O·H·I·O ENVIRONMENTAL COUNCIL

Water Canaries

Adapted from Project Wild

Grade 5-8

Duration: one or two 45-minute sessions; may take longer if done as a field study activity.

Objectives: Students will (1) identify several aquatic organisms and (2) asses the relative environmental quality of the vernal pool using indicators of pH, water temperature, and the diversity of organisms.

Key Terms: indicator species, quality, healthy, diversity, temperature, pH

Method: Students investigate a venal pool using sampling techniques.

Materials: identification book, student worksheets I and II sampling equipment, such as seine nets, sieves, trays, assorted containers, white trays (plastic porcelain), Magnifying lenses, eyedroppers, and forceps, water quality test kit,(test both pH and dissolved oxygen), thermometer, meter stick or tape measure;

Background: In the early days of coal mining canaries were brought into the mines and were a good indicator of the air quality in mine shafts. Because canaries were more sensitive to dangerous gases then humans if the canary seemed ill or died it was an indication that mine air was not fit to be breathed. This practice no longer takes place, but the reference still has meaning.

In vernal pools, streams and ponds the presence or absence of certain organisms can be an indication of high water quality. These organisms are called indicator species, and make up a biotic index (number of living organisms found in an ecosystem).
Water ecosystems containing a wide variety of organisms usually indicates a healthy system. Waters which contains few species, even though a large population may exist, is usually an indication of poor water quality. Pollution reduces the quality of water and the diversity of species that it will support.

Procedure:

Before the activity

1. Select a small vernal pool near your school or organization to be used a a sampling site. Please be sensitive to the impact students may have in and around the pool as samples are gathered. Ask the students to establish ethical guidelines for their sampling activities. Be sure to obtain permission to sample on a site that is located on private property.

NOTE: if visiting the site is not possible make arrangements to collect samples before the classroom time so that students may carry out the testing and identification during the classroom time. NOTE Amphibians should be handled with wet hands and photographed only not transported to classrooms for identification. For live specimens contact your local zoo or watershed group.

2. At the site be sure to go over the ethical rules with the students and ask that they attempt to minimize the impacts of sampling. Emphasize that all wildlife should be returned to the pool unharmed. Teachers may determine whether it is appropriate to take samples back to the classroom for further study.

3. Begin the activity by observing the pool surroundings and the water. Identify organisms at the surface and in the depths of the pool. Use the sieves nets and trays ask the students to carefully collect as many organisms as possible. Place the animals to be observed in the white trays for viewing and drawing. Keep an adequate amount of water in the trays.

4. On worksheet 1 have the students identify and draw the animals they observed in the aquatic environment and in the white trays. Ask them to keep a tally of the number of each kind found and the location of capture. Once these steps are completed carefully return the animals to their natural habitat.

NOTE: If you choose to take organisms back to the classroom be sure that adequate water is available that is as cool as the natural setting, Place the animal in a Petri dish or a shallow transparent dish, then use the overhead projector to project the image on a wall or screen.

5. Encourage the students to discuss their observations. How diverse are the aquatic organisms? Introduce the concept of diversity, and that diverse number of plants and animals is an indication of habitat health.

6. Now it is time to test the water for other indicators of health. Have the students use the water test kits to determine the pH, water temperature, air temperature and if available, dissolved oxygen. NOTE: it may be good to have the students test tap water before the sample water so that they are comfortable with the testing procedure.

7. Assist the students in understanding that the values of pH, water and air temperature, and pool habitat affect the diversity of life in the vernal pool. Help them to understand that based on pH temperature and surroundings you can predict the diversity of vernal pool habitats. Likewise certain indicator species can disclose information about water temperature and pH.

NOTE: A simple water quality test kit can be obtained from a scientific supply house dealing with high school biology supplies. Often a Hydrion or Hack kit can be borrowed from a high school biology teacher or a local waste water treatment plant.

8. Ideally this activity can be repeated at many different sites. Biologists often sample hundreds of site. Try to visit vernal pools, open field swales, and deep puddles and try to understand and predict what is happening in these systems. If another site is sampled divide the students into two teams and have one group finish worksheet I and the other finish worksheet II. After this have them come together and mutually predict what the other team found based on their observations.

9. Summarize the study with emphasis on the fact that diversity of animals is a useful indicator of habitat quality as well as an overall indicator of environmental quality.

Evaluation: Draw a simple illustration of one or more of the following organisms, predaceous diving beetle, spotted salamander, daphnia, fairy shrimp, stonefly nymph, dragonfly nymph. Identify each organism by writing the correct name next to its picture.

pH Ranges that Support Aquatic Life.

Most Acidic _____ Neutral _____ Most Basic
1 2 3 4 5 6 7 8 9 10 11 12 13 14

Bacteria
1.0_____ 13.0

Plants (algae, rooted etc.) 6.5_____ 13.0

Snails, clams, mussels 6.5_____9.0

Largest variety of animals 6.0_____8.5
(mayflies, stonefly, caddisfly, dragonfly)

Temperature Ranges (approximate) Required for Certain Organisms

Greater than 68 °F (20 °C)= Warm water	Much plant life, many fish diseases Catfish, bass, crappie, caddisfly, Dragonfly, mayfly
55- 68 °F (12.8 - 20 °C) = Cool water	Plant life some fish diseases. Salmon, trout, stonefly, mayfly, caddisfly, waterbeetles, minnows, darters,
Less than 55 °F (12.8 °C) = Cold water	Trout, caddisfly, mayfly, stonefly, minnows, darters, sculpins

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Disolved oxygen (DO) requirements in parts per million [ppm]

Below 68 °F cold water organisms 6 ppm	Above 68 °F Warm water organisms 5ppm

STUDENT WORKSHEET I

Where organisms were found	Sketch organism	Number found

STUDENT WORKSHEET II

Observations	Predictions
Water temperature _____	
Air temperature _____	
pH _____	
Dissolved O_2 _____	

State standards alignment

(http://www.dnr.state.oh.us/dnnapps/education/correlations/searchresults.asp?intpage=2&action=PREVIOUS&hidID=##)

Activity Guide	Activity Title	Grade Level Band	Grade Level	Content Standard	Benchmark	Organizer	Grade Level Indicator	Details
WILD-Aquatic	Water Canaries	6-8	7	Earth and Space Sciences (ES)	C	Earth Systems	4	Click here
WILD-Aquatic	Water Canaries	6-8	7	Earth and Space Sciences (ES)	C	Earth Systems	8	Click here
WILD-Aquatic	Water Canaries	6-8	6	Life Sciences (L)	C	Diversity and Interdependence of Life	8	Click here
WILD-Aquatic	Water Canaries	6-8	7	Life Sciences (L)	C	Diversity and Interdependence of Life	2	Click here
WILD-Aquatic	Water Canaries	6-8	7	Life Sciences (L)	C	Diversity and Interdependence of Life	3	Click here
WILD-Aquatic	Water Canaries	6-8	6	Science and Technology (ST)	A	Understanding Technology	1	Click here
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WILD-Aquatic	Water Canaries	6-8	6	Science and Technology (ST)	A	Understanding Technology	2	Click here
WILD-Aquatic	Water Canaries	6-8	7	Science and Technology (ST)	A	Understanding Technology	2	Click here
WILD-Aquatic	Water Canaries	6-8	6	Science and Technology (ST)	B	Abilities To Do Technological Design	5	Click here
WILD-Aquatic	Water Canaries	6-8	7	Science and Technology (ST)	B	Abilities To Do Technological Design	4	Click here

WILD-Aquatic	Water Canaries	6-8	8	Science and Technology (ST)	B	Abilities To Do Technological Design	3	Click here
WILD-Aquatic	Water Canaries	6-8	8	Science and Technology (ST)	B	Abilities To Do Technological Design	4	Click here
Activity Guide	Activity Title	Grade Level Band	Grade Level	Content Standard	Benchmark	Organizer	Grade Level Indicator	Details
WILD-Aquatic	Water Canaries	6-8	6	Scientific Inquiry (SI)	A	Doing Scientific Inquiry	1	Click here
WILD-Aquatic	Water Canaries	6-8	6	Scientific Inquiry (SI)	A	Doing Scientific Inquiry	2	Click here
WILD-Aquatic	Water Canaries	6-8	7	Scientific Inquiry (SI)	A	Doing Scientific Inquiry	1	Click here
WILD-Aquatic	Water Canaries	6-8	7	Scientific Inquiry (SI)	A	Doing Scientific Inquiry	2	Click here
WILD-Aquatic	Water Canaries	6-8	7	Scientific Inquiry (SI)	A	Doing Scientific Inquiry	3	Click here
WILD-Aquatic	Water Canaries	6-8	7	Scientific Inquiry (SI)	A	Doing Scientific Inquiry	4	Click here
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WILD-Aquatic	Water Canaries	6-8	8	Scientific Inquiry (SI)	A	Doing Scientific Inquiry	1	Click here
WILD-Aquatic	Water Canaries	6-8	8	Scientific Inquiry (SI)	A	Doing Scientific Inquiry	2	Click here
WILD-Aquatic	Water Canaries	6-8	6	Scientific Ways of Knowing (SWOK)	A	Ethical Practices	2	Click here
WILD-Aquatic	Water Canaries	6-8	7	Scientific Ways of Knowing (SWOK)	B	Ethical Practices	1	Click here
WILD-Aquatic	Water Canaries	6-8	7	Scientific Ways of Knowing (SWOK)	B	Ethical Practices	2	Click here
WILD-Aquatic	Water Canaries	6-8	8	Scientific Ways of Knowing (SWOK)	B	Ethical Practices	2	

Activity Guide	Activity Title	Grade Level Band	Grade Level	Content Standard	Benchmark	Organizer	Grade Level Indicator	Details
WILD-Aquatic	Water Canaries	6-8	6	Scientific Ways of Knowing (SWOK)	C	Science and Society	3	Click here
WILD-Aquatic	Water Canaries	6-8	6	Scientific Ways of Knowing (SWOK)	C	Science and Society	4	Click here
WILD-Aquatic	Water Canaries	6-8	7	Scientific Ways of Knowing (SWOK)	C	Science and Society	3	Click here