

# Macroinvertebrates

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<b>Strands</b>	Living Systems; Matter
<b>Topic</b>	Investigating watersheds
<b>Primary SOL</b>	6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include g) water monitoring and analysis using field equipment including hand-held technology.
<b>Related SOL</b>	6.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which a) observations are made involving fine discrimination between similar objects and organisms; j) current applications are used to reinforce science concepts. 6.5 The student will investigate and understand the unique properties and characteristics of water and its roles in the natural and human-made environment. Key concepts include f) the importance of protecting and maintaining water resources.

## Overview

Review resources to become familiar with sampling techniques and the necessary materials before taking a group into the field for investigation. If your time constraints and/or location do not permit an outside field exploration, an alternative to taking students to a stream or other body of water is to have them analyze macroinvertebrates in the classroom, using leaf packs. Information about leaf packs can be found at the Stroud Water Research Center Web site, and kits can be ordered from many science supply catalogs.

## Materials

- Dip nets
- Kick nets
- White, plastic ice cube trays
- Forceps
- Magnifying glass
- Waders
- Digital camera
- Field guides
- Macroinvertebrate cards
- Copies of the attached handouts

## Vocabulary

*carnivore, class, ecosystem, herbivore, kingdom, macroinvertebrate, omnivore, order, phylum*

## **Student/Teacher Actions (what students and teachers should be doing to facilitate learning)**

### *Introduction*

1. Provide each student with a copy of the attached Macroinvertebrate Fact Sheet.
2. Review the fact sheet with students, using various resources to supply students with a picture of each macroinvertebrate. You may want to acquire some of the commercial identification cards that are available. You may also want to laminate cards so students can take them into the field without damaging them.

### *Procedure*

1. Take students on a field investigation to a nearby stream or other body of water. Assign a student to document the area and findings with the digital camera. If available, use a GPS unit to mark the sampling location.
2. Give students hands-on experience collecting macroinvertebrate samples. Have them record their findings on the attached Macroinvertebrate Collection data sheet. Have them use ice cube trays to hold specimens for further observations.
3. Have students carefully examine the surrounding habitat, noting plants and animals that grow in or near the water and abiotic factors that might influence the living organisms. Have them record this information in their notebook or on the data sheet.
4. Upon return to the classroom, have students work in their teams to complete a field guide to the specimens they found. Each entry should include, among other things, name of specimen, location found, total number found, how tolerant it is of pollution, and a sketch.

### *Observations and Conclusions*

1. After teams have completed their field guides, have them report their findings to the class.
2. Lead a class discussion concerning what the specimens indicate about the water quality.

## **Assessment**

- **Questions**
  - What are the key features of macroinvertebrates?
  - How do environmental factors affect macroinvertebrate populations?
- **Journal/Writing Prompts**
  - Explain how macroinvertebrates are important to an ecosystem.
  - Describe how collecting macroinvertebrates can help a scientist determine the water quality of a body of water.
- **Other**
  - Use students' data sheets and field guides for assessment.
  - Have students conduct an imaginary interview with a macroinvertebrate about the body of water it calls home.

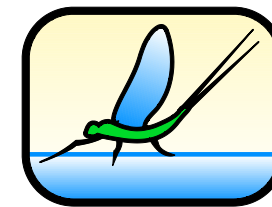
## **Extensions and Connections (for all students)**

- If students sample at the same location for the “Water Quality” lesson and this lesson, have them combine the results of the macroinvertebrate sampling with the water-quality testing data and analyze both sets of data together. If they sample at different locations, have them compare the quality of one body of water to the other.

- If you have convenient access to water year-round, have students collect data on a monthly basis and look for changes over time. If you do this each year, you can have students look at past data and discover how it has changed or stayed the same.

### **Strategies for Differentiation**

- Have students work in groups of three or four to select a common-name macroinvertebrate from the Macroinvertebrate Fact Sheet and construct a poster displaying a picture and important facts about the creature. Have groups share their posters with the class, and then hang the posters in the classroom.
- Have each student create two foldables for vocabulary review. Kingdom, phylum, class, and order should be listed in order on one foldable; the remaining terms should appear on the second foldable with pictures.
- Have students go to appropriate Web sites to find information on macroinvertebrates and make an electronic presentation consisting of actual photographs of macroinvertebrates.
- Use video clips from Internet sources such as *Discovery Education* to enhance students' understanding of macroinvertebrates.
- Collect samples of water prior to the field trip, and test them in the classroom.
- Tell students to make column notes to define macroinvertebrates—i.e., three columns: one for the name of the macroinvertebrate, one for a description, and one in which to draw a picture of the macroinvertebrate.
- Have students create a concept web with the macroinvertebrate in the center, the common name extended from that, and the scientific names extending from that.



# Macroinvertebrate Fact Sheet

Information based on *A Guide to Common Freshwater Invertebrates*

Common Name	Scientific Name	Sensitivity to Pollution	What It Eats	Interesting Adaptations	Life Cycle Notes	Importance in Ecosystem
<b>Aquatic Worm</b>	Kingdom: <i>Animalia</i> Phylum: <i>Annelida</i> Class: <i>Oligochaeta</i>	Tolerant	Omnivore: Eats mud as it travels through it, digests anything in the mud	<ul style="list-style-type: none"> <li>• Does not need much oxygen</li> <li>• Can regrow body part if it is severed</li> </ul>	<ul style="list-style-type: none"> <li>• Lives a few weeks up to a few years</li> <li>• Spends whole life in water</li> </ul>	<ul style="list-style-type: none"> <li>• Eaten by fish</li> </ul>
<b>Case-making Caddis Fly</b>	Kingdom: <i>Animalia</i> Phylum: <i>Arthropoda</i> Subphylum: <i>Atelocerata</i> Class: <i>Hexapoda</i> SubClass: <i>Insecta</i> Order: <i>Trichoptera</i>	Sensitive	Omnivore: Collects particles, scrapes algae, shreds plants and decomposing plants, eats small insects	<ul style="list-style-type: none"> <li>• Builds its own home (case) by gluing stream pebbles or sticks together with a silk it makes; named after 15<sup>th</sup>-century ribbon (caddice) sellers, who pinned many ribbons to coat</li> <li>• Soaks up oxygen all over its body</li> </ul>	<ul style="list-style-type: none"> <li>• Lives 6 months to 2 years</li> <li>• Spends egg, larva, and pupa stages in water</li> <li>• Adult lives on land/air</li> <li>• Female lays up to 800 eggs</li> </ul>	<ul style="list-style-type: none"> <li>• Adults eaten by birds</li> <li>• Larva eaten by carnivorous stream macroinvertebrates</li> <li>• Their shredding helps break things down, making smaller pieces for smaller animals.</li> </ul>
<b>Crayfish</b>	Kingdom: <i>Animalia</i> Phylum: <i>Arthropoda</i> Subphylum: <i>Crustacea</i> Class: <i>Malacostraca</i> Order: <i>Decapoda</i>	Somewhat sensitive	Omnivore: Shreds plants and decomposing plants; eats snails, insects, small fish, and fish eggs	<ul style="list-style-type: none"> <li>• Has large claws good for shredding food and for self-defense</li> <li>• Can regrow a leg if it is severed</li> <li>• Has gills to take in oxygen</li> </ul>	<ul style="list-style-type: none"> <li>• Lives 2 to 8 years</li> <li>• Spends whole life in water</li> <li>• Molts (sheds skin) several times as it grows to make a bigger shell</li> </ul>	<ul style="list-style-type: none"> <li>• Eaten by fish, snakes, raccoons, people</li> <li>• Their shredding helps break things down, making smaller pieces for smaller animals.</li> </ul>
<b>Dragonfly</b>	Kingdom: <i>Animalia</i> Phylum: <i>Arthropoda</i> Subphylum: <i>Atelocerata</i> Class: <i>Hexapoda</i> Subclass: <i>Insecta</i> Order: <i>Odonata</i>	Somewhat sensitive	Carnivore: Stalks prey or lies in wait and ambushes; eats mayflies and other insects	<ul style="list-style-type: none"> <li>• Has a lower lip like an arm with an elbow and sharp claw, which can be stretched out quickly to grab prey and bring the prey back to its mouth</li> <li>• Has gills to take in oxygen</li> </ul>	<ul style="list-style-type: none"> <li>• Lives 1 to 2 years</li> <li>• Spends egg, larva, and pupa stages in water</li> <li>• Crawls out of the water and sheds its skin to fly away as an adult</li> </ul>	<ul style="list-style-type: none"> <li>• Eaten by ducks, other shorebirds</li> </ul>
<b>Freshwater Clam</b>	Kingdom: <i>Animalia</i> Phylum: <i>Mollusca</i> Class: <i>Bivalvia</i>	Somewhat sensitive	Herbivore: Uses cilia (like moving hairs) to suck water in and filter out algae to eat	<ul style="list-style-type: none"> <li>• Has two shells hinged together, which can open to eat or close tightly for protection from predators</li> <li>• Has gills to take in oxygen</li> </ul>	<ul style="list-style-type: none"> <li>• Lives 1 to 4 years</li> <li>• Spends whole life in water</li> <li>• Female keeps hatched babies in her shell until they grow their own shells.</li> </ul>	<ul style="list-style-type: none"> <li>• Their filtering cleans the water to allow more sunlight to reach larger aquatic plants.</li> </ul>

Common Name	Scientific Name	Sensitivity to Pollution	What It Eats	Interesting Adaptations	Life Cycle Notes	Importance in Ecosystem
<b>Gilled Snail</b>	Kingdom: <i>Animalia</i> Phylum: <i>Mollusca</i> Class: <i>Gastropoda</i>	Sensitive	Herbivore: Uses a sharp tongue on its foot to scrape algae off of plants or rocks	<ul style="list-style-type: none"> <li>• Has gills to take in oxygen</li> <li>• Clings to plants or rocks with its foot so it is not carried away by current</li> </ul>	<ul style="list-style-type: none"> <li>• Lives 2 to 5 years</li> <li>• Spends whole life in water</li> <li>• Female attaches eggs to aquatic plants.</li> </ul>	<ul style="list-style-type: none"> <li>• Eaten by fish, amphibians, birds, crayfish</li> <li>• Scrapes algae off plants so they can get more sun</li> </ul>
<b>Leech</b>	Kingdom: <i>Animalia</i> Phylum: <i>Annelida</i> Class: <i>Hirudinea</i>	Tolerant	Carnivore: Sucks blood or body fluids out of prey, such as insect larvae, worms, snails, and sometimes fish or mammals	<ul style="list-style-type: none"> <li>• Soaks up oxygen all over its body</li> <li>• Has suckers to cling to rocks so it is not carried away by current</li> </ul>	<ul style="list-style-type: none"> <li>• Can live up to 15 years</li> <li>• Spends whole life in water</li> <li>• Hibernates in mud in winter</li> </ul>	<ul style="list-style-type: none"> <li>• Eaten by fish, newts, salamanders, snakes, birds</li> </ul>
<b>Lunged Snail</b>	Kingdom: <i>Animalia</i> Phylum: <i>Mollusca</i> Class: <i>Gastropoda</i> Subclass: <i>Pulmonata</i>	Tolerant	Herbivore and detritivore: Scrapes algae from plants, collects decomposing plant particles	<ul style="list-style-type: none"> <li>• Has lungs instead of gills, so it comes to the surface and carries a bubble of air back down in its shell to breathe</li> </ul>	<ul style="list-style-type: none"> <li>• Lives 1 year</li> <li>• Spends whole life in water</li> </ul>	<ul style="list-style-type: none"> <li>• Eaten by fish, amphibians, birds, crayfish</li> <li>• Scrapes algae off plants so they can get more sun</li> </ul>
<b>Mayfly</b>	Kingdom: <i>Animalia</i> Phylum: <i>Arthropoda</i> Subphylum: <i>Atelocerata</i> Class: <i>Hexapoda</i> Subclass: <i>Insecta</i> Order: <i>Ephemeroptera</i>	Sensitive	Herbivore and detritivore: Scrapes algae, collects and filters decomposing plant particles and algae	<ul style="list-style-type: none"> <li>• Has gills to get oxygen</li> <li>• After last molt in the water, it uses its shed skin as a raft to float on while its wings dry to fly.</li> </ul>	<ul style="list-style-type: none"> <li>• Lives for 1 year</li> <li>• Spends egg, larva, and pupa stages in water</li> <li>• Sheds skin (molts) many times—up to 27 times before it leaves the water</li> </ul>	<ul style="list-style-type: none"> <li>• Is a favorite food of fish</li> <li>• Eaten by carnivorous stream macroinvertebrates</li> </ul>
<b>Stonefly</b>	Kingdom: <i>Animalia</i> Phylum: <i>Arthropoda</i> Subphylum: <i>Atelocerata</i> Class: <i>Hexapoda</i> Subclass: <i>Insecta</i> Order: <i>Plecoptera</i>	Sensitive	Carnivore: Prey includes midges, mayflies, blackflies, caddis flies, beetles, moths, crustaceans, and other stoneflies.	<ul style="list-style-type: none"> <li>• Can do pushups to move water across its gills when it needs more oxygen</li> </ul>	<ul style="list-style-type: none"> <li>• Lives 1 to 3 years</li> <li>• Spends egg, larva, and pupa stages in water</li> </ul>	<ul style="list-style-type: none"> <li>• Eaten by ducks, fish, carnivorous stream macroinvertebrates</li> </ul>

