Reading The River, 2003

Macroinvertebrates

5th Grade

Science

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July 29, 2003

Macroinvertebrates

Objectives:

Students will understand the necessity for water conservation
Students will be able to use and interpret topographic maps
Students will be able to identify a variety of macroinvertebrates and use that knowledge to understand stream quality

Definition/Explanation of Concept/Skill

Water quality is a vital to humans and animals. Neither would be able to survive without clean water. Streams are just one source of water that is important in the study of water quality. The Kentucky Division of Water uses information collected by volunteers to help protect the quality of water found in Kentucky. One type of information that volunteers collect is the biodiversity of a particular stream.

Macroinvertebrate collection is a way volunteers assess the quality of a stream. Streams are constantly changing. Pollution can have a long term effect on a stream. A stream that is polluted one week may be clean the next, but the effects of the pollution does not go away that quickly.

Macroinvertebrates are organisms lacking a backbone and are visible to the naked eye. There are thousands of different species of fresh water macroinvertebrates in Kentucky streams. Since there are so many species, the importance of protecting them is important as well.

Different types of macroinvertebrates require different habitats for living and feeding. Some depend on others in order to live. Because they depend on one another, the more diversity you find, the better the water quality is.

As you can see, macroinvertebrate studies are an essential part of water conservation.

Program of Study:

Scientific Inquiry
Scientific Ways of Thinking and Working (2.1)

S-P-SI-1
Students will ask simple scientific questions that can be answered through observations.
S-P-SI-2
Students will use simple equipment (e.g., aquariums), tools (e.g., magnifiers, spoons), skills (e.g., observing, pouring), technology (e.g., video discs), and mathematics in scientific investigations.
S-P-SI-3
Students will use evidence (e.g., observations) from simple scientific investigations and scientific knowledge to develop explanations.
S-P-SI-6
Students will question scientific investigations and explanations of other students.

Life Science
Characteristics of Organisms

S-P-LS-1
Students will understand that organisms have basic needs (e.g., air, water, nutrients, light) and can only survive when these needs are met.
S-P-LS-3
Students will understand that organisms have different structures that serve different functions. These structures are used to sort organisms into groups.

Applications/Connections
Patterns, Systems, Scale and Models, Constancy, and Change Over Time (2.2-2.6)

S-P-AC-4
Students will examine how science fosters understanding of issues (e.g., use/misuse, availability, distribution) related to natural resources.

Core Content:

Conceptual Understandings: Life Science

Populations and Ecosystems

SC-M-3.5.1

A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose and ecosystem.

SC-M-3.5.4

The number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition). Given adequate biotic and abiotic resources and no diseases or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Scientific Inquiry:

Inquiry skills will be assessed only in the context of physical, Earth/space, and life sciences content.

Students Will:

Refine and refocus questions that can be answered through scientific investigation combined with scientific information.

Use appropriate equipment, tools, techniques, technology, and mathematics to gather, analyze, and interpret scientific data.

Use evidence (e.g., computer models), logic, and scientific knowledge to develop scientific explanations.

Communicate (e.g., write, graph) designs, procedures, observations, and results of scientific investigations.

Review and analyze scientific investigations and explanations of other students.

Materials:

Pencils
Bioassessment Form (attached)
Interpreting Data Questionnaire (attached)
Macroinvertebrate Groups Picture Key (attached)
Topographic map of local watershed
Bio-Assess Cards

Activity Procedure:

1. Begin class with a review of what the students know about watersheds. Talk about what you would find in a stream. Review the terminology (attached form) the students filled out the day before.

2. After discussion, divided students into three groups.

3. Explain to the groups that each group is a separate team but all three teams are working together to complete a bioassessment of a stream.

4. Give each group a deck of cards (blue, yellow, and white). Have 100 cards per deck counted out ahead of time.

5. Have each group examine their deck of cards. Explain that they are looking at pictures of macroinvertebrates ("bugs") that can be found in streams. Each card has the common and scientific name of the "bug".

6. Each group should sort their deck into piles (picture side up) based only on the picture of the bug.

7. Once they have their "bugs" separated into piles, they should use their Macroinvertebrate Identification Key to identify the different types of "bugs" they have.

8. Once they have identified the "bugs" they will notice they may have several different types of one particular "bug". Explain that different "bugs" have different looks at different stages in their life. They should now separate their piles into groups based on their name, not just their picture.

9. Give each group a copy of the Bioassessment Form. Students will work together to fill out this form using the piles of cards they just sorted.

10. They will count the number of "bugs" in each pile and give each name a letter code. If they find a "bug" that is not on their list they should add it to the bottom of the group it belongs in.

11. Once all the "bugs" have been coded, students will calculate the total number of taxa for each group.

12. They will use this number it find the index value and the cumulative index value.

13. This will give them the Stream Quality Assessment for their deck.

14. Groups will share their data and discuss it as a class.

15. Now have each group look at a topographic map of a local watershed. They will locate the map on the internet at topozone.com. (They will have looked at this same map in a previous lesson)

16. Discuss how this map could lead to the findings they found in their groups.

Assessment:

1. Monitor students during their group work. Assist them with any questions they may have.

2. Give each student a copy of the Interpreting Data Questionnaire (attached). After they have filled them out, discuss each question in depth as a class.

3. Follow up this lesson with a trip to the local stream that is part of the watershed the students mapped and used for this activity.

4. Have students collect samples of macroinvertebrates and identify them.

5. When they return to school, have them fill out a bioassessment form for the data they collected at the local stream.

6. Students can also use this activity to complete a writing assignment on stream quality and the importance of water conservation.

Reference:

This lesson was adapted from "Bioassessment" from W. Deutsh, Auburn University.

Watershed Watch Biological Stream Assessment, A publication of the Kentucky Water Watch Program 2000

TopoZone.com

Bioassessment Form

Macroinvertebrate Tally Codes: **R**= 1-3 macroivertebrates (Rare)
C= 4-9 Macroinvertebrates (Common)
A= 10 or more macroinvertebrates (Abundant)

Group 1 Taxa	Letter Code	Group 2 Taxa	Letter Code	Group 3 Taxa	Letter Code
Mayfly		Blackfly		Pouch Snail	
Stonefly		Water Penny Beetle		Midge	
Caddisfly		Sowbug		Aquatic Worm	
Snail		Asiatic Clam			
Riffle Beetle		Crayfish			
		Filtering Caddisfly			
		Crane Fly			
		Dragonfly			
		Hellgrammite			
	# of Taxa _____		# of Taxa _____		# of Taxa _____

Number of Taxa in: Group 1 ____ Group 2 _____ Group 3 _____

Index Value _____ _____ _____
(Multiply # of Taxa by 3

Total # of Taxa in each group _____

Cumulative Index Value _____
(Sum of index values)

Stream Quality Assessment: (Refer to Cumulative Index Value)

Excellent (>22) **Good (17-22)**

Fair (11-16) **Poor (<11)**

Interpreting Data Questionnaire

1. How did you categorize the pictures of macroinvertebrates?

2. Did you have more rare, common, or abundant organisms in each group?

_____
_____
_____

3. What can you infer about your stream quality based on the information gained in question 2?

_____
_____
_____
_____

4. What was your Stream quality assessment? _____

5. What does this number mean?

_____
_____
_____

6. What type of environmental issues could have lead to the type of stream quality you found? (Think about the topomap)

_____
_____
_____

Context of Curriculum Product

This lesson is a part of a series of lessons on water.

Lesson 1: The Water Cycle- what is water and where does it come from
Lesson 2: Many Forms of Water- water and its three states
Lesson 3: The necessity of Water- how water is used and why it is important to conserve
Lesson 4: The Watershed- what is a watershed and how does it affect me
Lesson 5: Mapping a Watershed- making a topomap of a local watershed
Lesson 6: Enviroscape- how the environment effects water quality
Lesson 7: Taking Data- instruments used in water quality data
Lesson 8 Ph- what is ph and how is it measured
Lesson 9: Dissolve Oxygen- what is it, why is it important, how is it measured
Lesson 10: Conductivity- what is it and how is it measured
Lesson 11: Macroinvertebrates- studying macroinvertebrates
Lesson 12: Stream Monitoring- trip to local stream