

Aquatic Ecologist

Environmental Education Lesson
EDWARDS YMCA CAMP AND CONFERENCE CENTER

Summary

Students will take an in-depth analysis of the waterways at Camp Edwards including the wetlands and the lake. They will study the abiotic and biotic factors that can affect the quality of the water. The students will cover topics of pH, turbidity, indicator species, macroinvertebrate collection, and chemical composition of the water.

Usage – Grade Levels 6th-12th. Year Round.

IL Standards

11.A.2a; 11.A.2b; 11.A.2d; 12.A.2a; 12.B.2b; 13.B.2a; 13.B.2b; 13.A.2c
11.A.3a; 11.A.3c; 11.A.3f; 12.A.3c; 12.B.3b; 13.A.3a
11.A.4a; 11.A.4b; 11.A.4c; 11.A.4e
11.A.5a; 11.A.5c

Objectives

Upon completion of this lesson students will...

- Understand the importance of water monitoring.
- Know the procedures for chemical water testing.
- Understand the pH scale and how it affects water.
- Understand the link between water quality and the type macroinvertebrates present.
- Be able to state the quality of water at Camp Edwards.

Materials

- pH chart
- Chemical test (DO, pH, phosphate)
- Water Cycle chart
- Plastic sampling cups
- Eye goggles for students to wear during chemical tests
- Pond Mucking Supplies
 - 5 gallon buckets
 - long handled scoop nets
 - sorting pans
 - Ice cube trays
 - Sorting equipment
 - eyedroppers (for very small organisms)
 - microscopes
 - Laminated Identification sheets
 - Macroinvertebrate count sheet

Introduction (15 minutes)

Why is water quality testing important? (Safety, quality of habitat and checking for pollution). Explain that they will be testing samples of water to see if the chemical properties of the water can support life, if it is safe and whether or not it is polluted.

Have students guess the percentage of fresh water on earth. (90% salt and 10% fresh). Explain that it is very important to know the quality of the fresh water we have and what influences the quality of that water.

Have the students imagine that they live on a farm uphill from Lake Beulah. Ask the students, when it is raining what could wash into the lake from the farm? (loose soils, chemicals and wastes). What would this do to the water chemistry (pH)? (Change because of runoff). What is pH? (Show diagram and explain). Fish prefer a level of 6.5 to 7.5.

How do fish and most insects breathe in the water? (Through Dissolved Oxygen). Explain that D.O. is like the oxygen we breathe but it is in the water. Explain how oxygen gets in the water. Explain how D.O. is measured (ppm) and what ppm means.

Today we are going to study our water quality here at Camp Edwards. The study of water is Hydrology, and we will be Hydrologists. There are two major ways that we are going to be investigating the water quality of Lake Beulah, by chemical testing and by macroinvertebrate collection.

Inform the students that we will be recording the results for our database in order to see change over time.

Chemical Testing (40 minutes)

Today we are going to be testing for a variety of substances and factors in the water we will collect in the lake. We will be testing for pH, Dissolved Oxygen, Phosphate, Nitrates, and Temperature.

Divide the group into pairs for this chemical testing portion. Hand each pair a clipboard to record their findings.

pH

pH stands for percent hydrogen. The pH scale measures how acidic or basic something is, rated on a scale from 0-14. (Zero being the most acidic, seven is neutral and fourteen the most basic/alkaline.) The pH scale is a logarithmic scale. The numbers increase ten times as you go up on the basic side or down on the acidic side. For example if you went from a pH of one to a pH of two, two would be ten times less acidic than one. If you went from zero to two, two would be one hundred times less acidic than one. Fish prefer a range of levels between 6.5-7.5 pH. If chemicals such as fertilizer are dumped into the water they can affect the pH of the water, causing a potential disaster for fish and insects. See common and some aquatic pH levels on the chart attached.

Dissolved Oxygen (DO)

D.O. is measured in ppm's (parts per million). Fish prefer different levels of dissolved oxygen. Larger fish prefer 12 ppm, while smaller fish prefer 5ppm. Dissolved oxygen levels of 5 or higher are perfect in a lake, while anything lower than a 3 is stressful on organisms living in the lake. If the level reaches 1ppm it is considered to be anoxic (no oxygen present) which would be fatal to all organisms in the lake. D.O. can enter the water through rain, turbulence, waves, wind and plants (photosynthesis).

Phosphate

Phosphate stimulates the growth of plankton and aquatic plants which provide food for fish and insects. This increased growth may cause an increase in the fish population and improve the overall water quality. However, if an excess of phosphate enters the waterway; algae and aquatic plants will grow wildly, choke up the waterway and use up large amounts of oxygen. This condition is known as eutrophication. The rapid growth of aquatic vegetation can cause the death and decay of vegetation and aquatic life because of the decrease in dissolved oxygen levels.

Nitrates

Nitrate reactions in fresh water can cause oxygen depletion. Thus, aquatic organisms depending on the supply of oxygen in the stream will die. The major routes of entry of nitrogen into bodies of water are municipal and industrial wastewater, septic tanks, feed lot discharges, animal wastes (including birds and fish) and discharges from car exhausts. Bacteria in water quickly convert nitrites to nitrates.

Temperature

Human activities should not change water temperatures beyond natural seasonal fluctuations. The temperature of the water can directly affect dissolved oxygen and other natural processes in the aquatic ecosystem.

Turbidity

Turbidity is a measure of cloudiness in water. The more turbid the water, the murkier it is. Turbidity can be caused by soil erosion, waste discharge, urban runoff, bottom feeders like carp that stir up sediments, household pets playing in the water, and algal growth. Suspended solids in turbid water can clog fish gills, reduce growth rates, decrease resistance to disease, and prevent egg and larval development. Settled particles smother eggs of fish and aquatic insects.

How to use the DO tests

How to use the pH tests

How to use the Phosphate test

How to use the Nitrite Test

How to use the Secchi Disk

Wrap-up

Go over with the students what they each found.

- Discuss variations within the groups and reasons for these differences.
- Talk about what the numbers could mean to the environment, either good or bad.

Macroinvertebrate Collection (40 Minutes)

Macroinvertebrate collection is another way to measure the quality of the aquatic ecosystem. The students will be filling out a Macroinvertebrate Count Sheet (MCS) and will be getting a final rating.

Hand out the MCS and the Dichotomous Key for Macroinvertebrate Identification. Based on the numbers from the Chemical Test have them come up with a Hypothesis (scientific guess) as to what they think the Water Quality Rating from the MCS will be and write it on the bottom of the sheet.

Separate the students into groups of 3-5 and pass out equipment. Explain the sampling procedure below and show the sampling area (along canoe launch pier, the boat bay and the beach area of the lake.) **Please stay off the rock wall for safety!** Remind students we are studying the organisms and returning them to their environment. We do not want to kill them. Fill your trays and 5 gallon pail with water from the boat bay. Use the large pond nets to scoop through water plants-this is where most organisms live. Demonstrate proper techniques of sampling with the aquatic nets. (Not too deep and plenty of vegetation). They need to swish the weeds around in the water in the pan. Look carefully for tiny organisms hiding in the weeds. Emphasize that all organisms found in the water rely on water to live and breathe and need to be put in a water tray or pail as soon as they are collected. The ice cube trays work great for holding and viewing insects. The small aquarium nets can be used to aid in catching and transferring the insects to the pan. The organisms can be identified through the use of laminated Pond Critter ID Guides. Tell students to save one of every organism that they find by putting it in water in their ice cube trays or buckets, to later show their classmates. (Not everyone is going to find the same things.) After collection and identification allow about 10 minutes for quick clean up and to go over what was found.

Wrap-up

Have each group fill out their MCS and tally up their Water Quality Rating.

- Did the Rating match up with your hypothesis?
- Why could it have varied?
- What does the Water Quality Rating say about the Quality of the water?

Conclusion (15 minutes)

Discuss why is it important to study the quality of water?

Human usage, protecting the environment, helping clean up the environment

How do you think that the water quality could change over time?

What can people do that could affect the water quality, both positively and negatively?

What was something new that you learned.

Post-Visit Activities

Check in with the updated data each month and talk about how the data can change over time and can vary with the seasons.

