Water Health Study

Purpose

To measure the temperature, dissolved oxygen, conductivity, pH, and insect activity to determine the overall health of the water body. We will also examine the relationships between these factors.

Overview of Measurements

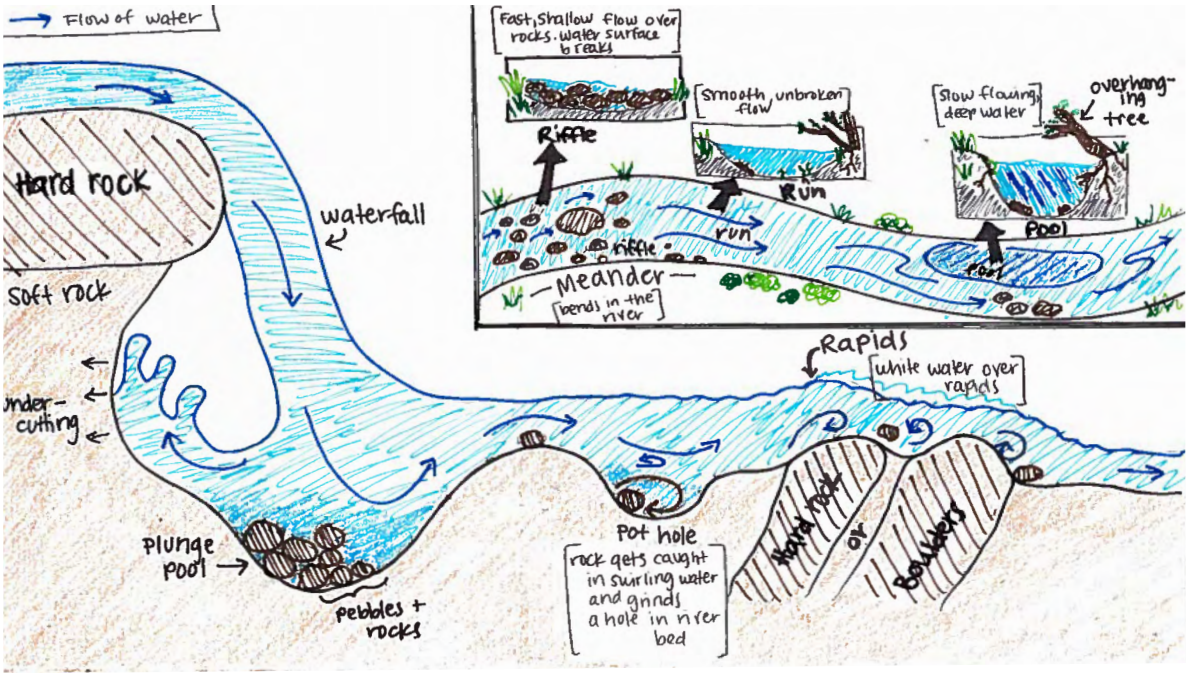
The following steps will be taken:

1. Define and Sketch the Site
2. Water Temperature
3. Dissolved Oxygen
4. Conductivity
5. pH
6. Insect Survey

Introduction

The hydrosphere is the part of the Earth system that includes water, ice and water vapor. Water participates in many important natural chemical reactions and is a good solvent. Changing any part of the Earth system, such as the amount or type of vegetation in a region or from natural land cover to concrete, can affect the rest of the system. Rain and snow capture aerosols from the air. Acidic water slowly dissolves rocks, placing dissolved solids in water. Dissolved or suspended impurities determine water's chemical composition.

A healthy waterway can help support life in many different ways. Having too much or little of some elements can cause the water to become an unsuitable habitat or unsafe to drink.



Documenting Your Site

(1) *Site Sketch*
Lay out your 50m transect along the bank of your study site and placemarkers (these can be sticks or stones) at every 10m. Use these markers to help you with spacing in your sketch. Take a few minutes to make a brief sketch of your site. Be sure to include any key features such as sandbars, waterfalls, pools, riffles or rapids, overhanging trees, exposed roots, and cliffs. Also include arrows to indicate the direction of flow and mark any prominant vegetation in or near the stream. Use symbols to mark the presence of these features and create a key in the margin of your notebook to indicate what each symbol represents.

(If you have already done this for River Erosion, you do not need to repeat this step)

Hydrology Protocols

In this investigation we will run various tests on the water to gauge the health of the water. We will also explore how these various variables relate to each other. These are the variables we will be testing **and the order** we will be testing them in:

a) Temperature. b) Dissolved oxygen. c) Conductivity. d) pH.

e) Insect Search and Survey.

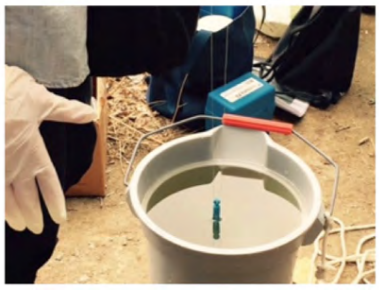
(2) *Water Temperature*- Use *either* a probe or alcohol-filled thermometer depending on availability.

Temperature- Using a Temperature Probe

Please refer to the user manual that comes with the probes for more complete and probe-specific directions.

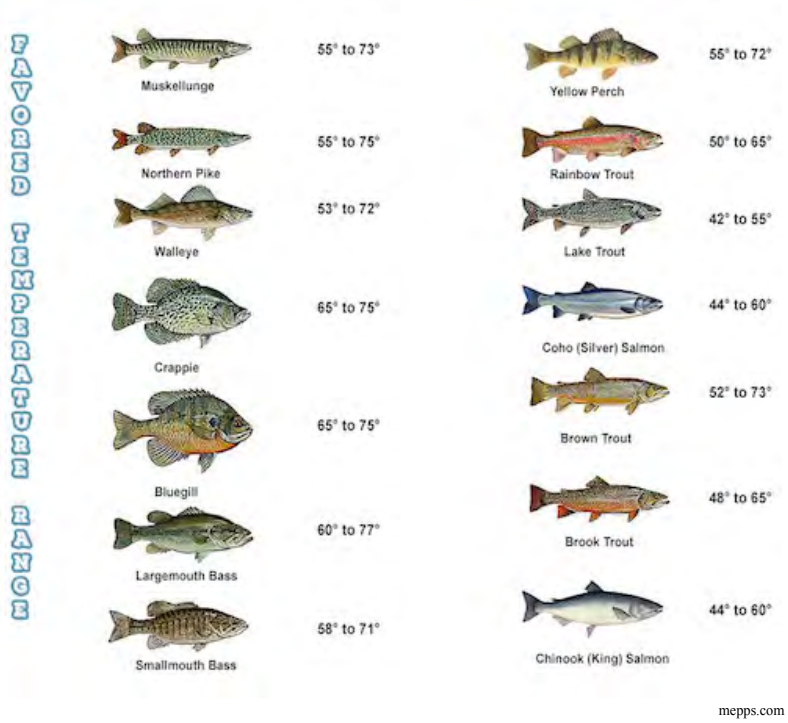
General Directions:

1. Put the metal end of the probe (not the plastic handle) into the sample water and keep it submerged until the reading stabilizes (stops changing).
2. Read the temperature on the meter without removing the probe from the water.
3. Record the temperature in your student journal.
4. Have two other students repeat the measurement with new water samples.
5. Calculate the average of the three measurements.
6. All temperatures should be within 1.0˚C of the average. If they are not, repeat the measurement.
8. Rinse the electrode with distilled water and blot dry.



Temperature- Using an Alcohol-Filled Thermometer

1. Slip the rubber band around your wrist so that the thermometer is not accidentally lost or dropped into the water.
2. Check the alcohol column on your thermometer to make sure there are no air bubbles trapped in the liquid. If the liquid line is separated, shake or swing thermometer until liquid is solid.
3. Put the bulb end of the thermometer into the sample water to a depth of 10cm.
4. Leave the thermometer in the water for three minutes.
5. Read the temperature without removing the bulb of the thermometer from the water.
6. Let the thermometer stay in the water sample for one more minute.
7. Read the temperature again. If the temperature has not changed, go to Step 8. If the temperature has changed since the last reading, repeat Step 7 until the temperature stays the same.
8. Record the temperature in your journal.
9. Have two other students repeat the measurement with new water samples.
10. Calculate the average of the three measurements.
11. All temperatures should be within 1.0˚C of the average. If they are not, repeat the measurement.

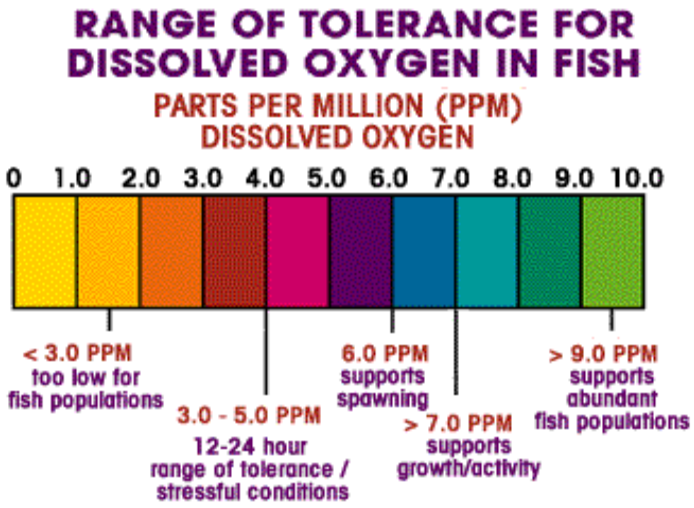


(3) *Dissolved Oxygen (DO)* *- Using a Probe*

Please refer to the user manual that comes with the probes for more complete and probe-specific directions.

General Directions:

1. Lower the tip of the probe into the sampling water and slowly move it back and forth. If you are measuring flowing water, you can just hold the probe in place.
2. When reading has stabilized, record the dissolved oxygen value in your journal.
3. Repeat the readings two more times and record the dissolved oxygen.
4. Check to make sure that the three readings are within 0.2mg/L of one another. If they are not, continue taking readings until the last three are within 0.2mg/L of one another.
5. Calculate the average of the three measurements.
6. Rinse the electrode with distilled water and blot dry.



(4) *Electrical Conductivity (EC)*- Use *either* a probe or EC meter depending on availability.

Electrical Conductivty-Using a Probe

Please refer to the user manual that comes with the probes for more complete and probe-specific directions.

General Directions:

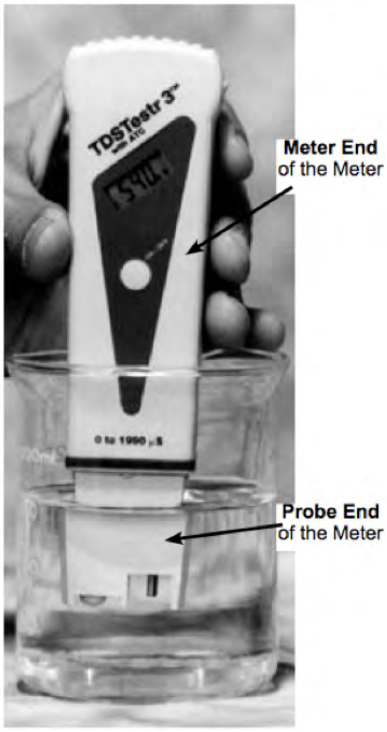
1. Lower the tip of the probe into the sampling water and slowly move it back and forth. If you are measuring flowing water, you can just hold the probe in place.
2. When reading has stabilized, record the conductivity value in your journal.
3. Repeat the readings two more times and record the conductivity.
4. Calculate the average of the three measurements.
5. Check to make sure that the three readings are within 40mS/cm of one another. If they are not, continue taking readings until the last three are within 40 mS/cm of one another.
6. Rinse the electrode with distilled water and blot dry.

Conductivity Averages (source: fondriest)

Electrical Conductivity- Using a Meter

1. Refer back to the temperature of the water already tested (step (2)). If water is between 20˚ – 30˚C, go to step 3.
2. If your water is below 20˚C or above 30˚C, fill a clean cup with the water to be tested. Allow water to sit out until the water to reaches 20˚ – 30˚C, record the temperature and then proceed to step 3.
3. Rinse two cups two times with sample water.
4. Pour about 50mL of water to be tested into the two cups.
5. Remove the cap from the probe end of the meter. Press the On/Off button to turn it on.
6. Rinse the probe with distilled water. Blot it dry. Do not rub or stroke the electrode while drying.
7. Put the probe in the water sample in the first cup. Stir gently for a few seconds. Do not let the meter rest on the bottom of the cup or touch the sides.
8. Take the probe out of the first cup. Shake gently to remove excess water, then put it into the second cup *without* rinsing with distilled water.
9. Leave the probes submerged for at least one minute. When the numbers stop changing, record the value in your student journal.
10. Have two other students repeat the measurement using fresh cups of water each time. Record these measurements.
11. Calculate the average of the three observations.
12. Each of the observations should be within 40mS/cm of the average. If one or more of the values is not within 40mS/cm, pour a fresh sample and repeat the measurements and calculate a new average.
13. Rinse the probe with distilled water, blot dry, and put the cap on the meter.

Figure HY-EC-1: Using the Conductivity Meter



(5) *pH*- Use *either* a probe or pH papers depending on availability.

Using a Probe

Please refer to the user manual that comes with the probes for more complete and probe-specific directions.

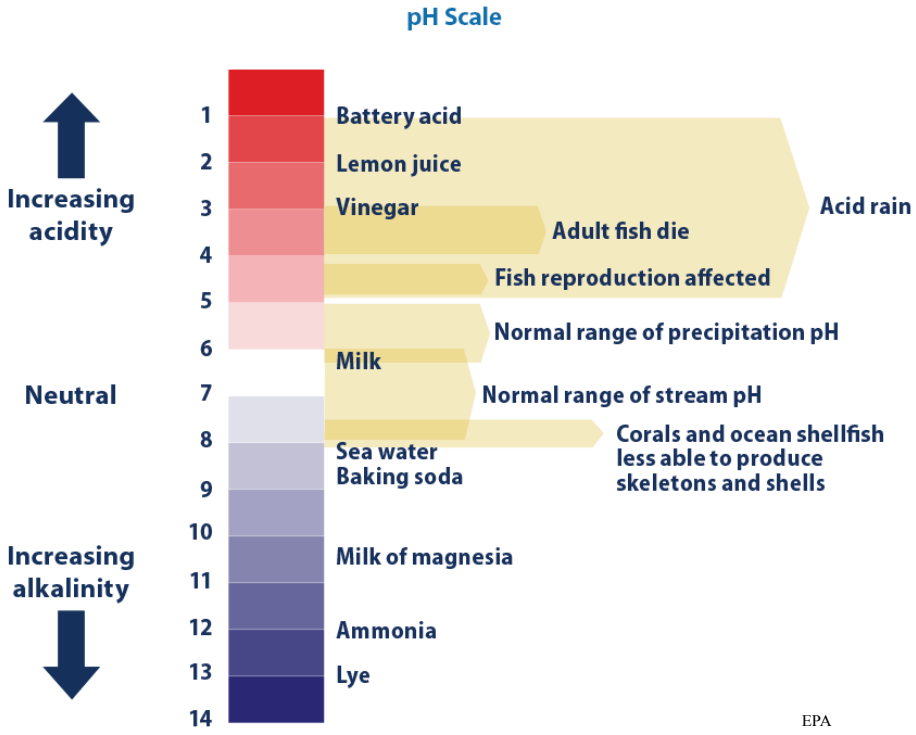
General Directions:

1. Lower the tip of the probe into the sample water and keep it submerged until the reading stabilizes (stops changing).
2. Read the pH on the meter without removing the probe from the water.

3. Record the pH in your student journal.
4. Have two other students repeat the measurement with new water samples.
5. Calculate the average of the three measurements.
6. All temperatures should be within 1.0˚C of the average. If they are not, repeat the measurement.
7. Rinse the electrode with distilled water and blot dry.

pH- Using pH Paper

1. Rinse a clean cup with sample water three times.
2. Fill the cup halfway with sample water.
3. If the electrical conductivity is greater than 200mS/cm than skip to step 8. If the conductivity is les than 200mS/cm go to step 4.
4. Add a pinch of salt to sample water and stir thouroughly.
5. Measure the electrical conductivity of the treated sample water.
6. If the conductivity is greater than 200mS/cm go to step 7. If the water is still less than 200mS/cm, repeat steps 5-7.
7. Follow the instructions that come with your paper for testing the pH of the sample.
8. Record your pH in the student journal.
9. Repeat steps 3-8 using new water samples and new pieces of paper. Record the data in your journal.
10. Find the average of the three observations.
11. Check to make sure that each observation is within 1.0 pH units of the average. If they are not within 1.0 units of the average, repeat the measurements.



Insect and Macroinvertebrate Search and Survey

Choose a habitat to study:

a. Rocky Substrates in Running Water: beneath and around the rocks in the water near the river bank
b. Multi-habitat River Bank: vegetation on river banks above and in water, snags (embedded trees) or branches in water, logs, roots, mud, sand, and gravel in and around the river bank
c. Woodland Habitat: living and dead vegetation in the surrounding forest

For option a:

Look for macroinvertebrates in a **riffle** (a shallower area with faster-flowing water and larger sediments) or **run** (an intermediate category between pool and riffle: water in a run does not have the turbulence of a riffle, but moves faster than in a pool- a **pool** is a deeper region with slower-moving water and smaller sediments). Look for samples under and around the rocks. Samples may need to be scraped off of rocks to be collected. Do not collect fish, tadpoles, or other larger organisms.

For option b:

Locate a plant growing in or near the water; a snag; tree branch or log in or near the water; or muddy, sandy, or gravelly areas in or near the water to look for macroinvertebrates. Look in, under, and around your habitat for your samples. Samples may need to be scraped off of rocks and plants to be collected. Do not collect fish, tadpoles, or other larger organisms.

For option c:

Locate a plant, downed tree or log, or area of high litter (dead leaves and wood) to look for insects. Look in, under, and around your habitat for your samples. Samples may need to be shaken off of leaves to be collected. Only collect insects, do not collect larger organisms.

For all: After locating your sample site...

1. Indicate which habitat you have collected from in your journal and make a note of the climatic conditions present. Is it rainy? Is it windy? Is it warm or cold?
2. Use nets or forcepts (tweezers) to help collect a few samples and place them on your paper plate for observation.
3. Use maginfying glasses or microscope lenses to take a closer look at your samples.
4. Take a photo or sketch your macroinvertebrate and insect samples in your journal to help you identify them later. If you already know the identification, label your sketch or record the name in your journal. If you have multiple macroinvertebrates or insects of the same species, place a checkmark next to the name or picture to help keep count of how many you have found.

Make sure all members of the group have all the data recorded in their journals.

Conclusions and Reflections

Spend some time journaling or discussing your results. Consider these questions as you fill out your conclusion table: Is the water healthy? If you were a fish in these waters would you survive? Would you want to drink the water, bathe in the water, use it for irrigation? Why or why not?

GROUP		ANIMALS		POLLUTION LEVEL
A	STREAM	 Mayfly nymph	 Stonefly nymph	If you find these animals in your stream, then there is **LITTLE OR NO POLLUTION**
A	POND	 Dragonfly nymph	 Damselfly nymph	If you find these animals in your pond, then there is **LITTLE OR NO POLLUTION**
B		 Caddis fly larva	 Freshwater shrimp	If you find these animals, but none from Group A, then there may be **SLIGHT POLLUTION**
C		 Hoglouse	 Bloodworm	If you find these animals, but none from Groups A or B, then there is probably **MEDIUM POLLUTION**
D		 Worm (*Tubifex*)	 Rat-tailed maggot	If you find these animals, but none from Groups A, B or C, then there is **A LOT OF POLLUTION**
E		No live animals found		If you find no animals at all, then the water is **VERY POLLUTED**

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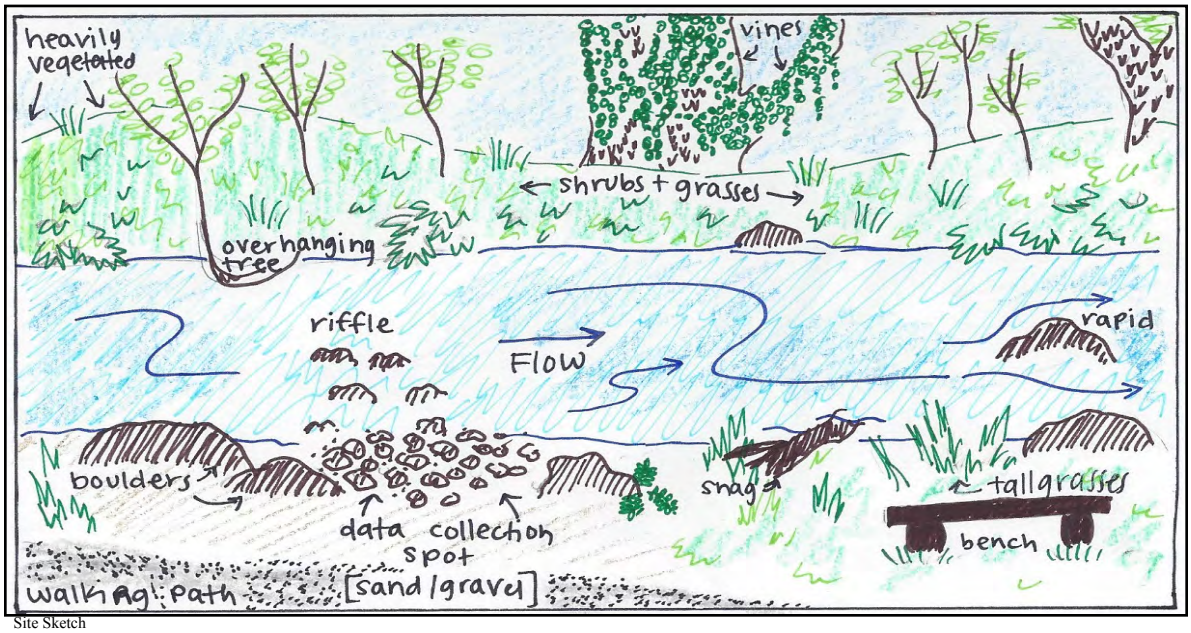
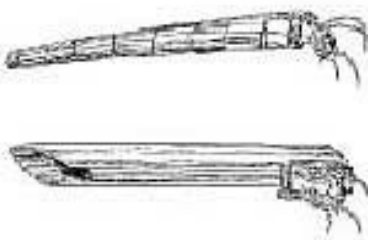


Site Sketch

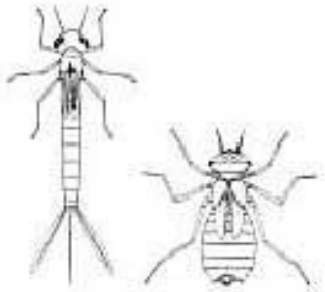
Plecoptera (stoneflies)

Ephemeroptera (mayflies)

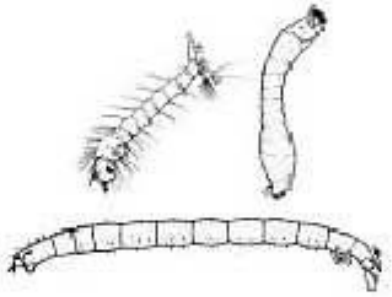
Trichoptera (caddis flies)



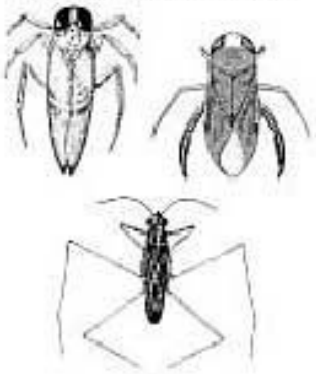
Odonata (damsel and dragonflies)



Diptera (flies and midges)



Hemiptera (waterbugs)



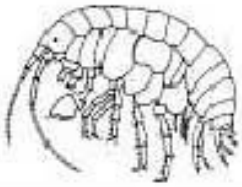
Megaloptera (dobsonflies)

Coleoptera (beetles)

Arachnida (water mites)

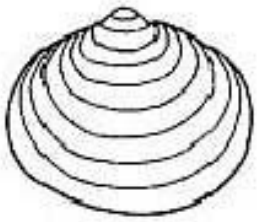
Decapoda (crayfish and freshwater shrimp)

Amphipoda (side swimmers)



Gastropoda (snails)

Bivalves (mussels)



Platyhelminthes (flatworms)

Annelids (leeches)