



Macroinvertebrate Stream Sampling

Students will learn about freshwater ecosystems while they collect macroinvertebrates from their natural habitats.

For grades 6-12

Created by the Athens-Clarke County Stormwater Management Program

Lesson Summary

The best way to learn about water is to jump on in! Oftentimes, the most interesting time spent in stream studies is spent in the stream, looking under rocks.

For this activity, water samples can either be brought to the classroom or students can visit a nearby stream to collect macroinvertebrates from their natural habitat under stream rocks and in leaf packs. After learning about freshwater ecosystems, students identify the type and amount of macroinvertebrates present using guides and a dichotomous key.

Objectives

- Students will learn that water quality is a complex, multi-faceted concept.
- Students will learn how to collect water quality data and develop new ways to represent the data.
- Students will collect and identify macroinvertebrates that live in freshwater habitats.

GSE Science Major Concepts

Biology

SB5. Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment.

Chemistry

SC6. Obtain, evaluate, and communicate information about the properties that describe solutions and the nature of acids and bases.

Environmental Science

SEV1. Obtain, evaluate, and communicate information to investigate the flow of energy and cycling of matter within an ecosystem.

SEV2. Obtain, evaluate, and communicate information to construct explanations of stability and change in Earth's ecosystems.

SEV3. Obtain, evaluate, and communicate information to evaluate types, availability, allocation, and sustainability of energy resources.

SEV4. Obtain, evaluate, and communicate information to analyze human impact on natural resources.

SEV5. Obtain, evaluate, and communicate information about the effects of human population growth on global ecosystems.

Materials

- stream water
- gloves
- goggles
- mini nets
- mini magnifying glasses
- clipboards
- pencils
- several copies of a dichotomous key (We recommend Stroud Water Research Center's key)
- smart phone (optional - to help identify microorganisms)

Background Information

(Some information taken from the Stroud Water Research Center)

Freshwater ecosystems

According to Encyclopedia.com, an ecosystem is a “complete community of living organisms and the nonliving materials of their surroundings.” Ecosystems include everything from animals, plants, and bacteria, to rocks, soil, bodies of water, and even the atmosphere around them. The size and make-up of ecosystems vary tremendously.

A freshwater ecosystem, specifically, is a type of aquatic ecosystem. These include lakes, ponds, rivers, streams, and springs. Freshwater ecosystems, as opposed to marine or saltwater ecosystems, are often classified by temperature, light penetration, and vegetation, and they are home to many different insects, amphibians, fish, and birds.

Macroinvertebrates

Macroinvertebrates are animals without a backbone that can be seen with the naked eye. These bottom-dwelling animals include crustaceans and worms, but most are aquatic insects. Beetles, caddisflies, stoneflies, mayflies, hellgrammites, dragonflies, true flies, and some moths are among the groups of insects represented in streams. Macroinvertebrates are an important link in the food web between the producers (leaves, algae) and higher consumers such as fish.

A well-balanced biological community is one of the best indicators of a healthy stream. Macroinvertebrates are often used in studies to determine the quality of waters because of their high numbers, known pollution tolerances, limited mobility, wide range of feeding habits, varied life spans, and dependence on the land environment around the stream. When chemical grab samples are taken, they are really a snapshot of the water at that moment, that can change rapidly, but the macroinvertebrates are living there all the time. Their composition will be affected by either periodic episodes of poor water quality or continuous poor water quality.

You can identify macroinvertebrates using a dichotomous key, or an identification document that consists of a series of choices that lead the user to the correct name of a given item. We recommend using the Stroud Water Research Center’s key, found at http://www.stroudcenter.org/education/MacroKey_Complete.pdf.

Procedure

Discuss the importance of chemical and physical water quality sampling. Water sampling and monitoring is important when determining the health of the body of water and of the entire watershed. Three different characteristics of a body of water are tested to determine its condition. Ask the students to name them and give examples of each.

- Chemical: pH, dissolved oxygen.
- Physical: temperature, turbidity, bank erosion.
- Biological: Benthic macroinvertebrates, fish, plants.

Explain that this activity focuses on the biological characteristics. Use the background information to discuss freshwater ecosystems and their components, with a focus on macroinvertebrates. Inform students that even though a stream's physical and biological characteristics change on a daily, weekly, seasonal and yearly basis, macroinvertebrates are always present. They are bioindicators of stream health because of their known pollution tolerances, feeding habits, varied life spans, and dependence on the land environment around the stream. Once we know which macroinvertebrates are present, we can make inferences about the health of the stream we're looking at.

Divide the participants into five groups of three or four students each. In a formal, large group setting, cap the number of students in each group at five. Hand out copies of the dichotomous key, nets, gloves, goggles, and magnifying glasses. Explain that they will be using these things to help them find and identify macros. They will need to check under rocks, along banks, and in the stream bed.

Once they find macros, have them use the dichotomous keys for identification. The Stroud Water Research Center key starts with the choice between "jointed legs" and "no jointed legs." After you make that choice, you move to the next pair of choices in the key. Students should follow the page reference to jump to the next part of key, and continue until arriving at an identification.

After they've identified a few different organisms, have them research the specific species. Are those organisms ultra sensitive to water pollution? If so, the stream they came from is most likely in good shape.

Assessment

Students will correctly or incorrectly identify their macroorganisms based on the dichotomous key. Students will also answer questions throughout and at the end of the activity.

Sample questions include:

- What is a freshwater ecosystem?
- What types of organisms can you find in a freshwater ecosystem?
- What are macroinvertebrates and what do they tell us about a stream?
- What could we do to increase the health of this stream?
- What are some of the common causes of water pollution?