Using Invertebrates to Assess Water Quality
Go to: http://www.mhhe.com/biosci/genbio/virtual_labs/BL_09/BL_09.html

Question: *How do population changes of aquatic invertebrates indicate water quality?*

Purpose: *In this investigation, you will demonstrate how water quality can be assessed by studying the effects of acid rain on different populations of aquatic invertebrates.*

Objectives: Investigate the effects of acid rain on different species of aquatic invertebrates

Describe how the presence or absence of populations of aquatic invertebrates indicates water quality

Procedure: On the screen you will see three aquatic invertebrates in the aquarium. The pH level indicator on the aquarium shows the current pH level. **Note:** The specimens are not drawn to scale. The computer randomly chooses three specimens at a time from the following: **aquatic earthworms, snails, tubifex worms, clams, leeches, sideswimmers, dragonfly nymphs, crayfish, fairy shrimps, and stonefly nymphs.**

You can click **RESET** until you get the selection you want to test.

Information: How do changes in populations of aquatic invertebrates indicate water quality? Acid rain results from the release of pollutants in the air. **The pollutants come from fossil fuels** such as gasoline, oil and coal being burned by automobiles, factories, and power plants. When the fossil fuels are burned, they release sulfur dioxide and nitrous oxides as byproducts. These pollutants can combine with water and other chemicals to form nitric acid and sulfuric acid in the atmosphere. When the water falls to Earth as rain, snow, sleet, fog or dew, it is called acid precipitation (acid rain). The carbonic acid used in this investigation represents acid rain.

The strength of acid rain is determined by reading a **pH scale.** The pH is a measurement of how acidic or basic a solution is. **The pH scale ranges from 0 to 14.** The lower the pH, the more acidic the solution. The higher the pH, the more basic the solution. On the pH scale, a change of one unit is actually a **ten-fold change.** For example, pure distilled water is neural at pH 7. A solution at pH 6 is ten times more acidic than pure water, and a solution at pH 5 is 100 times more acidic than pure water. Thus, a pH change of one or two units can seriously affect a great number of organisms in an ecosystem.

All rain naturally has some amount of acid in it. Unpolluted rain has a pH of 5.0-5.6. By contrast, acid rain has a pH range of 4.0-5.0. In highly industrialized regions, acid rain can be extremely acidic. With pH readings below 4.0, the acid rain in these areas can be as strong as vinegar (3.3.) and sometimes even as strong as lemon juice (2.30).

When acid rain falls, it can produce many problems for the environment, **particularly for forest and aquatic habitats.** All organisms are adapted to survive within particular pH ranges. Most freshwater fish, for example, survive best within a **pH range of 5.0-6.0**. When acid precipitation falls into a lake, it lowers the pH of the water, thus killing many aquatic organisms.

Indicator species are particular aquatic invertebrates that **alert us to pollution problems** in an environment. **The populations of these organisms change rapidly in response to changes in ecological variables, such as food availability, water, temperature, amount of dissolved water in the water, pH levels, and other factors.**

Click on the Population Bar Graph on the computer to see the population data for the three species at the present pH level. **Click the Table button** to open the TABLE and record the population data and the current pH level.

Click the PIPETTE to dispense three drops of carbonic acid (acid rain) into the aquarium

Click the Population Bar Graph to see the new data. Open the Table and record the population data and the current pH level

Continue to add Carbonic Acid and record the resulting population data and pH levels until you have completed the table. **When complete- copy data table (take screen shot) to include in write-up.**

After you have completed the Table, click the graph button to see the data displayed in a graph. **(Copy Graph and include in your write-up)**

Analysis Questions:

1: What are the names of the species used in this experiment? Which of these species was the most tolerant of increased acidity in the aquarium? Which species was the least tolerant?

2: Describe how acid precipitation affects ecosystems.

3: What is an indicator species? How are indicator species used to assess pollution levels in the environment?

4: Suppose you are an ecologist studying the effects of acid precipitation of plant life. Describe an experiment you would perform in order to determine which plant species would be an useful indicator species for acid rain pollution.

5: How do the data represented on the Population Bar Graph compare to the data represented in the line graph titled, "Populations of Aquatic Invertebrates at Various pH Levels?"