Locating the Salt Front

Students will use Hudson River salinity data to create a line graph that shows the location of the salt front, and use math skills to explore how this location varies over time.

Objectives: Students will use data from tables to:
- graph salinity data from sites along the Hudson River estuary;
- observe patterns of change in salinity along the estuary;
- use the graph to estimate the location of the salt front;
- compare the location of the salt front in different years.

Grade level: Elementary (Grades 4-5)

Subject Area: Math, Science

Standards: Mathematics, Science, & Technology Standards 3, 4

Skills:
- Use graphs to see patterns and relationships observed in the physical environment.
- Use whole numbers to identify locations and measure distances.
- Add and subtract whole numbers.

Vocabulary: chloride, concentration, dilute, downriver, estuary, river mile, salinity, salt front, upriver

Duration:
Preparation time: 5 minutes
Activity time: 40 minutes for each of two sections

Materials: Each student should have:
- ☐ Worksheet: Locating the Salt Front – Section 1
- ☐ Worksheet: Locating the Salt Front – Section 2
- ☐ Regular pencil
- ☐ Two colored pencils of different hues
- ☐ Ruler
- ☐ Hudson River Miles map

Background:
Ocean tides affect the lower 153 miles of the Hudson River from the Federal Dam in Troy, NY, to New York Harbor, which empties into the Atlantic Ocean. This part of the river is an estuary, where fresh water from the watershed and salt water from the ocean meet and mix.

Seawater is diluted by fresh water as it enters the Hudson; its leading edge—the salt front—is where the concentration of chlorides (mostly sodium chloride, like table salt) reaches 100 milligrams per liter (mg/L). The salt front's location depends on runoff from the watershed, and varies based on seasonal patterns of climate and weather events. In fresh water upriver from the salt front, chlorides are present at low concentrations, usually 20-50 mg/L. These low levels result from erosion of rocks and soil and also from some human activities.

Scientists locate the salt front using Hudson River Miles. Hudson River Miles (HRM) start at the southern tip of Manhattan. This spot, called The Battery, is HRM 0. The estuary part of the Hudson ends at the Federal Dam in Troy at HRM 153.

Activity:
1. Discuss the concepts of estuary and salt front.
2. Explain Hudson River Miles.
3. Do section 1 of worksheet in class; assign section 2 as homework.

Assessment:
- Have students share answers to questions from worksheets, or collect and grade sheets.
- Make up similar problems for quiz.

Answers:
Note: At Bear Mt. in 2004, 50 mg/L is an estimate; the test used there could not detect low salt levels.

Locating the Salt Front – Section 1
1. *Manhattan HRM 7; Ulster HRM 97*
2. *Steepest HRM 7 to HRM 46; 3210 mg/L*
   Flattest HRM 46 to HRM 97; 16 mg/L
3. *Piermont and Bear Mt.*
4. *approx. HRM 44*
5. *Incoming salt water is diluted by fresh water.*

Locating the Salt Front – Section 2
1. *Higher in 2006 by 5200 mg/L*
2. *Steepest HRM 7 to HRM 55; 7950 mg/L;*
   Flattest HRM 55 to HRM 97; 14 mg/L
3. *approx. HRM 54; upriver approx. 10 miles*
4. *Coming into Oct., 2004 was wetter than 2006; greater runoff pushed salt front downriver.*

Resources:
http://ny.water.usgs.gov/projects/dialer_plots/saltfront.html The U.S. Geological Survey Hudson River Salt Front website has tables and a map showing the front's location plus real-time data on water temperature, tide stage, and conductivity (a stand-in for salinity) from Hastings on Hudson, West Point, Poughkeepsie, and Albany (no conductivity data here).
http://www.ldeo.columbia.edu/edu/k12/snapshotday/ This site posts salinity and other data gathered during DEC's annual Day In the Life of the Hudson River event—a.k.a. Snapshot Day. On this day, students collect river data at dozens of sites from New York City to Troy dam.