

Macroinvertebrate Investigation

Investigative Questions: What is diversity? Why does a diversity of organisms matter? How does diversity and sensitivity of organisms used as indicators of water quality?

Goal: Students will understand the importance of macroinvertebrates as indicators of long term health of aquatic environments in an ecosystem. Students will understand how scientists classify organisms.

Learning Objectives

Knowledge: Students identify macroinvertebrates and evaluate them as indicators of water quality. Measure, record and analyze a variety of water quality indicators and describe what they mean to the health of an ecosystem.

Skills: Students develop observation skills and conduct a scientific tally of organisms.

Values: Students develop an appreciation for a diversity of organisms is part of/helps to create a healthy functioning ecosystem.

Virginia SOL: Science (2018) 6.1, 6.8, 6.9

Materials

- * Buckets
- * Small Nets
- * Forceps
- * Pipettes
- * Petri dishes
- * Datasheet for students
- * Identification guides
- * Dissecting Microscopes
- * Ice cube trays (for sorting)

Special Safety: These organisms needs to be returned alive to the water, DO NOT harm the organisms!

Procedure

1. This activity usually takes place in the Parkfield Learning Center. Once students arrive, give them a brief history of the PLC. This information is also found in student journals.
2. Instruct students to find the corresponding data sheets in their student journals (see below) to answer and discuss the questions.
3. Next, inform students that one of the things they are investigating today is determining the overall health of Lake Georgette. Inquire:
 - a. What are ways in which we can determine if a body of water is healthy or not?
 - b. What are things that we can see with the human eye? (trash, erosion) What may be things that we may not see with our human eye? (invertebrates, Ph, nitrates, phosphates)
 - c. What tools do scientists use to see organisms that are too small to see?
4. What is a macroinvertebrate? It is a small aquatic organism without vertebrae.
5. What is a microinvertebrate i.e. zooplankton? extremely small or microscopic animals such as copepods, daphnia, and rotifers

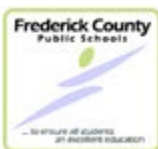


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6. Inform students they are to determine the health of the water with macroinvertebrates as indicators of health. Ask: What is an indicator? What does tolerance mean? Broadly, able to withstand a certain amount of change. Ask for an example of a tolerant organism. Or give examples if students have not yet discussed in class.
7. What is diversity? What is biological diversity?
 - a. The number and variety of species present in an area. If students have trouble understanding diversity, feel free to use food as an example. Give two examples that are starkly different (ex. In waterbody X I found 100 organisms, 99 mosquitos and one dragonfly. In waterbody Y, I found 100 organisms, 10 each of 10 different creatures.) and ask them which is more diverse.
8. How do we measure diversity? Why do we measure diversity? Why do we care about the health of the system?
9. Review microscope rules and how to handle the macroinvertebrates properly with the students. Be sure to include: These organisms are sensitive and are going back to the body of water when we are done. Take care to not harm them.
10. Explain the sampling method used to collect the organisms. Would we be able to use and accurately assess the health of our water if scientist used a different sampling method each time? What if a scientist only selected organisms that they wanted to look at? Would that be a representative sample? Doe that show bias?
11. Inform students where the organisms were taken from. Explain sampling method (Ex. Used a D-Net and sampled 6 times for 10 seconds at each location). Again, why is important that we sample the same way each time? (to be able to have accurate information to compare and to be able to replicate the experiment)
12. Instruct students to use the identification guides to identify organisms and record the data on the Macroinvertebrate Data Sheet in their Journal. Explain how scientists use dichotomous keys to help classify organisms. This includes plants, animals, insects etc.
13. Once organisms are identified, they need to be placed into the sorting trays on the tables. At the end of the activity, students will tally and record the organisms at their table and enter into a data sheet on computer. ***Where do these organisms live? IN THE WATER! Please have the organism in a small drop of water while you are viewing them so they are able to keep living! ***
14. Students may ask what the colors on their datasheet mean. These colors indicate whether the species is very tolerant, tolerant, or not tolerant to pollution. The green organisms mean that they are not tolerant to pollution. They are green because we connect green with healthy. When these species, which cannot tolerate a lot of pollution, are present in our water, then the stream has little pollution and is healthy. The red colored organisms are very tolerant of pollution meaning they are able to live in conditions that are not as favorable. Meaning our water is not as healthy.
15. Remember to stress the importance of diversity of organisms in our water. Yes, we want green but we like to be diverse. A rainbow is favorable! Reds, orange, greens and blues!
16. Wrap up- Ask if students think the water is diverse and healthy or not? Explain your reasoning using evidence!



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Macroinvertebrates at Parkfield Learning Center

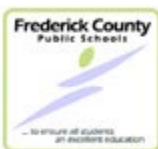
Welcome to Parkfield Learning Center (PLC), one of two environmental education classrooms at Blandy Experimental Farm. Does this building look like a one room school house? Well, the PLC (as Blandy staff call it) has not always been a classroom. At one time it was an apple packing shed, complete with root cellar. If you look very carefully at the floor inside, you might be able to find where the cellar doors once were.

The PLC plays a big role in the educational programs here. It is one of the few indoor places that students can meet in poor weather and is often used when students work with scientific tools to investigate. Today you will be using the dissecting microscopes to look at some of the pond life found in Lake Georgette.

Take your time and look around the outside of the PLC. Answer the questions below.

- How has this location been used historically?
- What is this location currently being used for?
- Look around- Predict how this area might change if a building is constructed here.
- How does water get to this site? Where does it go from here?

Your mission today is to determine the overall health of Lake Georgette. One factor we consider is the organisms that live here. You will use the dissecting microscopes to examine water samples for signs of life. Certain organisms can give a picture of the water health. You will learn how these animals help us to determine the health of the water. You will work in your groups to look at all this data to determine if you think the water is healthy or not.



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AQUATIC MACROINVERTEBRATE DATA SHEET

Sample Site _____

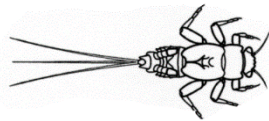
Date: _____ Time of day: _____

Group Members: _____

- INVERTEBRATE – organism without a backbone
- MACRO – visible to the naked eye
- AQUATIC – lives in the water for part of its life cycle
- INDICATOR- tells us about the health of an ecosystem

In your water Sample, find, identify, count and record the number of EACH type of macroinvertebrate.
You will use the data to find DIVERSITY and an INDEX of water quality.

Macroinvertebrate	Number found
Whirligig Beetle	
Water Strider	
Mosquito	
Giant Water Bug	
Back Swimmer	
Water Boatman	
Predacious Diving Beetle	
Ostracod	
Copepod	
Daphnia/ Water flea	
Pyralid Caterpillar	
Fishing Spider	



	INDICATOR Macroinvertebrate	Number found	Check if Present √	Number of Checks	Multiply by	Group Score
Pollution Sensitive	Mayflies				4	
	Caddisflies					
	Stoneflies					
	Dobsonflies					
	Gilled Snails					
	Water Penny					
	Riffle Beetle					
	Water Scorpion					
Moderately Sensitive	Damselfly				3	
	Dragonflies					
	Scuds					
	Craneflies					
	Aquatic Sowbug					
Moderately Tolerant	Water Mite				2	
	Midges					
	Blackfly					
	Flatworm					
	Leeches					
	Crawling Water Beetle					
Pollution Tolerant	Pouch Snails				1	
	Threadworm					
	Horsefly					
	Tubifex Worms					
	Blood Midge					
TOTAL # of ORGANISMS =			TOTAL SCORE=			
			≥ 23 Potentially Excellent Water Quality 17-22 Potentially Good Water Quality 11-16 Potentially Fair Water Quality ≤ 10 Potentially Poor Water Quality			