



Wacky Water Critters

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Program Purpose:

To provide students with a hands-on learning experience dealing with aquatic insects. Emphasis is placed on insect sorting and adaptations. Essential Question: Is this stream healthy and how do we know?

Length of Program: 1-3 hours

Ages: Grades 4th-9th

Maximum Number of Participants: 25

Objectives:

After completion of all activities, students will be able to:

- Recognize the biodiversity that exists in a wetland ecosystem.
- Recognize the impact of water quality on aquatic biodiversity
- Recognize factors that impact water quality
- Sort wetland organisms into categories by similarities.
- Identify individual wetland organisms.
- Define, identify, and understand the importance of adaptations.
- Describe the process of metamorphosis.
- If longer than 1 hour, calculate the Biotic Index for water quality of the Wisconsin River

Wisconsin Standards:

Environmental Education, Questioning and Analysis

A.4.2 Collect information, make predictions and offer explanations about questions asked

A.4.3 Develop answers, draw conclusions and revise their personal understanding as needed based on their investigations

*Knowledge of Environmental Processes and Systems
Energy and Ecosystems*

B.4.6 Cite examples of how different organisms adapt to their habitat

Science, Science Connections

A.4.1 When conducting science investigations, ask and answer questions that will help decide the general areas of science being addressed

Science Inquiry

C.4.4 Use simple science equipment safely and effectively, including rulers, balances, graduated cylinders, hand lenses, thermometers and computers to collect data relevant to questions and investigations

C.4.5 Use data they have collected to develop explanations and answer questions generated by investigations

C.4.8 Ask additional questions that might help focus or further an investigation

C.8.1 Identify questions they can investigate using resources and equipment they have available

E.8.6 Describe through investigations the use of the earth's resources by humans in both past and current cultures, particularly how changes in the resources used for the past 100 years are the basis for efforts to conserve and recycle renewable and non-renewable resources

F.8.2 Show how organisms have adapted structures to match their functions, providing means of encouraging individual and group survival within specific environments

F.8.8 Show through investigations how organisms both depend on and contribute to the balance or imbalance of populations and/or ecosystems, which in turn contribute to the total system of life on the planet

Preparation:

Before the class arrives:

- Organize wet lab with one critter tub next to each microscope.
- Glance at each critter tub to make sure all materials are present.
- Ensure that there are enough copies of the "Critter Adaptation" sheet present.

Basic Outline:

- I. Introduction (5 minutes)
- II. Adaptation Fun(5-10 minutes)
- III. Critter collecting and water monitoring(30 minutes)
 - I. Critter exploring directions (5 minutes)
 - II. Critter exploration (20 minutes)
 - III. Adaptation sheet (10 minutes)
 - IV. Clean-up (10 minutes)
 - V. Conclusion (10-15 minutes)

Materials:

1 complete critter tub per pair of students, including:

- 2 Plastic spoons
- 2 Pipettes
- 2 Petri dishes
- Magnifying bug box
- Ice cube tray
- Paintbrush
- Laminated branching key
- *Wonderful, Wacky Water Critter* book

1 big aquatic insect net per pair of students

1 small strainer per pair of students

Optional: Wetland function item box or bag, including:

- Sponge

- Small pillow
- Baby bottle
- Strainer
- Soap
- Rechargeable Battery
- Bottle of antacid
- Strainer

Dry erase board or large sheets of paper

Markers (for board or paper)

Critter adaptation sheets

Pictures of aquatic insects, if available

Introduction:

Introduce yourself and the title of the class. Explain to the students that today they are going to get a chance to be scientists and follow the scientific method.

Adaptation Fun!

On a dry erase board or large piece of white paper, draw a large squiggly river (to represent the Wisconsin River). Ask students to come up and quickly draw things that they would find in the water of the Wisconsin River. After several students have had a chance, ask them to close their eyes and turn around while you draw something. Draw a deer, or cow, or rabbit (something that doesn't live in the river) in the middle of the water. When they start to laugh, ask them why this animal doesn't live in the water. Explain to them that they just told you all of this animal's adaptations for helping it live on land. Ask the students what water adaptations they could add to the animal to help it live in the water (gills, fins, scales, i.e.). Draw these water adaptations on your land animal (it should turn into a very funny looking critter). Define adaptation (*something an animal has or does to help it live in its environment*). Explain that they will be looking at cool adaptations of water critters today. Give examples of some cool adaptations (some critter breathe out of (what appears to us) their butts; one uses a tank of air like a scuba diver, one has only one eye, etc).

Critter Collecting:

Assign partners (a quick way is to have the students make two lines of equal numbers and pair them with the student across the line from them). Have students put on a pair of waders (with their socks on) and stand next to their partner. Each pair should get one ice cream bucket, one large net, and one small strainer. Walk down to the backwater area (If water level is too high, conduct activity at PBM bridge) and demonstrate the following:

- *Filling the bucket with water* (1/2 full)
- *Collecting vegetation* (this is where all the critters hide, live, and sleep), emphasize not to get TOO much duck weed because it will be hard to see the critters in the lab.
- *Rinsing the net* in the bucket each time they sweep (turn it inside out and stick in the bucket to get all

the critters out). Just because you don't see anything in the net, doesn't mean there aren't any critters in there!

- *Collecting critters* (using the net: go up and down in the water—no splashing the net down and slapping the water).
- *Boundaries*

Walk around and assist in rinsing nets. Before you head back make sure that each bucket has enough water and vegetation in it. Ask the students to rinse the nets a final time in the water to remove as much vegetation as possible before you walk to the nature center.

Water Quality Testing:

This activity works best when it is conducted concurrently with the "Critter Collecting" activity, with the water quality tests taking place after the critters have been collected, but before the group goes back to the classroom. There are three sets of tests that can be conducted on the water in the backchannel.

The best set of tests to start with are dissolved oxygen, nitrates, and phosphates. If there is enough time to do so, all of the tests should be completed. The same tests can also be completed in the main channel of the river if time allows.

Critter Exploring Directions:

After everyone has taken off their waders and put on their shoes, have them sit down (outside works well if weather permits) and explain how to explore their critters. Bring out a tub and talk about everything in it.

- *White tub*: this is what you will SLOWLY dump your bucket into.
- *Ice cube tray*: put all the critters that look similar in the same section (make sure to put WATER in it first).
- *Spoons, pipettes, paintbrush*: used to pick up critters; only try to suck up very small critters with the eyedropper.
- *Petri dishes*: used (with water) to place critters in and look at under the microscope.
- *Bug box*: another container that critters can be viewed in.
- *Pencil*: used to complete the cool critter adaptation sheet.
- *Branching Identification key*: if you have time, draw a critter on the board and help the class identify it while explaining how to use the key.

Rules: 1) Start at the top

2) Follow the branch that most fits your organism to the next characteristic.

3) When you've followed as many options as you can, look at the pictures of the organisms to see if one matches your animal.

EX: first option is "Shells" or "No Shells"? If no shell is present on your organism, what is the next option? ("Without Backbone" or "With Backbone")

- *Wonderful, Wacky Water Critter book*: look up and read about your favorite critter.

Critter Exploration:

Now it's time to relax and let the students discover the critters. Walk around and help students use the identification sheet. Try not to tell the students what the name of each critter is without each student trying to identify the critters using the identification chart.

Adaptation Sheet:

With about ten minutes left before clean up and wrap-up time, start passing out the adaptation sheets. Watch to ensure that everyone has started their sheet and is reading about their critters.

If you are running short on time, draw three columns on the board and label them "name," "how it breathes," and "how it protects itself." Then, as the groups discover and read about their favorite critter, instruct the groups to write their critter's name on the board and list two adaptations (breathing and protection). This board can then be used for the conclusion.

If time permits, have students set their microscopes to view a particular macroinvertebrate in a petri dish. Allow the students to move between microscopes so that different organisms can be viewed. Alternatively, the student pairs can share a bucket of collected macroinvertebrates with other pairs. The students will stay at their microscope and "hunt" for critters to look at under their microscope.

If there are any rare or interesting finds, the instructor can show the entire class by using the digital microscope connected to the TV.

The handheld digital microscope can be used as well, to take magnified pictures of the critters. This should be done by the students, with the help of the instructor (for microscope troubleshooting). When a pair of students brings a sample to the front counter to view under the digital microscope, the pair can take pictures of it with the handheld digital microscope.

Macroinvertebrates that bite:

- Alderfly and Dobsonfly larvae
- Giant water bug
- Backswimmer
- Predaceous diving beetle

Biotic Index:

This activity is best done indoors. Data recording can happen on the provided worksheet or on the whiteboard in the classroom.

Why do we care about the diversity of macroinvertebrates present in the Wisconsin River? The presence or absence of certain macroinvertebrate species is a good indication of the cleanliness of the water. Macroinvertebrates are categorized according to their tolerance to water pollution (which often indicates low oxygen levels in the water). The biotic index works by

assigning different levels of tolerance to pollution to the different macroinvertebrates. Our biotic index has macroinvertebrates separated into four categories: tolerant, semi-tolerant, semi-sensitive, and sensitive to pollution.

To determine the biotic index value to a sampled site, first macroinvertebrates are collected and separated into groups of similar-looking organisms. Then an identification key is used to help determine which organisms are present. The organisms present are circled on the Citizen Monitoring Biotic Index poster (18" X 24"); then, determine the water quality score for the site, using two different methods. The first method is through an inventory of the species that were collected. Follow the steps below to complete this method.

- 1) Instruct students to indicate to you which organisms on the poster they had in their sample. Circle each one, making sure to include the collective data of all groups.
- 2) Ask the students to help you count the number of types of animals circled in each group. Write that number in the box provided.
- 3) Enter each boxed number in work area at the bottom of the poster. Ask the students to help you do the math as you multiply the entered number from each group by the group value. Complete this step for all groups.
- 4) Ask the students to help you do the math as you total the number of animals circled and the calculated values for all groups.
- 5) Ask for a brave volunteer to do long division (or an adult with a cell phone or calculator) to divide the total values by the total number of types of animals that were found (b/a).

- 6) Record this number in the "Index Value" box and ask the students to interpret what it means based on the information in the "How Healthy is the Stream?" box.

The second method that will be used to determine the water quality will be with the tools from the Water Quality Kits.

A water quality score of four indicates that the water is clean enough to support all four groups of invertebrates found on the group sheet. A score of three indicates that only the bottom three groups would be present. A score of two groups are likely to be found in that location. If the water quality score is one, then only group four, the most tolerant species, are likely to be present in that location.

After determining the biotic index and water quality scores, discuss with the class if this data is complementary and points to the same conclusion.

Does the data from the two methods agree or disagree?

Clean Up:

The critters need to be dumped back into the ice cream buckets. One partner can go back down and carefully pour the critters into the backwater (with adult supervision). The tub and all containers should be rinsed out. If you have time, you can fill a big tub with water and place it outside or in the sink. The students can rinse out their ice cube trays and containers in the water.

Everything should be placed back into the tub. When all the equipment is clean, call out the name of each object in the tub. The students should hold the piece of equipment in their raised hands and then place it in the tub. This will help ensure that each tub has the proper equipment.

Conclusion:

Assemble outside if weather permits. Ask the students to share what cool adaptations they discovered (from their sheets) and write them on a dry erase board. It works well to make four columns: organism, breathing, protection, and food. Reveal (if it hasn't happened already) what critters breathe from their "butts" (water scorpion and giant water bug are two cool ones), which insects breathe by trapping air bubbles (crawling water beetle), and which are one-eyed (Cyclops or copepod, a crustacean).

Before you leave the nature center, make sure that all the boots are hanging up, all the critters have been returned to the backwater, the tubs are organized, and the lab is clean. Please do not dispose of any solid debris in the sinks! THANKS!

References:

Strathe, S., Braun, D., & Brown, A. (1994). Wetland understanding leading to protection. Plymouth, Wisconsin: Outdoor Skills Center, Inc.

Wade, S. (2001). Wonderful, wacky, water critters. Madison, Wisconsin: University of Wisconsin-Extension.