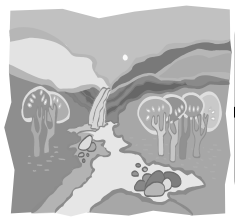

Macroinvertebrate Lesson

TEKS Science: 5.1(A,B), 5.2 (B,C,D,F), 5.3 (A,D), 5.4(A,B), 5.8(D), 5.9(A,B,C), 10(A,C)
Social Studies: 5.9 (A,B)
Reading: Students learn academic vocabulary in meaningful context, and 5.27(A), 5.28, 5.29

AISD Essential Science Vocabulary
Sedimentary, erosion, weathering, deposition, predators, pollutants, environment, evaluate, hypothesis, structures, adaption, data, results, nymph, larva, adult, life cycle, incomplete metamorphosis, complete metamorphosis
(Use the vocabulary words and identify examples during the activity whenever there are meaningful opportunities.)

Concept
Aquatic macroinvertebrates (organisms that live in water and do not have a backbone) can indicate water quality.

Objective - Students will:
1) collect aquatic macroinvertebrates using appropriate collection procedures;
2) identify aquatic macroinvertebrates collected;
3) apply the given mathematical formula to assess water quality;
4) understand diversity and food web interactions;
5) distinguish between complete and incomplete metamorphosis

Time
1 and 1/2 hours

Materials: Earth Camp Teacher Assistant will provide materials
For instruction:
- Laminated poster, “Is the Creek Clean or Polluted?”
- Dry erase marker

Group Materials:
- 1 bin for collecting bugs
- “Is the Creek Clean or Polluted?” bug identification sheet
- Wax pencil

Materials for Student Pairs:
- Magnifying viewer
- Forceps
- Net

MACRO LESSON

Site: In/near the parking lot

Explain Important Safety Rules

- Discuss avoidance of ***snake habitat*** (plants and brush) and ***snakes.*** Move backward slowly away from the snake if one is near. Do not yell, run, or wave arms. When a safe distance from the snake (5 to 6 feet), sit quietly and watch the snake. If a snake is seen in the water, tell adult and get out of the water.
- Be aware of ***poison ivy***.
- **DO NOT THROW ROCKS**. You might hurt someone or something in the water.

Watershed Identification

- Review the definition of a ***watershed*** (area of land that drains to a creek). Identify the watershed you are in. (Onion Creek at Mckinney falls, Bull Creek at St. Edwards Park)

Site: On the walk to the creek

- Ask students what type of rock surrounds the creek? ***(****Sedimentary, Limestone*)
- Look for signs of weathering, erosion and deposition. Follow the depositional trail to the creek.
- Tell students to observe and show signs of flooding, examples of volcanic ash, and fossils. Discuss how flooding would have weathered, eroded and then deposited the items that are found.

Site: At the creek

Identifiying Macroinvertebrate Habitat - "Why is ***oxygen*** important in the creek? (organisms breath it) Where does the oxygen organisms breath come from? (plants, algae, bubbles)" Point out the bubbles that oxygenate the water at the waterfall and downstream at the ***riffle*** where the water is flowing over the rocks. "Why are the macroinvertebrates important to the creek? (they are food for fish) Without oxygen and macroinvertebrates, what would happen to the creek? (the ***food web*** would break down) We will look for macroinvertebrates at the shallow, bubbly, rocky area (riffle) because it is their habitat. Riffle habitats provide protection from *predators* and are full of oxygen (bubbles)."

Site: At the Riffle Habitat

Purpose of the Macroinvertebrate Test – *"*One way to check the health of a creek is to identify and count the variety of aquatic macroinvertebrates. *Pollutants* in the water can kill the sensitive aquatic macros. A chemical test will not identify pollution in the water after it has washed downstream, but the aquatic macroinvertebrate community will change because the pollution will cause sensitive macros to die. A healthy creek will have most or all of the different kinds of macroinvertebrates. If sensitive water macros are not living in a riffle, then it is a sign something in the *environment* is not healthy. You will be collecting and identifying aquatic macroinvertebrates to *evaluate* the health of the creek."

ENGAGE

Hypothesis

"Based on the watershed you have observed, do you think the water in the creek will test clean or polluted? Why? (clean because surrounded by hundreds of acres of nature. Or polluted because near the City of Austin)"

EXPLORE

1. **Teach Macroinvertebrate Count (Use the large poster)**

- Discuss how to tell macroinvertebrates apart by looking at their body structures (i.e. count number of tails, does it have legs?). Discuss adaptations (ie. legs allow organisms to move faster). Demonstrate how to check off the type of macroinvertebrate found on the worksheet. Emphasize the importance of correct identification since the variety of organism types will determine the quality of water in the creek.

2. Demonstrate How to Collect Macroinvertebrates

- Go to a spot near the creek for demonstration.
- Show the students how to fill the bin with 1-2 inches of clear water for holding the macroinvertebrates after they've been collected.
- Tell the students they will work with a partner. Demonstrate by picking a couple students and have them hold a magnifier with creek water and a net. Bring a pair of forceps, and wade into the water. Explain to students the procedure as you bend down to pick up a rock sitting on the bottom of the creek (not buried), in a shallow area with running water (to bring oxygen). Lift the rock out of the water and inspect the bottom for movement or shapes. When a macro is spotted, use the forceps to carefully remove it and place it in water in a magnifier.
- Demonstrate how to use the net to sweep the plants and banks of the creek. Check the net and pick out any macros found with the forceps and put them in the magnifier.
- Tell students to walk slowly and carefully to spots where macroinvertebrates are living so the macros are not kicked downstream.

IMPORTANT RULES

- DO NOT PLAY OR SWIM IN THE WATER.
- DO NOT DROP ROCKS OR SPLASH IN THE WATER.
- DO NOT GET IN WATER DEEPER THAN YOUR KNEES (macroinvertebrates don't like the deeper water)
- DO NOT HARM THE ANIMALS.
- Note: If someone is too scared to go in the water or does not have water shoes, macroinvertebrates can be found under rocks in the water near the edge of the creek.

3. Demonstrate Macroinvertebrate Identification and Documentation

- Use the Bug ID sheet to help the students identify the macroinvertebrate collected.
- Check off the macro found on the worksheet.
- Tell students they will receive EC stamp for identifying correctly (this will help them stay focused on identification)
- Put the macros in the collection bin.

4. Activity

- Divide class into **2-3 groups,** each with an adult leader. Give each group materials. Assign one group an upstream site, one group a midstream site, and one group a downstream site so everyone is not crowded and collecting in the same area.
- Allow time for everyone to collect, identify and document (**20 minutes**). Adult leaders should actively keep students on task. NO SWIMMING!!

NOTE: *When the majority of students start to play, usually enough time has passed for their interest in the activity. If one or two students are disrupting the activity, ask them to sit out and identify macros from the bin on the streambank.*

5. **Final Documentation of Macro Data**

- Gather the class together (**SIT DOWN)**. Use the poster to check off all the macroinvertebrates found by every group. Ask students to check off on their worksheet any additional macros found by the class that might not have been found by their group. If there is an especially interesting macro, send the viewer around for everyone to observe.

NOTE: *Macros we don't often find include dobsonfly, stonefly, & beetle larva. If a student says he/she found one of these, check it.*

EXPLAIN

- "Did we find macros from all color categories on the poster?" Finding all categories of macroinvertebrates means a healthy ecosystem because it shows a diversity of organisms. If there are no macros found from the excellent or good category, then the creek is considered unhealthy. Finding a macroinvertebrate in the poor water quality group does not necessarily mean the creek is polluted; however if it was the only group of macros found, then the creek would be considered polluted. When there is not a good diversity of macros in the water, it affects the food web of the creek. Animals that depend on the macroinvertebrates in the water for food could lose their food supply. People also depend on the aquatic food web because we eat fish."
- "Now that the organisms we found are noted on our data sheet, does it look like a great enough diversity that would indicate a healthy creek?"
- "Let's calculate our results. (note: only calculate 1 of each type of macro) Look at the macroinvertebrates in the top green section of the poster. These are sensitive macros because they can only live in a healthy creek. They are worth 3 points. What is the total points for the green category? The macros in the middle yellow box can tolerate a little bit of pollution without dying, but are still sensitive because they cannot live in heavy pollution. They are worth 2 points. What is the total points for the yellow category? The macros in the bottom blue box can tolerate pollution but they are also found in a healthy creek. They are worth 1 point. What is the total points for the blue category? "

EVALUATE

- Add up score and rate the creek. Discuss the original hypothesis vs. the results and possible explanation.
- Remind students that this activity can be done at their own creek to test water quality.

ELABORATE

Use the photos of the nymph/larva stage vs. adult of the different organisms found. Discuss incomplete and complete metatmorphosis, identifying the life cycle for each organism.

CLOSING Carefully put macros back in the creek.