

Dissolved Oxygen and Temperature

What do DO and water temperature tell us about a lake?

Why are dissolved oxygen and temperature important?

Understanding lake dissolved oxygen (DO) and temperature patterns is important to lake management planning. These patterns reflect and influence lake productivity, and affect lake physical/chemical properties, phosphorus cycling, and fish and aquatic animal populations.

What is DO, and how much does the lake's biology need?

Atmospheric gases (oxygen, hydrogen, nitrogen, etc) are typically present in water in dissolved form. The amount of DO in water is particularly important, because like humans and land animals, creatures in aquatic environments need oxygen to power the life-sustaining respiration process. Different aquatic creatures require different amounts of DO. For example, trout and stoneflies need DO levels as high as 6-8 mg/L*. Smallmouth bass need DO between 5-6 mg/l. Some animals (like carp) can thrive with

very low oxygen (1-2 mg/L, and can even gulp air directly if needed). In any case, when aquatic organisms cannot find water with the proper amount of DO, they will soon die.

What else does DO affect?

DO also affects nutrient cycling in a lake. Low DO in deep water can cause phosphorus to be released from lake sediment. Excessive phosphorus can cause algal blooms. When algae decompose, this causes further DO reductions. This self-fueling pattern of low oxygen, high phosphorus levels, and excessive algae growth is challenging to reverse once it has begun.

How are DO and water temperature connected?

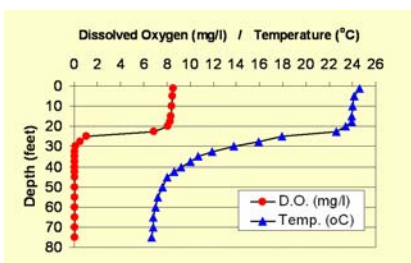
Colder water has the potential to hold more oxygen than warm water. However, colder water doesn't necessarily hold more oxygen in reality. The density of water increases as temperature decreases, so cold water sinks to the bottom of a lake and is separated from the source of oxygen (the atmosphere). Warmer, less-dense water floats at the top of a lake where mixing with the atmosphere keeps the upper waters aerated. The difference in water density results in distinct layers of different temperatures and different DO in a lake. This is known as thermal stratification.



The DO/Temperature meter comes with a very long cable attached to a probe. The probe is lowered from the lake surface to the lake bottom to get DO and temperature profiles (credit: MiCorps staff).

How are DO and temperature measured?

In the Cooperative Lakes Monitoring Program, DO and temperature are measured from the surface to within 3 feet of the bottom, as a profile, in the deepest basin of the lake. Measurements of DO and temperature are made every two to three weeks from mid-May to mid-September. CLMP volunteers use an oxygen/temperature meter connected to a long cable with a sensor probe. The meter displays the DO readout based on the rate of diffusion of molecular oxygen across the probe's membrane. The thermistor component of the instrument provides the temperature readout. Using the DO-temperature data, we can develop dissolved oxygen/temperature profiles, which show the changes in DO and temperature through depth.



This graph of Corey Lake shows the distinct thermal and DO stratification typical for a late summer, good quality, mesotrophic (moderately productive) lake. (credit: MiCorps staff)