Activity: **Microscopes**

Grade Level: Grade 5

Major Emphasis: Salt Water Habitat

Major Curriculum Area: Science

Related Curriculum Objectives:

Refer to Outdoor Education Curriculum Matrix 3-5:
- Career Education
- Mathematics
- Language Arts
- Social Studies

Program Indicator:

The students will compare/contrast habitats and adaptations of plant and animals in salt water (brackish) habitat.

Student Outcomes:

The student will be able to:

-Use a microscope to identify the adaptations of aquatic organisms.

Readiness:

1. Complete the fifth grade Unified Science Unit - Aquatic Biomes.
2. Introduce vocabulary:

habitat	variables	estuary
depth	salinity	sediments
pH	nekton	phytoplankton
zooplankton	micro-organisms	macro-organisms
clarity	wetland	brackish

3. Discuss basic ingredients for life: food, light, air and water.
4. Discuss variables that affect the plants and animals living in various environments.
5. Introduce and explain how to use the following pieces of equipment:

microscope	secchi disk	depth line
aquatic net	seine net	water sampling bottles
thermometer	bottom dredge	water test kits
plankton net		

Estuary Explorer Microscope Activity

1. Before students arrive, get PFDs from boathouse, enough for all students, instructor and chaperone.
2. Seat students in the lab for introduction. Welcome them to the microscope activity. Have a student read the outcome poster (The student will be able to use a microscope to identify the adaptations of aquatic microorganisms). Have students define adaptation (*a behavior or structure that helps a living thing survive in its environment*), aquatic (*lives in water*), and microorganism (*very small living thing*).
3. Explain that they are going to collect water samples from three places and look at them under the microscope:
    a. Severn River, which is a brackish water environment (mixture of fresh water and salt water; salty water from Chesapeake Bay and fresh water from streams)
    b. Bog or Pond, which is a fresh water environment.
    c. Oyster scrapings; taken from the oyster shells in the milk crate at the end of the pier in the Severn.

You will see two kinds of microscopic living things:

- Phytoplankton which, like plants, produce their own food using energy from the sun through the process of photosynthesis.
- Zooplankton which get energy from eating phytoplankton; the zooplankton become food for other, larger organisms. In general, you can recognize the zooplankton by movement.

4. Use "Plankton Puzzle" on bulletin board to show these relationships.
5. Review parts and use of microscope with "Micro Magic" display, using "e" slides (See Supplement B).
6. Pair students up; give each pair a small sample jar and plankton tow. Take students to waterfront to collect samples (See Supplement A). All students and adults should wear PFDs.
7. While chaperone supervises group at waterfront, take two students to end of pier to take scraping from oyster basket.
8. Take students to the bog to collect bog sample.
9. Return to lab and have students prepare slides. Observe river, bog, and oyster samples, then draw and identify three organisms from each sample and their adaptations (See Supplement D).
10. Allow time at the end for review and cleanup. Have students rinse slides and sample jars.

Review:

1. Three types of water environments observed? (brackish river, freshwater bog and oyster scraping.)
2. Two types of organisms? (Phytoplankton and Zooplankton.)
3. How does each get energy? (Phytoplankton gets energy from the sun through photosynthesis and zooplankton gets energy by eating phytoplankton.)
4. The rest of the food chain? (Larger organisms eat zooplankton.)
5. How can you be a Chesapeake Steward and help the plankton living in the Chesapeake Bay watershed? (See Chesapeake Steward discussion questions.)

Chesapeake Stewards Discussion Questions
Grade 5 Microscopes

Here at Arlington Echo, we are learning how to be Chesapeake Stewards who protect the Chesapeake Bay, its watershed and the other living things that we share it with.

In this activity, we learned about plankton. Plankton are an important part of the food chain of the Chesapeake Bay. That means other living things depend on plankton for their food.

How can Chesapeake Stewards protect water quality to help these microorganisms survive?

- *Reduce runoff and erosion with rain barrels, rain gardens, and bogs*
- *Use less lawn fertilizer, pesticides or weed killer (or none at all)*
- *Dispose of oil, paint, and chemicals properly; no dumping in storm drains or household drains*
- *Use phosphate-free cleaning products*
- *Clean up pet waste*
- *Plant more trees*

These are ways to clean the air, which also reduces water pollution:

- *Compost*
- *Recycle*
- *Reduce energy use*

Sampling Procedures

Plankton Tow

Materials: plankton nets, sample jars

Procedure:

1. Throw plankton net into the water.
2. Pull the net back toward you or move along the bulkhead with the net submerged just below the surface.
3. Pull the net slowly so the sample does not spill from the collecting tube.
4. Do not allow the net to sink to the bottom, to prevent getting a sample tube of mud or sand.
5. Make sure the net is towing properly with the collection tube extending behind it.
6. To concentrate your sample, repeat the procedure at least ten times. The sample will become concentrated at the end of the tube.
7. Place the sample jar upside down in the plankton net. Turn the net upside down and allow water from the tube to fill the jar.

Oyster Scrapings

Materials: trowel, sample jar, squirt bottle

Procedure:

1. Pull up oyster crate at end of pier.
2. Using the trowel, gently scrape any encrusted material from oysters.
3. Gently rinse the trowel with the squirt bottle into the sample jar.

Bog/Pond Water Sampling

Materials: sample jar, pole with cup on a string

Procedure:

1. Take sample jar and pole to bog.
2. Scoop water from bog.
3. Pour water sample into sample jar.

Procedure for the Use of the Zoom Microscope

Practice with Letter e Slide

1. Clip letter "e" slide onto stage. Make sure the letter "e" is over the hole in the stage.
2. Start with the lowest power adjustment, 4X (red). Total magnification 10X (eyepiece) x 4X (objective) = 40X.
3. Look through the eyepiece until light can be seen. (If no light can be seen, check dial under stage; rotate until largest hole is under the stage.)
4. Adjust the focus knob until letter "e" is clearly in view.
5. Turn objective to next higher (10X) power to see it bigger. Total magnification 10X (eyepiece) x 10X (objective) = 100X.

Looking at Water Samples

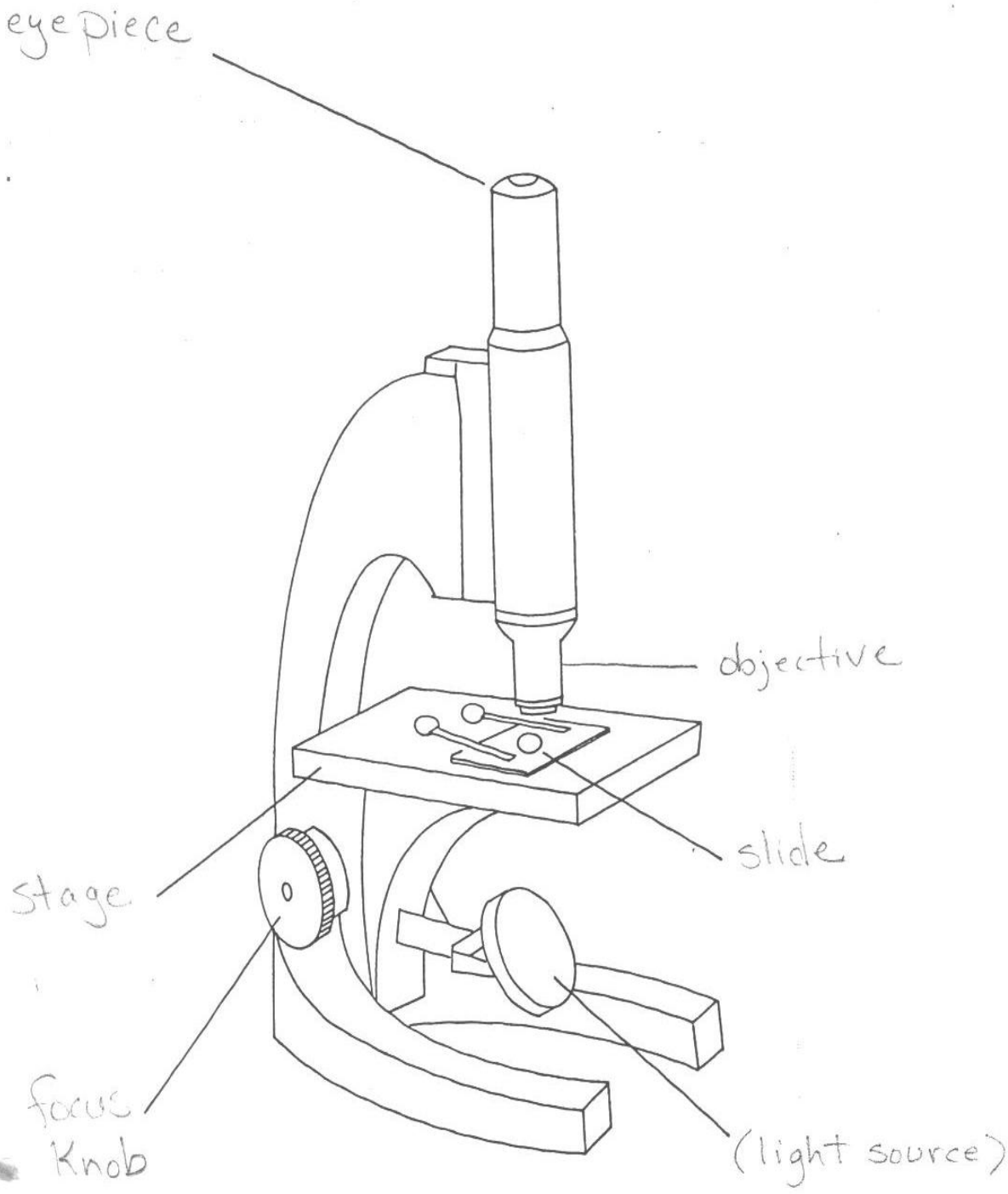
1. Run your finger over the slide to make sure that the concave side is up.
2. Place a small drop of the sample onto the slide with an eyedropper.
3. Clip the slide onto stage. Make sure the specimen on the slide is over the hole in the stage.
4. Start with the lowest power adjustment, 4X. Total magnification 10X (eyepiece) x 4X (objective) = 40X.
5. Look through the eyepiece until light can be seen. (If no light can be seen, check dial under stage; rotate until largest hole is under the stage.)
6. Adjust the focus knob until the specimen is clearly in view.
7. Move the slide around on the stage to locate the specimen.
8. After observing and drawing organisms, rinse slides repeat procedure with other water samples.
9. To observe larger specimens, use petri dish.

Demonstration Microscope

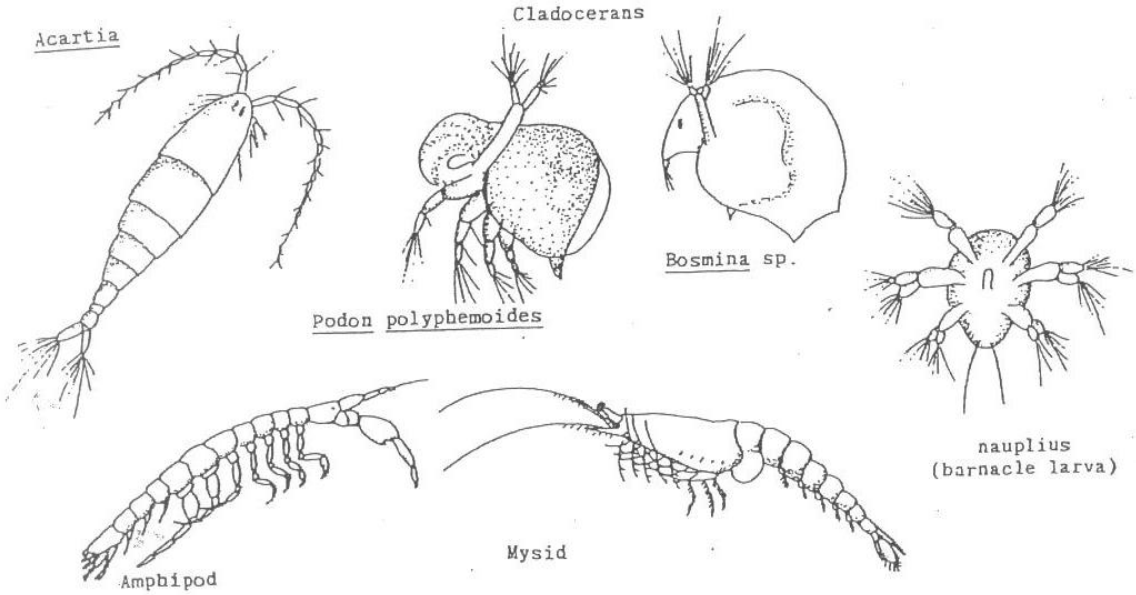
1. Turn on TV with remote.
2. Turn on microscope.
3. Turn on "Clear One" microscope camera.

View letter "e" slide and slides prepared by students.

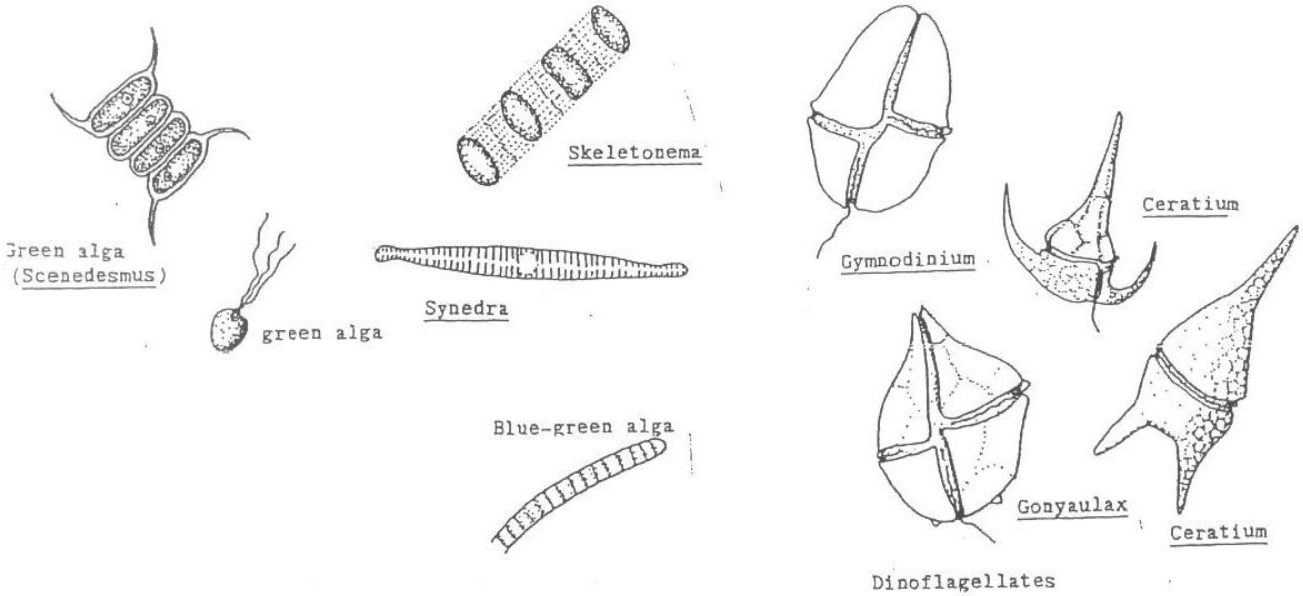
Parts of the Microscope

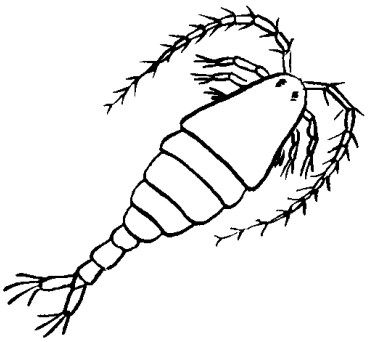


Common Zooplankton of the Chesapeake Bay



Common Phytoplankton of the Chesapeake Bay





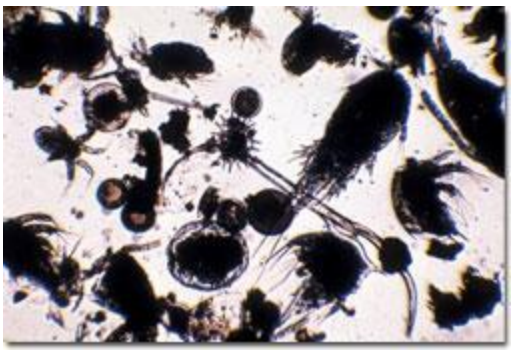
Micro-Organisms
Salt Water Adaptation

Name of Organism/ Water type	Sketch of Organism	Adaptive features which enable the animals to move, eat and protect themselves

Parent Take Home Sheet

Plankton

Plankton are free-floating, generally microscopic plants, animals and bacteria that are part of the lower food web. They generally have limited or no swimming ability and are transported by tides and currents. The name *plankton*, like the word *planet*, is derived from a Greek root that means "wanderer."



Plankton can be divided into three major classes:

- Phytoplankton, or algae, are planktonic plants.
- Zooplankton are planktonic animals
- Bacteria and viruses.

Why are plankton important?

- Plankton communities serve as the base of the Bay food web, supporting fish, shellfish and other upper level trophic organisms (trophic level means feeding level). All fish and shellfish depend on plankton for food during their larval phases, and some species continue to consume plankton their entire lives.
- Plankton are often used as indicators of environmental and aquatic health because of their short life span and high sensitivity to environmental change.

Phytoplankton

Phytoplankton (fahy-tuh-plangk-tuhn) are tiny, single-celled plants. They are the primary producers of food and oxygen in the Bay food web. Like plants on land, phytoplankton need light to go through photosynthesis. Because of this, the largest concentrations of phytoplankton are found near the surface of the water.

Major groups of phytoplankton in the Bay include:

- Diatoms
- Golden brown algae
- Green algae
- Blue-green algae
- Dinoflagellates
- Cryptomonads
- Microflagellates

Excess phytoplankton due to nutrient over-enrichment is one of the primary causes of poor water quality in the Bay. Phytoplankton multiply rapidly when water temperatures rise in the presence of excess nutrients. These “algae blooms” typically begin to occur each spring, as rain storms and melting snow wash excess nutrients into the Bay.

While increased amounts of phytoplankton provide more food for organisms at higher trophic levels, too much phytoplankton or toxin-producing phytoplankton can harm the overall health of the Bay. When algae blooms occur, most of the phytoplankton are left uneaten by fish and shellfish, so they die and sink to the bottom. There, they are decomposed by bacteria in a process that depletes bottom waters of dissolved oxygen needed to sustain all aquatic life. Algae blooms also block sunlight from reaching underwater bay grasses.

Zooplankton

Zooplankton (zoh-uh-plangk-tuhn) are planktonic animals that range in size from single-celled protozoa to larger jellyfish and comb jellies. One gallon of water can contain more than a half-million zooplankton.

The zooplankton community is composed of both primary consumers, which eat phytoplankton, and secondary consumers, which feed on other zooplankton.

- The smallest zooplankton are recyclers of water-column nutrients and are often closely tied to measures of nutrient over-enrichment.
- Larger zooplankton are important food for forage fish species and larval stages of all fish. They also link the primary producers (phytoplankton) with larger or higher trophic level organisms.
- Zooplankton also feed on bacteria and particulate plant matter.
- Copepods—tiny crustaceans about one millimeter long—are the most abundant type of zooplankton.
- Tiny larvae of fish and invertebrates, which feed on copepods, are also considered zooplankton. Although this planktonic stage is only temporary, larvae are a significant part of the zooplankton community because they are a food source for larger animals.
- Nearly all fish depend on zooplankton for food during their larval phases, and some species continue to eat zooplankton their entire lives. One herring may consume thousands of copepods in a single day.

Zooplankton are distributed according to salinity and the availability of phytoplankton, their main food source. Like phytoplankton, zooplankton make excellent indicators of environmental conditions within the Bay because they are sensitive to changes in water quality. Scientists can get a good picture of current Bay conditions by looking at the amount, populations and the number of different species of zooplankton.

Bacteria

Bacteria play an important function in the Bay.

- They are the decomposers, breaking down dead matter. Through this process, nutrients in dead plant and animal matter again become available for growing plants.
- Bacteria are food for zooplankton and other filter-feeding organisms in the Bay.

Some bacteria are residents of the Bay; others are introduced through various pathways, including human sewage and polluted runoff from the land.