Water Quality Monitoring (Nutrients) Teacher's Guide

Subject: Integrated Science (Life; Earth-Space; Physical)

Topic: Record keeping and sampling of abiotic factors within an ecosystem.

Summary: Students will use various types of equipment to explore selected parameters of water quality to gain a better understanding of the dynamics of the abiotic factors influencing freshwater systems and the inhabitants that reside in this ecosystem.

Objective(s): After completing the field lab, students will be able to:

1. Use water quality equipment properly and record data using proper units of measurement.
2. Explain the affects of human influence on a freshwater system.

Ecosystem(s): Lakes/Rivers/Springs

Equipment:

- Nitrate Test kit
- Phosphate test kit
- Distilled water
- 2 stopwatches
- Waste container
- Armored thermometer
- Lamotte Sampler
- Deionized Water
- Clipboards and data sheets
- GPS unit
- Test Tube Holder
- Waste Bottle (2)
- Multiple Directions

Background:

- Vocabulary: non point source pollution, titration,
- Reference Material: Healthy Water Healthy People http://www.wakullasprings.org/ref/FWSSP_Slide_Show.pdf
- Equipment Training: Nitrate and Phosphate test kits.

Procedure (Engage; Explore; Explain; Elaborate; Evaluate)

1. Engage the students by asking a specific question that gets to the heart of the activity: What do plants need to grow? What do people put on their lawns or crops? How is that related to this water body?
2. Use the students' answers to ascertain what they already know, clarify any misconceptions, and then ask them to formulate their own hypothesis relating to their own expectations of the outcome of the lab.
3. Explore the nutrients in the water system by following the procedures for the nitrate and phosphate test.
4. The group will split in two.
5. Group A will do the Nitrate test for 20 minutes. Group B will do Phosphate test for 20 minutes.
6. When finished with the tests the groups will switch. Group B will do Nitrate for 20 min and Group A will do Phosphate for 20 min.
7. After completing the labs, the groups will reconvene spend approx 15 minutes answering the discussion questions as a group. The students should explain their answers relating them to the concepts, processes and skills associated with the activity. Students should record their answers individually. At this time, facilitators can explain the specific concepts in a formal manner.

Sunshine State Standards:

Science: SC.7.N.1.1; SC.7.E.6.6; SC.7.L.17.3
Language Arts: LA.7.4.3.1,2; LA.7.4.2.2,3
Mathematics: MA.7.S.6.1
Social Studies: SS.B.2.3.9; SS.B.1.3.1

Water Quality Monitoring (Nutrients) Student Data Sheet

General Information

Full Name:		Science Teacher:	

Student Hypothesis and Rationale

If there is an abundance of algae mats in this location then the nutrient levels will be

(choose one: high or low) levels of nitrate according to the range charts on page 5, because

_____

_____.

Field Observations/Measurements/Data

	Group name:		Group name:		Group name:	
Location:						
Longitude:						
Latitude:						
Date:						
Time:						
Group Split	A	B	A	B	A	B
Water temperature:						
Nitrate:						
Phosphate:						

Water Quality Monitoring (Nutrients) Assessment

1. What was your Phosphate reading?

2. According to the reference chart on page 5, were the nitrate levels low, medium or high? Would you rate this water excellent, fair or poor ?

3. Was your hypothesis supported by your data? Whether your hypothesis is supported or not, what can you infer from your observations, measurements, and results?

4. Do you think there would be a seasonal pattern for Nitrate and phosphate readings? Why or why not? Do you think that the reading would be higher or lower in mid summer than it was today?

5. Nitrates have increased as population has grown in this area. List some factors that contribute to nutrients in the water.

6. Think about the observations you have just made. Did the activity raise new questions? Write a short question (start with "What, Why, Where, When, or How") about something you want to learn more about.

Water Quality Monitoring (Nutrients) Journal Prompt

A water drop that is filled with fertilizer may travel a long ways before the nutrients are used up. Imagine you are a drop of water that his filled with fertilizer. What types of activities are going to rid you of the Nitrates and Phosphates? What happens to those organisms that absorb your food? Write about your journey from the sprinkler head at the farm, to the spring vent, then down the river to the coast.

Water Quality Monitoring (Nutrients) **Reference material**

Freshwater Nitrate levels

Low	<0.2 mg/l	Excellent
Medium	0.2mg/l - 0.4 mg/l	Fair
High	>0.4mg/l - 0.8 mg/l	Poor
Maximum allowance (EPA)	1.0 mg/l	Extremely poor

http://www.wakullasprings.org/ref/FWSSP_Slide_Show.pdf

Note: The EPA's Drinking Water Standards allow up to 10mg/l in our drinking water.

Nitrates: To build proteins, all living things need nitrogen. In its molecular form (N_2), Nitrogen makes up 79% of the earth's air. Blue-green algae can convert N_2 ammonia (NH_3 and nitrate (NO_{-2}) that plants can use for growth. Aquatic animals obtain the necessary nitrogen to form proteins by eating plants or by eating other aquatic organisms that feed upon plants. Nitrogen in the form of ammonia and nitrates acts as a plant nutrient so it also causes eutrophication. Unlike phosphorous, nitrogen rarely limits plant growth, so plants are not as sensitive to increases in ammonia and nitrate levels.

Sewage is the main source of nitrates added to rivers by humans. Fertilizers and the runoff from cattle feedlots, dairies, and barnyards are two other sources of nitrates in water.

Water containing high nitrate levels can cause methemoglobinemia (Blue baby Syndrom) if it is used for infant milk formula. This condition prevents the baby's blood from carrying oxygen.

The United States Environmental Protection Agency (US EPA) has set a Maximum Contaminant Level (MCL) goal to maintain Nitrate levels below **10 mg/L**.

US EPA has set a MCL goal to maintain Nitrites below **1 mg/L**.

Total Phosphates:

Less than 1.0 mg/L	Excellent
1.1– 4.0 mg/L	Good
4.1 – 9.9 mg/L	Fair
More than 10 mg/L	Bad

Phosphorous is usually present in natural water as phosphate. Although it is essential for life, excessive amounts of phosphorous resulting from the release of human wastes, animal wastes, industrial wastes, soil erosion, and overuse of fertilizers can cause algal growth (blooms) to form in the water. This is a symptom of cultural eutrophication . Cultural eutrophication is the process by which a body of water becomes either naturally, or by pollution, rich in dissolved nutrients (phosphates) and often shallow with a seasonal deficiency in dissolved oxygen. Different species present in clean water are replaced by species tolerant of low dissolved oxygen.

http://www.sciotoswcd.org/testinfo.html