Experiment 9: Field Sampling for Class Project

CH3420: Environmental Chemistry, Plymouth State University

Adapted from "Standard Operating Procedures: Sample Collection Procedures," Center for the Environment's Environmental Research Lab, Plymouth State University, Plymouth, NH.

Additional Resources:

- Standard Methods for Examination of Water and Wastewater, American Public Health Association, 21st Edition, 2005.
- http://www.epa.gov/waterscience/methods/method/

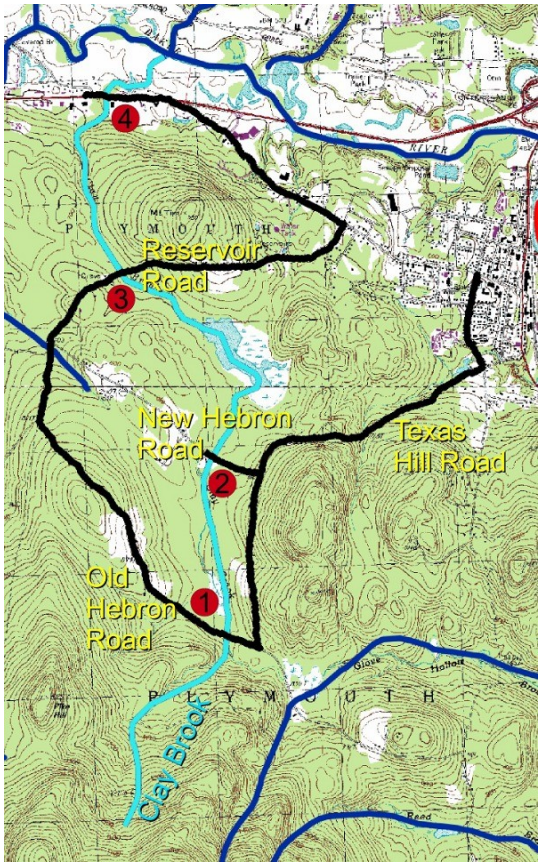

Figure 1: Map of Clay Brook road crossings

Introduction:

The last four weeks of lab in Environmental Chemistry will be dedicated to the Class Project, which will involve the analysis of water samples collected from the field. The purpose of the project is to perform common analyses on the water and search for trends related to the geography and human activity of the area.

This year, we will be sampling Clay Brook, a stream that drains from the north side of Plymouth Mountain (located just southwest of Plymouth, NH) and flows northward about 5 miles before joining the Baker river. In its short travels, it crosses a gravel road, two small paved roads, and a highway (NH Route 25), and it creates and drains a bog (Figure 1). The brook begins in an unpopulated area that sees little human activity except day hikers making the trek to the top of the mountain. Population density increases slowly, starting with just a few houses in the valley drained by the brook, until it ultimately crosses the heavily trafficked Route 25 in close proximity to a commercially developed area.

The analyses of environmental water samples include some that must be done at the time of sampling (e.g., pH, dissolved oxygen, temperature), and others that are best performed in the lab. A variety of probes are available for the critical in-field tests. Because the lab-based tests, necessarily will be done at a later time, samples must be preserved and stored appropriately, in accordance with the demands of the specific analysis. Examples of sampling and storage protocols for some analyses are given in Table 1.

Table 1: Sampling and Storage Protocols for Various Water Analyses

Analysis	Holding Time	Acidified	Filtered	Storage	Filling Procedure
Anions and Cations	7 Days		X	Store at < 4°C	To neck of bottle
Total Organic Carbon	14 days	X	X	Store at < 4°C	¾ full
Total Phosphorus	28 days	X		Store at < 4°C	To neck of bottle

Equipment:

- Clothing and footwear appropriate for a few hours of fieldwork.
- Probes to measure pH, dissolved oxygen, conductivity, and temperature in the field.
- 1 L polyethylene bottles, 500 mL beaker, 50 mL beaker
- conc. H_2SO_4 in dropper bottles, pH paper
- Coolers of ice
- Permanent marker
- *Optional*: digital camera, GPS

Safety Considerations:

- Fieldwork comes with the inherent dangers of being in the wilderness, including but not limited to twisted ankles, falling in streams, encounters with wildlife, getting dirty, and being lost. Use common sense and come appropriately attired!
- Strong acids will be used to acidify some of the samples.

Procedure:

In-field tests for pH, dissolved oxygen, conductivity, and temperature: Repeat the following steps for each of the probes. Note that some probes make more than one measurement

1. Rinse a 500 mL beaker twice with the stream water and fill a third time to make the measurement according to the following steps:
   a) Invert the beaker so opening is pointed down and plunge into the stream about a foot.
   b) Turn beaker right side up and allow it to fill. Pull beaker out of the water.
   c) For first two rinses, discard the water downstream and away from the water source.
2. Rinse the probe with about 100 mL of water from the beaker.
3. Insert the probe into the water. Swirl a few times gently to dislodge any bubbles.
4. Wait until the reading on the probe has stabilized. Record the reading.
5. Discard the water downstream and away from the water source.
6. Repeat for the remaining probes.

Sampling for In-lab tests

1. At each sampling point, fill two 1-L bottles. One bottle will be acidified, and one will not. Label each bottle with the location of the sampling sight, the date, and whether it is acidified.
2. Invert sample bottle so opening is pointed down and plunge down into water about a foot.
3. Turn bottle right side up and allow it to fill. Pull sample bottle up out of the water.
4. Fill each bottle just to the neck, allowing space for acid to be added.
5. For acid preservation:
   a) Add 2 mL of concentrated sulfuric acid to the bottle. Cap and invert gently a few times to mix.
   b) Test pH by pouring a small amount of water into a small beaker and inserting a pH strip into the beaker. After acidification, sample pH should be < 2. If not, add another drop of sulfuric acid and re-check.
6. Place samples in ice.

Analysis

The following should be done in your notebook. You may choose to do this after the lab, but your lab will not be signed off, and your duplicate pages will not be accepted, until it is completed. This analysis should also appear in your formal lab report.

1. Make a table recording the site, date and time of sampling, pH, dissolved oxygen, conductivity, and temperature at each sampling site.
2. Make note of any observations (e.g., weather, topography, pollution) that may be relevant to the levels of chemicals you will analyze for in the lab.

Conclusions

Answers to these questions must be included as part of your Conclusions in your written lab report. Include them in your Conclusions narrative, not as numbered list of questions and answers.

1. Make four graphs of the parameters you measured in the field (pH, dissolved oxygen, conductivity, and temperature) versus sampling site (i.e., distance downstream). Comment on any trends or the absence thereof.
2. Speculate as to why some samples need to be acidified for lab analysis, and others should not be acidified.

