The Return of the Cuyahoga

Objective 2, Lesson 2

Environmental Investigation and Analysis

BY: R. Berry, S. Mooney, and J. Powe

GRADE LEVEL: Middle Grades

GOALS: Collect, test, and analyze water samples from various sites along the Cuyahoga River.

LEARNING OBJECTIVE: Students will collect water samples and create a report based on their observations of the river sites.

STATE OF OHIO STANDARDS:

Life Science

BENCHMARK

Analyze data on the availability of fresh water that is essential for life and for most industrial and agricultural processes. Describe how rivers, lakes and groundwater can be depleted or polluted becoming less hospitable to life and even becoming unavailable or unsuitable for life.

Describe the processes that contribute to the continuous changing of Earth's surface (e.g., earthquakes, volcanic eruptions, erosion, mountain building and lithospheric plate movements).

Describe the characteristics an organism in terms of a combination of inherited traits and recognize reproduction as a characteristic of living organisms essential to the continuation of the species.

PERFORMANCE INDICATORS:

- Investigate the great diversity among organisms.
- Describe how organisms may interact with one another.

Interdependence of Life

BENCHMARK

Investigate how organisms or populations may interact with one another through symbiotic relationships and how some species have become so adapted to each other that neither could survive without the other (e.g., predator-prey, parasitism, mutualism and commensalisms).

Explain how the number of organisms an ecosystem can support depends on adequate biotic (living) resources (e.g., plants, animals) and abiotic (non-living) resources (e.g., light, water and soil).
Summarize the ways that natural occurrences and human activity affect the transfer of energy in Earth's ecosystems (e.g., fire, hurricanes, roads and oil spills).

Explain that photosynthetic cells convert solar energy into chemical energy that is used to carry on life functions or is transferred to consumers and used to carry on their life functions.

Explain how extinction of a species occurs when the environment changes and its adaptive characteristics are insufficient to allow survival (as seen in evidence of the fossil record).

PERFORMANCE INDICATORS:

-Investigate how overpopulation impacts an ecosystem.

- Explain that some environmental changes occur slowly while others occur rapidly (e.g., forest and pond succession, fires and decomposition).

- Explain that diversity of species is developed through gradual processes over many generations (e.g., fossil record).

- Investigate how an organism adapted to a particular environment may become extinct if the environment, as shown by the fossil record, changes.

- Investigate how overpopulation impacts an ecosystem.

- Explain that some environmental changes occur slowly while others occur rapidly (e.g., forest and pond succession, fires and decomposition).

- Explain that diversity of species is developed through gradual processes over many generations (e.g., fossil record).

- Investigate how an organism adapted to a particular environment may become extinct if the environment, as shown by the fossil record, changes.

MATERIALS/ RESOURCES:

- Testing kits
- Boots
- Kick nets
- Storage bags
- Ziploc Bags
- Hand sanitizer
- Clipboards
- Pencils
- Notebook paper
- Graph paper
- Tape measure
- Digital camera
- Collection containers
- Shovels
- pH probes
- Peterson's field guides
- Buckets
- Aluminum foil
- Paper towels
- White tray
- Magnifying glass
- Instruction manual from the "Low Cost Water Monitoring Kit"

- ***A Drop of Water: A Book of Science and Wonder*** by Walter Wick
- http://www.k12science.org/curriculum/dipproj2/en/activity3.shtml
- http://www.seanet.com/~leska/Online/Guide.html
- http://www.bugbios.com/entophiles/index.html
- http://www.people.virginia.edu/~sos-iwla/Stream-Study/Catalog/SensitiveTaxa.HTML
- http://wwwhttp://www.people.virginia.edu/~sos-iwla/Stream-Study/Catalog/NonSensitiveTaxa.HTML.people.virginia.edu/~sos-iwla/Stream-Study/Catalog/SomewhatSensitiveTaxa.HTML
- http://www.nalms.org/games/pondgame/plgame.htm
- http://www.siue.edu/OSME/river/water&kicknets/kicknets.htm (This site gives directions for making inexpensive kick nets)

PROCEDURES FOR TEACHING

1. Discuss and review safety procedures in and around the river with the class:
   - Wear boots if entering the water
   - Stay with partner – no working alone
   - Wear gloves when handling anything from the river or using nets
   - Do not wander away from the group
   - Report any cuts, bites, etc. to teacher

2. Divide the class into groups of 6 people and assign roles similar to the following:
   - One student to Water Quality Tester
   - One student to Water Quality Recorder
   - One student to Kick Nets
   - One Kick Nets Recorder
   - Two observation people (1 Visual Recorder and 1 Digital Camera Recorder)

This group of students represents one Field Team. The students may wish to give their Field Team a name for easy identification once they are in the field.

Teachers may also wish to provide nametags with the students roles attached for better classroom management.

Water Quality Testing Team is composed of a representative from each Field Team – the Water Quality Tester and the Water Quality Recorder.

WATER QUALITY TESTING TEAM RESPONSIBILITIES

A. Collect a water sample – use wide mouthed jar or container that is sterile and has a cap – approximately one liter.
B. Test for coli form bacteria – follow the directions in the Water Quality testing kit.
C. Test for Dissolved oxygen – follow the directions in the Water Quality testing kit.
D. Test for Biochemical Oxygen Demand (BOD) – follow the directions in the Water Quality testing kit.

****Note: The BOD tests have to be stored according to kit instructions for five days before determining results. *****

E. Test for nitrates – follow the directions in the Water Quality testing kit.
F. Test for pH – follow the directions in the Water Quality testing kit.
G. Test for phosphates – follow the directions in the Water Quality testing kit.
H. Test for temperature – follow the directions in the Water Quality testing kit.
I. Test for turbidity – follow the directions in the Water Quality testing kit.

Kick Net Team is composed of a representative from each Field Team – The Kick Net and the Kick Net Recorder.

KICK NET TEAM RESPONSIBILITIES

Using kick nets:

A. Select four people and have them prepare to go in the water (2 people in charge of net and 2 people to stir up the water and riverbed).
B. Position the two people holding the net downstream.
C. Place the kick net at the downstream edge of the riffle so that the current flows through it. Be sure the bottom of it fits tightly against the streambed. You may want to use rocks to hold the net down so that none of the organisms can escape under it. Also, do not allow any water to flow over the top of the net. This too could allow organisms to escape.
D. Position the other two people about 10-15 ft. upstream – ask them to stir up the water and river bed as they walk toward the people with the net.
E. The two people holding the net will allow the disturbed water to go through the net. Then, scooping the net up from the bottom, lift the net to the surface.
F. Identify what is in the net – this should be done by removing what is in the net and placing in a water filled bucket – observe and identify organisms using the field guides – it is also possible to photograph the organisms and identify them later.
G. Return the living organisms to the water as soon as possible.

Observation Team is composed two representatives from each Field Team - The Visual Observer and the Camera Observer.

OBSERVATION TEAM RESPONSIBILITIES

A. Photograph what was collected in the net for identification purposes.
B. Photograph various locations in the immediate area where the water sampling occurred.

C. The visual observers record in writing the conditions of the river (debris, dead organisms in the water, pollution, etc).
D. The visual observers also measure the distance across the river if possible or estimate a measurement.
E. The visual observer records the weather conditions and the description of the shoreline.

3. Once you have returned to the classroom, students would get into original Field Teams, which would now have a representative from each field activity, the Water Quality Tester and Recorder, the Kick Netter and Kick Net Recorder, the Visual Observer and the Digital Camera Observer. Each team member will report to his or her group the responsibilities that they accomplished and their results.
4. Each team should organize their data, photos, and observations into a team folder or journal for future use.

STUDENT PRODUCTS:

Student data collection worksheet
Journal entry
Pictures of river area and items collected in kick nets

ASSESSMENT:

Journal, student participation
A possible assessment or extension would be to use the following Website activity to assess students' ability to identify organisms commonly found in the river: http://www.nalms.org/games/pondgame/plgame.htm