Estuarine Water Quality — 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 estuarine waters and the inhabitants that reside in this ecosystem.

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

1. Describe the interaction of freshwater from rivers and seawater from the Gulf as it meets in the estuarine environment
2. Use water quality equipment properly and record data using proper units of measurement.

Ecosystem(s): Estuary

Equipment:

- First Aid Kit
- Safety goggles
- Gloves
- GPS unit
- LaMotte, Inc. sampler
- Dissolved Oxygen kit
- Armored Thermometer
- Ph Probe
- Turbidity Tube
- Refractometer
- Eye Dropper
- Lens or tissue paper
- Waste container
- Clean water squeeze
- Data Sheet & Clipboards

Background:

- Vocabulary: Parameter, abiotic, Salinity, Estuary, D.O.
  Reference Material: NERRS http://www.nerrs.noaa.gov/Monitoring/Water.html
  Data form adapted from CBA http://www.basinalliance.org/
  Methods adapted from Bayouside classroom http://www.lumcon.edu/education/studentdatabase/
- Equipment Training: Students should be given an overview of the equipment and importance of parameters before entering the field.

Procedure (Engage; Explain; Explore)

1. Engage the students by asking specific questions that gets to the heart of the activity: How do you think the water will differ from an enclosed lake compared with an estuary (area where salt and fresh water mix)? If salinity in the ocean is usually 35ppt, what do you think the salinity in the estuary will be? What about the lake?
2. Go over safety procedures. Wear gloves and goggles to protect skin and eyes, all waste should go into the waste container and be properly disposed of after returning from the field, etc.
3. Explain the importance of each parameter and how it supports life in the estuary.
4. Explore the following Parameters. Follow the procedures according to the directions for each instrument. (see bayouside classroom methods)
   a. Take Longitude and Latitude, time of day, tide and weather conditions. Explain why it is important to note this data when doing a field study.
   b. LaMotte, Inc. Sampler: explain how the sampler rinses the DO bottle 5 times as the sampler fills up. Let the sampler fill until the bubble stop.
   c. DO: carefully add chemicals to the according to the directions of the test kit.
   d. Temperature: hold the thermometer in the sample water within 1 minute of obtaining the sample
   e. PH: use the PH pen or the PH test kit according to equipment instructions.
   f. Turbidity: two students use a turbidity tube according to instructions.
   g. Salinity/conductivity: use a refractometer for salinity in brackish or salty water. The pH pen also can be used to take salinity and conductivity.
5. 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.
6. Elaborate the prior discussion about abiotic factors. How do the parameters affect the survival of organisms within the water column? Evaluate the students understanding of the interconnectiveness of the ecosystem by answering the discussion questions.

Sunshine State Standards:

Science: SC.D.1.3.3, SC.F.1.3.1.7.1, SC.G.1.3.4.7.2, SC.G.2.3.2.7.1, SC.G.2.3.2.7.3, SC.G.2.3.4.7.1
Math: MA.A.1.3.1, MA.A.1.3.2, MA.A.4.3.1, MA.B.3.3.1, MA.B.4.3.1, MA.B.4.3.2, MA.D.1.3.1, MA.D.1.3.2, MA.E.1.3.1, MA.E.3.3.1
Geography/Social Studies: SS.B.2.3.6 NATIONAL GEOGRAPHY STANDARDS: #4, #8
Language Arts: LA.C.1.3.1.7.1, LA.C.1.3.4.7.1, LA.C.1.3.4.7.4, LA.B.1.3.2.7.1, LA.B.1.3.2.7.3

Estuarine Water Quality Student Data Sheet

General Information

Full Name:		Date:	
School:		Teacher:	

Student Hypothesis and Rationale

If the salinity of the ocean is 35 ppt and the salinity of fresh water is usually less than 0.5 ppt, then I believe that the water in this location will have a (choose one: higher or lower) salinity in ppt than the ocean because _____ _____.

I think the salinity will be _____ ppt.

Field Observations/Measurements/Data

	Group name	Group name	Group Name	Average
Location:				
Date:				
Time:				
Weather conditions:				
Cloud cover:				
Air Temperature:				
Water Type: Ground water/ surface water				
Feature:				
Depth of water sample:				
Water temperature:				
Color of water:				
Transparency:				
pH:				
Conductivity:				
Salinity:				
D.O.				
Nitrate:				

Estuarine Water Quality Range Reference Chart

Dissolved Oxygen

5-6 ppm	Sufficient for most species.
<3 ppm	Stressful to most aquatic species
<2 ppm	Fatal to most species

Temperature: preferred temperature range for aquatic organisms

Bacteria	Live in all temperatures!
Algae and other green water plants	55- 100 degrees F 13-38 degrees C
Most aquatic animals	55-100 degrees F 13 – 38 degrees C
* Best range for a healthy aquatic ecosystem	55-80 degrees F 13 – 26 degrees C

pH: preferred pH ranges of aquatic organisms

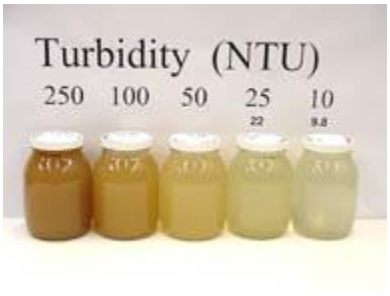
Bacteria	1.0 – 13.0
Algae and other green plants	6.5 – 13.0
Lower animal forms like snails	7.0 – 9.0
Most aquatic animals * Best range for a healthy ecosystem.	* 6.5 – 7.5

Acids have a low pH, Bases have a high pH

Salinity

Fresh water	<0.05 ppt
Brackish water	0.05 – 17 ppt
Ocean	35 ppt

Clarity- the measure of how deep light can penetrate through a body of water.
Secchi disk in meters



Estuarine Water Quality Discussion Questions

1. What was the measurement and unit for Nitrates?

2. Compare your Dissolved Oxygen results to the Dissolved Oxygen reference chart. Was the D.O. High, low or in the mid range? What are some causes for D.O. levels to change in an aquatic environment?

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. What effects would a hurricane possibly have on the salinity in a nearby estuary?

5. If a prolonged rainstorm occurred and loose soil and other run-off sources were allowed to flow into an estuary, which water quality measurement would most likely be affected and why?

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.

Estuarine Water Quality **Journal Prompt**

It is natural for people to seek inspiration from nature. Close your eyes and remember what you encountered in the estuary. Think about all of your senses. How did it smell? What animals did you encounter? What did you hear? See? Touch? What types of interactions did you see? How do organisms adapt to the ever changing habitat? Write down some notes about you inspirations then choose one of the options below and circle which one you choose.

- Write a non fiction story describing life in the estuary.
- Write a fictional story describing life in the estuary.
- Write a poem.