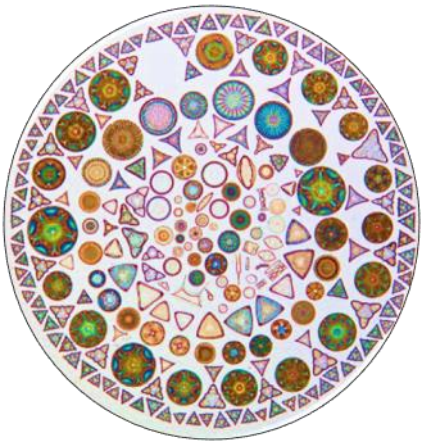
Lesson: Microorganism Discovery



Environmental Literacy Question: How have humans affected the Chesapeake Bay and its watershed?

Topic/Essential Question: "How can we reduce our energy use and help the environment?"

Unit/Lesson Sequence: One of two lessons in the "Water" 4th grade module based at Arlington Echo Outdoor Education Center. Possibly an inclement weather activity.

Content Standards:

Environmental Literacy

- 4.A.1.b. Explain and demonstrate food webs for a particular environment.
- 5.A.1. Analyze the effects on human activities on earth's natural processes.
- 6.A.1. Identify and describe natural changes in the environment that may affect the health of human populations and individuals.

Science

- 3.D.1.b. Explain that the characteristics of an organism affect its ability to survive and reproduce.
- 4.F.1.a Identify and describe the interactions of organisms present in a habitat.

Length of Lesson: 45 minutes (times subject to change based on arrival to AE)

Student Learning Outcome: The student will discover the important role that microorganisms play in a healthy aquatic food web and will gain technical skills in operating a microscope and plankton tow.

Knowledge of the Learner:

- Prerequisite knowledge, skills, and processes: Some classroom experience using a microscope. An understanding of the idea that there are living things too small to see without the aid of a microscope.
- Student needs, interests, previous learning: These will be determined during the Engage section.
- Conceptual difficulties: Understanding that plankton, which are so small that we can't see them without a microscope, have an enormous impact on every aquatic ecosystem.
- Differentiated: This lesson reaches multiple types of learners. Logical/mathematical and visual learners will benefit from the food web poster activity. Kinesthetic and naturalist learners should do well with the hands-on collection of plankton and using the microscopes.

Knowledge of Content

Vocabulary:

Microorganism	Phytoplankton	Zooplankton
Food Web	Carbon	Plankton tow

Materials:

Plankton word cards	Plankton identification sheets
Food web poster	Sheldon Plankton (from SpongeBob)
Copepod Plush Toy	Plankton tows
Sample jars	Toothbrushes
Squirt bottle	Prism microscopes
Plastic slides	Pipettes
Flashlights	Prepared slides

Supplements:

A: Engage Discussion Points and Questions
B: Background Information
C: Microorganism Sampling Procedures
D: Proper Use of Prism Microscopes
E: Evaluation Discussion Questions

Lesson setup

Arlington Echo staff will help set up the materials during your morning training session.
- Outside Location: Picnic tables near waterfront.
- Inside Location: Resource Lab.

Pick up one PFD per instructor from the boathouse. Set up the microscopes on the tables (one microscope per student). Place a blank plastic slide on each microscope. Place prepared slides on extra microscopes. Have sample jars, pipettes, a toothbrush, and squirt bottle ready for oyster shell sampling.

Instructional Delivery

Engage: Pre-Assessment Discussion

Welcome the students to the activity and introduce yourself. Tell the students that they are going to explore the world of microscopic organisms and discover why they are important to the health of the Chesapeake Bay.

- Ask the students if they can tell you anything about microorganisms. Encourage the conversation by asking the questions found in **Supplement A**.
- Ask them what they know about plankton. Show them the plush toy of Sheldon Plankton, a character from 'SpongeBob'.
- Use the plankton word cards as visual aids to help students guess characteristics of the two categories of plankton: phytoplankton and zooplankton. (**Supplement A**: Discussion Points and Questions and **Supplement B**: Background Information)

Explore: Plankton Collection and Observation

- Using the poster, review why plankton are so important to our land and water.
- If able to go outside, have students put on PFDs.
- Bring the group to the waterfront. Demonstrate how to use the plankton tows (**Supplement C**).
- Students may work in pairs for this activity. Allow each group ample time to tow on the water's surface and get an adequate sample of water.
- While down at the waterfront, students can also take a sample from the mock oyster reef. (**Supplement C**). Make sure to take this jar with you so multiple students can derive samples from it.

Explain:

- Bring the students back to the tables. Demonstrate to the students how to use the pipettes to put a sample from the jar onto the slides (1-2 drops).
- Explain how to use the microscopes. Students should be on the 10x magnification (red lens) when using the microscopes stationed inside the Resource Lab. Ask chaperones to help students focus their microscopes (**Supplement D**).
- Have students use the plankton identification sheets to identify different types of phytoplankton and zooplankton. If a slide doesn't appear to have any plankton, student can be given a fresh sample. Instructor can also use prepared slides to supplement. Just inform students that the samples have been colored to highlight the specimen - they are not really pink/blue.

Elaborate: Understanding the importance of plankton in the Bay

- Ask the students why plankton are crucial to the health of the river and the Chesapeake Bay as a whole (**Supplement A**).
- Ask the students what happens to the zooplankton if the phytoplankton dies. Continue doing this for all of the organisms on the poster. Go further and ask which land animals depend on the water *(humans, seagulls, eagles, bears, etc.).*

Evaluation: Debrief and Discussion

Ask the students the questions found in **Supplement E** to review what they have learned about plankton and to emphasize the importance of plankton in the Chesapeake Bay and other bodies of water.

Notes for Clean up

Please clean, organize and return the lesson materials to their proper locations at the end of the day. Remember to inform the Arlington Echo Staff if you need assistance or if any materials are damaged or missing.

Notes for overnights:

Remember to set up your materials prior to the morning activities (you will be dismissed early from breakfast). If you do not spend the night, please check in with the Arlington Echo staff assigned to the model and be at your teaching location at least 15 minutes before the activity begins to set up.

Notes for Inclement Weather:

Arlington Echo staff will make an appropriate location decision based on the weather the morning of your trip. We encourage keeping our outdoor activities outdoors—even in the rain—but in the case of severe weather (thunder, extreme cold, etc.), the rain location for this activity will be in the upper Resource Lab (RL). Collect water samples whenever there is a break in the weather.

Supplement A: Pre-Assessment Discussion Points and Questions

Discussion Point/Question	Answer/Direction
What is a microorganism?	• Micro refers to something so small you need a microscope to see it. Organism refers to something that is alive, such as a plant or animal. Therefore, a microorganism is a living thing that you can't see without a microscope.
What are plankton? (Use the PLANKTON card)	• Show Sheldon Plankton (the plush toy from Spongebob Squarepants). Many students have heard the word plankton from the cartoon series. Sheldon Plankton is an antagonist that attempts to steals the recipe for Crabby Patties. • "Plankton" comes from a Greek word meaning "to drift." • Plankton are organisms that move in the water with the current, tide, or wind. • An example of a large plankter (singular form of "plankton") is a jellyfish.
There are two different categories of plankton. What category do you think phytoplankton are? (Use the PHYTOPLANKTON card)	• "Phyto" comes from a Greek word meaning light ("photo" like photosynthesis). • Most (but not all) phytoplankton are microscopic plant-like organisms that make their own food using energy from the sun.
What category do you think zooplankton are? (Use the ZOOPLANKTON card)	• "Zoo" (pronounced zō –ō) comes from a Greek word meaning animal. • Most (but not all) zooplankton are microscopic animal-like organisms that consume other plankton for their energy.

Supplement B: Background Information

- Both phytoplankton and zooplankton can only move with the currents and tides, unlike fish, which can swim from one side of the river to the other.

- Plankton and zooplankton are comparable to plants and animals on land. Just like land plants and animals, there are thousands of different kinds of phytoplankton and zooplankton. Different types of habitats have different kinds of plankton.

- Some zooplankton are simple, microscopic organisms for their whole lives. Other zooplankton are the larval (baby) stages of larger organisms like crabs and fish. Sheldon Plankton is a specific kind of zooplankton called a Copepod, and he will always be microscopic.

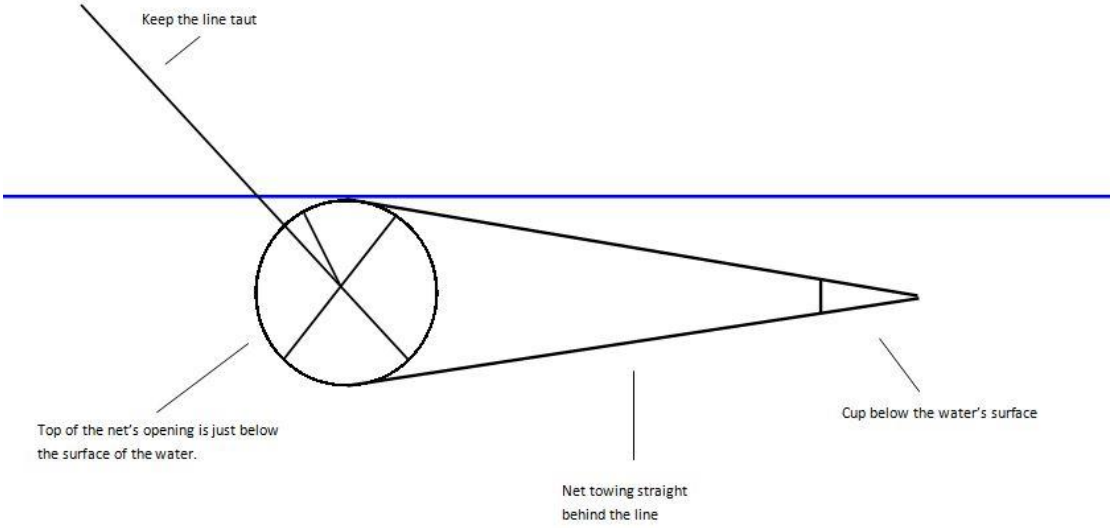
- Jellyfish and sea stars (common name: starfish) are zooplankton.

- When students are looking at organisms, most will look clear, like the pictures. Tell students that phytoplankton can't move very well at all, so if they see something moving across their slides it will be a zooplankton. If the zooplankton seems to be feeding on something, it is most likely feeding on phytoplankton.

Supplement C: Microorganism Sampling Procedures

Materials: plankton tow, sample jar
Procedure:
1. Drop plankton net into the water along the pier or bulkhead. Keep a firm hold on the tow line.
2. Swish the plankton tow back and forth to free any excess air bubbles.
3. Slowly walk 10-15 feet along the pier or bulkhead while towing the line across the surface of the water. Pull tow back and forth ten times (20 times each with partners).
4. Ensure that the top of the net's opening stays just below the water line and the line stays taut.
5. Pull the net in quickly and ensure the tube stays upright so you don't spill the sample.
6. Place the sample jar upside down in the plankton net and push it down as far as it will go.
7. Turn the net upside down and allow water from the tube to fill the jar.

Note that sampling from sunny areas may yield better results. Adjust as needed throughout the day.



Oyster Reef Model
Materials: toothbrush, squirt bottle, sample jar
Procedure:
1. Raise the mock oyster reef from the end of the pier.
2. Pass out the toothbrush, squirt bottle, and sample jar to three students.
3. Pick out an oyster shell and hand it to student with toothbrush.
4. Student should brush the shell over the sample jar while the third student squirts the shell with water.
5. If you don't find much on the shells, you can also brush the sides of the crate.

Supplement D: Proper Use of Microscopes

There are real stained slides of phytoplankton and zooplankton in with your supplies. You can use them to supplement what the students find. The instructor should be the only one to handle them because they are glass slides. Remind students that the slides are stained to show the organisms better. They are not really hot pink!

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 the 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 organisms, rinse slides. Repeat procedure with other water samples.
9. To observe larger specimens, use a petri dish.

Supplement E: Evaluation Discussion Questions

Discussion Point/Question	Answer/Direction
Why are plankton crucial to the health of the river and the Chesapeake Bay as a whole?	• They serve as the base of the food web, providing energy for larger organisms. Some zooplankton can also be the larval forms of larger organisms; including those we like to eat, such as the blue crab and yellow perch. • Phytoplankton absorb carbon dioxide and produce oxygen during photosynthesis. This helps to provide better air and water quality for organisms that need oxygen to survive. • Everyone take two breaths. 1 of those breaths came from plants like phytoplankton in the water.
How does erosion affect plankton?	• Too much sediment can make the water cloudy, eventually burying oysters and other aquatic life. Fertilizers can temporarily boost phytoplankton causing an algae bloom. Pesticides and other toxins can kill off plankton.
How are climate and weather connected to plankton?	• Phytoplankton, just like plants, take in carbon. Without phytoplankton, we have too much carbon released. Having more grasses in our water can help the plankton take in carbon as well. • An increase in CO2 in the atmosphere leads to warming and an increase in acidification of the oceans and other bodies of water, which harms plankton. • Major storm events and runoff wash pollutants and sediment into water, harming plankton. For example, when fertilizer is washed into the water, the nutrients cause an algae bloom that will be broken down by bacteria that use up all of the dissolved oxygen in the water.
As they mention that pollution can kill phytoplankton, take the phytoplankton picture off the poster. What happens to the zooplankton if the phytoplankton dies?	• The zooplankton does not have a food source and dies. Remove zooplankton from the poster.
What happens if the zooplankton die?	• Small fish lose a vital food source and also die. Remove small fish from the poster.
What happens to the large fish if the small fish die?	• The large fish will die from lack of resources. Remove large fish from the poster.
Now the river's food web has fallen apart. Does the disappearance of the river organisms have an effect on the food web on land? How so?	• There are many land animals that depend on the organisms in the water for food such as humans, seagulls, eagles, blue heron, bears, etc. When the rivers food web falls apart, these land animals and birds lose important resources. These animals may die or relocate to a new area where they will have to compete with organisms that already live there.