Module 3
Water Quality Fact Sheet – Dissolved Oxygen

Dissolved oxygen is one of the best indicators of the health of a water body. Dissolved oxygen is crucial for most animals and plants in the aquatic system. Both plants and animal require oxygen for respiration – a process critical for basic metabolic processes. The metabolic rates of aquatic organisms increase in warm water. Since metabolism requires oxygen, some species may not survive if there is not enough oxygen in the water to meet their needs.

Dissolved oxygen is not generally constant from the water surface to the bottom. An aquatic ecosystems' dissolved oxygen level is a function of:

- Water temperature
- Mixing (surface water interaction with atmosphere, wind, storms and tides, aquatic plant and phytoplankton photosynthesis)
- Depth
- Degree of stratification in the system
- Dissolved minerals
- Human influences

Temperature

The amount of oxygen that can dissolve in water (DO) depends on temperature. Colder water will have a higher DO level than warmer water. A difference in DO levels may be detected if the water is tested early in the morning when the water is cool and then later in the afternoon on a sunny day when the water temperature has risen. Similarly a difference in DO levels may be seen at different depths of the water if there is a significant change in water temperature.

In the spring and summer, the upper most layer of water tends to grow warmer and mixing between this surface water and the cooler bottom water slows. As air temperatures cool through the autumn, the surface water becomes increasingly cold which increases the density of the water. As the surface water sinks down, mixing occurs. Through the winter, temperatures remain fairly constant from top to bottom (in shallow systems).

Oxygen concentrations are much higher in air, which is about 21% oxygen, than in water, which is less than 1% oxygen. Where the air and water meet, this tremendous difference in concentration causes oxygen molecules in the air to dissolve into the water. More oxygen dissolves into water when wind stirs the water; as the waves create more surface area, more diffusion can occur.

Mixing

Dissolved oxygen can enter a water system through surface water interaction with atmosphere and as a result of aquatic plant and phytoplankton photosynthesis. Wind, storms, tides, and circulation in general allow the oxygen rich water to circulate or mix within the water system.

Depth and Stratification

Dissolved oxygen in deeper areas of a water body can have lower dissolved oxygen levels due to lack of interaction with the atmosphere or mixing circulating water with higher levels of oxygen in the entire water column. Stratification can serve as an invisible barrier preventing mixing, sometimes creating situations where the dissolved oxygen levels at the bottom can reach near 0ppm, becoming anoxic (lack of oxygen).

Dissolved minerals
Minerals dissolved in water can lower the ability or capacity of the water to hold oxygen.

Human Influence
A decrease in dissolved oxygen can be a result of natural causes, for example, decay of detritus, high summer heat, algal bloom, however often decreased in dissolve oxygen in a water body are caused by human influences, like thermal pollution increasing the water temperature and the release of excess nutrients.

Expected ranges for dissolved oxygen:

0.5 – 0ppm - anoxia, will not support most life forms
2 – 0.5ppm - hypoxia, will not support fish, very stressful to most other creatures
3 – 2ppm – stressful for most creatures, very stressful for fish
6 – 5ppm – required to support most growth and activity
10 – 8ppm – considered a very healthy range to support life