Teacher Supplement for Using Abiotic and Biotic Parameters to Monitor Water Quality: A Field Experiment

Introduction:

The Pollution Tolerance Index comes from "Save Our Streams" from The Izaak Walton League of America and the "Citizens Stream Quality Monitoring Program" of the Ohio Department of Natural Resources. It is based on the concept of using indicator organisms and their pollution tolerance levels to gauge the health of a stream. This index provides a rapid assessment of stream quality and is to be used for sampling riffles and other shallow areas to detect moderate to severe stream quality degradation. While looking at water chemistry is also important, unless this data is continuously taken over time (over the course of 24 hours and throughout the different seasons, before, during, and after it rains, etc.), this only gives a snapshot of stream health. The biota living in the stream provides a long-term look at the health of the water.

Methods:

Organisms are collected and identified by comparing them with the images found in student handout #2 where they are allocated into three groups based on their pollution tolerance. Each of the groups have been given an index value, with the least pollution tolerant group having the lowest value. The water quality is determined by multiplying the number of kinds of organisms found in each group by the index value, then adding up the values for each group. The abundance of each kind of organism is **not** factored in the index. Those organisms found in Group 1 have an index value of 3, those found in Group 2 have an index value of 2, and those found in Group 3 have an index value of 1.

Procedure:

Select several sampling sites for your students. Measure the area you want the students to sample (ex. 24 inches by 24 inches), and make sure it is the same substrate type throughout that particular sampling site (ex. all pebbles or all larger rocks or all sand mixed with pebbles). Be sure to sample enough sites to represent all the microhabitats within the stream. Separate the students into sampling groups. Using the water quality kit and probes provided in the equipment footlocker or similar sampling devices, have the students collect the abiotic data at each site, filling out the data sheet in handout #1. **Try not to disturb the sampling site while getting the water chemistry data as it can cause erroneous results.** After the abiotic data is taken, collect the biotic data. Using the kick net provided in the equipment footlocker or a similar sampling net, collect the insects by disturbing the substrate. Write the results on the data sheet provided in student handout #1. See the following for additional information.

Additional Tips

How to use a kick net –

Place the net downstream from your sample area (so that the specimens get washed into the net by the flow of water), disturb the substrate, turning over rocks and sediment, and take what you have collected to the white pan with stream water in it. The white background makes it easier to see the insects and the water encourages them to move. There is a kicknet in the SC LIFE Natural History Equipment Footlocker. You can also purchase your own kicknet from Carolina Biological for $29.15, I recommend the one with the guard on it as it helps keep the net from tearing. A white sampling pan also comes in the SC LIFE Natural History Equipment Footlocker. Or you can purchase your own from any photography store that carries developing trays. They come in a variety of sizes and prices.

Do not cast aside the rocks so easily –

Aquatic insects like to cling to objects so be sure to inspect the rocks in the sample area, putting them back when you are done.

Fill a white pan with water -

Take what you collected either in the sieve of the kick net, dump it into a pan with stream water in it, and wait for a few minutes, keeping the pan still. The insects will begin to move around and you will be able to collect them easier.

Be careful of the jaws! –

Some of these aquatic insects have hefty jaws and they have no problem with biting, so be careful. Use forceps if possible, but be careful not to mangle the insect when you do. I recommend Bioquip's featherweight forceps as they are field and student proof. The SC LIFE Natural History Equipment Footlocker has 2 pair of these forceps in them; however, if you want to purchase your own from Bioquip, they are $4.40 a piece.

Collecting the abiotic data–

Instructions for using the pH, temperature, dissolved oxygen and turbidity tests are in the kit (in the SC LIFE Natural History Equipment Footlocker). You can also purchase water quality kits from several sources, although I recommend using the LaMotte Green test kits. To get the overall stream flow, you can use a timer, a nerf ball or orange, and a tape measure, however, this does not work for flow in the small microhabitats. When using the flow meter, do not forget to use the mathematical formula to get the flow rate. The number on the meter only gives the number of revolutions the propeller makes.

Use the student handouts and the PowerPoint presentation-

The student handouts have great descriptions and examples of how to use the pollution tolerance index.

Plural vs. Singular -

Larvae is plural, larva is singular.