Title: Macroinvertebrates

Grade Level: Upper Elementary

Objective: At the culmination of this lesson, students will be able to:

- Identify a macroinvertebrate
- Discuss why the presence of pollution intolerant macroinvertebrates indicates clean water
- Calculate the water quality based on the presence of macroinvertebrates
- Examine stream habitats

Materials:

- Proper licensing to handle Macroinvertebrates
- Laminated cutouts of Macro Math card game (Indoor biosurvey)
- Device with Internet access
- Crayons/colored pencils
- Macroinvertebrate Coloring Pages
- What's a Macro info notes
- Macroinvertebrate Report Notes
- Roll A Macro sheet
- Dice
- Paper
- Bins with gems/rock/sand/marbles to hide macro cards (1 bin per group)
- Dichotomous Key (found with Macro Math card game)
- Water Tolerance (found with Macro Math card game)
- Bug viewers
- Waders (optional)
- Nets (D-net and kicknets recommended)
- Ice-cube trays
- Paintbrushes
- Macro memory game

Standards:

NGSS Science Standard: HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. (Grades 9 - 12)

Standard 1.2 Reading Informational Text -Students read, understand, and respond to informational text—with an emphasis on comprehension, vocabulary acquisition, and making connections among ideas and between texts with a focus on textual evidence

Standard: HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. (Grades 9 - 12)

Introduction:

- Watch the Video Macro Mayhem and fill out the Info Sheet: "*What's a Macro?*" that goes along with it
- **"Which macro are you?"** – Have students take the personality quiz to find which macroinvertebrate their answers relate to.
- Macroinvertebrate Coloring Pages – Using an identification, have students examine the markings of their macroinvertebrate and color the sheet.
- Macro Report : Have students research their macroinvertebrate (using either guidebooks, printed information, or the Internet). Then have them fill out the Information included in the Report.

Body:

1. **Macro ID**
   Quiz students on their identification of macroinvertebrates with this online game. You may allow them to use resources or try to complete it without any. Macro Identification Game

2. **Macro Memory**
   Partner students and allow them to play the Macro memory game in order to become familiar with the different types of species or macroinvertebrates they might encounter.

3. **Indoor Macro Dig**
   - Print off and laminate the Macro Math card game (Indoor biosurvey)
   - Prepare bins with either sand, rocks, gems, marbles or similar substrate to hide the laminated macroinvertebrates (1 bin per group). Differentiate the macro cards that you add to each bin so that various stream measurements can be done.
   - Split students into groups. Have them work together to dig for macroinvertebrates, identify them using a dichotomous key, and finding their water pollution tolerance using the chart.
   - Have students record their findings and calculate the Water Quality based on what macroinvertebrates they find.
   - Introduce the Macro App as an additional resource: https://play.google.com/store/apps/details?id=org.macroinvertebrates.mobile&hl=en_US&gl=US&pli=1
   - Discuss the findings and conclusions that students drew
   - If time and interest allow, have the groups switch their bins and do the dig again. (This can easily be turned into stations).

4. **Stream Ecology:**
   Read the Sampling Manual to learn how to sample macroinvertebrates. Take students to a local stream where they can look for macroinvertebrates themselves. If possible, allow students to use waders, kicknets and D-nets to examine the macroinvertebrates they find in the stream. Next, have them sort the macroinvertebrates into ice-cube trays with a paintbrush in order to count how many there are of each species. Allow students to reference their dichotomous keys,

   Other Resources:

   ➔ Macroinvertebrate Mix & Match