# Using Real-Time Data: Field Collection

**Time**: 1-2 class periods
**National Benchmarks:** Benchmarks 5A: Diversity of Life; 5D Interdependence of Life; 5E: Flow of Matter and Energy; 9B:Symbolic Relationships; 9D:Uncertainty; 12B:Computation and Estimation; 12D:Communication Skills; 12E:Critical-Response Skills.
**National Science Content Standards:** *Science as Inquiry: A*; *Life Science: C*: Biological Evolution; The Interdependence of Organisms; Matter, Energy, and Organization in Living Systems; *Science and Technology: E:* Abilities of Technological Design; Understandings about Science and Technology; *Science in Personal and Social Perspectives: F:* Population Growth; Natural Resources: Environmental Quality; Natural and Human-induced Hazards; Science and Technology in Local, National, and Global Challenges
**New York State Standards:** 1, 2, 4, 5, 6, 7

**Objective:** Students will know how water quality parameters change over location and time, and compare collected data with real-time data collected by scientific instruments in the Hudson River.

**Lesson Outline:**

1. Students conduct an outdoor investigation, comparing a marsh and a cove of the Hudson River.
2. Students use the data to discuss the relationship between dissolved oxygen, pH, and temperature.
3. Students compare their results with real-time data from the HR-ECOS database.

**Materials:** Dissolved oxygen meter or test kits; pH meter or test kits; thermometer; nitrate kit (optional).

**Engagement:** Before leaving for the field, ask students how they would find out the temperature or wind conditions on the Hudson River for a sailing trip. What resources would they look for? How do we know that these resources are accurate? Explain that during the field trip, students will be testing for water quality indicators themselves, and then comparing their results with scientific data collected by an automated instrument that is in the river all the time.
**Explore:** Students will test for dissolved oxygen, pH, temperature, and nitrate-nitrogen (optional) levels in a cove of the Hudson River and a marsh leading out to the river. After gathering the data, students will compare their results with data from the HR-ECOS sonde at Norrie Point. If students need background on water quality parameters, there are readings about each parameter and preparatory lab exercises in the Pollution module of the Changing Hudson Project.
**Explain:** Water quality results will vary based on the time of day that sampling occurs, tides, seasons, and weather. Below is a summary of possible explanations for each indicator.

1) pH: The Hudson River basin has a lot of limestone bedrock, which has a naturally high (alkaline) pH and is therefore well buffered. However, much of the rainfall in the region is acidic, with the average pH of rainfall around 5.0. With the buffering capacity of the bedrock, the Hudson tends to range between 7.5 and 8.0. After a long period without rain, the pH tends to increase, generally due to the decreasing levels of carbon dioxide as

photosynthesis occurs. Rainfall usually decreases the pH of the river, but time of year, amount of rainfall, and previous rainfall patterns all have an impact.

On a daily basis, pH will first increase during daylight hours due to the photosynthesis of plants and phytoplankton. As the sun goes down, pH decreases as carbon dioxide levels increase throughout the night as a result of respiration. Other factors can influence pH, however, such as clouds that block the sun's radiation, decreasing the photosynthetic rates of the plants and reducing the increase in pH. Tides can also influence pH, and a low tide can allow more sunlight to reach submerged plants, increasing their photosynthetic rates.

2) Dissolved oxygen: DO levels generally increase throughout the day as photosynthesis takes place, and plants add oxygen to the water. However, if you are testing under a water chestnut bed during the summer when plants have leafed out and created a floating bed, DO levels will be significantly lower. Tides can also affect dissolved oxygen levels, as newly oxygenated water enters into the cove at Norrie Point. When no macrophytes are present in the water, photosynthesis levels decline, although phytoplankton are still present and active.

3) Temperature: Temperature affects dissolved oxygen levels because as water warms, less gas is able to diffuse into the water. Students should calculate percent saturation to understand how temperature relates to their observed dissolved oxygen levels.

**Extend:** If you are able to remain at the field site for an entire tidal cycle, have some students collect high tide data and others collect low tide data. There will be noticeable differences that will provide them with a better comparison to the HR-ECOS data.
**Evaluate:** Collect student worksheets.