

## A Day in the Life of the Hudson River

### Teacher Notes: Hudson River Salinity Mapping Activity (MS & HS activity pages 1-2, ES activity page 3)

#### Introduction:

This is a student completed Data Visualization activity. With computer graphics being accessible to students, more and more often students are being exposed to data in graphic visualizations. Data visualization has become an active area of teaching, yet often the students have not considered that there is numeric data supporting the representations. This activity is designed to be a bridge that carries the students from reviewing the numeric data to turning those numbers into color graphics and to a deeper understanding of the colorized computer graphics they encounter in their continued education both in science and non science courses.

#### MS and HS Students Activity

This activity can be done as an analysis of a single year of salinity data, or as a comparison between two years of data (2008 and 2009). Students will need:

- \*A map
- \*Color pens or crayons to match the graphic key (red, orange, yellow, blue, green, purple)
- \*The data chart for further analysis of the data

Have the students start by looking at the map, laying it out in sections so they can see the full extent of the river. Ask them to consider where they would expect to find higher salinities. (Note that on the map some of the salinities have been entered.) Next have them look at the data sheet of the River Miles sampled, and the salinity for each location recorded as 'total salinity' in ppm. On the bottom right corner of the data sheet is the salinity color scheme or 'graphic key' for the activity. Have the students follow the key to create a color visualization of the salinity. For the color visualization students will work with the salinities recorded on the map. Using 6 colors of crayon (red, orange, yellow, green, blue and purple) create a visualization of the salinity gradient in the river.

Once the students have completed their coloring have them answer the following questions:

1. Why is the southern part of the river saltier than the northern part of the river?  
(Answer: *tidal influence of the Atlantic Ocean*)
2. Why is East River saltier than the Hudson River at the same latitude?  
(Answer: *the East River connects to saltwater bodies – Long Island Sound and the Atlantic Ocean. The Hudson connects freshwater from the South with salt water from the Atlantic.*)
3. Students can locate their school sampling site on the river.
4. How would you describe each section of the river? Is one section longer than the others – if so which one? Is one section very short – if so which one?

Now lets look at the numeric data sheet.

5. We often refer to the section of the river that is not considered fresh or salt water as 'brackish'. For our activity we will refer to salinities between 17000 ppm and 100 ppm as brackish water, less than 100 ppm as freshwater and greater than 17000 ppm as

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saltwater. On the numeric datasheet have students draw a line across both ends of the brackish section of the river. Now mark this on the map as well.

6. Referring back to their own sampling site on the river, using our definitions, is their site in the freshwater, brackish or saltwater section of the river?
7. If you are using the 2008 data look at RM 6 at 79<sup>th</sup> St. Boat Basin. This group collected a sample from the surface and from 40 feet deep in the water. Look at the difference in the salinities between the surface and the 40 ft. deep sample. Why would there be a difference?

*(Answer: Salt water is denser so the salt water coming in from the ocean flows underneath the freshwater coming down from the north.)*

8. If you are using the 2009 data look at RM 11 at Fort Washington Park. There were two different groups sampling at this site, one in the AM and one in the PM. Look at how the tide brings a higher concentration of salt into the river when it floods!

### IF YOU DECIDE TO HAVE YOUR STUDENTS COMPARE DATA FROM 2008 AND 2009

- Have the class work in teams of two - giving one partner 2008 and one partner 2009 data/activity. Have them complete the activity and then have them look at the two maps side by side.
- Ask them to make a list of their observations of the differences and similarities between the data collected in the 2 years.
- If students in 2008 looked at the variation of sampling at surface and depth at RM 6 have them compare to 2009 RM 76 where the same idea was tested with a surface and depth sample. What were the results? Why?  
*(Answer – there was only a background trace of salt in the river that is well mixed- no dense saltwater tongue pushes this far upriver to ride below the freshwater.)*
- Students will see that the overall sections of the river we call fresh and salty stay relatively constant, but that the actual salinity readings in these areas of the river will vary with weather, and to a lesser extent with tide. The brackish section has higher internal variability, again as a result of the weather and tides. If you were to look at the weather for 2009 you would see that there was a rain event the day before our sampling that added a freshwater pulse to the river as the watershed drained. Due to the lower levels of salt in the brackish section of the river the increase in freshwater has an impact in the data, which is noted in our sampling.

**\*Note that small variances in the data from location to location are not unexpected. They can result from the resolution of our sampling methods, the variation in time when the water was sampled (time in the tidal cycle), as well as the location of the sampling site (some of the sites are by freshwater tributaries that add a fresh pulse of water into the river by their site, or they may add a small amount of road salt still seeping from the stream shoulders during a rain event). Try and impress upon your students the amount of salt we are referring to when we discuss parts per million (ppm).**



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### For ES Students

#### Students will need:

\*A map - Select a single year 2008 or 2009

\*Color pens or crayons to match the graphic key (red, orange, yellow, blue, green, purple)

1. The Hudson River is a mix of freshwater from the upper section of the watershed and saltwater coming in from the ocean. This mixture creates 3 different habitats or environments – freshwater and saltwater and a third middle section of the river where they mix called ‘brackish’. We can separate those 3 sections by the amount of salt in the water.
2. For this activity we will refer to salinities over 17000 ppm as marine or saltwater, water between 17000 ppm and 100 ppm salinity as brackish water, and less than 100 ppm salinity as freshwater.
3. On the map have the students use a red crayon to draw a line across the map where they believe the salt reading of 17000 ppm would be.
4. On the map have the students use a purple crayon to draw a line across the map where they believe the salt reading of 100 ppm would be.
5. Next using their crayon have them color the section of the river that is higher than 17000 ppm red.
6. Have them color the section of the river that is between 17000 and 100 ppm green.
7. Have them color the section of the river that is below 100 ppm purple.
8. Now talk about where your sample site is on the river and have the students locate it on the map.
9. What part of the river are they in fresh? brackish? or saltwater? What would they expect their salinity reading to be in the river?

