Stream Study

Summary

In this investigation students learn about our local and regional watersheds as they assess the health of a local stream. Students work in small groups to conduct a stream/pond investigation, gaining hands on experience with scientific instruments and data collection. At the end of the lesson, students analyze their data and cite evidence to answer the questions, “How healthy is this local stream?” and “What does this tell us about our local and regional watersheds?” Students develop an action plan, which will improve water quality in their local watershed.

Standards

Next Generation Science Standards

Science and Engineering Practices: Constructing Explanations and Designing Solutions

MS-LS1-6 Construct a scientific explanation based on valid and reliable evidence obtained from sources.

Disciplinary Core Ideas

MS-LS2-1: Interdependent Relationships in Ecosystems
Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with non-living factors.

Crosscutting Concepts: Stability and Change

MS-LS2-4 Small changes in one part of a system might cause large changes in another part.

Environmental Literacy Standards

Populations, Communities and Ecosystems. The student will use physical, chemical, biological and ecological concepts to analyze and explain the interdependence of humans and organisms in population, communities and ecosystems.

MCPS Core Literacy Practices

Students will be:

- Asking relevant questions and using resources to clarify thinking.
- Analyzing patterns of evidence to draw conclusions.
- Developing precision with their use of academic language.

Enduring Understandings

- Scientists use many abiotic and biotic indicators to assess the health of a stream habitat.
- Scientists use a variety of tools and procedures to gather and to share data.
- Human activities in the local watershed can impact the health of the greater watershed.
- Children and adults can take action to improve water quality.

Essential Questions

What is a watershed?
How can you determine if your local watershed is healthy using abiotic and biotic indicators? How can you be a good steward of the environment?

**Vocabulary**
- abiotic, benthic, biotic, watershed, aquatic ecosystem, organism
- physical characteristics (flow, turbidity/clarity, stream buffer, temperature, runoff, erosion, sediment)
- chemical characteristics (DO, pH, nitrates, phosphates, nutrients)
- biological characteristics (macroinvertebrates and other stream organisms)

**Materials**
- Bay watershed map
- State map
- County map
- Critter Retention Trays (CRT)
- Nets of varying sizes (hand, bait, D-nets)
- Bucket
- Magnifiers - hand lenses, 2-way viewers
- Macro-invertebrate ID chart with taxa groupings
- Other ID support (books, charts, etc.)
- Measuring tape (50 ft)
- pH strips
- pH chart
- Dissolved Oxygen (DO) kit
- Green Kits for DO, Nitrate, Phosphate, Temperature, Turbidity, and pH
- Thermometer
- Data sheet

**Mastery Objectives**
By the end of this lesson, students will be able to:
- conduct various tests, collect data, and examine various biotic indicators to determine the health of a local stream.
- list potential sources of pollution in a local tributary of the Chesapeake Bay.
- identify examples of how human activities may have negative or positive consequences on the watershed.
- identify food chains within the stream ecosystem.

**Suggested ideas to do before you attend OE:**
- Use Google maps to show the Chesapeake Bay watershed and your local watershed.
- Use maps to show where your local stream is in the Chesapeake Bay.
- Visit your local stream and make observations or conduct tests.
- Introduce the academic language that you will use during the stream study.
- Connect Trout in the Classroom activities with the stream study.

**Engage**
Watershed Background (15-20 minutes)
Discussion:
Our task today is to find out how healthy this local stream is! Why do we care?

What is a watershed?
- What is our local watershed?
- States in CB watershed (inc. DC)?
- Over 100,000 streams in watershed
- Drains more water than the Great Lakes
- Locate local watersheds
- Diagram flow of water to Chesapeake Bay - note names of creeks, streams, rivers; and smaller to larger pattern
- Development - roads, homes, businesses and impact on watershed

How can you determine if a local stream is healthy? What observations can we make? What data can we collect?
- Temperature
- pH
- Dissolved Oxygen
- Biotic Index
- Stream Bottom and Buffer Analysis
- Pervious and impervious surfaces
- Surrounding land use

How to collect data (15 - 20 minutes)
Teacher demonstrates: (Refer to teacher resource materials for detailed procedures.)
- use of nets, containers, pH test strips, chemical test kits, magnifiers
- handling of animals
- identification of animals and taxa placement
- review of physical characteristics - buffer, erosion, water clarity, water flow, plant/tree cover; permeable/ impermeable and their impact (positive/negative)
- how to use the collection chart to record data!

Teacher emphasizes:
- appropriate investigations do not negatively impact the habitat
- general safe and responsible behaviors

Explore (60 - 75 minutes)
Stream Investigation:
- Divide into groups and pass out equipment.
- Take students to the stream study location.
- Have students complete tests and gather data - temperature, pH, D-O, flow, stream bottom analysis, stream buffer analysis, clarity, biotic index.
- Have students record results.
- Take time to show animals discovered with all groups.
- Return all animals to original habitat.
- Gather equipment and students and return to central location.
Explain (15 minutes)

Review Results
Please record data on chart provided in classroom and/or on website.

Students share with their partners the results they recorded from the various indicators, analyze those observations, and answer the following questions citing evidence from their observations and using precise academic language. Is this a healthy watershed? Explain your answer.

- Do any of the test results reflect the possibility of a problem?
- What factors might be influencing the health of this stream/pond?
- Could the water quality be improved? How?

**Biotic samples:** Help students understand that when they find any macroinvertebrates in Taxa 1 that the water quality is good even if they find organisms from Taxa 2 and Taxa 3.

To assist in your review with students, we have created a very brief description of each test.

<table>
<thead>
<tr>
<th>Water Quality Tests</th>
<th>Healthy Level</th>
<th>What is it? Why do we measure it?</th>
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</table>
| Phosphate           | 0-1 ppm       | Found naturally
|                     |               | Needed by all organisms for metabolic reactions. Excess nutrients can cause increase in algae growth - and decrease in dissolved oxygen. (eutrophication)* |
| Nitrate             | 0-5 ppm       | Found naturally
|                     |               | Needed by all organisms to build proteins. Excess nutrients can cause increase in algae growth - when they die, the bacteria multiply as they break down the dead algae and use a lot of the dissolved oxygen - that decreases the dissolved oxygen in the water. (eutrophication)* |
| Dissolved Oxygen    | 4-8ppm        | All aquatic animals need oxygen to survive. |
| Temperature         | 10 C – 23 C   | Important to water quality, increased temperatures will hold less dissolved oxygen |
| Turbidity           | 0 JTU** and clear | Clarity of the water. It is not the color of the water, but the amount of suspended material in the water. The more turbid the water, the less sunlight can penetrate. Plants cannot grow without sunlight. |
| pH                  | 6-8           | Measures the acidic/basic quality of water. Range is 1 - 14. Some organisms can survive extreme pH, but not the ones in our streams. |

*
There are several practical ways of checking water quality, the most direct being some measure of attenuation (that is, reduction in strength) of light as it passes through a sample column of water. The alternatively used Jackson Candle method (units: Jackson Turbidity Unit or JTU) is essentially the inverse measure of the length of a column of water needed to completely obscure a candle flame viewed through it. Modern instruments do not use candles, but this approach of attenuation of a light beam through a column of water should be calibrated and reported in JTUs.

Evaluate

Exit Card Question(s):

● What are four abiotic/biotic factors that scientists use to determine the overall health of stream habitat?

● Would the stream be considered healthy if a scientist found macroinvertebrates from all three taxa in one sample?

Other possible journal reflection questions (in their journal if applicable):

1. How would you rate the health of the stream and what data do you have to back it up?
2. What activities could we do in the areas surrounding the stream to improve the condition? Describe at least 2 and give reasons to support your answers.
3. Draw a food chain with at least 3 organisms from the stream.
4. How do you think the stream quality of this stream compares to the quality of a stream in your neighborhood? Provide at least three specific examples.
5. Describe two tests (including those that involve indicators) that help determine the health of a local stream.
6. List 3 major environmental problems in the local watershed.
7. Why do scientists monitor this stream?

Extend (Things to do back at school)

● Have students complete the "School Yard Report Card" from the Chesapeake Bay Foundation.
Students complete another stream study close to their home school, or some other location and compare their data with the data collected at Outdoor Education.

Students review data from other local streams from the DEP website and compare with the data collected at Outdoor Education.


Plan an action to improve your local watershed based on your observations and data. (A few examples: Rain barrels, rain gardens, remove invasives, create a video)

Have students explore action projects at the Montgomery County Department of Environmental Protection