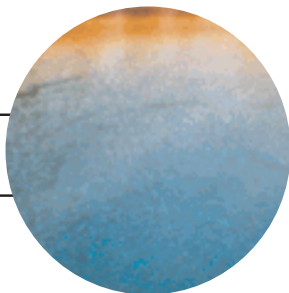


Does **OXYGEN** in the Water Matter?

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Without oxygen, life as we know it could not exist. Green plants produce oxygen during photosynthesis. We use this oxygen to breathe. But what happens in aquatic environments? How does oxygen get into water? How does the amount of oxygen affect the water quality of an aquatic site? How does it affect aquatic animals?

What is Dissolved Oxygen?

The amount of oxygen dissolved in water is called dissolved oxygen. It is usually measured in milligrams per liter (mg/L). This oxygen is used by fish and other aquatic animals for breathing. Adequate dissolved oxygen is necessary for good water quality. Oxygen needs depend on aquatic species.

How does oxygen get into water?

Oxygen is dissolved in water mainly by three processes:

- *From the air* — oxygen diffuses at the surface of the water
- *From waves and wind* — they cause aeration, which adds air into water. Rapids and water over falls also causes aeration.
- *From photosynthesis* — aquatic plants produce oxygen during photosynthesis.

Humans often use artificial methods to aerate an aquatic site and maintain healthy dissolved oxygen levels.

Why is the dissolved oxygen of an aquatic site important?

When fish breathe they transfer oxygen to their blood stream through their gills. In fact, all aquatic life including insects and bacteria need oxygen to grow and reproduce. Excessive quantities of dissolved oxygen in water can be harmful to aquatic life. In some occasions fish and aquatic invertebrate may suffer from "gas bubble disease." Air bubbles block the flow of blood through vessels, which often causes death. Too much oxygen can also cause external bubbles on fins and skin. Most aquatic species need a minimum of 5mg/L to survive. However, the required range for dissolved oxygen varies from species to species.



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Vocabulary

Diffusion The movement of molecules (e.g., oxygen molecules) from an area of higher concentration (e.g., the air) to an area of lower concentration (e.g., the water).

Dissolved Oxygen The amount of oxygen dissolved in water. It is usually measured in milligrams per liter (mg/L).

Ecosystem A group of organisms together with its environment, seen as a unit.

Gas bubble disease This disease is most frequently seen in heavily planted or Algae-ridden aquariums or ponds. In such a scenario, oxygen production can be so great that it upsets the proper balance of dissolved gases in the water causing very small gas bubbles to form inside of the fish. If these bubbles move to the blood stream they can be fatal.

Habitat The environment where a particular plant or animal is normally found.

Invertebrate An animal without a backbone.

Photosynthesis The process by which plants harness the energy of the sun to make food. In photosynthesis, plants absorb carbon dioxide (CO₂) and give off oxygen (O₂). Thus, there is an overall accumulation of carbon (C) in the plant.

Respiration The process occurring in living organisms, whereby food is oxidized to release energy

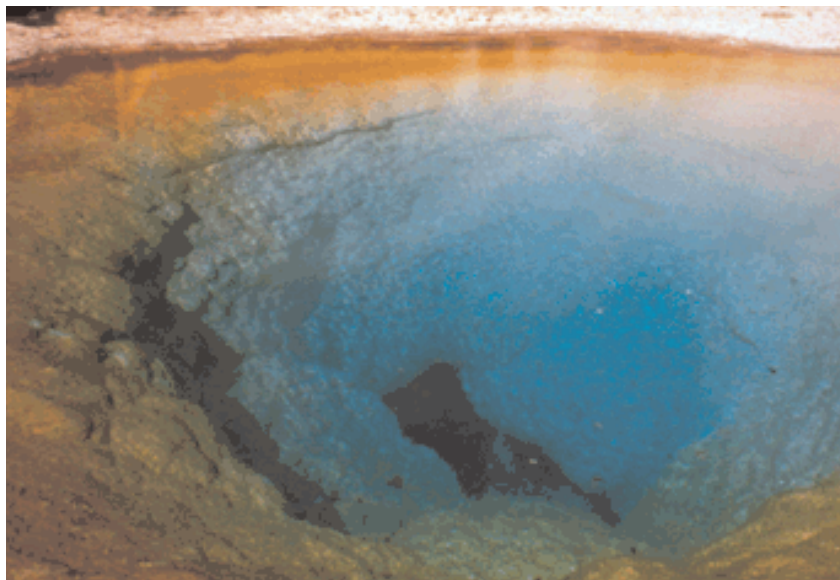
Salinity The amount of dissolved salt in water.

Watershed An area of land that delivers runoff water, sediment, and dissolved substances to surface water bodies, such as rivers or lakes. All watersheds consist of boundaries, a basin and collection areas.



Does OXYGEN in the Water Matter?

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When dissolved oxygen levels in water are low (below 5.0 mg/L), most aquatic animals are in danger. Low oxygen levels affect animal behavior, growth, and reproduction. Oxygen levels that remain under 1-2 mg/L for a few hours can cause the death of many fish. The table shows the minimum dissolved oxygen requirements of several organisms. Low oxygen level is a sign of pollution. Aquatic sites with good water quality have dissolved oxygen levels between 8 and 10 mg/L. When the level is between 4 and 5 mg/L, the site is polluted.

Do plants need oxygen?

Plants need oxygen too! As you know plants give off oxygen during photosynthesis. That does not mean they don't need oxygen. During photosynthesis plants take in water, carbon dioxide, and energy from the sun to make food (starch and sugar). In the process they release oxygen. Plants store starch and sugar and they use it to release energy needed for their own growth. But they need oxygen to do that. The process of

using oxygen to release energy from food is called respiration.

What factors affect dissolved oxygen?

Oxygen, like most gases, dissolves better in cold liquids. When the water is warm it means that there is less dissolved oxygen. Aquatic environments at high temperatures can increase the number of bacteria and other organisms. They use much of the oxygen in the water and when they die, decay also uses up oxygen. This causes problems for fish.

Aquatic plants release oxygen into the water during photosynthesis. At night, photosynthesis stops and plants absorb oxygen through respiration. When an aquatic site has heavy plant growth, plants use a lot of oxygen. When dissolved oxygen levels are very low, you can sometimes detect a rotten egg smell.

Unfortunately humans are also responsible for unhealthy levels of dissolved oxygen in water. Biodegradable wastes such as sewage and waste from industrial plants can also cause a decrease in

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the amount of dissolved oxygen. When such waste enters water, bacteria feed on them, using up oxygen. With so much food available, the bacteria multiply rapidly using much of the dissolved oxygen in the water. As a result other aquatic organisms cannot breathe. In 1995, waste that contaminated a river in North Carolina resulted in high levels of bacteria and algae growth consuming most of the dissolved oxygen. As a result an estimated 5,000 fish died!

Another factor that affects dissolved oxygen is aeration. Streams and rivers with white water increase the level of dissolved oxygen because more oxygen enters the water from the atmosphere. Salinity also affects dissolved oxygen levels. At a given temperature, fresh water can dissolve more oxygen than salt water.

Aquatic Organisms	Minimum Dissolved Oxygen (mg/L)
Trout	6.5
Smallmouth bass	6.5
Caddisfly larvae	4.0
Mayfly larvae	4.0
Catfish	2.5
Carp	2.0
Mosquito larvae	1.0

