



Measuring Water Quality with Macros (Scenario B: Learning Experience #2)

Lesson Plan



Summary

Since water quality is important to the on-going success of their projects from Learning Experience #1, students will learn how to collect and identify macroinvertebrates that are considered to be indicators of a healthy aquatic community.

Lesson Essential Question

- What can we learn about the quality of water in an aquatic habitat from the organisms that live there?

Objectives

The students will:

- work productively as a part of a project team.
- use a variety of resources to identify organisms found in an aquatic habitat.
- visit a local waterway, lake or wetland appropriate for this project.
- observe and describe the physical and biological characteristics of their study area.
- keep accurate, complete records in a journal.

Materials for Measuring Water Quality with Macros (LE#2)

- Copies of the following for each group:
 - *Is Anybody There* (Student Sheet #1)
 - *Planning for Improvement* (Student Sheet #2)
- The following materials for each group:
 - Sampling nets and trays such as white egg cartons
 - Access to a camera per team
 - Magnifying lenses (1 – 2 per group)
 - Forceps (1 – 2 per group)
 - Small bucket or tub
 - Small clear cup for water sampling





Materials for Measuring Water Quality with Macros (LE#2) – continued

The following materials for the entire class:

- Freshwater aquatic life identification books for your region
- Key to common freshwater macroinvertebrates (http://www.dec.ny.gov/docs/water_pdf/nysmacros.pdf)
- Computer and internet access for each team
- Notebooks or small binders or folders to be used as journals (1 per student)
- Letter to parents, *Learning Science in the Field* (1 per student)

Grade Level: 8-12

Subject Areas

Environmental science, biology, language arts, math

Timeline

Teacher preparation: 60 minutes

Learning Experience: Two-45 minute class periods including a field visit

Setting

Classroom; local waterway, lake/pond or wetland

Skills

Research in print materials and on web sites, collect and identify living specimens, demonstrate responsible behavior in a natural environment, articulate and communicate ideas orally and on paper

Vocabulary

Aquatic, bioassessment, biodiversity, habitat, indicator species, macroinvertebrate,





Advance Preparation

- If you did not send out the *Letter to Parents* in Learning Experience #1, do so now. One week before beginning the learning experience, make a copy of the letter for each student to take home and return signed by a parent or guardian.
- Make arrangements for your classes to go outside for a field trip if an appropriate study area is close to your school.
- Make copies of the student sheets listed, one for each project team.
- Collect the materials needed for your field experience.

Procedure

1. Introduce this learning experience by asking students to imagine that they have a tropical fish tank with a collection of five different species of fish and two snails that keep the inside of the glass clean. The students will be going on a winter vacation with their families for a month and leaving their fish in the care of a friend. In their journals write a set of instructions for the friend to follow. Share the instructions with the class by filling in a chart like the one below. Students should include what is to be done, why and a prediction of what will happen if the friend neglects that part of the job.

Fish Tank Instructions

Task	Reason Why	Result of Neglect

Ask students to predict what happens to the organisms in a stream or wetland when conditions such as water quality, temperature and food supply are degraded.



2. Students will work in project teams of three or four members. Each team member should be given a responsibility such as researcher, recorder, or communicator. Grouping students with a variety of abilities will promote peer teaching and differentiation of instruction.
3. Post the lesson essential question and explain that all students should be able to answer it by the time they are finished with this learning experience.
4. Explain that healthy streams and wetlands support diverse populations of animals, both microscopic and those that are large enough to be seen with the naked eye. Scientists sample the numbers and kinds of animals living in the water as one indicator of the quality of the water. Tell students that they will collect samples of the animals living in their project areas and identify them. The greater the diversity of animals in the site, the healthier the habitat is considered to be. Ask them to predict whether they will find a large number and variety of organisms, based on their prior observations of their study area. Student predictions and the reasoning behind the predictions should be recorded in student science journals.

Optional whole-class project: If all of your students completed Got Water (LE #1) at a single location, or if you prefer to take all of your students to a single nearby stream or wetland on one day, Learning Experience #2 can be done as a whole-class project.

5. Ask students to suggest rules for visiting field habitats and handling the animals that they find there. Stress to students the need to disturb the area as little as possible, to handle the animals that they collect with care, and to return them to the location where they found them.
6. Each team will need to take the following materials to the sampling site:
 - a small clear cup for sampling the water
 - macroinvertebrate identification key
 - sampling net
 - bucket or tub
 - forceps (optional)
 - journal or notebook
 - white ice cube tray or light-colored Styrofoam egg carton for sorting samples



7. Before anyone wades into the water to collect animals, begin the exploration by asking student groups to describe the condition of the water. The group recorders should make note of their team's answers to the following questions about the waterway:
 - a. Is it clear or cloudy?
 - b. Does it have a color?
 - c. Is it cool or warm?
 - d. Does it have an odor?
 - e. Do you see any plants or animals in the water?

8. Buckets or tubs should be filled with water and placed in the shade or some other cool place. Remembering the class sampling rules, students will collect animals that they discover on the bottom of the stream, under rocks and swimming free in the water.
 - a. All macroinvertebrate samples should be placed in the group's bucket or tub.
 - b. As two team members explore the site, another will fill the sections of egg cartons/ ice cube trays with water and carefully place a specimen from the bucket in each.
 - c. The recorder will sketch the specimens and identify specimens using Student Sheet #1.

9. Student teams will complete the table in the student sheet, including a count of how many of each kind of animal that they found. Then they will add their information to a data table for the entire class. This will give them a bioassessment for the site that they visited.

10. Ask the teams to discuss the relative health of their aquatic ecosystem, based on the bioassessment that they just completed. What other variables should be tested?

11. Ask students to answer these questions in their journals:
 - What should be done to improve the water quality in their team's project site?
 - Why is clean water important in their community or region?
 - Does the quality of water in their region affect the quality of aquatic ecosystems that are downstream? Explain.