Lesson Plans

MOSS

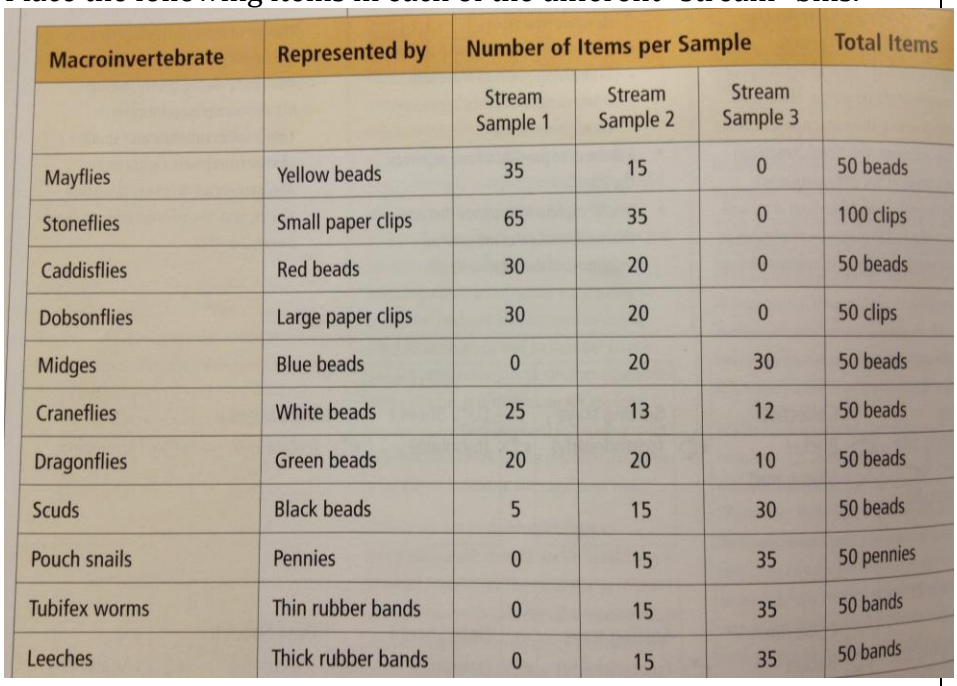
McCALL OUTDOOR SCIENCE SCHOOL

University of Idaho

College of Natural Resources

Title: Macroinvertebrates
Grade Level: 5th - 8th

Topic:	Indoor Macroinvertebrate Sampling activity
Background:	Benthic macroinvertebrates are important indicators of water quality. Benthic means "bottom dwelling", macro means "big enough to see with the naked eye," and invertebrate means "no backbone." They can more easily be referred to as "macros" for short. Macros consist of insects, mollusks, and crustaceans. Macros are great for testing water quality for many reasons. One, they are an inexpensive test because testing materials are cheap and usually consist of nets, buckets, and spoons. Two, most macro invertebrates spend a majority of their lives living in the water. For example, many of the macros observed are the larvae form of flies that will later emerge above the surface of the water. Some macros spend up to two years living under the surface, which makes useful for testing water quality. In addition to this point, these macros are not highly mobile, meaning they do not travel large stretches of the stream, so they will spend a majority of their underwater lives in the same relative area. This provides a better long term, overall sampling of the water quality of the body of water than going out and taking water chemistry samples (which would provide more of a "snapshot" of that day). In addition, macros can be found year round allowing for data collection through all seasons.
Next Generation Standards:	**Core Idea LS2.A**
Goals:	Students will learn about macroinvertebrates and their usefulness for water quality testing by discussion and an indoor "macro collecting" activity. • What are macroinvertebrates? • Why are macroinvertebrates used for water quality testing? • How does the quality of water affect the macroinvertebrates that live there? • Why is it better to find a wide diversity of macroinvertebrates in a body of water?
Objectives:	• Students will be able to define benthic macroinvertebrates. • Student will be able to explain why macros are an indicator of the health of a body of water. • Students will be able to categorize macros into one of three different tolerances of pollution: intolerant, moderately tolerant, and tolerant and be able to explain how each are important to a healthy body of water. • Students will understand that a wide variety of biodiversity throughout the three categories of pollution tolerance is a

<table>
<tr><td></td><td>good indicator of a healthy body of water.</td></tr>
<tr><td>Materials:</td><td>100 small paper clips
50 large paper clips
6 different shaped, sized, or colored beads or buttons (50 of each size/color/shape)
50 pennies
50 thin rubber bands
50 thick rubber bands
3 dishpan sized tubs
3 smaller tubs (like Chinese food containers)
3 cups or aquarium nets
3 ice cube trays/petri dishes/egg cartons
3 calculators
Water</td></tr>
<tr><td>Set up:</td><td>Label the three dish bins Stream 1, 2, and 3.
Place the following items in each of the different “stream” bins.
 
<table>
<tr><th>Macroinvertebrate</th><th>Represented by</th><th colspan="3">Number of Items per Sample</th><th>Total Items</th></tr>
<tr><th></th><th></th><th>Stream Sample 1</th><th>Stream Sample 2</th><th>Stream Sample 3</th><th></th></tr>
<tr><td>Mayflies</td><td>Yellow beads</td><td>35</td><td>15</td><td>0</td><td>50 beads</td></tr>
<tr><td>Stoneflies</td><td>Small paper clips</td><td>65</td><td>35</td><td>0</td><td>100 clips</td></tr>
<tr><td>Caddisflies</td><td>Red beads</td><td>30</td><td>20</td><td>0</td><td>50 beads</td></tr>
<tr><td>Dobsonflies</td><td>Large paper clips</td><td>30</td><td>20</td><td>0</td><td>50 clips</td></tr>
<tr><td>Midges</td><td>Blue beads</td><td>0</td><td>20</td><td>30</td><td>50 beads</td></tr>
<tr><td>Craneflies</td><td>White beads</td><td>25</td><td>13</td><td>12</td><td>50 beads</td></tr>
<tr><td>Dragonflies</td><td>Green beads</td><td>20</td><td>20</td><td>10</td><td>50 beads</td></tr>
<tr><td>Scuds</td><td>Black beads</td><td>5</td><td>15</td><td>30</td><td>50 beads</td></tr>
<tr><td>Pouch snails</td><td>Pennies</td><td>0</td><td>15</td><td>35</td><td>50 pennies</td></tr>
<tr><td>Tubifex worms</td><td>Thin rubber bands</td><td>0</td><td>15</td><td>35</td><td>50 bands</td></tr>
<tr><td>Leeches</td><td>Thick rubber bands</td><td>0</td><td>15</td><td>35</td><td>50 bands</td></tr>
</table>
For reference, the colored beads on the chart are going to be the six different shaped, sized, or colored beads or buttons gathered in the materials above.
In each of the stream bins, add four inches of water. Food coloring or hot chocolate mix can be added to Stream 3 to make the water murky to represent a polluted body of water. Stream 2 can also be a little murky, less so than Stream 3 though.</td></tr>
<tr><td>Classroom Time:</td><td>Two 45 minute class periods broken up depending on how long the first activity takes</td></tr>
<tr><td>Introduction (Engage):</td><td>Ask the students how they think water quality is tested out in the field. Most students do not know that macro invertebrates exist in</td></tr>
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	the water. Depending on their answers, go into what a benthic macro invertebrate is. Stress that macros are not scary, do not (generally) bite or pinch, and are really helpful for testing the water quality of a body of water. Explain to the students that for circumstances beyond your control you cannot bring them out to a body of water, but you did manage a replication of the sampling with everyday items in the classroom. Show students pictures of some of the critters they will be learning about.
Activity (Explore):	Split the class into three groups. If there are a multitude of students per group, assign them different roles, such as a recorder, scooper, sorter, etc, to keep them all occupied. Explain to the students that they will be sampling the three different "streams" for twenty seconds a piece using a cup or a net. They will then empty the cup or net into the smaller tub to begin sorting. They will sort the different "macros" into the ice cube tray, petri dish, or egg carton by the different types of objects (i.e. all red buttons together, etc). Make sure the students can identify their "macros" using the provided macro identification chart that tells them a red button represents some actual macro (i.e. midge). Next, using Data Sheet 1, have the students fill in the information about their sampling: the number of organisms in each group and the percent composition. Afterwards, Data Sheet 2 can be filled out to which will determine the water quality based on the diversity of the different organisms collected in the sample. Have the students analyze their data and draw conclusions about the stream.
Explanation:	Have the students present their findings about the three separate streams. Students can represent their data in some form of a chart. Elaborate on the three pollution tolerance levels of the macros that were examined. Ask the students how their sampling techniques worked, such as if there was room for improvement. Ask the students how classroom sampling will differ from real life sampling. They should understand that macros range in size from very small to rather large, they move at different speeds, they could be camouflaged, there are varying amount of sediments in the sample, etc.
Elaboration:	In order to elaborate about this activity, have students create their own macroinvertebrate for a body of water that you can create (amount of pollution, from what nearby source, temperature, pH, dissolved oxygen, etc. of the water). Have students draw their macro, identifying the body parts of their macros that make living in the water body possible. Possible body features include: size, number of legs, gills or lungs, shell or soft body, compactness, how it moves, how it eats, etc. Have them describe what it eats, its pollution tolerance level, etc. Have the students share to the group their creation; encourage creativeness!

Evaluation:	Evaluate their understanding of benthic macroinvertebrates and how they are affected by water quality based on the quality of their drawings and descriptions of their macro creations. If you give them a polluted stream, you should expect to see students come up with hardier organisms that can tolerate poor living conditions.

Additional resources:
This activity was modified from the Project WET (Curriculum and Activity Guide 2.0, pages 421-430) activity "Water Quality? Ask the Bugs!" This book has plenty of other resources and activities for all types of water education.
The following website provides additional curriculum support for water activities, including macro invertebrate work, as well as stream hydrology, watersheds, etc.
http://www.stroudcenter.org/education/educators/curriculum/
Attached:

1. **Macroinvertebrate Identification Sheet**
2. **Data Sheet 1**
3. **Data Sheet 2**