

# HEALTH of aquatic life

## a real problem?

### RESEARCH ARTICLE



*Temperature, water clarity, and dissolved oxygen are some of the factors that affect water quality and the health of any aquatic habitat. They often determine the variety of species in the habitat and which animals and plants survive and grow well. But, how do these factors affect water quality? Do human actions cause poor water quality that puts aquatic life at risk?*

#### Why is temperature important?

Temperature affects the chemistry of water and the behavior of aquatic life. Air temperature is important because it is linked to weather factors that can increase or decrease water temperature. When the temperature in the water increases, photosynthesis increases. This means that the habitat can support more aquatic plants. When the aquatic site has heavy plant growth, more oxygen is consumed by the growing plants. More growing plants means more dead plants, which are decomposed by bacteria — a process which also uses oxygen. When oxygen levels in water are very low, you can sometimes detect a rotten egg smell.

Aquatic animals are sensitive to water temperature changes. If temperatures in the water change too much, many organisms die; affecting the survival of the animals who depend on these organisms for food. Usually fish cannot survive temperatures below 0°C, and very few can tolerate temperatures above 36°C. If the temperature increases or decreases by just a few degrees Celsius, fish will swim to a different area to regulate their body temperature.



#### Vocabulary

**Dissolved Oxygen** The amount of oxygen oxygen in gas form present 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** A condition where air bubbles block the flow of blood through vessels, which often causes death.

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

**Photosynthesis** The process by which plants harness the energy of the sun to make food. In photosynthesis, plants absorb carbon dioxide (CO<sub>2</sub>) and give off oxygen (O<sub>2</sub>). Thus, there is an overall accumulation of carbon (C) in the plant.

**Thermal Pollution** An increase in water temperature caused by adding relatively warm water to a body of water at a lower temperature.

**Turbidity** The ability of light to penetrate water. A measure of “how cloudy the water is.” It is usually measured in Nephelometric Turbidity Units (NTU).

**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.



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### How does water clarity affect aquatic habitats? How does it affect us?

You can measure water clarity by measuring its turbidity. Turbidity measures the cloudiness in water. Murky water has high turbidity. Water with low turbidity is clear. Turbidity is usually measured in Nephelometric Turbidity Units (NTU). The turbidity of surface water is usually between 1 NTU and 50 NTU. When turbidity is above 5 NTU you can see the cloudiness in the water.

Aquatic plants need light to grow. When turbidity is high, solid particles prevent sunlight from reaching plants below the surface and photosynthesis decreases. When this happens plants are in danger. Their growth is reduced and they may even die.

When turbidity is high, particles absorb heat from the sun, raising the temperature of the water. In warm water dissolved oxygen levels drop (warm water holds less oxygen than cold water). Also, with less photosynthesis plants produce less oxygen. Low oxygen levels affect animal behavior, animal and plant growth, and reproduction, and may even cause death.

Particles in water clog fish gills, which can cause serious problems. Particles can also affect their growth and reproduction. Aquatic animals need light to feed. Poor water clarity blocks light and limits their movement, which makes it difficult to see their prey. Cloudy water also makes it difficult for predatory birds to see their prey.

Poor water clarity can make water unsuitable to drink and swim in. Some suspended particles support bacteria growth. The cost of filtering and disinfecting polluted water can be very high.



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#### Why is dissolved oxygen important?

The amount of oxygen dissolved in water is called dissolved oxygen. It is usually measured in milligrams per liter (mg/L). 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 about 5mg/L to survive. However, the required range for dissolved oxygen varies from species to species. 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. A low oxygen level is a sign of pollution. Aquatic sites with good water quality have dissolved oxygen levels between 8 and 9 mg/L. When the level is between 4 and 5 mg/L the site is heavily polluted.

#### How does water temperature, water clarity, and dissolved oxygen affect each other?

Water clarity increases the temperature of the water. The cloudier the water, the more particles it contains and the more heat they absorb from the sun. Warm water holds less oxygen than cold water, so in warm water dissolved oxygen levels drop. When water clarity is low, solid particles prevent sunlight from reaching plants below the surface and photosynthesis decreases. Also, with less photosynthesis, plants produce less oxygen. Low oxygen levels affect animal behavior. They also affect animal and plant growth, reproduction, and may even cause death.

#### How do humans affect the health of an aquatic site?

Humans often cause thermal pollution. It happens when warmer water flows into colder water. The result is an increase in water temperature. It often occurs near power plants. Power plants use water to cool equipment. The water heats up as it runs over the hot equipment and is discharged back into the aquatic sites. Urban runoff can also cause thermal pollution. It happens when water flows over warm streets, sidewalks, and parking lots. Those surfaces heat the water before it flows into the aquatic site.

Other ways humans affect water temperature is by cutting down trees, which leads to erosion. That means more soil ends up in the aquatic site. The soil in the water absorbs heat from sunlight and the water temperature then increases. Biodegradable wastes such as sewage and waste from industrial plants can severely affect water clarity and decrease 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.

