ES20-AS1

Analyze the function and condition of freshwater aquatic systems such as rivers, streams, lakes, wetlands and watersheds.

Indicators for this outcome

(a) Explain how to measure the condition of an aquatic ecosystem using chemical factors, physical factors and biological indicators including indicator species, keystone species and invasive species.

(c) Measure abiotic factors (e.g., turbidity, temperature, dissolved oxygen and particulates) of an ecosystem using a variety of techniques and technologies (e.g., probe ware, pH paper, Secchi disk, Imhoff settling cone and chemical water quality test kit) effectively and safely.

(d) Examine the diversity of life in a specific aquatic ecosystem through water sampling, classifying aquatic biota, assessing biodiversity and calculating a water quality index and/or algal productivity

(e) Assess the interdependencies between abiotic (e.g., pH, dissolved oxygen, turbidity, temperature, total dissolved solids, phosphorous, nitrogen, stream flow and biochemical oxygen demand [BOD]) and biotic factors in a functioning aquatic ecosystem.

(i) Recognize different characteristics of lakes from naturally oligotrophic to eutrophic as well as possible causes (e.g., clearing of land, excessive fertilizer runoff and treatment plants) and consequences of cultural eutrophication.

Creek Exploration

Where does the creek come from?

What keeps the creek going/running even though it is so small?

Where will the water in the creek eventually end up?

What is the historical significance of the land around the sampling site?

What is the land around the sampling site (Brightwater itself and Brightwater's neighbours) used for?

Are there any known sources of pollutants nearby or upstream?

What important role do Beavers play in protecting the creek's ecosystem?

Background – General

Physical, biological and chemical measurements can be used together to describe the overall quality or health of aquatic ecosystems.

Physical characteristics – temperature, colour, suspended solids and turbidity
Biological characteristics – the types and quantities of bacteria, protozoan parasites, algae, invertebrates, plants and other animals
Chemical characteristics – nutrients, minerals, metals, oxygen, organic compounds and a wide range of pollutants (e.g., pesticides, hydrocarbons, pharmaceuticals, PCBs)

Background – Biological Factors – Macro invertebrate Study

Macroinvertebrates are organisms that are large (macro) enough to be seen with the naked eye and lack a backbone (invertebrate). They inhabit all types of running waters, from fast-flowing mountain streams to slow-moving muddy rivers. Most live part or most of their life cycle attached to submerged rocks, logs, and vegetation.

Aquatic macroinvertebrates are good indicators of stream quality because:
- They are affected by the physical, chemical, and biological conditions of the stream.
- They can't escape pollution and show the effects of short- and long term pollution events.
- They may show the cumulative impacts of pollution.
- They may show the impacts from habitat loss not detected by traditional water quality assessments.
- They are a critical part of the stream's food web.
- Some are very intolerant of pollution.
- They are relatively easy to sample and identify.

The basic principle behind the study of macroinvertebrates is that some are more sensitive to pollution than others. Therefore, if a stream site is inhabited by organisms that can tolerate pollution and the more pollution sensitive organisms are missing a pollution problem is likely.

Data Collection – Physical Factors

Description of sampling site

(Take photos. What types of vegetation can you see in the creek? What types of vegetation are present near the creek bed? About how wide and how deep is the creek? What is the soil like? What colours do you see in the creek? What kinds of wildlife or signs of wildlife do you see near the creek?)

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Air Temperature: __________°C   Water Temperature: __________°C

Weather: (circle one)

Place an X along the lines below:

Turbidity: Clear - Very Cloudy
Speed: Slow - Fast

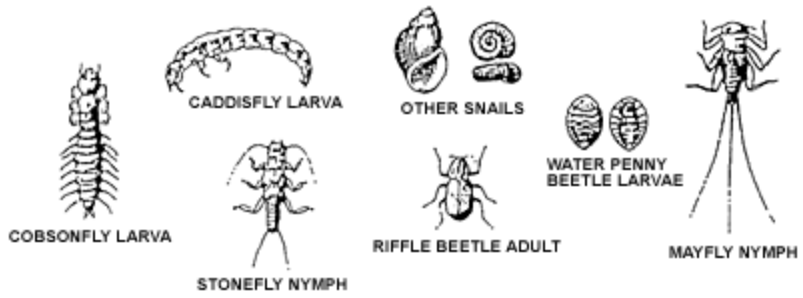
Data Collection – Biological Factors

1. Collect your sample – Sweep with net while stomping for 10 seconds. Clean the silt out of the net. Dump organisms into a white pan.
2. Use the "Key to Macroinvertebrate Life in the River" to determine what species are living in the area where your water was taken. Write the names of the organisms in the data table provided below.
3. Take a picture of the organisms collected and insert the picture in the lab report. Return the specimens to the water body after they have been identified, recorded and photographed.

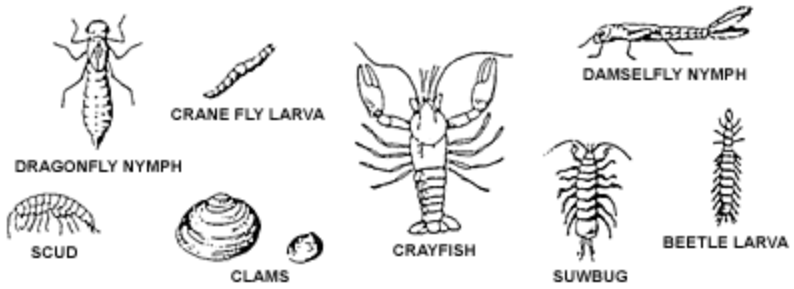
Data Table 1: Taxonomic Groupings Indicating Water Quality

Sample	Group 1 Organisms	Group 2 Organisms	Group 3 Organisms
1			
2			

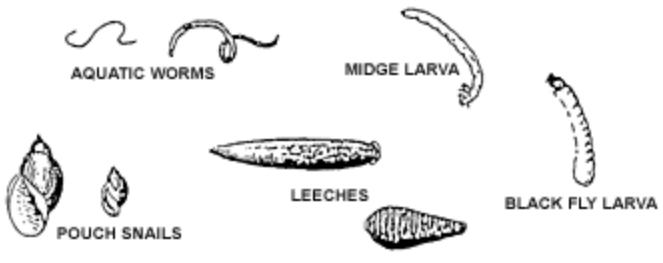
GROUP 1 (These organisms are generally pollution-intolerant. Their dominance generally signifies GOOD WATER QUALITY.)



GROUP 2 (These organisms can exist in a wide range of water quality conditions.)



GROUP 3 (These organisms are generally tolerant of pollution. Their dominance usually signifies POOR WATER QUALITY.)



Data Collection – Chemical Factors

Read the instructions on each of the individual test strip packages to make sure that you are using them accurately.

FYI: PPM is a term used in chemistry to denote a very, very low concentration of a solution. One gram in 1000 ml is 1000 ppm.

Test	**Result/Measurement**
pH (test strip)	
pH (probeware)	
Ammonia (test strip)	
Nitrite (test strip)	
Nitrate (test strip)	
Hardness (test strip)	
Chlorine (test strip)	
Alkanlinity (test strip)	
Dissolved Oxygen (probeware)	

Data Analysis – Biological Factors

Use your findings from Data Table 1 to complete the following table, which will be used to determine the biological **Water Quality Index**.

Data Table 2: Calculation of Water Quality Index					
Sample	Group 1	Group 2	Group 3	Water Quality Index	Water Quality Rating
	Number of species x 3	Number of species x 2	Number of species x 1	Sum of groups (1 + 2 + 3)	

Water Quality Rating (Circle): Excellent (>20) Good (16 – 20) Fair (11 – 15) Poor (<11)

Use the "Wonderful, Wacky, Water Critters" manual to find out more about ONE of the critters you found in the creek.

Critter Name:

How does it get its food?

What is its food?

How does it get away from enemies?

How does it get oxygen?

Other unique adaptations?

Data Analysis – Physical and Chemical Factors

Test	Result	Below, normal, or above?	Impact (What ecological significance does this have?)
Turbidity			
Temperature			
Dissolved Oxygen			
pH			
Chlorine			
Nitrate			
Nitrite			
Ammonia			
Alkalinity			
Hardness			

Conclusions

1. Based on your **physical and chemical tests**, what is the quality of Brightwater's creek water? Be specific.

2. Is it a healthy ecosystem for supporting life? Why or why not?

3. Based on the organisms you found, is it a productive ecosystem? Why or why not?

4. Look at the groupings of organisms that you found, and the water quality index rating that they determined. What does this tell us about the health of our local water system?