

## Aquatic Ecosystem Exploration

**Time:** 2-4 class periods spread out two days

**National Benchmarks:** Benchmarks 5A: Diversity of Life; 5D Interdependence of Life; 5E: Flow of Matter and Energy; 9B:Symbolic Relationships; 9D:Uncertainty; 12B:Computation and Estimation; 12D:Communication Skills; 12E:Critical-Response Skills.

**National Science Content Standards:** *Science as Inquiry: A*; *Life Science: C*: Biological Evolution; The Interdependence of Organisms; Matter, Energy, and Organization in Living Systems; *Science and Technology: E*: Abilities of Technological Design; Understandings about Science and Technology; *Science in Personal and Social Perspectives: F*: Population Growth; Natural Resources: Environmental Quality; Natural and Human-induced Hazards; Science and Technology in Local, National, and Global Challenges

**New York State Standards:** 1, 2, 4, 5, 6, 7

**Objective:** Students will know how an aquatic ecosystem works and be able to collect representative organisms, identify the organism and its trophic level, and create a food web of a local aquatic ecosystem.

**Lesson Outline:**

1. Students visit a local stream, pond, creek, or river and collect macroinvertebrates
2. Students sort macroinvertebrates and identify each species using a dichotomous key
3. Students decide on trophic levels and construct a possible food web for their ecosystem

**Materials:**

**Day 1:** nets, waders, collecting trays, magnifying glasses, collecting jars, permanent markers, tweezers, strainers, macroinvertebrate keys, isopropyl alcohol (if you need to preserve the animals for the next class period)

**Day 2:** dissecting microscopes, lights, Petri dishes, magnifying glasses, reference keys, tweezers, pipette

**Engagement:** Students should already be excited and interested in the field trip. You can use a pond, stream, river, or creek. Remind students of appropriate safety precautions. Look for a pond that has emergent vegetation along most of its shoreline, floating plants, dragonflies, frogs and a minimum of invasive exotic species such as common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*). Most streams and creeks will have a good representation of macroinvertebrates. Unless you or your institution owns the habitat, be sure to obtain permission of the landowner to access the property and collect organisms.

**Exploration:**

**Day 1:** Divide the class into groups of three or four students and provide each group with a data sheet, a macroinvertebrate key, and some supplies. At least one student in each

group will need to wade in the water in order to sample its biodiversity. It is best to obtain one pair of waders per group. If waders are not available, the students should be told to wear shorts and bring a hand towel and an old pair of sneakers to class. After the introduction give the students time to observe the ecosystem and record their group's observations on the data sheet. This information will be needed later to develop the aquatic food web.

Tell the students that one of the goals of this lab is to sample the biodiversity of the pond and to make a comprehensive list of all the organisms in the aquatic ecosystem. Ask them how they would do this for fish and emergent plants. Tell the students that in the time allotted it is not possible to systematically sample all the organisms, so today's lab will focus on macroinvertebrates, which are often important indicators of water quality.

Following the instructions in the lab handout, demonstrate how to use the aquatic net, emphasizing the need to keep the flat edge of the frame near the bottom. Dump the catch in a tray and show the students how to find and collect the animals. There is a tendency to overlook small things. Be sure that they understand that they need to put each different kind of invertebrate in a different container. Give the students as much time as possible to do their share of the sampling for aquatic organisms.

The lab handout instructs that students to count and record the number of organisms of each type and to save two or three of each in a small amount of water. Encourage them to count carefully. The numbers are important for the next lab.

If possible, keep the animals alive for the beginning of the identification part. This helps because the students can see how they behave normally. Then, the water can be removed from the jars and replaced with 70% ethanol or isopropyl alcohol to preserve the specimens. Pouring the collection through a small dip net or cheesecloth prevents the loss of small organisms.

**Day 2:** After students have returned to the lab and can sort their organisms, introduce the use of a dichotomous key by using one of the larger specimens. Some couplets in the key may need explanation. The students do not generally seem to realize that the hard outer coatings of beetles are actually "wings," and they tend not to recognize "wings hard and shell-like." Similarly, beak-like mouthparts are hard to see and wing pads and developing wings are difficult to recognize. Pointing out these features and/or providing pictures reduces errors in using the key.

Students will probably not be able to identify everything they collected. A few unidentified few specimens should be expected and it will not make a difference in the results when the class data are pooled for analysis.

**Explanation:** Students should be reminded of trophic levels and the relationship between organisms in a food web. If necessary, review these concepts as a class. Once students have completed their survey of the organisms, they should report their results on the board. All students are responsible for the class data, from which they can calculate relative abundance. Do one together as an example. Discuss the concepts of abundance/numbers, diversity, richness and dominance. Despite efforts to get a representative sample of macroinvertebrates, the collection may contain too many predators, especially dragonfly and damselfly nymphs and water boatmen. These organisms may be overrepresented because they are big and easy to collect. Ask the students to think about the class data and the relative abundance of the different trophic

levels. Primary consumers (herbivores) are usually more abundant than secondary consumers (predators).

**Extension:** Students can use a compound microscope to look at a drop of water under magnification and attempt to extrapolate the number of organisms in the entire sample based on what they see.

**Evaluation:** All students will complete a lab report.

**Comments:**