New Jersey School of Conservation
One Wapalanne Road
Branchville, NJ 07826-5116
800-624-7780 or 973-948-4646
973-948-5131 (Fax)
http://www.csam.montclair.edu/njsoc/

Water Ecology

Core Curriculum Content Standards: 3.3.A, 3.4.A, 5.1.A&B, 5.5.A&B, 5.6B, 5.8B, 5.10A&B, 6.6.E, 9.2.C

DESCRIPTION

This session is designed to show students that water as a key human resource. Session activities include a brief discussion of water as it relates to all life and to the students' home community, and a survey of water quality at the Big Flatbrook, using water test kits and aquatic organism sampling.

OBJECTIVES

•Students will determine the ***quality*** of the water in the Flatbrook through water testing and aquatic organism sampling.
•Students will learn which aquatic organisms are associated with clean water.

BACKGROUND INFORMATION

See the Information on Water Fact Sheet and Water Tests Sheet

MATERIALS

•Wading boots
•Dip strainers
•Seine net
•Bucket
•Holding Tray for aquatic invertebrates
•Water test kit – includes pH, temperature, phosphates, nitrates, dissolved oxygen
•Small plastic magnifying boxes for looking at individual organisms
•Biotic index picture Sheet

ORIENTATION

1. Discuss the importance of water as a resource for humans, plants, and wildlife.
    - What are ways each of you use water on a daily basis?
    - Based on all these uses, approximately how much water does one person use per day? (get guesses from everyone)
    - Review the list of daily uses of water and the amount for each kind of use.
    - The national average is 100 gal/day/per person

2. Discuss the ways we use water for recreational activities (swimming, boating, water

skiing, surfing, sailing, fishing, etc.). Ask the students why they think humans are drawn to water and connect the dots by emphasizing that we live on a water planet, all life has its evolutionary roots in water, most of our bodies are made of water, and we can't survive for more than 3 days without drinking it. It's no wonder humans are drawn to it!

3. Review with the students what will happen at the Flatbrook – that is the sampling of aquatic invertebrates for the purpose of determining the quality of the water in the stream. Illustrate the three sampling methods: Looking under rocks, particularly rocks that are in riffles; using the strainer to catch organism as you disturb the sediments; and using the seine net by working together with three students – two on each pole and one to disturb the sediments upstream.

4. Have the students select a pair of boots from the rack and hand out equipment to be carried to the Flatbrook. Make sure you bring the water test kit, laminated aquatic organism illustration sheet, tray for holding invertebrates, bucket, strainers, and seine net.

AT THE FLATBROOK

1. Turn the students loose in the stream, reminding them that every rock they pick up needs to be put back in its original place. Also remind the students that there are places in the stream where the water is deep and stepping in these areas will result in the boots filling up with water.

2. Since there are not enough strainers for everyone, have the students share strainers over the course of the investigation.

3. As the students start to bring aquatic organisms back to the holding tray, ask a few of the students to help you conduct some chemical tests on the water in the stream (there are always a few students who are not real excited about the insect discovery activity). Hand out the test tubes and instruction sheets to these students. When they get to the point where the instructions tell them to add one of the reagents to the test tube, have them bring the tube to you so that you can administer the reagent to the test tube (we would rather not have the students handle the reagents). The reagents are plainly marked in the water test kit. Once the students complete the test by comparing the color of the water in the test tube with the chart, have the students remember the number for later discussion.

3. After the students have collected a representative sample of organisms and have finished performing all the water tests, gather everyone at the stream bank. Take each different organism from the holding tray and place it in a plastic magnifying box. Pass the individual boxes around the group and have them identify the organisms using the laminated illustration sheet. After everyone has gotten a chance to see what was captured, have the students remove their boots and walk back to the classroom. Don't forget to check to make sure you are bringing back all the boots and equipment.

4. Back in the classroom, list all the Class 1, 2, and 3 organisms that were captured. Use this information to come to a conclusion about the quality of the water in the stream. Now review the water test results by having each student that performed a test report to the class his/her results. Use this information to corroborate the results from the collection of organisms.

5. Wrap things up by asking three important questions: Is water important? What are the threats to our water supply? and, is there anything the students can do to minimize their impact on our vital water resource?

VARIATIONS AND ADDITIONAL ACTIVITIES

Have the students determine the quantity of water flowing down the stream using the data collecting worksheet and instructions. After calculating the amount of water flowing in the stream over a period of one day, divide that quantity by 100 gallons to determine the number of people that the stream can support. Relate this number to the population of the school and/or community. Lesson: even a small stream can contribute a significant amount of water to meet the needs of human populations and should be protected from polluters.

Revised 2007 RWF

INFORMATION ON WATER TESTS

Dissolved Oxygen (DO) is important to the health of aquatic ecosystems. All aquatic animals need oxygen to survive. Natural waters with consistently high dissolved oxygen levels are most likely healthy and stable environments, and are capable of supporting a diversity of aquatic organisms. Natural and human-induced changes to the aquatic environment can affect the availability of dissolved oxygen.
Dissolved Oxygen % saturation is an important measurement of water quality. Cold water can hold more dissolved oxygen than warm water. High levels of bacteria from sewage pollution or large amounts of rotting plants can cause the % saturation to decrease. This can cause large fluctuations in DO levels throughout the day, which can affect the ability of plants and animals to survive.

Nitrate is a nutrient needed by all aquatic plants and animals to build protein. The decomposition of dead plants and animals and the excretions of living animals release nitrate into the aquatic system. Excess nutrients like nitrate increase plant growth and decay, promote bacterial decomposition, and therefore, decrease the amount of oxygen available in the water.
Sewage is the main source of excess nitrate added to natural waters, while fertilizer and agricultural runoff also contribute to high levels of nitrate.
Drinking water containing high nitrate levels can affect the ability of our blood to carry oxygen.

pH is a measurement of the acidic or basic quality of water. The pH scale ranges from a value of 0 (very acidic) to 14 (very basic), a measurement of 7 is neutral. The pH of natural water is usually between 6.5 and 8.2. Most aquatic organisms are adapted to a specific pH level and may die if the pH of the water changes even slightly.
pH can be affected by industrial waste, agricultural runoff, or drainage from improperly run mining operations.

Phosphate is a nutrient needed for plant and animal growth and is also a fundamental element in metabolic reactions. High levels of this nutrient can lead to overgrowth of plants, increased bacterial activity, and decreased dissolved oxygen levels.
Phosphate comes from several sources including human and animal waste, industrial pollution, and agricultural runoff.

Temperature is very important to water quality. Temperature affects the amount of dissolved oxygen in the water, the rate of photosynthesis by aquatic plants, and the sensitivity of organisms to toxic wastes, parasites and disease. Thermal pollution, the discharge of heated water from industrial operations, for example, can cause temperature changes that threaten the balance of aquatic systems.

Biotic Index Using Benthic Organisms

Benthic organisms dwell on the bottom layer of a body of water, and spend much of their time in the sediments. These macro-invertebrates lack a backbone and are visible to the naked eye. They can help us determine the quality of water in a stream or river based on their tolerance to pollutants. Class 1 organisms are very sensitive to pollutants, while Class 3 organisms are tolerant of pollutants. After collecting macro-invertebrates from your stream or river, use this index to assess how clean the water is. For example, if you a mix of organisms including Class 1 organisms, you can assume the water does not have pollutants. Finding only Class 3 organisms should tell you that pollutants are present.