scuds	
	<input type="checkbox"/> _____ sowbugs	
	<input type="checkbox"/> _____ fishfly larvae	
	<input type="checkbox"/> _____ alderfly larvae	
	<input type="checkbox"/> _____ watersnipe larvae	
boxes checked x 3 = _____ index value	boxes checked x 2 = _____ index value	boxes checked x 1 = _____ index value

WATER QUALITY RATING

Excellent (>22)

Fair (11-16)

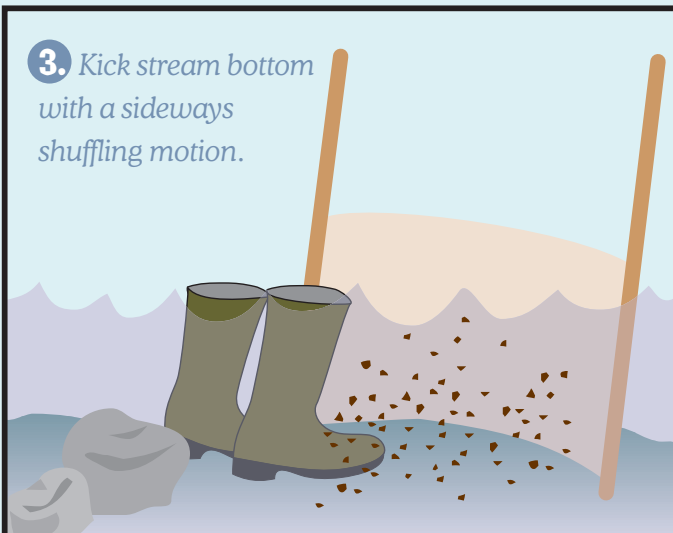
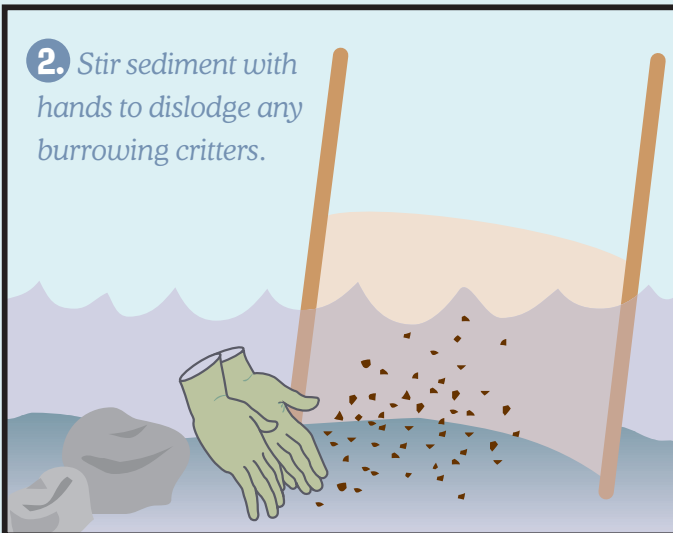
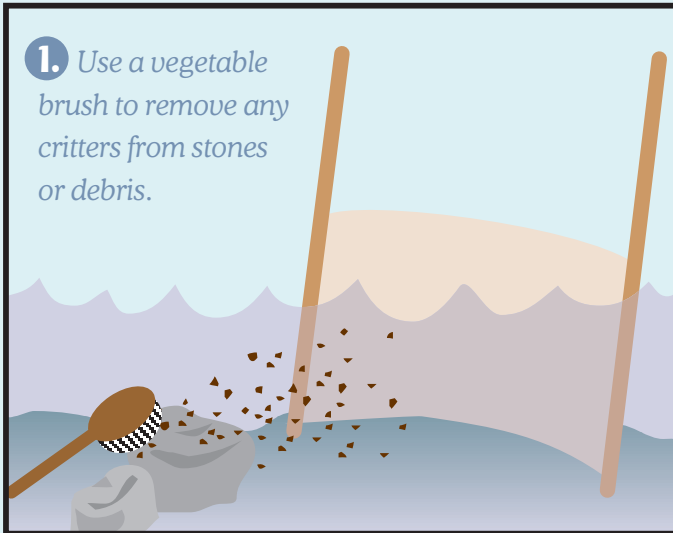
Total Index Value = _____

Good (17-22)

Poor (<11)

Monitoring Macroinvertebrates

Stream Sampling



Field Guide

Environmental biologists often classify freshwater macroinvertebrates as either “tolerant” or “intolerant” of pollution. The presence of insects like stoneflies, mayflies, and caddisflies is generally considered a sign of clean water. These insects spend most of their life cycles in the water. Many mussels, which spend their entire lives in the water, are also very sensitive to pollution. However, the diversity of organisms (large numbers as well as many kinds) gives a more complete picture of overall water quality.

The shape of the insect’s body and number of legs and tails are good identifiers. Helpful **identification or dichotomous keys** can be found in Internet Resources. Especially useful is a Web site from New York state: <http://www.dec.state.ny.us/website/dow/stream/orderpageone.htm>. It presents pictures of common macroinvertebrates, including stoneflies (part of the scientific order Plecoptera), mayflies (order Ephemeroptera), and caddisflies (order Trichoptera).

Suggested Reading

- Kellogg, Loren Larkin. *Save Our Streams Monitor’s Guide to Aquatic Macroinvertebrates*. Izaak Walton League of America. 1992.
- McCafferty, W. P. *Aquatic Entomology*. Jones and Bartlett Publishers Inc. 1983.
- Pobst, Dick. *Trout Stream Insects (An Orvis Streamside Guide)*. Lyons and Burford Publisher. 1990.
- Stokes, Donald. *A Guide to Observing Insect Lives*. Boston: Little, Brown & Co. 1983.
- Winborne, Ferne B. *A Guide to Streamwalking*. Raleigh, N.C.: N.C. Department of Environment and Natural Resources. 1999.

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- **Safety tips:** Pack a first-aid kit with antiseptic and bandages. Know the location of the nearest phone or, if possible, carry a cellular phone. Do not sample in bad weather or after storms or flooding. Do not climb on steep streambanks. Wear waterproof boots and latex gloves if the stream you are sampling is known to be polluted. Also, wear thick gloves when disturbing the bottom if there is danger of glass or metal in the stream.



The Extra Mile

Environmental public policy is often guided by information from citizens and volunteer monitors. You may wish to communicate your findings to government officials or environmental biologists. If diversity was high, the area may qualify for special protection. If diversity was low, action may be needed to restore water quality. Prepare and deliver a team presentation based on your research.



Field Notes

share

- What are some of the more interesting creatures you found in your investigation?
- What did you learn about the condition of waters in your community based on your macroinvertebrate surveys?
- Why was it helpful to carry out this activity as a group?

process

- What do you think investigators can learn from studying macroinvertebrate populations in streams that they can't determine using tests for chemicals and toxins?
- What are the advantages and disadvantages of macroinvertebrate surveys as a technique for measuring water quality?
- How was the activity hindered or helped by communication?

generalize

- What other kinds of animals have been historically regarded as indicators of environmental distress? Why?
- In what other ways do you communicate one-on-one and in groups to complete a task more efficiently?

apply

- What would you do differently if you conducted your team survey again?
- In what other ways could you use communication to draw attention to an important issue?