3.0 Living things in aquatic environments are affected by many factors.

A rich variety of organisms living and interacting within a water ecosystem indicates a healthy ecosystem. The more species you find, the more likely you will also find more oxygen, and less pollutants.

3.1 The Diversity of Organisms in Salt and Freshwater Systems

Diversity refers to the variety of different kinds of organism species (both plant and animal) living in a particular ecosystem or environment.

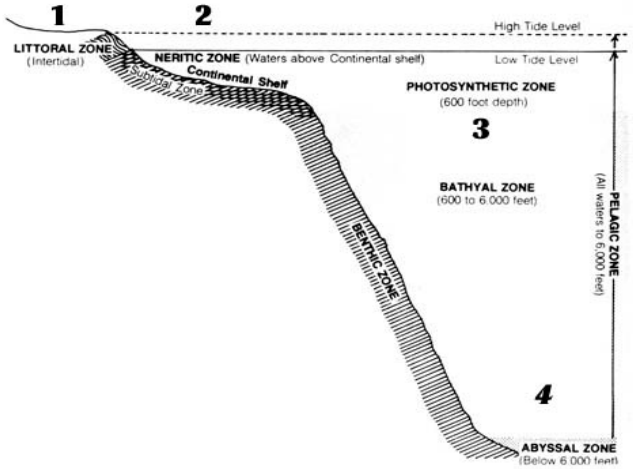
Freshwater (Pond Life) Diversity

Saltwater (Coral Reef – 2nd most diverse ecosystem in the world **) Diversity**

Lake Diversity (see diagram in textbook SIA p. 375)
Large bodies of water like oceans and lakes have layers or **zones**. Some organisms live in only one or two zones, while other organisms can live in all three. In Canada lakes are affected by extreme changes in temperature. Organisms living in the freshwater ecosystem of a lake or pond must be able to adapt to these changes in order to survive.

Lake Zones	Species you might find in this zone
Upper Zone – is the area of a lake from the shore down to where the aquatic plants stop growing	Plants – bulrushes, water lilies Animals – small fish, clams, insects, snails, worms, leeches, and frogs
Middle Zone – is the open water area that still has light penetration.	***Phytoplankton*** are food for fish that live here. Some of the fish that live in this zone also travel to the deeper zone.
Lowest/Deep Zone – is where no light penetrates, so no plants grow there. Food for organisms living in this zone comes from the zones above, in the form of waste.	Deep water fish (large size species)

Ocean Diversity (also, see diagram in textbook SIA pgs. 376-377)
Oceans have similarities to lakes in terms of zones, but with greater differences in water motion, salinity and depth, diversity is much greater in the oceans.



Ocean Zones	Species you might find in this zone
Estuary – one of the most diverse and richest ecosystems. This is where freshwater and saltwater mix to form ***brackish*** water.	- Marshes grow here providing habitat for many different kinds of plants, insects and other animals that can tolerate the brackish water. - These ecosystems are also rich in bird life, because of all the food and shelter available
1 Intertidal Zone – is the shoreline of an ocean.	Plants and animals living in this zone must be able to withstand the pounding of the waves and the rise and fall of tides. Animals with special adaptations live in this zone.
2 Continental Self – is warmer water than out in the deep ocean and this area has full light penetration.	Many varieties of plants and animals live in this zone because of the rich nutrients available. ***Phytoplankton*** are food for fish that live here. Some of the fish that live in this zone also travel to the deeper zone.
3 Oceanic (Deep Ocean) Zone – is where very little light penetrates, so no plants grow there. Food for organisms living in this zone comes from the zones above, usually in the form of waste.	**4 Abyssal Zone -** Deep water fish (specialized adaptations for survival under extreme pressure and no light)

Adaptations Of Organisms In Aquatic Environments

An **adaptation** is a *physical characteristic* or *behaviour* of a species that increases that species' chances of survival in a particular environment. All living things are adapted to live in particular environments. As changes occur within their environment, those organisms that can adapt to the changes have a better chance of surviving than those organisms that cannot adapt to the changes.

There are **five factors** that have led to the development of adaptations by aquatic species.

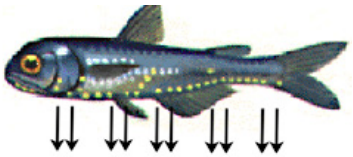
Temperature

Fish that live in cold water have adapted to the temperature. Their body would overheat in warm water. Fish that live in extremely cold water (Arctic) have a natural anitfreeze that keeps their blood and tissues from freezing. In the very deep parts of the ocean, near volcanic vents, organisms can actually survive in extremely hot water.

viperfish

Light

Most organisms need light. Plants need light to photosynthesize (make food). In the deepest parts of the ocean some organisms have adapted to the absence of light by producing their own light from spots on their bodies called **photophores**.



Photophores - light emitting organs

Pressure

As you travel deeper in the ocean, the pressure increases. Those animals that have adapted to different regions of the ocean would perish in other regions because they would be unable to survive the pressure difference.

Salinity

The salt content of the ocean water can be very high. Those organisms that live in this ecosystem cannot survive in freshwater. Freshwater organisms cannot live in saltwater, because the salt makes fluid leave their bodies.

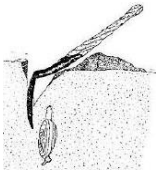
Salmon can survive in freshwater (where they are born) and saltwater (where they live most of their lives).

Water Movement

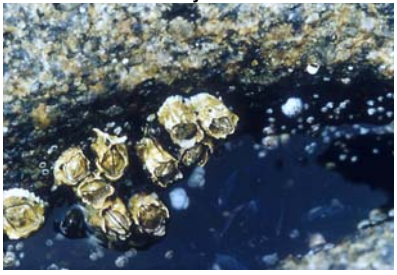
Some organisms are able to live in fast moving water.

Some organisms are adapted to dig themselves into the sand for protection. (Clams do this)

Clams show at the edge of the surf line when you pound the beach with a shovel handle or your foot. They may squirt sand and water out of the hole where they are located.



Barnacles attach themselves to rocks or other objects in the water.



3.2 Populations in Fresh and Salt Water

Natural changes in animal populations are not unusual, but the rapid decline in a species is a cause for concern. What caused the decline is important to know because it affects other species within the ecosystem as well.

Understanding Populations

The study of populations looks at groups within a particular species. A **population** is a group of organisms of the same species ***that live in a particular area***. .

Changes In Populations

A change in a population can mean an increase or a decrease in the number of individuals in that population. It can also mean the change in the number of males and females, or a change in the numbers of old and young individuals. A population within an ecosystem changes as a result of something happening in that ecosystem. There are three types of changes: **seasonal**, **short-term** and **long-term**.

Seasonal Changes

There are dramatic changes in populations of freshwater organisms between the seasons in northern regions (Canada) because of extreme temperature changes. Because of these extreme shifts in temperature, populations swell in the summer and disappear in the winter. The disappearance of a population may mean only that surviving individuals are dormant, or hibernating in the winter months. Breeding cycles can also cause seasonal changes in populations.

Short-Term Changes

Short-term changes take place over a relatively short period of time and don't last very long. They happen irregularly and may be part of a natural event, or caused by human activities. **El NiÑo** is a natural event that might adversely affect fish populations. An oil spill can have short-term effects and long-term consequences if the clean-up is not done effectively.

Long-Term Changes

Long-term changes in populations also result from natural events or human activities. A landslide can change the course of a river or stream. Addition of a new species (zebra mussels introduced by accident) to an area (the Great Lakes) may result in overpopulation of that species because there are no natural enemies. These changes can cause ripple effects because of the interactions that occur within every ecosystem.

3.3 Water Quality and Living Things

The quality of the water supply can change when natural events or human activities affect what is being added or taken from the water.

Changes In Water Quality

A wide range of species depends on the quality of the water for survival. Some species can tolerate certain changes because those changes are within their ***range of tolerance***. Other species may have a very different range of tolerance to certain conditions and will not be able to survive when the water quality changes.

Examples of Water Quality Changes

Acid rain can kill a lake. The lake's death results from altering the conditions, which specific species can tolerate. When this happens, because of a higher than normal acid level, not only the species that cannot tolerate the increased acid level dies, but those species which depend on that species for survival (in the food chain) will also perish. Sometimes light is blocked by algae growing on the surface of the water. This increased growth can occur when fertilizer is added to the water supply by runoff. Even though the ***algal bloom*** grows rapidly, water plants, which produce oxygen for other organisms in the water, die (because they don't get enough light). When there is not enough oxygen in the water, other organisms also perish, and soon, the lake cannot support any life at all (it dies).