Macroinvertebrate Investigation

Revised October 2011

PURPOSE: To introduce students to living aquatic macroinvertebrates in a field setting.

SUMMARY: Students will collect live macroinvertebrates from a river or stream. They will then classify and count the invertebrates and use that data to determine the EPT index (explained below).

BACKGROUND: Many macroinvertebrates make their homes in riffles and pools of gravel-bed streams. By turning over stones and examining the underside, you may find aquatic macroinvertebrates. Aquatic macroinvertebrates are often used as an indicator of water quality. The orders of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Tricoptera (caddisflies) are generally sensitive to pollution. Water Quality Biologists use these three orders to calculate an EPT index to determine the quality of a water body. If we find families from these three orders of invertebrates living in a stream or river the water is most likely not impacted from pollution. However, it is important to remember that the absence of these families does not always mean the quality is poor. There could be other reasons these families are not present.

MATERIALS:

Kick nets* (see page 4 on building your own kicknet)
Plastic tubs (1 per 5 students) *
Large transfer pipettes (1 per student)*
Plastic petri dishes (1 per student)*
Magnifying glasses (1 per student)* *
Dichotomous keys
Buckets (2)
Waders

Available for loan at USU Water Quality Extension or through your local Extension office. Please contact USU Water Quality Extension for details 435-797-2580 or http://extension.usu.edu/waterquality

PROCEDURE:

1. Choose your sample site. Be sure to take into account the safety of your students (see safety tips on page #5).

2. Explain to your students how to collect a macroinvertebrate sample.

   a. One student will wade into the stream and place the net so the mouth of the net is perpendicular to and facing the flow of water.

   b. Another student will stand upstream from the net and disturb the stream bottom with his/her feet and hands.

Suggested Grade level:
K-6

Duration:
30 minutes

Setting:
Outdoors

Core Alignments
Click the links (or visit streamsidescience.usu.edu for grade-by-grade alignments.

Kindergarten:
Science ILOs / Math
1st Grade:
Science ILOs / Math
2nd Grade:
Science ILOs / Math
3rd Grade:
Science ILOs / Math
4th Grade:
Science ILOs / Math
5th Grade:
Science ILOs / Math
6th Grade:
Science ILOs

c. Students can carefully pick up and rub stones directly in front of the net to remove attached animals. The stream bottom materials and organisms will be carried into the net by the current.
d. Tell the students to continue this process until they see no more organisms being washed into the net.

3. Have the students hold the sample over a plastic tub, and use a bucket of stream water to wash the organisms into the tub.

4. Have students sort and identify the macroinvertebrates using the transfer pipettes, magnifying glasses, petri dishes, and dichotomous keys. List the number of different families on the table below and calculate an EPT index.

A different "**family**" refers to animals that are related (e.g., all mayflies) but have enough different physical characteristics that they can easily be divided into separate groups. (See dichotomous key).

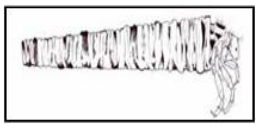
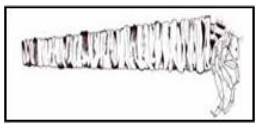
5. Discuss the different invertebrates the students found and what types of land uses might be impacting the site (see Background from "Water Pollution Graphing" lesson).

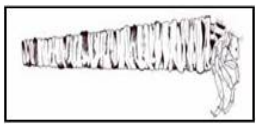
Aquatic Invertebrate Group (Orders)	Number of different found
Mayfies (Order Ephemeroptera)	
Stoneflies (Order Plecoptera)	
Caddisflies (Order Tricoptera)	
TOTAL	

Total "families" equals EPT Value:

> 10 Not affected (excellent water quality)
6-10 Slightly affected (good water quality)
2-5 Moderately affected (fair water quality)
<2 Severely affected (poor water quality)

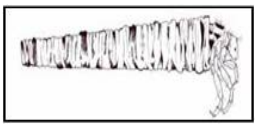
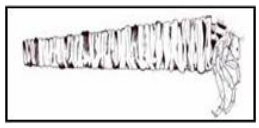
NOTE: A low EPT value does not always mean poor water quality. Factors other than pollution, such as physical characteristics of the stream or river, may cause the absence of some invertebrates.

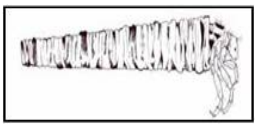
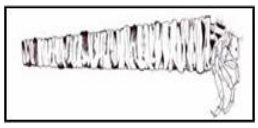






CONTINUED LEARNING:

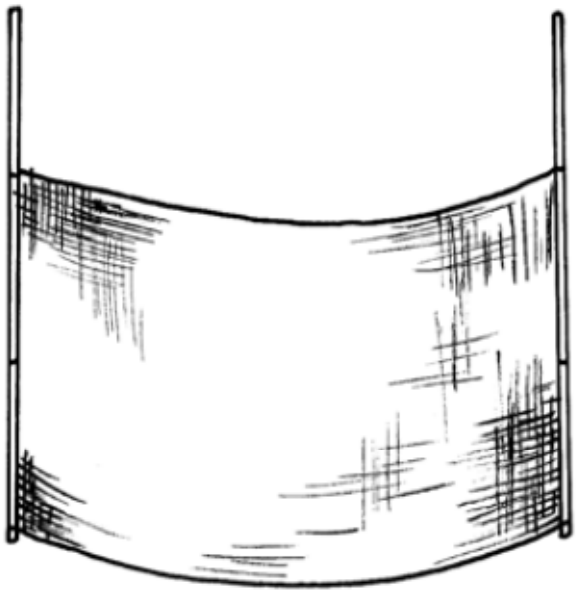
Have students rate the quality of the water using the EPT Value found above (or Water Quality Rating Index found in the Utah Stream Team Manual) found above. Have students sample other sites along the same stream or from two different types of water bodies (stream and lake) for comparison. Discuss what is different or similar between sites. You can also keep a yearly record and have students compare their sites over time.

Make your own Kicknet

Kick nets, which consist of screening material stretched between two poles, are used for sampling macroinvertebrates. Sampling is done by pushing the two poles into the substrate until the edge of the screen rests on the bottom. Organisms are dislodged by disrupting the substrate on the upstream side of the net, allowing them to be carried by the current into the screen.



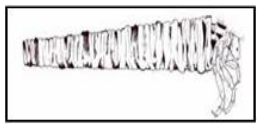
Materials

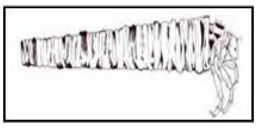
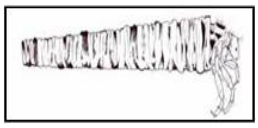
- two 3 ft x 5/8 in sections of wooden dowel
- one 3 ft x 2 ft section of fiberglass window screen
- staple gun
- duct tape (optional)

Directions

1. Stretch window screen length-wise between dowels

2. Wrap end of window screen around dowel once and staple along length of dowel. Wrap screen around the dowel a second time and staple again. You can repeat a third time if necessary and/or secure window screen to dowel with duct tape.

Safety tips for macroinvertebrate sampling

Kids and water are a natural combination. To ensure the two mix well, consider the following guidelines before going to the stream site:

- If possible, have 1 adult supervisor per six students.
- If you choose to split up into groups, keep a good line of communication between groups at all times (e.g. stay within hearing distance).
- Be aware of medical considerations and have ready access to first aid.
- Know which students are allergic to bee stings and how to handle a reaction.
- Know the causes and early warning signs of hypothermia and heat exhaustion.

Be aware of these safety precautions in choosing a stream site:

- Avoid steep, slippery banks. Holes, vertical banks, and other hazards can be especially difficult to see when the banks are very heavily vegetated.
- Scout the area for dangerous trash such as broken glass, rusted wire, or metal scraps.
- Scout the area for poison ivy, poison oak, and stinging nettle.
- Moving water is deceptively dangerous. **Don't let students enter water over their knees or water that is moving very fast!**
- Never visit a stream during a lighting storm and beware of sudden storms that could produce flash floods.

Do not let students enter the water without being prepared, i.e. waders, good wading shoes, and an available change of clothing.

About aquatic macroinvertebrates

Aquatic macroinvertebrates are small animals that live in water, are big enough to see with the naked eye, and have no backbone. These animals include many types of insects as well as other animals such as worms, mollusks, and crustaceans.

Most aquatic macroinvertebrates make their homes in rocks, leaves, and the sediment of streambeds. These organisms have many special adaptations allowing them to live in demanding environments. Marcroinvertebrates that live in riffles and fast-moving water may have features that help them hold on to rocky or hard substrates such as hooked feet or suction cups; or flat, streamlined bodies that can handle rapid water velocities.

Macroinvertebrates that house themselves deep in muddy substrates may have different sets of adaptations for low oxygen environments such as air tubes or oxygen trapping red hemoglobin in their tissue. See the "Adaptations" column in Appendix C for more examples.

These bugs are important because they are an integral part of the food chain. They provide food for fish and other aquatic organisms. Many of them are also key indicator species. They can tell us about the quality of the water where they are found. Bugs that have a low tolerance to pollution tell us that the water they are found in is relatively healthy. If we do not find these bugs, then it could possibly be due to some sort of pollutant or other impairment to the water body.