MACRO-INVERTEBRATE FIELD STUDY

2ND-5TH

OBJECTIVES

- Describe and identify the quality of a stream or water body by analyzing the aquatic macro-invertebrates that live there.

BACKGROUND INFORMATION

Sometimes it is easy to tell if a stream is polluted. Strange colors and dead fish are often indicators of poor water quality; however, biologists need to track water quality problems long before they reach this point. One of the most effective methods in detecting declining trends in water quality are through biological surveys of aquatic macro-invertebrates (small animals without backbones). Because different species have different tolerance levels to pollution, they respond rapidly to changes in water quality.

To evaluate the health and productivity of a stream, biologists look at the types of macro-invertebrate species that live there. If many pollution-intolerant organisms, such as stonefly or caddisfly nymphs, are present, then water quality is probably good. Although the presence of certain species is an indicator of good water quality, the absence of these species does not necessarily indicate poor water quality. Other factors besides pollution may account for their absence.

LEVELS OF SENSITIVITY IN MACRO-INVERTEBRATES

SENSITIVE (INTOLERANT) SPECIES:

Organisms easily killed, impaired, or driven off by bad water quality.

Includes many types of stoneflies, dobsonfly, and mayfly nymphs, caddisfly larvae, and water pennies.

SOMEWHAT TOLERANT SPECIES:

Organisms with the ability to live in good or poor-quality water.

Includes amphipods, scuds, beetle and cranefly larvae, crayfish, and dragonfly nymphs.

TOLERANT SPECIES:

Organisms capable of withstanding poor water quality.

Includes most leeches, aquatic worms, midge larvae, mosquito larvae, and sow bugs.

MATERIALS

- Plastic Tubs (1 per group of 4)
- Plastic Petri Dish (2 per group)
- Magnifying Lens (2 per group)
- 2 Large Buckets
- Pipettes (2 per group)
- Data Sheet (1 per group)
- Pencil (1 per group)
- 2 Large Nets
- Identification Sheets (1 per group)
- Latex Gloves
- Download the "Creek Critter App"

ANTICIPATORY SET

Bring your students out to a small body of water around your school yard. This could be a large puddle, stream, small pond, or even a retention ditch. Ask your students to make observations about this body of water and form a hypothesis about the water's quality. Once they have constructed a hypothesis, have them raise their hand for their hypothesis as you call out the three levels of water quality. *"Raise your hand if you think the water is very polluted.... somewhat polluted... etc."*

SETTING UP FOR THE INVESTIGATION

1. Discuss safety in the field with your class prior to the field exercise. Show them the boundary zones for this investigation. Be aware of your student's health concerns, and communicate with your school's administration and nurse about where you will be taking your class.
2. It is helpful to assign student roles prior to beginning this investigation. Have each group decide on two people to collect bugs, and two people to sort through the sample and pick out individual bugs onto Petri dishes. One student can be the designated Recorder, who writes down the types of bugs the group finds. Distribute gloves to the students sorting through plant material.
3. Once you are at your field location, have your students split into groups of four. Distribute all materials as stated in the "Materials" section.
4. Fill the two class buckets with water from your sample site. Distribute this water equally into each group's plastic tub. They should be filled about half way.

CONDUCTING THE INVESTIGATION

1. Depending on the water source your group is analyzing, the method for bug collection will vary.
    a. Small Pond or Stream: Carefully collect floating vegetation using your large net. Place this vegetation in the group's tub and have your students sift through the plant matter to find bugs. It's okay to pick up leaf litter from the bottom of the water body, or even small rocks!
2. Once each group has a collection of aquatic plants in their tubs, have your students carefully sift through the material to isolate individual bugs. They may have to agitate the plant material or the bottom of rocks to get bugs to reveal themselves. Individual bugs can be placed into the group's Petri dishes (just be sure they put water in their dishes first!)
3. As your students find individual bugs from their sample, they should work to ID them based on the identification sheets found at the end of this lesson. For each type of bug they find, they will mark a tally. The recorder for each group will take notes on the data sheet as their group is finding and identifying bugs. Encourage your students to use the magnifying lens to get a closer view at each bug! They may use the Creek Critter app if they are struggling to identify anything in the sample.
4. After about 15-20 minutes of investigating their water samples, instruct each group to place their bugs back into the water sample, and pour their water sample back into the source they retrieved it from.
5. Complete the lesson back in the classroom.

POST- INVESTIGATION ANALYSIS

1. Once your students are back in the classroom, give them plenty of time to talk as a group and determine if their original hypothesis was supported by the data they collected in the field.
2. Groups should analyze the tally marks they have in each group to determine whether the water quality was clean, somewhat polluted, or very polluted.
3. Each group will designate a Speaker, who will announce their group's findings to the class. Once all groups have shared out, come up with a class conclusion for this investigation.
4. **Discuss**: what do you think contributed to the water quality at the sample site?

RESOURCES

- Bugs Don't Bug Me, Retrieved from https://extension.usu.edu/waterquality/files-ou/Publications/Bugs-dont-bug-me.pdf

TEKS ALIGNMENT

Science, Adopted 2021:

- 2nd: (a) 1Ai, 1E, 3A,3B, 3C, 5. (b) 1A, 1B, 1C, 1D, 1E, 1F, 1G, 2B, 3B, 3C, 4A, 5A, 5B, 5C, 5D, 5F, 5G, 11B, 12A.
- 3rd: (a) 1Ai, 1E, 3A,3B, 3C, 5. (b) 1A, 1B, 1C, 1D, 1E, 1F, 1G, 2B, 3B, 3C, 4A, 5A, 5B, 5C, 5D, 5F, 5G, 11B, 11C, 12C, 13A.
- 4th: (a) 1Ai, 1E, 3A,3B, 3C, 5. (b) 1A, 1B, 1C, 1D, 1E, 1F, 1G, 2B, 3B, 3C, 4A, 5A, 5B, 5C, 5D, 5F, 5G.
- 5th: (a) 1Ai, 1E, 3A,3B, 3C, 5. (b) 1A, 1B, 1C, 1D, 1E, 1G, 2B, 3B, 3C, 4A, 5A, 5B, 5C, 5D, 5F, 5G, 11, 12A, 12B, 12C, 13A.

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Name: _____

Date: _____

Macro-invertebrate Field Investigation Data Sheet

Group A: Sensitive to Pollution

These organisms can not thrive in any level of pollution. Their presence indicates that the water is not polluted.

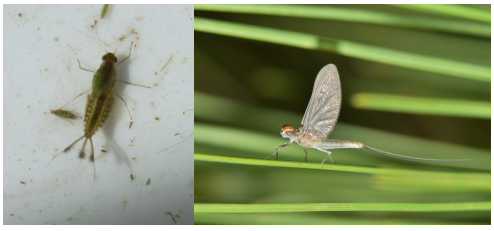
Tally each Individual that you find in the boxes below.

Caddisfly Larvae

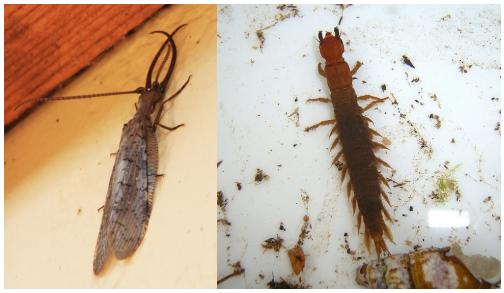
Water Penny

Aquatic Mite

Riffle Beetle



Mayfly Nymph and Adult



Dobsonfly Larvae and Adult

Total individuals from "Group A" found in your water sample:

_____

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Name: _____

Date: _____

Macro-invertebrate Field Investigation Data Sheet

Group B: Somewhat Tolerant to Pollution

These organisms can thrive in some level of pollution, though they prefer clean water. Their presence indicates that the water may either be slightly polluted, or clean.

Tally each Individual that you find in the boxes below.

Crawfish

Scud

Dragonfly Larva

Clam

Water Strider

Damselfly Larva

Total individuals from "Group B" found in your water sample:

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Name: _____

Date: _____

Macro-invertebrate Field Investigation Data Sheet

Group C: Tolerant to Pollution

These organisms can thrive in any level of pollution (clean, somewhat polluted, or very polluted). If you only find Group C organisms, this could indicate higher levels of pollution

Tally each Individual that you find in the boxes below.

Aquatic Worm

Mosquito Larva

Leech

Water Scorpion

Sow Bug

Planarian

Total individuals from "Group C" found in your water sample:

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Texas Stream Team

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Name: _____

Date: _____

Macro-invertebrate Field Investigation Data Sheet

Investigation Analysis

1.From which category did your group count the most bugs? Circle one.

- Group A- Able to live in clean water only
- Group B- Able to live in clean water, or slightly polluted water
- Group C- Able to live in very polluted water, slightly polluted, or clean water

2.What can you conclude about the water quality of the sample site?

3.What do you think contributed to these results?

4. What questions do you still have? Come up with TWO.

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