



ENVIRONMENT BULLETIN

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What's Going on Down Under?

Enquiring ice fishermen want to know.....

Dissolved Oxygen

Oxygen is an essential element in any aquatic system. The amount of oxygen dissolved in lake water varies from day to day and even between night and day. Most of the dissolved oxygen in lake water comes from the atmosphere and becomes dissolved into lake water by the action of wind and waves. Oxygen concentration varies significantly with water temperature, with colder waters able to contain more oxygen in solution than warmer waters. Oxygen is also produced during sunlight hours as a result of photosynthesis by phytoplankton and aquatic plants. It is consumed by these same plants during the night, when no photosynthesis can occur, and by the decay of organic materials at the bottom of the lake.

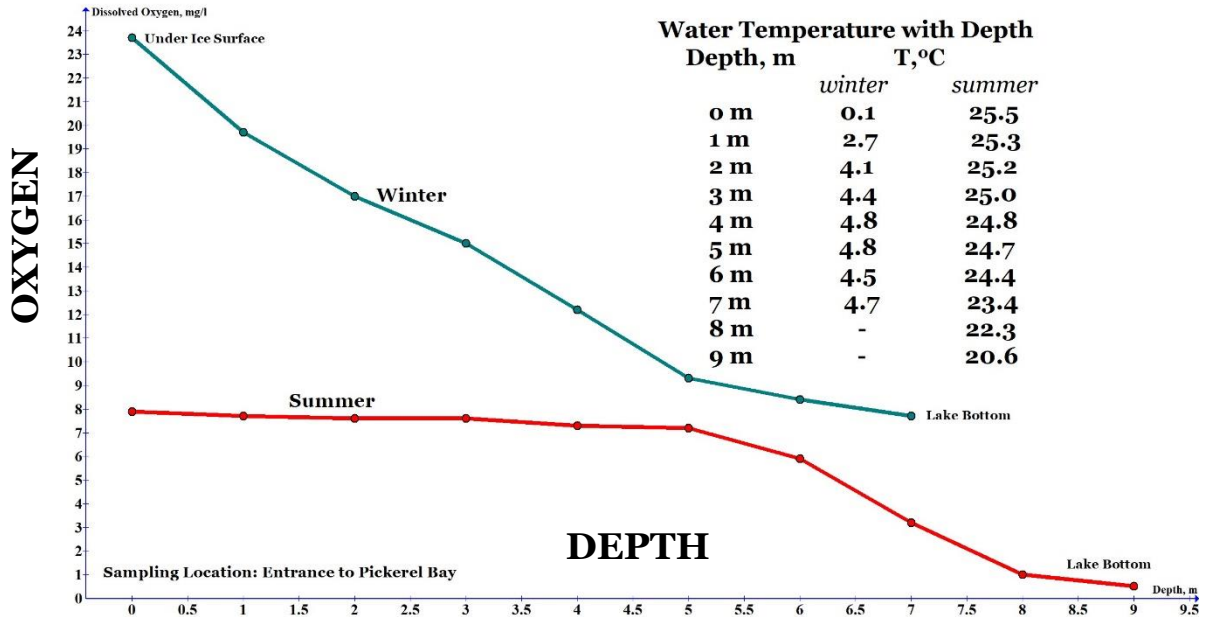
The concentration of oxygen in the water column can seriously affect fish populations. If dissolved oxygen concentrations dip below about 5 mg/L, fish stocks can be severely stressed or even die. Oxygen levels of from 7 to 11 mg/L are good for most fish and other aquatic organisms.

What Happens to Oxygen Levels in Winter Under the Ice?

During winter, ice covers the lake signalling a change in the water below the ice. During summer, the action of the wind and waves constantly mixes the lake as well as exposes water to the atmosphere where it becomes charged with oxygen. In winter, the lake is trapped under the ice and another force is predominant in ensuring the lake is well mixed.



Because the density of water is at its maximum at +4°C, water expands when heated above or cooled below this temperature. On the frozen lake, water just under the ice is cooled while water at the bottom of the lake is warmed by the sediment. The resulting density difference between the top and bottom waters causes warmer water to constantly rise from the bottom of the lake and cooler water to descend. This effect also explains why even a shallow lake like White Lake does not freeze solid from top to bottom.



The table contained in the graph above shows that in winter, the water temperature is close to a constant 5 degrees from a depth of 2 metres and below. More importantly, the graph shows that the concentration of oxygen dissolved in lake water is far more at all depths in winter than during the summer. A combination of factors is responsible for this: first, lake water can hold more oxygen when cold; second, there is less bacterial action in sediments and less oxygen demand from living things in cold than in warmer waters. This means that both fish and ice fisherman can be happy throughout the winter months!

If You Really Want to Know.....

The maximum amount of oxygen that can be dissolved in water is not the same in warm and cold waters. For example, water with a dissolved oxygen level of 7.7 mg/L at 4.7 degrees Celsius is 60% saturated whereas an oxygen level of 7.7 mg/L at 25.3 degrees Celsius is 94% saturated clearly illustrating that warmer water cannot hold as much oxygen in solution as colder water.