

# Micro Odyssey

**Adapted from:** “Micro Odyssey” in Project WILD Aquatic. Council for Environmental Education, 1992.

**Grade Level:** all

**Duration:** up to 3 periods

**Setting:** classroom and laboratory (optional step at field site)

**Summary:** Students draw microorganisms that they observe in pond water and learn about their roles in the aquatic ecosystem.

**Objectives:** Students will identify forms of microscopic life (phytoplankton and zooplankton) that live in water and describe the interrelatedness of various aquatic plants and animals.

**Related Module Resources:**

- “Sinking Slowly” Activity
- Video: World of Protozoa
- Books: about Plankton
- Poster: Protists
- Microscope Slides: algae, protozoa

**Vocabulary:** plankton, zooplankton, phytoplankton, protozoa

**Materials (Included in Module):**

- Magnifying glasses
- Brock microscopes
- Plankton net

**Additional Materials (NOT Included in Module):**

- Art supplies (paints, poster paper, markers, etc.)
- Additional microscopes

## ACADEMIC STANDARDS (ENVIRONMENT AND ECOLOGY)

### 7<sup>th</sup> Grade

4.1.7.C Explain the effects of water on the life of organisms in a watershed.

- Identify organisms that have aquatic stages of life and describe those stages

4.1.7.D Explain and describe characteristics of a wetland.

- Recognize the common types of plants and animals

4.3.7.C Explain biological diversity.

- Explain the complex, interactive relationships among members of an ecosystem

4.6.7.A Explain the flows of energy and matter from organism to organism within an ecosystem.

- Explain energy flow through a food web
- Identify niches for producers, consumers and decomposers within an ecosystem

4.7.7.A Describe diversity of plants and animals in ecosystems.

- Select an ecosystem and describe its different plants and animals.

### 10<sup>th</sup> Grade

4.1.10.C Describe the physical characteristics of a stream and determine the types of organisms found in aquatic environments

- Identify terrestrial and aquatic organisms that live in a watershed

4.7.10.A Explain the significance of diversity in ecosystems.

- Explain the role that specific organisms have in their ecosystem

### 12<sup>th</sup> Grade

4.6.12.A Analyze the interdependence of an ecosystem.

- Analyze the relationships among components of an ecosystem

## BACKGROUND:

Have you ever looked closely at a container of pond water and noticed small creatures moving around in it. Almost like dots in the water, there is a whole world of microorganisms that live in waterways - the world of plankton. **Plankton** are small marine and freshwater organisms that live near the surface of the water. While most are microscopic, some plankton are visible with the naked eye. There are two types of plankton- phytoplankton and zooplankton.

**Phytoplankton** are generally singled celled organisms (plants), although some species form cooperative colonies and chains or strands called filaments. They contain chlorophyll and photosynthesize their own food. Because they create their own food, phytoplankton are known as producers, and they provide the first link in the aquatic food chain. There are three main types of phytoplankton- blue-green algae, green algae, and diatoms.

Blue-green algae derive their name from a bluish pigment that is present in their cells, however they can also have a reddish or yellowish tint. Like other species of algae, their cells also contain chlorophyll. Blue-green algae exist as unicellular organisms and also in colonies or filamentous (bunch of single cells clinging together in strands or chains). They thrive in warm, slow moving water and form large, foul smelling blooms in mid to late summer. The onset of these blooms occurs when nitrogen and phosphorus levels in the water increases. As with any algal bloom, a large amount of oxygen is depleted as the algae decompose, which also produces excess carbon dioxide. These changes in the oxygen/carbon dioxide levels can have adverse effects on other organisms such as macroinvertebrates and fish.

Green algae are so named because of the chlorophyll contained in their cells. These algae are typically found in large colonies or chains. They too can form large blooms. Some examples of green- algae are Spirogyra which form chains, Volvox which form a radial colonies, and Euglena which propel themselves through the water with a flagellum.

Diatoms are organisms found mostly in lakes that are encased in intricate silica shells. These shells do not decompose after the diatom has died, so they sink and accumulate on the lakebed or riverbed, forming layers of sediment. These sedimentary layers can be studied to determine a lake's history and can also be used in fossil fuels. Diatoms contain chlorophyll and produce their own food. They occur in the greatest numbers in spring and early summer. Asterionella is a common diatom, along with Navicula, and Tabellaria.

**Zooplankton** consist of protozoa, small crustaceans, jellyfish, worms, mollusks, and also the eggs and larvae of aquatic animals. **Protozoa** are one-celled organisms that lack chlorophyll, so they must catch their own food and thus are considered consumers. Zooplankton are most abundant in fertile waters where phytoplankton is abundant. Examples of zooplankton that are commonly found include- water fleas (Daphnia), Copepods, and Hydras.

Water fleas or daphnia (class Crustacea, order Cladocera) are small organisms that propel themselves through the water column using five pairs of legs. These legs also move water past the mouth so the daphnia can filter out phytoplankton to eat. Most daphnia only live for a few weeks but some may live as long as 100 days. During this time daphnia may reproduce in one of two ways. The first method is through parthenogenesis (ovum matures without being fertilized). These eggs undergo development in a "brood chamber" and can be seen inside the daphnia under a microscope. They hatch as fully developed young, usually females. This usually occurs during warm months so the eggs are sometimes referred to as "summer eggs". The second method of reproduction is to create winter or resting eggs. The resting eggs are produced during times of environmental stress due to decreases in food abundance, primarily in the fall. These eggs may then be laid on the underside of a hard surface, even under the ice. The attached eggs must be fertilized by a male in order to fully develop. Studies have shown some eggs to remain dormant for up to 20 years before getting fertilized. Daphnia are commonly found in the open water of lakes, ponds, and shallow waterways.

Copepods (class Crustacea, order Copepoda) are small teardrop shaped organisms that have antennae extending from the anterior portion of their body. These slow growing organisms are common year round and sustain themselves by feeding on phytoplankton or small zooplankton. Copepods generally reproduce once annually, during this time females may be seen carrying egg sacs on the outside of their abdomen. Copepods are most likely to be found in quiet waters among emergent vegetation.

Hydras (class Hydrozoa) are close relatives of jellyfish and consequently have a hollow stalk that is attached to six or more stinging tentacles that are used to paralyze passing prey such as daphnia and copepods. Hydras are most abundant during the late spring and early summer in the still waters of unpolluted creeks or lakes. These organisms prefer to live in slightly alkaline waters where they attach to aquatic vegetation and submerged objects. Hydras may reproduce either asexually through budding or sexually through mating.

Plankton form the foundation of aquatic life. Phytoplankton are the primary producers that provide the first link in the aquatic food chain. Zooplankton depend upon the phytoplankton for food, but the zooplankton are then eaten by larger organisms, such as macroinvertebrates and fish prey, these are in turn eaten by larger fish, reptiles, amphibians, and mammals that provide the upper trophic levels that we commonly see. Without the microorganisms the aquatic ecosystem would collapse.

**OVERVIEW:** Students draw microorganisms that they observe in pond water and learn about their roles in the aquatic ecosystem. Students will use magnifying glasses and microscopes and numerous books about aquatic life.

**PROCEDURE:**

1. Use the plankton net to collect samples of pond water. Instructions for using the plankton net can be found in the Test Kit Instruction Section of the Module Resource Guide. Sample collection can either be done by the teacher prior to class or as a class field trip. Keeping the samples in one or two gallons of water should provide adequate space for the organisms to live comfortably.
2. Have students remove some of the pond water from the larger sample. **\*\*Note-** Be sure they take their sample from throughout the container and not just at the surface, and make sure students check any vegetation for clinging zooplankton. **\*\***
3. Next, students should examine their samples – do they see any microorganisms moving around? Any small vegetation or algae. Students can use hand lenses and microscopes to further examine their sample. Have students note the differences in what they observe between the different powers of magnification. Have the students make sketches of the organisms they observe. They should note how the organisms appear and move.

4. After they have sketched an organism or two, have the students pick a "favorite organism" and encourage them to construct a more detailed drawing of that life form. Students should strive for detail and accuracy in portraying the organism.
5. Now the students should identify the organism they drew. Have them research the characteristics and habitat of their subject and summarize their findings in one or two paragraphs. This information can be found in aquatic/pond life field guides and books.
6. After the students have completed their larger drawings and accompanying research papers, students could create a class mural of the pond and its aquatic environment. The drawings could be displayed on the mural in the habitats in which these organisms would naturally be found. The written reports should be displayed near the mural.
7. If possible, return any unused sample water to the pond from which it was obtained.

### **DISCUSSION:**

While putting the mural together, talk about where the different organisms should be placed. Which animals should be shown preying on others? Where should the plants be placed? If necessary each student could do some additional research to discover more about their animal or plant, its role in the aquatic system, and other items of interest.

You may want to create a list of other common zooplankton if only a few kinds were found.

You may want to review the difference between plankton, phytoplankton, zooplankton and protozoa. They are different. *See background section.*

What role does phytoplankton play in an aquatic ecosystem? *It is a first link in many aquatic food chains by being food for some filter-feeding aquatic macroinvertebrates, mussels, zooplankton, and some fish. Phytoplankton also produce oxygen.* What might happen if something eliminated the phytoplankton from a pond (perhaps a herbicide was added)? *It would affect the food chain.*

### **EVALUATION:**

- Draw a simple illustration of one or more pond organisms, such as: daphnia, euglena, hydra, spirogyra, rotifer, water mite. Your drawing should include labels of the organism's anatomy as well as information on the characteristics and habitat of that organism.
- Identify each of the organisms in the list above as a producer, consumer, or decomposer.
- Construct an aquatic food web that might be found in a pond using at least three of the organisms listed above.

**EXTENSIONS AND MODIFICATIONS:**

- Divide the class into "crews" and encourage them to think of their completed research as a microsubmarine dive. Have each crew create a detailed log of their journey through the microworld, complete with written descriptions, illustrations, maps, etc. Encourage them to be creative in compiling these logs. Remember that they are to act as if they were microsized. After every crew's log is complete, the crews should exchange logs. Using the logged information, each crew should decide what could be improved for the crew and craft before their next journey. Encourage students to make drawings from their written descriptions of a few micromonsters.

**NOTES (TEACHERS, PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE):**

Activity Version: October 2001
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