Water Quality? Ask the Bugs!

Adapted from Water Quality? Ask the Bugs! Project WET Curriculum and Activity Guide 2.0

Grades: 6-12

Duration: 45-60 minutes

Students will:

- Define the term macroinvertebrate
- Analyze the relationship between aquatic macroinvertebrate populations and water quality
- Explain the process of rapid bioassessment of aquatic macroinvertebrates
- Evaluate a stream's water quality using a Pollution Tolerance Index

Materials in bin:

- Copies of student worksheets
- Copies of laminated student worksheets
- Copies of laminated Macroinvertebrate Identification charts
- Laminated background sheet
- 6 labeled plastic bins with pre-sorted items
- Wet-erase markers
- Aquarium nets
- Aluminum trays
- Ice cube trays

Additional Materials Needed for Activity:

- Water
- Clean-up supplies like towels

Activity

1. Ask students to define the term "aquatic macroinvertebrate" (see background sheet for more information).
2. Briefly explain to students that aquatic macroinvertebrates are used as indicators of the relative health of a stream and that the common form of sampling them is called a bioassessment.
3. Inform students that they will be simulating a bioassessment of a stream using ordinary objects to represent macroinvertebrates.
4. Set up the six collecting stations, each containing the following:

a. Stream sampling site (plastic tubs with objects inside)
b. Collection bucket (aluminum tray)
c. Sorting tray (ice cube tray)
d. Net
e. Macroinvertebrate Identification Chart
f. Macroinvertebrate Data Sheets I and II

5. Fill the stream sampling sites (plastic tubs) with four inches of water.
6. The objects representing macroinvertebrates should already be in each bin. They are sorted according to the chart below. There are two bins representing each Stream Sample (1A, 1B, 2A, 2B, 3A, 3B).

Macroinvertebrate	Represented by	Number of Items per Sample		
		Stream Sample 1	Stream Sample 2	Stream Sample 3
Mayflies	Yellow beads	35	15	0
Stoneflies	Small paper clips	65	35	0
Caddisflies	Red beads	30	20	0
Dobsonflies	Large paper clips	30	20	0
Midges	Blue beads	0	20	30
Craneflies	White beads	25	13	12
Dragonflies	Green beads	20	20	10
Scuds	Black beads	5	15	30
Pouch snails	Pennies	0	15	35
Tubifex worms	Thin rubber bands	0	15	35
Leeches	Thick rubber bands	0	15	35

7. Divide students into six groups. Assign students within each group to one of the following four tasks: stream sampling, sorting at the collection bucket, counting/recording (Macroinvertebrate Data Sheet I) and calculating/evaluating (Macroinvertebrate Data Sheet II).

8. Instruct students to simulate a rapid bioassessment at their stream sampling site as follows:
    a. Using an aquarium net, the students at the site have 20 seconds to collect as many macroinvertebrates (paper clips, beads, etc.) from the stream as possible. They should place the macroinvertebrates in the collection bucket.
    b. Students at the collection bucket then sort the collected macroinvertebrates into like categories based on the **Macroinvertebrate Identification Chart** and place them in the ice cube tray. For example, they should place all the mayflies into one cube, caddisflies into another.
    c. Students using the **Macroinvertebrate Data Sheet I** tabulate the sorting results onto the data sheet and calculate the percent composition of each macroinvertebrate in the stream site.
    d. Students with **Macroinvertebrate Data Sheet II** use the data from Data Sheet I to complete the Pollution Tolerance Index to determine the Water Quality Assessment score for their stream sample.
9. Have students compare their results with the other groups. What were the similarities and differences between the three sites? Which stream had the highest level of water quality? The lowest?

Wrap Up Ideas

- Have students write a paragraph that describes their stream based on the macroinvertebrate sample they collected. If they sampled an impaired stream, they should describe the habitat, address possible pollution sources and give other pertinent details.
- Ask students what they think of this type of scientific sampling process. Do students feel that they could use this same process to perform a bioassessment in an actual stream? Did their samples accurately reflect the population of invertebrates in their stream? How do they know? Ask students to brainstorm how the process could be modified to increase its accuracy (e.g., conduct the sampling three times for each stream and compare or average the results).
- Have them identify positive and negative aspects of this type of sampling. For example, do they believe that they netted larger insects for easily than smaller insects? Can such biased sampling occur in an actual rapid bioassessment of invertebrates?
- Ask students why it’s important to conduct a bioassessment of a stream. (The presence or absence of different organisms can be a determining factor in the *use* of the water or the required treatment for use. For example, a polluted stream will require more treatment than a stream with high-quality water. Testing and measuring water quality are required to determine whether bodies of water meet specified water quality standards.