Topic 5 – Living In Water (pgs. 432 – 447)

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

Lakes and Ponds

Lake Diversity (see diagram in textbook SF p.432)

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 liliesAnimals - 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)

Freshwater Diversity

(Pond Life)

Rivers and Streams

Streams and rivers usually alternate between areas where water is calm (pools) and areas where water is moving quickly (riffles). Because of the constantly moving environment, organisms often attach themselves to rocks as their habitat.

Oceans

Ocean Diversity (see diagram in textbook SF pgs. 433)

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
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.
Continental Shelf - 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.
Oceanic 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. Deep water fish (large size species)

Saltwater Diversity

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.

(Coral Reef - 2nd most diverse ecosystem in the world)

Adaptations for an Aquatic Life

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. 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. 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. Many aquatic organisms filter the water to get their food.

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.
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.
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. Many aquatic animals use the buoyancy of the water to help them move and their streamlined shape in the water reduces drag.

Aquatic Plants

There are two types of aquatic plants: those attached to the bottom and those that float freely in the water (*phytoplankton*). Aquatic plants need sunlight and therefore can only survive in water where sunlight can penetrate.

Attached Plants

Attached plants are rooted in the soil on the bottom of a pond, or at the edge of a lake. Seaweed attach themselves to the bottom, using their ***'holdfast'***. Getting oxygen to waterlogged roots is accomplished by open channels in their spongy stems. Stomata are holes in the leaves where water and air can pass in and out (Review of Plants for Food and Fibre – Grade 7). A thin, flexible stem allows the plant to move with currents and waves. Aquatic plants must push their flowers above the water surface, so that insects or the wind can spread pollen and seeds.

Seaweeds

Seaweeds are marine plants, that do not have roots, flowers or leaves. They do photosynthesize and use the energy of the sun to create food.

Phytoplankton

Phytoplankton are tiny plants that live on the surface of lakes and oceans and produce oxygen. Their tiny irregular shape, and long spines are adaptations that help them stay in the zone of water where light can penetrate. **Diatoms** are one example of this type of aquatic plant.

Nutrients in Water

All aquatic plants need nutrients, such as nitrates and phosphates. These nutrients can be washed into the water from the land, or be provided from ***detritus*** – the decaying bodies of plants and animals. Nutrients are not always abundant throughout the year. The growth cycle of aquatic plants depends on the availability of sunlight and nutrients (which can be moved by currents, wind, and wave action).

Temperature Mixing

When temperatures cool in the fall, the surface water becomes denser, sinking to the bottom, allowing nutrients to resurface. This increases the phytoplankton growth. Cold water holds dissolved gases better than warm water – meaning higher oxygen levels in the surface waters in the fall.

A Steady State

The level of nutrients and salts in oceans is in a steady balance. Not only does it get added to the water as described earlier, but it is also taken out of the water. *Chlorine* is released into the atmosphere as it leaves the ocean in the form of *salt spray*. Some dissolved salts react (combine) with suspended solids and fall to the bottom as solid sediment.

Other chemicals, like *calcium* and *silica*, are removed from the water by animals that need these nutrients to make bones or shells.

Nutrient Pollution

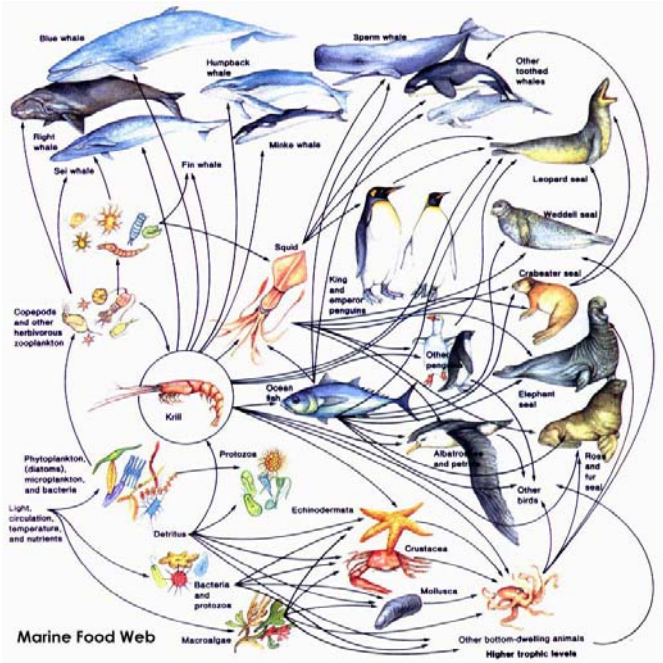
Too many nutrients can cause problems in aquatic environments. An increase in **algae** growth (*algal bloom*) covers the surface of the water, blocking out the light. As the algae dies, they are decomposed by bacteria, which use up all the oxygen. This cycle continues until a balance is achieved one again.

Aquatic Food Chains

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.

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. 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 population 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*.

Fishing

Fishing can affect the balance of fish populations. Over-fishing, specialized fishing, introduction of new species and pollution can all affect the fish populations. When the population of specific species of fish are modified by any of the reasons above, the populations of other species will also be affected within the same ecosystem.

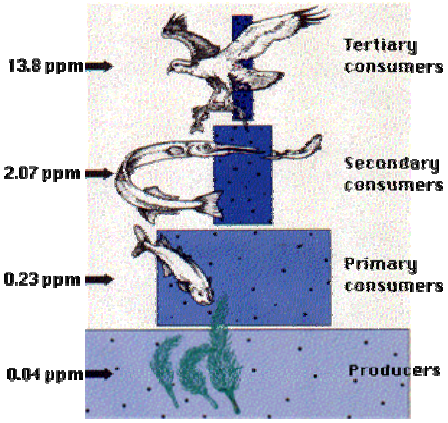
Toxins In Aquatic Habitats

Residues from pesticides, fertilizers and industrial chemicals can find their way into the water system. When this happens, the concentrations of these toxins can be magnified as they move up the food pyramid.

This is called **biomagnification**.

Animals that have a large amount of fatty tissues are highly susceptible to the toxins effects. This is because the toxins are stored in the fatty tissues.

The accumulation of these toxins can cause serious health problems or even death.



The numbers are representative values of the concentration in the tissues of **DDT** and its derivatives (in parts per million, ppm)

Exploring Aquatic Habitats

Highly advanced underwater technologies have enabled scientists to explore more of what could not be seen. The discovery of organisms living near ***sea-floor vents*** on the ocean bottom was spectacular. In the darkness of this region, organisms were using the chemical energy from the sea-floor vents to produce food and oxygen through a process called **chemosynthesis**. These organisms then become the producers for the ocean floor food chain.

Topic 5 Review
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