

# OXYGENATION IN AQUACULTURE

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## A Simple Equation

Managing and controlling dissolved gases (O<sub>2</sub>, N<sub>2</sub>, NH<sub>3</sub>, CO<sub>2</sub>) is a key factor when controlling water quality for successful fish culture. In general (for re-circulating and flow thru systems), the higher the fish density and the lower the water flow rate, the more critical this issue becomes. In intensive fish culture, dissolved oxygen is usually the first limiting factor.

## It's about Balance

When water is in contact with air, each of the gases contained in air (N<sub>2</sub>, O<sub>2</sub>, etc) will move into or out of solution to achieve equilibrium between the liquid and gas pressure phase. At the point of equilibrium, the water is said to be "air-saturated". If the concentration of any of the dissolved gases is altered (i.e. consumption of O<sub>2</sub>, production of CO<sub>2</sub>), the said gas will diffuse into or out of the water until equilibrium returns. The rate at which a particular gas dissolves in water depends on the following factors: surface area, pressure, salinity and concentration. When the consumption rate of oxygen becomes greater than the re-supply rate through aerators or the available oxygen in water supply, supplementation with pure oxygen becomes necessary.

## Supplementing Nature

Three common methods of increasing the concentration of dissolved oxygen in water are: Aerators, Oxygen Diffusers and Pressurized Packed Columns.

**Aerators** - add oxygen to water by increasing the air-water surface area by spraying water droplets into air or bubbling air into water. Although aerators can be very efficient, the amount of oxygen that can be dissolved in water is limited by the concentration of oxygen in the air (21%).

**Oxygen Diffusers** - diffuse very fine bubbles of pure oxygen into the water. The oxygen transfer rate is increased through the extremely high surface area of the bubbles and the use of pure oxygen. Pure oxygen systems achieve much higher dissolved oxygen levels than aerators. Read about Point Four's Microbubble Oxygen Diffusers.

**Pressurized Packed Columns (sealed)** - mix water with pure oxygen under high or low pressure conditions and can achieve very high oxygen transfer rate. Pressurized Packed Columns can achieve 100% oxygen utilization (or absorption efficiency) and there are no oxygen losses. Initial equipment costs for are relatively high and can be offset by lower operating costs. Read about Point Four's custom built Pressurized Packed Column systems.

## Point Four Expertise

Suitable methods of oxygen supplementation are application dependant and site specific - something we at Point Four Systems have been advising our customers on since 1988. As part of our Consultancy services, we can help you with considerations such as the trade-off between capital costs and system efficiency. Biological considerations such as minimum Dissolved Oxygen (DO) levels and Total Gas Pressure (TGP) limitations must be factored-in when selecting an appropriate system.

