

Student Handout #3:
Using Abiotic and Biotic Parameters to Monitor Water Quality: A Field Experiment
An Example of a Scientific Experiment

State the problem: What is it you want to know?

Example: I want to know what the water quality is in this particular stream or river.

Gather information: What information already exists out there that can help answer my question? Where will you go to find the answer (library, internet (but beware!), magazines, newspapers, scientific journals, personal interviews, etc.)?

Example: This stream or river runs downtown through business areas and residential homes. It receives runoff from all these areas and it has no vegetation buffer zone along its banks. There are signs posted by the EPA that say do not eat the fish.

Or perhaps

This stream is located in a forested area with no major roads or homes near it. It has a wide vegetation buffer zone along its banks and there is a sign posted by the Department of Natural Resources that fishing is allowed during April and May with no size limits.

After gathering all the information available, make a hypothesis.

Based on the information I have gathered, I expect the water quality of this stream to be poor (or excellent).

All of this goes in this order in the **Introduction** section of your paper, so don't forget to cite your references!

Next, design the experiment: What methods are you going to use to find the answer to your question? What are the abiotic methods? What are the biotic methods? Then decide where to sample and how often. Will it be every 50 meters along the stream? Will it be all the different zones found in a river or stream (riffle, runs, and pools)? How big of an area within the stream should I sample? What about replications? When should I sample, will that have an affect on my data? For example, after a big rainstorm, during the summer or winter months, etc. What type of analysis will I want to do with the data once I collect it?

Our class will sample a 2 foot by 2 foot area in 3 riffles, 3 runs, and 3 pools within this stream or river. In each sample area, we will measure the abiotic parameters of this stream (water flow, water temperature, pH, turbidity, dissolved oxygen, biological oxygen demand, nitrates, phosphates, and coliform bacteria). Then we will sample for aquatic invertebrates, identifying them using the handout provided and, using the Pollution Tolerance Index for Aquatic Insects and the abiotic parameters, we will gauge the water quality of this stream.

This goes in the **Materials and Methods** section, again don't forget to cite your references!

Next, you need to organize and analyze the data: What scientific calculations will you now apply to your data in order to find the answer to your question? Then calculate it!

Use the pollution tolerance index provided. Make a table or graph to show your results and your calculations.

This information goes in the **Results** section of your paper.

Present a conclusion: Explain the results of your calculations, what do the numbers mean? Do the data support your hypothesis? Why or why not? What could have been the causes of the data not supporting your hypothesis if that happened?

This is the original thought part of the process. If something did not turn out the way you expected, based on the research you did, what could be the cause or causes? Be truthful, if you believe you made a mistake, say so, or if you believe that changing part of the experimental design could solve the problem, say so. No one will criticize or ridicule your project if you state what you might have done different or if you would have changed something. Even if your data supported your hypothesis, what would you do to improve on the technique? This is a learning process. Other people will read your paper and your suggestions for improvement and take their experiment even further. That is scientific progress, learn from the mistakes, and build on the knowledge already gained in order to advance. **Remember: If you always do what you have always done, you will always get what you always got.**

This goes in the **Conclusion** part of you paper. Don't forget the **Reference** section!