



A STREAM IN A BUCKET

An introduction to aquatic macroinvertebrates and other stream life.

SAFETY NOTES:

Stream water is not sterile. Students should be instructed not to allow any water to enter their mouths. They should wash their hands before leaving the lab.

If this lab is done at a stream, students should be instructed to stay within sight and away from deep water.

Crayfish and Dobson fly larva (hellgrammites) can pinch - be careful!

INTRODUCTION:

In this exercise you will examine a collection of aquatic macroinvertebrates that was collected and brought into class or you will make a collection from a stream and then study it. Very few students realize the diversity of life that exists in a good quality stream. This activity will help them to learn the different types of bottom dwelling (benthic) macroinvertebrates. Most are the aquatic stages of insects such as stonefly, mayfly, dragonfly, and damselfly nymphs, or caddisfly, crane fly and midge larvae. Others, such as crayfish, aquatic snails, scuds, and cress bugs live in the water all of their lives.

There is also a strong relationship between the numbers and types of aquatic macroinvertebrates and water quality. Pollution and habitat degradation lowers the diversity and quantity of organisms present. Organisms such as mayflies and stoneflies are very sensitive to pollution, sedimentation, and low dissolved oxygen (DO). In this lab you will learn to use at least one method of determining water quality from studying the diversity of aquatic macroinvertebrates. For more background information benthic macroinvertebrates and how they are used as indicators of water quality consult chapter 6 of the Field Manual for Water Quality Monitoring by M. Mitchell and W. Stapp.

OBJECTIVES:

The learner will be able to ...

1. Identify members of at least five major groups of aquatic macroinvertebrates.
2. Use the identified organisms to calculate water quality using the Pollution Tolerance Index.
3. Explain why aquatic macroinvertebrates are often a better way to assess water quality than chemical testing.
4. (OPTIONAL) Collect a sample of aquatic macroinvertebrates by using a kick net or D-frame net.

MATERIALS:

Pre-collected Sample of OPTIONAL MATERIALS

macroinvertebrates* Kick net (1-3)

8 Field Manuals for Water D-frame net (1-3)

Quality Monitoring Collecting containers (6-10)

6-10 white-bottomed containers boots (hip waders or low boots)

6-8 Stereo Scopes or magnifying glasses

Aquatic Insect Slides

Slide projector

* Macroinvertebrates can be collected and held for 24 hours if they are kept cold.

Use a cooler with some stream water and non-Cl ice or sealed ice pack. Use a paper cup to scoop out a cup of water and dump it back into the cooler, thus adding DO to the water.

In Pennsylvania, if over age 15, you must have a current fishing license to legally collect macroinvertebrates (considered fish bait).

PROCEDURE:

1. Take notes on slides and/or discussion of the characteristics of the major groups of aquatic macroinvertebrates and how to recognize them.
2. OPTIONAL - Use kick net and/or D-frame net to collect aquatic macroinvertebrates.
3. Move to one of the numbered samples.
4. Use your Field Manual for Water Quality Monitoring (pages 129-133), your notes, and the lab write-up to identify, get an approximate count, and classify according to pollution tolerance the organisms in your sample.
5. Record your results on the **Macroinvertebrate Sample** data sheet.
6. Move to another numbered sample and repeat steps 4 and 5.
7. When instructed, use the information from your data sheet to calculate the Pollution Tolerance Index. Other methods, such as Sequential Comparison Index or the Diversity Index (page 126-133) can also be used to measure water quality.

Name - _____ Period - ____ Date - _____

Discussion Questions

1. What habitat requirements of an organism might make it “pollution-sensitive?”

2. List five organisms that are pollution-sensitive (pollution-intolerant).

1. _____ 2. _____ 3. _____

4. _____ 5. _____

3. Why are aquatic macroinvertebrates often better indicators of water quality than chemical testing?

4. Take the following data, collected from Laurel Run on October 4, 1995, and calculate a Pollution Tolerance Index, Cumulative Index Value, and give a Stream Quality Assessment:

- 5 green caddisflies
- 1 hellgrammite
- 2 swimming mayflies
- 7 crayfish
- 3 tan midge larva
- 1 aquatic worm

Cumulative Index Value = _____ Water Quality Assessment = _____

5. What stream substrate usually has the most diverse macroinvertebrates?

6. Explain how to tell a mayfly nymph from a stonefly nymph.

TEACHER NOTES FOR STREAM IN A BUCKET

Begin the lesson by quickly going over each aquatic macroinvertebrate group that your students will need to know. This varies with each stream that is sampled.

Stonefly Nymphs

Tiny to almost 2-inches long, two tails, gills look like a fuzzy mass where each leg joins the thorax. Plant eaters. Prefer streams with a rubble (assorted-sized stones) bottom in clean high DO (dissolved oxygen) water. Over 90 species in PA, but only several are common in our part of the state. [2 of the most common are in the slides]
Some species live in the nymph form for more than one year.

Mayfly Nymphs

Most species less than 1-inch long, most have 3 tails and rows of gills along the abdomen. Herbivores feed on algae or by shredding dead leaves. Most prefer swiftly flowing stream with clean, high DO water. Most species emerge (change from nymph to adult) during the same week each year. This is species and stream specific. Over 700 species occur in North America. There are three basic body types:

SWIMMING - streamlined bodies with 6 small legs. They swim by quickly arching and straightening their bodies.

CLINGING - flattened bodies with 6 strong muscular legs. Arms are used to cling to rocks in swift current. Flattened bodies allow the water to flow over them.

BURROWING - stocky bodies with small legs. Large gills are used to filter oxygen from lower DO water. Live in burrows that they dig in the sediment. Prefer slower velocity water.

Caddisfly Larva

An aquatic larva with 6 small legs all located near the head. Up to 1-inch long. Some caddis larva are free-living, some build webs in the current which they use to filter algae from the water, others build cases by gluing tiny sticks or stones together. [Thus the common names “stick worm” or “stone caddis.”] Stick builders tend to live in slower water, while the stone caddis use their “house” as ballast in swifter current.

Water Penny

Looks like a tiny suction cup or a miniature trilobite, up to 1/2-inch long. Eat algae from the surfaces of rocks. Needs high DO water.

Cress Bugs and Scuds

These tiny crustaceans spend all of their lives in the water. They are most common in limestone water. Cress bugs (aquatic sow bugs) can live with some organic pollution.

Cranefly Larva

These large semi-clear jelly-like “worms” are actually the aquatic larva of the cranefly, (which looks like a giant mosquito). Order: *Diptera*, Family: *Tipulidae* They usually live in areas of lower velocity. Some grow to over 2 inches long (10 - 25 mm). They do not need high DO.

Dragonfly and Damselfly Nymphs

Relatively large aquatic nymphs that live in the water for one to four years. Order: *Odonata*. They have large heads with big eyes. Dragonfly nymphs are predators - a favorite food is mosquito larva. They have stocky bodies which are sometimes covered with algae and look “fuzzy.” They have no tails. They can “jet” through the water by expelling water from their rectal chamber. Damselfly nymphs are more slender and they have 3 flattened “tails” (caudal lamella) at the end of their abdomen.

MACROINVERTEBRATE SAMPLE DATA SHEET

See pages 130-133 in the Field Manual for Water Quality Monitoring.

Stream Sampled - _____ Date- _____

Location - _____ Substrate - _____

Organisms from Group 1 Organisms from Group 2

_____	_____
_____	_____
_____	_____
_____	_____

Organisms from Group 3 Misc. Vertebrates

_____	_____
_____	_____
_____	_____

Calculate Pollution Tolerance Index

Cumulative Stream Quality

Index Value Assessment # Group 1 ____ **X 3 =** ____

23 and above = Excellent # Group 2 ____ **X 2 =** ____

17 - 22 = Good

11 - 16 = Fair # Group 3 ____ **X 1 =** ____

10 or less Poor _____

Cum. Index Value = _____

Stream Quality Assessment _____