

Freshwater Ecosystem

There are different types of freshwater regions:

Ponds and lakes

Streams and rivers

Wetlands

Freshwater resources include lakes and ponds, rivers and streams, reservoirs, wetlands, and groundwater.

- ❑ The world derives many benefits from these freshwater resources.**
- ❑ They provide the majority of global drinking water resources, water resources for agriculture, industry, sanitation, as well as food including fish and shellfish.**
- ❑ They also provide recreational opportunities and a means of transportation.**
- ❑ In addition, freshwater ecosystems are home to numerous organisms (e.g., fish, amphibians, aquatic plants, and invertebrates). It has been estimated that 40% of all known fish species on Earth come from freshwater ecosystems**

Some major groups of organisms known to inhabit freshwater ecosystems include :

- ❖ vertebrates (e.g., fish, amphibians, reptiles, birds, and mammals),
- ❖ invertebrates (e.g., protozoan, myxozoans, rotifers, worms, mollusks),
- ❖ plants, algae, fungi, and bacteria. Infectious agents such as viruses may also be present.
- ❖ phytoplankton and zooplankton form the base of the food chain.
- ❖ Periphyton, macrophytes (aquatic plants), insects, fish, and
- ❖ amphibians are also found in freshwater environments. Various birds species like osprey, ducks, raptors also frequent freshwater systems.

A. Lentic environments: Lakes, Ponds, and Reservoirs

- ❑ Lakes are inland bodies of freshwater ranging in size from less than one acre to several thousands of acres. Simply stated, lakes are the bodies of water that fill depressions in the earth's surface.**
- ❑ Lakes may be further described by their origin and classified by trophic status according to their characteristics.**
- ❑ Reservoirs are lakes, often man-made, that control water flow for hydroelectric power generation, flood control, and/or municipal water supplies.**



The main difference between lakes and ponds is size, but ponds are also usually artificially created and are not natural.

Lakes are deeper and larger bodies of water that can influence local climate if large enough.

Ponds are much smaller than lakes and usually have the same temperature from top to bottom, whereas lakes can have dramatically different temperatures from the surface to the bottom waters.

Lakes

Larger

Deeper

May have dramatically different temperatures from the surface to the bottom waters

Light generally does not reach bottom at deeper points

Lakes are natural

Can affect local climate if large enough

Ponds

Smaller

Shallower

Top and bottom waters generally have the same temperature

Light generally will reach the bottom in all areas of the pond

Ponds are usually man-made

Tend to be greatly affected by local climate.

❖ Many ponds are seasonal, lasting just a couple of months (such as sessile pools) while lakes may exist for hundreds of years or more.

❖ Ponds and lakes may have limited species diversity since they are often isolated from one another and from other water sources like rivers and oceans.

❖ Lakes and ponds are divided into three different “zones” which are usually determined by depth and distance from the shoreline.

Classifying Lakes and Ponds

Lakes, ponds, and reservoirs are classified many different ways. Some ways are according to the overall clarity of the water (trophic state), the parts of the water where sunlight reaches, or the temperature differences from top to bottom.

Trophic State: Trophic means nutrition or growth. A eutrophic ("well-nourished") lake has high nutrients and high plant growth. An oligotrophic lake has low nutrient concentrations and low plant growth. Mesotrophic lakes fall somewhere in between eutrophic and oligotrophic lakes

| Lake Trophic Classification | Nutrient Concentration | Biological Productivity(p hotosynthesis) |
|------------------------------------|-------------------------------|--------------------------------------------------|
| oligotrophic | low | low |
| mesotrophic | moderate | moderate |
| eutrophic | high | high |
| hypereutrophic | very high | very high |

Lake Zonation :

Lakes are divided into zones based on amount of sunlight.

There is the: 1) **littoral** at the lake's shoreline where sunlight can reach the bottom;

2) **the limnetic**, which is commonly recognized as the open waters; and

3) **the profundal**, or deep water where sunlight does not penetrate.

And based on the temperature:

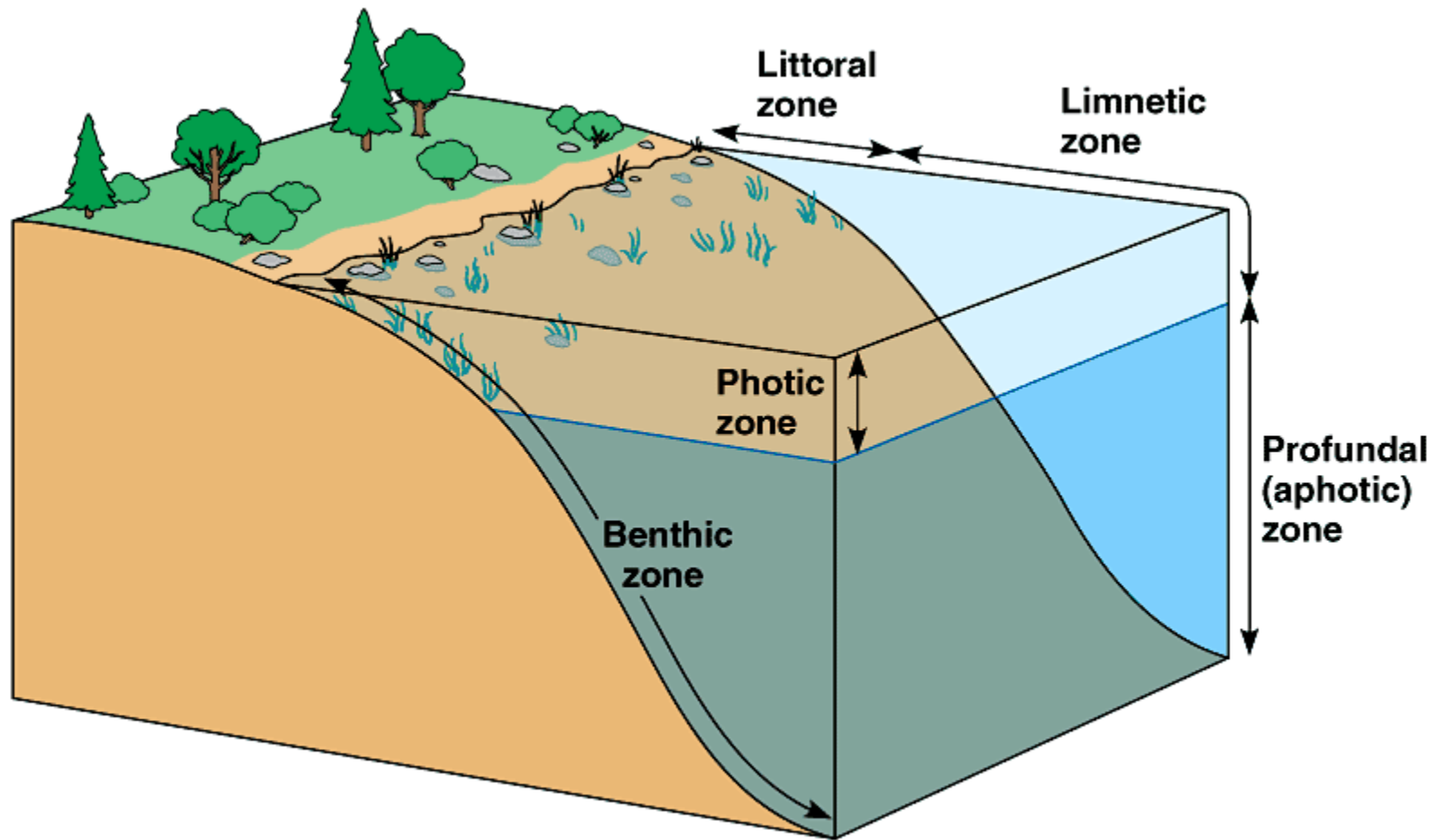
❖ The water column of deep-water lakes is further divided into three zones called the **epilimnion** (surface water),

❖ **hypolimnion** (bottom water), and

❖ **the metalimnion** (or thermocline), which is the transitional area between the bottom and surface water.



- ❖ **The topmost zone near the shore of a lake or pond is the *littoral zone*. This zone is the warmest since it is shallow and can absorb more of the Sun's heat.**
- ❖ **It sustains a fairly diverse community, which can include several species of algae (like diatoms), rooted and floating aquatic plants, grazing snails, clams, insects, crustaceans, fishes, and amphibians. In the case of the insects, such as dragonflies and midges, only the egg and larvae stages are found in this zone.**
- ❖ **The vegetation and animals living in the littoral zone are food for other creatures such as turtles, snakes, and ducks.**



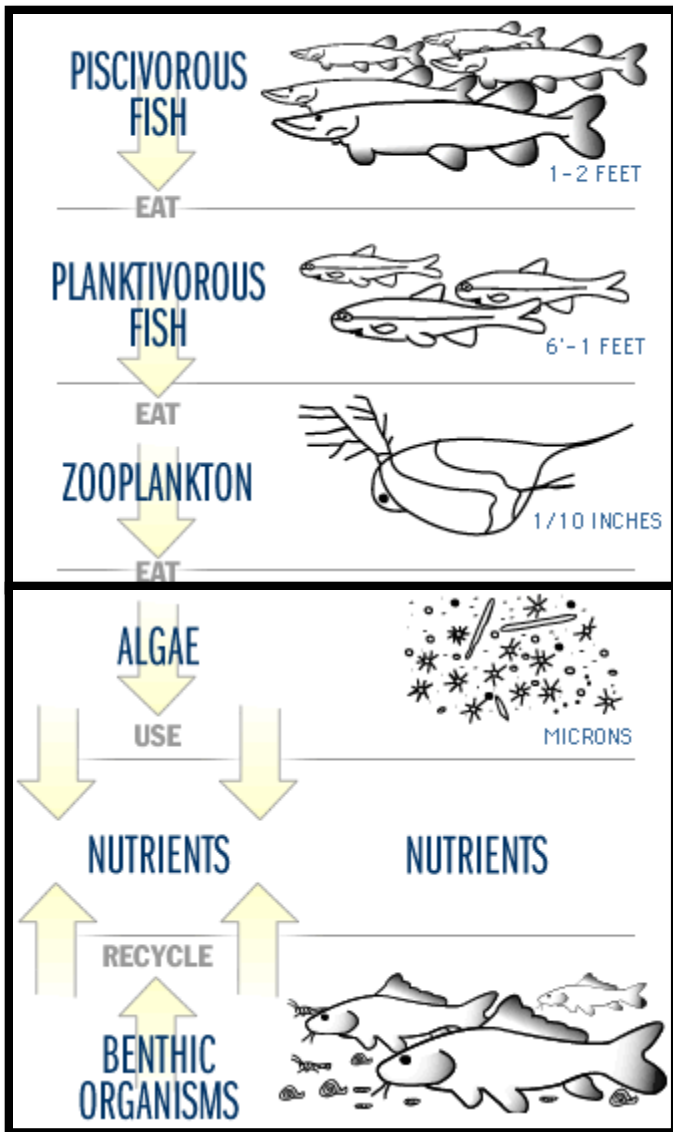
❖ The near-surface open water surrounded by the littoral zone is the *limnetic zone*.

❖ The limnetic zone is well-lighted (like the littoral zone) and is dominated by plankton, both phytoplankton and zooplankton. Without aquatic plankton, there would be few living organisms in the world, and certainly no humans. A variety of freshwater fish also occupy this zone.

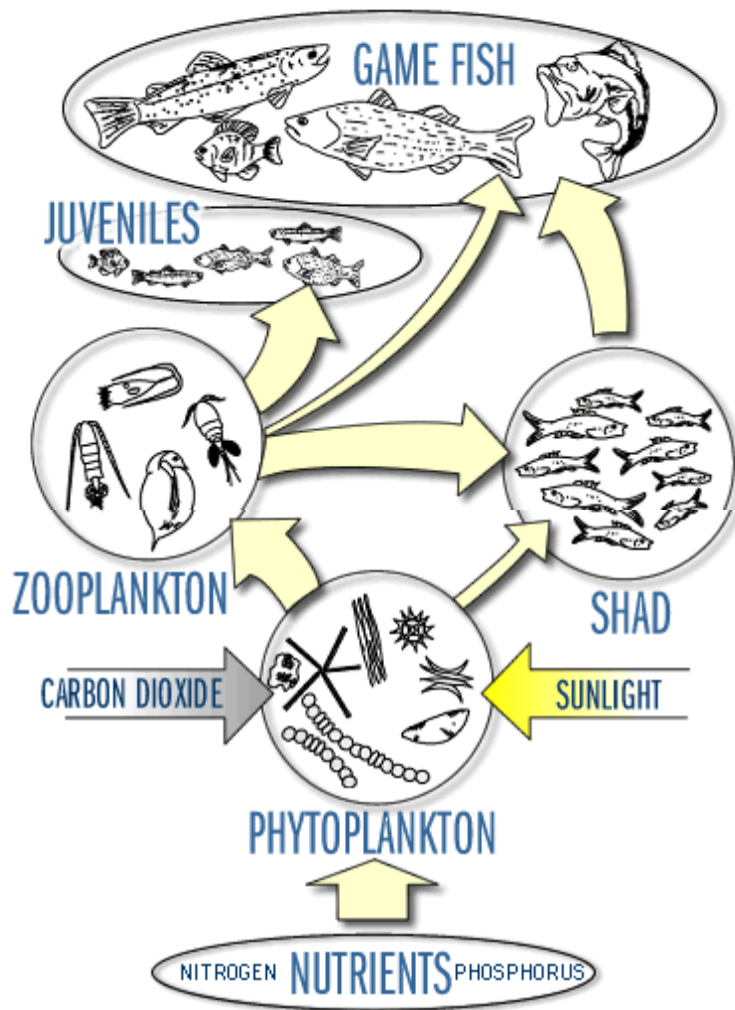
❖ Plankton have short life spans — when they die, they fall into the deep-water part of the lake/pond, *the profundal zone*. This zone is much colder and denser than the other two. Little light penetrates all the way through the limnetic zone into the profundal zone. The fauna are heterotrophs, meaning that they eat dead organisms and use oxygen for cellular respiration.

A Glimpse at the Structure of a Food Web

- ❑ Primary producers dominate the open water of the limnetic zone. Photosynthesis occurs in this zone where phytoplankton that oxygenate the water are ingested by the slightly larger zooplankton.**
- ❑ Insects and fish eat zooplankton, and are eaten by larger fish, insects, amphibians, and other animals.**
- ❑ The rate of production by phytoplankton is directly related to nutrient concentrations, phytoplankton variety and the flushing rate of the waterbody.**
- ❑ Rapid influxes of nutrients lead to blooms, or rapid, abundant growth of phytoplankton.**
- ❑ Blooms give lakes and ponds their familiar dark green color. Of course, the presence of herbivorous zooplankton may greatly affect the growth of phytoplankton.**

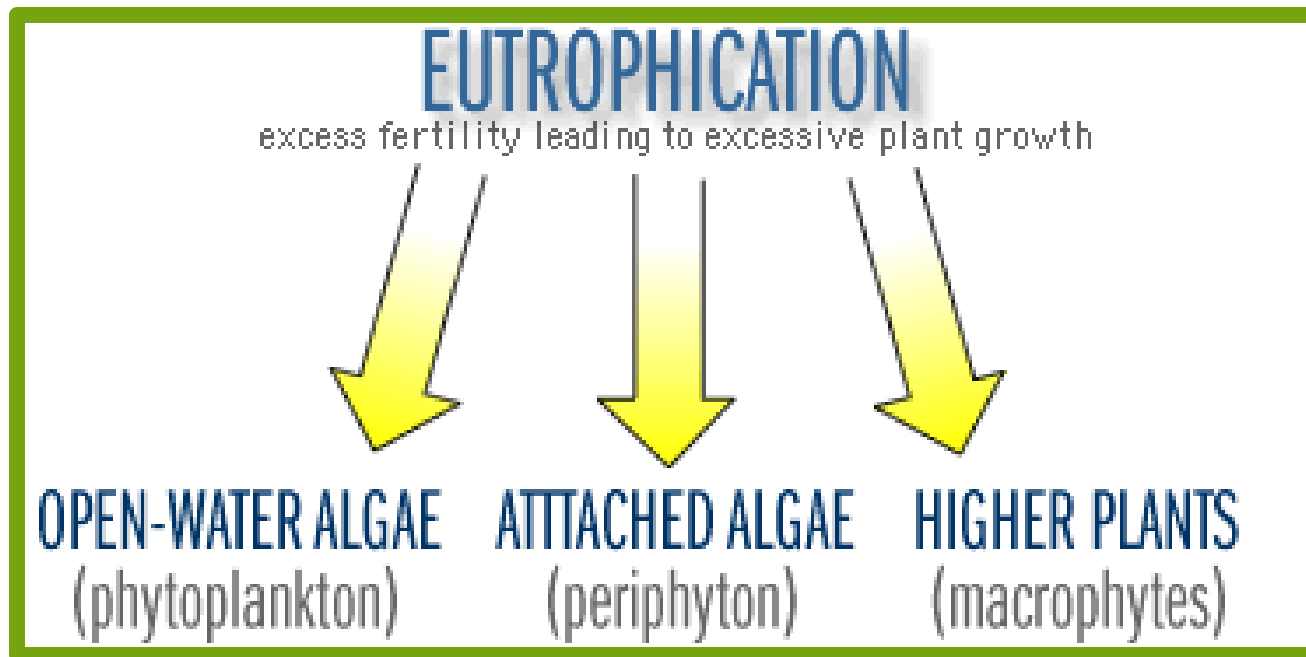


TYPICAL FOOD CHAIN



FOOD WEB FOR LAKE MEAD

EUTROPHICATION



WATER QUALITY IMPACTS ASSOCIATED WITH EUTROPHICATION



Noxious algae (scums, blue-greens, taste and odor, visual)

❖ Excessive macrophyte growth (loss of open water)

❖ Loss of clarity (secchi depth goes down)

❖ Possible loss of macrophytes (via light limitation by algae and periphyton)

❖ Low dissolved oxygen (loss of habitat for fish and fish food)

❖ Excessive organic matter production (smothering eggs and bugs)

❖ Blue-green algae inedible by some zooplankton (reduced food chain efficiency)

❖ "Toxic" gases (ammonia, H₂S) in bottom water (more loss of fish habitat)

❖ Possible toxins from some species of blue-green algae

❖ Drinking water degradation from treatment disinfection byproducts

❖ Carcinogens, such as chloroform (from increased organic matter reacting with disinfectants like chlorine)

When nutrient levels become excessively high and the waterbody's trophic classification is eutrophic, **algal blooms** may occur.



- ❑ **Algal blooms** can be very dangerous to the health of their respective ecosystems.
- ❑ Algal blooms are the result of too much food for the algae making them grow and reproduce. The food is in the form of nutrients, often washed in from the land during a rainfall.
- ❑ The bad part is that they grow so fast that they become so thick, they block the sunlight from reaching algae below the surface. The algae without the sunlight begin to die and drop to the bottom of the lake or pond.
- ❑ When they die, bacteria help decompose the cells in a process that uses up the oxygen dissolved in the water. This decreases the oxygen concentration which affects the aquatic life.