WATER EDU-KIT

Teacher's Guide

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1.0 INTRODUCTION

1.1 Trout Unlimited Canada

Trout Unlimited Canada (TUC) is Canada's leading freshwater conservation and education organization. Our mission is to "conserve, protect, and restore Canada's freshwater ecosystems and their coldwater resources, for current and future generations".

1.2 The Water Edu-Kit Program

The Water Edu-Kit program is a national education program aimed at rasing awareness amoung youth about issues relating to **water quality** and pollution. Kits can be ordered online here: https://tucanada.org/water-edu-kits/. Please contact Lynn Robb, Director of Education at lrobb@tucanada.org or 1-800-909-6040 with any question or concerns.

1.3 How to Get Started

Before You Head Out

Make sure that you (and your group) are properly insured to participate in a water-related field trip, and that a plan is in place for emergency situations. Ensure that everyone has a working partner, and is under the supervision of a capable adult group leader. Research the water body you will be working with beforehand to determine its origin, **stream order** and connections.

Testing Locations

Please ensure that your class or group has notified the appropriate individuals, or have received permission from the landowner to gain access and sample water at the chosen site(s). If the site poses a health or safety risk to the participants, seek professional advice and assistance on how to proceed. Always be aware of your surroundings and potential hazards such as poisonous plants, electrical lines and changing weather.

Safety Supplies

Safety always comes first when handling the testing chemicals and sampling gear. Before sampling, make sure to put on the supplied safety gloves and refer to the safety kit instructions in the LaMotte water monitoring kit manual. Always bring a first aid kit, cell phone, and emergency phone numbers, and be knowledgeable of directions to the nearest hospital or emergency center. Always let someone know where you will be sampling to ensure that you can be easily located if an emergency arises.

1.4 Program Objectives

The Water Edu-Kit program provides tools and instructions for teachers, community leaders and youth to improve their water literacy; learning about the science of water, and exploring ways to make a positive difference to their local waters. Youth will learn about their watersheds and water bodies in detail and including: water quality, aquatic biology, and water stewardship.

Important questions to be answered include:

- What are the major issues effecting water quality?
- What is currently being done to protect the quality of our water?
- What are the key parameters and methods used to measure water quality?
- What can be done to protect our freshwater species and **ecosystems**?

1.5 Canadian Curriculum Links

Grade 7-9: Interactions and Ecosystems, Freshwater and Saltwater, Water Systems, Biological Diversity, Environmental Chemistry, Sustainable Ecosystems, and Ecology

1.6 Manual and Supplies

This manual provides the methodology and information to assess the health of your local water body and how to implement change. Each Water Edu-kit consists of a box containing:

- 3- Dip nets for capturing invertebrates
- 3- Plastic turkey basters for separating invertebrate samples
- 3- Ice-cube trays for grouping and identifying invertebrates
- 3- White bins for holding water and aquatic invertebrates
- 3- Magnifying sheets for examining aquatic invertebrates
- 3- 16 oz. HDPE bottles for collecting water samples
- 3- TUC measuring tapes for sizing aquatic invertebrates and measuring water depth
- 1- LaMotte water monitoring kit (measures seven water quality parameters)
- 3- Clipboards and 3 pencils for notes and field data sheets
- 1- Flagging Tape for designating a safe study area
- 3- Sets of vinyl gloves for handling chemicals

Upon completion of the water study, youths will have the opportunity to use their results to make informed decisions to positively change their watershed. Participants will also learn about future activities they can take part in to improve the health of their watershed and waterbodies.

Seven different water quality parameters can be tested using the instructions outlined in the Earth Force LaMotte Water Monitoring Kit:

- Temperature (Degrees Celsius)
- Turbidity (Total Suspended Solids/TSS)
- pH
- Dissolved Oxygen (DO)
- Biological Oxygen Demand (BOD)
- Nitrate (NO_3^-)
- Phosphate (PO_4)

1.7 Site Set-up

Water sampling is best between early spring (April) to late fall (October). To ensure everyone's safety, do not sample during high flow periods, specifically following spring floods or fall storms. It is very important to discuss any physical (e.g. high water levels) or biological hazards (e.g. poisonous plants) before going out to the field. Try to plan for alternate days to accommodate for the potential risks of inclement weather, this will enable the group to achieve their monitoring goal within the needed time frame. Multiple samples should be consistently spaced out to track changes between seasons or months. Avoid any potential risks when determining the sample sites such as: steep banks, deep water, fast currents, or water pollution. Consider what your goals are for water monitoring and choose a site that coincides with those goals. Using maps, talking to landowners or experts, and doing a site assessment beforehand is important and advisable.

Sampling using your Water Edu-Kit involves both water quality sampling and **macroinvertebrate** sampling. A kit can accommodate 25-30 participants split into four groups of approximately 6-8 individuals. Three groups will conduct macroinvertebrate sampling using the identification guide provided, and one group will conduct water quality sampling using the LaMotte Water Monitoring Kit.

1.8 Collecting Samples

A field monitoring data sheet is provided in the kit and under the appendices of this document (Pg. 28) to help in the documentation of important details and will keep a record of the sample ID numbers, locations, dates, time, weather conditions, watershed characteristics, permanent features (roads, bridges), and other general or particular observations. Please use the Site Sketch template provided (Pg. 31) to record an observation of your sampling site and general surroundings. If possible, using a GPS unit (not included in the kit) to record your sampling locations will make locating the same sampling sites easier. For your safety, remember to always work in pairs and never alone.

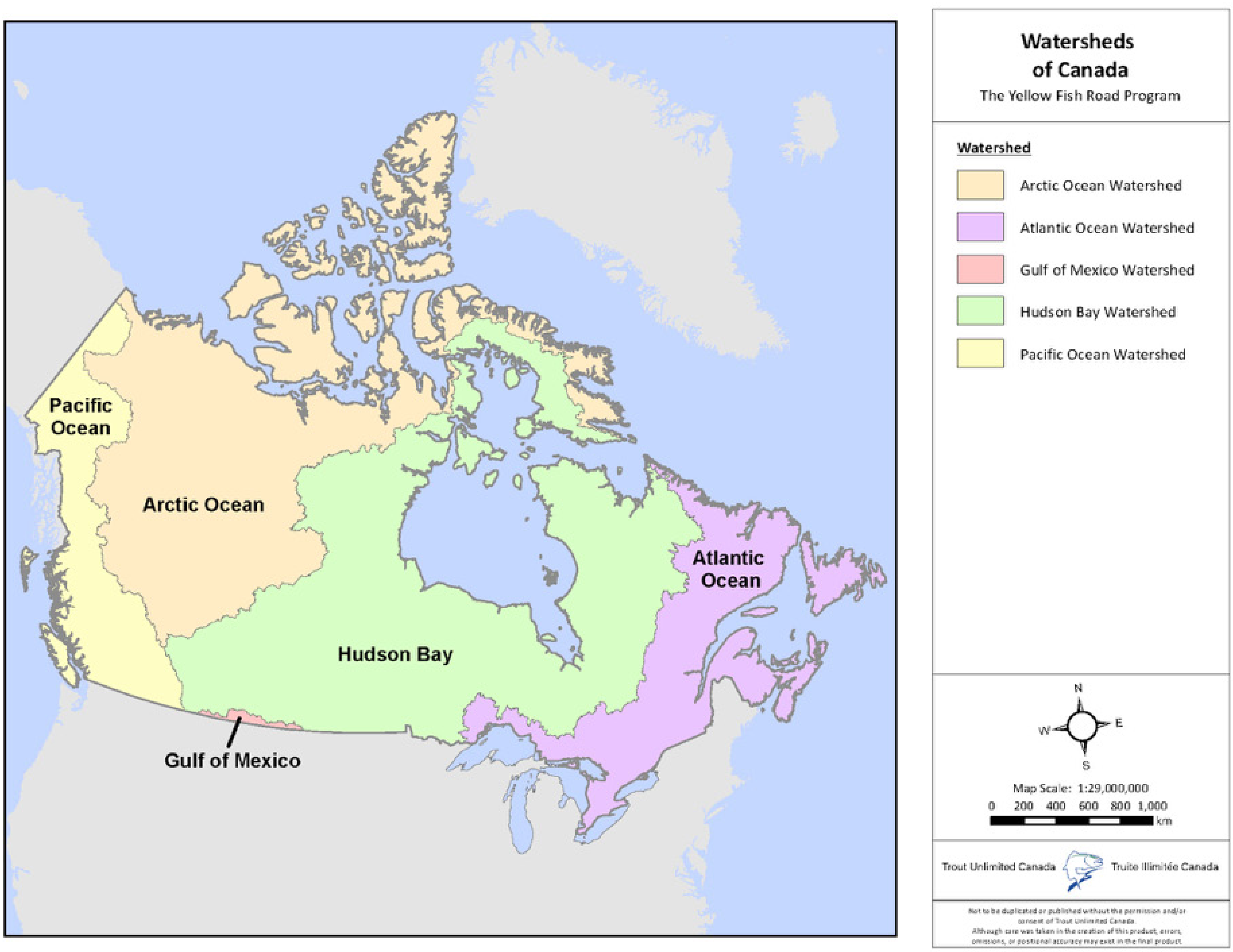
Water quality parameters being tested in the field include: temperature, turbidity, pH and dissolved oxygen, along with three additional parameters: nitrate, phosphate and biological oxygen demand (BOD).

2.0 UNDERSTANDING YOUR WATER

2.1 What is a Watershed?

We all live in a watershed! Our homes, schools, roads and waterbodies are all part of a watershed. A watershed is an area of land in which rain, snow, surface water and groundwater, drains into the same river, lake or ocean, much like a large funnel. Watersheds can start in one type of landscape such as mountains, and end in another like a **stream**; connecting different features in between, including farms, cities, towns, forests, and other waterbodies. Everything we do on land affects the water in our watersheds and the life within and around it. Watersheds come in all shapes and sizes and each watershed can be divided into smaller sub-watersheds. The quality of Canada's freshwater is highly dependent on the characteristics of each interconnected watershed, surface water, groundwater, and land use. Healthy watersheds contribute to the overall health of the environment and our quality of life. Refer to Figure 1 below for an overview of Canadian Watersheds.

Figure 1: Canadian Watersheds



2.2 Geology and Water

Geology is the study of physical forces that act on the Earth, the chemistry of it's constituent materials including rocks, minerals, soils and water, and the biology of it's past inhabitants as revealed by fossils. Canada's geology spans four billion years and has a diverse and active geological past that has shaped the landscape we see today, showcasing geological processes caused by shifting plates and mountain building and natural hazards of earthquakes, volcanoes, and landslides (Natural Resources Canada, 2017). It has seen tropical coral reefs and saltwater lagoons and was sculpted by glaciation depositing massive quantitites of galcial till. Our current river systems and soils were when the last ice retreated. The resulting landforms we see today were then eroded by rivers and creeks and later altered by urban and industrial development, forestry, hydroelectric dams, agriculture, and resource extraction.

2.3 The Riparian Zone

The riparian zone includes the area adjacent to a water body where terrestrial and aquatic ecosystems intersect and interact (Fitch & Ambrose, 2003). They are often considered the thin lines of green along a shoreline and can feature native grasses, flowers, shrubs and trees. A healthy riparian zone filters and reduces runoff and absorbs water, minimizes the severity of flooding by stabilizing stream banks and reducing erosion, and absorbs excessive nutrients and pollutants before they meet the stream. Furthermore, they create and enhance fish and wildlife habitat. Landscape features such as soil type, slope, geology and vegetation shape the riparian zone. A healthy riparian zone helps to protect the health and quality of water bodies for all who use it (Fitch & Ambrose, 2003).

2.4 Climate and Climate Change

Through the combustion of fossil fuels, deforestation and agriculture, greenhouses gases are intensifying the greenhouse effect, creating a giant heat-trapping blanket around the earth (National Aeronautics and Space Administration , 2017). Greenhouse gases also occur naturally through decomposition, ocean release, plant and animal respiration, and volcanoes (What's Your Impact, 2018). Climate change is increasing the risk of extreme weather events such as heat waves, heavy rainfall and related flooding, dry spells or droughts and forest fires (Government of Canada, 2015). All of these can result in potentially large-scale damage to human communities and the natural environment. Aquatic habitats may see a change in species range, extent of habitat, breeding season and food sources. Some of the impacts due to climate change include (Government of Canada, 2015):

- Higher rate of warming (from 1948-2013 average annual temperature increase of 1.6°C)
- Increased winter and spring temperatures
- Changing ocean environments: changes in sea levels, wave regimes and ice conditions
- Dramatic reductions in Arctic sea ice cover

3.0 STATUS OF FRESHWATER SYSTEMS

3.1 Introduction

Canada is known for its clean freshwater and is home to an abundance of water, laying claim to approximately 20% of the worlds freshwater (Government of Canada, 2012). Water has played a major role in the history and development of the country, and has historically provided important transportation, trading routes and food sources. Our freshwater provides for our social, cultural, economic, and environmental needs, and is crucial to our basic human needs. Knowing this, it is important to maintain a balance between these needs in order to keep Canada's water clean and healthy.

As Canada's population and economy grows, the demands put on our water resources increase. Our freshwater resources are shared by plant and animal communities, and numerous other uses including: manufacturing, industry, agriculture, hydroelectric dams, and recreation. All of these uses results in an ever-increasing pressure on our freshwater resources. Some of the major issues affecting watersheds across Canada include:

- flooding and erosion
- increased glacial melting
- excessive loading of nutrients
- increasing demand on water
- climate change and extreme weather
- invasive species
- disease pathogens

4.0 WATER QUALITY PARAMETERS

4.1 Physical Water Quality Parameters

4.1.1 Temperature

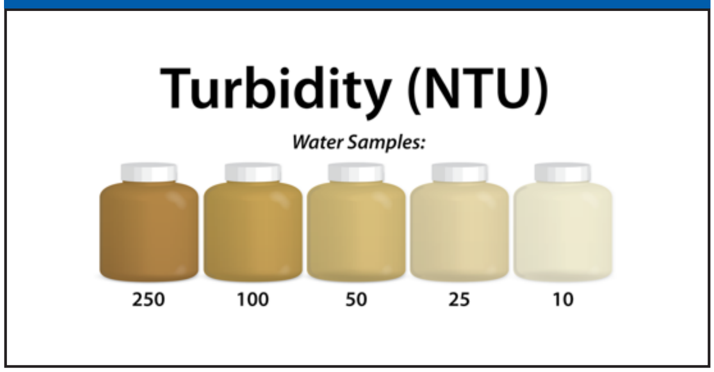
Water temperature is mainly influenced by the suns energy absorbed by the water as well as by the surrounding soil and air (The GLOBE Program, 2017). Temperature plays a major role in influencing aquatic life and the physical and chemical parameters of the aquatic environment (Canadian Council of Ministers of the Environment, 2003). Factors that influence water temperature include the season, weather conditions, time of day, and stream flow and velocity. Other variables affecting water temperature include direct sunlight or shade, heat exchanges with the air, heat loss or gain through evaporation/condensation, discharges of warmer or cooler water, and reradiated heat from land cover.

Water temperature may indicate where the water originates, for instance, water close to the source of a glacier or snowmelt will be cold, where some ground water is warm (The GLOBE Program, 2017). The further the water is from the source the more it is influenced by atmospheric temperature. An increase in water temperatures results in an increase in the rate of photosynthesis/plant growth, chemical reactions, and metabolism in animals (Kadlec & Knight, 1996). Increased metabolic rates of aquatic species can result in increasing respiratory and digestive responses which can be detrimental to species (Canadian Council of Ministers of the Environment, 2003).

4.1.2 Turbidity

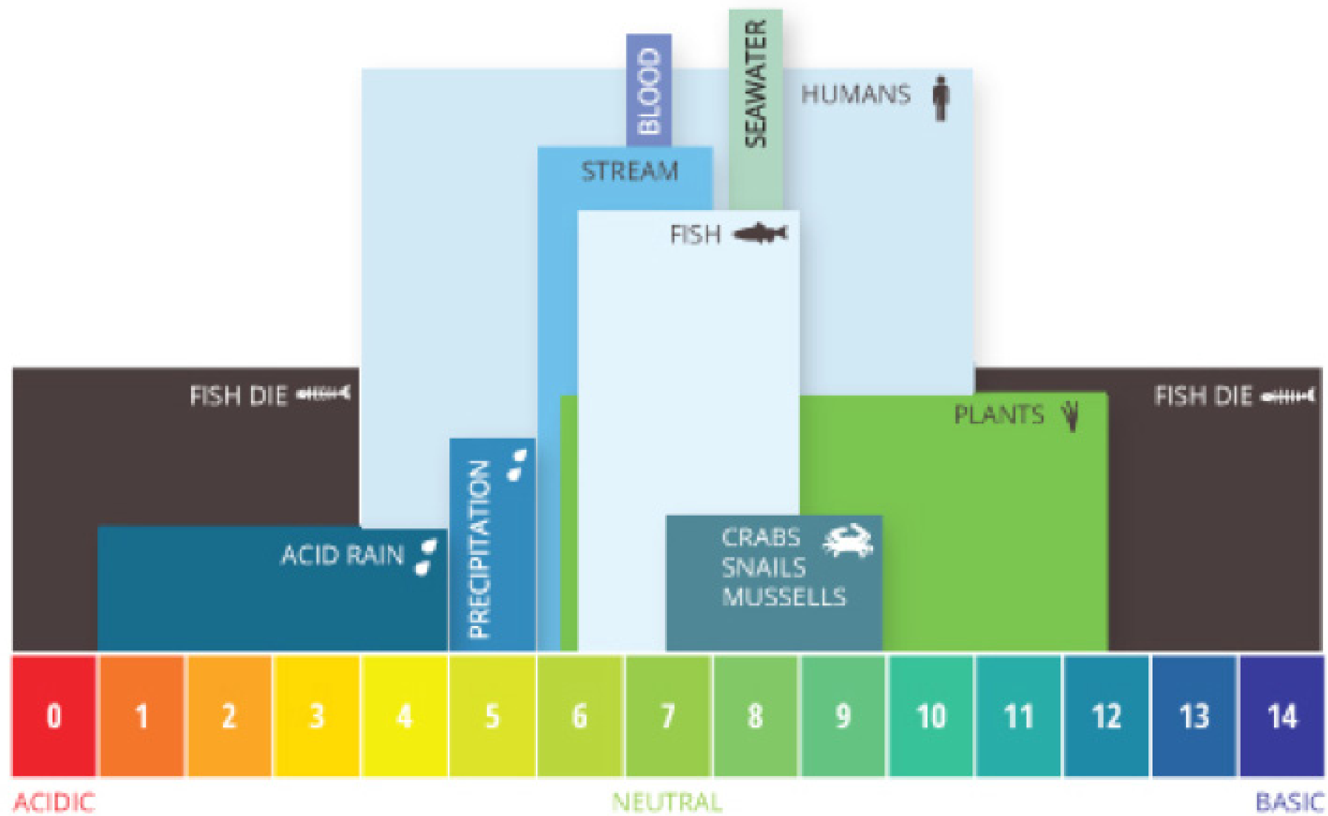
Turbidity is a measure of water clarity (or cloudiness) of water caused by suspended or dissolved substances such

Figure 4: Visual Representation of Turbidity



as clay, silt, organic or **inorganic** materials and microscopic organisms (Canadian Council of Ministers of the Environment, 2002). Light is essential for the growth of plants providing habitat for aquatic life. High turbidity increases the cost of water treatment for drinking and food processing. Fish and invertebrates adapted to live in aquatic habitats with low turbidity can be adversely affected; turbid water can suffocate newly hatched **larvae** or clog gill structures. Natural sources can include phytoplankton, **algae**, suspended inorganic or mineral material, organic detritus, tannic acids, weather events, or biological activity within the water body (Health Canada, 2014). Human-induced disturbances that accelerate turbidity include land development, dredging operations, direct discharges and channelization (Canadian Council of Ministers of the Environment, 2002). The Secchi disk is commonly used to measure turbidity with the unit of measure called a Nephelometric/Jackson Turbidity Unit (NTU/JTU). See the turbidity graphic above by Clean Stream for a visual representation of various turbidity levels adapted from (Clean Stream, 2017).

Figure 5: Aquatic pH scales



4.2 Chemical water quality parameters

4.2.1 pH

The pH of a liquid is measured on a scale from 1-14, describing the water's acidity or alkalinity. pH stands for the power of hydrogen. Pure water has a neutral pH value of 7, values below 7 are considered acidic and waters above 7 are considered basic or alkaline (The GLOBE Program, 2017). A high pH between 8.5 and 14 and a low pH between 1 and 6.5 is unhealthy for most aquatic life (Fondriest Environmental, 2016). The pH of a water body influences most of its chemical processes (The GLOBE Program, 2017). pH is primarily influenced by the local geology of the watershed, biological processes (e.g. photosynthesis and respiration) and patterns of precipitation (air-water surface interactions). pH can be impacted by rain and surface runoff from land uses like mining, agriculture, urban and industrial development (Kadlec & Knight, 1996) . Streams that drain soils with high mineral content are typically alkaline, while streams that drain peatlands and bogs are typically acidic. The following table illustrates the pH tolerance ranges for humans, fish and aquatic life (Fondriest Environmental, 2016).

4.2.2 Dissolved Oxygen (DO)

Water is made up of two hydrogen atoms and one oxygen atom, otherwise known as H_20. When oxygen gas mixes with a body of water dissolved oxygen is formed. Dissolved oxygen (DO) is essential for aquatic life. The amount of oxygen dissolved in water affects the number and diversity of plants and animals found there. DO enters water by diffusion with the air, aeration of the water as it moves, and as a by-product of photosynthesis. Dissolved Oxygen content is evaluated as a concentration in milligrams per liter (mg/L). Aquatic animals like fish and invertebrates breathe the oxygen molecules dissolved (DO) in the water, levels below 3mg/L are stressful to most aquatic organisms and they suffocate (The GLOBE Program, 2017). Figure 6 from Fondriest Environmental illustrates the oxygen requirements for various fish species (Fondriest Environmental, 2016).

4.2.3 Biochemical Oxygen Demand (BOD)

Biological Oxygen Demand (BOD) is measured in parts per million (ppm) and is defined as the amount of oxygen needed by bacteria and other microorganisms while they decompose organic matter, under aerobic conditions, at a specified temperature over a specific period of time (Canadian Council of Ministers of the Environment, 2002). Organic matter refers to dead plants, leaves, grass clippings, manure, sewage, or even food waste present in the water. During the breakdown

Figure 6: Dissolved Oxygen needs for fish species

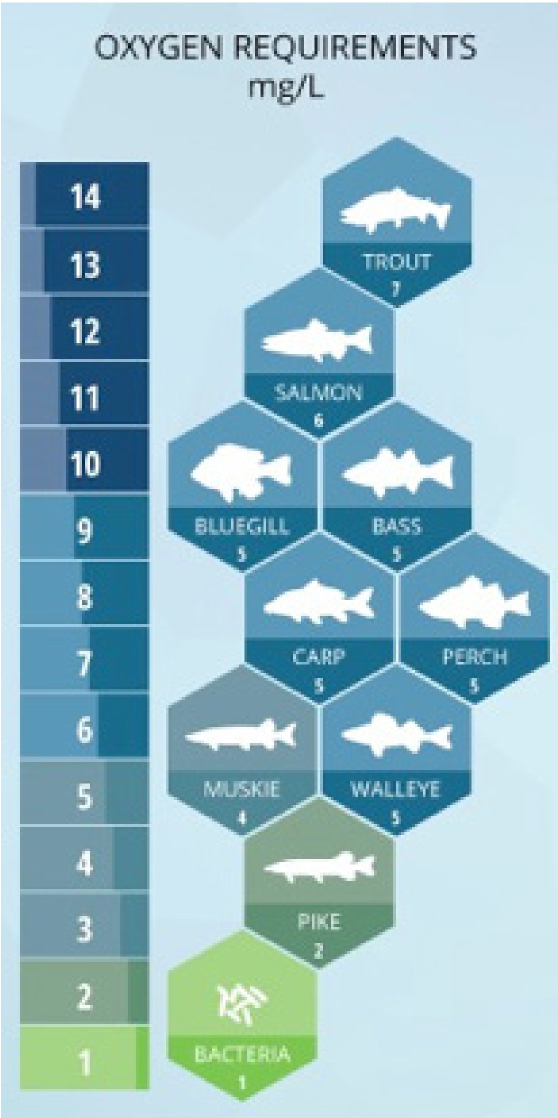


Figure 7: Experimental Lakes Area

of this waste, dissolved oxygen is consumed by oxygen-using microorganisms, decreasing the oxygen present in the water. The parameter BOD is mainly important for analyzing waste water discharges (e.g., water and sewage treatment plants) and **effluents**. Freshwaters which contain a lot of organic matter will require more oxygen consuming organisms to decompose this waste; therefore, BOD will be high.

4.3.4 Nitrate (NO_3^-)

All freshwater plants require three major nutrients for their growth: carbon, **nitrogen** and phosphorus (The GLOBE Program, 2017). Nitrogen in the form of nitrate (NO3-) is the most important compound for plant growth (The GLOBE Program, 2017) . Nitrate is the salt or ester of nitric acid and is the final product in the **nitrogen cycle**. When an excess of nitrate is present in surface waters it produces increased algal and aquatic plant growth, leading to eutrophication and algal blooms (Delfino & Mytyk, 2004). Nitrate in freshwater can originate from both natural and human sources. Natural sources include nitrogen-rich geological deposits, volcanic activity and native soil organic nitrogen (Canadian Council of Ministers of the Environment, 2012). Human sources of nitrate include point sources such as municipal and industrial wastewater, and water discharges from mining activity (e.g. explosives). **Non-point sources** include agricultural runoff, feedlot discharges, septic beds, plant and animal decay (organic forms of nitrogen which undergo nitrification), urban runoff, lawn fertilizers, landfill leachate, vehicular exhaust, and storm sewer overflow (Canadian Council of Ministers of the Environment, 2002).

4.3.5 Phosphorus (PO_4)

Along with carbon and nitrogen, phosphorus is one of three major **nutrients** required for plant and animal growth (The GLOBE Program, 2017). Sources of phosphorus include atmospheric inputs, agricultural **run-off** from fertilizers and animal manures, and municipal wastewaters containing sewage, detergents, and other commercial products. High amounts of phosphorus in water can cause increased growth of plant and algae (Chislock, Doster, Zitomer, & Wilson, 2013). Increased risk to aquatic life, animals and humans may develop because of excessive growth of **toxin** producing cyanobacteria or algae; when this excess organic matter dies off it requires large amounts of oxygen to decompose and can cause low oxygen conditions (Canadian Council of Ministers of the Environment, 2004). The photograph in Figure 7 shows the effect of phosphorus in the Experimental Lakes Area in Manitoba (Schindler, 1974), which was established as an outdoor freshwater ecosystem research laboratory. The yellow curtain in the figure separates non-enriched water on the top left from phosphorus enriched water on the lower right.

5.0 BIOLOGICAL PARAMETERS

5.1 Freshwater Macroinvertebrates

Many macroinvertebrate species are **biological indicators** of the aquatic health. Macroinvertebrates are food sources for aquatic life, and their **population** size and diversity is important to determine whether the water body is being impacted by pollution (e.g. sediment, chemicals). Start the collection downstream and work upstream towards the control sample location, being careful not to disturb the sampling area. Do not sample near obstructions (e.g., bridges or roads), modified areas, or near fish spawning habitat. Sample insect benthos groups, assess species diversity and predominant **taxon** ratio, and characterize the habitat site using the work sheets provided. To understand macroinvertebrates in relation to water quality use the Indicator **Benthic** Macroinvertebrates sheet for identification included in the kit.

6.0 IDENTIFYING AND DESCRIBING FEATURES

Water Body Type: Wetland (bog, marsh, and pond), side channel, stream, creek, or a river.

Land Use: What is the main use? Agricultural, industrial, resource extraction, residential, cultivated, park, recreational, or natural area.

Riparian Health: Riparian zones support a diverse growth of grasses, shrubs and trees. Please refer to the two figures below for some examples of poor and healthy riparian habitat.

Indicators of Poor Riparian Health

- Lack of established vegetation & fish
- Cloudy, turbid, muddy or green water
- Eroded and exposed soil
- Sinking and unstable banks
- Non-native/introduced plant species
- Vegetation grazed or manicured
- Litter and animal waste along banks

Indicators of Good Riparian Health

- Established vegetation and fish
- Clear water, see the river bottom
- Channel meanders, no exposed soil
- Secure and stable riverbanks
- Established native/natural species
- Protective vegetation canopy
- Free of litter and animal waste

7.0 WHAT YOU CAN DO TO HELP

Get Involved: Now that you have learned about the health of your local waterbody, you may want to protect it by getting involved and joining local environmental and stewardship groups. Please read below for a list of organizations that are making a difference to watersheds:

Nature Conservancy
http://www.natureconservancy.ca/en/what-you-can-do/conservation-volunteers/

CPAWS
http://www.cpaws.org/about/jobs/volunteer/volunteering-with-cpaws

CWAST
http://www.cawst.org/wavemakers

The David Suzuki Foundation
http://www.davidsuzuki.org/what-you-can-do/

The Sierra Club
http://www.sierraclub.ca/en/prairie

Trout Unlimited Canada
http://www.tucanada.org/

Write Testimonials: Now that you've gone outside and got connected to water, send us your feedback, it helps us too! We want to improve our Water Edu-Kit program and launch it nationally. Let us know how we are doing and how we can improve, we use your feedback! Your words can go a long way when we include them in our reports or grant applications. https://www.surveymonkey.com/r/P9LK5H8

Write a Letter: Be a voice for clean water and let leaders in government (school board, municipal, provincial, and federal) know your concerns and what you think needs to be done to ensure we all have access to clean, cold, and connected water. Have a writing bee and write to your local newspaper or newsletter, they may even publish it, so more people will hear what you have to say!

Spread the Word: Help us share your experience. Send us your pictures and stories, so we can highlight your adventures in water discovery through our Trout https://www.surveymonkey.com/r/P9LK5H8Unlimited Canada website and social media, including Facebook, Twitter and Instagram.

Share Your Results: Host a 'Celebration of Learning', with an evening of demonstrations, posters, and displays, focusing on what you have learned and experienced with the Water Edu-kits. Teach others in your school how they can use the kits to learn about their watershed.

Design a Website or Start a Blog: Design a water website or blog for your school to teach others about their watershed. Look at the challenges we face in protecting our water, and some solutions that are protecting and improving water quality.

Make a Video: Be creative and turn your Water Edu-Kit experience into a water video. Video topics could include: fun facts you learned about water, how you collected water samples, how you used a kick net, what aquatic macroinvertebrates you found, site sketches of your sampling area, and what you can do to protect your local waterbodies.

Start an Eco Water Team: Gather together like-minded community members who want to get involved to protect water. Learn more about the challenges and solutions to water pollution. Write a monthly newsletter or contribute to one on water issues. Host a World Water Day.

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9.0 GLOSSARY

Acid - A substance that has a pH of less than 7.

Algae - Simple, single and multi-cellular plants, most are aquatic and lack cell and tissue types.

Aerobic – Referring to a biological process which requires oxygen

Alkaline - A substance that has a pH above 7, also called a base.

Bankfull width - The width of a stream, side to side, measured from the lowest rooted woody plants (trees and shrubs), or permanently rooted vegetation on the banks.

Benthic - The region on, or in, the bottom of a water body including the sediment and subsurface.

Biological indicator - An organism whose presence, condition, and numbers provide information about the health of a specific habitat.

Channel - A landform outlining the boundary or path of a body of water.

Ecosystem - A community of living organisms and non-living elements in nature, and their interactions.

Effluent - Liquid waste or sewage discharged into a waterbody from a wastewater treatment plant.

Eutrophic - A water body with high nutrient concentrations resulting in high productivity.

Inorganic - Refers to any matter that is not organic, most inorganic compounds are derived from minerals and do not contain carbon.

Larvae - The immature form of an animal as it goes through some metamorphosis.

Macroinvertebrate - An animal without a backbone that is visible to the naked eye.

Nitrogen - Is a nutrient essential to all plants. In aquatic environments, it is present as ammonia (NH3), nitrate (NO3-) or nitrite (NO2-).

Nitrogen cycle - The process involved in nitrogen fixation and cycling of nitrogen into various forms in the environment.

Non-point source pollution - Pollution spread over a large area and not from one specific location, this pollution is hard to trace (e.g. urban runoff, acid rain).

Nutrient - A substance that provides a source of energy and nourishment for an organism.

Nymphs - The immature form of an insect that undergoes incomplete metamorphosis.

Population - A group of a species within a geographic area.

Run-off - Surface water that does not penetrate into the ground, it flows from land to water.

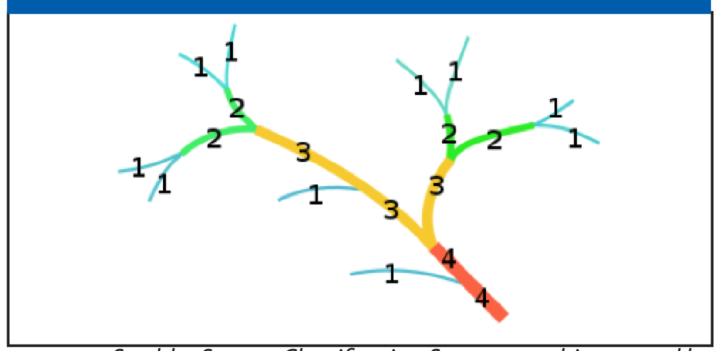
Substrate - A surface or layer that underlines the stream bed.

Saturate - When a substance is filled to/has absorbed its capacity of another substance.

Stormwater - Surface water that flows through a drainage system, into a water body.

Strahler Stream Order - Stream size based on a hierarchy of tributaries, where: 1+1=2, 2+2=3… but **1+2 ≠ 3** (See diagram below).

Strahler Stream Order



Strahler Stream Classification System graphic: created by Kilom691, distributed under a CC BY-SA 3.0 license.

Stream - A small, flowing body of water.

Taxon - Refers to a specific level of classification for an organism within the scientific system.

Tolerance - The ability to endure the effects of certain conditions, or the resistance to a stressor or toxin.

Toxin - Any poisonous substance produced by living cells.

Tributary - A water body that flows into a larger body of water.

Water quality - Refers to the biological, chemical and physical characteristics of water with respect to its use for specific species or human use.

Wetted width - The width of a stream, side to side, where the water is currently flowing. Unless the stream is flooding, or the channel is deep and narrow, wetted width will be less than bankfull width.

APPENDIX: FIELD SHEETS FOR TEACHERS AND YOUTHS

Field Trip Checklist

Mandatory (Bring or put in backpack):

- [ ] Jacket/Rain Gear: Dress for the elements
- [ ] Toque/Hat: Warm headwear or to keep the sun off your face
- [ ] Sunglasses and Sunscreen
- [ ] Outdoor Shoes (No flip flops/sandals/open toed shoes)
- [ ] Gloves/Mitts
- [ ] Water: Bring lots of drinking water to stay hydrated
- [ ] Lunch and Snacks: Bring a big lunch and healthy snacks
- [ ] Waders or High Rubber Boots

Optional/Recommended:

- [ ] Binoculars: For viewing animals far away
- [ ] Camera: For capturing the location/condition of the site
- [ ] Journaling/Drawing Supplies
- [ ] Bug Spray
- [ ] Something to Sit On

You may supply:

- [ ] Field Guides
- [ ] Whistle
- [ ] Rope/Throw bag
- [ ] Permits/Licenses
- [ ] Emergency Phone
- [ ] Bear Spray
- [ ] First Aid Kit
- [ ] Emergency Numbers
- [ ] Hand Sanitizer
- [ ] Garbage Bags

Water Sample Collection

Please refer to the LaMotte Water Monitoring Kit manual for sampling instructions. **Please note:**

- Dissolved Oxygen-Small glass tube with twist lid-0125
- Biological Oxygen demand- Small glass tube with twist lid-0125 put in aluminum tube
- Nitrate test-Long plastic glass tube with plug lid-0106 goes in a second aluminum tube
- pH test- Long plastic glass tube with plug lid-0106
- Phosphate test- Long plastic glass tube with plug lid-010
- Temperature-2 numbered strips

To ensure that all tests are done using the same water sample, collect the sample using one of the three provided 16 oz. HDPE bottles. The bottle should first be labelled with the date, time, and sample location and then rinsed 2 - 3 times in the water body prior to filling it. Collect the water sample from a shore location where the sediments are not disturbed and ensure that the sample is collected away from the onshore vegetation, due to the effect of vegetation on the results. Collect the water samples by holding the bottle 5 - 10 cm (2 - 4 inches) below the water body surface, turning it away from you and into the current. Pour the required amount of water from the bottle into the test tubes from the LaMotte kit to sample for the various water quality parameters (following the instructions provided in the LaMotte kit).

****Prior to testing for nitrates, please read the Safety Data Sheet (SDS) for the nitrate reagent.**

Water Montioring Kit

Table 2: Water Quality Ranking (LaMotte Water Monitoring Kit Instruction Manual)

Water Quality Parameter	Excellent	Good	Fair	Poor
Dissolved Oxygen (DO)	91 - 110% Sat	71 - 90% Sat	51 - 70% Sat	< 50% Sat
Turbidity-JTU Jackson Turbidity Units	0 JTU	>0 - 40 JTU	>40 - 100 JTU	>100 JTU
Nitrate-N (n/a=No ranking)	n/a	n/a	5 ppm	20 or 40 ppm
Phosphate-P	1 ppm	2 ppm	4 ppm	n/a
pH	7	6 or 8	n/a	≤5 and ≥9
Temperature Range (between upstream and sampling locations)	0 – 2°C	3 – 5 °C	6 – 10 °C	>10 °C
Biological Oxygen Demand (BOD)	0 ppm	4 ppm	8 ppm	n/a

Use the Earth Force website to learn more about your results www.earthforce.org

Edu-Kits Water Quality Field Monitoring Survey: On-Site

Sample I.D. ________________________ Date: _______________ Time of Sampling: _________________

Coordinates of sampling location (latitude/longitude): __________________________ Elevation (m): __________

Coordinates of control (upstream site) (latitude/longitude): _______________________ Elevation (m): __________

Stream name/Nearest City or Town ___________________, _______________________

Weather

Daytime Air Temperature	0 Cold < 2 ° C	Cool 2-10°C	Warm > 10°C
Precipitation	Dry	Drizzle	Rain
Wind	Calm	Fresh Breeze	Strong

Wind Direction (blowing from): N NE E SE S SW W NW

Watershed Description:

Rooted or Bankfull Width (m)_______________________Wetted width (m): __________________

Water Depth (m) __________________Riparian Buffer Width (average)(m): __________________

Land Use/Type (% agriculture, residential, park, etc.) _____________________________________

Riparian Health (Scale of 1-3): ______________

Shade level (low <25%, high>75%) __________ Strahler stream order (1-4) _____________

Dominant substrate (sand, pebble, gravel, cobble, boulder): ______________________________

Dominant riparian vegetation (grass, shrubs, trees): _____________________________________

Catchment Notes and Adjacent Land Use:

____

____

____

Recent runoff Active Recent None

Field Analyses:

Temperature _______ ° C pH _________ Turbidity ________ JTU

Dissolved Oxygen_______ ppm Nitrate _______ mg/L Phosphate________ mg/L

Biological Oxygen Demand __________ mg/L

Comments and Water Quality concerns:

____

____

____

Macroinvertebrate Survey

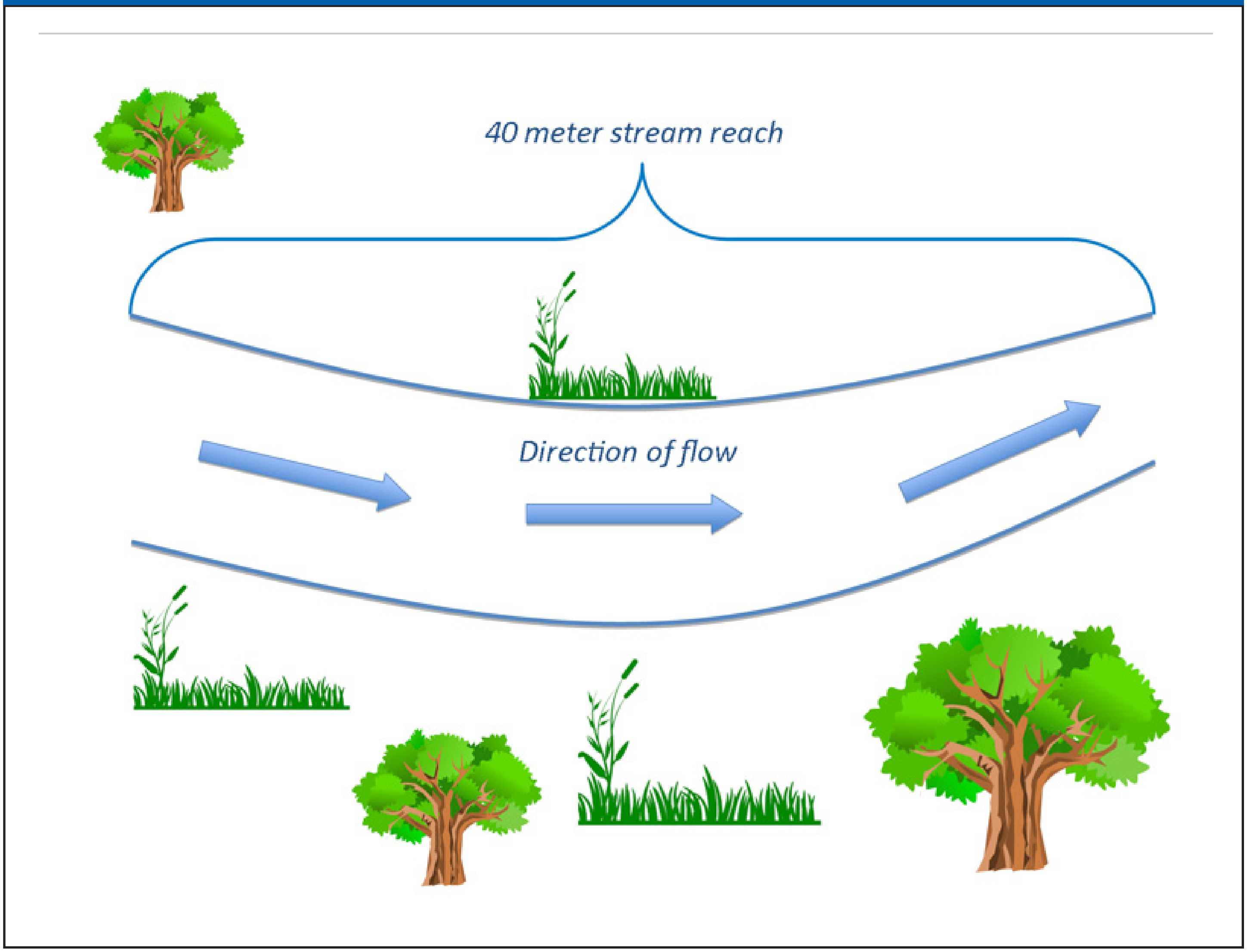
Macroinvertebrate Sample Collection:

Choose a section of a stream or river site that is approximately 40 metres in length (where 1 stride equals approximately 1 metre) where the banks are level from one side to the other and the stream is relatively equal depth throughout the stretch. Use a visible marker, the flagging tape provided, to equally space the three sites. Each group will sample one site.

Begin sampling at your downstream limit. Place the dip nets close to the stream bottom so no macroinvertebrates pass underneath the nets and then hold still so that the current is flowing into the net. Stand upstream of the net and kick up the substrate to a depth of 5cm back and forth across the current, picking up smaller rocks and dislodging any macroinvertebrates and collect them. Working with your group, have three people hold onto the nets while the others kick up the stream bottom.

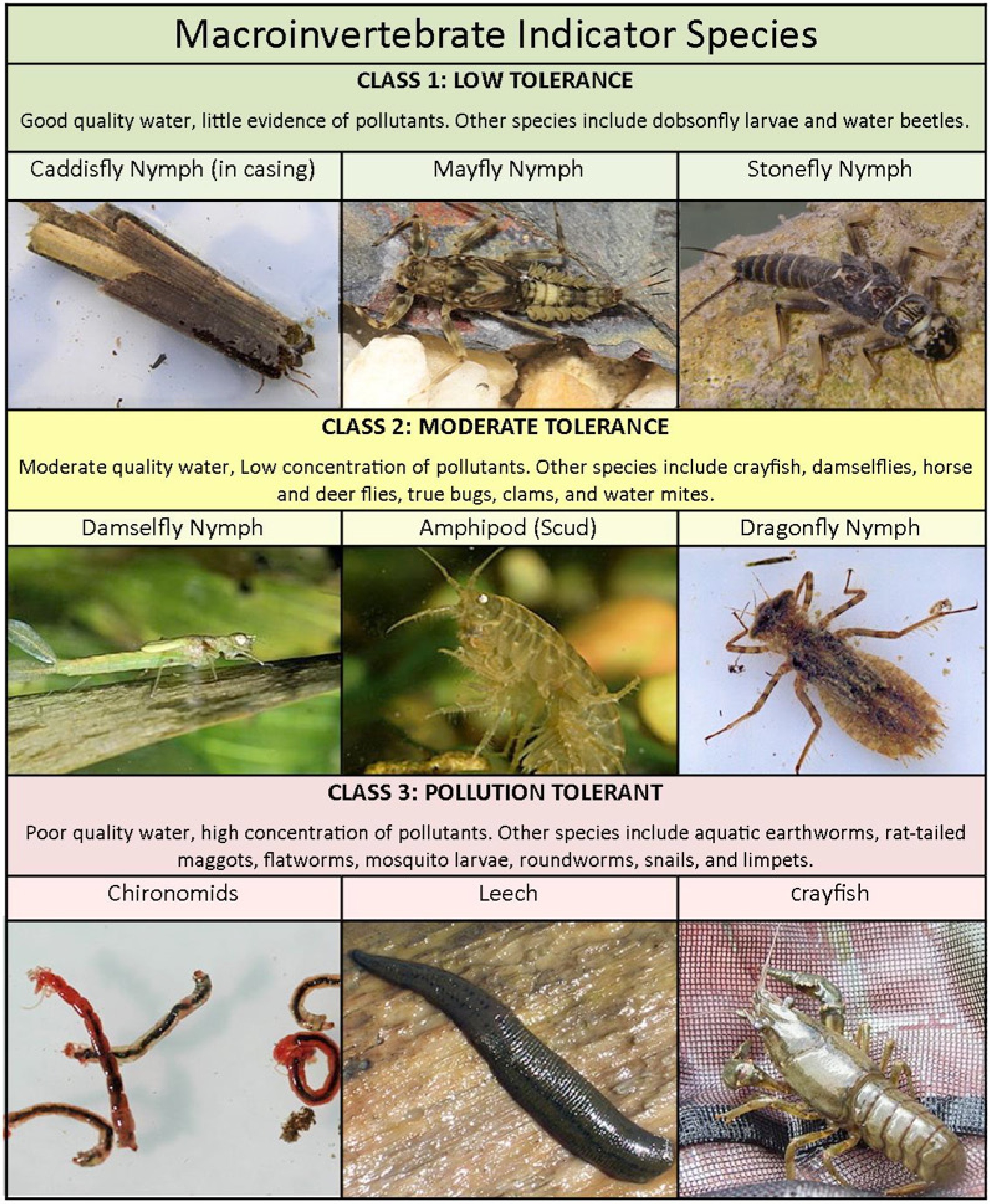
Remove any debris caught in the net being careful not to lose any macroinvertebrates clinging to the nets. Fill your buckets with water then transfer all of your captured macroinvertebrates into the bucket. Examine the macroinvertebrates and carefully separate them and place them into the ice-cube containers for closer examination with magnifiers for identification. Continue to sample, pulling and organizing until you have a good number (25-50) of samples recorded.

Figure 8: Example Site Sketch of Sampling Reach for Water Sampling



Macroinvertebrate Field Survey Data Sheet

Figure 8: Example Site Sketch of Sampling Reach for Water Sampling



All images courtesy of Phil Rowley – Fly Craft Angling Adventures

Site Sketch Template

Draw a bird's eye view of the sampling site including stream features, riparian vegetation, permanent features (bridges, roads, pathways etc.). Make sure to include a North Arrow.

LEGEND