



# Outdoor School at Home

Calapooia Watershed Council

**Title:** Macroinvertebrates

**Grade:** 6

**Duration:** 55-60 minutes

**Location:** Home/Backyard/Park

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**Materials:**

- Macroinvertebrate ID Guide (provided online)
- Journals/Paper
- Markers/Colored Pencils
- Clay/Playdough (optional)
- Pipe Cleaners/cotton swabs, sticks/etc. (optional)
- Pasta noodles (optional)
- Glue (optional)
- 1-2 Dice (optional)

**Lesson Preparation:**

- Print out or have the Macroinvertebrate ID Guide, Worksheet, and Simulation available on a computer/tablet.
- Print and cut out macroinvertebrate names for lesson use. Put it aside for the lesson.
- Ensure paper and writing materials are available for the students.
- Have crafting materials set up and available

**Objectives: Students will**

- Identify two important roles macroinvertebrates play in an ecosystem by discussing their ideas.
- Present the natural history of a macroinvertebrate species by sharing information they recorded in their journals.
- Determine water quality by running a stream simulation with macroinvertebrate species
- Brainstorm two ways humans can improve or preserve the local water quality

<p><b>Introduction</b> (5 minutes)</p>	<p><b>Hook:</b> Have students imagine that they have been shrunk down to size of a quarter, and that they live underwater.</p> <ul style="list-style-type: none"><li>● Ask students how they might survive living in an underwater habitat</li><li>● Have a few students share their ideas</li><li>● Ask students about their food, shelter, mobility, etc.</li></ul>
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<p><b>Body</b> (45 minutes)</p>	<ul style="list-style-type: none"><li>● After the students have shared their ideas, tell students that their ideas are actually put into use every day by organisms that live underwater.</li> <li>● The organisms that we are going to investigate today are <b>macroinvertebrates</b>.<ul style="list-style-type: none"><li>○ Ask students if they know what macroinvertebrates are</li><li>○ If an explanation is needed, break down the term into:<ul style="list-style-type: none"><li>■ <u>Macro</u> - something that is visible to the eye (doesn't require microscope)</li><li>■ <u>Invertebrates</u> - an organism lacking a backbone</li></ul></li></ul></li> <li>● Ask students why it might be important to learn about macroinvertebrates? Discuss what an <b>indicator species</b> is.<ul style="list-style-type: none"><li>○ See Background Information on definition</li><li>○ Have students discuss and share their answers</li><li>○ Some topics students might cover: Food web, food chain, water filtration, pollution</li></ul></li> <li>● After the discussion share with students that for us to better understand these macroinvertebrates, we need to study them for an up close look.<ul style="list-style-type: none"><li>○ Hand out the Macroinvertebrate ID Guide or open it on your computer<ul style="list-style-type: none"><li>■ Have each student choose 2-4 macroinvertebrates from the guide</li><li>■ Have students record information from the guide and mold/sketch each macroinvertebrate using the provided craft materials<ul style="list-style-type: none"><li>- Students should sketch and take notes in their journal of their macroinvertebrate(s)</li><li>- Have students research more macroinvertebrates if they want to</li></ul></li></ul></li></ul></li> <li>● After the students have finished learning about their macroinvertebrates, have the students present their findings<ul style="list-style-type: none"><li>○ Ask students about the macros diet, how they might move, where they might live, etc.</li><li>○ Ask students about their pollution tolerance<ul style="list-style-type: none"><li>■ This will vary from <u>Very Sensitive</u> (needs clean waters) to <u>Tolerant</u> (can survive in polluted waters)</li><li>■ Refer to Background Information below</li></ul></li></ul></li> <li>● Share with students now that they have learned more about</li></ul>
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	<p>macroinvertebrates, we can now use them as bioindicators.</p> <ul style="list-style-type: none"> <li>○ Using the stream visual and macroinvertebrate names, have the student select 6 macroinvertebrate names and place them on the stream visual (names drawn from a hat or upside down so student can't see during selection)</li> <li>○ Roll dice to see how many macroinvertebrates of each species were found - record this next to each macroinvertebrate that was selected</li> <li>○ <b>OR</b> use the online stream simulation and ID Guide to “collect” macroinvertebrates             <ul style="list-style-type: none"> <li>■ <a href="https://www.biologysimulations.com/macroinvertebrates">https://www.biologysimulations.com/macroinvertebrates</a></li> </ul> </li> <li>○ Using the Macroinvertebrate worksheet, have the student(s) record their information and calculate the health of the stream</li> <li>○ Have students present their results and how they determined stream health</li> <li>○ Repeat this activity for different results!</li> </ul>
<p><b>Closing</b> (5 Minutes)</p>	<ul style="list-style-type: none"> <li>● Have students turn to a partner and/or discuss two reasons why macroinvertebrates are important to us as humans             <ul style="list-style-type: none"> <li>○ Allow them to share their ideas</li> <li>○ Follow up with questions such as, how do we help our macroinvertebrate populations?, What could be happening to our water if we only find tolerant macroinvertebrate species?, etc.</li> </ul> </li> </ul>

**Background Information:**

**Indicator Species:** an organism whose presence, absence or abundance reflects a specific environmental condition. Indicator species can signal a change in the biological condition of a particular ecosystem, and thus may be used as a proxy to diagnose the health of an ecosystem.

**Macroinvertebrates** are organisms that are large (macro) enough to be seen with the naked eye and without a backbone (invertebrate). They inhabit all types of running waters, from fast-flowing mountain streams to slow-moving muddy rivers. Examples of aquatic macroinvertebrates include insects (in their adult, larval or nymph form), mollusks, crustaceans and worms (Viklund, 2011). Most of them live part or most of their life cycle attached to submerged rocks, logs, and vegetation or else in soft sediment.



Aquatic macroinvertebrates serve multiple functions in freshwater ecosystems. In addition to their role as primary consumers processing live organic material, they also serve as detritivores, consuming decomposing organic matter; predators, consuming macroinvertebrates and other small organisms; and prey, serving as food for fish, amphibians, reptiles, aquatic birds, and mammals. Many species of aquatic macroinvertebrates have evolved highly specialized feeding structures and behaviors in order to adapt to different food sources and competition within the aquatic environment. As a result, aquatic ecologists have categorized the many species of aquatic macroinvertebrates into four functional feeding groups (Cummins 1973) which can be used to describe how aquatic ecosystems function: shredders, collectors, grazers (or scrapers), and predators.

- **Shredders** are responsible for processing coarse particulate organic matter (CPOM). CPOM is greater than 1 mm in size and typically derived from allochthonous sources, such as woody debris, leaves, and other vegetation from the neighboring riparian corridor. Examples of shredders in the Southwest include the caddisfly (*Heteroplectron californicum*) and the stonefly (*Zapada cinctipes*).
- **Collectors/Filter Feeders** filter and collect smaller particles of organic matter (FPOM) found in the water column and bottom sediments. FPOM can range in size from 0.01-1.0 mm and usually arrives in water columns and benthic sediments as a result of CPOM being broken up by shredder species. Examples of collector species include the beetle (*Zaitzevia parvula*) and the Dipteran (true flies) (*Antocha monticola*).
- **Grazers** are found on rocks and woody debris, feeding on periphyton, detritus, and submerged aquatic plants. Most gastropods (snails) are grazer species; other grazers in the Southwest include the caddisfly (*Helicopsyche borealis*) and the beetle (*Optioservus quadrimaculatus*).
- **Predators** prey on animal tissue. The primary food sources for this group are other Glen Canyon National Recreation Area aquatic macroinvertebrates. Many southwestern dragonflies, such as the riffle darter (*Opolonaeschna armata*) and Pacific spiketail (*Cordulegaster dorsalis*), are voracious predatory species.



Macroinvertebrates are used as **bioindicators** that can reflect characteristics of a water body based on the type and number of macroinvertebrates found living within that system. Chemical water tests are limited because they only tell us what's in the water at the specific moment the sample is collected. They don't give an indication of what was in the water an hour ago, yesterday or last week. Every day, macroinvertebrates are surrounded by water and any pollutants that may be in the water. If pollutants were in the water last week or yesterday, the quantity and diversity of macroinvertebrates present would reflect this in the water quality.

Different types of macroinvertebrates have different requirements to survive. Some require cooler temperatures, relatively high dissolved oxygen levels or certain habitats. Other macroinvertebrates may be able to survive in less-than-ideal conditions — where there are low dissolved oxygen levels or more sediment — or where the water temperature is warmer.

An important thing to remember for this lesson is that there aren't any "bad" macroinvertebrates, but the population present may indicate that there are poor stream conditions in which only the tolerant macroinvertebrates can survive.

<https://environment.arlingtonva.us/streams/macroinvertebrates/>

<https://www.nature.com/scitable/knowledge/library/bioindicators-using-organisms-to-measure-environmental-impacts-16821310/>