

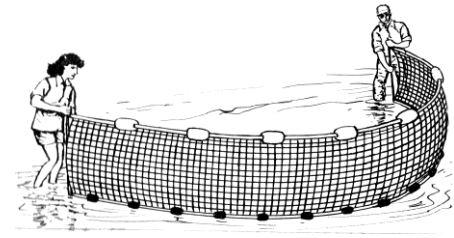
Lesson: Water's Living Things: Seining and Water Quality Testing

Arlington Echo works to continuously improve our lessons. This lesson may be modified over the course of the school year.

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

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

Unit/Lesson Sequence: One of two lessons 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 of 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:

Overnight Program 60 minutes

Day Program 45 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 comprehension 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 of 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 activity leader: Provided in the Lesson Plan and Supplements.

- **Vocabulary:**

Fishable	Swimmable	Drinkable	Turbidity
Dissolved Oxygen	Salinity	Producer	Consumer
Seine Net	Aerator		

- **Resources:**

PFD for each child and adult	Waders
Turbidity tube	Plastic containers for specimens
Salinity Meter	Aerator
Thermometer	Fish fact cards
Dissolved oxygen test kit	Seine net
Dip nets	5 gallon bucket for water
iPad	hotspot
Water Quality Poster	Oyster basket
2 large trays	

- **Supplements:**

- A: Using the Seine Net
- B: Indian Creek Assessment Guide
- C: Water Quality Information Sheet
- D: Water Quality Testing Instructions
- E: Sample Report Card Poster
- F: Vocabulary
- G: Online Water Quality Reporting Procedure

Lesson setup:

Move the waders from the S-hooks and lay them along the wooden wall by size (written on the front) with the front of the waders facing out. Collect the teaching materials from the shed at the end of the boat pier – containers, fish fact cards, water quality poster, dip nets, seine net, turbidity tube, thermometer, salinity meter, dissolved oxygen test kit, and two buckets.

Collect water from the creek in plastic containers with aerators to hold any organisms caught while seining. Place the thermometer in the water at the end of the pier. Before each lesson, ask a student volunteer or chaperone to fill one bucket about ¾ full with water from Indian Creek for turbidity, salinity, and dissolved oxygen tests. Pull up the oyster basket and set it in a tray on the end of the dock. Place another tray of water beside it.

Instructional Delivery

Module Introduction: All students and activity leaders will meet at the porch behind the Dining Hall. Arlington Echo staff will inform students about PFDs and hand them out to students and chaperones.

Each student must keep their PFD on for the duration of the activities unless otherwise instructed. Adults must wear a PFD if they go into the water. Arlington Echo staff will discuss with students ways to behave safely down at the waterfront (no running, wearing a PFD, paying attention to instructions, leaving small rocks on the ground).

Set-up

1. Introduce yourself and ask students to take a seat on the lower ledge facing the water. Ask chaperones to help you pass out waders to students based on shoe size (size 4 or 5 to smallest students, 6 fits most students, 7 or above for larger students).
2. Explain the proper procedure for putting on a pair of waders:
 - *Sit down and take off your PFD and place it behind you.*
 - *Remove one shoe, slide that foot all the way into the boot of the waders (make sure the waders are facing the correct way); remove the other shoe and slide that foot all the way into the other boot of the waders. 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. (Do NOT try to jump up and down to pull on the waders.)*
 - *Put on PFD over the waders.*

Tip: activity leaders should put on waders before the lesson begins; students often need assistance when putting on waders. Ask chaperones to help as well.
3. Make sure each student securely fastens their PFD over the waders. The students must keep their PFD on for the duration of all waterfront activities.
4. Chaperones may put on waders if they wish to seine; adults must also wear a PFD when seining.

Engage:

1. Ask the students how they think human land use affects living things and their habitats in the Chesapeake Bay?
 - a. **Negative effects:** *Polluted runoff can harm aquatic habitats; fertilizer and pet waste can cause algal blooms and dead zones in the water; stormwater runoff can carry salt from roads into waterways; removal of forested areas, wetlands, and living shorelines destroys critical habitats and intensifies erosion.*
 - b. **Positive effects:** *The creation of living shorelines provides habitats and prevents erosion; utilizing rainscaping techniques such as rain gardens, bioretention areas, green roofs, and rain barrels controls stormwater runoff; protecting and restoring forest and wetland areas preserve habitats, control erosion and runoff, and filters out pollutants.*
2. Explain to students that we will be exploring and testing the waters of Indian Creek.
 - When a body of water is healthy enough to support life we consider it **fishable**; when a water body is clean enough for people to swim in we consider it **swimmable** (*Clean Water Act*)
 - In this activity, we will be testing to see whether or not Indian Creek is **fishable**.

Explore:

If groups are larger than 10, divide the students into two groups: one group will focus on seining while the other group tests water quality. Halfway through the lesson, the groups will switch and do the water quality testing.

- At least one activity leader should be in the water with the seiners while the other(s) help the water quality testing group.
- Allow 15-20 minutes for one group to seine while the other tests water quality. Switch and allow 15-20 minutes to complete the second activity.

Seining:

1. Lead students onto the dock.
2. Discuss the conditions of the water and where the students can and cannot go while they are investigating (*this will be communicated to activity leaders from Arlington Echo staff during morning training based on water conditions*).
3. Before entering the water, remind students to take small steps and shuffle their feet to avoid tripping (walk like a penguin); NOT to run, swim, or bend/sit down in the water.
4. Demonstrate the proper technique for using a seine net (**Supplement A**) and a dip net.
5. Lead students into the water. At least one adult must be in the water anytime students are in the water (chaperone and/or activity leader).
6. Two students (or one adult and one student) can use the seine net while the rest use dip nets. *Remind students with dip nets that many of the organisms they are trying to catch use the grasses for shelter; so while they may be tempted to use their dip nets in the open water, they will be more successful closer to shore.*
7. When organisms are caught, assist students in transferring them to a plastic container with an aerator (for oxygen). *If aerator stops working, please let AE staff know immediately—animals cannot be left without an aerator. Remind students to wet their hands before handling fish (dry hands can remove the scales and mucus layer that protect the fish from disease).
 - Only adults should transfer crabs and jellyfish with tentacles to the container. Always pick up crabs from the back, behind their swim fins to avoid being pinched. Always hold jellyfish by the top being careful to avoid the tentacles.
8. If time allows, give each student the opportunity to use both seine and dip nets.
9. Allow the students to search for organisms in the oyster shells. Students can transfer the oyster shells from the basket to the empty bin. Make sure they look closely at the shells (some organisms are very small).
10. Give students time to examine what is collected, using fish cards for identification. Students should also take note of any other living things they see around them (birds, plants and animals).
11. Allow students a few minutes to change out of their waders before moving on to water quality testing or to their next activity.

If there is a limited catch or if you find anything unusual, keep specimens in buckets with aerators for next groups just in case they don't find anything.

Explain:

Students will be testing the water quality to determine the health of the creek and to explain why we found the animals we did while seining.

Water Quality Testing

1. Instruct students to take a seat at the table for water quality testing. Students must keep their PFDs on the entire time they are at the waterfront. (If students have come from seining, they no longer need to wear waders, if they have not seined yet they should have waders on.)
2. Explain to students that they will take four different measurements of water quality to determine if Indian Creek is fishable (healthy enough to support life).
3. Before EACH test, discuss with students: (**Supplements B and C**)
 - What the test is measuring and why it is important

- What levels of the measurement classify the water as healthy (“fishable”) and how these levels vary for different species
 - The different factors (human or natural) that may affect this water quality measurement
4. For the following tests, record all results on the Indian Creek Waterfront Report Card Poster. Instructor should record results on Survey123 using the iPad. **(Supplements D, E, G).**
- a. Perform the dissolved oxygen test first, since it takes a while for results to show. Add 2 tablets to the vial and then use the bucket of water collected at the beginning of the lesson to fill the vial with water and cap the vial while it is still underwater (to prevent air from getting in). Ask a student to turn the vial over 10 times and then continue passing it to the next student until fully dissolved (about 5 minutes).
 - b. Meanwhile, ask another student to pull the thermometer out of the water, read the temperature and report to rest of group (return thermometer to water). Compare the temperature to the average water temperature on the “Indian Creek Water Quality” temperature graph and decide if result is low, normal or high. Record in on report card poster.
 - c. Perform the salinity and turbidity tests using the bucket of water collected at the beginning of the lesson, comparing the results to the “Indian Creek Water Quality” charts for salinity and turbidity.
 - d. By now the dissolved oxygen test sample should be ready. Compare results to the dissolved oxygen color chart to determine dissolved oxygen range.

Elaborate:

Water Quality Testing Assessment:

1. Using **Supplements B and C**, review the students’ results and compare to the assessment guide. For example, there may be enough dissolved oxygen for the blue crab to live, but the water temperature may be too low – as in winter.
2. Have students discuss and decide whether or not they think Indian Creek is a healthy “fishable” water habitat. Students should also refer to what they found or observed during seining (i.e. if they caught a lot of organisms and saw a lot of birds, Indian Creek is probably fairly healthy). There’s no right or wrong answer as long as they can come up with a justification based on what they observed.
3. Based on their findings, ask students to give Indian Creek a grade on the report card poster (A for extremely healthy, F for extremely poor).
4. 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, salinity, temperature, and dissolved oxygen.

Lesson Conclusion:

After both activities, give the students who seined time to change out of their waders while the water quality students record their data online. When the entire group is ready, make sure waders are laid out on the ledge and that all students have their shoes and PFDs.

Evaluate:

Report Card:

What did you test during the seining activity to determine the quality of the river? (*Turbidity, salinity, temperature and dissolved oxygen levels*). Tell the students that every year, people take similar water quality tests all over the Chesapeake Bay and its tributaries in order to give the

Chesapeake Bay a report card (just like they get a report card in school). What do you think the grade was 6 years ago in 2011? (Raise hands for A, B, C, etc.)

Show the groups the report card for 2011 and point out how there are more Ds than Cs, there are two Fs and no As or Bs, and the overall grade is a D.

Over time do you think the health of the Bay improved? (Thumbs up for yes, thumbs down for no it's gotten worse, thumbs in the middle for it's stayed consistent). Show them the report card for 2016.

Talking points and good news about the 2016 report:

- Now there are more Cs than Ds, there are no Fs and the overall grade is a C.
- Point out the spots that say DC and BALT and discuss why those rivers may be impaired. *(DC and Baltimore rivers are located near big cities with lots of people and pollution from transportation on roads and waterways, storm water runoff from impervious surfaces, sewage, pet waste, fertilizer, litter, and specifically in Baltimore factories and harbor traffic).*
- Good news—the amount (in acres) of underwater grasses in the Chesapeake Bay and connecting rivers and streams increased by more than 50% (58%) between 2011 and 2015 to over 91,000 acres, the most in over 30 years! Why are underwater grasses important? *(Act as food and shelter for animals, provide oxygen, absorb pollution, prevent erosion near the shore, etc.) Chesapeake Bay Barometer 2016 CBP.*
- More good news—in the past year (from 2015-2016) both the number of young blue crabs and the number of female blue crabs of spawning age (can have babies) increased. Why are blue crabs important? *(Cultural symbol of the Bay, commercial and recreational fishing, part of the healthy food web, etc.) Chesapeake Bay Barometer 2016 CBP.*

Point out the AE sticker: what does this sticker stand for? *(Arlington Echo!)* What grade did the rivers near us at Arlington Echo and Anne Arundel County get? *(D)* Ask students to share their thoughts on this—is it what you were expecting? Are you pleased with that grade? Could we improve the health of our local waterways?

How can we help improve the Bay, specifically near the AE sticker where we live? *(Ride bikes/walk instead of driving cars, carpool, canoe instead of motorboat, pick up litter, reduce reuse recycle, eat sustainably, compost and reduce food waste, pick up pet waste, enjoy the outdoors, save electricity, plant trees, use reusable water bottles, etc.)*

Notes for clean up

Please clean, organize and return the lesson materials to the boat shed on the pier at the end of each day of instruction. Waders should be hung up on the hooks to dry. **The last group of students should bring their life vests up to the boathouse after the lesson.** 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 8:45 a.m.

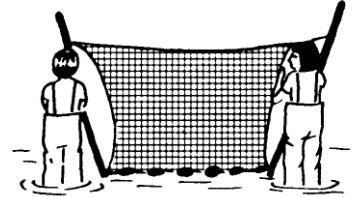
Notes for Inclement Weather:

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 will be a watershed activity using the AR Sandbox. Students can conduct water quality tests using water that has been supplied by AE staff.

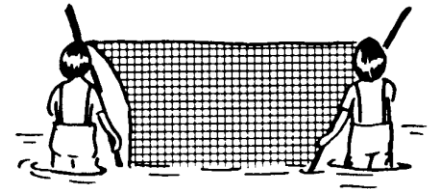
Supplement A:

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 45 degrees (as pictured).




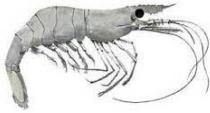




Step 3. Students stop walking and prepare to raise the net out of the water. Students should count aloud to 3 and coordinate their motions so they each flip their pole horizontally and raise the net out of the water and parallel to the surface of the water in one swift motion on “3”.

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

Supplement B:

Indian Creek Assessment Guide:

At what levels is Indian Creek fishable?

Species	Dissolved Oxygen	Salinity	Water Temperature	Habitat
 Blue Crab	At least 3 ppm	3-30+ ppt	At least 59 degrees Fahrenheit for growth	Needs grassy areas to hide while molting
 Grass Shrimp	At least 2 ppm	1-2 ppt	Between 50 and 60 degrees Fahrenheit	Needs 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