

**Title: Water Science: Data Dilemma in Great Bay**

**Guiding Question:** What do data buoys in Great Bay tell us about the Estuary?

Grades: 8 – 12	Subjects: science and math
Length: 60 minutes	Site: Classroom
Summary: Students use water quality and meteorology data from buoys in Great Bay to understand the physical processes in the Estuary	
Objectives: <ul style="list-style-type: none"> <li>• Students will use real world data from Great Bay to understand relationships between salinity, temperature, DO, pH, weather, and tides</li> <li>• Students will apply what they know to a real world scenario</li> </ul>	
Materials <ul style="list-style-type: none"> <li>• Computer Access</li> <li>• Paper Printout of Student Sheets</li> <li>• Pencil</li> </ul>	

**Background**

Great Bay is a tidal estuary 12 miles inland from the Atlantic Ocean in NH. As both a fresh water and saltwater system, the tidal Piscataqua River drains and flushes 50% of the water from Great Bay twice each day. Great Bay is a diverse and productive estuary and has been named as one of only 28 nationwide as “estuaries of national significance.” There are 7 major rivers that flow into the Bay. This lesson explores several properties of water listed below.

*Temperature:* Temperature in Great Bay changes daily with tidal shifts, monthly with seasonal changes, and yearly in response to temperature changes in the Gulf of Maine.

*Salinity:* As a tidal estuary, Great Bay experiences a large range of salinity levels, from fresh water to salinity levels close to 32 ppt (the same level as the Gulf of Maine). Fresh water is less dense and when the water is not well mixed, such as during rain events, you can find changes in salinity with water depth

*Dissolved Oxygen (DO):* DO is essential for supporting life in the water. Increasing temperature, waves, salinity, and photosynthesis can increase DO values, while a lack of light, high turbidity, excessive nutrient loading and decomposition can decrease DO levels. Oxygen is recorded as either content (mg/L) or as a percent of saturation (up to and exceeding 100%).



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pH: pH is a measure of the hydrogen ion content in water. A pH of 7 is neutral, less than 7 is acidic and more than 7 is basic. Ocean water has an average pH of 8, and Great Bay typically has values between 6.5 and 8.

### Procedure

1. Go to the National Estuarine Research Reserve System and find the data buoys in Great Bay (<http://cdmo.baruch.sc.edu/get/export.cfm>)
2. Select any one of the following buoys that reports water quality data (Oyster River, Great Bay, or Squamscott River) and graph the data for a single week for temperature and salinity. Answer the questions on the Student Sheet. You will use this same week period for the next several steps so record your data carefully.
3. Using the same station, graph the other parameters over the same time period and answer the questions on the student sheet.
4. Comparing different stations: select two of the stations and compare temperature and salinity data over the same time period.
5. Select one of the stations that reports meteorological data and select the same time period. Answer the questions on the student sheet.
6. Data dilemma – using the data buoys in Great Bay, graph the salinity parameter for Sept 1-10, 2008. Using the available data, and your skills as a researcher, explain what occurs during this time period that causes the changes in the salinity level

### Assessment

Review students answer on the student sheet to assess their understanding of how the various water quality and meteorological data interact.

### Extensions

Ask students to create a presentation about their selected time period. What happens during this time and how can you explain it with the available data.

How does the data during your selected time period impact the various biological processes going on?

Ask students to compare these stations to stations in other estuaries.



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## Make it Place-Based

Ask students to map the data stations in the Estuary

Visit one of the data buoy locations and use your own water quality data to take measurements at this location

### Resources

National Estuary Research Reserve System: <http://cdmo.baruch.sc.edu/>

NH Dept of Environmental Services:

<https://www.des.nh.gov/organization/divisions/water/wmb/coastal/great-bay-estuary.htm>

Great Bay Real-Time Environmental Monitoring Network: <http://www.greatbaydata.org/>

The Great Bay Estuary and Great Bay Coastwatch:

[http://nsgd.gso.uri.edu/nhu/nhut04005/nhut04005\\_part1.pdf](http://nsgd.gso.uri.edu/nhu/nhut04005/nhut04005_part1.pdf)

### Standards

HS-ESS3-6 Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.



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