Captured Critters

Lesson Abstract

Summary:	Students learn some of the common benthic aquatic macro-invertebrates used as water quality indicators and determine how long-term monitoring indicates water quality trends.
GLE:	SC4.1.A.6, 4.1.B.6,4.1.D.6, 4.3.C.6, 5.3.A.6
Subject Areas:	Science
Show-Me Standards:	Goals – 1.3, 1.6, 1.8, 3.5, 4.1 Strands – SC 3, 4, 5, 8
Skills:	Matching, identifying, comparing and contrasting
Duration:	1 class period (50 minutes)
Setting:	Classroom/Stream (optional)
Key Vocabulary:	Benthic, benthos, aquatic, macroinvertebrates, taxa

Rationale:

- The types of insects that live in water reflect the quality of the water.

Student relevance:

- Students will identify common aquatic macroinvertebrates that indicate water quality conditions and understand the taxa grouping as it relates to water quality

Learning Objectives:

Upon completion, students will be able to . . .

- Identify the most common benthic macroinvertebrates determining water quality.
- Recognize that taking multiple samples of benthic macroinvertebrates over a period of time will show changes in water quality.
- Understand the need for scientific protocol in sampling.

Students Need to Know:

- How to match line drawings to macroinvertebrates and read names from a chart.
- Insects and other animals live in surface water.

Teachers Need to Know:

- The basic concepts in using macroinvertebrates as indicators.
- A greater diversity of macroinvertebrates indicates higher water quality, when two similar streams are compared.
- All surface waters in the world have some degree of contamination.

Resources:

McCafferty, W. Patrick. *Aquatic Entomology: The Fisherman's Guide and Ecologists' Illustrated Guide to Insects and Their Relatives.* Jones & Bartlett Publishers, 1983

Mitchell, M.K. and W.B. Stapp. *Field Manual for Water Quality Monitoring – An Environmental Education Program for Schools.* Ann Arbor, MI 1992. Available from Global Rivers Environmental Education Network (GREEN), 721 East Huron, Ann Arbor, MI 48104, (313)761-8142

DePew, Jeffrey C., Suzanne F. Reed and Jennifer L. Gleason. *Stream Ecology: A Journal for Action.* St. Louis, MO: Missouri Botanical Garden, 1993.

Save Our Streams Program
Information available from the Izaak Walton League of America (IWLA), 707 Conservation Lane, Gaithersburg, MD 20878, 1-800-BUG-IWLA.

Missouri STREAM TEAM Program
Information available from the Missouri Department of Conservation, Stream Team Section, P.O. Box 180, Jefferson City, MO 65102-0180, (573)751-4115 or 800-781-1989

Flyfishing Organizations (see Resource References in the back)

Materials Needed for Lesson: Classroom Activity

Stream Insects & Crustaceans Chart (one copy per student or team) – chart provided in previous lesson
Stream Insects & Crustaceans Chart (cut out individual bugs from four copies)

Scissors
Rulers
Plain paper
Pencils
Large box or container

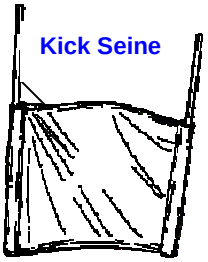
Materials Needed for Lesson: Stream Activity

Stream Insects & Crustaceans Chart (one copy per student or team) – chart provided in previous lesson. If you can laminate these bug cards it is recommended because of the proximity to water.

Macro Invertebrate ID Critter Cards (Color Photos) MDC

White ice cube trays for each group of students to have one.

A kick net seine for each group. Kick nets can be made by stapling a 3'x3' section of fine nylon screen wire to two dowel rods 1 ¼" diameter by 4 ½' long.
Tweezers (per student)
Magnifying glasses



Procedure: Classroom Activity

- This activity can be done with students working individually or in teams.
- Thoroughly mix critter cut outs in a large box or container.
- Have each team draw out 10 critters and determine the general water quality using a copy of the *Stream Insects & Crustaceans Chart* with a rating of good, fair or poor.
- To determine water quality, students will assign a value to each critter based on taxa group number. Group One taxa critters = 1, Group Two = 2, and Group Three = 3. The lowest sum equals better water quality.
- Tell students to draw a timeline to represent three samplings.
- Record the water quality sum on the timeline for each sampling (determined by three separate drawings).
- Note: Be sure all critters are returned to box for each sampling. On the third sample, take out all Group One Taxa without students' knowledge to show poor water quality.
- Determine the trend in water quality from the time line.
- Have students discuss what factors in the watershed are responsible for trend changes.
- Have groups share their findings.

Procedure: Stream Activity

- Locate a suitable site with a riffle. Be sure to keep safety in mind and don't choose a riffle more than knee deep to your smallest students.
- Collect three net sets of invertebrates from three different

microhabitats. This ensures a complete picture of what lives in your stream and more accurately reflects stream health.

- If possible, take all three net sets from different areas within a stable riffle. Microhabitats to sample include differences in: rock size, flow, leaf packs, and emergent vegetation.
- Always work in an upstream direction so that sampling activities do not disturb portions of the riffle to be sampled later.
- If, and only if, you do not have a riffle at your site, or the riffle is too small to get three net sets out of it, you may also want to sample root mats and/or woody debris.
    - Prioritize sampling of macrohabitats as follows:
        - Riffles
        - Root mats
        - Snags
        - Non-Flow
    - Whatever you decide to sample at your site (e.g.: two riffle net sets and one root mat), always sample those same three microhabitats at the site every time you sample there. This will ensure that the data you collect remains consistent over time.

Sampling Streams With Riffles

Sampling requires at least two people; one to hold the net and the other to dislodge invertebrates from the substrate or two students on the net and two rubbing rocks and (stream dancing) works even better. The rest of the team will pick bugs from the net and sort into the ice trays.

1. **Place** the net in the riffle facing upstream and tilted enough to provide a "pocket."
2. **Ensure the bottom of the net** is on the stream bottom leaving no room between the net and substrate (prevents organisms from washing under net).
3. **Rub all large stones** in the 3'x3' area immediately upstream of the net to dislodge invertebrates and wash them into the net.
4. **Dance** and **kick** with your feet in the 3'x 3' area until you have disturbed all of the substrate 3-6" deep to dislodge the invertebrates into the net.

Streams Without Riffles (or without riffles not large enough for 3 net sets)

Sample collection from Root Mats – Adequate sampling requires two people.

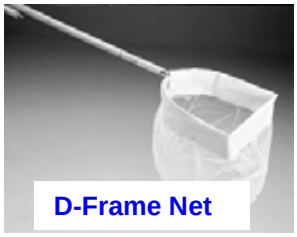
1. Have one student place the kick net against the bank on the downstream side of the root mat.
2. Make sure that the net is anchored at the bottom**.**
3. The other student will then kick the root mat **in a swirling motion** with one foot to create a circular current in order to dislodge the invertebrates from the root mat. The circular motion of the sampler's foot will drive the invertebrates into the net, even if there is not a current.

Sample Collection from Snags – Adequate sampling requires two people.

1. Have one student hold the net in a horizontal position 6-12" under the water.

2. The 2nd student will remove the snag from the water. When removing snags from the water, pull the snag out of the water quickly. If the snag is removed too slowly the invertebrates may swim off.
3. Brush the snag down with a brush above the net to dislodge invertebrates.

Sample non-flow area in the same manner as a riffle, collecting three separate samples. However, the samplers will need to use a swirling motion with the foot to create a current to move debris into the net. Although this habitat can be sampled using a kick net, it is easier with a D-frame net.


D-Frame Net

- Scoop the net forward after disturbing the substrate and take the net to the bank and begin picking the bugs from the net and sort them into the ice cube trays.

- After each method, identify the invertebrates and determine if they are sensitive, somewhat sensitive or tolerant. Based on the absence or presence of the sensitive organisms you can get a general idea of the long term quality of the stream. Any bugs not identified can be taken back to class and researched for identification.

Evaluation Strategies:

- Have students infer where they would find the different pollution tolerant and intolerant insects.
- Have students make a list of watershed land use practices that would increase or decrease intolerant aquatic macroinvertebrates.

Extension Activities:

- Have students adopt a critter, research and create a story about their pick (what their baby pictures were like, their jobs and careers, who came to dinner, an obituary of how they died, etc.).
- Have students write a summary of the field trip and make their own inferences as to the quality of the stream monitored.
- If you have small clear vials and alcohol available the students can start a reference collection by preserving specimens.
- Join Missouri STREAM TEAM Volunteer Water Quality Monitoring Program – adopt a stream, attend workshops, and begin monitoring.

Suggested Scoring Guide:

Captured Critters

Teacher Name: _____

Student Name: _____

CATEGORY	4	3	2	1
Contributions	Routinely provides useful ideas when participating in group and classroom discussions. A definite leader who contributes a lot of effort.	Usually provides useful ideas when participating in group and in classroom discussions. A strong group member who tries hard!	Sometimes provides useful ideas when participating in the group and in classroom discussion. A satisfactory group member who does what is required.	Rarely provides useful ideas when participating in the group and in classroom discussion. May refuse to participate.
Focus on the task	Consistently stays focused on the task and what needs to be done. Very self-directed.	Focuses on the task and what needs to be done most of the time. Other group members can count on this person.	Focuses on the task and what needs to be done some of the time. Other group members must sometimes nag, prod, and remind to keep this person on-task.	Rarely focuses on the task and what needs to be done. Lets others do the work.
Problem Solving	Actively looks for and suggests solutions to problems.	Refines solutions suggested by others.	Does not suggest or refine solutions, but is willing to try out solutions suggested by others.	Does not try to solve problems or help others solve problems. Lets others do the work.
Monitors Group Effectiveness	Routinely monitors the effectiveness of the group and makes suggestions to make it more effective.	Routinely monitors the effectiveness of the group and works to make the group more effective.	Occassionally monitors the effectiveness of the group and works to make the group more effective.	Rarely monitors the effectiveness of the group and does not work to make it more effective.
Preparedness	Brings needed materials to class and is always ready to work.	Almost always brings needed materials to class and is ready to work.	Almost always brings needed materials but sometimes needs to settle down and get to work.	Often forgets needed materials or is rarely ready to get to work.
Working with Others	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others. Does not cause "waves" in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team player.

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