



# Salinity Sleuths



## Grade Level:

Upper Elementary, Middle School

## Subject Area:

Physical Science – Density

## Duration:

Subject Introduction: 10 to 15 minutes

Activity Time: 20 to 30 minutes

Wrap Up: 10 to 20 minutes

## Location:

Classroom or any outdoor setting

## Objective:

1. Illustrate the physical property of density in water.
2. Demonstrate how density affects water stratification throughout the Hudson Estuary system.

## NYC Performance Standards:

### Science:

Physical Sciences Concepts – S1a

Life Science Concepts – S2e

Earth & Space Sciences Concepts – S3a

Scientific Connections & Applications – S4a

Scientific Thinking – S5a, S5b, S5d, S5f

Scientific Tools and Technologies – S6a

Scientific Communication – S7a

Scientific Investigation – S8a

### English Language Arts:

Writing – E2a, E2c

## Background Information:

If you have ever tasted ocean water, you know that it tastes salty. The majority of the salt in the ocean is the same salt you would find on your table at home, also known as sodium chloride (NaCl). In comparison, if you were to do a taste test between ocean water and water in a lake or freshwater river you would taste very little or no salt in the freshwater samples. This is because the **salinity**, or amount of salt in the freshwater systems is very low compared to that of the ocean.

This difference in salinities between ocean and freshwater systems creates a unique **stratification** in areas where the two systems meet. Salty water has a **higher density** than freshwater. In other words the salty water is heavier than the fresh water and therefore sinks while the freshwater floats on top creating the stratification.

In **estuaries** the lack of mixing enables many different animal and plant species that have varying salt tolerances to survive in one system. Sometimes this stratification can result in extremely low oxygen levels and depth creating less than optimal living conditions for many species. However, estuaries are extremely fertile environments due in large part to the large quantities of nutrients washed into the system by rivers.

Many of the species that live in estuarine systems have developed special adaptations to survive in the constantly changing saline environment. The



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Hudson River Estuary, which includes the Harlem River, is a good local example of a stratified water system. The salinity in the Hudson River Estuary depends on the amount of freshwater flowing from the Hudson River. In years where there is a lot of rain or snow melt and the river flow is high, freshwater can be found almost to Manhattan. In drier years salt water can flow as far north as West Point, New York. Organisms that live in this environment must be able to adapt to the salinity changes or migrate out of the area.

## Vocabulary:

Density – The condition of being packed closely together

Salinity – A concentration of salt in a solution.

Stratification – An arrangement in layers.

Estuary – Where salt water meets freshwater.

## Materials:

- 30 Glass test tubes
- 8-10 Test tube racks
- 3 Large glass containers or flasks
- 1 Red food color
- 1 Blue food color
- Disposable plastic Pasteur pipettes

## Table Salt

### Procedures:

#### Pre-Activity Set-Up:

1. Make the solutions of varying salinity for the class.

*Solution #1:* Plain tap or distilled water; no salt added.

*Solution #2:* Dissolve 1/8 cup salt in 500 mL of water. Add red food coloring. This is the mid-grade saline solution.

*Solution #3:* Dissolve 1/4 cup salt in 500 mL of water. Add blue food coloring. This is the high-salinity solution.

Be sure that all the water is the same temperature—if it varies between solutions, the stratification will not be as dramatic.

2. Label the solutions as Sample #1, Sample #2 and Sample #3.

#### Warm Up:

1. Discuss with students the differences between salty and freshwater.
2. Demonstrate how the density of water affects stratification by making two types of water. Show this by adding salt and green food color to a bottle of water.
3. Next fill one test tube half full with green salt water and a second test tube half full with clear freshwater.
4. Using a plastic Pasteur pipette add freshwater to the green salty water, and vice versa. Demonstrate how to add the water slowly and down the



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- side of the tube to minimize the solutions mixing.
5. Discuss with students why the water stratified. Did both test tubes stratify or was there a lot of mixing on one of them. Normally if you add a more saline solution to a less saline solution there is a higher degree of mixing and less stratification. This is because the higher salinity solution is more dense and as it sinks it mixes with the lesser saline solution.
  6. Give a brief lecture on estuaries and how they work. Emphasize that estuaries are often stratified and that salinity changes over distance.

4. Using a plastic Pasteur pipette **slowly** add clear water to Test tube #1 and also to Test Tube #2. Next add red water to Test Tube #3.

## Wrap Up:

Based on the stratification results, discuss with the students which water sample came from which sample location. Have students explain why they think their answer is correct.

## Main Activity:

1. Explain to the students that you "collected" three different water samples along the Hudson River but forgot to label the bottles. Let them know that they are going to be scientific detectives to determine which sample came from Poughkeepsie, Hastings-On-Hudson, or the Atlantic Ocean. Show them a map of the river so that they can get a general idea of each location.
2. Divide the class into 8 to 10 groups. Give each group 3-test tubes and one test tube rack.
3. Each group should begin by adding the following to their test tubes:
  - Test tube #1* – half full with red water
  - Test tube #2* – half full with blue water
  - Test tube #3* – half full with blue water.

Label each test tube (1, 2, and 3).



**NYRP Education Worksheet**  
**Aquatic Science- Salinity Sleuths**

Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Date: \_\_\_\_\_

**I. Vocabulary Words – Define the vocabulary words below**

- a) Density
- b) Salinity
- c) Stratification
- d) Estuary

**II. I'll Have Salt With That**

Color in your results for each test tube using the test tubes below. Next to each color word tell me where the water came from: Poughkeepsie, Hastings-On -Hudson, or the Atlantic Ocean. You can use the map on the backside of this page for help.



**Test Tube #1**

**Test Tube #2**

**Test Tube #3**

**Red Water:** \_\_\_\_\_

**Blue Water:** \_\_\_\_\_

**Clear Water:** \_\_\_\_\_

