



Peabody Fellows Program

PEABODY MUSEUM OF NATURAL HISTORY • YALE UNIVERSITY

Biodiversity and Human Health Curriculum Unit "Biodiversity in East Rock Park: Its Effect on Human Health"

Lesson Titles:	Biodiversity of East Rock Park (Lesson 1)
	Fishy Tales (Lesson 2)
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Grade:	6
Program Year:	2004

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Abstract

This lesson, directed toward 6th grade students, will take at least four one-hour periods. It can easily be modified for grades 4 to 8. East Rock Park, our neighborhood park, contains a rich diversity of animals and plants. The Mill River runs through the park into New Haven Harbor. People are seen fishing at various locations along the river. Are these fish safe to eat? Is the Mill River safe or polluted?

Introduction

Event: The fish in many of Connecticut's rivers are not safe to eat because of the pollution of their habitat. What is the condition of the Mill River? Are the fish that people catch contaminated or safe to eat? Students will learn about (a) the biodiversity in East Rock Park, including the Mill River, and (b) the Mill River Watershed area and its effect on the health of the river. They will also make the connection between the health of the Mill River and the health of people who fish and consume the fish they catch in the river. The students frequent East Rock Park to play and take part in environmental activities. This study will help them realize the fragile condition of our parks' environments and show them ways they can help to better this situation.

Background

East Rock Park is unique in many ways. There is a wonderful history of the park in a book called *Exploring East Rock Park*. Briefly, the East Rock area was formed about 200 million years ago from sandstone. Then trap rock formed from molten material flowing between the cracks of the sandstone.

There are many colorful stories about the local use of the park that students would find interesting. The hills provided great lookouts for Native Americans. The bird life in East Rock Park has made it famous. It is a major route for bird migration, and many of these birds need healthy salt marshes for food along the way. Over 200 species of birds have been recorded in the park (some rarely seen elsewhere in the state). Mammals and reptiles are abundant (to name just a few: skunks, raccoons, opossums, muskrats, red foxes, bats, flying squirrels, and moles). The plant life is also abundant. The water shamrock, from Lake Whitney and Bantam Lake, unique to this area, is the source of all the water shamrocks in the United States. The smallest fish, the fourspine and ninespine, live at the Whitney Dam. They grow only to about one to two inches. Farther downstream there are four-inch killifish, and further still, the mummichop, which can survive the pollution and saltiness of the river. Tidewater silversides are also found here, but are easily affected if the water is low in oxygen or polluted. The larger fish, which reside in the middle of the river, are: golden shiners, goldfish, carp, and largemouth bass.

Objectives

The purposes of this unit are (a) to help students better understand not only the importance of all living things but also the role they play in the web of life, and (b) to enable them to think critically and design experiments to prove or disprove a hypothesis. By studying an environment that they are familiar with and consider

almost their backyard, they will see that science (experiments on pollution), the world (people trying to protect water supplies), and they, themselves, can help to preserve the habitat in East Rock Park.

The National Science Education Standards and New Haven Public School science standards to be met are:

National Science Education Standards:

Content Standard A: Science as inquiry

- Identify questions that can be answered through scientific investigations
- Design and conduct a scientific investigation
- Use appropriate tools and techniques to gather, analyze, and interpret data
- Develop descriptions, predictions, and models using evidence
- Think critically and logically to make the relationships between evidence and explanations

Content Standard C: Life science

- Structure and function in living systems
- Populations and ecosystems
- Diversity and adaptations of organisms

Content Standard F: Science in personal and social perspectives

- Personal health
- Populations, resources, and environments

New Haven Public Schools Standards

Content Standard 1.0: Scientific inquiry

Content Standard 6.0: Ecology, environmental science and society

Assessment

- Mural of biodiversity and human health made by the group.
- Ability to discuss and explain what is being studied.
- Journals containing students' writings and drawings. These journals will be used each time we work on this project.
- Final essay on what student has learned.

Biodiversity of East Rock Park (Lesson 1)

Kathy Scully Grade 6
Worthington Hooker Middle School



Objectives

Students will:

- Identify questions that can be answered through scientific investigations.
- Use appropriate tools to gather, analyze, and interpret data.
- Develop descriptions, predictions, and models using evidence.
- Think critically and logically to show the relationships between evidence and explanation.
- Understand populations and ecosystems.
- Study the diversity and adaptations of organisms in their environment.

Materials

Materials from the BioAction Lab: specimens from the Lab, Mantis microscope

Materials to make the mural: felt, paper, two-sided tape

Journals: each student will need a journal in which to write and sketch throughout the project

A variety of drawing and writing materials: colored pencils, pencils, markers

Maps of East Rock Park

Set up

Collect the following supplies before the start of class: large pieces of paper, large piece of felt to make a mural, and tape to attach students' drawings to the mural.

Staffing needs

Teacher

Extra staff for the field trip

Background

Students will enjoy learning the history of East Rock Park and how the park was formed. (Molten rock seeped through cracks in the sandstone base, cooled, and formed trap rock.) Students should have some information on the ways humans have used the park. (The Native Americans were the first people to use it, possibly as a lookout; other uses included for sheep grazing and a zoo. Yale's track team has even used the stairs for practice.)

Vocabulary

Biodiversity The variety of life in an environment.

Community The population of all species that occupy a particular habitat.

Ecosystem A community of organisms and the physical environment in which they live, including such things as water, weather, and soil composition.

Erosion The process of wearing away gradually, as in running water eroding the soil and forming a gully.

Estuary The mouth of a river where the salty tide meets the freshwater current.

Genes Tiny structures inside cells that determine how a species will turn out. A gene is the section of DNA that codes for a particular trait, for example, short or tall.

Habitat The environment within which a species is typically found, that meets its needs.

Pollution Contamination (of water, air, soil) by introduced substances such as harmful chemicals and waste material.

Species A naturally existing population of similar organisms that usually interbreed only among themselves.

Set induction

1. Study the map of East Rock Park.
2. List the animals and plants students have seen in the park.
3. List questions students have about the park.
4. These lists will be posted in the room for students to add either their questions or the knowledge gained during the study of East Rock Park.

Lesson procedure

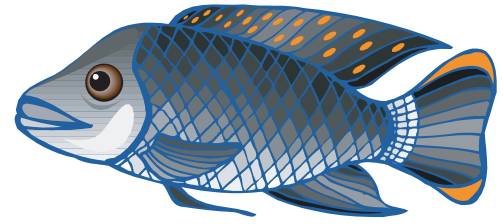
1. Visit the park with the naturalist. Students should bring their journals, which will be used throughout this study, to sketch or take notes on their observations. After returning to school, students should have ample time to add to the class list the things they learned on the trip.
2. Start making a biodiversity mural.
3. Study the specimens in the BioAction Lab closely. Use the Mantis microscope for any plant specimens students brought from the park and for BioAction Lab specimens.
4. Students will need many classes to research the plants and animals of the park that interest them, and to record information and sketches in their journals about these species. They should have ample time to share with the whole group. When students are researching the animals and plants, always ask them to record some facts (list the type of facts), but also ask them to find something about their specimen that is interesting to them.
5. During the study students will be adding sketches to the biodiversity mural. The mural should show the biodiversity of the park.

Assessment

The students' journals will provide an excellent assessment of their understanding of biodiversity in the park. Sharing will also show the students' understanding. Students will be asked to write an essay on their experience studying the park.

Fishy Tales (Lesson 2)

Kathy Scully Grade 6
Worthington Hooker Middle School



Objectives

Students will:

- Identify questions that can be answered through scientific investigations.
- Use appropriate tools to gather, analyze, and interpret data.
- Develop descriptions, predictions, and models using evidence.
- Think critically and logically to make the relationships between evidence and explanation.
- Understand populations and ecosystems.
- Study the diversity and adaptations of organisms in their environment.

Materials

Mural from the lesson on biodiversity
BioAction Lab specimens
Prepared media (Nutrient Easygel®) and plates from Living Materials
Samples of water from different locations of the Mill River (at least four samples)
Journals: continue using the journals from the biodiversity unit (each student should have one)
Maps of East Rock Park and the Mill River Watershed area
A variety of materials for drawing, writing, and adding to the mural; examples: colored pencils, markers, paper, etc.
Mantis microscope
Microscopes
Hand lenses
6 two-liter soda bottles
Camera

Set up

Prepare the nutrient media and plates. The biodiversity mural should be hanging up where students can add to it.

Staffing needs

Teacher

Museum educator

If another field trip is planned, at least one more person will be needed.

Background

Students should know about the different fish and their approximate location in the Mill River. The smallest fish are found by the Whitney Dam. These are the fourspine and ninespine (named for the number of spines on their backs). These fish grow to about one to two inches. Further downstream, the fish are bigger. The next group you'll find is the four-inch banded killifish, and further down the river the mummichop. These fish can survive the pollution and saltiness of the river. You will also find tidewater silverside fish; however, they have difficulty surviving if the water is low in oxygen or is polluted. Many larger fish are found in the deeper middle of the river. Some of these are: golden shiners, goldfish, carp, pumpkinseeds, largemouth bass, and alewife (members of the shad family).

Vocabulary

Fertilizer Any material, such as manure or chemicals, put into the soil to improve the quality or quantity of plant growth.

Medium A sterilized nutritive mixture for cultivating bacteria.

Nutrient Anything that nourishes (for example, food) or that promotes growth, development or good health.

Oxygen The most common element in the earth's crust and essential to life processes.

Pesticide Any chemical used for killing insects.

Petri dish A shallow, cylindrical, transparent glass or plastic dish with an overlapping cover, used for the culture of microorganisms.

Watershed All the land that drains to a common outlet.

Set induction

Discuss our trip to the park and focus on the river. Also discuss the fact that people fish in the Mill River. Are the fish from the Mill River safe for humans to consume?

Lesson procedure

1. Revisit the map of East Rock Park; have a map for each student plus one for the overhead projector. Focus on the Mill River.
2. Discuss with the students what can pollute the river and from where these pollutants come.
3. Display a map of the Mill River Watershed. Students will discover that this area includes Cheshire, Wallingford, North Haven, Hamden, and New Haven. Bring into the discussion that the watershed area includes forest, residential areas, shopping centers, industries, schools, and parks.
4. Students are familiar with the fact that overuse of fertilizer can be destructive, so start with an example of someone in Cheshire putting fertilizer on the lawn. What happens when it rains? Where could the fertilizer end up?
5. Set up an experiment using soda bottles. Cut a two-liter soda bottle in half. Secure netting over the mouth of the bottle. Fill the bottom about one third

with water. Turn the top upside down and tape it into the bottom. Place about one inch of small stones in the top and then about 3 inches of soil. Pour colored water into the top. What happens? Let the students work in pairs for this activity so they can all get an opportunity to make the system, pour in the contaminated water (colored water), and observe what happens.

6. It is very important that students always have their journals available and write in them. They should record how the experiment was set up and their observations, including their thoughts on how the Mill River can become polluted. A camera would come in handy to record results, especially for the experiment with growing bacteria.
7. The next discussion should be about what happens when fish are exposed to a polluted environment. Have students seen people fishing in the Mill River or at the place where the Mill River and the Quinnipiac River come together in New Haven Harbor? Do they think these fish are safe to consume? See whether they can come up with a way to test the cleanliness of the river.
8. Collect water samples from at least three different areas of the river. With the samples in front of them students will work in small groups to design an experiment to test for bacterial contamination in the water. It will be necessary to explain the use of Petri dishes and growing medium to the students before they design their experiments. Discuss their experiments with them, being sure that they use all the necessary safety precautions and that each group's experiment is well planned. The entire plan must be in their journals before they start.
9. Students will prepare the plates and, with supervision, test the samples of water.
10. It will take several days before anything is visible. During this time students will continue recording observations in their journals. They will also interview the park naturalist about the condition of the river.
11. Each day students will come together to share their thoughts, observations, and research with their groups.
12. After several days there may or may not be growth on the plates. There will be many discussions on the findings. Students will use graphs, photos, sketches, and written responses to present their results.

Assessment

The students' journals will be used to assess their understanding of the lesson. Journals should contain all of their questions, ideas, observations, and conclusions. They will also be asked to respond to the question: What did you learn from your study of the Mill River? They will be asked to write an essay of at least a page.

Annotated Bibliography

Brainard, Ellen, Carol Cooper, Betsy Liapunov, and Lise Orville (eds.). No publication date. *Exploring East Rock Park*. Advocate Press, Inc., New Haven, CT.

This valuable resource can be found at the East Rock Ranger Station. It contains a wonderful history of the park, which both students and teachers will enjoy. It also contains many details on the biodiversity found in the park. The photos and sketches are fascinating and beautiful.

Citizens Park Council of Greater New Haven. 1990. *New Haven Outdoors - A Guide to the City's Parks*. Field Graphics, Inc., New Haven, CT.

This resource has a brief description of East Rock Park, its history, biodiversity, and uniqueness.

Donahoe, Sydney. Illustrated by Patricia Wryne, Peter Spacek, and Andy Levine. Biodiversity. American Museum of Natural History, New York.
Contains excellent diagrams and simple explanations for students. This can also be helpful for teachers.

Patent, Dorothy H. 1996. *Biodiversity*. Clarion Books, New York.
This is an excellent resource for both students of the middle grades and teachers. It gives an overview of biodiversity and its importance in our world.

Websites

www.Cityofnewhaven.com/Parks/Outdooradventure/media/CanoeGuide-MillRiver.pdf
Map of Mill River in Connecticut from Davis St. bridge in Hamden to tidal gates near upper State Street in New Haven.

www.seagrant.uconn.edu/publ.htm#hq
A series of eleven fact sheets dealing with issues related to water quality.