Teachers Guide for the Macroinvertebrate Lunch Movie

Grade Levels: 4-7

Subject Areas: Environmental science

Duration: 1-3 class periods, depending on the age of the students, and the teacher's choice of extension activities.

About This Project: The Bryant Watershed Project is proud to introduce the accompanying movie to this lesson plan, *Macroinvertebrate Lunch.* Created by West Plains Middle School students and teachers, partnering with a professional graphic artist and SMSU education students, it is a first of its kind. We invite you to learn more about the creation of this project at http://www.watersheds.org/artstream/artstream.htm

Objectives: At the end of this lesson, students should be able to:

1. Define the term benthic macroinvertebrate, and identify their common characteristics.

2. Explain how the diverse populations of benthic macroinvertebrate organisms in a stream sample can indicate the "health" of that stream ecosystem.

3. Illustrate a food chain in which macroinvertebrates are involved, and predict how the death of macroinvertebrates due to pollution would affect this food chain.

4. List common pollutants, and sources of polluted runoff.

Show-Me Standards:

Process:

Goal #1.4 – Use technological tools and other resources to locate, select and organize information.

Goal #1.5 – Comprehend and evaluate written, visual and oral presentations and works.

Goal #1.8 – Organize data, information and ideas into useful forms (including charts, graphs, outlines) for analysis or presentation.

Content:

Science 4. Knowledge of changes in ecosystems and interactions of organisms with their environments.

Science 8. Knowledge of the impact of science, technology and human activity on resources and the environment.

Preparation:

1. View the Macroinvertebrate Lunch movie before showing it to your class. Note especially where the pause are for classroom discussion opportunities.

2. Go to Stream Team Does Critters http://www.watersheds.org/nature/streamteam.htm for background information on how a stream team samples a stream. The activity presented in this lesson plan replicates a stream team.

Materials / Technology:

1 "Macroinvertebrate Lunch" movie: http://www.watersheds.org/stream_movie.htm

2. Smart board for viewing an Internet movie as a class, or individual computers for partner viewing.

3. Chalk or marker board.

4. Print a student guide for each student: http://www.watersheds.org/artstream/macro_student.pdf

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Anticipatory Set:

1. Before viewing the Macroinvertebrate Lunch movie, open a class discussion about polluted vs. healthy streams, as well as plants and animals that live in the streams.
    Propose the following scenario as an opener for conversation: "If you were walking near a stream in the woods and noticed the water was so crystal clear that you could see the bottom rocks, would you think it OK to take a drink?" "Why or why not?"

2. As the students identify ways to distinguish a polluted vs. a non-polluted stream, list their ideas on the board. Consider using a Venn diagram with "very polluted"

and "clean" categories, and "moderately polluted" as a common overlapping category in the center.

3. Now that you have students thinking about clean vs. polluted water, steer their thinking in the direction of macroinvertebrates that normally live in the water. The students have no doubt unknowingly already listed some macroinvertebrates, so the teacher must define and discuss this new term, and announce that today's lesson will involve learning about their important role in streams.

Learning Activities:

4. Write the word 'macroinvertebrate' on the board and break it down into the prefix – macro meaning "large", and the word "invertebrate" meaning without a backbone. Explain that 'vertebrate' comes from the word vertebra, or backbone. Point to a vertebral column on any classroom model, and then have students feel their own vertebral column, (or backbone). The water animals in today's lesson DO NOT have a vertebral column (hence, <u>IN</u>vertebrate).

5. Ask students to refer to their animals listed on the board, and identify which creatures have a backbone, and which do not, reinforcing the terms 'vertebrate' and 'invertebrate'.

6. If the students have not included a crawdad (crayfish) to their list, mention it and add 'crayfish' to the list. With this as a leader, introduce the word "exoskeleton". Exo- is a prefix meaning 'outer'. Ask if anyone can predict where an exoskeleton would be located? (*Outside their body like a suit of armor*).

7. Announce to the class that they will be going to a web site to view a movie on Benthic Macroinvertebrates. Instruct the class to pay close attention during the

movie, and see if they can determine what the word 'benthic' means. (*lives on the bottom*)

8. Hand out a student guide to each student. Instruct the class to pay close attention to the movie, and then answer the questions on their student guide after viewing the movie. (*Instructors may consider showing the movie twice in order to allow students to get all necessary information.*)

9. Start the web-movie by clicking on "click here to start". Allow a few moments for the movie to load up. It will pause after introducing benthic macroinvertebrates, allowing the teacher to quiz students. During this pause, see if students can identify which creatures (on the computer screen) are macroinvertebrates? What does 'benthic' mean? What is an invertebrate?

10. Explain that in this next portion of the movie, the class will be learning about the importance of diversity of macroinvertebrate life present in the water. Diversity means how many different varieties we find. It is important to have a large *diversity* of macroinvertebrates present in the stream, because this can indicate important information about the health of the stream. Direct students to watch for information, which will explain how the *kinds* of invertebrates present can indicate the level of pollution in a stream. Also remind students to watch for pollution sources, and kinds of pollution.

11. Click on "resume" to continue with the remainder of the movie, which will take about 5 minutes. Use the built in pauses as you wish for m ore discussion.

12. After viewing the movie, discuss the role that macroinvertebrates play in identifying a polluted stream from a non-polluted stream. Please refer to the macroinvertebrate identification key:

http://www.barnard.columbia.edu/iue/ForestCurricula/StreamInsectCrustaceanIDKey.pdf

Text and illustrations are drawn from Stream Insects and Crustaceans, Save Our Streams, Izaak Walton League of America, 1401 Wilson Blvd. Level B, Arlington, VA 22209.

See also: **Meet the Macroinvertebrates**: the Cast of Characters in the movie, with links to photos of macroinvertebrates by Missouri Department of Conservation biologists. http://www.watersheds.org/nature/macroinv.htm

> A. *Some macroinvertebrates like caddisfly larvae, riffle beetles and mayfly nymphs are very sensitive to small amounts of pollution. As pollution levels start to rise, these are the first creatures to die.*
>
> B. *Other macroinvertebrates like clams, crayfish, and sowbugs are more resistant to pollution. A stream that is polluted enough to start killing off these invertebrates is showing a moderate amount of pollution.*
>
> C. *Finally, the toughest macroinvertebrates are aquatic worms, leeches, blackfly larvae and some snails. If they are the only creatures present in the stream, it may indicate an even higher level of pollution.*

13. **Discussion question**: What if there are no invertebrates present but the water is clear? Does that mean the water is safe to drink? (*No it may mean there are pollutants such as chemicals, which have killed off <u>all</u> the invertebrates*)

14 a. If time and resources permit, the activity "Water Canaries" is ideal to do now. This involves taking a trip to a local stream, sampling the water, and identifying the macroinvertebrates present. (see web site showing pictures of a 'stream team identifying critters:

http://www.watersheds.org/nature/streamteam.htm

This may also be done as a second day activity, using this first day to learn about macroinvertebrates and their role in the stream ecology. You may obtain the Water Canaries lesson plan from Project Wild Aquatic Education Activity Guide. Contact Project Wild, 707 Conservation Lane, Suite 305, Gaithersburg MD, 20878, Phone (301) 527-8900, e-mail info@projectwild.org. Water Canaries is recommended for students in grades 4-8.

14 b. If the "water canaries" activity is not possible, the following may be used as an in-class substitute. It would be helpful to thoroughly read through the lesson Water Canaries for background information.

15. **Activity:** Divide the class into teams. Each team is given a Ziploc bag of cards displaying macroinvertebrate animals they "collected" from their stream. (Modification: the bags may include a wide assortment of different colored discs, bottle caps, colored hole punches, buttons, Popsicle sticks, or any other small object. Each color represents a different macroinvertebrate. Identification keys must be provided).

16. Each team must identify the number and type of macroinvertebrates from their sample, and list them on the macroinvertebrate count sheet: http://www.watersheds.org/artstream/bugs.pdf. Also, describe the location where the animals were found.

17. Each team must determine whether their water sample indicates a healthy non-polluted stream, a moderately healthy, or polluted stream.

Teams will present their findings to the class. **Optional activity**: Instructors may want to have students make a bar graph of their results. List the macroinvertebrates found on the X axis, and the quantity on the Y axis.

For Further Information:
18. After viewing the movie, discuss different types of pollution, and list several sources of polluted runoff. Visit "what is non point source pollution' http://www.watersheds.org/earth/nps.htm
19. Find out what you can do to help reduce polluted runoff by visiting http://www.watersheds.org/earth/nps2.htm

Assessment: Students will turn in their team worksheets, along with student guides for the macroinvertebrate movie.

Answer Sheet for Student Guide: http://www.watersheds.org/artstream/answers.pdf

Resources:

Web site for making graphic organizers:

http://teachers.teach-nology.com/web_tools/graphic_org/

Extension Activities:

1. "Drop in the bucket": This is an excellent activity from the Utah Water Quality Extension that demonstrates how limited our supply of freshwater is on earth, and why it is a precious resource.

https://extension.usu.edu/waterquality/PDF%27s/A%20drop%20in%20the%20bucket .pdf

This is a pdf file. If it does not load up on your computer, try the home page at:

https://extension.usu.edu/waterquality/WQsearch.htm

2."Who polluted the Potomac?" This activity uses an interactive story with student involvement to demonstrate how waterways become polluted. This page offers a PDF link; allow a few moments for the pdf file to load up on your computer.

http://www.populationconnection.org/Reports_Publications/Reports/report344.html

3. Macroinvertebrate Mayhem: In this game of tag, students learn how environmental stressors deplete populations of macroinvertebrates in a stream. Refer to the Project Wet Curriculum and Activity Guide at Project Wet, 201 Culbertson Hall, Montana State University, Bozeman, Montana 59717-0570. Phone (406) 994-5392. Or e-mail projectwet@montana.edu

Reflection: After doing this lesson, reflect any changes you would do the next time you teach it. What modifications would you make?