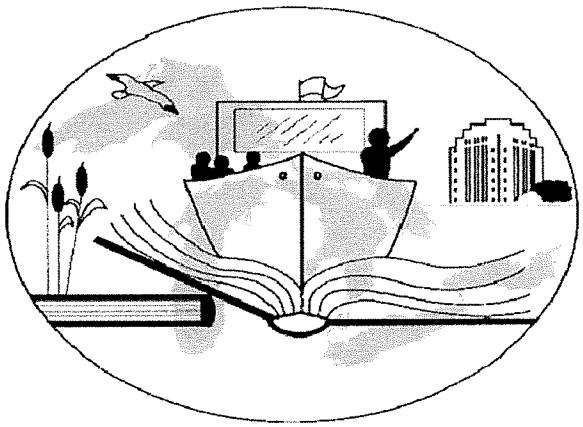
My
Great Lakes Education Program
Cruise

A take-home summary to share with parents, siblings, neighbors, anyone!



Student name:	
Cruise date:	
School:	
Teacher:	

The Great Lakes Education Program is sponsored by:

MICHIGAN STATE UNIVERSITY EXTENSION WAYNE COUNTY

Sea Grant Michigan

MARINE KNOT TYING (Marlinespike)

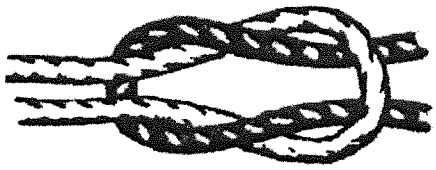
Sailors and other people who work near the water use rope (called "line" aboard a vessel) and knots to make their jobs easier and safer. They also often use rope and knots to make beautiful works of art called *marlinespike seamanship*.

Good knot:
Easy to tie
Easy to untie
Stays secured/does its job

Bad knot:
Hard to tie
Hart to untie
Comes undone when it shouldn't

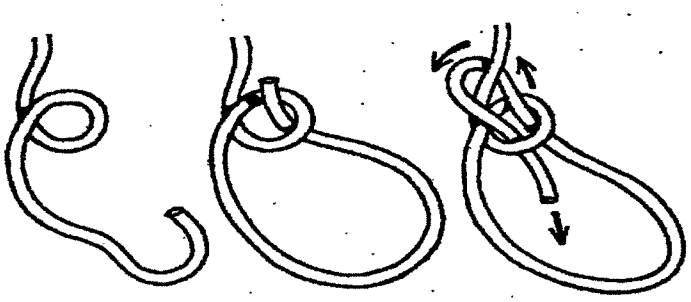
Square knot

This knot is good for tying lines together.



Bowline

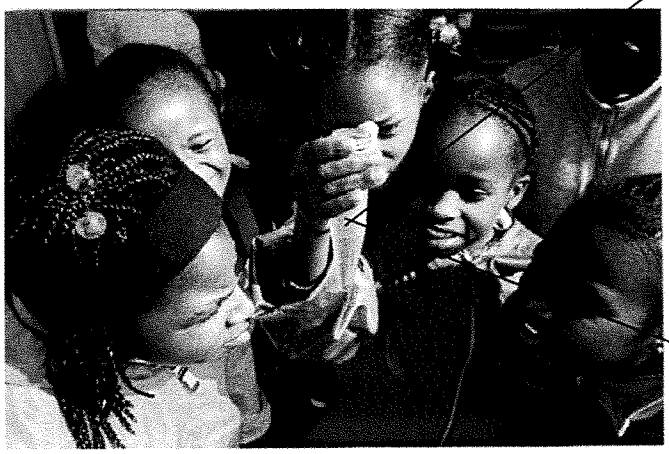
We use this knot to tie all our GLEP equipment to the boat.

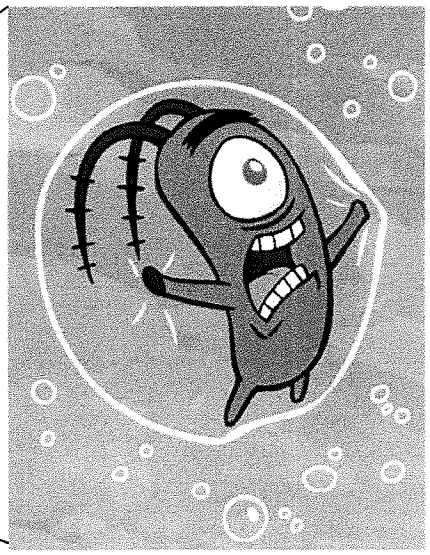


To see if you **REALLY** know how to tie a knot, try to tie it with your **eyes closed!**

PLANKTON

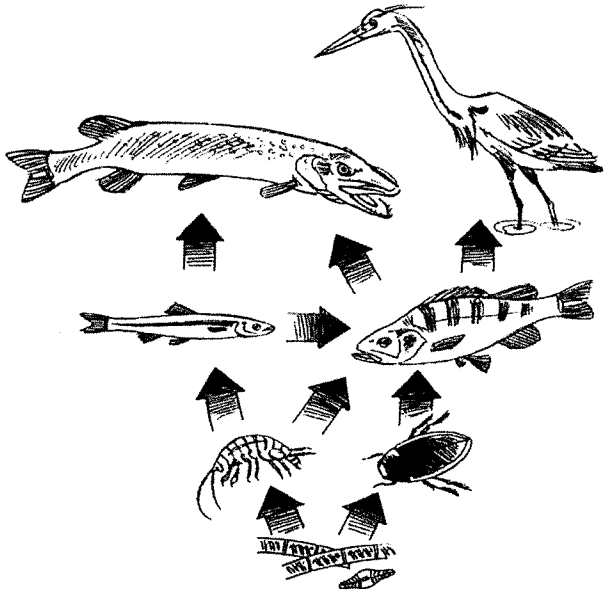
Remember, **plankton is GOOD**, not evil...



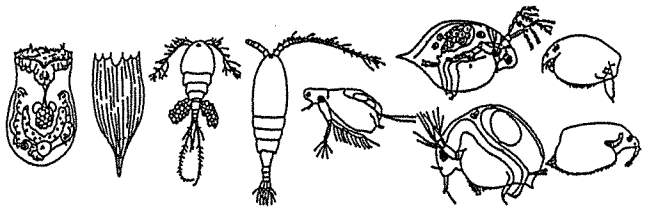


Plankton magnified 10 times

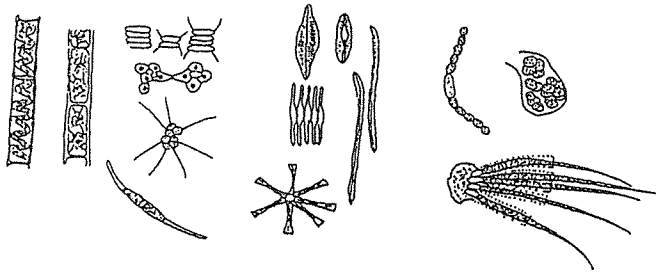
Plankton forms the base of the aquatic food web!

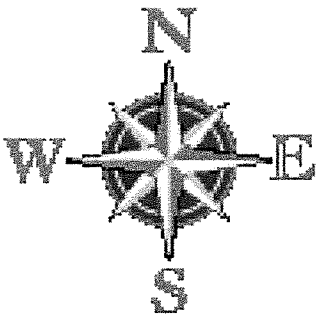


Zooplankton is animal plankton. Zooplankton can swim on its own, but is largely carried from place to place by currents.



Phytoplankton is plant plankton. Phytoplankton is green because of the chlorophyll it contains, and like other green plants, it makes oxygen.
Most of the oxygen we breathe comes from phytoplankton in the oceans!

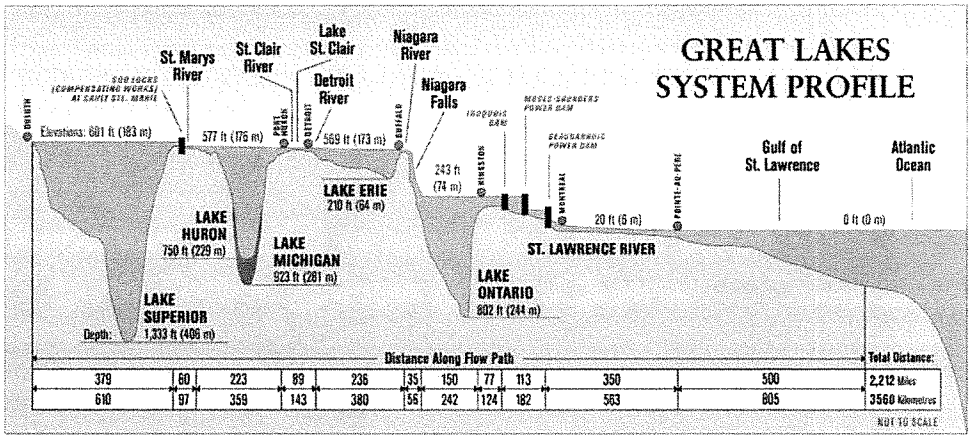


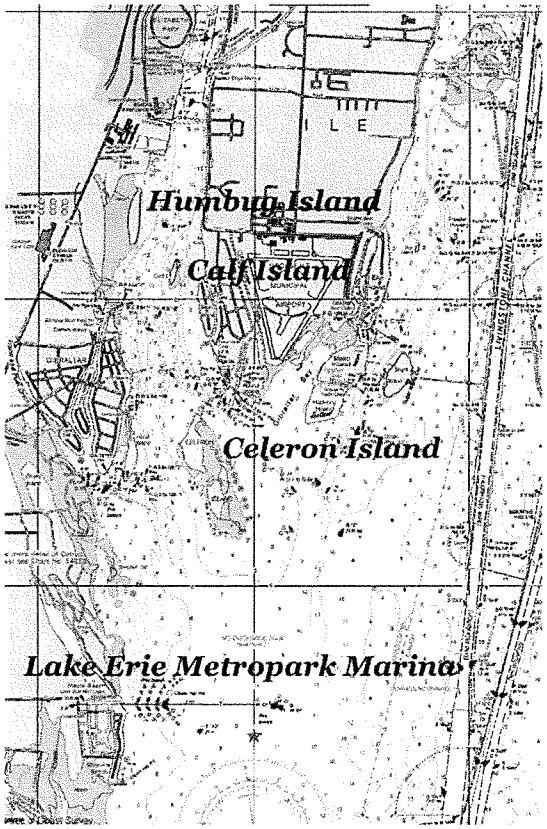


NAVIGATION

Remember **HOMES** to name the 5 Great Lakes
Huron, **O**ntario, **M**ichigan, **E**rie, and **S**uperior

1. **What way does water flow through the Great Lakes?**
   Water flows downhill from Lake Superior into Michigan/Huron (really one lake), then Erie, next through Ontario and eventually into the Atlantic Ocean.





2. **What are the blue markings between open water and dry land, mostly on the Canadian side of the lake?**
   Wetlands

3. **Why aren't there many wetlands on the U.S. side?**
   Coastal development

4. **What do the black numbers on the water represent?**
   Water depth

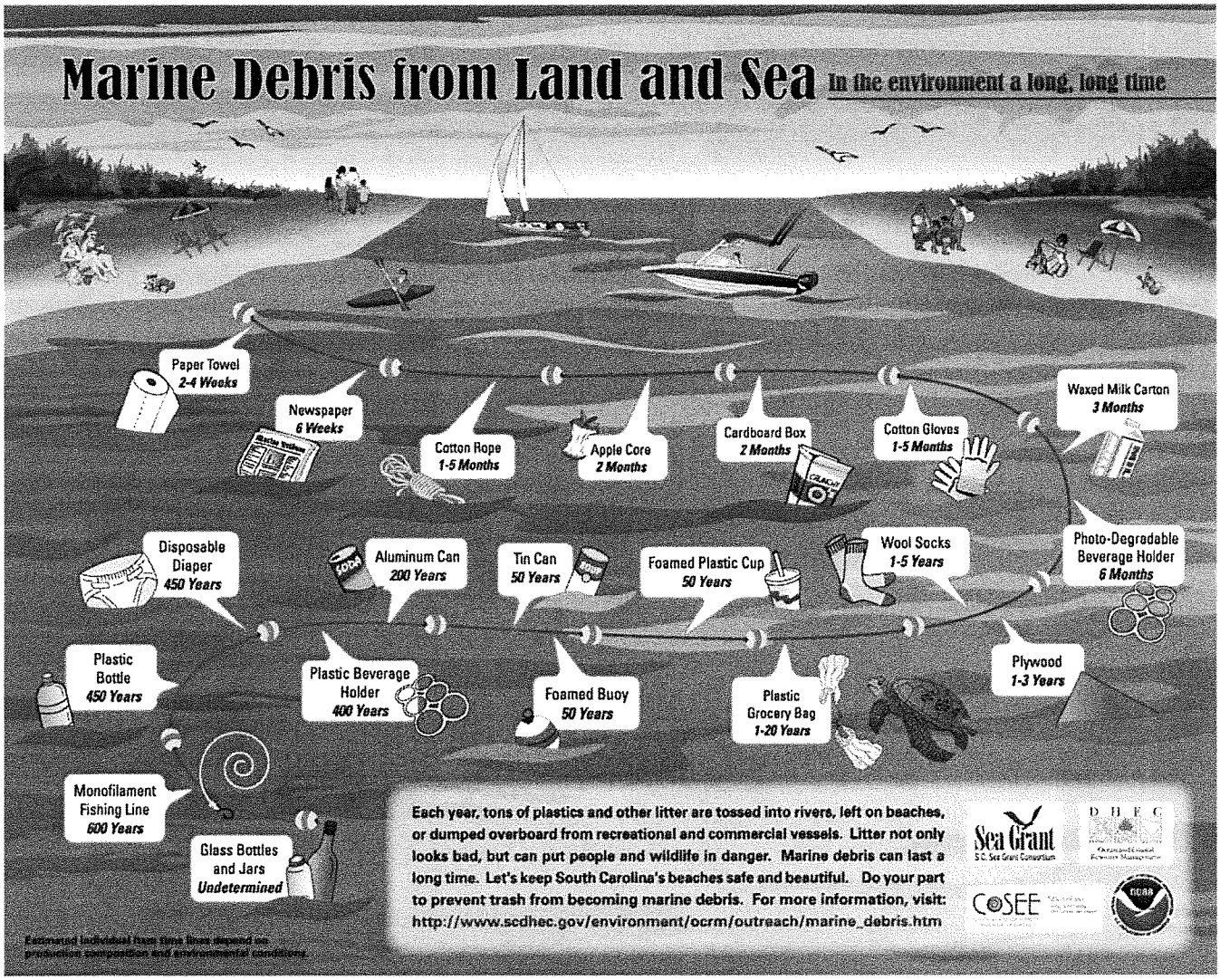
5. **What do the purple and green teardrop shaped objects represent?**
   Navigation buoys.

BEAT THE TEACHER

(*Marine Debris)*

Marine debris, also known as marine litter, is human-created waste that has deliberately or accidentally been released in the environment that ends up in a lake, sea, ocean or any waterway. Litter can come from land or be released directly to the aquatic environment.

Anything man-made can become marine debris once lost or thrown into the environment. The most common materials that make up marine debris are **plastics, glass, metal, paper, cloth, rubber, and wood**. Glass, metal, rubber, and plastics are used for a wide range of products. While they can be worn away or broken down into smaller and smaller fragments, they generally do not **biodegrade** entirely. As these materials are used commonly in our society, their occurrence as marine debris is common. The poster below shows how long it takes for items to **degrade** or **decompose** in an aquatic environment.

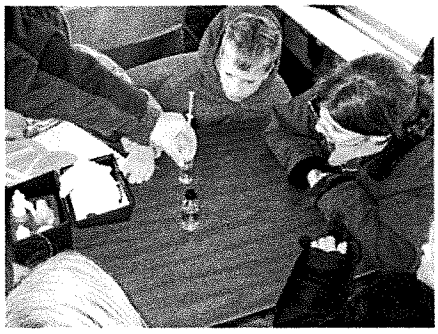


Decompose - to break down, rot or decay. Broken down physically and chemically usually by bacterial or fungal action.

Degradable: capable of being broken down into simpler and/or smaller parts

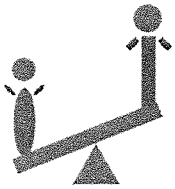
- Biodegradable - broken down by biological action, often by microorganisms
- Photodegradable - broken down by exposure to light
- Chemically degradable – broken down by chemical action
- Physically degradable – broken down into smaller parts by physical action such as abrasion

DISSOLVED OXYGEN & CARBON DIOXIDE



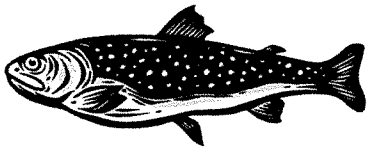
Dissolved oxygen and carbon dioxide are both important to living things in the water. We can tell if a lake or river is a good environment for living things by measuring the dissolved oxygen and carbon dioxide levels in the water.

Aquatic plants depend on carbon dioxide for life and growth, just like plants on land. **Aquatic animals, like fish, depend on oxygen**, just like people do.



Maintaining a balance between dissolved oxygen and carbon dioxide is important in a lake or river, because as one goes up, the other goes down, like a teeter-totter. **Plants use carbon dioxide and produce oxygen**, while **animals use oxygen and produce carbon dioxide**.

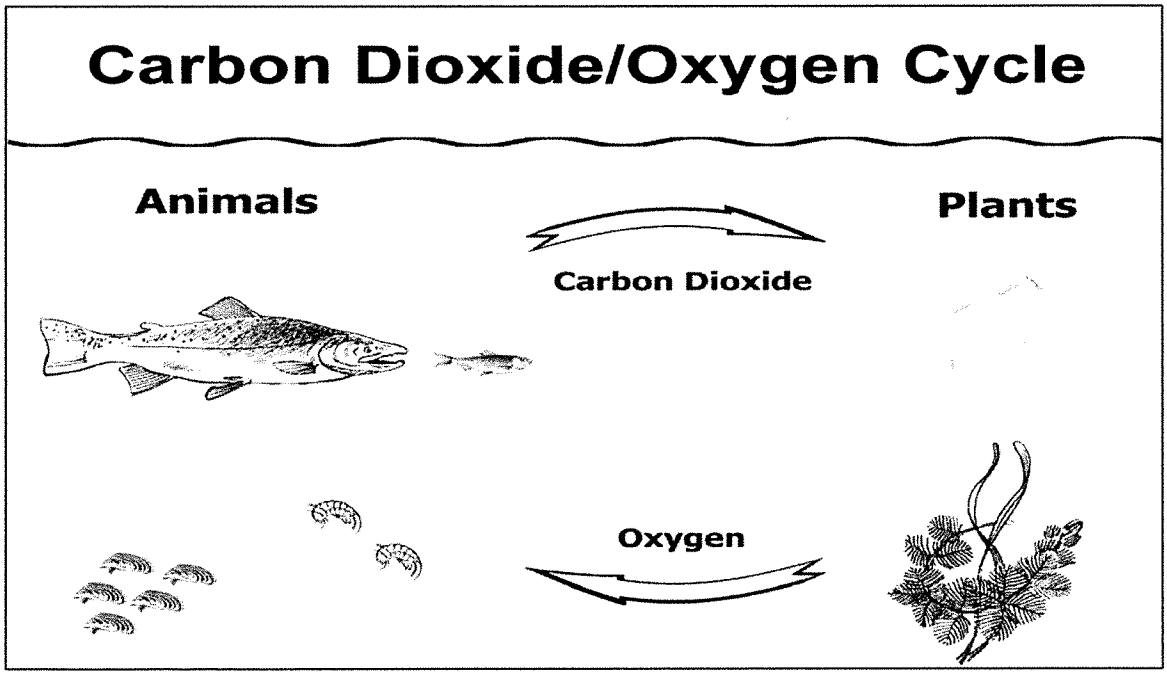
More oxygen can be dissolved in cold water than in warm water. Lake Erie is called a warm lake, because it is relatively shallow and small in size compared with the other Great Lakes. **In warm water lakes, the dissolved oxygen must be at least 4.0 ppm** in order for fish to thrive. Warm water fish include bluegills, crappie, perch, walleye, catfish and carp.



Cold-water lakes need at least 5.0 ppm dissolved oxygen. Popular cold-water fish include trout and salmon.

Where does dissolved oxygen come from? A lot comes from **aquatic plants** that produce oxygen through the process of **photosynthesis**, and a lot comes from the **atmosphere**.

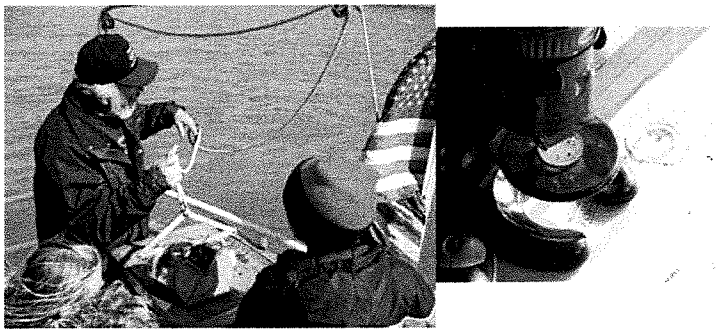
Where does carbon dioxide come from? A lot comes from **aquatic animals** through the process of **respiration**, and a lot comes from the **limestone** that underlays much of the Great Lakes region.

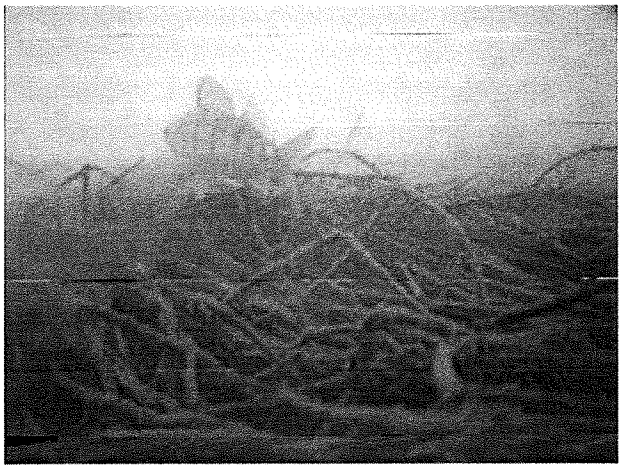


Exploring the Bottom (Benthic) Habitat

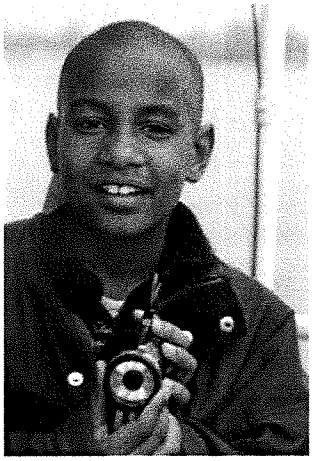
A wide variety of benthic (bottom dwelling) life can exist in lakes and rivers, depending on the water quality and the characteristics of the bottom sediments. We use two sampling devices to explore the bottom – a **bottom dredge**, and an **underwater camera**.

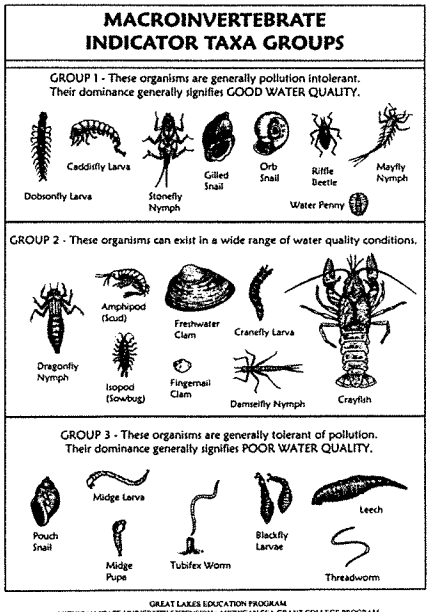
The **bottom dredge** takes a bite out of the bottom, and we bring the sample up to the boat for examination. We usually find **bottom sediment**, **aquatic animals** that live on or in the sediment, and **aquatic plants**. The type of bottom, as well as the type of aquatic plants and animals found in the sample, vary from one location to another. That is why we sample at three locations.





The **underwater camera** allows us to see what is beneath the schoolship. We "fly" the camera over the bottom as we drift with the current. We videotape what we see for the teacher to take back to the classroom. Sometimes we see fish, like the perch at left.

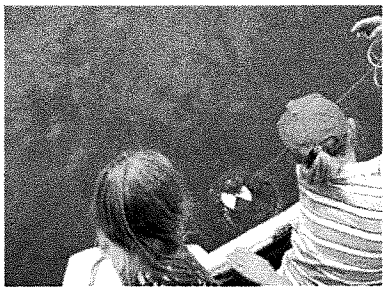




Every type of aquatic animal has a limited range of physical and chemical conditions in which it can survive. Some organisms can survive in a wide range of conditions and are more "tolerant" of pollution. Others are very sensitive to changes in conditions and are "sensitive" to pollution. **Species sensitive to pollution** are called **indicator species**.

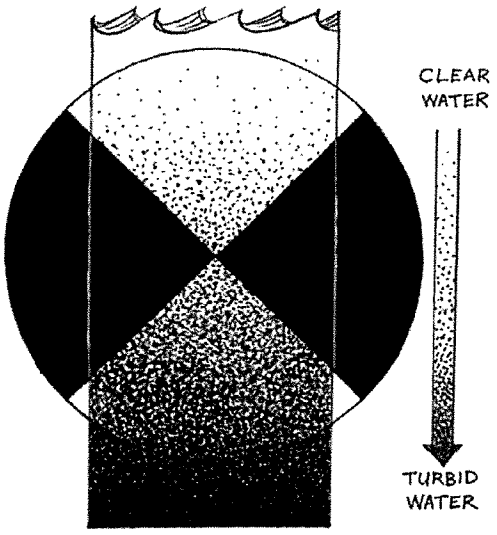
We can determine water quality by comparing the number and types of pollution-tolerant organisms at a sample site with the number and types of pollution-sensitive organisms. Wherever we find an abundance of pollution-sensitive organisms (indicator species), we are in an area of **good water quality**. If we find many pollution tolerant organisms but few/no pollution-sensitive organisms, we are sampling in an area of **poor water quality**.

WATER CLARITY



Water Clarity is an important factor in aquatic habitats because **aquatic plants need sunlight**. They will die if they cannot get enough. Water clarity is a measurement of how clear the water is. In very clear water, a great deal of sunlight can reach aquatic plants. In water that is not clear (**turbid water**), much less sunlight can be used by aquatic plants.

Reducing the available sunlight reduces the abundance of aquatic plants. Since many aquatic animals feed on aquatic plants, a reduction in available sunlight results in less food. It also means less production of oxygen, since plants give off oxygen through photosynthesis. And since young and otherwise vulnerable aquatic animals find protection in beds of underwater plants, it means reduced habitat.



We measure water clarity using a **Secchi Disk**. We learn how far we can see through the water (a measure of water clarity) by seeing how deep we can lower the Secchi Disk into the water and still see it.

Water is **clearest** when no solid particles are suspended in it. However, **water is never completely free of suspended particles**. These particles can be things that are normally in the water, like plankton. Or they can be things like silt, carried into the water from the land through **runoff**.

The type of particle often influences the water color. For example, **silt** usually gives the water a **brown** color, while **phytoplankton** makes the water **green**.

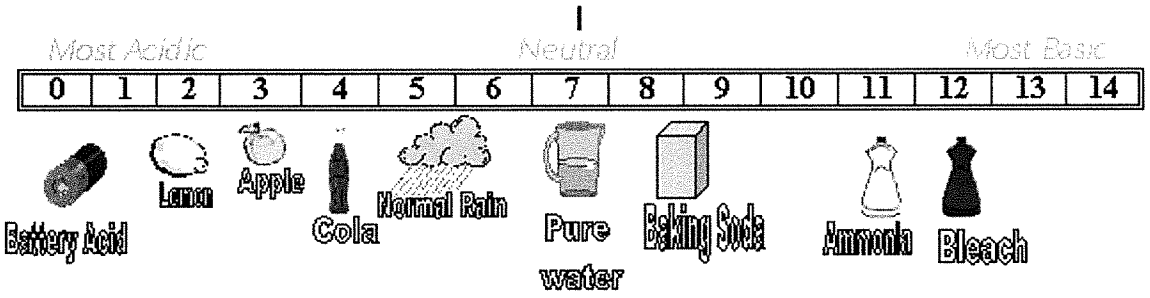
Regardless of the type of particle, they all reduce the water clarity and the amount of sunlight reaching the bottom. **Particles suspended in the water also absorb heat from the sun**. As a result, the water temperature and carbon dioxide level goes up, while the dissolved oxygen level goes down. The combination of warmer water, less light and a reduced dissolved oxygen level can make it difficult for some aquatic plants and animals to live.

pH

pH is a measure of the **power** of **hydrogen ions** in the water. It is represented by a **small "p"** and a **capital "H"** (H = symbol for hydrogen).

The pH scale ranges from 0 (most acidic) to 14 (most basic), with the value 7 representing neutral.

Everyday examples of pH

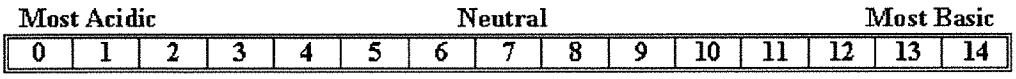


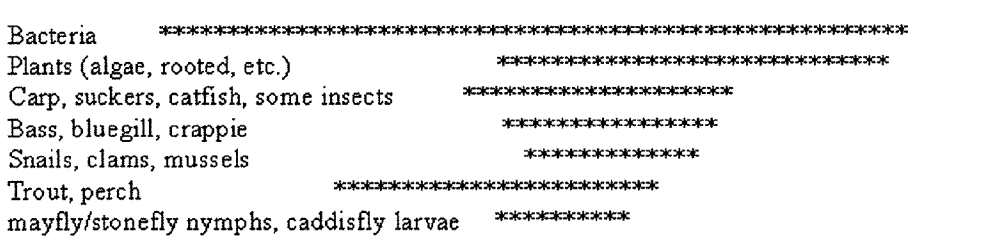
Most natural waters in the Great Lakes region have pH values between 6.5 and 8.5. Rain usually has a pH of between 5.0 and 6.0, but the "acid rain" that we hear about has lower pH values, averaging 4.3.

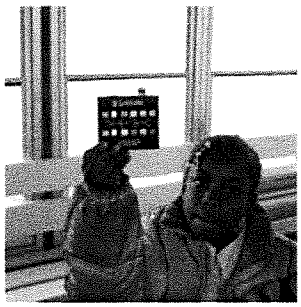
SO WHAT?

The largest variety of plants and animals can live in the water when the pH is neutral. If the pH range is more acidic or more basic, fewer animals and plants will be able to live there.

pH ranges that support aquatic life







WEATHER, WIND & TEMPERATURE

Weather affects water temperatures throughout the year, even on a daily basis. During **winter**, the whole water column (the depth from surface to bottom) becomes cold, often near freezing. The surface is sometimes frozen.

Wind speed is measured using an anemometer

During the **spring**, the sun warms the top water, and the wind mixes the warm water with the cold bottom water. This mixing also helps to mix up nutrients in the water column. This is called **Spring Turnover**.

In the **summer** swimmers may notice a **thermocline**. This is a sharp temperature difference between the surface and bottom waters. The surface water is very warm from the sun, but the bottom water is very cold. This is because there is less wind in the summer, and it does not mix the whole column, or depth, of water.

In the **fall**, the wind gets stronger and again mixes the whole column of water is mixed. This is called **Fall Turnover** .

Most **waves are also created by the wind**. Wave size depends on how strong the wind is, how long it blows, and the distance over which it blows.

Daily changes in weather also cause water temperature differences, although these differences are less pronounced. Wind, rain, and sunshine can all affect water temperature on a daily basis.

Water temperatures on GLEP cruises are determined by reading a **thermometer** within the **water sampler**.

Surface and bottom water temperatures are both obtained and recorded.