Lesson: Water's Living Things: Seining and Water Quality Testing

Environmental Literacy Question: How has human land use affected the living things in the Chesapeake Bay?

Topic/Essential Question: How have humans affected aquatic plants and organisms in the Chesapeake Bay Watershed?

Unit/Lesson Sequence: One of three lessons (overnight trip) or one of two lessons (day trip) in the "Water's Living Things" 4th grade module based at Arlington Echo Outdoor Education Center.

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.
  8.F.1.b. Identify actions that can be taken as individuals and those that require the involvement of other people, organizations and government.
- **Science**
  3.F.1.a. Identify and describe the interactions of organisms present in a habitat.
  6.B.1. Recognize and describe that people in Maryland depend on, change, and are affected by the environment.
  3.A.1.b. Classify a variety of animals and plants according to their observable features and provide reasons for placing them into different groups
- **Common Core Standards for English Language Arts Standards-Speaking and Listening-4th Grade**
  Comprehension and Collaboration
  - CCSS.ELA-Literacy.SL.4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.

Length of Lesson: 35 minutes.

Student Outcome: The student will evaluate Indian Creek's suitability as a wildlife habitat based on physical water quality and the abundance of wildlife present.

Knowledge of the Learner:

- Prerequisite knowledge, skills, and processes: The functions of different members of a food web. The understanding that different organisms can tolerate different levels of water quality.
- Student needs, interests, previous learning: These will be determined during the pre-assessment.
- Conceptual difficulties: Understanding how human actions on the land can affect the quality

of the water.
- Differentiated: The lesson will reach different types of learners. Naturalist and kinesthetic learners will benefit from the hands-on experience by using scientific equipment and studying living organisms. Logical/mathematical, interpersonal, and intrapersonal learners will learn by interpreting, reflecting on, and discussing the collected data.

Knowledge of Content:
- Content knowledge for instructor: Provided in the Lesson Plan and Supplements.
- Vocabulary: Turbidity Dissolved Oxygen, Salinity, Producer, Consumer, Sein net, hydrometer, aerator.
- Resources:

PFD for each child and adult
Turbidity tube
Hydrometer
Thermometer
Dissolved oxygen test kit
Seine net
Three (3) dip nets
Waders
Plastic containers for caught specimens
Aerator
Fish fact cards/books
Supplements A- E (Attached to lesson plan)
Indian Creek Water Quality Poster

Lesson setup:
Pick up one PFD per instructor from the boathouse.
Move the waders from the drying rack at the sand spit and lay them along the wood wall were the students can easily find their size and put them on.
Collect the teaching materials from the shed at the end of the pier. Containers, fish fact cards/books, posters, dip nets, seine net, turbidity tube, thermometer and two buckets.
Collect water from the creek in plastic containers to hold collected fish, and set up the aerators.
Put thermometer in the water at end of pier.
Fill one bucket with water for Turbidity and Salinity tests.

Instructional Delivery
Module Introduction: All students and instructors will meet on the Dining Hall patio (outside the dining hall on the right side) for a water safety talk from an Arlington Echo staff member. At this time, everyone will receive PFDs they must keep on for the duration of all three activities (two activities on a day trip).

Pre-Assessment:
The Module introduction will ask questions related to the watershed and How has human land use affected the living things in the Chesapeake Bay?

Motivation/Warm-up
1. Explain the proper procedure for putting on a pair of waders (Sit down. Take off one shoe and slide that foot all the way into the boot of the waders, and then take off the other shoe and repeat. Keep socks off the ground the whole time; this helps keep dirt

out of the waders. Once both feet are in the boots, stand up and pull waders up and over the shoulders. Fasten straps). Make sure PFD's are securely fastened over the waders.

Procedure

2. Divide the students into two groups. One group will focus on seining while the other groups will tests water quality. Halfway through the lesson, the groups will switch. At least one instructor should be in the water with the seiners while the other(s) help the water quality group. Allow 15 minutes for one group to seine while the other tests water quality. Switch and allow 15 minutes to complete the second activity.

For Seining:

3. Discuss the conditions of the water and where the students can and cannot go while they are investigating the water. Guide students into the water, reminding them to take small steps to avoid tripping and NOT TO RUN! Two students will collect specimens with the seine net while three use dip nets in the grasses or near fallen logs.
4. Demonstrate the proper technique for using a seine net (refer to Supplement B). When specimens are caught, assist students in transferring them to a plastic container. Take care to always wet your hands before handling fish. Always pick up crabs from the back, behind their swim fins, to avoid being pinched.
5. Allow all students to have at least one turn with the seine net and dip nets.
6. Give students time to look at what is collected, using fish cards to identify any that were caught. They can also take into account other living things they see around them (birds, such as osprey, plants and animals). If there is a limited catch or if you find anything unusual, keep specimens for next groups just in case they don't find anything.

Assessment:

1. Ask the students to discuss and decide whether or not they think Indian Creek is a healthy habitat for wildlife. Ask them to give a grade to the shoreline. There's no right or wrong answer so long as they can come up with a justification based on what they have observed.

For Water Quality Testing: Students will perform 4 water quality tests: Dissolved Oxygen, Turbidity, Salinity, and Temperature. (refer to Supplement A)

2. Have students open their journals to page "Arlington Echo Waterfront Report Card."
3. Perform the dissolved oxygen test first, since it takes a while for results to show. Have one student collect a water sample from the left side of the pier, where seiners are **not** walking around and kicking up sediment. Add 2 tablets to bottle and ask that student to shake it until dissolved.
4. Meanwhile, have another student pull the thermometer out of the water, read the temperature and report to rest of group. (Return thermometer to water.) Compare degrees to average water temperature on "Indian Creek Water Quality Poster" and decide if result is low, normal or high. Record in journal.
5. Preform the Salinity and Turbidity Tests (see Supplement A), comparing the results to the "Indian Creek Water Quality poster" and record the results in their journals. By now the dissolved oxygen should be ready. Compare results to Poster.

Assessment:

6. Using Supplement D –What Some of Indian Creek's Critters Need to Survive, review the students' test results and compare to the chart. For example, there may be enough dissolved oxygen for the blue crab to live, but the water temperature may be to low – as what happens in winter.
7. Ask the students to discuss and decide whether or not they think Indian Creek is a healthy water habitat. There's no right or wrong answer so long as they can come up with a justification based on what they have observed.
8. Ask the students what could be done better or differently on land to help improve the quality of the water. Remind them of the ways human development impacts turbidity, temperature, and dissolved oxygen.
9. Record their water quality grades in their journals.

Module Debrief:

After all groups rotate through all waterfront activities, they will meet back up at the Dining Hall patio to return their PFDs and have a large group debrief. This will be an opportunity for students to tell an Arlington Echo staff member what they learned and discovered over the course of the three activities. Students should be prepared to give their informed opinion on the health of Arlington Echo's waterfront and have a justification for that opinion. A sample response could be along the lines of, "I think the habitat is so-so. We found lots of zooplankton with the plankton net and caught some fish and crabs when we seined, but the water was very cloudy. We also saw more bulkheads and piers than natural habitats when we went canoeing."

Notes for Clean up

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

Notes for morning set up (overnight trips):

Remember to set up your materials prior to the mornings activities. If you do not spend the night, please check in with the AE staff assigned to the model and be at your teaching location by 9:00 a.m.

Notes for Day Trips:

Arlington Echo staff will determine if this activity is to be taught on a daily basis. Sometimes on a day trip the Microorganism activity is taught instead.

Notes for Inclement Weather:

Arlington Echo encourages keeping our outdoor activities outdoors—even in the rain—but in the case of severe weather (thunder, severe cold, etc), the rain location for this activity will be in the lower Resource Lab. The alternate activity is the Fish Adaptations lesson. Students will design their own fish using craft materials provided. (See Design a Fish lesson plan.)
You'll find several aquariums with fish and reptiles representative of those found in habitats like Indian Creek. Students can examine these animals, read about them, and fit them into their food web diagram. Students can also conduct water quality tests using the water that has been supplied by Arlington Echo staff.

Supplement A:

Water Quality Testing Instructions

Hydrometer (salinity):

Dip hydrometer into water and allow it to fill. Set the hydrometer on a flat surface for about 30 seconds to get an accurate reading. The hydrometer measures the specific gravity, or buoyancy, of the water to give information about how much salt is in the water (salinity). The salinity is displayed in Parts Per Thousand (PPT) on the side of the hydrometer.

Water thermometer (water temperature):

Allow the water thermometer to fill with water so it sinks into the creek. Hold the line so you don't lose the thermometer. Allow 3 to 5 minutes to get an accurate temperature reading.

Turbidity tube (turbidity):

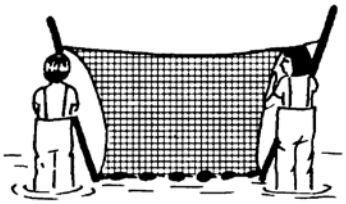
Collect a sample of water in the provided bucket, being careful not to scrape up excess sand from the bottom. Hold the turbidity tube upright and fill it from the bucket. Stand so you can stare straight down into the tube. Have someone else slowly start releasing water from the release hose at the bottom of the tube. Continue releasing water until the black and white marking at the bottom of the tube **just** becomes visible. Measure the water level using the markings on the side of the tube and refer to the key (Supplement C) to determine/calculate turbidity.

Dissolved Oxygen Tablets (dissolved oxygen):

Fill the small glass vial with water from Indian Creek. Place two dissolved oxygen tablets into the vial and firmly twist on the cap. Turn the vial end over end for about five minutes or until the tablets dissolve completely. Refer to the key to match the color of the water to the dissolved oxygen content in Parts Per Million (PPM).

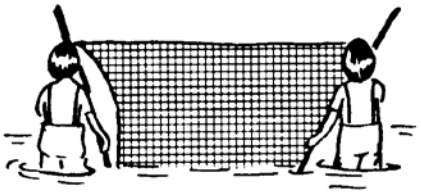
Supplement B:

Using the Seine Net



Step 1. Two students carefully unroll the seine net so the weighted side is in contact with the river bottom

Step 2. Students walk out to hip-deep water, bumping poles along the bottom and tilting poles about 30 degrees toward themselves.

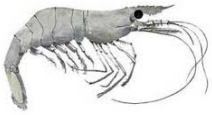


Step 3. Students stop walking and prepare to raise the net out of the water. Students should count aloud and coordinate their motions so they each flip their pole horizontal and raise the net out of the water in one swift motion.

Step 4*.* Students on the pier or a third student in the water can assist with getting the catch out the net with their hands or a dip net. Hands should be wet when handling fish to prevent harm to the fish's skin!

Supplement C: Indian Creek Assessment Poster

What Some of Indian Creek's Critters Need to Survive:

Species	Dissolved Oxygen	Salinity	Water Temperature	Habitat
 Blue Crab	At least 3 ppm	3-30+ ppt	At least 59 degrees Fahrenheit for growth.	Need grassy areas to hide while molting.
 Grass Shrimp	At least 2 ppm	1-2 ppt	Between 50 and 60 degrees Fahrenheit .	Need grassy areas to avoid predators.
 Pumpkinseed	At least 6 ppm	0-17 ppt	39 to 75 degrees Fahrenheit.	Needs shallow, clear areas to build nests.
 Striped Bass	At least 6 ppm	1-11 ppt for young striped bass. Up to 30 ppt for adults	40 to 70 degrees Fahrenheit for feeding.	Needs grassy, fresh areas to hide when young. Moves to saltier water when older.
 Inland Silverside	At least 6 ppm	3-5 ppt	50-86 degrees Fahrenheit .	Needs grasses for hiding.
 Mummichog	At least 6 ppm	1-2 ppt up to over 30 ppt	40-100 degrees Fahrenheit.	Needs grasses for hiding.

Supplement D

Water Quality Volunteer Information Sheet

Turbidity: A measure of how cloudy or murky the water is. Turbid water is high in suspended solids, such as soil eroded from the land, and therefore cloudy. Waterways with high turbidity suffer because sunlight can't get through to the submerged plants below, and the plants need sunlight for photosynthesis. Without aquatic plants, there can't be suitable habitat for other aquatic life. Turbidity can also result from excess bacteria or algae.

Salinity: A measure of how much salt is in the water. Indian Creek is a fresh body of water but, at its mouth, it mixes with the brackish (partly salty) Severn River. Salinity can fluctuate with changes in season, tide, rainfall, and runoff.

Water temperature: Water temperature naturally fluctuates with changes in season. Temperature shares a direct relationship with the amount of **dissolved oxygen** in the water: cold water holds more dissolved oxygen than warm water. Stormwater from surfaces like roads and parking lots runs off and enters streams and rivers at a higher temperature. In this way, human development can impact the temperature of natural water bodies.

Biodiversity: Having a wide variety of different species in a given environment, and a healthy population of each of those species. In general, a diverse environment is healthier and more resistant to environmental stresses. For example, if a disease affecting striped bass hits an area where striped bass are the only species of fish, the fish population will suffer greatly. In an area with many different species of fish, the disease will have a smaller impact on the overall environment.

Food web: An interconnected web of food chains (predator-prey-producer relationships). Producers like plants use photosynthesis to create energy from nutrients and sunlight, plant-eating primary consumers (herbivores) eat producers, and higher-level consumers (carnivores) eat other consumers. Detritivores (scavengers) eat anything they can, especially dead material. Everything is connected and every part of the food web matters, from microscopic plankton and tiny grass shrimp all the way up to the mighty osprey.

Biodiversity is essential for a healthy **food web**. Think about people: if we only had one source of food available to us, such as potatoes, and something happened to make all the potato plants die or disappear, we'd be in big trouble (so the Irish potato famine is a historic example of what can happen where there's no biodiversity). All organisms need a **diverse** selection of energy sources. Osprey can eat minnows or pumpkinseed or striped bass or yellow perch or any other of countless fish species.

Ecologists use a mathematical formula involving the number of species and number of individuals of each species to calculate a **biodiversity index**, but for the purposes of this lesson students can just think about how many different species of fish they caught and chart them on their food web diagram.

Supplement E: Sample Echo Investigative Journal Page

Arlington Echo Waterfront Report Card

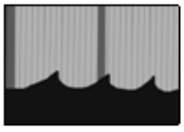
Turbidity: _____ Turbidity Units Bad Okay Good	Dissolved Oxygen: _____ ppm Bad Okay Good
Salinity: _____ ppt Low Normal High	Water Temperature: _____ Degrees F Low Normal High

Water Quality Grade:

Place a **check** next to the type of shoreline that makes the best habitat. **Circle** the shoreline you saw most at Arlington Echo

Living Shoreline

Rock Riprap



Wooden Bulkhead

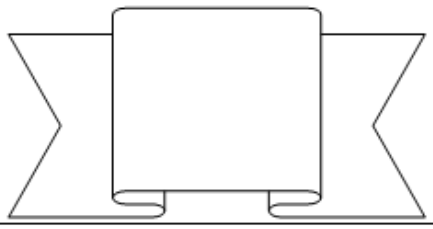
Shoreline Grade:

Count how many **different species** of animals you saw at the waterfront. **Shade in** that many squares:

1	2	3	4	5	6	7	8	9	10+

Wildlife Grade:

Overall Grade:



2