Observing Macroinvertebrates

Potter County Conservation District

Essential Guiding Question: How do macros tell us the health of a stream?

This lesson introduces the world of benthic macroinvertebrates.
First, explain what macros are using drawings, posters, or replicas. PA Fish and Boat Commission Bug Fact Sheets are very useful here! Next, have students explore some of the sampling equipment (nets, ID sheets, magnifying glasses, trays, tweezers or spoons) and surmise how to use them. You'll demonstrate the correct way to use them afterwards.
Although pollution tolerance groups should be analyzed by all ages, younger students will be able to organize the bugs into major orders only (dragonfly, mayfly, etc.) Older students should be encouraged to complete a Pollution Tolerance Index worksheet to generate quantitative data. In some cases, older students might also be encouraged to take note of surrounding vegetation and/or chemical parameters. All ages should be asked why they think, based on the bugs found, if the stream is healthy.

Estimated time: 1.5—2 hours **Ages: 10-18, depending on lesson extension**

Materials:

- Pans, ice cube-like trays, spoons or eye droppers
- Nets! D-frame, kick nets, or most any net that allows water through it will work
- Boots, waders, or other water footwear to protect toes
- Macro ID sheets with Pollution Tolerance Groups listed
- Paper and pencils to record findings, older students should use a worksheet that outlines formulas to generate Index Scores (link in PCCD's Macro Story Map!)

Learning Objectives

1) Students will explore the stream through collecting macros, understanding where and how they live
2) Students will analyze macros' adaptations and ID them according to order and appropriate pollution tolerance group
3) Students will evaluate findings to determine if the water in the stream is of good quality

Set Up:

1) Set up stations with one pan, one ice cube tray, spoons or eye droppers, and ID sheets. Students will work here in small groups.
2) Place collection materials nearby for students to examine and practice with.
3) Have a larger ID poster, drawings, or PAFBC fact sheets with you for your intro on macros

Activity 1—Macro Intro and Equipment (30-40 minutes)

This gorgeous native Brook Trout depends on macros to survive!

<u>Opening question: What lives in streams?</u>

Explain that streams are cradles of life, holding much more than just fish. The food web of a stream includes leaf litter, algae, macros, amphibians, adult bugs, fish, and mammals!

In groups have students write, draw, or discuss all that lives in streams. If time allows, have them present their scene or ideas to the group.

Share some information about the "bottom of the food chain" - live plants, dead leaf litter and particles of dead organisms (detritus), algae, and macroinvertebrates. In particular, macros tell a lot about the stream's health and also serve as food for wild fish. Also explain that certain bugs have certain adaptations necessary for them to live. Point out one or two adaptations as you go through each type of macro.

This is an important time for students to practice with the equipment (especially magnifying glasses) as well as flex the observational muscle, writing down a few things to look out for: gill type, number of tails, legs, wing pads, eye size, swimming ability, and more.

Activity 2—Macro Collection and Identification (30 to 60 minutes)

Students should know to ALWAYS keep their creatures in water! They will suffocate without it, and as many as possible should be returned safely to the stream. Ask them to rinse their hands first as well, as sunscreen, bug spray, or other oils on our hands can also harm them.

Students should stay in groups again to collect, organize, and identify their macroinvertebrates. In some cases, an in-depth ID guide and teacher assistance might be necessary. PAFBC has larger guides that might be handy in this event.

Sites with higher water will require waders or high boots.

Identifying for Ages 10-13—younger students should be asked to take note of adaptations. Those younger than 10 might also enjoy drawing a replica of what they see under magnification. Ask students to take a tally of all bugs belonging to each group, so they have a final total number of group 1, 2, 3, or 4.

Identifying for Ages 14-18— older students should be encouraged to take totals within each order (example, 18 mayflies, 20 stoneflies, 4 dragonflies, etc.) These numbers will be used later in a formula that gives weighted scores according to pollution tolerance group. A link to this can be found on our Macro Story Map . Older students might also benefit from taking note of weather, vegetation, and some basic water chemistry parameters.

Extensions

1) Build-a-bug—this works well as a supplement to your intro. Have groups take a random assortment of adaptations, written on paper scraps (three to four each group), out of a paper bag. Together they should draw the bug, name it, and use all the adaptations picked. They should then work together to present the bug to the group.
2) Matching Game—Trout Unlimited has a free matching game online, called “Stream Explorers: Catch the Critter,” that is a good addition especially if inclement weather occurs. It is available on their education resources tab to print.
3) Chemical Parameters—test pH and temperature, and if time allows, repeat macros and chemical testing at another, very different stream or section of stream. Compare and contrast!

Conclusion (10-15 minutes)

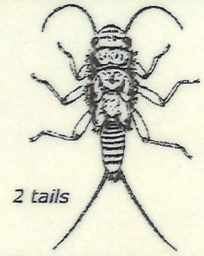
The conclusion of any lesson is crucial to an educator’s success. This short time facilitates synthesis of the ideas you worked to convey in the last hour or more. Refer to the **Teaching Toolkit Assessment Guide** for ideas on how to phrase your conclusion!

The conclusion for this lesson should carefully assess the overall health of the stream. After asking each group to share their findings, ask students why or why not they believe the stream’s water is of good quality. Especially for older students, pose the question “what is my stream at home like? What can I do to find out? How can I explore what might harm my stream?” A brief listing of common impacts should be explained here, perhaps even in the form of short case studies, for students to consider.

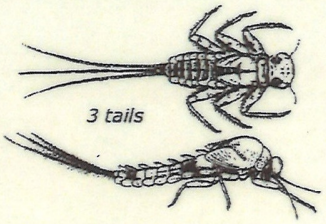
After this lesson, students should understand the basics of benthic macroinvertebrates and have a good idea of what a bio indicator is.

Macroinvertebrate Identification Key

GROUP 1 – Very Intolerant to Pollution

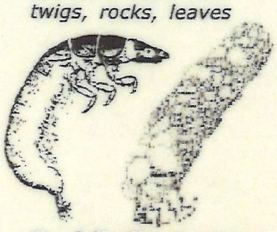


Stonefly Nymph

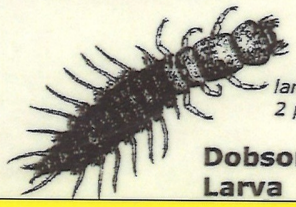


Mayfly Nymph

Riffle Beetle Adult & Larva



Caddisfly Larva

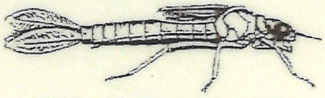


Dobsonfly Larva

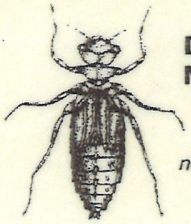
Water Penny Larva

Right-Handed Snail

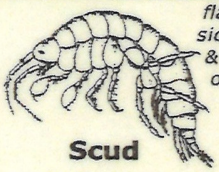
GROUP 2 – Moderately Intolerant to Pollution



Damselfly Nymph



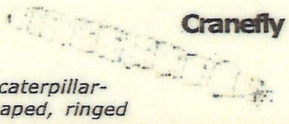
Dragonfly Nymph



Scud

Sowbug

flattened top to bottom (looks like a pill bug)



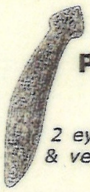
Cranefly

Clam/Mussel

GROUP 3 – Fairly Tolerant to Pollution

Midge Larva

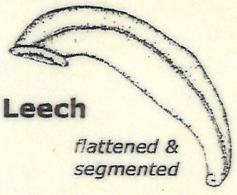
visible head & prolegs



Planaria

2 eye spots & very small

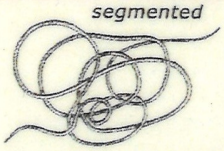
Black Fly Larva



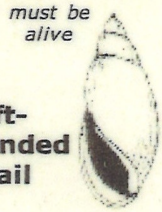
Leech

flattened & segmented

GROUP 4 - Very Tolerant to Pollution

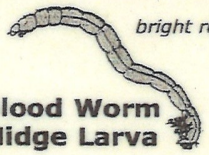


Aquatic Worms



Left-Handed Snail

Rat-tailed Maggot



Blood Worm Midge Larva