

Lesson 7: Hungry, Hungry Macros *A Feeding Experiment*

Lesson Summary:

Students will learn about the feeding strategies of macroinvertebrates by conducting an experiment using two functional feeding groups (shredders and grazers). Organisms will be placed into individual microenvironments and students will hypothesize about which macroinvertebrate they expect to consume the greatest amount of leaf material.

Materials:

- Tea bags
- Plastic containers
- Wire
- Macroinvertebrate samples
- Dry leaves
- Hole puncher

Knowledge and Skills developed:

- Students will learn about feeding strategies of macroinvertebrates
- Students will learn how to set up an experiment

Next Generation Science Standards

Practices <input type="checkbox"/> Asking questions <input type="checkbox"/> Developing and using models <input checked="" type="checkbox"/> Planning / carrying out investigations <input type="checkbox"/> Analyzing / interpreting data <input type="checkbox"/> Math / computational thinking <input type="checkbox"/> Constructing explanations <input type="checkbox"/> Engaging in argument from evidence <input type="checkbox"/> Obtaining / evaluate / communicate	Crosscutting Concepts <input type="checkbox"/> Patterns <input type="checkbox"/> Cause and effect: Mechanism / explanation <input type="checkbox"/> Scale, proportion, and quantity <input type="checkbox"/> Systems and system models <input type="checkbox"/> Energy / matter: Flows, cycles, conservation <input type="checkbox"/> Structure and function <input type="checkbox"/> Stability and change
Disciplinary Core Ideas and Concepts LS2.A: Interdependent Relationships in Ecosystems Organisms and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.	

Environmental Literacy Strands

2. Physical, living and human systems
 - b. Structure, function, interaction and change in living systems. Explain the dynamic and interconnected nature of Earth's living systems

Teacher Background Information:

Macroinvertebrates are classified into four functional feeding groups: shredders, scrapers and grazers, collectors and predators. Shredders use sharp mouthpieces to obtain nutrients from dead and decaying organic matter such as twigs and leaves. Scrapers, or grazers, scrape algae off of rocks, sand and leaves. Collectors filter the water column for particulates, microscopic organisms, and other nutrient rich matter. Predators feed on other organisms and are designed to catch prey. Most macroinvertebrates are highly specialized for their feeding type and inhabit areas of the stream relative to their feeding type. These four types of macroinvertebrates work in unison to obtain nutrients from all different areas of the stream. Together they demonstrate a vast feeding relationship; shredders, collectors, and grazers feed on decaying organic matter, these then feed predatory fish, birds, and macroinvertebrates.

A demonstration of the feeding relationship between detritus (decaying organic matter) and macroinvertebrates can be modeled through a simple experiment. Macroinvertebrates that should be used are shredders and grazers. Common examples include: mayflies, caddisflies, and stoneflies. Students will construct temporary habitats for their macroinvertebrates. Students will either cut strips or hole punch leaves, creating pieces of equal size. A specific number of these strips or punches will then be placed in teabags along with a macroinvertebrate. The macroinvertebrates will be labeled and placed in a cold area (outside if possible) into an aquarium or plastic container (such as yogurt or Tupperware) to incubate for a week. Half of the water in the aquarium should be changed every two days. Macroinvertebrates can be sensitive and should be kept in cool water as close to the conditions of the stream they were taken from as possible. After a week students will count the number of leaf strips left, compile data and make inferences.

Introduction:

Inform students they will use the macroinvertebrates that were collected in their leaf packs to further explore feeding mechanisms by conducting an experiment using shredders and grazers. Remind students of what they have already learned about how different macroinvertebrates eat, and how that affects where they live in the stream.

The Core Lesson:

1. Talk to students about whether they would expect a shredder or grazer to eat more leaf material in a week's time. Have them think about how and what shredders and grazers eat. As a class develop a hypothesis.
2. Ask students: "how can we test our hypothesis"
 - Can we go out and watch the macroinvertebrates in the stream?
 - Can we take the macroinvertebrates to a restaurant and ask them what they prefer?
3. Inform students that an easy way to monitor how much a macroinvertebrate eats is to put them in a controlled environment with a specific amount of food, measuring the food before and after the experiment.

4. Show students the materials that they have to work with, and have them brainstorm how they might set up an experiment to test their hypothesis. What would their experimental process be? As a class, come up with an experimental process that everyone can follow. Determine how much leaf material will go into bags.
 - Inform students that the conditions must be exactly the same for each of the macroinvertebrates in order to rule out any variables that would change the results.
5. Have students work in teams to set up their experiments.
 - a. Pass out the teabags, wire, leaves, hole punches, and plastic containers.
 - b. Have students create their temporary habitats. Students can use hole punches to get a specific amount of leaf material and wire to prop the tea bag and create room in the bag for the macroinvertebrates to move around.
 - c. Have students fill up their plastic containers with cold water (stream water is preferable) and submerge the teabag environments to prepare them for the macroinvertebrates.
6. Assign each student group a macroinvertebrate that was collected during the Leaf Pack experiment. Assign 50% of students as shredders and 50% as grazers.
 - a. Have student's record which type of macroinvertebrate they were given.
 - b. Have the students then place their macroinvertebrate in their temporary environment.
7. The Macroinvertebrates must be kept in cool water for a week. If it is the right time of year, store them outside. It is important to change half the water every couple of days in order to maintain oxygen levels and get rid of wastes. If the water is not optimal, the macroinvertebrates can go into shock, causing them to eat less, if at all. **You may also need to rearrange the wire, after changing the water, to make sure the macroinvertebrate can still move around and feed.**
8. After a week, have the students retrieve their macroinvertebrates and count the amount of leaf material that is left. Have students use magnifying glasses to get a close look.
9. As a class, analyze the students' data. Get an average of the number of punches degraded for shredders and grazers. Have each group report the amount of leaves eaten from each teabag for both shredders and grazers, write it on the board in separate columns, add it all together as a class, and find the average. Have students create simple bar or pie charts to represent their data. Demonstrate by drawing one of each on the board and explain that each bar or segment of the pie should be its own color and represent separate feeding data. Demonstrate how to label the graph, each piece, and the axes if a bar graph.
10. Discuss the following as a class:
 - a. What conclusions can they draw from their findings?
 - b. Who ate more, shredders or grazers? Why might this be?
 - c. What variables might have affected their experiments?